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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32402		Lancaster			P-040-160615-1119-jcr-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	49	ppm			
[2]Magnesium (Mg)	13	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.7% Mg (2.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
43	8.1	8.5	1.5	1.3	2.5				2.2	1.2	25.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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7/7/2016	S16-32403		Lancaster			P-040-160615-1119-jcr-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	53	ppm			
[2]Magnesium (Mg)	18	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
51	9.9	10.4	1.3	1.4	2.4				1.4	0.9	23.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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7/7/2016	S16-32404		Lancaster			P-040-160615-1119-jcr-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	44	ppm			
[2]Magnesium (Mg)	23	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

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Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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35	8.1	8.6	1.3	2.2	2.0				1.3	1.1	19.6

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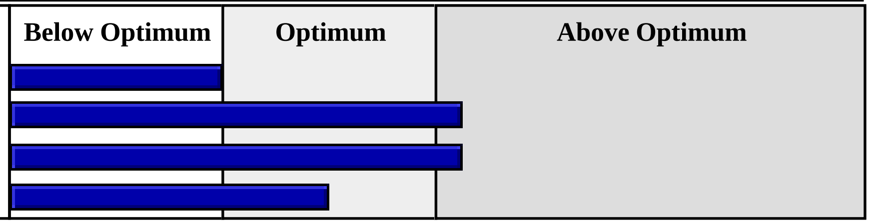
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32405		Lancaster			P-063-160614-0950-rll-S1A	

SOIL NUTRIENT LEVELS

Soil pH[1]	6.5	
Phosphorus (P)[2]	57	**ppm**
Potassium (K)[2]	151	**ppm**
Magnesium (Mg)[2]	97	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: NONE

Calcium Carbonate equivalent

Magnesium (Mg): NONE

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			Trace Elements[2] *See back for comments*		
Calcium[2] (ppm)	Acidity[3] (meq/100 g)	CEC[4] (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
2839	3.9	19.3	2.0	4.2	73.6				2.8	1.9	10.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32406		Lancaster			P-063-160614-0950-rll-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.8				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	43	ppm			
[2]Magnesium (Mg)	66	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 3000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
1092	4.5	10.6	1.0	5.2	51.4				1.1	0.9	7.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32407		Lancaster			P-063-160614-0950-rll-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	75	ppm			
[2]Magnesium (Mg)	207	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
76	10.5	12.8	1.5	13.5	3.0				2.2	1.9	5.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32408		Lancaster			P-068-160614-1338-sdd-S1A	

SOIL NUTRIENT LEVELS — Below Optimum | Optimum | Above Optimum

[1]Soil pH	6.1	
[2]Phosphorus (P)	119	ppm
[2]Potassium (K)	139	ppm
[2]Magnesium (Mg)	232	ppm

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
3230	5.1	22.4	1.6	8.6	67.0				15.8	1.3	17.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high calcium level in this sample indicates the probable presence of soluble calcium. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable calcium level of 15 meq/100 g.

Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32409		Lancaster			P-068-160614-1338-sdd-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.3				
[2]Phosphorus (P)	263	ppm			
[2]Potassium (K)	67	ppm			
[2]Magnesium (Mg)	60	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
952	9.9	15.3	1.1	3.3	31.0				6.8	1.2	23.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table - Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32411		Lancaster			P-068-160614-1338-sdd-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	85	ppm			
[2]Potassium (K)	39	ppm			
[2]Magnesium (Mg)	23	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 80 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
87	9.3	10.0	1.0	1.9	4.3				1.3	0.7	9.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32412		Lancaster			P-068-160614-1338-sdd-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.2				
[2]Phosphorus (P)	10	ppm			
[2]Potassium (K)	46	ppm			
[2]Magnesium (Mg)	44	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 30 lb/A

Limestone containing .4% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
414	8.7	11.3	1.0	3.3	18.4				1.4	0.9	8.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32413		Lancaster			P-069-160614-1158-sdd-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	27	ppm			
[2]Potassium (K)	51	ppm			
[2]Magnesium (Mg)	21	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

****Calcium Carbonate equivalent***

Magnesium (Mg): 80 lb/A

Limestone containing .9% Mg (1.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
77	10.5	11.2	1.2	1.6	3.4				3.2	0.8	24.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32414		Lancaster			P-069-160614-1158-sdd-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6		■		
[2]Phosphorus (P)	10	ppm	■		
[2]Potassium (K)	27	ppm	■		
[2]Magnesium (Mg)	16	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.4% Mg (2.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
52	8.7	9.2	0.8	1.5	2.8				1.5	0.8	17.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32415		Lancaster			P-069-160614-1158-sdd-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	39	ppm			
[2]Magnesium (Mg)	35	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
62	8.7	9.4	1.1	3.1	3.3				1.4	0.8	20.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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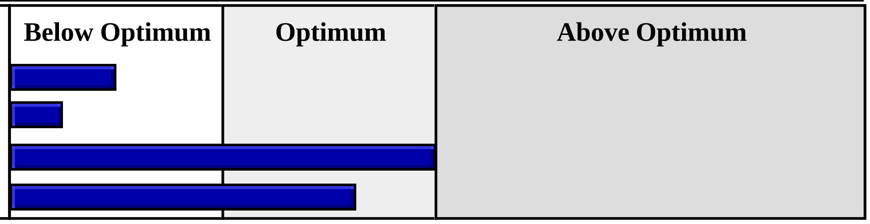
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32416		Lancaster			P-100-160609-1105-def-S1A	

SOIL NUTRIENT LEVELS

[1]**Soil pH**	3.8	
[2]**Phosphorus (P)**	8	**ppm**
[2]**Potassium (K)**	149	**ppm**
[2]**Magnesium (Mg)**	101	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 21000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / [2]**Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
445	23.1	18.4	2.1	4.6	12.1				3.7	0.9	16.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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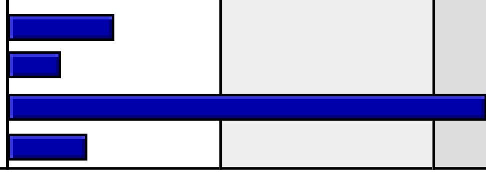
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32417		Lancaster			P-100-160609-1105-def-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1] Soil pH	4.0				
[2] Phosphorus (P)	7	ppm			
[2] Potassium (K)	177	ppm			
[2] Magnesium (Mg)	35	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .4% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2] Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
59	19.5	16.0	2.8	1.8	1.8				2.0	0.7	11.6

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32418		Lancaster			P-100-160609-1105-def-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8		■		
[2]Phosphorus (P)	8	ppm	■		
[2]Potassium (K)	61	ppm	■		
[2]Magnesium (Mg)	16	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing .9% Mg (1.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
42	12.9	13.4	1.2	1.0	1.6				3.7	1.0	23.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32419		Lancaster			P-121-160616-0950-mgw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	6.0				
[2]Phosphorus (P)	41	ppm			
[2]Potassium (K)	227	ppm			
[2]Magnesium (Mg)	207	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
1829	6.3	17.8	3.3	9.7	51.5				5.4	1.2	29.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32420		Lancaster			P-121-160616-0950-mgw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	142	ppm			
[2]Magnesium (Mg)	132	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
515	12.9	16.9	2.1	6.5	15.2				2.0	0.9	11.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32421		Lancaster			P-121-160616-0950-mgw-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	90	ppm			
[2]Magnesium (Mg)	227	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
568	12.9	17.9	1.3	10.6	15.9				1.5	1.6	9.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32422		Lancaster			P-121-160616-0950-mgw-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]**Soil pH**	4.8				
[2]**Phosphorus (P)**	2	**ppm**			
[2]**Potassium (K)**	74	**ppm**			
[2]**Magnesium (Mg)**	244	**ppm**			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

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3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS: | **Optional Tests:** | [2]**Trace Elements** *(See back for comments)*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
578	10.5	15.6	1.2	13.0	18.5				1.3	1.5	8.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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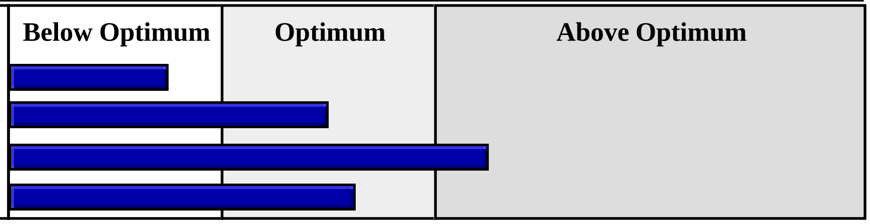
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32423		Lancaster			P-126-160615-1410-mgw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum / Optimum / Above Optimum
[1]Soil pH	5.1		
[2]Phosphorus (P)	39	ppm	
[2]Potassium (K)	161	ppm	
[2]Magnesium (Mg)	101	ppm	



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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381	11.1	14.3	2.9	5.9	13.4				4.3	0.9	24.3

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32424		Lancaster			P-126-160615-1410-mgw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.1				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	92	ppm			
[2]Magnesium (Mg)	46	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 30 lb/A

Limestone containing .2% Mg (.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
107	20.1	16.2	1.5	2.4	3.3				2.4	0.8	17.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

ST-4 Interpreting Soil Tests for Agronomic Crops -Explains the soil test report and provides additional information on the recommendations.

Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32425		Lancaster			P-126-160615-1410-mgw-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.5				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	49	ppm			
[2]Magnesium (Mg)	23	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .7% Mg (1.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
66	12.3	12.9	1.0	1.5	2.5				2.0	0.9	18.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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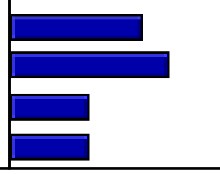
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32426		Lancaster			P-126-160615-1410-mgw-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	22	ppm			
[2]Potassium (K)	35	ppm			
[2]Magnesium (Mg)	26	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .8% Mg (1.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
47	11.7	12.2	0.7	1.8	1.9				1.4	0.9	15.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32427		Lancaster			P-126-160615-1410-mgw-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	49	ppm			
[2]Magnesium (Mg)	45	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .5% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
106	12.3	13.3	0.9	2.8	4.0				1.2	0.8	10.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32428		Lancaster			P-134-160615-1506-sdd-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.9				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	107	ppm			
[2]Magnesium (Mg)	95	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 24000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
392	26.1	18.0	1.5	4.4	10.9				5.9	1.2	10.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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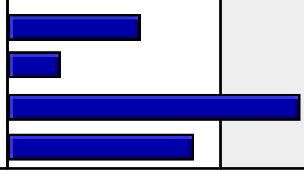
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32429		Lancaster			P-134-160615-1506-sdd-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]**Soil pH**	4.6				
[2]**Phosphorus (P)**	6	ppm			
[2]**Potassium (K)**	112	ppm			
[2]**Magnesium (Mg)**	53	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 20 lb/A

Limestone containing .1% Mg (.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
380	15.9	17.6	1.6	2.5	10.8				3.5	1.1	18.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32430		Lancaster			P-134-160615-1506-sdd-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	76	ppm			
[2]Magnesium (Mg)	30	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
54	11.1	11.8	1.6	2.1	2.3				1.7	0.8	28.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32431		Lancaster			P-134-160615-1506-sdd-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	67	ppm			
[2]Magnesium (Mg)	81	ppm			

RECOMMENDATIONS:
(See back messages for important information)

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients:
(If manure will be applied, adjust these recommendations accordingly. See back of report.)

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
52	12.3	13.4	1.3	5.0	1.9				1.2	0.6	24.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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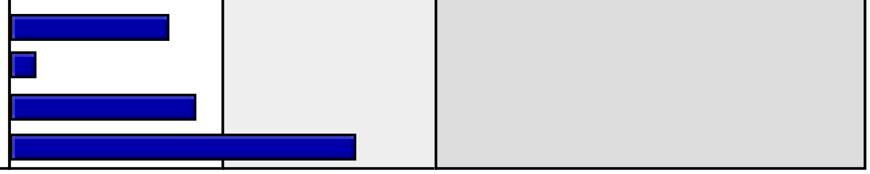
(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32432		Lancaster			P-134-160615-1506-sdd-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	89	ppm			
[2]Magnesium (Mg)	100	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
53	10.5	11.8	1.9	7.0	2.2				1.2	0.8	20.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32433		Lancaster			P-156-160606-1355-dat-S1A	

SOIL NUTRIENT LEVELS — Below Optimum | Optimum | Above Optimum

[1]Soil pH	3.7		
[2]Phosphorus (P)	5	ppm	
[2]Potassium (K)	151	ppm	
[2]Magnesium (Mg)	62	ppm	

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
169	19.5	16.7	2.3	3.1	5.0				2.4	0.7	12.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

Agronomy

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32434		Lancaster			P-156-160606-1355-dat-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.0				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	54	ppm			
[2]Magnesium (Mg)	19	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 80 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
59	9.9	10.5	1.3	1.5	2.8				1.3	0.7	7.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
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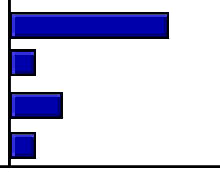
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32435		Lancaster			P-156-160606-1355-dat-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	29	ppm			
[2]Magnesium (Mg)	10	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 110 lb/A

Limestone containing 2.8% Mg (4.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
38	5.7	6.0	1.2	1.4	3.1				2.9	0.8	36.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32436		Lancaster			P-156-160606-1355-dat-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	30	ppm			
[2]Magnesium (Mg)	11	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 2.8% Mg (4.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
36	5.7	6.0	1.3	1.5	3.0				2.4	0.8	40.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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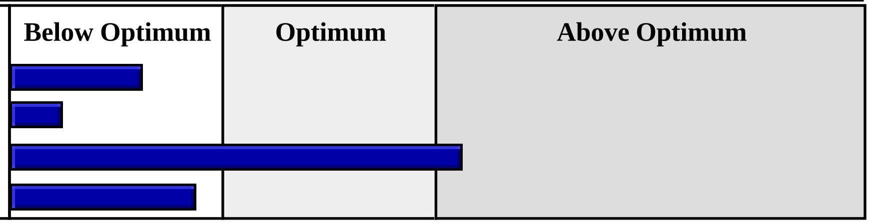
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32438		Lancaster			P-157-160606-1512-dat-S1A	

SOIL NUTRIENT LEVELS

[1] **Soil pH**	4.1	
[2] **Phosphorus (P)**	9	**ppm**
[2] **Potassium (K)**	151	**ppm**
[2] **Magnesium (Mg)**	54	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5.
Calcium Carbonate equivalent

Magnesium (Mg): 20 lb/A
Limestone containing .1% Mg (.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2] Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
137	15.3	16.5	2.3	2.7	4.1				2.9	0.8	12.7

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32439		Lancaster			P-157-160606-1512-dat-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.3				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	61	ppm			
[2]Magnesium (Mg)	27	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
93	13.5	14.3	1.1	1.6	3.2				2.0	1.1	15.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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(814) 863-0841 Fax: (814) 863-4540

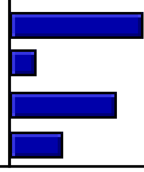
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32440		Lancaster			P-157-160606-1512-dat-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	46	ppm			
[2]Magnesium (Mg)	13	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.7% Mg (2.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
35	7.5	7.9	1.5	1.4	2.2				2.4	1.0	26.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32441		Lancaster			P-157-160606-1512-dat-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	62	ppm			
[2]Magnesium (Mg)	16	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.4% Mg (2.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
40	8.7	9.2	1.7	1.5	2.2				1.4	1.2	33.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32442		Lancaster			P-157-160606-1512-dat-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	88	ppm			
[2]Magnesium (Mg)	28	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
34	10.5	11.1	2.0	2.1	1.5				1.1	1.8	40.9

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Agronomy

Recommendation Messages

Enclosures

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Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32443		Lancaster			P-157-160606-1512-dat-S6A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.5				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	84	ppm			
[2]Magnesium (Mg)	29	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
37	11.1	11.7	1.8	2.1	1.6				1.0	1.7	27.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32444		Lancaster			P-157-160606-1512-dat-S7A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1] Soil pH	4.7				
[2] Phosphorus (P)	1	ppm			
[2] Potassium (K)	50	ppm			
[2] Magnesium (Mg)	15	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.3% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2] Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
45	9.9	10.4	1.2	1.2	2.1				0.9	1.6	18.8

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32445		Lancaster			P-162-160606-1040-jsw-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.4				
[2]Phosphorus (P)	9	ppm			
[2]Potassium (K)	161	ppm			
[2]Magnesium (Mg)	35	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 15000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .5% Mg (.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
214	17.1	16.8	2.5	1.7	6.4				2.8	1.4	15.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table - Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32446		Lancaster			P-162-160606-1040-jsw-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.4				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	82	ppm			
[2]Magnesium (Mg)	16	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 100 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
32	15.3	15.5	1.4	0.9	1.0				2.1	1.6	20.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32447		Lancaster			P-162-160606-1040-jsw-SA3	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6		■		
[2]Phosphorus (P)	6	ppm	■		
[2]Potassium (K)	72	ppm	■		
[2]Magnesium (Mg)	27	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .8% Mg (1.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
51	11.7	12.4	1.5	1.8	2.1				1.6	1.5	58.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32448		Lancaster			P-162-160606-1040-jsw-SA4	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	59	ppm			
[2]Magnesium (Mg)	35	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .9% Mg (1.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
53	10.5	11.2	1.3	2.6	2.4				1.1	1.4	62.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32449		Lancaster			P-162-160606-1040-jsw-SA5	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6		■■■■		
[2]Phosphorus (P)	5	ppm	■		
[2]Potassium (K)	69	ppm	■■■■		
[2]Magnesium (Mg)	30	ppm	■■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .8% Mg (1.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
61	9.9	10.6	1.7	2.4	2.9				1.2	1.4	23.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32450		Lancaster			P-170-160620-1122-def-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.7				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	98	ppm			
[2]Magnesium (Mg)	31	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 17000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .4% Mg (.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
209	18.9	16.6	1.5	1.6	6.3				2.7	1.1	7.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

ST-4 Interpreting Soil Tests for Agronomic Crops -Explains the soil test report and provides additional information on the recommendations.

Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum	Optimum	Above Optimum
Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32451		Lancaster			P-170-160620-1122-def-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.6				
[2]Phosphorus (P)	11	ppm			
[2]Potassium (K)	100	ppm			
[2]Magnesium (Mg)	22	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 17000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .5% Mg (.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
50	18.3	15.7	1.6	1.2	1.6				2.1	1.1	8.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32452		Lancaster			P-170-160620-1122-def-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]**Soil pH**	3.9		■■■■		
[2]**Phosphorus (P)**	7	**ppm**	■■		
[2]**Potassium (K)**	22	**ppm**	■■		
[2]**Magnesium (Mg)**	14	**ppm**	■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.1% Mg (1.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
40	10.5	10.9	0.5	1.1	1.8				1.3	1.4	6.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32453		Lancaster			P-170-160620-1122-def-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.4				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	25	ppm			
[2]Magnesium (Mg)	11	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.1% Mg (1.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
34	11.7	12.0	0.5	0.8	1.4				1.5	1.3	26.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32454		Lancaster			P-170-160620-1122-def-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	26	ppm			
[2]Magnesium (Mg)	10	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 5000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 2.2% Mg (3.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients:

(If manure will be applied, adjust these recommendations accordingly. See back of report.)

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
33	6.3	6.6	1.0	1.3	2.5				1.4	1.2	23.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32455		Lancaster			P-170-160620-1122-def-S6A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8		▇▇▇▇		
[2]Phosphorus (P)	6	ppm	▇▇		
[2]Potassium (K)	20	ppm	▇▇		
[2]Magnesium (Mg)	9	ppm	▇		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 2.8% Mg (4.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
32	5.7	6.0	0.9	1.3	2.7				1.2	1.1	22.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32456		Lancaster			P-173-160620-1112-def-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	6.7				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	104	ppm			
[2]Magnesium (Mg)	128	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: NONE

**Calcium Carbonate equivalent*

Magnesium (Mg): NONE

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** *See back for comments*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
2224	2.2	14.7	1.8	7.3	75.9				3.1	1.5	6.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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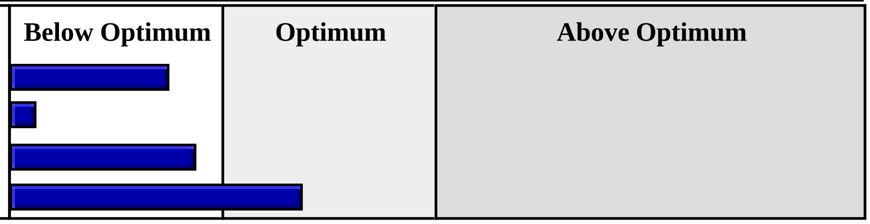
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32457		Lancaster			P-173-160620-1112-def-S2A	

SOIL NUTRIENT LEVELS

[1]Soil pH	5.2	
[2]Phosphorus (P)	4	ppm
[2]Potassium (K)	88	ppm
[2]Magnesium (Mg)	87	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1332	11.7	19.3	1.2	3.8	34.5				3.6	1.5	12.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32458		Lancaster			P-173-160620-1112-def-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.2				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	75	ppm			
[2]Magnesium (Mg)	46	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 30 lb/A

Limestone containing .4% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
600	8.7	12.3	1.6	3.1	24.5				1.5	1.4	9.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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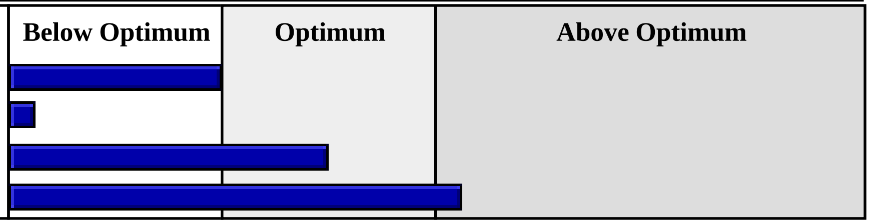
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32459		Lancaster			P-173-160620-1112-def-S4A	

SOIL NUTRIENT LEVELS

[1] Soil pH	6.5	
[2] Phosphorus (P)	1	ppm
[2] Potassium (K)	125	ppm
[2] Magnesium (Mg)	147	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: NONE

Calcium Carbonate equivalent

Magnesium (Mg): NONE

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2] Trace Elements** (*See back for comments*)

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
3246	3.9	20.4	1.6	6.0	73.4				1.0	1.5	7.4

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

The high calcium level in this sample indicates the probable presence of soluble calcium. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable calcium level of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32460		Lancaster			P-176-160621-1155-rll-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.8				
[2]Phosphorus (P)	15	ppm			
[2]Potassium (K)	161	ppm			
[2]Magnesium (Mg)	181	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
1844	5.7	16.8	2.5	9.0	54.7				6.9	1.6	10.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32461		Lancaster			P-176-160621-1155-rll-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	7	ppm			
[2]Potassium (K)	154	ppm			
[2]Magnesium (Mg)	74	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** *(See back for comments)*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
260	6.9	9.2	4.3	6.7	14.1				3.7	1.0	10.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table - Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32462		Lancaster			P-176-160621-1155-rll-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.6				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	60	ppm			
[2]Magnesium (Mg)	63	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 2000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
131	3.4	4.7	3.3	11.1	13.8				1.3	1.3	4.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32463		Lancaster			P-176-160621-1155-rll-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.2				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	147	ppm			
[2]Magnesium (Mg)	150	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1122	11.1	18.3	2.1	6.8	30.6				1.0	1.0	63.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32464		Lancaster			P-187-160607-1427-jsw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	24	ppm			
[2]Potassium (K)	175	ppm			
[2]Magnesium (Mg)	46	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 30 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** *(See back for comments)*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
138	14.1	15.6	2.9	2.5	4.4				9.5	1.2	40.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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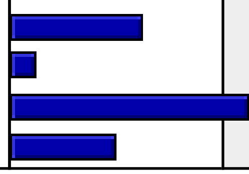
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32465		Lancaster			P-187-160607-1427-jsw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	103	ppm			
[2]Magnesium (Mg)	32	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .5% Mg (.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
140	13.5	14.7	1.8	1.8	4.7				2.9	1.5	21.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32466		Lancaster			P-187-160607-1427-jsw-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8		■		
[2]Phosphorus (P)	5	ppm	■		
[2]Potassium (K)	64	ppm	■		
[2]Magnesium (Mg)	22	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
48	9.9	10.5	1.6	1.7	2.3				1.9	1.5	15.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32467		Lancaster			P-215-160602-1037-jsw-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.8				
[2]Phosphorus (P)	16	ppm			
[2]Potassium (K)	148	ppm			
[2]Magnesium (Mg)	32	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 17000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .4% Mg (.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
150	18.3	16.4	2.3	1.6	4.6				2.3	1.2	9.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Recommendation Messages

Enclosures

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32468		Lancaster			P-215-160602-1037-jsw-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.8				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	49	ppm			
[2]Magnesium (Mg)	16	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing .8% Mg (1.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
52	13.5	14.0	0.9	1.0	1.9				1.5	1.2	12.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32469		Lancaster			P-215-160602-1037-jsw-S3A	

SOIL NUTRIENT LEVELS

Nutrient	Level	Unit	Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.8				
[2]Phosphorus (P)	13	ppm			
[2]Potassium (K)	45	ppm			
[2]Magnesium (Mg)	13	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing .8% Mg (1.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
51	13.5	14.0	0.8	0.8	1.8				1.3	1.1	8.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

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Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32471		Lancaster			P-215-160602-1037-jsw-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	33	ppm			
[2]Magnesium (Mg)	9	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
30	8.1	8.4	1.0	0.9	1.8				1.5	0.9	28.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32472		Lancaster			P-215-160602-1037-jsw-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	34	ppm			
[2]Magnesium (Mg)	9	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
33	8.1	8.4	1.0	0.9	1.9				1.4	1.0	31.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32473		Lancaster			P-215-160602-1037-jsw-S6A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.3				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	15	ppm			
[2]Magnesium (Mg)	8	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 2.8% Mg (4.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
36	5.7	6.0	0.6	1.1	3.0				0.9	0.8	37.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32474		Lancaster			P-222-160607-1055-dat-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
1 Soil pH	3.8		■		
2 Phosphorus (P)	9	ppm	■		
2 Potassium (K)	79	ppm	■		
2 Magnesium (Mg)	34	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 20000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **2 Trace Elements** *(See back for comments)*

2 Calcium (ppm)	3 Acidity (meq/100 g)	4 CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
175	20.7	16.4	1.2	1.7	5.3				2.5	1.1	18.5

Test Methods: 1 1:1 soil:water pH, 2 Mehlich 3 (ICP), 3 Mehlich Buffer pH, 4 Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32475		Lancaster			P-222-160607-1055-dat-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	56	ppm			
[2]Magnesium (Mg)	16	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.4% Mg (2.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
66	8.7	9.3	1.5	1.4	3.6				3.2	1.5	18.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32476		Lancaster			P-222-160607-1055-dat-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	44	ppm			
[2]Magnesium (Mg)	14	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.7% Mg (2.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
41	8.1	8.5	1.3	1.4	2.4				1.3	1.1	23.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum	Optimum	Above Optimum
Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32477		Lancaster			P-222-160607-1055-dat-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	55	ppm			
[2]Magnesium (Mg)	32	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

****Calcium Carbonate equivalent***

Magnesium (Mg): 60 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
56	8.1	8.8	1.6	3.0	3.2				1.1	1.0	19.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32478		Lancaster			P-222-160607-1055-dat-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	56	ppm			
[2]Magnesium (Mg)	52	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 20 lb/A

Limestone containing .3% Mg (.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
70	7.5	8.4	1.7	5.1	4.2				1.3	1.1	14.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32479		Lancaster			P-225-160601-1130-mel-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	75	ppm			
[2]Magnesium (Mg)	60	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
197	9.9	11.6	1.7	4.3	8.5				1.4	1.4	15.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32480		Lancaster			P-225-160601-1130-mel-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	52	ppm			
[2]Magnesium (Mg)	111	ppm			

RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients:

(If manure will be applied, adjust these recommendations accordingly. See back of report.)

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
164	12.3	14.2	0.9	6.5	5.8				1.2	1.1	28.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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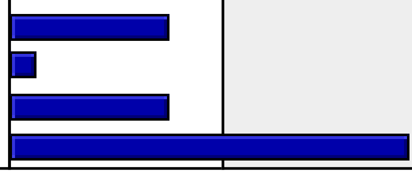
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32481		Lancaster			P-225-160601-1130-mel-S3A	

SOIL NUTRIENT LEVELS — Below Optimum | Optimum | Above Optimum

[1]Soil pH	5.0	
[2]Phosphorus (P)	2	ppm
[2]Potassium (K)	73	ppm
[2]Magnesium (Mg)	113	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): NONE

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
164	9.9	11.8	1.6	7.9	6.9				1.1	1.0	11.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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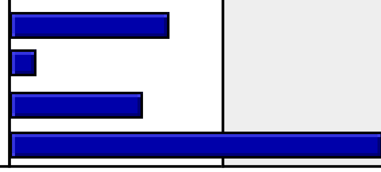
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32482		Lancaster			P-225-160601-1130-mel-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	66	ppm			
[2]Magnesium (Mg)	107	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
145	12.3	14.1	1.2	6.3	5.1				1.1	1.2	24.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32483		Lancaster			P-225-160601-1130-mel-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
1 Soil pH	4.8				
2 Phosphorus (P)	1	ppm			
2 Potassium (K)	41	ppm			
2 Magnesium (Mg)	105	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			2 Trace Elements (See back for comments)		
2 Calcium (ppm)	3 Acidity (meq/100 g)	4 CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
83	13.5	14.9	0.7	5.9	2.8				1.1	1.1	57.9

Test Methods: 1 1:1 soil:water pH, 2 Mehlich 3 (ICP), 3 Mehlich Buffer pH, 4 Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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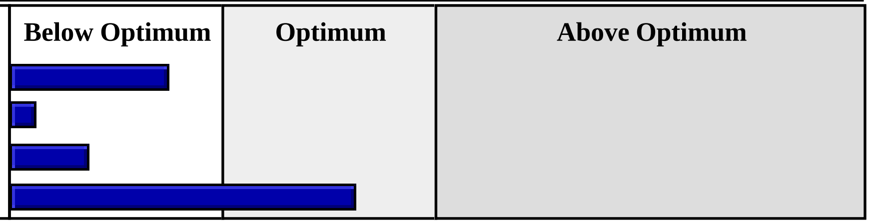
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32484		Lancaster			P-225-160601-1130-mel-S6A	

SOIL NUTRIENT LEVELS

[1]Soil pH	4.9	
[2]Phosphorus (P)	1	ppm
[2]Potassium (K)	37	ppm
[2]Magnesium (Mg)	101	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
81	12.3	13.6	0.7	6.2	3.0				1.0	1.2	66.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32485		Lancaster			P-225B-160601-1312-sdd-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	17	ppm			
[2]Potassium (K)	99	ppm			
[2]Magnesium (Mg)	148	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
608	10.5	15.0	1.7	8.2	20.2				7.4	1.4	10.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32486		Lancaster			P-225B-160601-1312-sdd-S2A	

SOIL NUTRIENT LEVELS

	Value	Unit	Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	61	ppm			
[2]Magnesium (Mg)	49	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 20 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
65	9.3	10.2	1.5	4.0	3.2				1.9	1.2	13.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32487		Lancaster			P-225B-160601-1312-sdd-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	50	ppm			
[2]Magnesium (Mg)	49	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 20 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
39	9.9	10.6	1.2	3.8	1.8				1.3	1.2	24.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

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Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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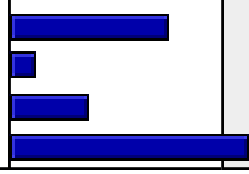
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32488		Lancaster			P-225B-160601-1312-sdd-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	31	ppm			
[2]Magnesium (Mg)	68	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
33	9.3	10.1	0.8	5.6	1.6				1.1	1.1	24.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32489		Lancaster			P-227-160601-1500-jsw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.2				
[2]Phosphorus (P)	7	ppm			
[2]Potassium (K)	101	ppm			
[2]Magnesium (Mg)	85	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 21000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
664	22.5	19.3	1.3	3.7	17.2				3.5	1.4	7.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32490		Lancaster			P-227-160601-1500-jsw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.1				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	89	ppm			
[2]Magnesium (Mg)	39	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 20000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
103	21.3	16.1	1.4	2.0	3.2				4.2	1.5	14.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32491		Lancaster			P-227-160601-1500-jsw-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	11	ppm			
[2]Potassium (K)	63	ppm			
[2]Magnesium (Mg)	27	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing 1% Mg (1.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
65	9.9	10.6	1.5	2.1	3.1				2.3	1.2	13.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32492		Lancaster			P-227-160601-1500-jsw-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	21	ppm			
[2]Potassium (K)	39	ppm			
[2]Magnesium (Mg)	25	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.1% Mg (1.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
64	11.1	11.7	0.9	1.8	2.7				1.5	1.4	11.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32493		Lancaster			P-239-160607-1427-def-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	112	ppm			
[2]Magnesium (Mg)	85	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
481	11.7	15.1	1.9	4.7	15.9				3.0	1.4	11.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32494		Lancaster			P-239-160607-1427-def-S2A	

SOIL NUTRIENT LEVELS — Below Optimum / Optimum / Above Optimum

[1]Soil pH	5.0		Below Optimum
[2]Phosphorus (P)	4	ppm	Below Optimum
[2]Potassium (K)	46	ppm	Below Optimum
[2]Magnesium (Mg)	101	ppm	Below Optimum

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
147	11.1	12.8	0.9	6.6	5.8				1.4	1.4	21.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32495		Lancaster			P-239-160607-1427-def-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	68	ppm			
[2]Magnesium (Mg)	198	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
174	6.3	9.0	1.9	18.3	9.7				1.5	1.2	11.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32496		Lancaster			P-239-160607-1427-def-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	7	ppm			
[2]Potassium (K)	83	ppm			
[2]Magnesium (Mg)	176	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
134	12.9	15.2	1.4	9.6	4.4				2.0	1.4	12.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32498		Lancaster			P-239A-160607-1430-def-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	14	ppm			
[2]Potassium (K)	151	ppm			
[2]Magnesium (Mg)	156	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 13000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
602	14.7	19.4	2.0	6.7	15.5				7.5	1.5	30.6

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Agronomy

Recommendation Messages

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32499		Lancaster			P-239A-160607-1430-def-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	119	ppm			
[2]Magnesium (Mg)	61	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
63	10.5	11.6	2.6	4.4	2.7				2.2	1.5	12.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table - Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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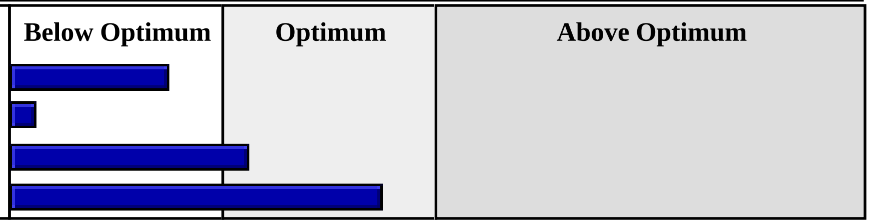
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32500		Lancaster			P-239A-160607-1430-def-S3A	

SOIL NUTRIENT LEVELS

[1]**Soil pH**	4.9	
[2]**Phosphorus (P)**	2	**ppm**
[2]**Potassium (K)**	104	**ppm**
[2]**Magnesium (Mg)**	111	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | [2]**Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
75	9.9	11.5	2.3	8.1	3.3				1.3	1.2	12.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32501		Lancaster			P-239A-160607-1430-def-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.4				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	93	ppm			
[2]Magnesium (Mg)	211	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
251	6.3	9.6	2.5	18.4	13.2				1.2	1.4	6.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32502		Lancaster			P-239A-160607-1430-def-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	76	ppm			
[2]Magnesium (Mg)	145	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
130	6.9	9.0	2.2	13.5	7.2				1.2	1.6	7.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32503		Lancaster			P-253-160608-0950-mel-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.6				
[2]Phosphorus (P)	23	ppm			
[2]Potassium (K)	144	ppm			
[2]Magnesium (Mg)	134	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1539	8.7	17.9	2.1	6.2	43.0				6.2	1.5	17.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32504		Lancaster			P-253-160608-0950-mel-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	11	ppm			
[2]Potassium (K)	110	ppm			
[2]Magnesium (Mg)	43	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 30 lb/A

Limestone containing .3% Mg (.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
277	11.1	13.1	2.1	2.7	10.6				2.2	1.7	15.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32505		Lancaster			P-253-160608-0950-mel-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	40	ppm			
[2]Magnesium (Mg)	17	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing 1.3% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
49	9.3	9.8	1.0	1.4	2.5				1.2	1.4	17.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32506		Lancaster			P-253-160608-0950-mel-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	15	ppm			
[2]Potassium (K)	39	ppm			
[2]Magnesium (Mg)	26	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing 1.1% Mg (1.8 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
50	8.7	9.3	1.1	2.3	2.7				1.3	1.4	11.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
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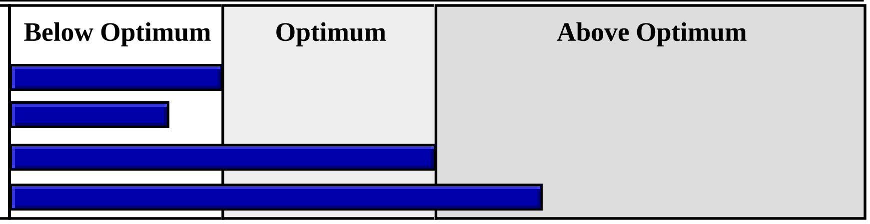
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32507		Lancaster			P-254-160608-1050-mel-S1A	

SOIL NUTRIENT LEVELS

[1] Soil pH	6.6	
[2] Phosphorus (P)	23	ppm
[2] Potassium (K)	145	ppm
[2] Magnesium (Mg)	267	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: NONE **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2] Trace Elements** (*See back for comments*)

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
3605	2.0	19.6	1.9	11.4	76.5				16.3	1.8	20.6

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

The high calcium level in this sample indicates the probable presence of soluble calcium. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable calcium level of 15 meq/100 g.

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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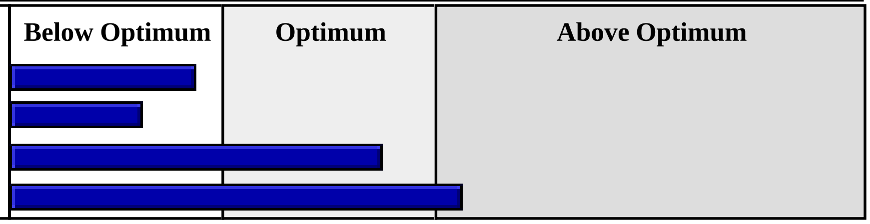
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32508		Lancaster			P-254-160608-1050-mel-S2A	

SOIL NUTRIENT LEVELS

[1]Soil pH	5.8	
[2]Phosphorus (P)	17	ppm
[2]Potassium (K)	138	ppm
[2]Magnesium (Mg)	162	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1908	6.9	18.1	2.0	7.4	52.6				9.7	1.5	16.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32509		Lancaster			P-254-160608-1050-mel-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	7	ppm			
[2]Potassium (K)	85	ppm			
[2]Magnesium (Mg)	32	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
130	11.1	12.2	1.8	2.2	5.3				1.2	1.4	8.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32510		Lancaster			P-254-160608-1050-mel-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1		■		
[2]Phosphorus (P)	19	ppm	■		
[2]Potassium (K)	81	ppm	■		
[2]Magnesium (Mg)	83	ppm	■	■	

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
359	9.9	12.6	1.6	5.5	14.3				1.2	1.4	7.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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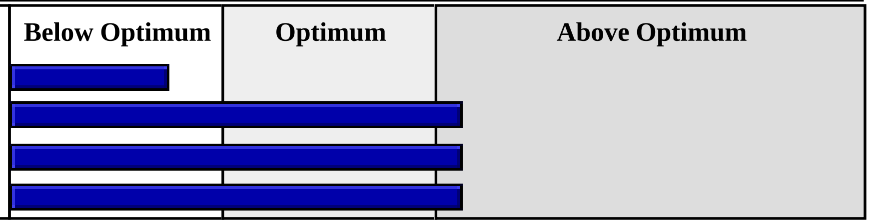
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32511		Lancaster			P-069-160614-1158-sdd-S1A	

SOIL NUTRIENT LEVELS

[1]Soil pH	4.9	
[2]Phosphorus (P)	67	ppm
[2]Potassium (K)	154	ppm
[2]Magnesium (Mg)	127	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1289	11.7	19.6	2.0	5.4	32.9				6.8	1.9	23.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32512		Lancaster			P-069-160614-1158-sdd-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.2				
[2]Phosphorus (P)	35	ppm			
[2]Potassium (K)	75	ppm			
[2]Magnesium (Mg)	27	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .6% Mg (.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
79	15.9	15.8	1.2	1.4	2.5				2.7	1.9	22.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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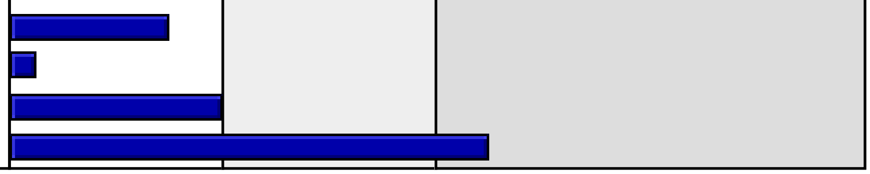
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32709		Lancaster			P-276-160610-0838-jsw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	95	ppm			
[2]Magnesium (Mg)	187	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
943	9.9	16.4	1.5	9.5	28.7				5.1	1.9	10.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32710		Lancaster			P-276-160610-0838-jsw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	81	ppm			
[2]Magnesium (Mg)	235	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
648	8.7	14.1	1.5	13.9	23.0				3.0	1.7	9.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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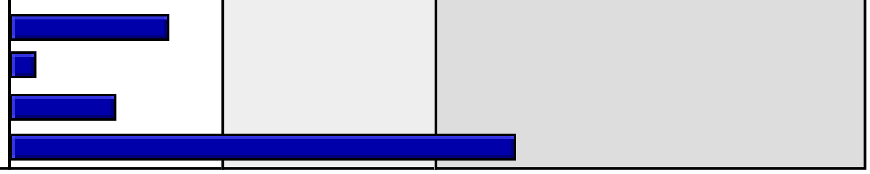
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32711		Lancaster			P-276-160610-0838-jsw-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.4				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	48	ppm			
[2]Magnesium (Mg)	233	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 3000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
430	4.5	8.7	1.4	22.3	24.7				1.7	1.7	3.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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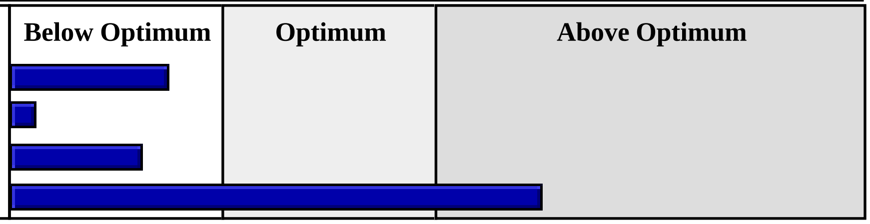
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32712		Lancaster			P-276-160610-0838-jsw-S4A	

SOIL NUTRIENT LEVELS

[1]Soil pH	5.6	
[2]Phosphorus (P)	2	ppm
[2]Potassium (K)	66	ppm
[2]Magnesium (Mg)	290	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 4000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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502	5.1	10.2	1.7	23.7	24.6				1.6	2.0	4.9

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Agronomy

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University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32713		Lancaster			P-276-160610-0838-jsw-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.9				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	54	ppm			
[2]Magnesium (Mg)	214	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 2000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
414	2.8	6.8	2.0	26.3	30.5				1.0	1.1	2.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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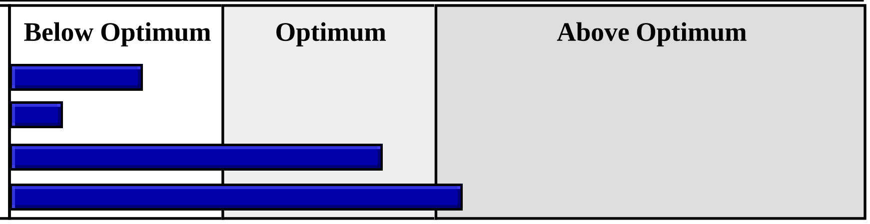
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32714		Lancaster			P-279-160610-1359-dat-S1A	

SOIL NUTRIENT LEVELS

[1]Soil pH	4.7	
[2]Phosphorus (P)	7	ppm
[2]Potassium (K)	140	ppm
[2]Magnesium (Mg)	126	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 13000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
557	14.7	18.9	1.9	5.6	14.7				5.1	1.1	15.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32715		Lancaster			P-279-160610-1359-dat-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.4				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	101	ppm			
[2]Magnesium (Mg)	85	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 16000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:			% Saturation of the CEC			Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
296	17.7	17.4	1.5	4.1	8.5				2.6	1.4	12.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32716		Lancaster			P-279-160610-1359-dat-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	104	ppm			
[2]Magnesium (Mg)	64	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

****Calcium Carbonate equivalent***

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
80	11.1	12.3	2.2	4.3	3.3				1.4	1.6	8.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32717		Lancaster			P-279-160610-1359-dat-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	72	ppm			
[2]Magnesium (Mg)	46	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 30 lb/A

Limestone containing .4% Mg (.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
48	9.3	10.1	1.8	3.8	2.4				1.1	1.4	8.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32718		Lancaster			P-279-160610-1359-dat-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	10	ppm			
[2]Potassium (K)	80	ppm			
[2]Magnesium (Mg)	133	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
134	6.9	8.9	2.3	12.5	7.5				2.7	4.1	6.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32719		Lancaster			P-279A-160610-1450-def-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
¹Soil pH	4.2		■		
²Phosphorus (P)	5	ppm	■		
²Potassium (K)	74	ppm	■		
²Magnesium (Mg)	39	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 13000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .4% Mg (.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			²Trace Elements (See back for comments)		
²Calcium (ppm)	³Acidity (meq/100 g)	⁴CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
257	14.7	16.5	1.2	2.0	7.8				2.2	1.3	13.6

Test Methods: ¹1:1 soil:water pH, ²Mehlich 3 (ICP), ³Mehlich Buffer pH, ⁴Summation of Cations

Agronomy

Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32720		Lancaster			P-279A-160610-1450-def-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	48	ppm			
[2]Magnesium (Mg)	22	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing 1.3% Mg (2.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** *See back for comments*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
61	7.5	8.1	1.5	2.3	3.8				1.4	1.1	7.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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The Pennsylvania State University
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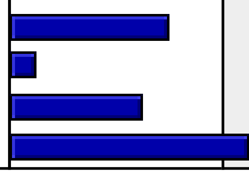
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32721		Lancaster			P-279A-160610-1450-def-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1] Soil pH	5.1				
[2] Phosphorus (P)	1	ppm			
[2] Potassium (K)	63	ppm			
[2] Magnesium (Mg)	71	ppm			



RECOMMENDATIONS:

(See back messages for important information)

Limestone*: 6000 lb/A for a target pH of 6.5.

Magnesium (Mg): NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2] Trace Elements (*See back for comments*): Zinc ppm	Copper ppm	Sulfur ppm
117	8.1	9.4	1.7	6.3	6.2				1.3	1.1	7.0

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

Agronomy

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32722		Lancaster			P-279A-160610-1450-def-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	62	ppm			
[2]Magnesium (Mg)	152	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
107	10.5	12.5	1.3	10.2	4.3				1.3	1.3	35.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32724		Lancaster			P-283-160606-0743-def-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	10	ppm			
[2]Potassium (K)	149	ppm			
[2]Magnesium (Mg)	95	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
1071	14.1	20.6	1.9	3.8	26.0				6.5	1.5	9.6

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32725		Lancaster			P-283-160606-0743-def-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1] Soil pH	4.5		■		
[2] Phosphorus (P)	3	ppm	■		
[2] Potassium (K)	40	ppm	■		
[2] Magnesium (Mg)	26	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 13000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .6% Mg (1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2] Trace Elements (See back for comments)		
[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
58	14.7	15.3	0.7	1.4	1.9				1.9	1.4	18.8

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

ST-4 Interpreting Soil Tests for Agronomic Crops -Explains the soil test report and provides additional information on the recommendations.

Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32726		Lancaster			P-283-160606-0743-def-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7		■■■■■		
[2]Phosphorus (P)	2	ppm	■		
[2]Potassium (K)	44	ppm	■■■■		
[2]Magnesium (Mg)	30	ppm	■■■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .8% Mg (1.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
55	9.3	9.9	1.1	2.5	2.8				1.5	1.3	13.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32727		Lancaster			P-283-160606-0743-def-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
1 Soil pH	4.9				
2 Phosphorus (P)	1	ppm			
2 Potassium (K)	62	ppm			
2 Magnesium (Mg)	59	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			2 Trace Elements (See back for comments)		
2 Calcium (ppm)	3 Acidity (meq/100 g)	4 CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
75	9.3	10.3	1.5	4.8	3.6				1.1	1.2	13.6

Test Methods: 1 1:1 soil:water pH, 2 Mehlich 3 (ICP), 3 Mehlich Buffer pH, 4 Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32728		Lancaster			P-283-160606-0743-def-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	69	ppm			
[2]Magnesium (Mg)	109	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
56	10.5	11.9	1.5	7.7	2.4				1.1	1.0	30.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32729		Lancaster			P-283-160606-0743-def-S6A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]**Soil pH**	5.0				
[2]**Phosphorus (P)**	2	**ppm**			
[2]**Potassium (K)**	67	**ppm**			
[2]**Magnesium (Mg)**	105	**ppm**			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
48	10.5	11.8	1.5	7.4	2.0				1.2	1.2	17.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32730		Lancaster			P-286-160606-0808-def-S1A	

SOIL NUTRIENT LEVELS — Below Optimum | Optimum | Above Optimum

[1]Soil pH	3.9		Below Optimum
[2]Phosphorus (P)	7	ppm	Below Optimum
[2]Potassium (K)	142	ppm	Below Optimum
[2]Magnesium (Mg)	81	ppm	Optimum

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 22000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
372	23.7	17.9	2.0	3.8	10.4				2.6	1.0	10.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32731		Lancaster			P-286-160606-0808-def-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8		■■■■■		
[2]Phosphorus (P)	2	ppm	■		
[2]Potassium (K)	46	ppm	■■■■		
[2]Magnesium (Mg)	12	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
49	7.5	8.0	1.5	1.3	3.1				1.5	1.0	40.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32732		Lancaster			P-286-160606-0808-def-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	71	ppm			
[2]Magnesium (Mg)	21	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .9% Mg (1.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
55	10.5	11.1	1.6	1.6	2.5				1.0	1.0	49.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

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Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32733		Lancaster			P-286-160606-0808-def-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8		■■■■■		
[2]Phosphorus (P)	1	ppm	■		
[2]Potassium (K)	69	ppm	■■■■■		
[2]Magnesium (Mg)	31	ppm	■■■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .8% Mg (1.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
37	9.9	10.5	1.7	2.5	1.8				1.2	1.1	22.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32734		Lancaster			P-290-160606-1445-mel-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.1				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	136	ppm			
[2]Magnesium (Mg)	36	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 30000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .2% Mg (.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
236	30.9	16.8	2.1	1.8	7.0				4.0	1.1	11.8

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32735		Lancaster			P-290-160606-1445-mel-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.5		■■■		
[2]Phosphorus (P)	9	ppm	■■		
[2]Potassium (K)	58	ppm	■■■		
[2]Magnesium (Mg)	20	ppm	■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 15000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 80 lb/A

Limestone containing .5% Mg (.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
111	17.1	15.9	0.9	1.1	3.5				2.0	1.1	11.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32736		Lancaster			P-290-160606-1445-mel-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	40	ppm			
[2]Magnesium (Mg)	10	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
39	7.5	7.9	1.3	1.1	2.4				1.3	1.0	18.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32737		Lancaster			P-290-160606-1445-mel-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.5				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	42	ppm			
[2]Magnesium (Mg)	11	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 110 lb/A

Limestone containing 1.6% Mg (2.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
44	8.7	9.1	1.2	1.0	2.4				1.0	0.9	23.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

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Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32738		Lancaster			P-291-160606-1330-mel-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.3		■		
[2]Phosphorus (P)	4	ppm	■		
[2]Potassium (K)	65	ppm	■		
[2]Magnesium (Mg)	33	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 16000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .3% Mg (.5 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
143	17.7	16.2	1.0	1.7	4.4				1.7	1.1	10.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32739		Lancaster			P-291-160606-1330-mel-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.5				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	37	ppm			
[2]Magnesium (Mg)	11	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.2% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
37	11.1	11.5	0.8	0.8	1.6				1.1	1.4	12.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32740		Lancaster			P-291-160606-1330-mel-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	52	ppm			
[2]Magnesium (Mg)	36	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .4% Mg (.6 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
95	15.9	15.9	0.8	1.9	3.0				1.8	1.6	20.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32741		Lancaster			P-291-160606-1330-mel-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7		■■■■■■		
[2]Phosphorus (P)	1	ppm	■		
[2]Potassium (K)	58	ppm	■■■■■		
[2]Magnesium (Mg)	41	ppm	■■■■■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .4% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
33	14.1	14.8	1.0	2.3	1.1				1.7	1.7	12.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32742		Lancaster			P-347-160621-1409-def-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.2				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	133	ppm			
[2]Magnesium (Mg)	131	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	% Saturation of the CEC Mg	% Saturation of the CEC Ca	Optional Tests: Organic Matter %	Optional Tests: Nitrate-N ppm	Optional Tests: Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
378	19.5	18.3	1.9	6.0	10.3				4.6	1.5	13.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

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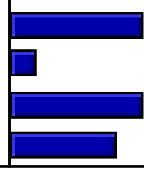
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32743		Lancaster			P-347-160621-1409-def-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	5	ppm			
[2]Potassium (K)	63	ppm			
[2]Magnesium (Mg)	37	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .5% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
48	12.3	13.0	1.2	2.4	1.9				2.3	1.9	15.9

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32744		Lancaster			P-352-160621-1145-def-S1A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	13	ppm			
[2]Potassium (K)	155	ppm			
[2]Magnesium (Mg)	189	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
1217	13.5	21.6	1.8	7.3	28.2				8.9	1.7	17.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32745		Lancaster			P-352-160621-1145-def-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.0				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	94	ppm			
[2]Magnesium (Mg)	152	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:			% Saturation of the CEC			Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
631	11.1	15.8	1.5	8.0	20.0				2.0	1.5	11.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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7/7/2016	S16-32746		Lancaster			P-352-160621-1145-def-S3A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.2				
[2]Phosphorus (P)	4	ppm			
[2]Potassium (K)	66	ppm			
[2]Magnesium (Mg)	131	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:			% Saturation of the CEC			Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
262	11.1	13.7	1.2	8.0	9.6				1.5	2.2	9.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32747		Lancaster			P-352-160621-1145-def-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.4				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	98	ppm			
[2]Magnesium (Mg)	216	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** *(See back for comments)*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
280	9.9	13.3	1.9	13.5	10.5				1.4	2.3	8.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32748		Lancaster			P-352-160621-1145-def-S5A	

SOIL NUTRIENT LEVELS — Below Optimum | Optimum | Above Optimum

[1]Soil pH	5.3		Below Optimum
[2]Phosphorus (P)	2	ppm	Below Optimum
[2]Potassium (K)	117	ppm	Below Optimum
[2]Magnesium (Mg)	276	ppm	Above Optimum

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 5000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
278	6.3	10.3	2.9	22.3	13.5				1.1	1.8	6.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

Enclosures

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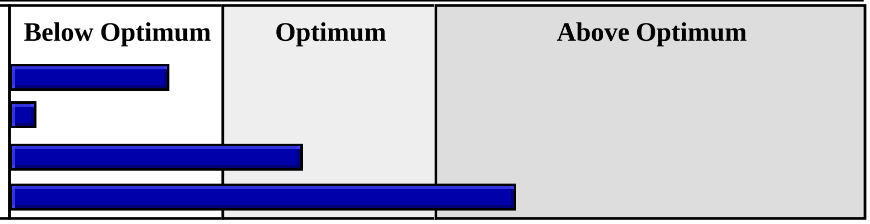
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32749		Lancaster			P-352-160621-1145-def-S6A	

SOIL NUTRIENT LEVELS

[1]Soil pH	5.3	
[2]Phosphorus (P)	1	ppm
[2]Potassium (K)	112	ppm
[2]Magnesium (Mg)	260	ppm



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Magnesium (Mg): NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
262	8.1	11.9	2.4	18.3	11.0				1.0	2.0	7.5

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Agronomy

Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32750		Lancaster			P-010-160620-1315-mgw-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.8				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	152	ppm			
[2]Magnesium (Mg)	128	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
832	10.5	16.1	2.4	6.6	25.8				4.2	1.3	7.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32751		Lancaster			P-010-160620-1315-mgw-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.6		■		
[2]Phosphorus (P)	17	ppm	■		
[2]Potassium (K)	64	ppm	■		
[2]Magnesium (Mg)	33	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .3% Mg (.4 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
225	20.1	16.6	1.0	1.7	6.8				2.8	1.4	10.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32752		Lancaster			P-010-160620-1315-mgw-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.1				
[2]Phosphorus (P)	7	ppm			
[2]Potassium (K)	46	ppm			
[2]Magnesium (Mg)	17	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 18000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing .6% Mg (.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
72	19.5	15.6	0.8	0.9	2.3				2.4	1.4	21.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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Zn (ppm)	Cu (ppm)	S (ppm)
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32753		Lancaster			P-010-160620-1315-mgw-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1] Soil pH	4.7				
[2] Phosphorus (P)	7	ppm			
[2] Potassium (K)	25	ppm			
[2] Magnesium (Mg)	11	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.2% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2] Trace Elements *See back for comments*		
[2] Calcium (ppm)	[3] Acidity (meq/100 g)	[4] CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
45	11.1	11.5	0.6	0.8	2.0				2.2	1.0	25.5

Test Methods: [1] 1:1 soil:water pH, [2] Mehlich 3 (ICP), [3] Mehlich Buffer pH, [4] Summation of Cations

Agronomy

Recommendation Messages

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

Distribution of Soil Test Results Summaries of soil test results may be used in educational programs. However, individual results will not be released outside of Penn State without permission of the client. Electronic copies of your results are available to you, contact the lab for more information.

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Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32754		Lancaster			P-010-160620-1315-mgw-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	17	ppm			
[2]Magnesium (Mg)	8	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.4% Mg (2.2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
36	9.9	10.2	0.4	0.7	1.8				1.9	1.1	37.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

Recommendations N,P, and K recommendations are made for three crop years on this field. New samples should be taken after 3 years. The recommendations for the 2nd and 3rd year assume that the earlier recommendations were followed. These recommendations are based on the results of the soil test and the information provided with the sample. If you think that there is an error on the report, contact the lab at the address on the front of the report. Tables that can be used to adjust or change recommendations for all crops based on the soil test can be found on the web at: www.aasl.psu.edu.

Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32755		Lancaster			P-010-160620-1315-mgw-S6A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	25	ppm			
[2]Magnesium (Mg)	9	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.2% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
44	10.5	10.9	0.6	0.7	2.0				1.6	1.1	24.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

Nitrogen Nitrogen recommendations on this report are not based on a soil test. They are based on crop requirements for the expected yield of the crop to be grown. The pre-sidedress nitrate soil tests (PSNT) and the Chlorophyll meter test are both available for improving nitrogen recommendations on corn especially when manure is being applied. See: Agronomy Facts 17 "Pre-sidedress Soil Nitrate Test for Corn" and Agronomy Facts 53 "The Early-season Chlorophyll Meter Test for Corn". For optimum efficiency, N should be applied as close to the time of crop need as practical. For corn apply 50-90% of the N when the corn is 10-20" tall. For winter grains apply the N in the spring prior to growth stage 5. For forage grasses split the recommended N for each cutting.

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Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32756		Lancaster			P-010-160620-1315-mgw-S7A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	23	ppm			
[2]Magnesium (Mg)	9	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.2% Mg (2 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
48	10.5	10.9	0.5	0.7	2.2				1.1	1.1	25.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32758		Lancaster			P-010-160620-1315-mgw-S8A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.6				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	30	ppm			
[2]Magnesium (Mg)	14	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 15000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 100 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
55	17.1	15.5	0.5	0.8	1.8				1.0	0.9	33.3

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32759		Lancaster			P-045-160614-1019-jcr-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.4				
[2]Phosphorus (P)	8	ppm			
[2]Potassium (K)	127	ppm			
[2]Magnesium (Mg)	54	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

***Calcium Carbonate equivalent**

Magnesium (Mg): 20 lb/A

Limestone containing .2% Mg (.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: / **Optional Tests:** / **[2]Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
313	13.5	15.8	2.1	2.8	9.9				2.8	1.1	12.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32760		Lancaster			P-045-160614-1019-jcr-S2A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.5				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	63	ppm			
[2]Magnesium (Mg)	33	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 11000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .5% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
131	12.3	13.4	1.2	2.1	4.9				1.9	1.1	9.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32761		Lancaster			P-045-160614-1019-jcr-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	65	ppm			
[2]Magnesium (Mg)	34	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 8000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .6% Mg (1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
80	9.9	10.7	1.6	2.6	3.7				1.9	1.2	7.1

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Agronomy

Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32762		Lancaster			P-045-160614-1019-jcr-S4A	

SOIL NUTRIENT LEVELS

	Value	Unit	Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.3				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	83	ppm			
[2]Magnesium (Mg)	122	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
443	8.7	12.1	1.8	8.4	18.2				1.3	1.2	5.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32763		Lancaster			P-077-160617-1035-sdd-S1A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
1 Soil pH	5.1				
2 Phosphorus (P)	34	ppm			
2 Potassium (K)	144	ppm			
2 Magnesium (Mg)	188	ppm			

RECOMMENDATIONS:
(See back messages for important information)

Limestone*: 11000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

2 Calcium (ppm)	3 Acidity (meq/100 g)	4 CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	2 Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
1497	12.3	21.7	1.7	7.2	34.5				10.3	1.5	17.1

Test Methods: 1 1:1 soil:water pH, 2 Mehlich 3 (ICP), 3 Mehlich Buffer pH, 4 Summation of Cations

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Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32764		Lancaster			P-077-160617-1035-sdd-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9		■■■■■■		
[2]Phosphorus (P)	25	ppm	■■■■■■		
[2]Potassium (K)	60	ppm	■■■■■		
[2]Magnesium (Mg)	28	ppm	■■■■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .6% Mg (1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | **[2]Trace Elements** *(See back for comments)*

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
103	11.7	12.6	1.2	1.9	4.1				4.1	1.5	14.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

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7/7/2016	S16-32765		Lancaster			P-077-160617-1035-sdd-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	38	ppm			
[2]Magnesium (Mg)	57	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 20 lb/A

Limestone containing .2% Mg (.3 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
281	11.7	13.7	0.7	3.5	10.3				1.3	1.3	7.4

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Agronomy

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Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32766		Lancaster			P-077-160617-1035-sdd-S4A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	48	ppm			
[2]Magnesium (Mg)	86	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 10000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
299	11.7	14.0	0.9	5.1	10.6				1.3	1.4	8.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32767		Lancaster			P-077-160617-1035-sdd-S5A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.9				
[2]Phosphorus (P)	1	ppm			
[2]Potassium (K)	63	ppm			
[2]Magnesium (Mg)	80	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
170	15.3	16.7	1.0	4.0	5.1				1.3	1.4	12.6

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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Zn (ppm)	Cu (ppm)	S (ppm)
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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32768		Lancaster			P-293-160606-1056-mel-S1A	

SOIL NUTRIENT LEVELS

[1]**Soil pH**	4.6		Below Optimum
[2]**Phosphorus (P)**	10	ppm	Below Optimum
[2]**Potassium (K)**	175	ppm	Below Optimum / Optimum
[2]**Magnesium (Mg)**	98	ppm	Below Optimum / Optimum

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 14000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS: | **Optional Tests:** | [2]**Trace Elements** (*See back for comments*)

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
405	15.3	18.3	2.5	4.5	11.1				4.0	0.9	18.2

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high acidity of this sample indicates that a portion of the acidity is not in the exchangeable form. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable acidity of 15 meq/100 g.

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Agronomy

Recommendation Messages

Enclosures

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32769		Lancaster			P-293-160606-1056-mel-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	3.9				
[2]Phosphorus (P)	6	ppm			
[2]Potassium (K)	100	ppm			
[2]Magnesium (Mg)	33	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 12000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 50 lb/A

Limestone containing .4% Mg (.7 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments) Zinc ppm	Copper ppm	Sulfur ppm
54	14.1	14.9	1.7	1.8	1.8				2.1	0.9	12.4

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

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Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32770		Lancaster			P-293-160606-1056-mel-S3A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	27	ppm			
[2]Magnesium (Mg)	12	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements (See back for comments)		
[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
42	8.1	8.5	0.8	1.2	2.5				1.4	0.9	12.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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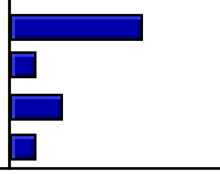
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32771		Lancaster			P-293-160606-1056-mel-S4A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7				
[2]Phosphorus (P)	2	ppm			
[2]Potassium (K)	27	ppm			
[2]Magnesium (Mg)	11	ppm			



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 110 lb/A

Limestone containing 1.8% Mg (2.9 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
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[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	Zinc ppm	Copper ppm	Sulfur ppm
35	8.1	8.4	0.8	1.1	2.1				1.5	1.0	15.0

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

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Recommendation Messages

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DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32772		Lancaster			P-293-160606-1056-mel-S5A	

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH	4.7		■		
[2]Phosphorus (P)	1	ppm	■		
[2]Potassium (K)	26	ppm	■		
[2]Magnesium (Mg)	29	ppm	■		

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 9000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): 60 lb/A

Limestone containing .7% Mg (1.1 % MgO) will satisfy the magnesium requirement

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

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40	10.5	11.0	0.6	2.2	1.8				1.3	1.0	24.9

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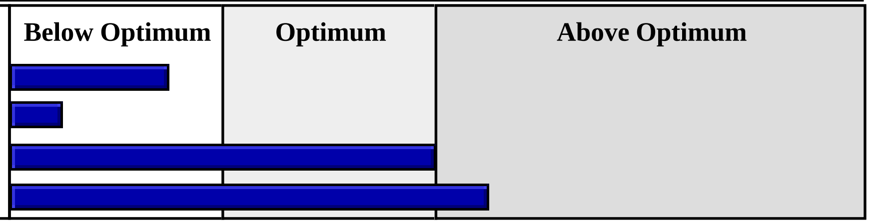
SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32773		Lancaster			P-225A-160601-1130-jcr-S1A	

SOIL NUTRIENT LEVELS

[1]**Soil pH**	5.1	
[2]**Phosphorus (P)**	6	**ppm**
[2]**Potassium (K)**	141	**ppm**
[2]**Magnesium (Mg)**	197	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5.

Calcium Carbonate equivalent

Magnesium (Mg): NONE

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]**Calcium** (ppm)	[3]**Acidity** (meq/100 g)	[4]**CEC** (meq/100 g)	**% Saturation of the CEC** K	Mg	Ca	**Optional Tests:** Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]**Trace Elements** *See back for comments* Zinc ppm	Copper ppm	Sulfur ppm
882	8.7	15.1	2.4	10.9	29.2				40.1	2.1	7.7

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

ST-4 Interpreting Soil Tests for Agronomic Crops -Explains the soil test report and provides additional information on the recommendations.

Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum	Optimum	Above Optimum
Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Manure Manure is a very important part of a fertility program. Manure applications may supply all or most of the nutrients recommended and in some cases may apply significantly more than the crop requires. Manure nutrients should be taken into account in developing your fertility program. For details on how to do this see the Penn State Agronomy Guide. Manure analysis kits are available through your county agent.

Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

Distribution of Soil Test Results Summaries of soil test results may be used in educational programs. However, individual results will not be released outside of Penn State without permission of the client. Electronic copies of your results are available to you, contact the lab for more information.

For additional information on these topics please see the current **Penn State Agronomy Guide** or the **AASL website**: www.aasl.psu.edu. This soil test is part of an ongoing research and extension program of Penn State. If you have any questions or comments about this program or would like copies of publications referenced here, please contact your Penn State County Extension agent.

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SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603	DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603

DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32774		Lancaster			P-225A-160601-1130-jcr-S2A	

SOIL NUTRIENT LEVELS

			Below Optimum	Optimum	Above Optimum
[1]Soil pH	5.1				
[2]Phosphorus (P)	3	ppm			
[2]Potassium (K)	97	ppm			
[2]Magnesium (Mg)	165	ppm			

RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 7000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

***Calcium Carbonate equivalent**

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	Other	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:

[2]Calcium (ppm)	[3]Acidity (meq/100 g)	[4]CEC (meq/100 g)	% Saturation of the CEC: K	Mg	Ca	Optional Tests: Organic Matter %	Nitrate-N ppm	Salts mmhos/cm	[2]Trace Elements (See back for comments): Zinc ppm	Copper ppm	Sulfur ppm
277	8.7	11.7	2.1	11.7	11.8				2.4	1.5	7.1

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

ST-2 Fertilizer Recommendation Table- Guidelines for making recommendations for other crops and for adjusting for a different expected yield.

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Soil Nutrient Levels Soil nutrient levels are given as parts per million (ppm) elemental P, K , and Mg. As a rule of thumb to convert ppm to lb/A multiply ppm x 2. The elemental results in lb/A can be converted to oxide forms using the following conversions: P x 2.3=P_2O_5, K x 1.2=K_2O, Mg x 1.6=MgO

Below Optimum-Nutrient is deficient. There should be an economic response to adding the recommended nutrient.	**Optimum-**Nutrient is adequate. There will be no yield response to adding more of a nutrient but a recommendation is made to replace what the crop removes and thus maintain the soil test in the optimum range.	**Above Optimum-**The nutrient is more than adequate. Not only will there not be a yield response but the soil nutrient levels are also adequate to accommodate crop removal.

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Limestone Recommendations The recommended limestone application should be adequate for 3 years. Limestone recommendations are based on 100% calcium carbonate equivalent limestone and assume "Fine-sized" limestone with 95% passing 20 mesh, 60% passing 60 mesh and 50% passing 100 mesh. Use "ST-2 Liming Materials Conversion Table (enclosed) to adjust for limestone quality. Also see Agronomy Facts #3 "Soil Acidity and Aglime".

Magnesium Only one Mg Recommendation is made for three years. Magnesium is most economically applied by using a limestone containing Mg. Low Mg levels in soils may result in low Mg levels in forage crops especially if a significant amount of N and/or K fertilizer is applied. This can result in potentially fatal grass tetany in animals. Use caution if grazing. Apply the recommended Mg and be sure your feed rations are properly balanced.

Starter Fertilizer Starter fertilizer is important to get a corn crop off to a good start when planting in cold, wet conditions. However, on optimum or higher testing soils, as planting dates get later and soils warm up, the benefit from starter fertilizer goes down. An N only starter is often adequate when soil test levels are above optimum. The correct material, rate, and placement for starter fertilizer are critical to be effective. See Agronomy Facts #51 "Starter Fertilizer".

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Very High Soil Test Levels Very high soil test levels should be avoided as much as possible. High soil nutrient levels might not only represent an economic loss but they may also indicate potential crop, animal or environmental problems.

Very high pH can results in micronutrient deficiencies and may affect the activity of some pesticides resulting in injury or poor pest control.

Very high phosphorus levels in the soil may lead to crop production problems especially with no manure and may result in potentially harmful P loss to the environment. Best management practices may be necessary to reduce the potential for environmental problems with P.

Zinc, Copper and Sulfur Results The normal ranges for zinc (Zn) copper (Cu), and sulfur (S) in Pennsylvania soils are listed below. Cu, Zn and S deficiencies are uncommon in PA, but may occur on soils testing below the normal range. Cu, Zn and S toxicities may occur at levels testing well above the normal range, but have not been observed in Pennsylvania in agronomic crops even on soils testing 2 to 3 times above the normal range. For additional information, see ST4.

Normal ranges of Zn, Cu and S in Pennsylvania Soils (Mehlich 3)		
Zn (ppm)	Cu (ppm)	S (ppm)
1.1 - 9.4	1.2 - 5.5	10 - 25

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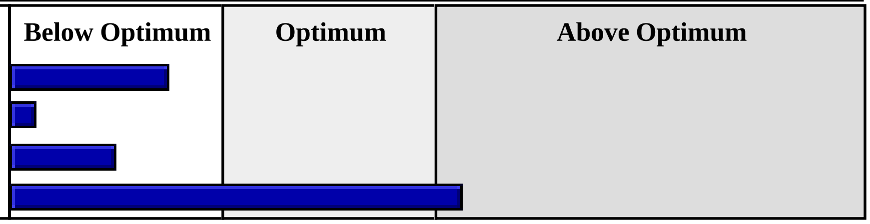
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCS ID	FIELD ID	SOIL
7/7/2016	S16-32775		Lancaster			P-225A-160601-1130-jcr-S3A	

SOIL NUTRIENT LEVELS

[1]**Soil pH**	5.4	
[2]**Phosphorus (P)**	2	**ppm**
[2]**Potassium (K)**	58	**ppm**
[2]**Magnesium (Mg)**	167	**ppm**



RECOMMENDATIONS: *(See back messages for important information)*

Limestone*: 6000 lb/A for a target pH of 6.5. **Magnesium (Mg):** NONE

Calcium Carbonate equivalent

Plant Nutrients: ***(If manure will be applied, adjust these recommendations accordingly. See back of report.)***

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
2	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
3	**Other**	0	0	0	0	*See ST2 for other crop recommendations*

No crop was specified. Therefore no recommendation is given.

ADDITIONAL RESULTS:						Optional Tests:			[2]Trace Elements *See back for comments*		
[2]**Calcium** (ppm)	[3]**Acidity** (meq/100 g)	[4]**CEC** (meq/100 g)	**% Saturation of the CEC** **K**	**Mg**	**Ca**	**Organic Matter %**	**Nitrate-N ppm**	**Salts** mmhos/cm	**Zinc ppm**	**Copper ppm**	**Sulfur ppm**
382	7.5	11.0	1.4	12.7	17.4				1.3	1.3	9.5

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

Agronomy

Recommendation Messages

Enclosures

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Attachment 9
AASLAB Particle Size Analysis Results

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**7/7/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-003-160620-1025-rll-S2A		S16-32385	33.0	38.8	28.2	Clay Loam
P-003-160620-1025-rll-S3A		S16-32386	16.9	42.6	40.5	Silty Clay
P-003-160620-1025-rll-S4A		S16-32387	22.8	47.2	29.9	Clay Loam
P-012-160620-1115-mgw-S2A		S16-32389	54.9	27.3	17.8	Sandy Loam
P-012-160620-1115-mgw-S3A		S16-32390	55.9	25.5	18.6	Sandy Loam
P-012-160620-1115-mgw-S4A		S16-32391	53.7	31.0	15.3	Sandy Loam
P-012-160620-1115-mgw-S5A		S16-32392	49.2	24.6	26.2	Sandy Clay Loam
P-022-160614-1050-jsw-S2A		S16-32394	57.5	19.4	23.1	Sandy Clay Loam
P-022-160614-1050-jsw-S3A		S16-32395	79.6	12.2	8.2	Loamy Sand
P-022-160614-1050-jsw-S4A		S16-32396	66.8	11.4	21.8	Sandy Clay Loam
P-022-160614-1050-jsw-S5A		S16-32397	13.6	59.6	26.8	Silt Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/11/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-022-160614-1050-jsw-S6A		S16-32398	22.9	31.1	45.9	Clay
P-022-160614-1050-jsw-S7A		S16-32399	8.8	37.2	54.0	Clay
P-040-160615-1119-jcr-S2A		S16-32401	35.9	46.0	18.1	Loam
P-040-160615-1119-jcr-S3A		S16-32402	18.4	51.4	30.2	Silty Clay Loam
P-040-160615-1119-jcr-S4A		S16-32403	29.2	39.0	31.8	Clay Loam
P-040-160615-1119-jcr-S5A		S16-32404	19.6	44.0	36.4	Silty Clay Loam
P-063-160614-0950-rll-S1A		S16-32405	34.8	41.0	24.2	Loam
P-063-160614-0950-rll-S2A		S16-32406	21.7	37.6	40.7	Clay
P-063-160614-0950-rll-S3A		S16-32407	8.8	48.7	42.4	Silty Clay
P-068-160614-1338-sdd-S2A		S16-32409	74.1	16.6	9.3	Sandy Loam
P-068-160614-1338-sdd-S3A		S16-32411	53.5	25.1	21.4	Sandy Clay Loam

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SOIL TEST REPORT FOR:		ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603		DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603
DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/12/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-068-160614-1338-sdd-S4A		S16-32412	37.3	32.7	30.0	Clay Loam
P-069-160614-1158-sdd-S3A		S16-32413	40.9	39.0	20.1	Loam
P-069-160614-1158-sdd-S4A		S16-32414	50.3	31.1	18.6	Loam
P-069-160614-1158-sdd-S5A		S16-32415	64.3	22.4	13.2	Sandy Loam
P-100-160609-1105-def-S2A		S16-32417	48.8	38.7	12.5	Loam
P-100-160609-1105-def-S3A		S16-32418	25.2	37.8	37.0	Clay Loam
P-121-160616-0950-mgw-S2A		S16-32420	48.8	33.5	17.7	Loam
P-121-160616-0950-mgw-S3A		S16-32421	25.5	43.4	31.0	Clay Loam
P-121-160616-0950-mgw-S4A		S16-32422	39.4	34.0	26.6	Loam
P-126-160615-1410-mgw-S2A		S16-32424	39.2	38.0	22.7	Loam
P-126-160615-1410-mgw-S3A		S16-32425	21.6	51.2	27.2	Clay Loam

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SOIL TEST REPORT FOR:		ADDITIONAL COPY TO:
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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/12/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-126-160615-1410-mgw-S4A		S16-32426	31.4	41.4	27.1	Clay Loam
P-126-160615-1410-mgw-S5A		S16-32427	43.2	32.8	24.1	Loam
P-134-160615-1506-sdd-S2A		S16-32429	40.0	34.4	25.6	Loam
P-134-160615-1506-sdd-S3A		S16-32430	26.0	40.4	33.6	Clay Loam
P-134-160615-1506-sdd-S4A		S16-32431	49.9	23.1	27.0	Sandy Clay Loam
P-134-160615-1506-sdd-S5A		S16-32432	55.9	22.5	21.7	Sandy Clay Loam
P-156-160606-1355-dat-S2A		S16-32434	65.6	23.5	10.9	Sandy Loam
P-156-160606-1355-dat-S3A		S16-32435	56.7	22.5	20.8	Sandy Clay Loam
P-156-160606-1355-dat-S4A		S16-32436	56.9	21.9	21.2	Sandy Clay Loam
P-157-160606-1512-dat-S2A		S16-32439	55.5	29.6	14.9	Sandy Loam
P-157-160606-1512-dat-S3A		S16-32440	45.6	24.7	29.7	Sandy Clay Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**7/14/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-157-160606-1512-dat-S4A		S16-32441	37.6	26.2	36.2	Clay Loam
P-157-160606-1512-dat-S5A		S16-32442	12.1	23.3	64.6	Clay
P-157-160606-1512-dat-S6A		S16-32443	12.6	25.0	62.4	Clay
P-157-160606-1512-dat-S7A		S16-32444	28.4	18.0	53.6	Clay
P-162-160606-1040-jsw-S2A		S16-32446	48.8	26.1	25.2	Sandy Clay Loam
P-162-160606-1040-jsw-SA3		S16-32447	34.0	25.8	40.2	Clay
P-162-160606-1040-jsw-SA4		S16-32448	45.7	19.8	34.5	Sandy Clay Loam
P-162-160606-1040-jsw-SA5		S16-32449	43.5	22.6	33.9	Clay Loam
P-170-160620-1122-def-S2A		S16-32451	84.9	9.0	6.2	Loamy Sand
P-170-160620-1122-def-S3A		S16-32452	76.6	15.0	8.4	Sandy Loam
P-170-160620-1122-def-S4A		S16-32453	67.1	14.3	18.6	Sandy Loam

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DATE RECEIVED	DATE COMPLETE	COUNTY
07/05/2016	**07/15/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-170-160620-1122-def-S5A		S16-32454	65.2	13.9	20.9	Sandy Clay Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**7/18/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-170-160620-1122-def-S6A		S16-32455	75.5	8.9	15.6	Sandy Loam
P-173-160620-1112-def-S2A		S16-32457	28.6	37.4	34.0	Clay Loam
P-173-160620-1112-def-S3A		S16-32458	20.0	40.8	39.2	Silty Clay Loam
P-173-160620-1112-def-S4A		S16-32459	5.9	22.3	71.9	Clay
P-176-160621-1155-rll-S2A		S16-32461	62.7	27.2	10.1	Sandy Loam
P-176-160621-1155-rll-S3A		S16-32462	65.8	18.2	16.0	Sandy Loam
P-176-160621-1155-rll-S4A		S16-32463	28.2	11.8	60.0	Clay
P-187-160607-1427-jsw-S2A		S16-32465	25.6	38.4	35.9	Clay Loam
P-187-160607-1427-jsw-S3A		S16-32466	37.3	39.6	23.1	Loam
P-215-160602-1037-jsw-S2A		S16-32468	58.3	22.5	19.3	Sandy Loam
P-215-160602-1037-jsw-S3A		S16-32469	64.6	23.5	11.9	Sandy Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/19/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-215-160602-1037-jsw-S4A		S16-32471	49.0	23.8	27.3	Sandy Clay Loam
P-215-160602-1037-jsw-S5A		S16-32472	46.6	24.8	28.6	Sandy Clay Loam
P-215-160602-1037-jsw-S6A		S16-32473	75.5	9.9	14.6	Sandy Loam
P-222-160607-1055-dat-S1A		S16-32474	39.1	43.1	17.7	Loam
P-222-160607-1055-dat-S2A		S16-32475	30.0	40.2	29.8	Clay Loam
P-222-160607-1055-dat-S3A		S16-32476	33.8	36.8	29.4	Clay Loam
P-222-160607-1055-dat-S4A		S16-32477	49.1	28.6	22.3	Loam
P-222-160607-1055-dat-S5A		S16-32478	46.2	30.9	22.9	Loam
P-225-160601-1130-mel-S1A		S16-32479	23.2	43.1	33.7	Clay Loam
P-225-160601-1130-mel-S2A		S16-32480	18.6	33.7	47.6	Clay
P-225-160601-1130-mel-S3A		S16-32481	45.7	19.0	35.3	Sandy Clay

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/20/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-225-160601-1130-mel-S4A		S16-32482	32.9	28.0	39.1	Clay Loam
P-225-160601-1130-mel-S5A		S16-32483	12.0	44.2	43.9	Silty Clay
P-225-160601-1130-mel-S6A		S16-32484	20.3	43.9	35.8	Clay Loam
P-225B-160601-1312-sdd-S1A		S16-32485	40.3	36.5	23.2	Loam
P-225B-160601-1312-sdd-S2A		S16-32486	23.8	43.0	33.1	Clay Loam
P-225B-160601-1312-sdd-S3A		S16-32487	23.5	41.3	35.2	Clay Loam
P-225B-160601-1312-sdd-S4A		S16-32488	20.7	39.3	40.0	Clay Loam
P-227-160601-1500-jsw-S2A		S16-32490	34.3	38.4	27.3	Clay Loam
P-227-160601-1500-jsw-S3A		S16-32491	42.4	33.1	24.5	Loam
P-227-160601-1500-jsw-S4A		S16-32492	40.1	33.9	26.0	Loam
P-239-160607-1427-def-S1A		S16-32493	53.1	30.3	16.6	Sandy Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/05/2016	**07/21/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-239-160607-1427-def-S2A		S16-32494	45.0	30.8	24.2	Loam
P-239-160607-1427-def-S3A		S16-32495	66.8	15.0	18.2	Sandy Loam
P-239-160607-1427-def-S4A		S16-32496	46.3	23.4	30.3	Sandy Clay Loam
P-239A-160607-1430-def-S1A		S16-32498	49.9	32.8	17.3	Loam
P-239A-160607-1430-def-S2A		S16-32499	38.0	32.4	29.6	Clay Loam
P-239A-160607-1430-def-S3A		S16-32500	57.9	18.6	23.6	Sandy Clay Loam
P-239A-160607-1430-def-S4A		S16-32501	35.6	32.1	32.3	Clay Loam
P-239A-160607-1430-def-S5A		S16-32502	36.5	34.1	29.4	Clay Loam
P-253-160608-0950-mel-S2A		S16-32504	57.1	27.5	15.4	Sandy Loam
P-253-160608-0950-mel-S3A		S16-32505	62.4	17.7	19.9	Sandy Loam
P-253-160608-0950-mel-S4A		S16-32506	57.6	20.7	21.7	Sandy Clay Loam

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DATE RECEIVED	DATE COMPLETE	COUNTY
07/05/2016	**07/22/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-254-160608-1050-mel-S2A		S16-32508	45.8	33.2	21.0	Loam
P-254-160608-1050-mel-S3A		S16-32509	36.6	38.0	25.5	Loam
P-254-160608-1050-mel-S4A		S16-32510	45.0	29.4	25.6	Loam
P-069-160614-1158-sdd-S2A		S16-32512	48.7	36.0	15.3	Loam
P-276-160610-0838-jsw-S2A		S16-32710	56.3	20.8	22.8	Sandy Clay Loam
P-276-160610-0838-jsw-S3A		S16-32711	74.7	11.9	13.4	Sandy Loam
P-276-160610-0838-jsw-S4A		S16-32712	61.0	20.9	18.1	Sandy Loam
P-276-160610-0838-jsw-S5A		S16-32713	75.6	6.8	17.6	Sandy Loam
P-279-160610-1359-dat-S2A		S16-32715	50.5	29.1	20.3	Loam
P-279-160610-1359-dat-S3A		S16-32716	63.7	19.9	16.4	Sandy Loam
P-279-160610-1359-dat-S4A		S16-32717	77.5	10.2	12.2	Sandy Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/06/2016	**07/22/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-279-160610-1359-dat-S5A		S16-32718	77.7	10.6	11.7	Sandy Loam
P-279A-160610-1450-def-S1A		S16-32719	50.2	33.6	16.2	Loam
P-279A-160610-1450-def-S2A		S16-32720	44.1	32.1	23.8	Loam
P-279A-160610-1450-def-S3A		S16-32721	61.6	15.3	23.1	Sandy Clay Loam
P-279A-160610-1450-def-S4A		S16-32722	45.7	22.2	32.1	Sandy Clay Loam
P-283-160606-0743-def-S2A		S16-32725	31.5	44.2	24.2	Loam
P-283-160606-0743-def-S3A		S16-32726	44.9	31.0	24.1	Loam
P-283-160606-0743-def-S4A		S16-32727	52.7	23.5	23.7	Sandy Clay Loam
P-283-160606-0743-def-S5A		S16-32728	50.5	25.7	23.8	Sandy Clay Loam
P-283-160606-0743-def-S6A		S16-32729	62.2	16.3	21.5	Sandy Clay Loam
P-286-160606-0808-def-S2A		S16-32731	32.4	39.7	27.9	Clay Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/06/2016	**07/25/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-286-160606-0808-def-S3A		S16-32732	31.8	37.2	31.0	Clay Loam
P-286-160606-0808-def-S4A		S16-32733	32.4	37.2	30.5	Clay Loam
P-290-160606-1445-mel-S2A		S16-32735	40.9	43.5	15.7	Loam
P-290-160606-1445-mel-S3A		S16-32736	33.6	41.7	24.6	Loam
P-290-160606-1445-mel-S4A		S16-32737	40.0	35.9	24.1	Loam
P-291-160606-1330-mel-S1A		S16-32738	35.1	43.5	21.4	Loam
P-291-160606-1330-mel-S2A		S16-32739	24.3	40.5	35.2	Clay Loam
P-291-160606-1330-mel-S3A		S16-32740	14.8	30.9	54.3	Clay
P-291-160606-1330-mel-S4A		S16-32741	27.9	35.3	36.8	Clay Loam
P-347-160621-1409-def-S1A		S16-32742	59.2	18.4	22.4	Sandy Clay Loam
P-347-160621-1409-def-S2A		S16-32743	50.9	19.8	29.3	Sandy Clay Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/06/2016	**07/26/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-352-160621-1145-def-S2A		S16-32745	37.3	31.8	30.9	Clay Loam
P-352-160621-1145-def-S3A		S16-32746	20.6	32.7	46.8	Clay
P-352-160621-1145-def-S4A		S16-32747	26.4	29.5	44.1	Clay
P-352-160621-1145-def-S5A		S16-32748	48.4	11.5	40.1	Sandy Clay
P-352-160621-1145-def-S6A		S16-32749	36.7	21.6	41.7	Clay
P-010-160620-1315-mgw-S2A		S16-32751	64.3	17.2	18.5	Sandy Loam
P-010-160620-1315-mgw-S3A		S16-32752	45.4	25.1	29.5	Sandy Clay Loam
P-010-160620-1315-mgw-S4A		S16-32753	42.6	25.0	32.4	Clay Loam
P-010-160620-1315-mgw-S5A		S16-32754	43.3	22.9	33.8	Clay Loam
P-010-160620-1315-mgw-S6A		S16-32755	43.3	21.0	35.7	Clay Loam
P-010-160620-1315-mgw-S7A		S16-32756	41.4	20.7	37.9	Clay Loam

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DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/06/2016	**07/26/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-010-160620-1315-mgw-S8A		S16-32758	23.5	19.8	56.7	Clay
P-045-160614-1019-jcr-S2A		S16-32760	32.1	42.7	25.2	Loam
P-045-160614-1019-jcr-S3A		S16-32761	24.3	51.2	24.5	Silt Loam
P-045-160614-1019-jcr-S4A		S16-32762	27.0	45.4	27.6	Clay Loam
P-077-160617-1035-sdd-S2A		S16-32764	50.3	32.5	17.1	Loam
P-077-160617-1035-sdd-S3A		S16-32765	32.9	37.0	30.2	Clay Loam
P-077-160617-1035-sdd-S4A		S16-32766	44.7	33.5	21.9	Loam
P-077-160617-1035-sdd-S5A		S16-32767	32.8	34.5	32.7	Clay Loam
P-293-160606-1056-mel-S2A		S16-32769	5.5	42.0	52.4	Silty Clay
P-293-160606-1056-mel-S3A		S16-32770	61.8	28.1	10.1	Sandy Loam
P-293-160606-1056-mel-S4A		S16-32771	48.7	26.0	25.3	Sandy Clay Loam

PENNSTATE
1855

(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:		ADDITIONAL COPY TO:
DAN FENSTERMACHER RETTEW ASSOCIATES INC 3020 COLUMBIA AVE LANCASTER PA 17603		DUANE TRUAX RETTEW ASSOCIATES 3020 COLUMBIA AVE LANCASTER PA 17603
DATE RECEIVED	**DATE COMPLETE**	**COUNTY**
07/06/2016	**07/27/2016**	**Lancaster**

Particle Size Analysis

Customer ID	Serial Number	Lab ID	Sand %	Silt %	Clay %	Soil Textural Class
P-293-160606-1056-mel-S5A		S16-32772	60.1	16.9	23.0	Sandy Clay Loam
P-225A-160601-1130-jcr-S1A		S16-32773	41.7	33.4	24.9	Loam
P-225A-160601-1130-jcr-S2A		S16-32774	61.8	18.5	19.7	Sandy Loam
P-225A-160601-1130-jcr-S3A		S16-32775	48.6	25.1	26.3	Sandy Clay Loam

Attachment 10

ALS Environmental TOC and LOI Results

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156362**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

SAMPLE SUMMARY

Workorder: 2156362 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156362001	P-003-160620-1025-rll-S1B	Solid	6/20/2016 10:25	7/5/2016 13:19	Collected by Client
2156362002	P-003-160620-1025-rll-S2B	Solid	6/20/2016 10:25	7/5/2016 13:19	Collected by Client
2156362003	P-003-160620-1025-rll-S3B	Solid	6/20/2016 10:25	7/5/2016 13:19	Collected by Client
2156362004	P-003-160620-1025-rll-S4B	Solid	6/20/2016 10:25	7/5/2016 13:19	Collected by Client
2156362005	P-012-160620-1115-mgw-S1B	Solid	6/20/2016 11:15	7/5/2016 13:19	Collected by Client
2156362006	P-012-160620-1115-mgw-S2B	Solid	6/20/2016 11:15	7/5/2016 13:19	Collected by Client
2156362007	P-012-160620-1115-mgw-S3B	Solid	6/20/2016 11:15	7/5/2016 13:19	Collected by Client
2156362008	P-012-160620-1115-mgw-S4B	Solid	6/20/2016 11:15	7/5/2016 13:19	Collected by Client
2156362009	P-012-160620-1115-mgw-S5B	Solid	6/20/2016 11:15	7/5/2016 13:19	Collected by Client
2156362010	P-022-160614-1050-jsw-S1B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362011	P-022-160614-1050-jsw-S2B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362012	P-022-160614-1050-jsw-S3B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362013	P-022-160614-1050-jsw-S4B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362014	P-022-160614-1050-jsw-S5B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362015	P-022-160614-1050-jsw-S6B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362016	P-022-160614-1050-jsw-S7B	Solid	6/14/2016 10:50	7/5/2016 13:19	Collected by Client
2156362017	P-040-160615-1119-jcr-S1B	Solid	6/15/2016 11:19	7/5/2016 13:19	Collected by Client
2156362018	P-040-160615-1119-jcr-S2B	Solid	6/15/2016 11:19	7/5/2016 13:19	Collected by Client
2156362019	P-040-160615-1119-jcr-S3B	Solid	6/15/2016 11:19	7/5/2016 13:19	Collected by Client
2156362020	P-040-160615-1119-jcr-S4B	Solid	6/15/2016 11:19	7/5/2016 13:19	Collected by Client

SAMPLE SUMMARY

Workorder: 2156362 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

ALS Environmental

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID:	**2156362001**	Date Collected:	6/20/2016 10:25	Matrix:	Solid
Sample ID:	**P-003-160620-1025-rll-S1B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	55.8		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	53.6	3	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	374000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	44.2	1,2	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

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Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID:	**2156362002**	Date Collected:	6/20/2016 10:25	Matrix:	Solid
Sample ID:	**P-003-160620-1025-rll-S2B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	33.7		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	15.8	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	100000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	66.3	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362003** Date Collected: 6/20/2016 10:25 Matrix: Solid

Sample ID: **P-003-160620-1025-rll-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	19.1		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	5.0	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	8780		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	80.9	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362004** Date Collected: 6/20/2016 10:25 Matrix: Solid
Sample ID: **P-003-160620-1025-rll-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.1		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	3.4	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	2270		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	87.9	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362005** Date Collected: 6/20/2016 11:15 Matrix: Solid
Sample ID: **P-012-160620-1115-mgw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	57.6		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	96.9	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	484000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	42.4	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362006** Date Collected: 6/20/2016 11:15 Matrix: Solid
Sample ID: **P-012-160620-1115-mgw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	34.6		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	18.1	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	147000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	65.4	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362007** Date Collected: 6/20/2016 11:15 Matrix: Solid
Sample ID: **P-012-160620-1115-mgw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	34.0		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	16.4	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	92400		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	66.0	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID:	**2156362008**	Date Collected: 6/20/2016 11:15	Matrix: Solid
Sample ID:	**P-012-160620-1115-mgw-S4B**	Date Received: 7/5/2016 13:19	

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	25.8		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	8.7	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	49800		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	74.2	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362009** Date Collected: 6/20/2016 11:15 Matrix: Solid
Sample ID: **P-012-160620-1115-mgw-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	22.9		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	6.4	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	21600		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	77.1	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362010** Date Collected: 6/14/2016 10:50 Matrix: Solid
Sample ID: **P-022-160614-1050-jsw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	57.8		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	64.6	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	473000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	42.2	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID:	**2156362011**	Date Collected:	6/14/2016 10:50
Sample ID:	**P-022-160614-1050-jsw-S2B**	Date Received:	7/5/2016 13:19

Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	40.0		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	33.3	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	238000		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	60.0	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362012** Date Collected: 6/14/2016 10:50 Matrix: Solid
Sample ID: **P-022-160614-1050-jsw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	10.6		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	1.3	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	5540		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	89.4	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362013** Date Collected: 6/14/2016 10:50 Matrix: Solid

Sample ID: **P-022-160614-1050-jsw-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.9		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	13000		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	87.1	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362014** Date Collected: 6/14/2016 10:50 Matrix: Solid

Sample ID: **P-022-160614-1050-jsw-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.0		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	2230		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	85.0	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362015** Date Collected: 6/14/2016 10:50 Matrix: Solid

Sample ID: **P-022-160614-1050-jsw-S6B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.3		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	710		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	81.7	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental

34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362016** Date Collected: 6/14/2016 10:50 Matrix: Solid

Sample ID: **P-022-160614-1050-jsw-S7B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	19.1		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	6.0	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	1110		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	80.9	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID:	**2156362017**	Date Collected:	6/15/2016 11:19	Matrix:	Solid
Sample ID:	**P-040-160615-1119-jcr-S1B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	44.8		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	38.8	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	411000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	55.2	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362018** Date Collected: 6/15/2016 11:19 Matrix: Solid
Sample ID: **P-040-160615-1119-jcr-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.3		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	10.1	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	75700		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	78.7	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
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34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362019** Date Collected: 6/15/2016 11:19 Matrix: Solid
Sample ID: **P-040-160615-1119-jcr-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.5		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	7880		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	81.5	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156362 89962000

Lab ID: **2156362020** Date Collected: 6/15/2016 11:19 Matrix: Solid

Sample ID: **P-040-160615-1119-jcr-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.3		%	0.1	S2540G-11			7/8/16 13:58	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/8/16 13:58	SLC	A
Total Organic Carbon (TOC)	1790		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	84.7	1	%	0.1	S2540G-11			7/8/16 13:58	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156362001	1	P-003-160620-1025-rll-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362001	2	P-003-160620-1025-rll-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 8.3%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 47.9 and 44.1%.				
2156362001	3	P-003-160620-1025-rll-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362002	1	P-003-160620-1025-rll-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362002	2	P-003-160620-1025-rll-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362003	1	P-003-160620-1025-rll-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362003	2	P-003-160620-1025-rll-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362004	1	P-003-160620-1025-rll-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362004	2	P-003-160620-1025-rll-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362005	1	P-012-160620-1115-mgw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362005	2	P-012-160620-1115-mgw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362006	1	P-012-160620-1115-mgw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362006	2	P-012-160620-1115-mgw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362007	1	P-012-160620-1115-mgw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362007	2	P-012-160620-1115-mgw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362008	1	P-012-160620-1115-mgw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362008	2	P-012-160620-1115-mgw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362009	1	P-012-160620-1115-mgw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362009	2	P-012-160620-1115-mgw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362010	1	P-022-160614-1050-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362010	2	P-022-160614-1050-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156362 89962000

2156362011	1	P-022-160614-1050-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362011	2	P-022-160614-1050-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362012	1	P-022-160614-1050-jsw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362012	2	P-022-160614-1050-jsw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362013	1	P-022-160614-1050-jsw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362013	2	P-022-160614-1050-jsw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362014	1	P-022-160614-1050-jsw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362014	2	P-022-160614-1050-jsw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362015	1	P-022-160614-1050-jsw-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362015	2	P-022-160614-1050-jsw-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362016	1	P-022-160614-1050-jsw-S7B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362016	2	P-022-160614-1050-jsw-S7B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362017	1	P-040-160615-1119-jcr-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362017	2	P-040-160615-1119-jcr-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362018	1	P-040-160615-1119-jcr-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362018	2	P-040-160615-1119-jcr-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362019	1	P-040-160615-1119-jcr-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362019	2	P-040-160615-1119-jcr-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156362020	1	P-040-160615-1119-jcr-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156362020	2	P-040-160615-1119-jcr-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

Samples in 2 Bins.

ALS Environmental

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Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

8

COC # AL * 2 1 5 6 3 6 2 *

1 of 19

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-003-160620-1025-rll-S1B	6/20/2016	1025	G	SO	X	X
P-003-160620-1025-rll-S2B	6/20/2016	1025	G	SO	X	X
P-003-160620-1025-rll-S3B	6/20/2016	1025	G	SO	X	X
P-003-160620-1025-rll-S4B	6/20/2016	1025	G	SO	X	X
P-012-160620-1115-mgw-S1B	6/20/2016	1115	G	SO	X	X
P-012-160620-1115-mgw-S2B	6/20/2016	1115	G	SO	X	X
P-012-160620-1115-mgw-S3B	6/20/2016	1115	G	SO	X	X
P-012-160620-1115-mgw-S4B	6/20/2016	1115	G	SO	X	X
P-012-160620-1115-mgw-S5B	6/20/2016	1115	G	SO	X	X
P-022-160614-1050-jsw-S1B	6/14/2016	1050	G	SO	X	X

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.2 Therm ID: TH-352
No. of Coolers: ____

	Y	N	Initial
Custody Seals Present?		✓	JS
(If present) Seals Intact?			
Received on Ice?			
COC/Labels Complete/Accurate?			
Cont. in Good Cond.?			
Correct Containers?			
Correct Sample Volumes?			
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #: 7534 9325 8660
Sample/COC Comments

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	DFenstermacher Rettew	7/1/16	11:00	2	ALS	7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ] [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

*G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

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34 Dogwood Lane
Middletown, PA 17057
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ALS Environmental

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156362 — 2 of 19

ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-022-160614-1050-jsw-S2B	6/14/2016	1050	G	SO	X	X
P-022-160614-1050-jsw-S3B	6/14/2016	1050	G	SO	X	X
P-022-160614-1050-jsw-S4B	6/14/2016	1050	G	SO	X	X
P-022-160614-1050-jsw-S5B	6/14/2016	1050	G	SO	X	X
P-022-160614-1050-jsw-S6B	6/14/2016	1050	G	SO	X	X
P-022-160614-1050-jsw-S7B	6/14/2016	1050	G	SO	X	X
P-040-160615-1119-jcr-S1B	6/15/2016	1119	G	SO	X	X
P-040-160615-1119-jcr-S2B	6/15/2016	1119	G	SO	X	X
P-040-160615-1119-jcr-S3B	6/15/2016	1119	G	SO	X	X
P-040-160615-1119-jcr-S4B	6/15/2016	1119	G	SO	X	X

Enter Number of Containers Per Sample or Field Results Below.

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26.2 Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	JS
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. In Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D Fenstermacher Rettew	7/1/16	1100	2	[signature] ALS	7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Reportable to PADEP? Yes [ ]
PWSID #
EDDS: Format Type-

Special Processing: USACE [ ] Navy [ ]
Sample Disposal: Lab [ ] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV

*G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

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July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156363**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2156363 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156363001	P-040-160615-1119-jcr-S5B	Solid	6/15/2016 11:19	7/5/2016 13:19	Collected by Client
2156363002	P-063-160614-0950-rll-S1B	Solid	6/14/2016 09:50	7/5/2016 13:19	Collected by Client
2156363003	P-063-160614-0950-rll-S2B	Solid	6/14/2016 09:50	7/5/2016 13:19	Collected by Client
2156363004	P-063-160614-0950-rll-S3B	Solid	6/14/2016 09:50	7/5/2016 13:19	Collected by Client
2156363005	P-068-160614-1338-sdd-S1B	Solid	6/14/2016 13:38	7/5/2016 13:19	Collected by Client
2156363006	P-068-160614-1338-sdd-S2B	Solid	6/14/2016 13:38	7/5/2016 13:19	Collected by Client
2156363007	P-068-160614-1338-sdd-S3B	Solid	6/14/2016 13:38	7/5/2016 13:19	Collected by Client
2156363008	P-068-160614-1338-sdd-S4B	Solid	6/14/2016 13:38	7/5/2016 13:19	Collected by Client
2156363009	P-069-160614-1158-sdd-S1B	Solid	6/14/2016 11:58	7/5/2016 13:19	Collected by Client
2156363010	P-069-160614-1158-sdd-S2B	Solid	6/14/2016 11:58	7/5/2016 13:19	Collected by Client
2156363011	P-069-160614-1158-sdd-S3B	Solid	6/14/2016 11:58	7/5/2016 13:19	Collected by Client
2156363012	P-069-160614-1158-sdd-S4B	Solid	6/14/2016 11:58	7/5/2016 13:19	Collected by Client
2156363013	P-069-160614-1158-sdd-S5B	Solid	6/14/2016 11:58	7/5/2016 13:19	Collected by Client
2156363014	P-100-160609-1105-def-S1B	Solid	6/9/2016 11:05	7/5/2016 13:19	Collected by Client
2156363015	P-100-160609-1105-def-S2B	Solid	6/9/2016 11:05	7/5/2016 13:19	Collected by Client
2156363016	P-100-160609-1105-def-S3B	Solid	6/9/2016 11:05	7/5/2016 13:19	Collected by Client
2156363017	P-121-160616-0950-mgw-S1B	Solid	6/16/2016 09:50	7/5/2016 13:19	Collected by Client
2156363018	P-121-160616-0950-mgw-S2B	Solid	6/16/2016 09:50	7/5/2016 13:19	Collected by Client
2156363019	P-121-160616-0950-mgw-S3B	Solid	6/16/2016 09:50	7/5/2016 13:19	Collected by Client
2156363020	P-121-160616-0950-mgw-S4B	Solid	6/16/2016 09:50	7/5/2016 13:19	Collected by Client

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SAMPLE SUMMARY

Workorder: 2156363 89962000

Notes

-- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
-- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
-- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
-- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
-- The Chain of Custody document is included as part of this report.
-- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
-- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
-- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
-- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363001** Date Collected: 6/15/2016 11:19 Matrix: Solid

Sample ID: **P-040-160615-1119-jcr-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.0		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	2.5	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	1400		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	85.0	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363002** Date Collected: 6/14/2016 09:50 Matrix: Solid
Sample ID: **P-063-160614-0950-rll-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	26.8		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	11.1	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	49800		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	73.2	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363003** Date Collected: 6/14/2016 09:50 Matrix: Solid

Sample ID: **P-063-160614-0950-rll-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.0		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	3.5	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	2470		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	83.0	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363004** | Date Collected: 6/14/2016 09:50 | Matrix: Solid

Sample ID: **P-063-160614-0950-rll-S3B** | Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.7		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	2.7	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	1100		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	86.3	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363005** Date Collected: 6/14/2016 13:38 Matrix: Solid

Sample ID: **P-068-160614-1338-sdd-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	43.7		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	60.3	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	270000		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	56.3	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363006** Date Collected: 6/14/2016 13:38 Matrix: Solid

Sample ID: **P-068-160614-1338-sdd-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.7		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	8.8	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	62900		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	83.3	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363007** Date Collected: 6/14/2016 13:38 Matrix: Solid

Sample ID: **P-068-160614-1338-sdd-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	7.3		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	1.9	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	2280		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	92.7	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363008** Date Collected: 6/14/2016 13:38 Matrix: Solid

Sample ID: **P-068-160614-1338-sdd-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.1		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	2.7	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	4200		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	85.9	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363009** Date Collected: 6/14/2016 11:58 Matrix: Solid
Sample ID: **P-069-160614-1158-sdd-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	48.4		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	47.3	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	123000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	51.6	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363010** Date Collected: 6/14/2016 11:58 Matrix: Solid

Sample ID: **P-069-160614-1158-sdd-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	28.1		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	11.4	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	72000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	71.9	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363011**	Date Collected: 6/14/2016 11:58	Matrix:	Solid
Sample ID: **P-069-160614-1158-sdd-S3B**	Date Received: 7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.2		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	5.5	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	37600		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	82.8	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363012** Date Collected: 6/14/2016 11:58 Matrix: Solid
Sample ID: **P-069-160614-1158-sdd-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.0		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	2.2	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	1630		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	89.0	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363013**　　Date Collected: 6/14/2016 11:58　　Matrix: Solid

Sample ID: **P-069-160614-1158-sdd-S5B**　　Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.7		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	2.5	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	1530		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	90.3	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363014** Date Collected: 6/9/2016 11:05 Matrix: Solid

Sample ID: **P-100-160609-1105-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	67.0		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	93.0	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	522000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	33.0	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363015** Date Collected: 6/9/2016 11:05 Matrix: Solid

Sample ID: **P-100-160609-1105-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	62.2		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	56.5	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	292000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	37.8	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363016** Date Collected: 6/9/2016 11:05 Matrix: Solid

Sample ID: **P-100-160609-1105-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.3		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	12.2	3	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	17000	1	mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	83.7	2	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363017** Date Collected: 6/16/2016 09:50 Matrix: Solid

Sample ID: **P-121-160616-0950-mgw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	66.3		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	77.2	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	362000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	33.7	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363018** Date Collected: 6/16/2016 09:50 Matrix: Solid
Sample ID: **P-121-160616-0950-mgw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.6		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	33800		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	87.4	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363019** Date Collected: 6/16/2016 09:50 Matrix: Solid
Sample ID: **P-121-160616-0950-mgw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.8		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	6.0	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	18900		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	78.2	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156363 89962000

Lab ID: **2156363020**
Sample ID: **P-121-160616-0950-mgw-S4B**
Date Collected: 6/16/2016 09:50
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.5		%	0.1	S2540G-11			7/8/16 14:56	SLC	A
Solids, Total Volatile	4.4	2	%	1.0	S2540G-11			7/8/16 14:56	SLC	A
Total Organic Carbon (TOC)	13300		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	85.5	1	%	0.1	S2540G-11			7/8/16 14:56	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156363001	1	P-040-160615-1119-jcr-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363001	2	P-040-160615-1119-jcr-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363002	1	P-063-160614-0950-rll-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363002	2	P-063-160614-0950-rll-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363003	1	P-063-160614-0950-rll-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363003	2	P-063-160614-0950-rll-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363004	1	P-063-160614-0950-rll-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363004	2	P-063-160614-0950-rll-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363005	1	P-068-160614-1338-sdd-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363005	2	P-068-160614-1338-sdd-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363006	1	P-068-160614-1338-sdd-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363006	2	P-068-160614-1338-sdd-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363007	1	P-068-160614-1338-sdd-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363007	2	P-068-160614-1338-sdd-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363008	1	P-068-160614-1338-sdd-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363008	2	P-068-160614-1338-sdd-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363009	1	P-069-160614-1158-sdd-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363009	2	P-069-160614-1158-sdd-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363010	1	P-069-160614-1158-sdd-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363010	2	P-069-160614-1158-sdd-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363011	1	P-069-160614-1158-sdd-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363011	2	P-069-160614-1158-sdd-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156363 89962000

2156363012	1	P-069-160614-1158-sdd-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363012	2	P-069-160614-1158-sdd-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363013	1	P-069-160614-1158-sdd-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363013	2	P-069-160614-1158-sdd-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363014	1	P-100-160609-1105-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363014	2	P-100-160609-1105-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363015	1	P-100-160609-1105-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363015	2	P-100-160609-1105-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363016	1	P-100-160609-1105-def-S3B	SW846 9060A	Total Organic Carbon (TOC)
The recovery of the Matrix Spike (MS) associated to this analyte was outside of the established control limits.				
2156363016	2	P-100-160609-1105-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363016	3	P-100-160609-1105-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363017	1	P-121-160616-0950-mgw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363017	2	P-121-160616-0950-mgw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363018	1	P-121-160616-0950-mgw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363018	2	P-121-160616-0950-mgw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363019	1	P-121-160616-0950-mgw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363019	2	P-121-160616-0950-mgw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156363020	1	P-121-160616-0950-mgw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156363020	2	P-121-160616-0950-mgw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC

ALS (

* 2 1 5 6 3 6 3 *

3 of 19

Client Name: RETTEW Associates, Inc.

Address: 3020 Columbia Ave
Lancaster, PA 17603

Contact: Dan Fenstermacher or Duane Truax

Phone#: 412-275-2219 or 717-205-2228

Project Name/#: 89962000

Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.

Date Required: 13-Jul-16 Approved By:

Email? [X]-Y Dfenstermacher@rettew.com

Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)									Sample/COC Comments
P-040-160615-1119-jcr-S5B	6/15/2016	1119	G	SO	X	X									
P-063-160614-0950-rll-S1B	6/14/2016	950	G	SO	X	X									
P-063-160614-0950-rll-S2B	6/14/2016	950	G	SO	X	X									
P-063-160614-0950-rll-S3B	6/14/2016	950	G	SO	X	X									
P-068-160614-1338-sdd-S1B	6/14/2016	1338	G	SO	X	X									
P-068-160614-1338-sdd-S2B	6/14/2016	1338	G	SO	X	X									
P-068-160614-1338-sdd-S3B	6/14/2016	1338	G	SO	X	X									
P-068-160614-1338-sdd-S4B	6/14/2016	1338	G	SO	X	X									
P-069-160614-1158-sdd-S1B	6/14/2016	1158	G	SO	X	X									
P-069-160614-1158-sdd-S2B	6/14/2016	1158	G	SO	X	X									

Condition (Completed by Receiving Lab)

Cooler Temp: 2.6°C Therm ID: 352

No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(If present) Seals Intact?			
Received on Ice?		X	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?		✓	

Courier/Tracking #:

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME

REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 DFenstermacher : Rettew	7/1/16	1100	2 DS	7/5/16	1315
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV

Reportable to PADEP? Yes [ ]

PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

*G=Grab; C=Composite **Matrix - Al=Air; DW=Drinking Water; GW=Groundwater; Ol=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156363-3
4 of 19
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)								Sample/COC Comments
P-069-160614-1158-sdd-S3B	6/14/2016	1158	G	SO	X	X								
P-069-160614-1158-sdd-S4B	6/14/2016	1158	G	SO	X	X								
P-069-160614-1158-sdd-S5B	6/14/2016	1158	G	SO	X	X								
P-100-160609-1105-del-S1B	6/9/2016	1105	G	SO	X	X								
P-100-160609-1105-del-S2B	6/9/2016	1105	G	SO	X	X								
P-100-160609-1105-del-S3B	6/9/2016	1105	G	SO	X	X								
P-121-160616-0950-mgw-S1B	6/16/2016	950	G	SO	X	X								
P-121-160616-0950-mgw-S2B	6/16/2016	950	G	SO	X	X								
P-121-160616-0950-mgw-S3B	6/16/2016	950	G	SO	X	X								
P-121-160616-0950-mgw-S4B	6/16/2016	950	G	SO	X	X								

Enter Number of Containers Per Sample or Field Results Below.

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26°c Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	GS
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?			
Cont. in Good Cond.?			
Correct Containers?			
Correct Sample Volumes?			
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/16 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	Dfenstermacher Rettew	7/1/16	1100	2		7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV/VA

Reportable to PADEP? Yes [ ]
PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156364**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory’s NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental
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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2156364 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156364001	P-126-160615-1410-mgw-S1B	Solid	6/15/2016 14:10	7/5/2016 13:19	Collected by Client
2156364002	P-126-160615-1410-mgw-S2B	Solid	6/15/2016 14:10	7/5/2016 13:19	Collected by Client
2156364003	P-126-160615-1410-mgw-S3B	Solid	6/15/2016 14:10	7/5/2016 13:19	Collected by Client
2156364004	P-126-160615-1410-mgw-S4B	Solid	6/15/2016 14:10	7/5/2016 13:19	Collected by Client
2156364005	P-126-160615-1410-mgw-S5B	Solid	6/15/2016 14:10	7/5/2016 13:19	Collected by Client
2156364006	P-134-160615-1506-sdd-S1B	Solid	6/15/2016 15:06	7/5/2016 13:19	Collected by Client
2156364007	P-134-160615-1506-sdd-S2B	Solid	6/15/2016 15:06	7/5/2016 13:19	Collected by Client
2156364008	P-134-160615-1506-sdd-S3B	Solid	6/15/2016 15:06	7/5/2016 13:19	Collected by Client
2156364009	P-134-160615-1506-sdd-S4B	Solid	6/15/2016 15:06	7/5/2016 13:19	Collected by Client
2156364010	P-134-160615-1506-sdd-S5B	Solid	6/15/2016 15:06	7/5/2016 13:19	Collected by Client
2156364011	P-156-160606-1355-dat-S1B	Solid	6/6/2016 13:55	7/5/2016 13:19	Collected by Client
2156364012	P-156-160606-1355-dat-S2B	Solid	6/6/2016 13:55	7/5/2016 13:19	Collected by Client
2156364013	P-156-160606-1355-dat-S3B	Solid	6/6/2016 13:55	7/5/2016 13:19	Collected by Client
2156364014	P-156-160606-1355-dat-S4B	Solid	6/6/2016 13:55	7/5/2016 13:19	Collected by Client
2156364015	P-157-160606-1512-dat-S1B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156364016	P-157-160606-1512-dat-S2B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156364017	P-157-160606-1512-dat-S3B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156364018	P-157-160606-1512-dat-S4B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156364019	P-157-160606-1512-dat-S5B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156364020	P-157-160606-1512-dat-S6B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client

SAMPLE SUMMARY

Workorder: 2156364 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364001** Date Collected: 6/15/2016 14:10 Matrix: Solid
Sample ID: **P-126-160615-1410-mgw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	41.5		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	59.5	3	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	322000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	58.5	1,2	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID:	**2156364002**	Date Collected:	6/15/2016 14:10	Matrix:	Solid
Sample ID:	**P-126-160615-1410-mgw-S2B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	24.5		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	10.9	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	106000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	75.5	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364003**
Sample ID: **P-126-160615-1410-mgw-S3B**
Date Collected: 6/15/2016 14:10
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.2		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	4.6	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	14600		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	84.8	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364004** Date Collected: 6/15/2016 14:10 Matrix: Solid
Sample ID: **P-126-160615-1410-mgw-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.0		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	7330		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	86.0	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364005** Date Collected: 6/15/2016 14:10 Matrix: Solid
Sample ID: **P-126-160615-1410-mgw-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.4		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	3310		mg/kg	500	SW846 9060A			7/8/16 08:30	CF	A
Total Solids	85.6	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364006** Date Collected: 6/15/2016 15:06 Matrix: Solid

Sample ID: **P-134-160615-1506-sdd-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	58.8		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	78.2	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	388000		mg/kg	500	SW846 9060A			7/7/16 09:00	CF	A
Total Solids	41.2	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364007** Date Collected: 6/15/2016 15:06 Matrix: Solid

Sample ID: **P-134-160615-1506-sdd-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	36.2		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	18.4	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	113000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	63.8	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID:	**2156364008**	Date Collected:	6/15/2016 15:06	Matrix:	Solid
Sample ID:	**P-134-160615-1506-sdd-S3B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.3		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.8	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	5700		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	81.7	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364009** Date Collected: 6/15/2016 15:06 Matrix: Solid
Sample ID: **P-134-160615-1506-sdd-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.8		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.3	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	1720		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	86.2	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364010** Date Collected: 6/15/2016 15:06 Matrix: Solid

Sample ID: **P-134-160615-1506-sdd-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.3		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.1	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	1650		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	87.7	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364011** Date Collected: 6/6/2016 13:55 Matrix: Solid

Sample ID: **P-156-160606-1355-dat-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	75.6		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	80.2	3	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	373000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	24.4	1,2	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364012** Date Collected: 6/6/2016 13:55 Matrix: Solid
Sample ID: **P-156-160606-1355-dat-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	26.1		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	6.1	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	42000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	73.9	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364013** Date Collected: 6/6/2016 13:55 Matrix: Solid

Sample ID: **P-156-160606-1355-dat-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.3		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	1.7	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	2830		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	83.7	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID:	**2156364014**	Date Collected:	6/6/2016 13:55	Matrix:	Solid
Sample ID:	**P-156-160606-1355-dat-S4B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.1		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	1.5	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	1610	3	mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	84.9	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364015**
Sample ID: **P-157-160606-1512-dat-S1B**

Date Collected: 6/6/2016 15:12
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	72.4		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	78.0	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	355000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	27.6	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364016** Date Collected: 6/6/2016 15:12 Matrix: Solid

Sample ID: **P-157-160606-1512-dat-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	30.1		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	7.9	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	42800		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	69.9	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364017** Date Collected: 6/6/2016 15:12 Matrix: Solid
Sample ID: **P-157-160606-1512-dat-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.2		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	2.9	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	8340		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	81.8	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364018** Date Collected: 6/6/2016 15:12 Matrix: Solid
Sample ID: **P-157-160606-1512-dat-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.1		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	2.6	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	4370		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	84.9	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364019** Date Collected: 6/6/2016 15:12 Matrix: Solid

Sample ID: **P-157-160606-1512-dat-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	19.9		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.4	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	1540		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	80.1	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156364 89962000

Lab ID: **2156364020** Date Collected: 6/6/2016 15:12 Matrix: Solid
Sample ID: **P-157-160606-1512-dat-S6B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.1		%	0.1	S2540G-11			7/8/16 17:06	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/8/16 17:06	SLC	A
Total Organic Carbon (TOC)	2300		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	79.9	1	%	0.1	S2540G-11			7/8/16 17:06	SLC	A

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PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156364001	1	P-126-160615-1410-mgw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364001	2	P-126-160615-1410-mgw-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 17.8%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 69.9 and 58.5%.				
2156364001	3	P-126-160615-1410-mgw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364002	1	P-126-160615-1410-mgw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364002	2	P-126-160615-1410-mgw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364003	1	P-126-160615-1410-mgw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364003	2	P-126-160615-1410-mgw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364004	1	P-126-160615-1410-mgw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364004	2	P-126-160615-1410-mgw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364005	1	P-126-160615-1410-mgw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364005	2	P-126-160615-1410-mgw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364006	1	P-134-160615-1506-sdd-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364006	2	P-134-160615-1506-sdd-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364007	1	P-134-160615-1506-sdd-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364007	2	P-134-160615-1506-sdd-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364008	1	P-134-160615-1506-sdd-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364008	2	P-134-160615-1506-sdd-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364009	1	P-134-160615-1506-sdd-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364009	2	P-134-160615-1506-sdd-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364010	1	P-134-160615-1506-sdd-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364010	2	P-134-160615-1506-sdd-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156364 89962000

2156364011	1	P-156-160606-1355-dat-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364011	2	P-156-160606-1355-dat-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 16.5%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 28.8 and 24.2%.				
2156364011	3	P-156-160606-1355-dat-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364012	1	P-156-160606-1355-dat-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364012	2	P-156-160606-1355-dat-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364013	1	P-156-160606-1355-dat-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364013	2	P-156-160606-1355-dat-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364014	1	P-156-160606-1355-dat-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364014	2	P-156-160606-1355-dat-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364014	3	P-156-160606-1355-dat-S4B	SW846 9060A	Total Organic Carbon (TOC)
Due to sample matrix, an average of four individual injections were used to calculate the final result. No two injections met method criteria. JWB 7-17-16				
2156364015	1	P-157-160606-1512-dat-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364015	2	P-157-160606-1512-dat-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364016	1	P-157-160606-1512-dat-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364016	2	P-157-160606-1512-dat-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364017	1	P-157-160606-1512-dat-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364017	2	P-157-160606-1512-dat-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364018	1	P-157-160606-1512-dat-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364018	2	P-157-160606-1512-dat-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156364019	1	P-157-160606-1512-dat-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364019	2	P-157-160606-1512-dat-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156364 89962000

2156364020	1	P-157-160606-1512-dat-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156364020	2	P-157-160606-1512-dat-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC

ALS

2156364

5 of 19

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.

Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6 Therm ID: TM-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	DS
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-126-160615-1410-mgw-S1B	6/15/2016	1410	G	SO	X	X	
P-126-160615-1410-mgw-S2B	6/15/2016	1410	G	SO	X	X	
P-126-160615-1410-mgw-S3B	6/15/2016	1410	G	SO	X	X	
P-126-160615-1410-mgw-S4B	6/15/2016	1410	G	SO	X	X	
P-126-160615-1410-mgw-S5B	6/15/2016	1410	G	SO	X	X	
P-134-160615-1506-sdd-S1B	6/15/2016	1506	G	SO	X	X	
P-134-160615-1506-sdd-S2B	6/15/2016	1506	G	SO	X	X	
P-134-160615-1506-sdd-S3B	6/15/2016	1506	G	SO	X	X	
P-134-160615-1506-sdd-S4B	6/15/2016	1506	G	SO	X	X	
P-134-160615-1506-sdd-S5B	6/15/2016	1506	G	SO	X	X	

ALS Field Services: __Pickup __Labor
__Composite Sampling __Rental Equipment
__Other:

Project Comments:

LOGGED BY(signature): DATE 7/1/16 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 DFenstermacher Rettew	7/1/16	1100	2 ALS	7/1/16	1319
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

Reportable to PADEP? Yes [ ]
PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

*G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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ALS Environmental

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F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 21Sl03Z4 | 6 of 19
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

ANALYSES/METHOD REQUESTED (Container Type / Container Size / Preservative)

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-156-160606-1355-dat-S1B	6/6/2016	1355	G	SO	X	X	
P-156-160606-1355-dat-S2B	6/6/2016	1355	G	SO	X	X	
P-156-160606-1355-dat-S3B	6/6/2016	1355	G	SO	X	X	
P-156-160606-1355-dat-S4B	6/6/2016	1355	G	SO	X	X	
P-157-160606-1512-dat-S1B	6/6/2016	1512	G	SO	X	X	
P-157-160606-1512-dat-S2B	6/6/2016	1512	G	SO	X	X	
P-157-160606-1512-dat-S3B	6/6/2016	1512	G	SO	X	X	
P-157-160606-1512-dat-S4B	6/6/2016	1512	G	SO	X	X	
P-157-160606-1512-dat-S5B	6/6/2016	1512	G	SO	X	X	
P-157-160606-1512-dat-S6B	6/6/2016	1512	G	SO	X	X	

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26.2 Therm ID: TH-352
No. of Coolers: Y N Initial
Custody Seals Present? ✓ CR
(if present) Seals Intact?
Received on Ice? ✓
COC/Labels Complete/Accurate? ✓
Cont. in Good Cond.? ✓
Correct Containers? ✓
Correct Sample Volumes? ✓
Correct Preservation? ✓
Headspace/Volatiles?
Courier/Tracking #:

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	DFenstm Rettew	7/1/16	1100	2	ALS	7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ] PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156365**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

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SAMPLE SUMMARY

Workorder: 2156365 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156365001	P-157-160606-1512-dat-S7B	Solid	6/6/2016 15:12	7/5/2016 13:19	Collected by Client
2156365002	P-162-160606-1040-jsw-S1B	Solid	6/6/2016 10:40	7/5/2016 13:19	Collected by Client
2156365003	P-162-160606-1040-jsw-S2B	Solid	6/6/2016 10:40	7/5/2016 13:19	Collected by Client
2156365004	P-162-160606-1040-jsw-SA3	Solid	6/6/2016 10:40	7/5/2016 13:19	Collected by Client
2156365005	P-162-160606-1040-jsw-SA4	Solid	6/6/2016 10:40	7/5/2016 13:19	Collected by Client
2156365006	P-162-160606-1040-jsw-SA5	Solid	6/6/2016 10:40	7/5/2016 13:19	Collected by Client
2156365007	P-170-160620-1122-def-S1B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365008	P-170-160620-1122-def-S2B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365009	P-170-160620-1122-def-S3B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365010	P-170-160620-1122-def-S4B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365011	P-170-160620-1122-def-S5B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365012	P-170-160620-1122-def-S6B	Solid	6/20/2016 11:22	7/5/2016 13:19	Collected by Client
2156365013	P-173-160620-1112-def-S1B	Solid	6/20/2016 11:12	7/5/2016 13:19	Collected by Client
2156365014	P-173-160620-1112-def-S2B	Solid	6/20/2016 11:12	7/5/2016 13:19	Collected by Client
2156365015	P-173-160620-1112-def-S3B	Solid	6/20/2016 11:12	7/5/2016 13:19	Collected by Client
2156365016	P-173-160620-1112-def-S4B	Solid	6/20/2016 11:12	7/5/2016 13:19	Collected by Client
2156365017	P-176-160621-1155-rll-S1B	Solid	6/21/2016 11:55	7/5/2016 13:19	Collected by Client
2156365018	P-176-160621-1155-rll-S2B	Solid	6/21/2016 11:55	7/5/2016 13:19	Collected by Client
2156365019	P-176-160621-1155-rll-S3B	Solid	6/21/2016 11:55	7/5/2016 13:19	Collected by Client
2156365020	P-176-160621-1155-rll-S4B	Solid	6/21/2016 11:55	7/5/2016 13:19	Collected by Client

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SAMPLE SUMMARY

Workorder: 2156365 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365001** Date Collected: 6/6/2016 15:12 Matrix: Solid
Sample ID: **P-157-160606-1512-dat-S7B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.3		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	3.9	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	2320		mg/kg	500	SW846 9060A			7/15/16 11:30	CF	A
Total Solids	78.7	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365002** Date Collected: 6/6/2016 10:40 Matrix: Solid

Sample ID: **P-162-160606-1040-jsw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	74.2		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	84.2	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	501000		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	25.8	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365003** Date Collected: 6/6/2016 10:40 Matrix: Solid

Sample ID: **P-162-160606-1040-jsw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	29.8		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	9.5	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	42500		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	70.2	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

Brad W. Kintzer
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Project Coordinator

ALS Environmental

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365004** Date Collected: 6/6/2016 10:40 Matrix: Solid

Sample ID: **P-162-160606-1040-jsw-SA3** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.6		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	5.7	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	12600		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	78.4	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365005** Date Collected: 6/6/2016 10:40 Matrix: Solid

Sample ID: **P-162-160606-1040-jsw-SA4** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.0		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	3.5	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	1100		mg/kg	500	SW846 9060A			7/11/16 15:00	CF	A
Total Solids	82.0	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365006** Date Collected: 6/6/2016 10:40 Matrix: Solid

Sample ID: **P-162-160606-1040-jsw-SA5** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.1		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	3.0	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	670		mg/kg	500	SW846 9060A			7/15/16 11:30	CF	A
Total Solids	85.9	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365007** Date Collected: 6/20/2016 11:22 Matrix: Solid

Sample ID: **P-170-160620-1122-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	61.1		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	95.8	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	507000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	38.9	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365008** Date Collected: 6/20/2016 11:22 Matrix: Solid

Sample ID: **P-170-160620-1122-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	55.3		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	56.5	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	264000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	44.7	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365009** Date Collected: 6/20/2016 11:22 Matrix: Solid

Sample ID: **P-170-160620-1122-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.9		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	14700		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	88.1	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365010** Date Collected: 6/20/2016 11:22 Matrix: Solid
Sample ID: **P-170-160620-1122-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.4		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	4.7	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	21300		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	84.6	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365011**	Date Collected: 6/20/2016 11:22	Matrix: Solid	
Sample ID: **P-170-160620-1122-def-S5B**	Date Received: 7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.2		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	3050		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	88.8	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365012**
Sample ID: **P-170-160620-1122-def-S6B**
Date Collected: 6/20/2016 11:22
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.8		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	1.7	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	2340		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	90.2	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365013** Date Collected: 6/20/2016 11:12 Matrix: Solid
Sample ID: **P-173-160620-1112-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	45.2		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	76.3	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	371000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	54.8	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365014**
Sample ID: **P-173-160620-1112-def-S2B**

Date Collected: 6/20/2016 11:12
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.1		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	9.0	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	48400		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	78.9	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365015** Date Collected: 6/20/2016 11:12 Matrix: Solid
Sample ID: **P-173-160620-1112-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.5		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	8220		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	85.5	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365016** Date Collected: 6/20/2016 11:12 Matrix: Solid
Sample ID: **P-173-160620-1112-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	19.0		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	5.7	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	6020		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	81.0	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365017** Date Collected: 6/21/2016 11:55 Matrix: Solid
Sample ID: **P-176-160621-1155-rll-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	31.4		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	74.7	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	389000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	68.6	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365018** Date Collected: 6/21/2016 11:55 Matrix: Solid
Sample ID: **P-176-160621-1155-rII-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	29.1		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	12.2	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	57700		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	70.9	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365019** | Date Collected: 6/21/2016 11:55 | Matrix: Solid

Sample ID: **P-176-160621-1155-rll-S3B** | Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.5		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	1.0	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	1080		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	87.5	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156365 89962000

Lab ID: **2156365020** Date Collected: 6/21/2016 11:55 Matrix: Solid

Sample ID: **P-176-160621-1155-rll-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	27.4		%	0.1	S2540G-11			7/8/16 19:06	SLC	A
Solids, Total Volatile	7.0	2	%	1.0	S2540G-11			7/8/16 19:06	SLC	A
Total Organic Carbon (TOC)	2220		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	72.6	1	%	0.1	S2540G-11			7/8/16 19:06	SLC	A

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PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156365001	1	P-157-160606-1512-dat-S7B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365001	2	P-157-160606-1512-dat-S7B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365002	1	P-162-160606-1040-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365002	2	P-162-160606-1040-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365003	1	P-162-160606-1040-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365003	2	P-162-160606-1040-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365004	1	P-162-160606-1040-jsw-SA3	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365004	2	P-162-160606-1040-jsw-SA3	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365005	1	P-162-160606-1040-jsw-SA4	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365005	2	P-162-160606-1040-jsw-SA4	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365006	1	P-162-160606-1040-jsw-SA5	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365006	2	P-162-160606-1040-jsw-SA5	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365007	1	P-170-160620-1122-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365007	2	P-170-160620-1122-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365008	1	P-170-160620-1122-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365008	2	P-170-160620-1122-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365009	1	P-170-160620-1122-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365009	2	P-170-160620-1122-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365010	1	P-170-160620-1122-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365010	2	P-170-160620-1122-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365011	1	P-170-160620-1122-def-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365011	2	P-170-160620-1122-def-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156365 89962000

2156365012	1	P-170-160620-1122-def-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365012	2	P-170-160620-1122-def-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365013	1	P-173-160620-1112-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365013	2	P-173-160620-1112-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365014	1	P-173-160620-1112-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365014	2	P-173-160620-1112-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365015	1	P-173-160620-1112-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365015	2	P-173-160620-1112-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365016	1	P-173-160620-1112-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365016	2	P-173-160620-1112-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365017	1	P-176-160621-1155-rll-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365017	2	P-176-160621-1155-rll-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365018	1	P-176-160621-1155-rll-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365018	2	P-176-160621-1155-rll-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365019	1	P-176-160621-1155-rll-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365019	2	P-176-160621-1155-rll-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156365020	1	P-176-160621-1155-rll-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156365020	2	P-176-160621-1155-rll-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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CHAIN OF CUSTODY/ ~~REQUEST FOR ANALYSIS~~

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

* 2 1 5 6 3 6 5 *

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6° Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

ANALYSES/METHOD REQUESTED — Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-157-160606-1512-dat-S7B	6/6/2016	1512	G	SO	X	X	
P-162-160606-1040-jsw-S1B	6/6/2016	1040	G	SO	X	X	
P-162-160606-1040-jsw-S2B	6/6/2016	1040	G	SO	X	X	
P-162-160606-1040-jsw-SA3	6/6/2016	1040	G	SO	X	X	
P-162-160606-1040-jsw-SA4	6/6/2016	1040	G	SO	X	X	
P-162-160606-1040-jsw-SA5	6/6/2016	1040	G	SO	X	X	
P-170-160620-1122-def-S1B	6/20/2016	1122	G	SO	X	X	
P-170-160620-1122-def-S2B	6/20/2016	1122	G	SO	X	X	
P-170-160620-1122-def-S3B	6/20/2016	1122	G	SO	X	X	ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:
P-170-160620-1122-def-S4B	6/20/2016	1122	G	SO	X	X	

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 D. Fenstermacher Rettew	7/1/16	1100	2 ALS	7/5/16	1319
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 21560365 | 8 of 19
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

ANALYSES/METHOD REQUESTED

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-170-160620-1122-def-S5B	6/20/2016	1122	G	SO	X	X
P-170-160620-1122-def-S6B	6/20/2016	1122	G	SO	X	X
P-173-160620-1112-def-S1B	6/20/2016	1112	G	SO	X	X
P-173-160620-1112-def-S2B	6/20/2016	1112	G	SO	X	X
P-173-160620-1112-def-S3B	6/20/2016	1112	G	SO	X	X
P-173-160620-1112-def-S4B	6/20/2016	1112	G	SO	X	X
P-176-160621-1155-rll-S1B	6/21/2016	1155	G	SO	X	X
P-176-160621-1155-rll-S2B	6/21/2016	1155	G	SO	X	X
P-176-160621-1155-rll-S3B	6/21/2016	1155	G	SO	X	X
P-176-160621-1155-rll-S4B	6/21/2016	1155	G	SO	X	X

Enter Number of Containers Per Sample or Field Results Below.

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6°C Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(if present) Seals Intact?			
Received on Ice?			
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:
Sample/COC Comments

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:
LOGGED BY(signature): DATE 7/6
REVIEWED BY(signature):

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D. Fenstermacher Rettew	7/1/16	1100	2	ALS	7/1/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Reportable to PADEP? Yes [ ]
PWSID #
EDDS: Format Type-

Special Processing: USACE [ ] Navy [ ] [ ]
Sample Disposal: Lab [ ] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156366**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory’s NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

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SAMPLE SUMMARY

Workorder: 2156366 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156366001	P-187-160607-1427-jsw-S1B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156366002	P-187-160607-1427-jsw-S2B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156366003	P-187-160607-1427-jsw-S3B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156366004	P-215-160602-1037-jsw-S1B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366005	P-215-160602-1037-jsw-S2B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366006	P-215-160602-1037-jsw-S3B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366007	P-215-160602-1037-jsw-S4B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366008	P-215-160602-1037-jsw-S5B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366009	P-215-160602-1037-jsw-S6B	Solid	6/2/2016 10:37	7/5/2016 13:19	Collected by Client
2156366010	P-222-160607-1055-dat-S1B	Solid	6/7/2016 10:55	7/5/2016 13:19	Collected by Client
2156366011	P-222-160607-1055-dat-S2B	Solid	6/7/2016 10:25	7/5/2016 13:19	Collected by Client
2156366012	P-222-160607-1055-dat-S3B	Solid	6/7/2016 10:25	7/5/2016 13:19	Collected by Client
2156366013	P-222-160607-1055-dat-S4B	Solid	6/7/2016 10:25	7/5/2016 13:19	Collected by Client
2156366014	P-222-160607-1055-dat-S5B	Solid	6/7/2016 10:25	7/5/2016 13:19	Collected by Client
2156366015	P-225-160601-1130-mel-S1B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156366016	P-225-160601-1130-mel-S2B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156366017	P-225-160601-1130-mel-S3B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156366018	P-225-160601-1130-mel-S4B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156366019	P-225-160601-1130-mel-S5B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156366020	P-225-160601-1130-mel-S6B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client

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SAMPLE SUMMARY

Workorder: 2156366 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366001** Date Collected: 6/7/2016 14:27 Matrix: Solid
Sample ID: **P-187-160607-1427-jsw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	55.5		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	52.5	3	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	311000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	44.5	1,2	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366002** Date Collected: 6/7/2016 14:27 Matrix: Solid

Sample ID: **P-187-160607-1427-jsw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.6		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	9.4	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	60300		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	79.4	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366003** Date Collected: 6/7/2016 14:27 Matrix: Solid

Sample ID: **P-187-160607-1427-jsw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.2		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	5.1	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	14600		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	87.8	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID:	**2156366004**	Date Collected:	6/2/2016 10:37	Matrix:	Solid
Sample ID:	**P-215-160602-1037-jsw-S1B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	66.7		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	82.7	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	505000		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	33.3	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366005** Date Collected: 6/2/2016 10:37 Matrix: Solid
Sample ID: **P-215-160602-1037-jsw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.0		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	35800		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	80.0	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366006** Date Collected: 6/2/2016 10:37 Matrix: Solid
Sample ID: **P-215-160602-1037-jsw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	22.9		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	6.9	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	39900		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	77.1	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366007** Date Collected: 6/2/2016 10:37 Matrix: Solid

Sample ID: **P-215-160602-1037-jsw-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	19.8		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	13500		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	80.2	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366008**　　Date Collected: 6/2/2016 10:37　　Matrix: Solid

Sample ID: **P-215-160602-1037-jsw-S5B**　　Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.1		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	2.6	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	3700		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	83.9	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental
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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366009** Date Collected: 6/2/2016 10:37 Matrix: Solid

Sample ID: **P-215-160602-1037-jsw-S6B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.7		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	1.1	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	ND		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	88.3	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366010** Date Collected: 6/7/2016 10:55 Matrix: Solid
Sample ID: **P-222-160607-1055-dat-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	31.4		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	16.0	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	183000		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	68.6	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366011** Date Collected: 6/7/2016 10:25 Matrix: Solid

Sample ID: **P-222-160607-1055-dat-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.6		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	5.4	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	20300		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	82.4	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366012** Date Collected: 6/7/2016 10:25 Matrix: Solid

Sample ID: **P-222-160607-1055-dat-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.6		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.5	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	5660		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	82.4	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366013** Date Collected: 6/7/2016 10:25 Matrix: Solid
Sample ID: **P-222-160607-1055-dat-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.7		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	2790		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	85.3	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Mr. Brad W Kintzer
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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366014** Date Collected: 6/7/2016 10:25 Matrix: Solid

Sample ID: **P-222-160607-1055-dat-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.6		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	1830		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	84.4	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366015** Date Collected: 6/1/2016 11:30 Matrix: Solid

Sample ID: **P-225-160601-1130-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	29.1		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	8.6	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	34100		mg/kg	500	SW846 9060A			7/12/16 04:00	CF	A
Total Solids	70.9	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID:	**2156366016**	Date Collected:	6/1/2016 11:30	Matrix:	Solid
Sample ID:	**P-225-160601-1130-mel-S2B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.2		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	3960		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	81.8	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID:	**2156366017**	Date Collected:	6/1/2016 11:30
Sample ID:	**P-225-160601-1130-mel-S3B**	Date Received:	7/5/2016 13:19

Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.7		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	1740		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	90.3	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Brad W. Kintzer

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Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366018** Date Collected: 6/1/2016 11:30 Matrix: Solid
Sample ID: **P-225-160601-1130-mel-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.3		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.4	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	3260		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	82.7	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Mr. Brad W Kintzer
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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366019** Date Collected: 6/1/2016 11:30 Matrix: Solid

Sample ID: **P-225-160601-1130-mel-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.1		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	1910		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	79.9	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156366 89962000

Lab ID: **2156366020** Date Collected: 6/1/2016 11:30 Matrix: Solid

Sample ID: **P-225-160601-1130-mel-S6B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.1		%	0.1	S2540G-11			7/11/16 12:36	SLC	A
Solids, Total Volatile	3.9	2	%	1.0	S2540G-11			7/11/16 12:36	SLC	A
Total Organic Carbon (TOC)	2070		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	79.9	1	%	0.1	S2540G-11			7/11/16 12:36	SLC	A

Mr. Brad W Kintzer
Project Coordinator

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156366001	1	P-187-160607-1427-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366001	2	P-187-160607-1427-jsw-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 12.3%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 50.3 and 44.5%.				
2156366001	3	P-187-160607-1427-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366002	1	P-187-160607-1427-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366002	2	P-187-160607-1427-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366003	1	P-187-160607-1427-jsw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366003	2	P-187-160607-1427-jsw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366004	1	P-215-160602-1037-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366004	2	P-215-160602-1037-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366005	1	P-215-160602-1037-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366005	2	P-215-160602-1037-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366006	1	P-215-160602-1037-jsw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366006	2	P-215-160602-1037-jsw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366007	1	P-215-160602-1037-jsw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366007	2	P-215-160602-1037-jsw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366008	1	P-215-160602-1037-jsw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366008	2	P-215-160602-1037-jsw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366009	1	P-215-160602-1037-jsw-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366009	2	P-215-160602-1037-jsw-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366010	1	P-222-160607-1055-dat-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366010	2	P-222-160607-1055-dat-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156366 89962000

2156366011	1	P-222-160607-1055-dat-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366011	2	P-222-160607-1055-dat-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366012	1	P-222-160607-1055-dat-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366012	2	P-222-160607-1055-dat-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366013	1	P-222-160607-1055-dat-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366013	2	P-222-160607-1055-dat-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366014	1	P-222-160607-1055-dat-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366014	2	P-222-160607-1055-dat-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366015	1	P-225-160601-1130-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366015	2	P-225-160601-1130-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366016	1	P-225-160601-1130-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366016	2	P-225-160601-1130-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366017	1	P-225-160601-1130-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366017	2	P-225-160601-1130-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366018	1	P-225-160601-1130-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366018	2	P-225-160601-1130-mel-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366019	1	P-225-160601-1130-mel-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366019	2	P-225-160601-1130-mel-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156366020	1	P-225-160601-1130-mel-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156366020	2	P-225-160601-1130-mel-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26.2 Therm ID: TM-352
No. of Coolers: ______ (Y / N / Initial)
Custody Seals Present? ✓ N
(if present) Seals Intact?
Received on Ice? ✓ Y
COC/Labels Complete/Accurate? ✓ Y
Cont. in Good Cond.? ✓ Y
Correct Containers? ✓ Y
Correct Sample Volumes? ✓ Y
Correct Preservation? ✓ Y
Headspace/Volatiles?
Courier/Tracking #:

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-187-160607-1427-jsw-S1B	6/7/2016	1427	G	SO	X	X	
P-187-160607-1427-jsw-S2B	6/7/2016	1427	G	SO	X	X	
P-187-160607-1427-jsw-S3B	6/7/2016	1427	G	SO	X	X	
P-215-160602-1037-jsw-S1B	6/2/2016	1037	G	SO	X	X	
P-215-160602-1037-jsw-S2B	6/2/2016	1037	G	SO	X	X	
P-215-160602-1037-jsw-S3B	6/2/2016	1037	G	SO	X	X	
P-215-160602-1037-jsw-S4B	6/2/2016	1037	G	SO	X	X	
P-215-160602-1037-jsw-S5B	6/2/2016	1037	G	SO	X	X	
P-215-160602-1037-jsw-S6B	6/2/2016	1037	G	SO	X	X	
P-222-160607-1055-dat-S1B	6/7/2016	1055	G	SO	X	X	

Enter Number of Containers Per Sample or Field Results Below.

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D Fenstermacher Rettew	7/1/16	1100	2	ALS	7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ] [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ]
Sample Disposal: Lab [ ] Special [ ]
PWSID #
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air, DW=Drinking Water, GW=Groundwater, OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

ALS Environmental

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Middletown, PA 17057
P. 717-944-5541
F.717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156326
10 of 19
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-222-160607-1055-dat-S2B	6/7/2016	1025	G	SO	X	X
P-222-160607-1055-dat-S3B	6/7/2016	1025	G	SO	X	X
P-222-160607-1055-dat-S4B	6/7/2016	1025	G	SO	X	X
P-222-160607-1055-dat-S5B	6/7/2016	1025	G	SO	X	X
P-225-160601-1130-mel-S1B	6/1/2016	1130	G	SO	X	X
P-225-160601-1130-mel-S2B	6/1/2016	1130	G	SO	X	X
P-225-160601-1130-mel-S3B	6/1/2016	1130	G	SO	X	X
P-225-160601-1130-mel-S4B	6/1/2016	1130	G	SO	X	X
P-225-160601-1130-mel-S5B	6/1/2016	1130	G	SO	X	X
P-225-160601-1130-mel-S6B	6/1/2016	1130	G	SO	X	X

Enter Number of Containers Per Sample or Field Results Below.

Receipt Information (completed by Receiving Lab)
Cooler Temp: 3.2 Therm ID: TA-35
No. of Coolers: ____ Y N Initial

	Y	N
Custody Seals Present?		✓
(if present) Seals Intact?		
Received on Ice?		✓
COC/Labels Complete/Accurate?	✓	
Cont. in Good Cond.?	✓	
Correct Containers?	✓	
Correct Sample Volumes?	✓	
Correct Preservation?	✓	
Headspace/Volatiles?		

Courier/Tracking #:
Sample/COC Comments

ALS Field Services: _Pickup _Labor
_Composite Sampling _Rental Equipment
_Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D.Fenstermacher Rettew	7/1/16	1100	2	ALS	7/5/16	1310
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Reportable to PADEP? Yes [ ]
PWSID #
EDDS: Format Type-

Special Processing: USACE [ ] Navy [ ] [ ]
Sample Disposal: Lab [ ] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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Rev 10/14

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July 21, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Revised Report - 7/21/2016 9:59:53 AM - See workorder comment section for explanation

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156367**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

SAMPLE SUMMARY

Workorder: 2156367 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156367001	P-225B-160601-1312-sdd-S1B	Solid	6/1/2016 13:12	7/5/2016 13:19	Collected by Client
2156367002	P-225B-160601-1312-sdd-S2B	Solid	6/1/2016 13:12	7/5/2016 13:19	Collected by Client
2156367003	P-225B-160601-1312-sdd-S3B	Solid	6/1/2016 13:12	7/5/2016 13:19	Collected by Client
2156367004	P-225B-160601-1312-sdd-S4B	Solid	6/1/2016 13:12	7/5/2016 13:19	Collected by Client
2156367005	P-227-160601-1500-jsw-S1B	Solid	6/1/2016 15:00	7/5/2016 13:19	Collected by Client
2156367006	P-227-160601-1500-jsw-S2B	Solid	6/1/2016 15:00	7/5/2016 13:19	Collected by Client
2156367007	P-227-160601-1500-jsw-S3B	Solid	6/1/2016 15:00	7/5/2016 13:19	Collected by Client
2156367008	P-239-160607-1427-def-S1B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156367009	P-239-160607-1427-def-S2B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156367010	P-239-160607-1427-def-S3B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156367011	P-239-160607-1427-def-S4B	Solid	6/7/2016 14:27	7/5/2016 13:19	Collected by Client
2156367012	P-239A-160607-1430-def-S1B	Solid	6/7/2016 14:30	7/5/2016 13:19	Collected by Client
2156367013	P-239A-160607-1430-def-S2B	Solid	6/7/2016 14:30	7/5/2016 13:19	Collected by Client
2156367014	P-239A-160607-1430-def-S3B	Solid	6/7/2016 14:30	7/5/2016 13:19	Collected by Client
2156367015	P-239A-160607-1430-def-S4B	Solid	6/7/2016 14:30	7/5/2016 13:19	Collected by Client
2156367016	P-239A-160607-1430-def-S5B	Solid	6/7/2016 14:30	7/5/2016 13:19	Collected by Client
2156367017	P-253-160608-0950-mel-S1B	Solid	6/8/2016 09:50	7/5/2016 13:19	Collected by Client
2156367018	P-253-160608-0950-mel-S2B	Solid	6/8/2016 09:50	7/5/2016 13:19	Collected by Client
2156367019	P-253-160608-0950-mel-S3B	Solid	6/8/2016 09:50	7/5/2016 13:19	Collected by Client
2156367020	P-253-160608-0950-mel-S4B	Solid	6/8/2016 09:50	7/5/2016 13:19	Collected by Client
2156367021	P-227-160601-1500-jsw-S4B	Solid	6/1/2016 15:00	7/5/2016 13:19	Collected by Client

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SAMPLE SUMMARY

Workorder: 2156367 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

PROJECT SUMMARY

Workorder: 2156367 89962000

Workorder Comments

This report was modified on 7/21/16 correct the Sample ID on 021. BWK

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367001** Date Collected: 6/1/2016 13:12 Matrix: Solid

Sample ID: **P-225B-160601-1312-sdd-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	50.0		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	21.8	3	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	140000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	50.0	1,2	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367002** Date Collected: 6/1/2016 13:12 Matrix: Solid

Sample ID: **P-225B-160601-1312-sdd-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.2		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	3.4	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	3990		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	82.8	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer
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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367003** Date Collected: 6/1/2016 13:12 Matrix: Solid

Sample ID: **P-225B-160601-1312-sdd-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.7		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	2070		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	83.3	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367004** Date Collected: 6/1/2016 13:12 Matrix: Solid

Sample ID: **P-225B-160601-1312-sdd-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.2		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	2.9	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	790		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	84.8	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367005** Date Collected: 6/1/2016 15:00 Matrix: Solid

Sample ID: **P-227-160601-1500-jsw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	56.8		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	59.1	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	233000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	43.2	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367006** Date Collected: 6/1/2016 15:00 Matrix: Solid

Sample ID: **P-227-160601-1500-jsw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	36.4		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	32.5	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	119000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	63.6	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367007** Date Collected: 6/1/2016 15:00 Matrix: Solid
Sample ID: **P-227-160601-1500-jsw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.8		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	5.9	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	20000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	84.2	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer
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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367008** Date Collected: 6/7/2016 14:27 Matrix: Solid
Sample ID: **P-239-160607-1427-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	34.0		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	13.8	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	70900		mg/kg	500	SW846 9060A			7/15/16 11:30	CF	A
Total Solids	66.0	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer
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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367009** Date Collected: 6/7/2016 14:27 Matrix: Solid

Sample ID: **P-239-160607-1427-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.8		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	4.6	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	5050		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	85.2	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367010**
Sample ID: **P-239-160607-1427-def-S3B**

Date Collected: 6/7/2016 14:27
Date Received: 7/5/2016 13:19

Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	8.8		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	3.9	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	980		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	91.2	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367011** Date Collected: 6/7/2016 14:27 Matrix: Solid
Sample ID: **P-239-160607-1427-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.9		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	3.8	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	24800	3	mg/kg	500	SW846 9060A			7/15/16 11:30	CF	A
Total Solids	88.1	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer
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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367012** Date Collected: 6/7/2016 14:30 Matrix: Solid

Sample ID: **P-239A-160607-1430-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	28.5		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	10.6	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	69900		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	71.5	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367013** Date Collected: 6/7/2016 14:30 Matrix: Solid

Sample ID: **P-239A-160607-1430-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.9		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	4.0	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	6120		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	87.1	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ALS Environmental
34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367014** Date Collected: 6/7/2016 14:30 Matrix: Solid
Sample ID: **P-239A-160607-1430-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	7.5		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	2.6	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	2990		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	92.5	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID:	**2156367015**	Date Collected:	6/7/2016 14:30	Matrix:	Solid
Sample ID:	**P-239A-160607-1430-def-S4B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.8		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	4190		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	78.2	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367016**
Sample ID: **P-239A-160607-1430-def-S5B**
Date Collected: 6/7/2016 14:30
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	24.4		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	4350		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	75.6	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367017** Date Collected: 6/8/2016 09:50 Matrix: Solid

Sample ID: **P-253-160608-0950-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	46.7		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	27.6	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	273000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	53.3	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367018** Date Collected: 6/8/2016 09:50 Matrix: Solid
Sample ID: **P-253-160608-0950-mel-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.3		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	6.7	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	35400		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	79.7	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367019** Date Collected: 6/8/2016 09:50 Matrix: Solid

Sample ID: **P-253-160608-0950-mel-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.0		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	9800		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	86.0	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367020** Date Collected: 6/8/2016 09:50 Matrix: Solid
Sample ID: **P-253-160608-0950-mel-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.0		%	0.1	S2540G-11			7/11/16 14:42	SLC	A
Solids, Total Volatile	2.8	2	%	1.0	S2540G-11			7/11/16 14:42	SLC	A
Total Organic Carbon (TOC)	4740		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	89.0	1	%	0.1	S2540G-11			7/11/16 14:42	SLC	A

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156367 89962000

Lab ID: **2156367021**	Date Collected: 6/1/2016 15:00	Matrix:	Solid
Sample ID: **P-227-160601-1500-jsw-S4B**	Date Received: 7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.9		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	2860		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	87.1	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156367001	1	P-225B-160601-1312-sdd-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367001	2	P-225B-160601-1312-sdd-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 5.6%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 50 and 52.9%.				
2156367001	3	P-225B-160601-1312-sdd-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367002	1	P-225B-160601-1312-sdd-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367002	2	P-225B-160601-1312-sdd-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367003	1	P-225B-160601-1312-sdd-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367003	2	P-225B-160601-1312-sdd-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367004	1	P-225B-160601-1312-sdd-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367004	2	P-225B-160601-1312-sdd-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367005	1	P-227-160601-1500-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367005	2	P-227-160601-1500-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367006	1	P-227-160601-1500-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367006	2	P-227-160601-1500-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367007	1	P-227-160601-1500-jsw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367007	2	P-227-160601-1500-jsw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367008	1	P-239-160607-1427-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367008	2	P-239-160607-1427-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367009	1	P-239-160607-1427-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367009	2	P-239-160607-1427-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367010	1	P-239-160607-1427-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367010	2	P-239-160607-1427-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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ANALYTICAL RESULTS

Workorder: 2156367 89962000

2156367011	1	P-239-160607-1427-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367011	2	P-239-160607-1427-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367011	3	P-239-160607-1427-def-S4B	SW846 9060A	Total Organic Carbon (TOC)
Due to sample matrix, an average of four individual injections were used to calculate the final result. No two injections met method criteria. JWB 7-17-16				
2156367012	1	P-239A-160607-1430-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367012	2	P-239A-160607-1430-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367013	1	P-239A-160607-1430-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367013	2	P-239A-160607-1430-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367014	1	P-239A-160607-1430-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367014	2	P-239A-160607-1430-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367015	1	P-239A-160607-1430-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367015	2	P-239A-160607-1430-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367016	1	P-239A-160607-1430-def-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367016	2	P-239A-160607-1430-def-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367017	1	P-253-160608-0950-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367017	2	P-253-160608-0950-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367018	1	P-253-160608-0950-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367018	2	P-253-160608-0950-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367019	1	P-253-160608-0950-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367019	2	P-253-160608-0950-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367020	1	P-253-160608-0950-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156367 89962000

2156367020	2	P-253-160608-0950-mel-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156367021	1	P-227-160601-1500-jsw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156367021	2	P-227-160601-1500-jsw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 1 of 9

ALS Quote: * 2 1 5 6 3 6 7 *

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.

Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

ANALYSES/METHOD REQUESTED (Container Type / Container Size / Preservative)

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-225B-160601-1312-sdd-S1B	6/1/2016	1312	G	SO	X	X
P-225B-160601-1312-sdd-S2B	6/1/2016	1312	G	SO	X	X
P-225B-160601-1312-sdd-S3B	6/1/2016	1312	G	SO	X	X
P-225B-160601-1312-sdd-S4B	6/1/2016	1312	G	SO	X	X
P-227-160601-1500-jsw-S1B	6/1/2016	1500	G	SO	X	X
P-227-160601-1500-jsw-S2B	6/1/2016	1500	G	SO	X	X
P-227-160601-1500-jsw-S3B	6/1/2016	1500	G	SO	X	X
P-239-160607-1427-def-S1B	6/7/2016	1427	G	SO	X	X
P-239-160607-1427-def-S2B	6/7/2016	1427	G	SO	X	X
P-239-160607-1427-def-S3B	6/7/2016	1427	G	SO	X	X

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6°C Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	DS
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments: Rec'd P-227-160601-1500-DEF-S4B

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 DFenstermacher/RETTEW	7/1/16	1109	2 [signature] ALS	7/5/16	1315
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Reportable to PADEP? Yes [ ]
PWSID #

Special Processing: USACE [ ] Navy [ ] [ ]

Sample Disposal: Lab [ ] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

EDDS: Format Type-

*G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

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34 Dogwood Lane
Middletown, PA 17057
P.717-944-5541
F.717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156367 — 12 of 19
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:
TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

ANALYSES/METHOD REQUESTED (Container Type / Container Size / Preservative)

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-239-160607-1427-def-S4B	6/7/2016	1427	G	SO	X	X	
P-239A-160607-1430-def-S1B	6/7/2016	1430	G	SO	X	X	
P-239A-160607-1430-def-S2B	6/7/2016	1430	G	SO	X	X	
P-239A-160607-1430-def-S3B	6/7/2016	1430	G	SO	X	X	
P-239A-160607-1430-def-S4B	6/7/2016	1430	G	SO	X	X	
P-239A-160607-1430-def-S5B	6/7/2016	1430	G	SO	X	X	
P-253-160608-0950-mel-S1B	6/8/2016	950	G	SO	X	X	
P-253-160608-0950-mel-S2B	6/8/2016	950	G	SO	X	X	
P-253-160608-0950-mel-S3B	6/8/2016	950	G	SO	X	X	
P-253-160608-0950-mel-S4B	6/8/2016	950	G	SO	X	X	

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26.2 Therm ID: TH-352
No. of Coolers: ___

	Y	N	Initial
Custody Seals Present?		✓	JS
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:

LOGGED BY(signature): Date: 7/6
REVIEWED BY(signature):

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D Fenstermacher Rettew	7/1/16	1100	2	ALS	7/5/16	1350
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Reportable to PADEP? Yes [ ]
PWSID #
EDDS: Format Type-

Special Processing: USACE [ ] Navy [ ] [ ]
Sample Disposal: Lab [ ] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

* G=Grab; C=Composite **Matrix - AI=Air, DW=Drinking Water, GW=Groundwater, OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156368**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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SAMPLE SUMMARY

Workorder: 2156368 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156368001	P-254-160608-1050-mel-S1B	Solid	6/8/2016 10:50	7/5/2016 13:19	Collected by Client
2156368002	P-254-160608-1050-mel-S2B	Solid	6/8/2016 10:50	7/5/2016 13:19	Collected by Client
2156368003	P-254-160608-1050-mel-S3B	Solid	6/8/2016 10:50	7/5/2016 13:19	Collected by Client
2156368004	P-254-160608-1050-mel-S4B	Solid	6/8/2016 10:50	7/5/2016 13:19	Collected by Client
2156368005	P-276-160610-0838-jsw-S1B	Solid	6/10/2016 08:38	7/5/2016 13:19	Collected by Client
2156368006	P-276-160610-0838-jsw-S2B	Solid	6/10/2016 08:38	7/5/2016 13:19	Collected by Client
2156368007	P-276-160610-0838-jsw-S3B	Solid	6/10/2016 08:38	7/5/2016 13:19	Collected by Client
2156368008	P-276-160610-0838-jsw-S4B	Solid	6/10/2016 08:38	7/5/2016 13:19	Collected by Client
2156368009	P-276-160610-0838-jsw-S5B	Solid	6/10/2016 08:38	7/5/2016 13:19	Collected by Client
2156368010	P-279-160610-1359-dat-S1B	Solid	6/10/2016 13:59	7/5/2016 13:19	Collected by Client
2156368011	P-279-160610-1359-dat-S2B	Solid	6/10/2016 13:59	7/5/2016 13:19	Collected by Client
2156368012	P-279-160610-1359-dat-S3B	Solid	6/10/2016 13:59	7/5/2016 13:19	Collected by Client
2156368013	P-279-160610-1359-dat-S4B	Solid	6/10/2016 13:59	7/5/2016 13:19	Collected by Client
2156368014	P-279-160610-1359-dat-S5B	Solid	6/10/2016 13:59	7/5/2016 13:19	Collected by Client
2156368015	P-279A-160610-1450-def-S1B	Solid	6/10/2016 14:50	7/5/2016 13:19	Collected by Client
2156368016	P-279A-160610-1450-def-S2B	Solid	6/10/2016 14:50	7/5/2016 13:19	Collected by Client
2156368017	P-279A-160610-1450-def-S3B	Solid	6/10/2016 14:50	7/5/2016 13:19	Collected by Client
2156368018	P-279A-160610-1450-def-S4B	Solid	6/10/2016 14:50	7/5/2016 13:19	Collected by Client
2156368019	P-283-160606-0743-def-S1B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client
2156368020	P-283-160606-0743-def-S2B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client

SAMPLE SUMMARY

Workorder: 2156368 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368001** Date Collected: 6/8/2016 10:50 Matrix: Solid

Sample ID: **P-254-160608-1050-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	59.9		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	67.8	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	300000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	40.1	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368002** Date Collected: 6/8/2016 10:50 Matrix: Solid
Sample ID: **P-254-160608-1050-mel-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.1		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	8.7	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	29400		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	79.9	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368003** Date Collected: 6/8/2016 10:50 Matrix: Solid

Sample ID: **P-254-160608-1050-mel-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.4		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.4	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	10800		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	85.6	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368004** Date Collected: 6/8/2016 10:50 Matrix: Solid

Sample ID: **P-254-160608-1050-mel-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.2		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.4	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	6940		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	86.8	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368005** Date Collected: 6/10/2016 08:38 Matrix: Solid

Sample ID: **P-276-160610-0838-jsw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	40.3		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	20.8	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	86500		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	59.7	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368006** Date Collected: 6/10/2016 08:38 Matrix: Solid
Sample ID: **P-276-160610-0838-jsw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.9		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.5	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	25700		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	86.1	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368007** Date Collected: 6/10/2016 08:38 Matrix: Solid

Sample ID: **P-276-160610-0838-jsw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.6		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	7530		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	90.4	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368008** Date Collected: 6/10/2016 08:38 Matrix: Solid

Sample ID: **P-276-160610-0838-jsw-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.0		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.9	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	11000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	84.0	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368009** Date Collected: 6/10/2016 08:38 Matrix: Solid

Sample ID: **P-276-160610-0838-jsw-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	8.6		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.1	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	2800		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	91.4	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368010** Date Collected: 6/10/2016 13:59 Matrix: Solid

Sample ID: **P-279-160610-1359-dat-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	47.4		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	36.3	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	212000		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	52.6	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368011** Date Collected: 6/10/2016 13:59 Matrix: Solid

Sample ID: **P-279-160610-1359-dat-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	31.3		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	17.3	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	92400		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	68.7	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368012** Date Collected: 6/10/2016 13:59 Matrix: Solid

Sample ID: **P-279-160610-1359-dat-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.4		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.5	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	19400		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	85.6	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368013** Date Collected: 6/10/2016 13:59 Matrix: Solid
Sample ID: **P-279-160610-1359-dat-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	10.7		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	2.8	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	3870		mg/kg	500	SW846 9060A			7/12/16 16:00	CF	A
Total Solids	89.3	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368014**
Sample ID: **P-279-160610-1359-dat-S5B**
Date Collected: 6/10/2016 13:59
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	6.9		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	2.7	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	2050		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	93.1	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368015** Date Collected: 6/10/2016 14:50 Matrix: Solid

Sample ID: **P-279A-160610-1450-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	26.6		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	11.4	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	83900		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	73.4	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ALS Environmental
34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368016** Date Collected: 6/10/2016 14:50 Matrix: Solid

Sample ID: **P-279A-160610-1450-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.1		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	5870		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	84.9	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

Brad W. Kintzer

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368017** Date Collected: 6/10/2016 14:50 Matrix: Solid

Sample ID: **P-279A-160610-1450-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.9		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.0	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	2880		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	90.1	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368018** Date Collected: 6/10/2016 14:50 Matrix: Solid
Sample ID: **P-279A-160610-1450-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.1		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.6	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	1040		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	84.9	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368019** Date Collected: 6/6/2016 07:43 Matrix: Solid

Sample ID: **P-283-160606-0743-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	72.8		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	89.8	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	453000		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	27.2	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

Brad W. Kintzer

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156368 89962000

Lab ID: **2156368020** Date Collected: 6/6/2016 07:43 Matrix: Solid

Sample ID: **P-283-160606-0743-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	23.0		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	7.6	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	35600		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	77.0	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156368001	1	P-254-160608-1050-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368001	2	P-254-160608-1050-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368002	1	P-254-160608-1050-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368002	2	P-254-160608-1050-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368003	1	P-254-160608-1050-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368003	2	P-254-160608-1050-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368004	1	P-254-160608-1050-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368004	2	P-254-160608-1050-mel-S4B	S2540G-11	Solids, Total Volatile
WETC-103				
2156368005	1	P-276-160610-0838-jsw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368005	2	P-276-160610-0838-jsw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368006	1	P-276-160610-0838-jsw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368006	2	P-276-160610-0838-jsw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368007	1	P-276-160610-0838-jsw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368007	2	P-276-160610-0838-jsw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368008	1	P-276-160610-0838-jsw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368008	2	P-276-160610-0838-jsw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368009	1	P-276-160610-0838-jsw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368009	2	P-276-160610-0838-jsw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368010	1	P-279-160610-1359-dat-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368010	2	P-279-160610-1359-dat-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368011	1	P-279-160610-1359-dat-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368011	2	P-279-160610-1359-dat-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156368 89962000

2156368012	1	P-279-160610-1359-dat-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368012	2	P-279-160610-1359-dat-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368013	1	P-279-160610-1359-dat-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368013	2	P-279-160610-1359-dat-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368014	1	P-279-160610-1359-dat-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368014	2	P-279-160610-1359-dat-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368015	1	P-279A-160610-1450-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368015	2	P-279A-160610-1450-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368016	1	P-279A-160610-1450-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368016	2	P-279A-160610-1450-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368017	1	P-279A-160610-1450-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368017	2	P-279A-160610-1450-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368018	1	P-279A-160610-1450-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368018	2	P-279A-160610-1450-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368019	1	P-283-160606-0743-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368019	2	P-283-160606-0743-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156368020	1	P-283-160606-0743-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156368020	2	P-283-160606-0743-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
P. 717-944-5541
F.717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

* 2 1 5 6 3 6 8 *

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

ANALYSES/METHOD REQUESTED — Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-254-160608-1050-mel-S1B	6/8/2016	1050	G	SO	X	X	
P-254-160608-1050-mel-S2B	6/8/2016	1050	G	SO	X	X	
P-254-160608-1050-mel-S3B	6/8/2016	1050	G	SO	X	X	
P-254-160608-1050-mel-S4B	6/8/2016	1050	G	SO	X	X	
P-276-160610-0838-jsw-S1B	6/10/2016	838	G	SO	X	X	
P-276-160610-0838-jsw-S2B	6/10/2016	838	G	SO	X	X	
P-276-160610-0838-jsw-S3B	6/10/2016	838	G	SO	X	X	
P-276-160610-0838-jsw-S4B	6/10/2016	838	G	SO	X	X	
P-276-160610-0838-jsw-S5B	6/10/2016	838	G	SO	X	X	
P-279-160610-1359-dat-S1B	6/10/2016	1359	G	SO	X	X	

Receiving Lab
Cooler Temp: 26°C Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	JS
(If present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/12 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 DFenstermacher Rettew	7/1/16	1/04	2	7/11/16	1319
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ] [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156368

ALS Quote #:

Client Name: RETTEW Associates, Inc.

Address: 3020 Columbia Ave
Lancaster, PA 17603

Contact: Dan Fenstermacher or Duane Truax

Phone#: 412-276-2219 or 717-205-2228

Project Name/#: 89962000

Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.

Date Required: 13-Jul-16 Approved By:

Email? [X] -Y Dfenstermacher@rettew.com

Fax? [ ] -Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-279-160610-1359-dat-S2B	6/10/2016	1359	G	SO	X	X	
P-279-160610-1359-dat-S3B	6/10/2016	1359	G	SO	X	X	
P-279-160610-1359-dat-S4B	6/10/2016	1359	G	SO	X	X	
P-279-160610-1359-dat-S5B	6/10/2016	1359	G	SO	X	X	
P-279A-160610-1450-def-S1B	6/10/2016	1450	G	SO	X	X	
P-279A-160610-1450-def-S2B	6/10/2016	1450	G	SO	X	X	
P-279A-160610-1450-def-S3B	6/10/2016	1450	G	SO	X	X	
P-279A-160610-1450-def-S4B	6/10/2016	1450	G	SO	X	X	
P-283-160606-0743-def-S1B	6/6/2016	743	G	SO	X	X	
P-283-160606-0743-def-S2B	6/6/2016	743	G	SO	X	X	

Receipt Information (completed by Receiving Lab)

Cooler Temp: 26°C Therm ID: TH-352

No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:

LOGGED BY(signature): DATE 7/1/16 TIME

REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	D Fenstermacher - Rettew	7/1/16		2	ALS	7/1/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA

Reportable to PADEP? Yes [ ]

PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

ALS Environmental
34 Dogwood Lane ■ Middletown, PA 17057 ■ Phone: 717-944-5541 ■ Fax: 717-944-1430 ■ www.alsglobal.com

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156369**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

SAMPLE SUMMARY

Workorder: 2156369 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156369001	P-283-160606-0743-def-S3B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client
2156369002	P-283-160606-0743-def-S4B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client
2156369003	P-283-160606-0743-def-S5B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client
2156369004	P-283-160606-0743-def-S6B	Solid	6/6/2016 07:43	7/5/2016 13:19	Collected by Client
2156369005	P-286-160606-0808-def-S1B	Solid	6/6/2016 08:08	7/5/2016 13:19	Collected by Client
2156369006	P-286-160606-0808-def-S2B	Solid	6/6/2016 08:08	7/5/2016 13:19	Collected by Client
2156369007	P-286-160606-0808-def-S3B	Solid	6/6/2016 08:08	7/5/2016 13:19	Collected by Client
2156369008	P-286-160606-0808-def-S4B	Solid	6/6/2016 08:08	7/5/2016 13:19	Collected by Client
2156369009	P-290-160606-1445-mel-S1B	Solid	6/6/2016 14:45	7/5/2016 13:19	Collected by Client
2156369010	P-290-160606-1445-mel-S2B	Solid	6/6/2016 14:45	7/5/2016 13:19	Collected by Client
2156369011	P-290-160606-1445-mel-S3B	Solid	6/6/2016 14:45	7/5/2016 13:19	Collected by Client
2156369012	P-290-160606-1445-mel-S4B	Solid	6/6/2016 14:45	7/5/2016 13:19	Collected by Client
2156369013	P-291-160606-1330-mel-S1B	Solid	6/6/2016 13:30	7/5/2016 13:19	Collected by Client
2156369014	P-291-160606-1330-mel-S2B	Solid	6/6/2016 13:30	7/5/2016 13:19	Collected by Client
2156369015	P-291-160606-1330-mel-S3B	Solid	6/6/2016 13:30	7/5/2016 13:19	Collected by Client
2156369016	P-291-160606-1330-mel-S4B	Solid	6/6/2016 13:30	7/5/2016 13:19	Collected by Client
2156369017	P-347-160621-1409-def-S1B	Solid	6/21/2016 14:09	7/5/2016 13:19	Collected by Client
2156369018	P-347-160621-1409-def-S2B	Solid	6/21/2016 14:09	7/5/2016 13:19	Collected by Client
2156369019	P-352-160621-1145-def-S1B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client
2156369020	P-352-160621-1145-def-S2B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client

SAMPLE SUMMARY

Workorder: 2156369 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369001** Date Collected: 6/6/2016 07:43 Matrix: Solid

Sample ID: **P-283-160606-0743-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.2		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.8		%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	6890		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	86.8	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369002** Date Collected: 6/6/2016 07:43 Matrix: Solid

Sample ID: **P-283-160606-0743-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.9		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	1360		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	88.1	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID:	**2156369003**	Date Collected:	6/6/2016 07:43	Matrix:	Solid
Sample ID:	**P-283-160606-0743-def-S5B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.3		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	1030		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	86.7	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369004** Date Collected: 6/6/2016 07:43 Matrix: Solid
Sample ID: **P-283-160606-0743-def-S6B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	9.7		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	1610		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	90.3	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID:	**2156369005**	Date Collected:	6/6/2016 08:08	Matrix:	Solid
Sample ID:	**P-286-160606-0808-def-S1B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	65.1		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	91.1	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	470000		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	34.9	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369006** Date Collected: 6/6/2016 08:08 Matrix: Solid

Sample ID: **P-286-160606-0808-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.3		%	0.1	S2540G-11			7/7/16 10:31	SLC	A
Solids, Total Volatile	3.8	2	%	1.0	S2540G-11			7/7/16 10:31	SLC	A
Total Organic Carbon (TOC)	6910		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	81.7	1	%	0.1	S2540G-11			7/7/16 10:31	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369007** Date Collected: 6/6/2016 08:08 Matrix: Solid
Sample ID: **P-286-160606-0808-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.5		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	1.8	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	1450		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	86.5	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369008** Date Collected: 6/6/2016 08:08 Matrix: Solid

Sample ID: **P-286-160606-0808-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	12.7		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	3.6	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	1950		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	87.3	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369009** Date Collected: 6/6/2016 14:45 Matrix: Solid

Sample ID: **P-290-160606-1445-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	67.5		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	97.1	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	526000		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	32.5	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369010** Date Collected: 6/6/2016 14:45 Matrix: Solid
Sample ID: **P-290-160606-1445-mel-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	27.9		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	8.2	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	36800		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	72.1	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369011** Date Collected: 6/6/2016 14:45 Matrix: Solid
Sample ID: **P-290-160606-1445-mel-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.2		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	2.7	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	7620		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	79.8	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369012** Date Collected: 6/6/2016 14:45 Matrix: Solid
Sample ID: **P-290-160606-1445-mel-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.4		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	3.4	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	2730		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	82.6	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369013** Date Collected: 6/6/2016 13:30 Matrix: Solid

Sample ID: **P-291-160606-1330-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	29.1		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	11.8	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	82800		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	70.9	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369014**
Sample ID: **P-291-160606-1330-mel-S2B**
Date Collected: 6/6/2016 13:30
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	20.4		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	4.1	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	10300		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	79.6	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369015** Date Collected: 6/6/2016 13:30 Matrix: Solid

Sample ID: **P-291-160606-1330-mel-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.8		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	5.5	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	4500		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	78.2	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369016** Date Collected: 6/6/2016 13:30 Matrix: Solid

Sample ID: **P-291-160606-1330-mel-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.9		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	3.3	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	1260		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	88.1	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369017** Date Collected: 6/21/2016 14:09 Matrix: Solid

Sample ID: **P-347-160621-1409-def-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.5		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	17.9	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	198000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	82.5	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369018** Date Collected: 6/21/2016 14:09 Matrix: Solid

Sample ID: **P-347-160621-1409-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.6		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	6.1	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	14100		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	84.4	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369019**
Sample ID: **P-352-160621-1145-def-S1B**
Date Collected: 6/21/2016 11:45
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	69.6		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	66.8	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	324000		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	30.4	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156369 89962000

Lab ID: **2156369020** Date Collected: 6/21/2016 11:45 Matrix: Solid

Sample ID: **P-352-160621-1145-def-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	28.1		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	10.7	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	54800		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	71.9	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156369001	1	P-283-160606-0743-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369002	1	P-283-160606-0743-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369002	2	P-283-160606-0743-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369003	1	P-283-160606-0743-def-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369003	2	P-283-160606-0743-def-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369004	1	P-283-160606-0743-def-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369004	2	P-283-160606-0743-def-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369005	1	P-286-160606-0808-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369005	2	P-286-160606-0808-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369006	1	P-286-160606-0808-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369006	2	P-286-160606-0808-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369007	1	P-286-160606-0808-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369007	2	P-286-160606-0808-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369008	1	P-286-160606-0808-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369008	2	P-286-160606-0808-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369009	1	P-290-160606-1445-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369009	2	P-290-160606-1445-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369010	1	P-290-160606-1445-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369010	2	P-290-160606-1445-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369011	1	P-290-160606-1445-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369011	2	P-290-160606-1445-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369012	1	P-290-160606-1445-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156369 89962000

2156369012	2	P-290-160606-1445-mel-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369013	1	P-291-160606-1330-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369013	2	P-291-160606-1330-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369014	1	P-291-160606-1330-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369014	2	P-291-160606-1330-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369015	1	P-291-160606-1330-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369015	2	P-291-160606-1330-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369016	1	P-291-160606-1330-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369016	2	P-291-160606-1330-mel-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369017	1	P-347-160621-1409-def-S1B	S2540G-11	Total Solids
The RPD associated with this sample was recovered at 6.4%. The RPD is outside method acceptance limits of 5.0%. The results used to calculate the RPD were 87.9 and 82.5%.				
2156369017	2	P-347-160621-1409-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369018	1	P-347-160621-1409-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369018	2	P-347-160621-1409-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369019	1	P-352-160621-1145-def-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369019	2	P-352-160621-1145-def-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156369020	1	P-352-160621-1145-def-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156369020	2	P-352-160621-1145-def-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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34 Dogwood Lane
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P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

* 2 1 5 6 3 6 9 *

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.

Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-283-160606-0743-def-S3B	6/6/2016	743	G	SO	X	X
P-283-160606-0743-def-S4B	6/6/2016	743	G	SO	X	X
P-283-160606-0743-def-S5B	6/6/2016	743	G	SO	X	X
P-283-160606-0743-def-S6B	6/6/2016	743	G	SO	X	X
P-286-160606-0808-del-S1B	6/6/2016	808	G	SO	X	X
P-286-160606-0808-del-S2B	6/6/2016	808	G	SO	X	X
P-286-160606-0808-def-S3B	6/6/2016	808	G	SO	X	X
P-286-160606-0808-def-S4B	6/6/2016	808	G	SO	X	X
P-290-160606-1445-mel-S1B	6/6/2016	1445	G	SO	X	X
P-290-160606-1445-mel-S2B	6/6/2016	1445	G	SO	X	X

Receipt Information (completed by Receiving Lab)

Cooler Temp: ____ Therm ID: 74-352
No. of Coolers: ____

	Y	N	Initial
Custody Seals Present?		✓	DS
(If present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:

LOGGED BY(signature): Date 9/10
REVIEWED BY(signature):

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	Dfenstermacher Rettew	7/1/16	1100	2	ALS	7/5/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

*G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

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F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156369
ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

ANALYSES/METHOD REQUESTED — Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-290-160606-1445-mel-S3B	6/66/16	1445	G	SO	X	X	
P-290-160606-1445-mel-S4B	6/66/16	1445	G	SO	X	X	
P-291-160606-1330-mel-S1B	6/66/16	1330	G	SO	X	X	
P-291-160606-1330-mel-S2B	6/66/16	1330	G	SO	X	X	
P-291-160606-1330-mel-S3B	6/66/16	1330	G	SO	X	X	
P-291-160606-1330-mel-S4B	6/66/16	1330	G	SO	X	X	
P-347-160621-1409-def-S1B	6/21/2016	1409	G	SO	X	X	
P-347-160621-1409-def-S2B	6/21/2016	1409	G	SO	X	X	
P-352-160621-1145-def-S1B	6/21/2016	1145	G	SO	X	X	
P-352-160621-1145-def-S2B	6/21/2016	1145	G	SO	X	X	

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6°C Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	DFenstermacher Rettew	7/1/16	1000	2	ALS	7/5/16	1315
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ] [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] VA
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 21, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156370**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2156370 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156370001	P-352-160621-1145-def-S3B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client
2156370002	P-352-160621-1145-def-S4B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client
2156370003	P-352-160621-1145-def-S5B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client
2156370004	P-352-160621-1145-def-S6B	Solid	6/21/2016 11:45	7/5/2016 13:19	Collected by Client
2156370005	P-010-160620-1315-mgw-S1B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370006	P-010-160620-1315-mgw-S2B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370007	P-010-160620-1315-mgw-S3B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370008	P-010-160620-1315-mgw-S4B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370009	P-010-160620-1315-mgw-S5B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370010	P-010-160620-1315-mgw-S6B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370011	P-010-160620-1315-mgw-S7B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370012	P-010-160620-1315-mgw-S8B	Solid	6/20/2016 13:15	7/5/2016 13:19	Collected by Client
2156370013	P-045-160614-1019-jcr-S1B	Solid	6/14/2016 10:19	7/5/2016 13:19	Collected by Client
2156370014	P-045-160614-1019-jcr-S2B	Solid	6/14/2016 10:19	7/5/2016 13:19	Collected by Client
2156370015	P-045-160614-1019-jcr-S3B	Solid	6/14/2016 10:19	7/5/2016 13:19	Collected by Client
2156370016	P-045-160614-1019-jcr-S4B	Solid	6/14/2016 10:19	7/5/2016 13:19	Collected by Client
2156370017	P-077-160617-1035-sdd-S1B	Solid	6/17/2016 10:35	7/5/2016 13:19	Collected by Client
2156370018	P-077-160617-1035-sdd-S2B	Solid	6/17/2016 10:35	7/5/2016 13:19	Collected by Client
2156370019	P-077-160617-1035-sdd-S3B	Solid	6/17/2016 10:35	7/5/2016 13:19	Collected by Client
2156370020	P-077-160617-1035-sdd-S4B	Solid	6/17/2016 10:35	7/5/2016 13:19	Collected by Client

SAMPLE SUMMARY

Workorder: 2156370 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

ALS Environmental
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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370001** Date Collected: 6/21/2016 11:45 Matrix: Solid
Sample ID: **P-352-160621-1145-def-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	15.9		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	5.5	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	17600		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	84.1	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

ALS Environmental
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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370002** Date Collected: 6/21/2016 11:45 Matrix: Solid
Sample ID: **P-352-160621-1145-def-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.3		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	4.9	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	15700		mg/kg	500	SW846 9060A			7/13/16 17:15	CF	A
Total Solids	81.7	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: A2LA 0818.01
State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370003** Date Collected: 6/21/2016 11:45 Matrix: Solid

Sample ID: **P-352-160621-1145-def-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	8.9		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	10.8	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	5570		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	91.1	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID:	**2156370004**	Date Collected:	6/21/2016 11:45	Matrix:	Solid
Sample ID:	**P-352-160621-1145-def-S6B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.2		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	5.8	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	6060		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	85.8	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370005** Date Collected: 6/20/2016 13:15 Matrix: Solid
Sample ID: **P-010-160620-1315-mgw-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	60.8		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	86.3	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	476000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	39.2	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370006** Date Collected: 6/20/2016 13:15 Matrix: Solid

Sample ID: **P-010-160620-1315-mgw-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	52.4		%	0.1	S2540G-11			7/7/16 13:00	SLC	A
Solids, Total Volatile	41.4	2	%	1.0	S2540G-11			7/7/16 13:00	SLC	A
Total Organic Carbon (TOC)	185000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	47.6	1	%	0.1	S2540G-11			7/7/16 13:00	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370007** Date Collected: 6/20/2016 13:15 Matrix: Solid
Sample ID: **P-010-160620-1315-mgw-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	36.0		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	14.8	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	67200		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	64.0	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370008** Date Collected: 6/20/2016 13:15 Matrix: Solid
Sample ID: **P-010-160620-1315-mgw-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	29.6		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	8.1	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	30500		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	70.4	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370009** Date Collected: 6/20/2016 13:15 Matrix: Solid

Sample ID: **P-010-160620-1315-mgw-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.7		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	5.1	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	7200		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	78.3	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370010**
Sample ID: **P-010-160620-1315-mgw-S6B**

Date Collected: 6/20/2016 13:15
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.9		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	4.3	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	3280		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	83.1	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370011** Date Collected: 6/20/2016 13:15 Matrix: Solid
Sample ID: **P-010-160620-1315-mgw-S7B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	17.0		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	5.9	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	2360		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	83.0	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370012** Date Collected: 6/20/2016 13:15 Matrix: Solid

Sample ID: **P-010-160620-1315-mgw-S8B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.0		%	0.1	S2540G-11			7/20/16 08:13	VKB	A
Solids, Total Volatile	5.0	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	2810		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	84.0		%	0.1	S2540G-11			7/20/16 08:13	VKB	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370013**	Date Collected: 6/14/2016 10:19	Matrix:	Solid
Sample ID: **P-045-160614-1019-jcr-S1B**	Date Received: 7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	44.4		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	49.4	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	273000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	55.6	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370014** Date Collected: 6/14/2016 10:19 Matrix: Solid
Sample ID: **P-045-160614-1019-jcr-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	18.5		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	9.6	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	53700		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	81.5	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370015** Date Collected: 6/14/2016 10:19 Matrix: Solid

Sample ID: **P-045-160614-1019-jcr-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	8.6		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	3.2	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	4230		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	91.4	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370016** Date Collected: 6/14/2016 10:19 Matrix: Solid

Sample ID: **P-045-160614-1019-jcr-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	10.0		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	3.8	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	3480		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	90.0	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370017** Date Collected: 6/17/2016 10:35 Matrix: Solid

Sample ID: **P-077-160617-1035-sdd-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	66.9		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	87.2	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	194000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	33.1	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370018** Date Collected: 6/17/2016 10:35 Matrix: Solid
Sample ID: **P-077-160617-1035-sdd-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	21.5		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	8.7	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	68700		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	78.5	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370019** Date Collected: 6/17/2016 10:35 Matrix: Solid

Sample ID: **P-077-160617-1035-sdd-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.0		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	3.6	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	6160		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	89.0	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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ANALYTICAL RESULTS

Workorder: 2156370 89962000

Lab ID: **2156370020** Date Collected: 6/17/2016 10:35 Matrix: Solid
Sample ID: **P-077-160617-1035-sdd-S4B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	11.8		%	0.1	S2540G-11			7/12/16 13:51	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/12/16 13:51	SLC	A
Total Organic Carbon (TOC)	5130		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	88.2	1	%	0.1	S2540G-11			7/12/16 13:51	SLC	A

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PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156370001	1	P-352-160621-1145-def-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370001	2	P-352-160621-1145-def-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370002	1	P-352-160621-1145-def-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370002	2	P-352-160621-1145-def-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370003	1	P-352-160621-1145-def-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370003	2	P-352-160621-1145-def-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370004	1	P-352-160621-1145-def-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370004	2	P-352-160621-1145-def-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370005	1	P-010-160620-1315-mgw-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370005	2	P-010-160620-1315-mgw-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370006	1	P-010-160620-1315-mgw-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370006	2	P-010-160620-1315-mgw-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370007	1	P-010-160620-1315-mgw-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370007	2	P-010-160620-1315-mgw-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370008	1	P-010-160620-1315-mgw-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370008	2	P-010-160620-1315-mgw-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370009	1	P-010-160620-1315-mgw-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370009	2	P-010-160620-1315-mgw-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370010	1	P-010-160620-1315-mgw-S6B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370010	2	P-010-160620-1315-mgw-S6B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370011	1	P-010-160620-1315-mgw-S7B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370011	2	P-010-160620-1315-mgw-S7B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ANALYTICAL RESULTS

Workorder: 2156370 89962000

2156370012	2	P-010-160620-1315-mgw-S8B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370013	1	P-045-160614-1019-jcr-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370013	2	P-045-160614-1019-jcr-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370014	1	P-045-160614-1019-jcr-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370014	2	P-045-160614-1019-jcr-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370015	1	P-045-160614-1019-jcr-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370015	2	P-045-160614-1019-jcr-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370016	1	P-045-160614-1019-jcr-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370016	2	P-045-160614-1019-jcr-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370017	1	P-077-160617-1035-sdd-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370017	2	P-077-160617-1035-sdd-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370018	1	P-077-160617-1035-sdd-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370018	2	P-077-160617-1035-sdd-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370019	1	P-077-160617-1035-sdd-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370019	2	P-077-160617-1035-sdd-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156370020	1	P-077-160617-1035-sdd-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156370020	2	P-077-160617-1035-sdd-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

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F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC
ALS
2156370

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dienstermacher@rettew.com
Fax? [ ] -Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)	Sample/COC Comments
P-352-160621-1145-def-S3B	6/21/2016	1145	G	SO	X	X	
P-352-160621-1145-def-S4B	6/21/2016	1145	G	SO	X	X	
P-352-160621-1145-def-S5B	6/21/2016	1145	G	SO	X	X	
P-352-160621-1145-def-S6B	6/21/2016	1145	G	SO	X	X	
P-010-160620-1315-mgw-S1B	6/20/2016	1315	G	SO	X	X	
P-010-160620-1315-mgw-S2B	6/20/2016	1315	G	SO	X	X	
P-010-160620-1315-mgw-S3B	6/20/2016	1315	G	SO	X	X	
P-010-160620-1315-mgw-S4B	6/20/2016	1315	G	SO	X	X	
P-010-160620-1315-mgw-S5B	6/20/2016	1315	G	SO	X	X	
P-010-160620-1315-mgw-S6B	6/20/2016	1315	G	SO	X	X	

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26°c Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?			
(If present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?			
Cont. in Good Cond.?			
Correct Containers?			
Correct Sample Volumes?			
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #:

ALS Field Services: __Pickup __Labor __Composite Sampling __Rental Equipment __Other:

Project Comments:
LOGGED BY(signature): DATE 7/1 TIME
REVIEWED BY(signature): DATE TIME

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	Dienstermacher Rettew	7/1/16	1100	2	[signature] ALS	7/1/16	1319
3				4			
5				6			
7				8			
9				10			

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]
Special Processing: USACE [ ] Navy [ ] [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV/va
Reportable to PADEP? Yes [ ]
PWSID #
Sample Disposal: Lab [ ] Special [ ]
EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
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F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2156370 — 18 of 19

ALS Quote #:

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X]-Y Dfenstermacher@rettew.com
Fax? [ ]-Y No.:

ANALYSES/METHOD REQUESTED (Container Type / Container Size / Preservative)

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-010-160620-1315-mgw-S7B	6/20/2016	1315	G	SO	X	X
P-010-160620-1315-mgw-S8B	6/20/2016	1315	G	SO	X	X
P-045-160614-1019-jcr-S1B	6/14/2016	1019	G	SO	X	X
P-045-160614-1019-jcr-S2B	6/14/2016	1019	G	SO	X	X
P-045-160614-1019-jcr-S3B	6/14/2016	1019	G	SO	X	X
P-045-160614-1019-jcr-S4B	6/14/2016	1019	G	SO	X	X
P-077-160617-1035-sdd-S1B	6/17/2016	1035	G	SO	X	X
P-077-160617-1035-sdd-S2B	6/17/2016	1035	G	SO	X	X
P-077-160617-1035-sdd-S3B	6/17/2016	1035	G	SO	X	X
P-077-160617-1035-sdd-S4B	6/17/2016	1035	G	SO	X	X

Receipt Information (completed by Receiving Lab)
Cooler Temp: 26°C Therm ID: 7# 352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	GS
(If present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?			
Cont. in Good Cond.?			
Correct Containers?			
Correct Sample Volumes?			
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: _Pickup _Labor _Composite Sampling _Rental Equipment _Other:

Project Comments:

LOGGED BY(signature): DATE 7/6 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 D. Fenstermacher @ Rettew	7/1/16	1009	2 [signature]	7/5/16	1315
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV

Reportable to PADEP? Yes [ ]
PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

July 18, 2016

Mr. Duane Truax
Rettew Associates Inc.
3020 Columbia Avenue
Lancaster, PA 17603

Certificate of Analysis

Project Name:	**2016-TOC AND LOI ON SOILS**	Workorder:	**2156371**
Purchase Order:		Workorder ID:	**89962000**

Dear Mr. Truax:

Enclosed are the analytical results for samples received by the laboratory on Tuesday, July 5, 2016.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Mr. Brad W Kintzer (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

This laboratory report may not be reproduced, except in full, without the written approval of ALS Environmental.

ALS Spring City: 10 Riverside Drive, Spring City, PA 19475 610-948-4903

CC: Mr. Dan Fenstermacher , Rettew

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

SAMPLE SUMMARY

Workorder: 2156371 89962000

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collected By
2156371001	P-077-160617-1035-sdd-S5B	Solid	6/17/2016 10:35	7/5/2016 13:19	Collected by Client
2156371002	P-293-160606-1056-mel-S1B	Solid	6/6/2016 10:56	7/5/2016 13:19	Collected by Client
2156371003	P-293-160606-1056-mel-S2B	Solid	6/6/2016 10:56	7/5/2016 13:19	Collected by Client
2156371004	P-293-160606-1056-mel-S3B	Solid	6/6/2016 10:56	7/5/2016 13:19	Collected by Client
2156371005	P-293-160606-1056-mel-S4B	Solid	6/6/2016 10:56	7/5/2016 13:19	Collected by Client
2156371006	P-293-160606-1056-mel-S5B	Solid	6/6/2016 10:56	7/5/2016 13:19	Collected by Client
2156371007	P-225A-160601-1130-jcr-S1B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156371008	P-225A-160601-1130-jcr-S2B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client
2156371009	P-225A-160601-1130-jcr-S3B	Solid	6/1/2016 11:30	7/5/2016 13:19	Collected by Client

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SAMPLE SUMMARY

Workorder: 2156371 89962000

Notes

- -- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- -- All Waste Water analyses comply with methodology requirements of 40 CFR Part 136.
- -- All Drinking Water analyses comply with methodology requirements of 40 CFR Part 141.
- -- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.
- -- The Chain of Custody document is included as part of this report.
- -- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- -- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- -- Method references listed on this report beginning with the prefix “S” followed by a method number (such as S2310B-97) refer to methods from “Standard Methods for the Examination of Water and Wastewater”.
- -- For microbiological analyses, the "Prepared" value is the date/time into the incurbator and the "Analyzed" value is the date/time out the incubator.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Reporting Detection Limit
ND	Not Detected - indicates that the analyte was Not Detected at the RDL
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371001** Date Collected: 6/17/2016 10:35 Matrix: Solid
Sample ID: **P-077-160617-1035-sdd-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.3		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	1300		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	85.7	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371002** Date Collected: 6/6/2016 10:56 Matrix: Solid
Sample ID: **P-293-160606-1056-mel-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	69.7		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	66.7	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	333000		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	30.3	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer
Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371003** Date Collected: 6/6/2016 10:56 Matrix: Solid
Sample ID: **P-293-160606-1056-mel-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	32.2		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	11.5	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	57100		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	67.8	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

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ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371004** Date Collected: 6/6/2016 10:56 Matrix: Solid

Sample ID: **P-293-160606-1056-mel-S3B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	16.6		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	4.0	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	9790		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	83.4	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID:	**2156371005**	Date Collected:	6/6/2016 10:56	Matrix:	Solid
Sample ID:	**P-293-160606-1056-mel-S4B**	Date Received:	7/5/2016 13:19		

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.2		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	3.7	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	5700		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	86.8	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Mr. Brad W Kintzer
Project Coordinator

ALS Environmental
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State Certifications: DE ID 11 , MA PA0102 , MD 128 , VA 460157 , WV 343

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371006** Date Collected: 6/6/2016 10:56 Matrix: Solid
Sample ID: **P-293-160606-1056-mel-S5B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	13.0		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	2.5	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	3740		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	87.0	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371007** Date Collected: 6/1/2016 11:30 Matrix: Solid
Sample ID: **P-225A-160601-1130-jcr-S1B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	31.3		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	10.7	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	55300		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	68.7	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371008** Date Collected: 6/1/2016 11:30 Matrix: Solid

Sample ID: **P-225A-160601-1130-jcr-S2B** Date Received: 7/5/2016 13:19

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	7.4		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	11.2	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	4780		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	92.6	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

ANALYTICAL RESULTS

Workorder: 2156371 89962000

Lab ID: **2156371009**
Sample ID: **P-225A-160601-1130-jcr-S3B**
Date Collected: 6/1/2016 11:30
Date Received: 7/5/2016 13:19
Matrix: Solid

Parameters	Results	Flag	Units	RDL	Method	Prepared	By	Analyzed	By	*Cntr*
WET CHEMISTRY										
Moisture	14.9		%	0.1	S2540G-11			7/12/16 14:37	SLC	A
Solids, Total Volatile	4.2	2	%	1.0	S2540G-11			7/12/16 14:37	SLC	A
Total Organic Carbon (TOC)	4040		mg/kg	500	SW846 9060A			7/14/16 17:00	CF	A
Total Solids	85.1	1	%	0.1	S2540G-11			7/12/16 14:37	SLC	A

Brad W. Kintzer

Mr. Brad W Kintzer
Project Coordinator

PARAMETER QUALIFIERS

Lab ID	#	Sample ID	Analytical Method	Analyte
2156371001	1	P-077-160617-1035-sdd-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371001	2	P-077-160617-1035-sdd-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371002	1	P-293-160606-1056-mel-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371002	2	P-293-160606-1056-mel-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371003	1	P-293-160606-1056-mel-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371003	2	P-293-160606-1056-mel-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371004	1	P-293-160606-1056-mel-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371004	2	P-293-160606-1056-mel-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371005	1	P-293-160606-1056-mel-S4B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371005	2	P-293-160606-1056-mel-S4B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371006	1	P-293-160606-1056-mel-S5B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371006	2	P-293-160606-1056-mel-S5B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371007	1	P-225A-160601-1130-jcr-S1B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371007	2	P-225A-160601-1130-jcr-S1B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371008	1	P-225A-160601-1130-jcr-S2B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371008	2	P-225A-160601-1130-jcr-S2B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				
2156371009	1	P-225A-160601-1130-jcr-S3B	S2540G-11	Total Solids
Analyte was analyzed past the 7 day holding time.				
2156371009	2	P-225A-160601-1130-jcr-S3B	S2540G-11	Solids, Total Volatile
Analyte was analyzed past the 7 day holding time.				

ALS Environmental

34 Dogwood Lane
Middletown, PA 17057
P.717-944-5541
F.717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC 19 of 19

ALS * 2 1 5 6 3 7 1 *

Client Name: RETTEW Associates, Inc.
Address: 3020 Columbia Ave
Lancaster, PA 17603
Contact: Dan Fenstermacher or Duane Truax
Phone#: 412-275-2219 or 717-205-2228
Project Name/#: 89962000
Bill To:

TAT [X] Normal-Standard TAT is 10-12 business days.
[ ] Rush-Subject to ALS approval and surcharges.
Date Required: 13-Jul-16 Approved By:
Email? [X] -Y Dfenstermacher@rettew.com
Fax? [ ] -Y No.:

Container Type / Container Size / Preservative

ANALYSES/METHOD REQUESTED

Enter Number of Containers Per Sample or Field Results Below.

Sample Description/Location (as it will appear on the lab report)	Sample Date	Time	*G or C	**Matrix	TOC	Total Volatile Solids (Organic -C loss on ignition)
P-077-160617-1035-sdd-S5B	6/17/2016	1035	G	SO	X	X
P-293-160606-1056-mel-S1B	6/6/2016	1056	G	SO	X	X
P-293-160606-1056-mel-S2B	6/6/2016	1056	G	SO	X	X
P-293-160606-1056-mel-S3B	6/6/2016	1056	G	SO	X	X
P-293-160606-1056-mel-S4B	6/6/2016	1056	G	SO	X	X
P-293-160606-1056-mel-S5B	6/6/2016	1056	G	SO	X	X
P-225A-160601-1130-jcr-S1B	6/1/2016	1130	G	SO	X	X
P-225A-160601-1130-jcr-S2B	6/1/2016	1130	G	SO	X	X
P-225A-160601-1130-jcr-S3B	6/1/2016	1130	G	SO	X	X

Receipt Information (completed by Receiving Lab)
Cooler Temp: 2.6°C Therm ID: TH-352
No. of Coolers:

	Y	N	Initial
Custody Seals Present?		✓	
(if present) Seals Intact?			
Received on Ice?		✓	
COC/Labels Complete/Accurate?	✓		
Cont. in Good Cond.?	✓		
Correct Containers?	✓		
Correct Sample Volumes?	✓		
Correct Preservation?	✓		
Headspace/Volatiles?			

Courier/Tracking #:

Sample/COC Comments

ALS Field Services: _Pickup _Labor
_Composite Sampling _Rental Equipment
_Other:

Project Comments:

LOGGED BY(signature): DATE 9/16 TIME
REVIEWED BY(signature): DATE TIME

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 D. Fenstermacher Rettew	7/1/16	1100	2 J. Smith ALS	7/5/16	1315
3			4		
5			6		
7			8		
9			10		

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE [ ]

Special Processing: USACE [ ] Navy [ ] [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [X] WV/Va

Reportable to PADEP? Yes [ ]
PWSID #

Sample Disposal: Lab [ ] Special [ ]

EDDS: Format Type-

* G=Grab; C=Composite **Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS ENVIRONMENTAL SHIPPING ADDRESS: 34 DOGWOOD LANE, MIDDLETOWN, PA 17057

Rev 10/14

Attachment 11

ACP Soil Mapping Key – Observation Summary

Attachment 11

Order 1 Soil Mapping Key - Observation Summary

Parent Material Types			Slope Class			Drainage Class			Diagnostic Subsurface Horizon			Restrictive Layer Type			Depth to Restrictive Layer			Family Particle Size Class		
PM	**MNF**	**GWNF**	**Slope**	**MNF**	**GWNF**	**Class**	**MNF**	**GWNF**	**Symbol**	**MNF**	**GWNF**	**Type**	**MNF**	**GWNF**	**Class**	**MNF**	**GWNF**	**Class**	**MNF**	**GWNF**
1	33	101	**A**	10	14	**1**	0	0	**A**	22	73	**0**	22	83	**1**	2	9	**A**	0	0
2	0	4	**B**	9	46	**2**	0	1	**B**	0	1	**1**	62	186	**2**	11	78	**B**	0	0
3	5	42	**C**	12	31	**3**	3	14	**C**	55	180	**2**	1	6	**3**	32	83	**C**	13	45
4	45	120	**D**	21	53	**4**	6	23	**D**	1	1				**4**	16	37	**D**	21	45
5	0	1	**E**	24	88	**5**	73	174	**E**	0	12				**5**	24	68	**E**	0	0
6	0	0	**F**	8	43	**6**	3	56	**C/A**	5	3							**F**	2	4
7	0	0	**G**	1	0	**7**	0	7	**AB**	1	5							**G**	0	0
8	0	6							**D/A**	1	0							**H**	0	3
9	2	0																**I**	47	176
10	0	1																**J**	0	0
																		K	0	0
																		E/D/K	1	0
																		I/K	0	1
																		C/K	0	1
																		C/B	1	0

ACP Order 1 Soil Mapping Key

Parent Material	**Slope Class**	**Drainage Class**	**Diagnostic Subsurface**	**Restrictive Layer Type**	**Depth to Restrictive Layer**	**Family Particle Size Class**
1 – Residuum	A – 0-3%	1 – Very Poorly	A – Argillic	0 – None	1 – ≤12"	A – Coarse Silty
2 – Alluvium	B – >3-8%	2 – Poorly	B – Fragipan	1 – Bedrock	2 – >12-24"	B – Fine Silty
3 – Colluvium	C – >8-15%	3 – Somewhat Poorly	C – Cambic	2 – Fragipan	3 – >24-36"	C – Coarse Loamy
4 – Colluvium over Residuum	D – >15-25%	4 – Moderately Well	D – Spodic		4 – >36-48"	D – Fine Loamy
5 – Colluvium over Alluvium	E – >25-45%	5 – Well	E – None		5 – >48"	E – Sandy
6 – Human Transported Materials (HTM)	F – >45-70%	6 – Somewhat Excessively				F – Fine
7 – Organic Soil Materials	G – >70%	7 – Excessively				G – Very Fine
8 – Alluvium over Colluvium						H – Sandy-Skeletal
9 – HTM over Colluvium						I – Loamy-Skeletal
10 – Alluvium over Residuum						J – Clayey-Skeletal
						K – Clayey

Supplemental Document A
ACP Soil Survey Protocols

Prepared for:

Dominion Transmission, Inc.
707 East Main Street
Richmond, VA 23219

ATLANTIC COAST PIPELINE

ORDER 1 SOIL SURVEY PROTOCOLS

MONONGAHELA NATIONAL FOREST, WV AND GEORGE WASHINGTON NATIONAL FOREST, VA

April 2016
Updated May 23, 2016
Addendum 1 – June 30, 2106

Prepared by:

RETTEW

Geosyntec consultants

engineers | scientists | innovators

Reviewed by:

The Nicholas Putnam Group

U.S. Forest Service, Monongahela National Forest and George Washington National Forest

TABLE OF CONTENTS

Order 1 Soil Survey Protocols
Atlantic Coast Pipeline Project
Updated May 23, 2016

1.0 INTRODUCTION

Addendum: A June 30, 2016 Addendum to The Order 1 Soil Survey Protocols, dated April 2016, and Revised May 23, 2016 for the Atlantic Coast Pipeline Project includes the resume of an additional soil scientist that participated in the Order 1 Soil Survey. This resume is an addendum to “Attachment 2 – Soil Scientist Resumes” of the Soil Survey Protocols. The soil scientist resume was submitted and approved by the U.S. Forest Service on June 14, 2016.

Updated: The Order 1 Soil Survey Protocols for the Atlantic Coast Pipeline Project have been updated based on meetings with the U.S. Forest Service to reflect new information gathered during the Preliminary Field Reconnaissance conducted May 9-13, as well as recent personnel changes. The report sections with updated information are as follows:

- 1.0 – Introduction: updated special use permits
- 1.2 – Soil Survey Team: updated Soil Scientist Team Project Manager/Team Lead
- 2.2 – Preliminary Field Reconnaissance: updated language regarding transects and taxonomic groups
- 2.2 – Soil Test Pit Excavation: included language for encountering water table
- 2.3.4 – Soil Logging: addition of profile descriptors
- 2.3.5 – Chemical Analysis: addition of alternative soil test laboratory
- 4.0 – Schedule: updated language and timeline to reflect activities completed to date
- Attachment 1 – Organizational Charts: updated Soil Scientist Team Project Manager/Team Lead
- Attachment 4 – Figures: updated figures to reflect updated schedule

An Order 1 Soil Survey will be performed along the approximately 20-mile portion of the Rev 10 reroute between MP 47 and MP 115 on the proposed Atlantic Coast Pipeline (ACP) route that crosses through parts of the Marlinton Ranger District in the Monongahela National Forest (MNF) and parts of the Warm Springs, North River, and Pedlar Ranger Districts in the George Washington National Forest (GWNF). Approximately 5.42 miles of the Rev 10 reroute crosses parts of the MNF and about 14.47 miles crosses parts of the GWNF.

The soil survey activities have been planned to be compliant with the requirements outlined in special use permit #GBR205003, dated April 22, 2015 issued by U.S. Forest Service for surveys in the MNF, and the requirements outlined in special use permit #GWP433201T, dated March 31, 2015 issued by the U.S. Forest Service for surveys in the GWNF. The MNF special use permit #GBR2050003 was updated by special use permit #MAR205001 issued by the U.S.

Forest Service on April 13, 2016. The GWNF special use permit #GWP433201T was updated by special use permit #GWP433202T issued by the U.S. Forest Service on April 11, 2016. The Order 1 Soil Survey will follow the methods outlined in the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Soil Survey Manual for an Order 1 Survey (Soil Survey Division Staff. 1993. Soil Survey Manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18).

The certified professional soil scientists (CPSSs) or North Carolina (NC) or Virginia (VA) licensed soil scientists (LSSs) pre-approved by the Forest Service for this project will be responsible for the Order 1 Soil Survey including selection of excavation locations, observation, logging, and description of excavations, photographic documentation of the excavations, collection and laboratory assignment of samples, interpretation of findings, and preparation of the Order 1 Soil Survey Report. It is understood that although Geosyntec is serving in the role of Program Manager, it will not influence, provide interpretations or edit the soil data or data collection efforts. All technical soil activities that affect the outcome and results of the Order 1 Soil Survey will be conducted by the soil survey team listed in this survey protocol. These activities include soil pit location identification, determination of pit dimensions, number of soil pits to be excavated, all soil classification determinations, data interpretations, and principle technical authorship of the Order 1 Soil Survey report.

Geosyntec personnel will provide field support for the soil survey team, but will not conduct technical soil activities that affect the outcome and results of the Order 1 Soil Survey. Geosyntec's team will also be observing the Order 1 Soil Survey activities in support of ACP's geohazard program.

1.1 Purpose

The purpose of the Order 1 Soil Survey is to provide more site-specific soil data for the proposed pipeline corridor to support construction of the 42-inch diameter pipeline. The site-specific soil data will be used to update the Soil Resource Section for the Final Environmental Impact Statement (EIS), and to make more informed decisions related to design, construction, restoration, and maintenance of the proposed pipeline, right-of-way, and other project components. The Order 1 Soil Survey is not intended to replace the published soil survey information, but rather to supplement it.

1.2 Soil Survey Team

The soil survey will be conducted by a team of CPSSs or NC or VA LSSs. Daniel Fenstermacher, CPSS with RETTEW will serve as the Soil Scientist Team Project Manager/ Team Lead. John Stipe III, CPSS will serve as the Soil Scientist Team QA/QC Lead. Dr. John Galbraith will act as the Technical Advisor. Stephen Carpenter and Charles Delp with the Nicholas Putnam Group will provide Third Party Review. Kathleen Harrison, PG with Geosyntec Consultants Inc. (Geosyntec) will serve as the overall Program Manager and programmatic liaison between Dominion and the soil scientist team and associated subcontractors. The soils scientist team will be supported by Triple H Enterprises providing laborers to assist with soil pit excavation. Organizational charts are presented in Attachment 1. Soil Scientist resumes are presented in Attachment 2.

If during the project there is a need to include other qualified professional soil scientist on the soil survey team, the names and resumes for those individuals will be provided to the Forest Service for review and acceptance prior to their involvement on the project.

2.0 SOIL SURVEY PROTOCOLS

This section outlines the protocols that will be used to complete the Order 1 Soil Survey. Soil units will be mapped at a scale appropriate to capture inclusions and not-to-exceed a scale of 1:12,000. The minimum soil polygon area will be 2.5 acres or less, with no minimum delineation size. Special symbols will be used to identify restrictive features such as wet spots, caves, sinkholes, rock outcrop, etc. and to identify ephemeral drainage ways to perennial waters across the entire width of the corridor, as defined in the Soil Survey Manual. Hydric soils will be identified across the entire width of the corridor following the National Technical committee for Hydric Soil (NTCHS) Field Indicators of Hydric Soils Ver. 7.0.

2.1 Desktop Survey

A preliminary desktop evaluation will be conducted using the collected topographic data, detailed geologic maps, existing SSURGO soil map unit boundaries, aerial photography, and other pertinent remotely- sensed data to highlight potential landscape trends and to aid in field location of test pits.

Preliminary GIS-generated maps will be developed that include topographic contours, SSURGO map units, the pipeline centerline, and the limits of the 300-foot survey corridor. Preliminary survey sample locations will be identified along the center line of the pipeline at 350-foot intervals to assess initial map unit coverage. Actual soil pit locations will be field determined by the soil scientist.

The findings of the desktop evaluation will be shared with the Forest Service, the Technical Advisors, and the Nicholas Putnam Group.

2.2 Preliminary Field Reconnaissance

The soil team leads under the direction of the Team Lead and advised by the Technical Advisor and the Nicholas Putnam Group, will conduct a preliminary field reconnaissance along the pipeline corridor to do a coarse evaluation of the soil resources using select test pit locations based on the desktop evaluation to help develop preliminary, reconnaissance-level soil-landscape relationships for the project area.

Results of the field reconnaissance will be used to generate a list of the main soil taxonomic groups and a draft mapping unit legend for the project personnel to use when conducting mapping exercises. The preliminary soil pit location map developed during the desktop study will be developed into a more refined soil test pit sampling plan based on the preliminary field reconnaissance. The 350-foot spacing interval of the soil pits may be modified by the soil scientist. The actual spacing and location of the test pits will be determined based on field conditions (e.g. topography, vegetation trends). If any modifications are made to the location of test pits, it will be for the purpose of gathering more data where necessary. At no point will the modifications result in fewer test pits sampled or result in a less intensive assessment of soil properties.

The Forest Service, the Technical Advisor, and the Nicholas Putnam Group will review the results of the reconnaissance findings and the proposed soil test pit sampling plan prior to commencement of the remainder of the soil survey.

2.3 Soil Survey

2.3.1 Training

Prior to the start of the full-scale mapping effort, the soil scientist field teams will be provided with in-field training led by the Team Lead and supported by the Technical Advisor, and the Nicholas Putnam Group. The purpose of the training is to highlight unique soil properties that might be encountered, provide guidance on soil profile description best practices, develop a map unit identification matrix and naming system, discuss the soil-landscape relationships that are likely to be encountered during the soil survey, and to discuss other pertinent information gathered during the reconnaissance phase, including criteria for identifying the soil map unit boundaries and composition.

All training materials will be provided to the Forest Service, the Technical Advisor, and the Nicholas Putnam Group for review and comment prior to the initiation of any training activities.

2.3.2 Soil Test Pit Placement

Proposed soil test pits will be field located within the 300-foot wide corridor and mapped with a GPS (sub-meter accuracy). In the field, soil scientists will confirm the soil test pit locations and modify the location as required based on changes in topography, vegetation, geology, rock outcrops, or other features that would indicate a change in soil type. All sample locations will be located in the field using a mapping grade hand-held GPS device (sub-meter accuracy).

Based on a minimum of one sampling location per 2.5 acres, it is anticipated that up to 290 soil test pits will be observed; with 80 soil test pits in the MNF and 210 test pits in the GWNF. Additional soil test pits may be required to ensure survey accuracy along the centerline. In addition to the soil test pits, periodic additional shovel excavations or auger holes may be required to confirm the continued presence and/or boundary of a specific soil type.

The tables below summarize the approximate number of soil sampling locations (soil test pits) per soil map unit in the MNF and GWNF. These estimates are based on the SSURGO mapped soil series traversed by the proposed pipeline center line. The actual number of soil test pits in each soil series will vary based on the actual placement of the soil test pits within the 300-foot wide corridor and placement of soil test pits based on field observations.

Monongahela NF Map Units	Number of Sampling Locations
Berks	39
Berks-Weikert	3
Calvin-Dekalb-Berks	4
Cateache	16
Dekalb-Hazelton	1
Elliber	2
Weikert	15

Monongahela NF Map Units	Number of Sampling Locations
Total	**80**

George Washington NF Map Units	Number of Sampling Locations
Berks-Weikert	7
Berks	82
Caneyville	3
Cataska	4
Craigsville	3
Dekalb-Alticrest	2
Dekalb-Lily-McClung	1
Dekalb-Watahala-McClung	4
Gilpin	2
Hartleton	1
Hazleton	6
Lehew-Berks	2
Lew	12
Lily-McClung-Dekalb	1
Macove-Berks	2
Macove	3
Madsheep	1
McClung-Watahala-Dekalb	5
Monongahela	3
Oriskany-Murrill	2
Oriskany	10
Shelocta-Berks	1
Weikert-Berks-Rough	20
Weikert-Berks	31
Weikert	2
Total	**210**

2.3.3 Soil Test Pit Excavation

Soil test pits will be excavated to bedrock, a water table, or 50 inches, whichever is encountered first, to expose the soil profile. Soil test pits will be excavated with hand tools by laborers. The soil scientist will confirm the adequacy of the depth of the soil test pit.

2.3.4 Soil Logging

The exposed soil profile and site properties will be described using the USDA-NRCS protocols in accordance with the Field Book for Describing and Sampling Soils, Version 3.0 (Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff, 2012, Natural Resources Conservation Service, Natural Resources Conservation Service, National Soil Survey, Lincoln NE). Additional reference is the NRCS National Soil Survey Handbook Section 629 Glossary of Landform and Geomorphic Terms. Photographs of all test pits will be taken and categorized with the descriptions.

Soil profile descriptions will be prepared for all excavated test pits. Soil profile descriptions will not be recorded for any supplemental shovel probes or auger holes used for the purpose of refining the placement of soil map unit boundaries unless the soil scientist deems the information necessary or they are part of a transect. Soil profile descriptions of master horizons will be recorded in shovel probes or auger holes related to transect. The location of supplemental testing and special symbols such as rock outcrops will be recorded with a GPS with sub-meter accuracy in either case.

Soil profile descriptions within soil test pits will include the following:

- Horizon depth and thickness
- Horizon nomenclature
- Matrix color (moist)
- Rock fragment type, size, and abundance (surface and subsurface)
- Rock outcrops
- USDA soil texture class
- Soil structure type, grade, and size
- Moist consistence (e.g. friable, firm, very firm, etc.)
- Boundary topography and distinctness
- Depth to, abundance, and contrast of redoximorphic features

- Soil pH (field determination at select locations)
- Fragipans or water-restrictive subsoil features
- Slope and Aspect
- Estimate of soil mineralogy
- Soil stickiness and plasticity estimates
- Root size and abundance
- Parent material type
- Bedrock type and characteristics
- Depth to bedrock and bedrock structure/ dip slope and strike
- Determination of drainage class
- Topographic position
- Indications of past shallow slope failures both natural and those attributed to anthropogenic disturbance such as road building, logging, mining and other activities
- Presence of apparent subsurface water tables. Seasonal water tables will be indicated by drainage class or wetness class
- Dominant vegetation
- Observations of special features (wet spots, springs, etc.)
- Pocket penetrometer measurements

Upon completion of soil observations, the excavated soil pits and supplemental shovel probes or auger holes will be backfilled with the excavated soil.

2.3.5 Chemical Analysis

In addition to the soil profile descriptions logged at each test pit location, soil samples will be collected from representative soil profiles for each major soil unit, soils representative of identified potentially problematic areas, and soils that are representative of the geologic or parent material changes along the proposed pipeline route. The collected soil samples will be prepared for shipment to Virginia Tech Soil Testing Laboratory, the Penn State Agricultural Analytical Laboratory, or another accredited laboratory. Once mapping commences, a determination will be made on the number of soil units present in the pipeline corridor, the location of any potentially problematic areas, and the location of major geologic landform changes. Based on a preliminary review of the SSURGO database, approximately 35 soil series are located along the proposed pipeline route within the MNF and GWNF. Assuming five horizons per soil series, an estimated 175 to 200 soil samples will be submitted for laboratory analysis and evaluated for effectiveness in use for reclamation such as vegetation establishment. The intent of the laboratory analysis is to characterize the soil chemical properties associated with the differing soil and geologic conditions along the proposed pipeline route as well as to identify any potentially problematic conditions that may be encountered and provide data that will help determine the appropriate seed mixtures and application rates for lime and fertilizer.

Soil samples will be analyzed for:

- Total organic carbon (TOC), and loss on ignition (LOI)
- Soil texture classification
- Soil pH
- Standard soil fertility analysis

The laboratory methodologies are included Attachment 3 to this Soil Survey Protocols document.

2.3.6 Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) protocols will be implemented:

- The findings of the soil survey will be reviewed by the Technical Advisor. Reviews will occur at 10%, 50%, and 100% completion at a minimum.
- Independent verification and review of soil classification by third-party review (Nicholas Putnam Group).
- The Forest Service will be provided access to all information shared with the Technical Advisor and the Nicholas Putnam Group, as well as the review comments generated by those parties.

3.0 REPORTING

The field collected data will be used to further refine the soil-landscape relationships to aid in developing the soil map unit polygons. Field data will be shared with the Technical Advisor, the Nicholas Putnam Group, and the Forest Service on at least a weekly basis.

A soil survey report will be completed that will provide information on the soil map units and the collected data to accompany the soil survey map. The soil survey report will be formatted similar to the guidance provided in the Standards and Procedures for Site Specific Soil Mapping in Rhode Island (Stolt, 2007).

4.0 SCHEDULE

The anticipated schedule for completion of the Order 1 Soil Survey is outlined below.

Kick-Off Meeting with Forest Service: 1 day (March 9, 2016 - completed).

Desktop Survey (completed): The desktop survey will be conducted a minimum of two weeks prior to the Field Reconnaissance phase.

Preliminary Field Reconnaissance (completed): The preliminary field reconnaissance was following the completion of the desktop survey. Three days were spent in the GWNF and two days were spent in the MNF.

Soil Scientist Team Training (June 1, 2016): Soil scientist team members will be provided site-specific soil training by the Team Lead supported by the team's Technical Advisor and the Nicholas Putnam Group. Soil training will be conducted on June 1, 2016 on a site in the GWNF and may be supplemented with written information. All training materials will be provided to the Forest Service, the Technical Advisor, and the Nicholas Putnam Group for review and comment.

Soil Survey (June 2 – 22, 2016): Eight soil scientists have been identified to conduct the soil survey. For the purposes of determining the project schedule, it is assumed that five soil scientists will operate in any given week. Additionally, if needed, one soil scientist will be dedicated to locating the soil pits to be dug and staying with the digging crews until they can be sure each pit is representative of the soil and is not disturbed, substandard, or non-representative. To account for time needed to access the test pit locations, excavation time by the laborers, and the potential need for confirmatory augering/digging, it is assumed that each soil scientist will be able to describe four test pits and map approximately six to seven acres per day. Based on five soil scientists per day and travel time, it is assumed that the field work can be conducted in approximately three weeks, weather permitting. During the soil survey investigation, field data will be sent to the team's Technical Advisor, to the Nicholas Putnam Group, and to the Forest Service for review. If necessary, the soil survey field work may be paused to address areas of concern or additional investigations may be warranted based on the reviewer's feedback. Soil samples will be submitted for laboratory analysis periodically throughout the duration of the soil survey.

Deliverable: The findings of the field investigation will be used to generate a GIS based Order 1 soil survey map with accompanying written documentation detailing the composition of map units, the results of the laboratory data, and other pertinent information. The GIS attribute data will include parameters specific to the analysis of the feasibility of constructing a natural gas pipeline, such as, but not be limited to, depth to bedrock, depth of topsoil, soil acidity, indications of soil slippage, soil wetness issues, etc. The map and report will be reviewed, at a minimum, by the Soil Scientist Team Lead, the QA/QC Lead, the Technical Advisor and the Nicholas Putnam Group prior to submission to the Forest Service for review.

Timeline

- Kick-Off Meeting: March 9, 2016
- Desktop Survey: April 25 – May 6, 2016
- Preliminary Field Reconnaissance: May 9 - 13, 2016
- Update Protocols and Prepare Field Training Program based on Field Reconnaissance Findings: May 16 - May 27, 2016
- Soil Training: June 1, 2016
- Soil Survey: June 2 – June 22, 2016 (assuming completion of soil survey in 3 weeks)

A preliminary schedule of the soil survey by milepost is outlined in the table below and illustrated on Figures 1 and 2 in Attachment 4.

Survey Date	Date	Team 1	Team 2	Team 3	Team 4	Team 5	Forest
Training	6/1/2016	All Teams					GWNF/MNF
1	6/2/2016	Mile 154-158					GWNF
2	6/3/2016	Mile 121.75-123					GWNF
3	6/6/2016	Mile 120-121.75					GWNF
4	6/7/2016	Mile 118.75-120					GWNF
5	6/8/2016	Mile 117.25-118.75					GWNF
6	6/9/2016	Mile 106	Mile 115.75-117.25				GWNF
7	6/10/2016	Mile 96.5-97.5			Mile 99.25-99.75		GWNF
8	6/13/2016	Mile 86.5-87	Mile 93.5-94.5			Mile 96-96.25	GWNF

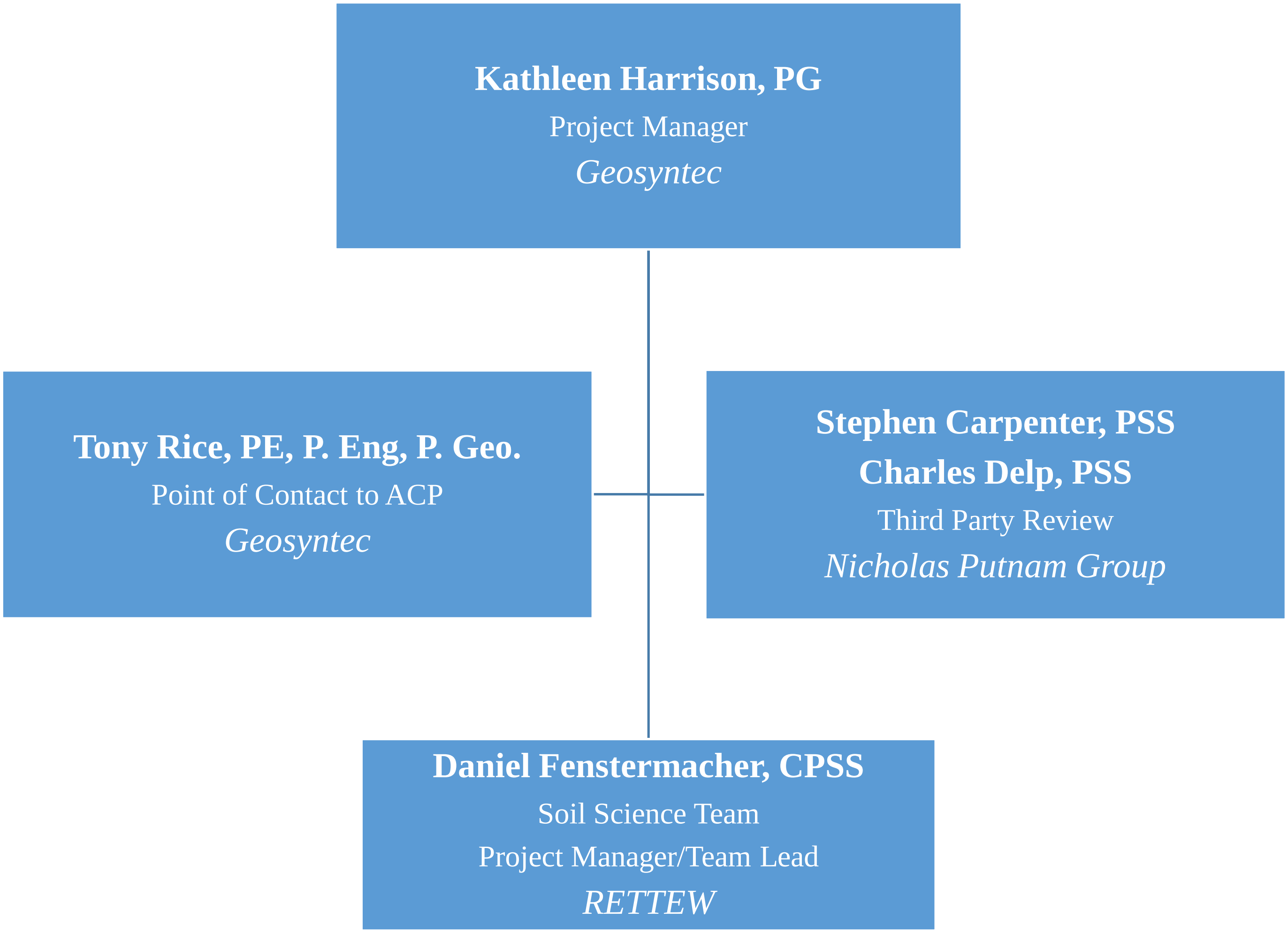
Survey Date	Date	Team 1	Team 2	Team 3	Team 4	Team 5	Forest
9	6/14/2016	Mile 85.75-86.75					GWNF
10	6/15/2016	Mile 84.75-85.75					GWNF
11	6/16/2016	Mile 83.75-84	Mile 84-84.75				GWNF/MNF
12	6/17/2016	Mile 82.75-83.75					MNF
13	6/20/2016	Mile 81.75-82.75					MNF
14	6/21/2016	Mile 80-81		Mile 81.25-81.75			MNF
15	6/22/2016	Mile 71-72		Mile 73-74			MNF

ATTACHMENTS

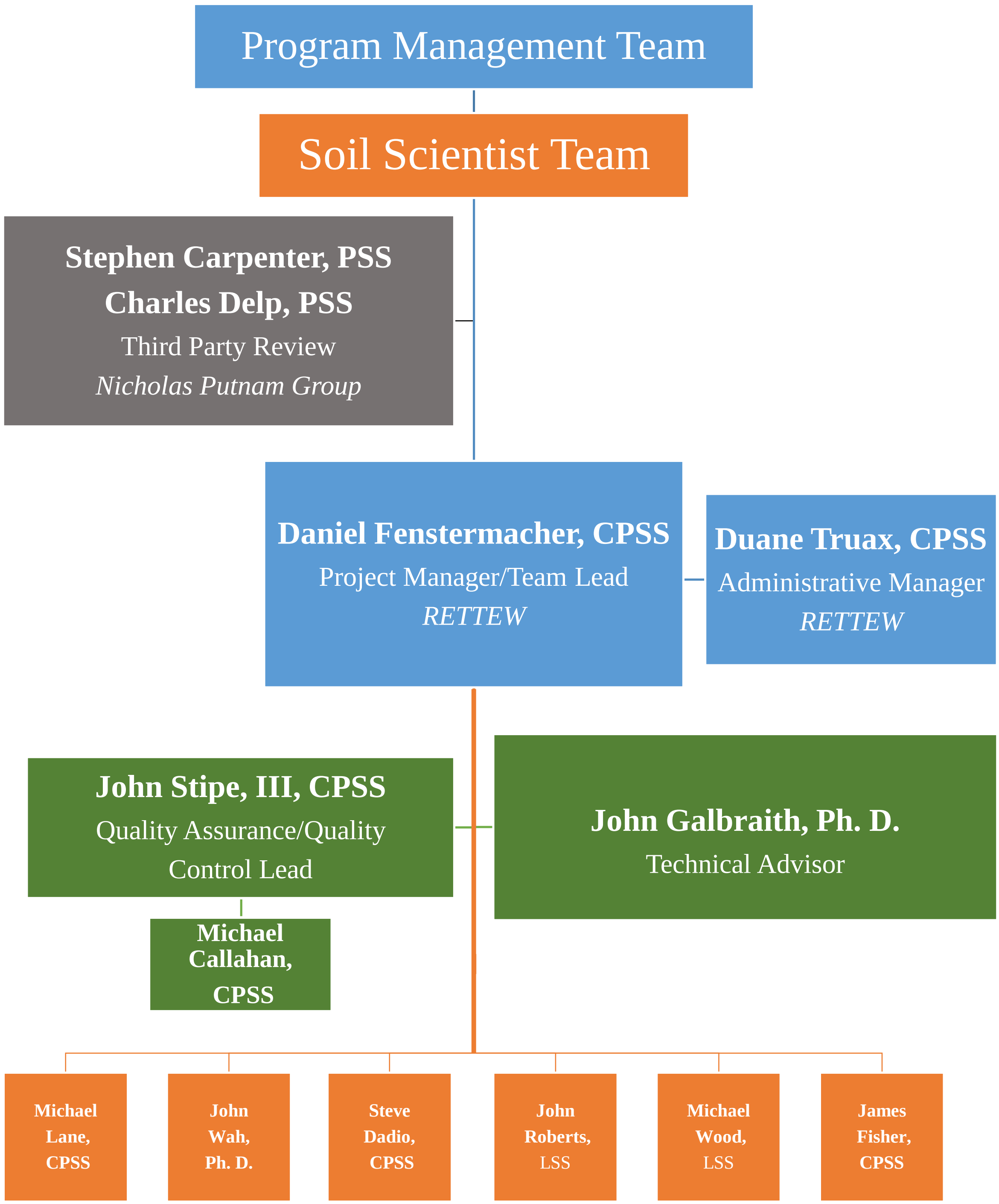
1. Organizational Charts
2. Soil Scientist Resumes
3. Laboratory Methodologies
4. Figures

Attachment 1
Organizational Charts

Atlantic Coast Pipeline Project
Order 1 Soil Survey
Organizational Chart – Management Team



Atlantic Coast Pipeline Project
Order 1 Soil Survey
Organizational Chart – Soil Science Team



Attachment 2
Soil Scientist Resumes

John B. Stipe III, CPSS
Director of Geosciences

Education
B.S., Environmental Resource Management, 1998, The Pennsylvania State University
Post Baccalaureate Studies in Geology and Soil Science, 2004-2006, Millersville University

Affiliations
SSSA - Soil Science Society of America
PAPSS - Pennsylvania Association of Professional Soil Scientists
Air and Waste Management Association
Marcellus Shale Coalition (MSC)

Training
OSHA, 40-Hour HAZWOPER
OSHA, 8-Hour HAZWOPER Supervisor
SafeLandUSA, First Aid/CPR
PA DEP, Advanced Soils Training
Dauphin County Conservation District, Site Evaluation, Soil Testing, and Infiltration: Applying the PA Stormwater BMP Manual
PAPSS, Interim Regional Supplement to the USACE Wetland Delineation Manual

Certifications
SSSA, Certified Professional Soil Scientist (CPSS)
PA Sewage Enforcement Officer (SEO)

Experience
Mr. Stipe is the Director of Geosciences at RETTEW with more than 17 years of experience as an environmental consultant. As a consulting soil scientist, Mr. Stipe provides detailed evaluations for site development including site evaluations for stormwater management and infiltration best management practices (BMPs), infiltration testing, geologic and karst hazard evaluations, soil mapping and classification, site investigations for on-site sewage disposal, soil permeability and percolation testing, on-lot septic system design, soil investigations for sewage sludge disposal, and soil investigations for hazardous waste disposal. With his understanding of the land development process and state and local policies, Mr. Stipe provides recommendations to consulting engineers and developers for planning, site feasibility, and design.

Mr. Stipe also serves the firm's energy clients engaged in the exploration of the Marcellus and Utica Shale Plays in Pennsylvania, Ohio, and West Virginia. Services provided to both exploration and production and midstream clients include the design and implementation of baseline water quality sampling programs, large-scale Phase I and II ESAs, soil quality investigations, remedial actions, environmental permitting, waste reporting, geotechnical investigations related to oil and gas field development and appurtenances, landslide and slip repair, surface and groundwater water source development, and SPCC plans.

Related experience includes the following projects:

Soil Mapping Investigation, Lancaster County, PA. Completed a soil mapping exercise to evaluate the accuracy of soil boundaries mapped by the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) in the Soil Survey of Lancaster County. The client intended to construct a commercial building in a floodplain soil type. However, because of ordinance restrictions, construction in the soil type was not permitted. The investigation confirmed the soils at the site differed from the floodplain soil type indicated by the County soil survey. Following review of the soils report, the Township issued the client a building permit.

Soil Mapping Investigation, Chester County, PA. Completed a soil mapping exercise to evaluate the accuracy of soil boundaries mapped by USDA-NRCS in the Soil Survey of Chester County. The client intended to construct a stormwater infiltration BMP (rain garden) in a floodplain soil type. However, because of ordinance restrictions, construction in the soil type was not permitted. The investigation confirmed the soils at the site differed from the floodplain soil type indicated by the County soil survey. Following review of the soils report, the local municipality approved the stormwater management plan.

Soil Investigations for Stormwater Management, Multiple Clients, Multiple Locations, PA. Served as Project Manager and technical lead for hundreds of feasibility studies to evaluate soil and geologic suitability for the design and construction of stormwater BMPs in karst and non-karst areas. Field activities included infiltration testing, soil classification, mapping and interpretation, field view, and field truthing of mapped soil and geologic features. Infiltration testing procedures included double-ring infiltrometer tests, permeameter tests, and standpipe tests.

Soil Investigation for Community On-Site Sewage Disposal, Drip Irrigation of Wastewater, Chester County, PA. While serving as Project Manager, conducted an investigation to evaluate large agricultural tracts for drip irrigation of 40,000 gpd of wastewater from a proposed athletic training facility. Coordinated the investigation closely with PA DEP and the County Health Department. Project included soil mapping, soil morphology evaluations, permeability testing, percolation testing, preparation of water balance calculations, and calculation of hydraulic loading rates for disposal.

Geotechnical Investigations, Proposed Natural Gas Facilities, Confidential Natural Gas Clients, Marcellus Shale Play, PA and WV. Provided technical oversight for the completion of multiple geotechnical investigations at multiple proposed natural gas facilities including well pads, compressor stations, metering sites, and pipeline facilities. Completed the investigations to evaluate subsurface conditions and site constraints to facilitate construction activities.

Soil Investigation for Community On-Site Sewage Disposal, Drip Irrigation of Wastewater, Chester County, PA. While serving as Project Manager, conducted an investigation to evaluate a 3-acre site for drip irrigation of 6,000 gpd of wastewater from an educational facility. Coordinated the investigation closely with PA DEP and the County Health Department. Project included a soil morphology evaluation, soil mapping exercise, and permeability testing. Prepared water balance calculations and assigned loading rates for disposal based on the observed soil morphology and measured soil hydraulic conductivities. Worked closely with environmental engineers to provide input for the system design and obtain the needed sewage permit from PA DEP.

Daniel E. Fenstermacher, CPSS
Soil Scientist

RETTEW

Education
B.S., Environmental Biology, 2009, Delaware Valley College
M.S., Soil and Watershed Science, 2012, University of Maryland

Affiliations
MAHSC - Mid-Atlantic Hydric Soils Committee
MAPSS - Mid-Atlantic Association of Professional Soil Scientists
SSSA - Soil Science Society of America
SWS - Society of Wetland Scientists

Training
Excavation and Trenching Awareness
MAPSS, Field Indicators of Hydric Soils in the Northern Piedmont
OSHA, 40-Hour HAZWOPER
OSHA, 8-Hour HAZWOPER Refresher
SafeLandUSA

Certifications
SSSA, Certified Professional Soil Scientist (CPSS)

Experience
Mr. Fenstermacher is a Soil Scientist in RETTEW's Geosciences group with five years of environmental consulting experience. Mr. Fenstermacher conducts soil classification, stormwater testing, geotechnical investigations, wetland delineations, and water sampling for the firm's oil and gas exploration and production clients. Through this experience, as well as his wetland restoration involvement, he has built relationships with numerous regulatory agencies including PA DEP and USDA's Agricultural Research Service.

Related experience includes the following projects:

Delmarva Bay Carbon Study, University of Maryland, Caroline County, MD. Led research to assess the impact of the historical conversion to agriculture on soil carbon and how that impact has altered the Delmarva Bay landscape. Examined the soils of Delmarva Bay wetlands under natural and agricultural land uses, including prior converted cropland, to determine if the conversion to agriculture affected carbon stocks and the potential for carbon sequestration through ecosystem restoration.

Conservation Effects Assessment Project, USDA, Multiple Counties, Multiple States. Conducted research to assess the effectiveness of depressional wetland restoration along the coastal plain. Focused on carbon sequestration and sedimentation as a component of a much larger collaborative study. Examined and determined carbon stocks for soils of natural, agricultural, and restored wetlands and analyzed data for these groups to examine the effects of land use change and restoration techniques.

Delmarva Bay Hydroperiod Study, USDA, Caroline County, MD. Examined soils and carbon stocks of wetlands to determine if soils influenced the hydroperiod and how the hydroperiod influenced carbon stocks.

Well Pad, Confidential Natural Gas Client, Columbiana County, OH. Served as Environmental Scientist responsible for conducting geotechnical investigations including soil classification via test pits and soil core borings.

Natural Gas Well Pad and Impoundment Wetland Delineations, Confidential Natural Gas Client, Multiple Counties, PA. Served as Environmental Scientist for conducting wetland delineations, habitat assessments, and top soil surveys for multiple oil and gas well pads and impoundments.

Cellular Tower Sites, Verizon Wireless, Multiple Counties, PA. Served as Soil Scientist for multiple proposed cell phone towers. Conducted soil classification and stormwater infiltration testing for stormwater management plans.

Natural Gas Well Pads Geotechnical Investigations, Confidential Natural Gas Client, Multiple Counties, WV. Served as Environmental Scientist for conducting geotechnical investigations for multiple oil and gas projects. Work included soil penetration testing, rock coring, logging bores, and collection of samples.

Well Pad, Confidential Natural Gas Client, Mercer County, PA. Served as Environmental Scientist responsible for conducting soil characterization and infiltration testing for designing stormwater management features.

Michael Callahan, CPSS
Senior Soil Scientist

RETTEW

Education
B.S., Environmental Soil Science, 2001, The Pennsylvania State University
M.S., Soil Science, 2004, The Pennsylvania State University

Affiliations
NOWRA - National On-Site Wastewater Recycling Association
PAPSS - Pennsylvania Association of Professional Soil Scientists
POWRA - Pennsylvania On-Site Wastewater Recycling Association
SSSA - Soil Science Society of America

Training
SafeLandUSA

Certifications
SSSA, Certified Professional Soil Scientist (CPSS)
Sewage Enforcement Officer (SEO)

Experience
Mr. Callahan is a Certified Professional Soil Scientist, with more than ten years of experience evaluating soils and landscapes in multiple locations in the U.S. His responsibilities include the classification and interpretation of soil morphological properties, the implementation of field data collection, analysis of field and laboratory data, and the preparation of environmental permits. Mr. Callahan has mapped soils on sites ranging from less than 1 acre to more than 1,000 acres. He has coupled his soil morphology experience with remote data technologies to facilitate more accurate findings and more focused investigations. He also has extensive experience in soil phosphorous. Mr. Callahan has served as an officer for many professional organizations; participated in industry workgroups on special topics of concern; and routinely interacts with federal, state, and local agency personnel in the soil science and environmental science arenas. He also serves as an Adjunct Professor of Soil Science at the Delaware Valley University.

Related experience includes the following projects:

Soil Investigations for Community On-Site Sewage Disposal Systems, West Penn Township, Schuylkill County, PA. To evaluate the potential for a community land application option as a long-term solution for sewage disposal, evaluated a prioritized list of 53 potential land application sites with Township officials and PA DEP to complete detailed investigations at the ten highest-priority sites. Investigations included soil classification, soil mapping, permeability testing, and percolation testing. Following the completion of the detailed investigations, completed a cost benefit analysis to determine if public sewer or a land-based application is the best long-term solution for community sewage disposal.

Soil and Site Evaluation for Community-Scale Septic System, Haywood County, NC. As Lead Soil Scientist, conducted a preliminary soil and site evaluation for an 800-acre property. The investigation characterized the soil in site conditions in relation to their suitability to serve as an infiltration drain field for residential sewage effluent. Based on the results of the preliminary study, conducted an additional detailed soil and site evaluation on 8 acres to gather the data needed to properly locate and size the drain field. During this phase of testing, examined backhoe-excavated soil test pits, conducted constant head-saturated hydraulic conductivity tests, and analyzed collected data in a comprehensive environmental and regulatory framework that balanced the needs of the facility with the natural constraints of the landscape. The analysis included an agronomic analysis of the soil and water balance for the site that incorporated the effluent volume.

Hydric Soil Investigation, Union County, NC. Conducted a detailed soil mapping of hydric soil boundary on several potential stream and wetland restoration sites. The focus was to accurately determine the extent of hydric and relict hydric soils on the properties to determine the potential for stream and wetland restoration for a mitigation banking company. Incorporated results into a decision support matrix to aid the client in determining the most effective sites to pursue.

Stormwater Feasibility, Fort Bragg, Cumberland County, NC. Evaluated potential stormwater infiltration sites to determine potential depth of infiltration structure and design loading rate. Analyzed backhoe-excavated soil test pits and conducted saturated hydraulic conductivity measurements according to the results of the morphological evaluation. Relayed results to the project design engineer to aid in overall site design.

General Permit, Forsyth County, NC. Worked in conjunction with field biologist to delineate jurisdictional streams and wetlands on the site and prepared the permit applications for federal and state agencies for an abandoned firing range. The need for the removal of lead- and chromium-contaminated soil behind an abandoned firing range prompted an evaluation of the environmental resources of the site. Field investigations revealed the presence of a wetland in the vicinity of the contaminated soil. Prepared general permit for removal of the contaminated soil and placement of fill material. Used GPS in the field to collect data points and in the office to prepare map products for the client and permit application.

Bench-Scale Incubation Study, USDA-Agricultural Research Service, University Park, Centre County, PA. Served as the Project Support Scientist. Aided in the design, construction, implementation, data analysis, and preparation of results of a bench-scale soil incubation study. The study investigated the efficacy of various industrial byproducts to increase the retention time of soil phosphorus in high phosphorus concentration agricultural soils. Analyzed results in the context of the bench-scale study as well as in relation to separate plot- and field-scale studies to determine efficacy across scales.

Curriculum Vitae John M. Galbraith

Education

- Ph. D. Cornell University 1997 Soil Science, Agronomy, Geomorphology
- M.S. Texas Tech University 1983 Range Science
- B.S. Texas Tech University 1978 Range and Wildlife Management

Professional appointments (60% teaching, 30% extension, 10% research)

- Associate Professor, Crop and Soil Envir Sci , Virginia Tech, Blacksburg, VA, 2005-present
- Assistant Professor, Crop and Soil Envir Sci, Virginia Tech, Blacksburg, VA, 1999-2005
- Post-Doctoral Associate, Soil and Water Science, Univ. of Florida, Gainesville, FL, 1998-1999
- Post- Doctoral Associate, Crop, Soil, and Atmos. Sci., Cornell University, Ithaca, NY, 1997-1998
- Research Support Specialist, Crop, Soil, and Atmos. Sci., Cornell Univ., Ithaca, NY, 1990-1997
- Supervisory Soil Scientist, USDA-SCS, Havre, MT, 1987-1990
- Soil Scientist, USDA-SCS, Pearsall and Kenedy, TX, 1983-1987
- Range Conservationist, USDA-SCS, Menard and Andrews, TX, 1977-1979

Awards

- Elected Fundamental Soil Sci. Group, Repr. to the Soil Sci. Soc. Am. Board Directors. 2013-2016.
- Elected Chair, Div. 1.4 Soil Classification, Int. Union Soil Sci. 2010-2014.
- Elected Chair, Div. S-5 (Pedology), Soil Sci. Soc. Am. 2008.
- NE Cooperative Soil Survey Conference - Silver Spade Award presented for outstanding regional and/or national service to soil survey. 2008.
- Harry A. McDonald Award for Excellence in Teaching, Dept. Soil, Crop, and Atmospheric Sci., Cornell University. 1997.

Publications (refereed journal articles since 2006) * indicates student author. (10 of 23 total)

- Mikhailova, E., Post, C., Schlautman, M.A., and J.M. Galbraith. 2013. Potential Contribution of Combined Atmospheric Ca^{2+} and Mg^{2+} Wet deposition within the Continental U.S. to Soil Inorganic Carbon Sequestration. Pedosphere. Accepted Aug. 2013.
- Kayastha, N., Thomas, V.A., and J.M. Galbraith. 2012. Monitoring wetland change using inter annual Landsat timeseries data. Wetlands 32:1149–1162. DOI 10.1007/s13157-012-0345-1
- Galbraith, J.M. 2012. Shepherding Undergraduate Students Through a Research Experience. No. Am. Col. Teach. Agric. J. 56 (2): 76-82
- Galbraith, J.M. 2012. Using Student Competition Field Trips to Increase Teaching and Learning Effectiveness. J. Nat. Res. Life Sci. Edu. 41(1): 54-58
- Chakraborty, S., Weindorf, D.C., Zhu, Y., Li, B., Morgan, C.L.S., Ge, Y., and J.M. Galbraith. 2012. Assessing spatial variability of soil petroleum contamination using visible near-infrared diffuse reflectance spectroscopy. J. Envir. Monit. 14: 2886-2892. DOI 10.1039/c2em30330b
- Chakraborty, S., Weindorf, D.C., Zhu, Y., Li, B., Morgan, C.L.S., Ge, Y., and J.M. Galbraith. 2012. Spectral reflectance variability from soil physicochemical properties in oil contaminated soils. Geoderma 177-178: 80-89. DOI 10.1016/
- Chakraborty, S., Weindorf, D.C., Morgan, C.L.S., Ge, Y., Galbraith, J.M., Li, B., and C.S. Kahlon. 2010. Rapid Identification of Oil-Contaminated Soils Using Visible Near-Infrared Diffuse Reflectance Spectroscopy. J. Environ. Qual. Vol 39(4): 1378-1387.

- Goddard, M.A.*, Mikhailova, E.M., Post, C.J., Schlautman, M.A., and J.M. Galbraith. 2009. Continental United States Atmospheric Wet Calcium Deposition and Soil Inorganic Carbon Stocks. Soil Sci. Soc. Am. J. 73:989-994.
- Pantaleoni, E.*, R. Wynne, J. Galbraith, and J. Campbell. 2009. A logit model for predicting wetland location using ASTER and GIS. Inter. J. of Rem. Sens. 30(9): 2215-2236
- Pantaleoni, E.*, R. Wynne, J. Galbraith, and J. Campbell. 2009. A comparison of CART and logistic regression for mapping wetland types in the Coastal Plain of Virginia using the ASTER sensor. Inter. J. of Rem. Sens. 30(13): 3423-3440.
- Showalter, J.M.*, J.A. Burger, C.E. Zipper, J.M. Galbraith, and P.F. Donovan. 2007. Influence of Mine Soil Properties on White Oak Seedling Growth: A Proposed Mine Soil Classification Model. So. J. Appl. For. 31(2): 99-107.
- Galang*, J., C.Zipper, S. Prisley, J. Galbraith, and P. Donovan. 2006. Evaluating Terrestrial Carbon Sequestration Options for Virginia. Env. Mngmnt. 39(2):139-150
- Casselman*, C.N., T.R. Fox, Burger, J.A., Jones, A.T., and J.M. Galbraith. 2006. Effects of silvicultural treatments on survival and growth of trees planted on reclaimed mine lands in the Appalachians. For. Ecol. and Mngmnt. 223:403-414.
- Burdt*, A.C., J.M. Galbraith, and J.P. Megonigal. 2006. CO_2 efflux rates by land-use treatment in wet flats of Southeast Virginia. Wetl. Ecol. and Mngmnt. 14(2):133–145.

Competitive grants (current)

- J. Galbraith, 100%, USDA-NRCS, $11,089, 9/01/13 to 8/30/15, Soil Taxonomy Forum Update, maintenance, and Hosting (CESU).
- J. Galbraith, 100%, NPS, $10,000, 7/30/12 to 9/30/13, Geological and Soils Study of Mound Sites, Canaveral National Seashore (CESU).
- Fike J., J. Galbraith, 20%, DOE/Sungrant, $175,999, 4/1/10 to 3/31/15, Switchgrass Feedstock Research.
- Fike J., J. Galbraith, 20%, NC Sungrant/DOE, $106,499, 4/1/10 to 3/31/15, Miscanthus Feedstock Research.
- Sanders, K., J. Galbraith, A. Abaye, S. Cook, J. McKenna, B. Potter , 25%, Terry Lynn Poerner Charitable Foundation, $50,000, 10/01/08 to 09/30/13, Virginia Indians Pre-College Outreach Initiative.

Courses taught (100% involvement unless otherwise indicated)

- Soils (40%)
- Soil Description and Interpretation
- Soil Description and Sampling
- Advanced Wetland Soils (70%)

Soils in the Landscape (40%)
Soil Genesis and Classification
Wetland Soils and Mitigation
Advanced Wetland Soils [on-line] (70%)

Student advising (summary)

- Co-major advisor for doctoral candidates [Kayastha]; on four other committees [Bartens; Chakraborty; Zheng; Severson].
- Major or co-major advisor for master's candidates [Liu; Troyer; Morrow; Stephenson; Teany; Morgan; Templeton]; on one other M.S. committee [Bonzey].
- Former Advisor to 15 undergraduates, now to all CSES Soil and Land Rehabilitation students
- Major advisor to one Doctoral and five Masters students who completed their degree.

Diversity initiatives or contributions (selected)

- Developed relationship to assist Oglala Lakota College (Tribal College, 1994 Land Grant) in reestablishing Basic Soils and add a summer school Wetlands class
- Voluntary teacher for one-week at Red Cloud Indian School, Pine Ridge, SD 2014
- Member of Virginia Indians Pre-College Outreach Initiative Planning Team
- Member Native @ VT student organization
- Attendee, Virginia Indian Nations Summit on Higher Education (VINSHE)
- Successfully co-authored a $50,000 grant from a private foundation for initial funding of theVirginia Indians Pre-College Outreach Initiative
- Association of Women Soil Scientists 2008-present

Outreach and professional service (summary, arranged by date)

- Appointed representative to Virginia Sewage Handling and Disposal Advisory Committee 2013-present
- Meeting Associate Editor for Divisions S-10 and S-5. Soil Sci. Soc. Am. J. 2005-2008
- Appointed by the Virginia Governor's Office for the Board for Professional Soil Scientists and Wetland Professionals 2004-2007
- Associate Editor for the Southern Region. Soil Survey Horizons (published by the American Society of Agronomy) 2002-2006
- Member of one international, four national, four regional, five state, one university, and two departmental committees 1998-present
- Nine outreach-related publications and nine outreach-related websites 1999-present
- Appointed to Comm. to develop Universal Soil Classification System 2010-2018
- Appointed to Comm. to write a simplified version of Soil Taxonomy 2011-present
- Appointed William H. Patrick Lectureship selection committee 2008-present
- Southeast Region representative - Soil Judging Committee 1999-2002
- Soil Judging Committee 1999-2002
- Soil Geomorphology Committee 2002-present
- Northeast Region - Research Needs Committee 2000-present
- Northeast Region – Standards and Procedures/Soil Tax. Committee 1996-present

Associations and society memberships (arranged alphabetically, appointed positions indicated)

- Affiliated Faculty – Conservation Management Inst., Center for Geospatial Info. Technologies, and Center for Envir. Applications of Remote Sensing 2006 -present.
- Association of Women Soil Scientists 2008-present
- International Union of Soil Scientists (formerly ISSS) 1977-present
- North American Colleges and Teachers of Agriculture 1999-present
- Soil Science Society of America 1977-present
- Society of Wetland Scientists 2000-present
- Virginia Association of Professional Soil Scientists 1999-present
- Virginia Association of Wetland Professionals 2000-present
- Wetland Mapping Consortium co-founder, web site manager 2008-present

Duane A. Truax, CPSS
Senior Soil Scientist

RETTEW

Education
B.S., Soil Science, 2000, The Pennsylvania State University
B.S., Turfgrass Science, 2000, The Pennsylvania State University

Affiliations
ASA - American Society of Agronomy
CSSA - Crop Science Society of America
MAPSS - Maryland Association of Professional Soil Scientists
PAPSS - Pennsylvania Association of Professional Soil Scientists
PTC - Pennsylvania Turfgrass Council
SSSA - Soil Science Society of America

Training
Maryland E&S Control
SafeLandUSA
USACE, Wetland Delineation

Certifications
SSSA, Certified Professional Soil Scientist (CPSS)
PDA, Licensed Pennsylvania Pesticide Applicator, Category No. 7

Experience
Mr. Truax is a Soil Scientist in RETTEW's Geosciences group with 15 years of experience in soils and geotechnical consulting. His geotechnical engineering experience includes proposal preparation, project management, drilling inspection, test pit monitoring and documentation, soil classification and logging, in situ infiltration testing, data analysis and evaluation, and report preparation. He has worked with single and multistory commercial buildings, warehouses, freshwater impoundments for natural gas production, stormwater management facilities, retaining walls, and roadways. Mr. Truax manages testing and inspection for construction materials including soils, foundation subgrade, rebar reinforcement, concrete, masonry, structural steel, precast-concrete, sprayed-on fire-resistive materials, and intumescent paint projects.

Related experience includes the following projects:

Commercial Site Development, High Real Estate Group, Lancaster County, PA. Provided on-site test pit observation and infiltration testing for the proposed commercial development of a parcel of land located in East Lampeter Township. Based on the requirements of the Township stormwater management ordnance, the bottoms of stormwater BMPs must be located a minimum of 4 feet above any observed limiting zone such as bedrock and seasonal high water tables. Assisted with identifying limiting zones in the soil profiles at the site and completed full soil profile descriptions based on USDA soil classification system.

Tanger Outlet Center Lancaster Expansion, Tanger Outlet Centers, Lancaster County, PA. Served as Senior Soil Scientist on both the geotechnical investigation and stormwater infiltration testing phases at this site. Proposed improvements included construction of three single-story retail buildings and associated parking and access areas, as well as stormwater management facilities to accommodate the new construction. The majority of this expansion project is proposed on the property adjacent to the existing outlet retail center. This site is underlain by karst (carbonate) geology, which is susceptible to sinkhole development.

Proposed Townhouse Development Soil and Geotechnical Investigation, Hovnanian Enterprises, Chester County, PA. Served as Senior Soil Scientist for the soils investigation. Proposed improvements included construction of townhouses and associated access roads and stormwater management facilities. Client used the results of site investigation, consisting of test pits, and subsequent analysis, to plan for the proposed townhouse foundations as well as other earthwork requirements related to the project.

Signature Senior Living Community Development, SDR Development, Inc., Lancaster County, PA. Served as Senior Soil Scientist on both the geotechnical investigation and stormwater infiltration testing phases at this site. Project included construction of a new single-story, assisted-living facility with associated parking and access areas. Stormwater management facilities are also proposed to accommodate the new construction. The site is underlain by karst (carbonate) geology, which is susceptible to sinkhole development.

SpringHill Suites at Saucon Valley, High Hotels, Ltd., Lehigh County, PA. Served as Senior Soil Scientist on both the geotechnical investigation and stormwater infiltration testing phases at this site. Proposed improvements included two hotels with associated parking and access areas, as well as stormwater management facilities to accommodate the new construction. This site posed several unique challenges to the proposed development including its underlying karst (carbonate) geology, which is susceptible to sinkholes and subsidence. Investigated a historic quarry at the site using geotechnical borings and geophysical techniques to determine its extent.

Geotechnical and Soil Investigations, Confidential Natural Gas Client, Multiple Counties, PA. Completed site investigations and analyses on an accelerated schedule while maintaining a high level of accuracy. Conducted soil investigations for proposed freshwater impoundments and provided on-site documentation of test pit and drill logging during the site investigation. Prepared detailed reports including findings, conclusions, and recommendations relative to the construction of freshwater impoundments.

Freshwater Impoundment, Confidential Natural Gas Client, Hunt Marcellus Operating Co., LLC, Marcellus Shale Play, PA. As Project Soil Scientist, provided a subsurface investigation and evaluation of this proposed freshwater impoundment in support of natural gas operations. Used data obtained from the test pit observations and laboratory analysis of soil samples obtained at the site to provide recommendations for the design and construction of the impoundment.

Natural Gas Well Pad, Confidential Natural Gas Client, Shell Exploration & Production Company, Utica Shale Play, PA. As Project Soil Scientist, performed test pits and infiltration testing at this future natural gas well pad site. Used the data obtained from the test pit observations and infiltration testing to provide recommendations for the design and construction of stormwater management BMPs.

JOHN S. WAH

P.O. Box 186, Shippensburg, PA 17257 ∴ (240) 604-6639

matapeake.soil@gmail.com

Summary of Experience

Trained in pedology and archaeology. Over 10 years post-Ph.D. experience in soil/geomorphological investigations for archaeological research and cultural resource management with a focus on the Northeast and Mid-Atlantic regions including PA, NY, NJ, MD, DE, VA and WV. Experience in the physical, chemical, and mineralogical laboratory characterization of soils. Preparation of technical and scientific reports and presentations. Teaching in field, laboratory, and classroom settings.

Education

Ph.D. (2003), Soil Science, University of Maryland, College Park.
Dissertation: "Origin and Pedogenic History of Quaternary Silts on the Maryland Coastal Plain."
Advisor: Dr. M.C. Rabenhorst

M.S. (1998), Soil Science, University of Tennessee, Knoxville.
Thesis: "Characteristics of Soils along the Elk River, Southcentral Tennessee: Implications for Soil and Landscape Genesis, and Archaeology."
Advisor: Dr. J.E. Foss

B.A. (1993), Anthropology and Medieval Studies, Pennsylvania State University, University Park.

Experience

Soil Scientist, Principal Investigator, Matapeake Soil and Environmental Consultants, LLC, Shippensburg, PA (2008 to present)

- Responsible for project design, budgeting, and implementation
- Performed soil/geomorphological field research in archaeological investigations
- Prepared technical and scientific reports and presentations
- Laboratory analysis of physical and mineralogical soil properties
- Provided soils training for Penn State, Juniata College, Washington College, and PBS Time Team America archaeological Field Schools

Research Collaborator, Smithsonian Institution National Museum of Natural History, Washington, D.C. (2010 to present)

- Soils and geomorphological research in interdisciplinary archeological investigations

Assistant Professor, Adjunct, Shippensburg University, Department of Geography & Earth Science, Shippensburg, PA (2008, 2010, 2011).

- Developed and taught ESS393/594 'Environmental Field Soils' a field, laboratory, and classroom course for graduate and undergraduate students
- Developed and taught ESS594-21 'Soils, Sediments, and Landscapes: Processes and the Archaeological Record' a graduate seminar course

Assistant Professor, Adjunct, Wilson College, Department of Environmental Sciences, Chambersburg, PA (2011)

- Developed and taught ENV370 'Stewardship of Watershed Ecosystems'

Soil Scientist, Principal Investigator, AXIS Research, Inc., James Creek, PA (2005 to 2008)

- Responsible for project design, budgeting, and implementation.
- Performed soil/geomorphological field research in archaeological investigations.
- Prepared technical and scientific reports and presentations.
- Managed soil research laboratory, physical and chemical soil analysis.
- Guest instructor for Field Methods course at Shippensburg University and Archaeological Field Schools at Penn State and Washington College.

Soil Scientist, Geo-Sci Consultants, Inc., University Park, MD (2001 to 2006).

- Performed field research in soil-archaeology investigations.
- Detailed soil mapping and hydraulic conductivity testing for spray irrigation.

Research Assistant, Department of Natural Resource Sciences, University of Maryland, College, Park, MD (1998 to 2003).

- Performed field and laboratory research in examination of soil genesis, morphology, classification, hydric soils, and soils in archaeology.
- Oversaw daily operations of pedology laboratory: physical, chemical, and mineralogical analysis of soils.
- Assistant coach University of Maryland Soil Judging Team (1998-2001).
- Teaching assistant for NRSC 424: Field Study in Soil Morphology (Summer 2000, 2002).

Research Assistant, Department of Plant and Soil Science, University of Tennessee, Knoxville (1994 to 1998).

- Performed field and laboratory research in examination of soil genesis, soil geomorphology, and soils in archaeology.
- Instructor for PSS 211: Introduction to Soil Science Lab (Fall 1997).

Field and Teaching Assistant, State Museum of Pennsylvania/Elizabethtown College, Ephrata, PA (June 1995 to August 1995 and June 1994 to August 1994)

- Oversaw daily excavation activities at field school in historical archaeology at Ephrata Cloister.
- Instructed students in field and laboratory techniques.

Archaeologist, Archaeological and Historical Consultants, Inc., Centre Hall, PA (1994).

- Performed phase I and II cultural resource survey.

Archaeologist, Heberling Associates, Huntingdon, PA (1993).

- Performed phase I and II cultural resource survey.

Archaeologist, Friends of the State Museum, Harrisburg, PA (June 1993 to August 1993)

- Assistant on the State Museum of Pennsylvania/Pennsylvania State University field school in historical archaeology at Ephrata Cloister.

Publications, Abstracts, and Presentations

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Wah, J.S. 2003. Introduction to biogenic opal in soils and archaeology. West Virginia Association of Professional Soil Scientists Annual Meeting, Shepherdstown, WV. June 6-7, 2003. (Invited).

Wah, J.S. 2003. Biogenic opal in soils on the Delmarva Peninsula, Maryland. West Virginia Association of Professional Soil Scientists Annual Meeting, Shepherdstown, WV. June 6-7, 2003. (Invited).

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Wah, J.S. 2012. Soils and geomorphology along Chickies Creek southwest of Manheim, Lancaster County, Pennsylvania. Report submitted to Rettew Associates, Inc., Lancaster, PA. 16 p.

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Wah, J.S. 2011. Soils and geomorphology along the WB Linden to Seeley Trunkline, Lycoming County, Pennsylvania. Report submitted to Rettew Associates, Inc., Lancaster, PA. 14 p.

Wah, J.S. 2011. Soils and geomorphology along Lycoming Creek for the Huff Surface Water Withdrawal, Lycoming County, Pennsylvania. Report submitted to Rettew Associates, Inc., Lancaster, PA. 12 p.

Wah, J.S. 2011. Investigation of soils and geomorphology along the Marsh Creek Water Line Corridor on Oak Ridge, Tioga County, Pennsylvania. Report submitted to Rettew Associates, Inc., Lancaster, PA. 9 p.

Wah, J.S. 2011. Investigation of soils and geomorphology along the Oelschlager Lateral Pipeline, Westmoreland County, Pennsylvania. Report submitted to Rettew Associates, Inc., Lancaster, PA. 24 p.

Wah, J.S. 2011. Soils and landscape evaluation along Swatara Creek, Dauphin County, Pennsylvania. Report submitted to Heberling Associates, Inc., Alexandria, PA. 31 p.

Wah, J.S. 2010. An evaluation of soils and the potential for deeply buried cultural materials on the floodplain of the Susquehanna River southeast of Wyalusing, Bradford County, Pennsylvania. Report submitted to Environment & Archaeology, Florence, KY. 15 p.

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Wah, J.S. 2008. Soils and geomorphology along the Canisteo River, Steuben County, New York. Report submitted to Environment & Archaeology, Florence, KY. 33 p.

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Wah, J.S. 2007. Investigation of soils and landscapes at the confluence of the Seneca and Oneida rivers, Onondaga County, New York. Report submitted to Panamerican Consultants, Inc., Buffalo, NY. 15 p.

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Professional Societies
Pennsylvania Association of Professional Soil Scientists
Mid-Atlantic Association of Professional Soil Scientists (2011 President)
The American Quaternary Association

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Brickhouse Environmental

MICHAEL E. LANE, CPSS

SENIOR SOIL SCIENTIST

Education:
B.S., Environmental Resource Management, The Pennsylvania State University, 1994
Professional Licenses and Certifications:
SSSA Certified Professional Soil Scientist 34591
Certified Sewage Enforcement Officer, Pennsylvania 02679
OSHA 40 Hour Health and Safety Training and Annual Refresher
Memberships:
Pennsylvania Association of Professional Soil Scientists,
President 2011-2012, Treasurer 2013-2016, Board of Directors 2008-present
Soil Science Society of America
Continuing Education:
PA Association of Sewage Enforcement Officers Annual Conference, presenter 2009, 2013
PA Septage Management Association Annual Conference, presenter 2006
PA Association of Professional Soil Scientists Technical Sessions, 2005-2015
40-Hour U.S. Army Corps Wetland Delineator Certification Preparatory Training
U.S. Army Corps Wetland Delineation Regional Supplement Training, 2010-2015
Publications:
White, Ruble, and Lane. The effect of changes in land use on nitrate concentration in water supply wells in southern Chester County, Pennsylvania. Environmental Monitoring and Assessment, March 6, 2012.
Lane, Which Came First? The License or the Rules? Soil Science Licensing. Soil Survey Horizons, Spring 2010, v51 no1.
References:
Ms. Karen Vickers, KV Excavating, Aston, PA 610-494-8600
Mr. Thomas Quinn, Chester County Health Department, 610-344-6526

Mr. Lane is a Senior Soil Scientist with Brickhouse Environmental. He is experienced in the evaluation of the physical properties of soils and interpretation of those properties for soil mapping and site characterization. His project experience ranges from wastewater and stormwater investigations for land development projects, to identification and mapping of hydric and alluvial soils, to groundwater and soil sampling for environmental remediation projects, to landfill monitoring and permitting. He has provided testimony before Township boards and commissions and has presented expert testimony before the Pennsylvania Environmental Hearing Board.

Mr. Lane has completed Phase I and Phase II environmental site assessments, environmental impact assessments, sewage facilities planning and design, wetland delineation and permitting, tree surveys, and habitat assessments for endangered and threatened species.

PROJECT EXPERIENCE

Artesian Water Company, Sussex County, DE
Developed and implemented a soil mapping plan comprising soil sampling for nutrients, backhoe test pits, infiltration tests, and several hundred auger borings to create detailed soil mapping of 1,600 acres. Responsible for preparation of a Site Investigation Report for a proposed spray irrigation wastewater disposal system to service 4,000 homes generating 7 million gallons of wastewater per day. The Site Investigation Report was approved by the Delaware Department of Natural Resources and Environmental Control.

Qualified Professional Soil Science Consultant, Chester County Health Department, PA
On behalf of Chester County, responsible for examination of soils for suitability for onlot sewage disposal systems and submission of written reports for subdivisions of more than 10 lots, for multi-residential and commercial projects where sewage flows are greater than 4,000 gallons per day, and for morphological evaluations of soils as required by the PA DEP. Also responsible for providing technical resolution of soils evaluation disputes for all individual lots at the request of the Health Department.

Expert Report in Support of Litigation, Lycoming County, PA
On behalf of a pipeline construction company, prepared an expert rebuttal report related to the construction of a 30-mile natural gas transmission pipeline and appurtenant facilities. Brickhouse was retained by the construction company in support of their efforts to collect over $17 million in unpaid invoices. The pipeline owner alleged that errors in erosion and sedimentation control and obtaining environmental permits by the construction company and its subcontractors directly resulted in project delays and significant additional costs. Brickhouse found that the wetland delineation and permitting was proper and was conducted in accordance with the industry standard. Brickhouse used detailed reviews of the plan drawings and daily precipitation records, along with a flyover site inspection, to confirm that the construction conformed to accepted practices. The expert rebuttal report and real-time trial support provided by Brickhouse resulted in a court victory for the construction company on all counts, with a total award in excess of $20 million.

Southeastern Chester County Refuse Authority (SECCRA), Chester County, PA
Responsible for detailed soils mapping of hydric and alluvial soils and preparation of a water budget for constructed wetland and stream recharge components of stormwater management system for permitted landfill expansion. Responsible for detailed soils testing, spray irrigation design, and water quality permitting for land application of treated landfill leachate. Assists with quarterly groundwater surface water and leachate sampling events for compliance with PADEP solid waste regulations and SECCRA's solid waste permit.

Artesian Water Company, New Castle County, DE
Responsible for preparation of a Site Investigation Report for a proposed rapid infiltration basin (RIB) wastewater system capable of disposing of 1.5 million gallons of wastewater per day. Developed and implemented a site testing plan comprising soil borings, test pits, and infiltration tests on multiple disposal sites. Provided oversight during construction of four full-sized test RIBs. Preliminary dosing of the test RIBs has confirmed the results of the investigation.

Crane Property Soil Mapping, Delaware County, PA
Conducted deep test pit evaluations along proposed roadway to determine ease of excavation and depth to bedrock for proposed residential development.

Kemblesville Wastewater, Franklin Township, Chester County, PA
Responsible for soils evaluations and permeability testing for a proposed drip irrigation sewage disposal system for combined sewage flows of 128,000 gallons per day. The detailed testing plan involved multiple sites and coordination with the PADEP soil scientist and the Township's wastewater engineer.

Anson B. Nixon Park and Cloud Landfill, Chester County, PA
Responsible for soils evaluation and reporting for stormwater facilities and wetland delineation for beneficial reuse of closed sanitary trench landfills located in southeastern Pennsylvania.

Kennett Development Group, Kennett Township, Chester County, PA
Completed wetland delineation, tree survey, soils testing for stormwater management, sewage facilities planning, and pump station design for a 500,000-square foot office complex.

Pennsylvania Emergency Management Headquarters, Dauphin County, PA
Responsible for wetland delineation and jurisdictional determination submission for the proposed 100,000-square foot state-wide emergency operations facility.

Swatara Creek Bridge Replacement (SR 1022, Section 001), Lebanon County, PA
Performed wetland delineation and categorical exclusion evaluation for the replacement of an existing twin-span bridge over Swatara Creek.

M.O.T. Water Farm No. 1 and Lea Eara Farms, New Castle County, DE
Developed and implemented a soil sampling and vegetation sampling plan for two spray irrigation wastewater disposal sites. Provide annual reporting for soil fertility and vegetation monitoring, including recommendations to optimize treatment and crop yield. The two facilities are permitted to provide 165 acres of spray irrigation disposal for 1.2 million gallons per day of treated residential, commercial, and industrial sewage.

Smith Memorial Playhouse and Playground, Philadelphia, PA
Responsible for site selection, test pit evaluations, percolation testing, system design, and permitting for the replacement onlot sewage disposal system for the 100-year-old children's playhouse and playground in Fairmount Park. Tree removal was minimized through the use of directional boring techniques and conveyors to place the system aggregate.

Heritage Building Group, Warwick Township, Chester County, PA
Provided testimony before the Township planning commission, and provided expert testimony before the Environmental Hearing Board for the proposed on-site community wastewater disposal system.

Delaware Solid Waste Authority, DE
Assists with coordination and implementation of the groundwater, surface water, landfill gas migration, and leachate monitoring programs for four municipal waste landfills operated by the Delaware Solid Waste Authority. These extensive monitoring programs include monthly leachate monitoring and landfill inspections, as well as quarterly monitoring of groundwater. Groundwater sampling includes the collection of groundwater samples for dissolved methane gas analysis from select monitoring wells using low-flow well purging techniques.

Stephen D. Dadio, CPSS - Environmental Manager

CEDARVILLE Engineering Group, LLC

EDUCATION

M.S.– Soil Science
Pennsylvania State University

B.S. - Soil Science
Cornell University

PROFESSIONAL CERTIFICATIONS

SSSA (ARCPACS) Certified Professional Soil Scientist

SSSA (ARCPACS) Certified Professional Soil Classifier

PAPSS Registered Professional Soil Scientist

Delaware DNREC Licensed Class D Soil Classifier

Pennsylvania Licensed Sewage Enforcement Officer

NICET Certified in Highway Construction and E&S Control

SUMMARY OF EXPERIENCE

Mr. Dadio, Environmental Manager at CEDARVILLE Engineering Group, LLC, has 17 years of professional experience and leads our environmental department. He has used his extensive technical knowledge in ecological and hydrological fields for wetland delineations, watershed studies, environmental site assessments, and nonpoint source pollution prevention programs. Mr. Dadio has extensive experience in the field of soil science for a wide variety of land uses. Specializing in urban and disturbed landscapes, his career has focused on green infrastructure solutions in maintaining natural hydrologic conditions. He also regularly serves as a Construction Manager, with experience in estimating, field management, site inspection and quality control.

PROFESSIONAL AFFILIATIONS

- Adjunct Faculty, Delaware Valley University, Doylestown, PA
- Pennsylvania Association of Professional Soil Scientists, President - 2009, 2010
- Member, DEP Stormwater Loading Re-Write Workgroup
- Member, Soil Science Society of America
- Member, W.B. Saul Agricultural High School (Philadelphia) Natural Resources Curriculum Advisory Board

CEDARVILLE EXPERIENCE

United States Environmental Protection Agency, Cincinnati, Ohio – CEDARVILLE Engineering Group, LLC conducted detailed soil surveys and hydrologic investigations in the cities of Phoenix, AZ, Atlanta, GA, New Orleans, LA, Portland, ME, Detroit, MI, Omaha, NE, Camden, NJ, Cincinnati, OH, Cleveland, OH, San Juan, PR, and Tacoma, WA to determine the stormwater management potential for the soils in vacant lots in order to mitigate Combined Sewer Overflow (CSO) events. The urbanized soils collected from the sites were analyzed to identify feature classifications that are similar to native material, to develop a database of soil information on a regional basis for planning.

NPDES Program Manager-City of Coatesville – Plan all stormwater activities required to maintain compliance with the MS-4; PAG Permit. This includes the development of a TMDL plan for sediments, nitrogen, and phosphorous. Also served on the Christina Basin TMDL Improvement Committee (CTIP) as a municipal representative.

NPDES Program Manager-Westtown Township – Plan all stormwater activities required to maintain compliance with the MS-4; PAI Permit. This includes the development of a TMDL plan for phosphorous.

NPDES Program Manager-West Norriton Township – Plan all stormwater activities required to maintain compliance with the MS-4; PAG Permit. This includes the development of a Pollutant Reduction Plan for impaired waters.

On-Lot Sewage Sewage Management Program, Newlin Township – Developed a Sewage Management Program for Newlin Township. This program involves the implementation of an ordinance, resident education, and associated record documentation.

Grant Writing, City of Coatesville—Successfully procured two grants for the City of Coatesville to repair aging infrastructure, particularly stormwater inlets. These grants totaled $277,500 from both the PA DCED WRPP Program ($127,500) and PA DEP Growing Greener ($150,000).

CONTACT

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Suite 300
North Coventry, PA 19465

P: 610.705.4500 · F: 610.705.4900
sdadio@cedarvilleeng.com

www.cedarvilleeng.com

Stephen D. Dadio, CPSS - Environmental Manager

Construction Manager, Several Municipalities—Supervised three construction inspectors working on various land development projects throughout southeastern Pennsylvania. Coordinated work with both municipal officials as well as private construction managers.

Timber Harvest Reviewer, West Nantmeal Township—Review and inspect timber harvests in accordance with local regulations. Interact with Chester County Conservation District in the facilitation of these unique permits.

Stargazer Road land acquisition, Newlin Township – Conducted Phase 1 Environmental Site Assessment for property that was purchased by Newlin Township.

305 Kimberton Road Phase 1 and Phase 2, Schuylkill Township – Conducted Phase 1 and Phase 2 Environmental Site Assessment for property that was purchased for a private land development. These tasks include detailed site characterization for possible contaminants.

USDA Agricultural Research Service (USDA-ARS) – Completed detailed evaluation of soils in central Pennsylvania to determine the presence of dense, brittle soil horizons (fragipans). This project involved detailed site characterization and sampling to assist with the greater research project.

Valley Forge Distribution Center – Supervised the design of a water line extension from an existing facility to the main several hundred feet away. This involved the design of a water meter pit and also required extensive coordination with PA American.

Wetland Delineation for Giant, Lower Paxton Township, Dauphin County – Completed a wetland delineation for the construction of a supermarket. This included field delineation and submission of a completed wetland report.

Geotechnical Borings, 827 Carpenter Street, Philadelphia, PA – Completed geotechnical borings and produced soil bearing capacity calculations for the construction of a 3-story residence in South Philadelphia.

Historic Resources Evaluation, Whitehall Inn, Spring City, PA – Completed all forms and documentation as required by the PHMC for this redevelopment project.

On-Site Sewage System Testing and Design, West Bradford Township – Completed detailed soil testing to determine the suitability of on-site sewage disposal. Completed a design for an in-ground system that was required by the Chester County Health Department in order to receive a permit.

Stormwater Management and Loading Rate Determination, Phoenxiville, PA - Completed soil testing for a stormwater infiltration basin. Produced report with a justification of enhanced loading rates in accordance with PADEP guidance. When the basin encountered problems, completed a forensics investigation to determine the problem source (compaction); developed a remediation strategy to restore the functionality of the basin.

Stormwater Streetscape Project in Port Richmond, Philadelphia, PA - Completed detailed soil and stormwater evaluation for a PWD-funded streetscape project in the Port Richmond section of Philadelphia. This involved detailed urban soil investigation as well as permeability testing in accordance with PWD regulations.

Environmental Permitting, Brandywine Branch Distillery, Elverson, PA - Completed detailed soil and stormwater evaluation, wetland determination, PNDI clearance, and archaeological screening for the repurposing of a barn to a craft distillery. Interacted with local, state, and federal agencies to gain approvals.

Environmental Permitting, Flourtown Road Project, Lafayette Hill, PA - Completed detailed soil and geologic investigation for stormwater evaluation and wetland investigation for proposed land development.

Environmental Permitting, Brandywine, Lower Moreland High School, Huntington Valley, PA - Completed detailed soil and stormwater evaluation, wetland determination, and PNDI clearance for the redevelopment of Lower Moreland High School. Interacted with local, state, and federal agencies to gain approvals.

Construction Supervision, Barley Sheaf Apartment Complex, Coatesville, PA - Completed evaluation of failing stormwater infrastructure at this complex. Prepared bid documents and solicited bids from local contractors. Inspected remediation work and approved quantities in accordance with the contract.

RECENT PUBLICATIONS & PRESENTATIONS

2015. Dadio S., Barkasi, A. Urban Soils: The Foundation for Green Infrastructure. Villanova Urban Stormwater Partnership Symposium, VUSP, Villanova, PA.

2014. Shuster W., Dadio, S., Urban fingerprints on soil morphology and hydrology – a summary of field investigations in US cities, across different soil orders. Soils in the City Conference. IEWA, Chicago, Illinois.

2012. Dadio S., Drohan, P.J., Utilizing Ground Penetrating Radar and EM to Supplement Deep Borings in Urban Soil Surveys. Abstract 287-1, Soil Science Society of America, Cincinnati, Ohio, poster presentation and abstract.

2012. Losco, R., S, Dadio., A Contrasting Study of Ohio Urban Soils - Cleveland Vs. Cincinnati. Abstract 287-2, Soil Science Society of America, Cincinnati, Ohio, poster presentation and abstract.

2011. Barkasi, A, S. Dadio, W. Shuster, R. Losco. Urban Soils and Vacant Land as an Urban Stormwater Resource, Abstract 89, ASCE-EWRI World Environmental and Water Resources Congress, Albuquerque, New Mexico, oral presentation (published)

2011. Shuster, W., A. Barkasi, S. Dadio, P.J. Drohan, T. Gerber, T. Houser, R. Losco, K. Reinhold, J. Wander, and M. Wigington. Moving beyond the udorthent – a proposed protocol for surveying urban soils to service contemporary urban ecosystem management data needs. Soil Survey Horizons, 52:1-8.

2010. Drohan, P.J., Ciolkosz, E.J., Lindeburg, K. S.; Waltman, W.J.; Dadio, S.D. Last glacial aeolian deposits in the conterminous U.S. Abstract 227-4 E. Soil Science Society of America, Long Beach, CA. Poster presentation.

2010. Drohan, P.J. A Pedologist's perspective of the Critical Zone. Abstract 111-5. Soil Science Society of America, Long Beach, CA. Poster presentation.

2009. Drohan, P., Dadio, S., Lindbo, D., Ciolkosz, E., Waltman, W., Braun, D., and S. Waltman. The Unified Theory of Fragipan Genesis. Soil Science Society of America, Pittsburgh, PA. #2009.52729, oral presentation and abstract.

2009. Dadio, S., Waltman, W., Drohan, P., Lindbo, D., Ciolkosz, E., and S. Waltman. Testing the Unified Theory of Fragipan Genesis: Geomorphic Trends Between Fragipans, Eolian Affected Soils, and Periglacial Landscapes. Soil Science Society of America, Pittsburgh, PA. #2009.5341, poster and abstract.

2009. Lindeburg, K., Young, A., Drohan, P., Waltman, W., Ciolkosz, E., Dadio, S., Lupton, M., and E. Erich. Mineralogical and Geochemical Trends Associated with Fragipan Prism Morphology in a Late Wisconsinan Glacial till. Soil Science Society of America, Pittsburgh, PA. #2009.52773, poster and abstract.

Drohan, P.J., Waltman, S., and S. Dadio. Identifying marginal lands suitable for biofuels production in the North-Central Appalachian region, USA.

Drohan, P.J., Ciolkosz, E., Dadio, S., Waltman, S., and K. Lindeburg. Extent and depth of loess additions to soils across the lower 48 U.S.

2008. Drohan, P.J., Bills, B., Miller, D., Waltman, S., Dadio, S., and E. White. Soil Science Society of America, Houston, TX: Geomorphic Relationships in the Fragi taxon across Pennsylvania: Clues to Genesis and Cementation Mechanisms. 140938. Oral presentation. (published).

2008. Dadio, S., Drohan, P. J., Clark, T., and S. Ogden. Soil Science Society of America, Houston, TX: Chemical and mineralogical cementing agents in fragipans from Pennsylvania parent materials. 140920. Oral presentation. (published).

2008. Drohan, P.J., Waltman, S., Bills, B., Miller, D., Foster, C., Dadio, S., and E. White. Soil Science Society of America, Houston, TX: Extent of fragi taxons on CRP/CREP lands and potential environmental, management and economic effects on biofuels production due to fragipan soil limitations. 141041. Oral presentation. (published).

RUSSELL L. LOSCO, M.A., P.G., C.P.S.S.

Principal Fields of Expertise:

Applied Soil Science Investigation, Applied Geomorphology, Soil Mapping and Classification, Indicators of Seasonal High Water Tables, Permeability Testing, Characterization of Soils for Recycling of Treated Wastewater and Stormwater, Innovative Solutions to Wastewater Recycling on Challenging Sites, Mapping and Characterization of Alluvial, Upland and Urban Soils, Anthropogenic Influences on Soil Development, Paleo-geomorphology and Peri-glacial Features, Environmental Site Remediation, Wetlands, Karst Analysis, Hydrogeology, Urban Soils, Green Infrastructure.

Qualifications:

Mr. Losco is a seasoned soil scientist and geologist with over 29 years of experience in soil mapping, site investigation, geomorphology, soil testing, on-site wastewater disposal and recycling testing and design, environmental investigation and soil and geologic research. He is active in numerous professional organizations and has served on advisory working groups to aid regulatory agencies in Pennsylvania and Delaware to draft sound, science-based regulations. He freely donates time to train both regulators and peer scientists and consultants and is an adjunct faculty member at the Delaware County Community College. He is active in research and publishes regularly and is the lead author of the **PAPSS Manual for Soil Investigation in Pennsylvania**.

Mr. Losco has handled high definition soil mapping and geomorphological analysis projects ranging in size from less than one acre to several thousand acres. He has accurately and consistently mapped upland, urban and alluvial soils, correcting and updating published maps. Through original research he has discovered unique geologic features in the Delmarva Peninsula and previously unknown processes in soil development. He has handled projects ranging from single residential lot septic systems to 7 million gallon per day wastewater recycling projects. He has spearheaded the use of new and innovative technologies for efficient and environmentally sound solutions to wastewater disposal and recycling. In collaboration with the United States Environmental Protection Agency, he has developed and implemented a protocol for characterizing and mapping urban soils for use in green infrastructure and urban renewal. He is a member of the Board of Directors of the Pennsylvania Stormwater Technical Working Group and has spearheaded the development of soil testing protocols for stormwater management and is co-author of the proposed **Pennsylvania Stormwater Best Management Practices Manual** (in prep.).

PROFESSIONAL EXPERIENCE:

Adjunct Professor — **August 2015 to Present**
West Chester University of PA — **West Chester, PA**

Teach ESS 490/590, Fundamentals of Soil.

Adjunct Professor — **August 2011 to Present**
Delaware County Community College, Pennocks Bridge Campus — **West Grove, PA**

Teach ESS 100, Introduction to Earth Science. I have based the content of this class upon the model of West Chester University's ESS 101 and structured the class so that they would be equivalent to each other.

Principal Soil Scientist & Geologist — **July 1993 to Present**
Lanchester Soil Consultants, Inc. — **West Grove, PA**

Conduct soil profile description, evaluation, mapping, and classification. Perform soil and geomorphological analysis of land development sites. Perform site evaluations and morphological soil assessments for individual and community drip irrigation sewage disposal systems and ABS systems in Pennsylvania and for all systems in Delaware. Perform feasibility studies and site investigation reports for individual and community on-site sewage disposal systems. Perform wetland delineations. Design individual and community on-lot sewage disposal systems including drip irrigation and

ABS systems in both Pennsylvania and Delaware. Perform topographic survey, layout, stakeout, and inspection and installation supervision of sewage disposal systems. Perform percolation and soil permeability testing for on-lot sewage disposal and stormwater infiltration. Assist in design of land developments, green infrastructure, stormwater infiltration structures and sewage treatment plants. Represent clients at municipal, county and state meetings. Provide expert testimony in the fields of soil science, geology and wastewater treatment and disposal. Conduct urban soil assessments as a sub-contractor to Cedarville Engineering for the United States Environmental Protection Agency, Office of Research and Development. Delineate wetlands. Planned and supervised rehabilitation of Penn Township municipal Rapid Infiltration Basins (RIBs). Assist in development of science-based regulations and ordinances for Delaware and Pennsylvania. Conduct Environmental Site Remediation and Hydrogeologic analysis and groundwater monitoring. Conduct urban soils mapping and assessment. Conduct hydrogeological analyses for quantity and quality of groundwater. Conduct site remediation (Act 2). Conduct karst analysis for sinkholes in carbonate bedrock areas.

Served on the Board of Directors of the Pennsylvania Association of Professional Soil Scientists (PAPSS), the Pennsylvania On-Site Wastewater Recycling Association (POWRA) and Pennsylvania Association of Sewage Enforcement Officers (PASEO). Instrumental in organizing successful Technical Conferences for PAPSS and POWRA. Provided commentary on proposed regulatory changes in sewage disposal regulations and stormwater infiltration regulations in PA. Member of London Grove Township Environmental Advisory Committee.

Consulting soil scientist for Penn Township, Chester County from 2001 to present. Sewage Enforcement Officer for East Earl Township, Lancaster County from 1996 to 1997. Alternate Sewage Enforcement Officer Edgmont Township, Delaware County from 1994 to 1996. Perform sewage needs study for Sadsbury Township, Chester County.

Environmental Designer/ Soil Scientist — **July 1989 to July 1993**
James C. Kelly & Associates, Inc. — **Glen Mills, PA**

Conducted soil profile description, classification, mapping, and percolation testing. Designed on-lot sewage disposal systems ranging from individual lots to large-volume community systems. Inspected and supervised installation of on-lot sewage disposal systems ranging from individual systems to large-volume community systems. Assisted in design of stream discharge sewage treatment plants ranging from 400 to 40,000 gallons per day. Performed wetlands delineations and determinations. Designed wetlands for mitigation and stormwater treatment. Sewage Enforcement Officer for Birmingham Township, Delaware County from November 1989 to December 1993. Alternate S.E.O. for Upper Providence Township, Delaware County from November 1989 to July 1993.Wrote Act 537 Sewage Facilities Plans. Worked under direction of staff Geologist.

Environmental Health Specialist — **March 1987 to July 1989**
Chester County Health Department — **West Chester, PA**

Sewage Enforcement Officer for up to 15 municipalities. Evaluate and describe soil profiles to determine suitability for on-lot sewage disposal. Describe soil profiles on subdivisions in cooperation with county's consulting soil scientists. Enforce County Health Code as pertained to sewage disposal, water wells, and environmental health. Cooperated with federal, state, county, and municipal governments and agencies. Instrumental in revising county environmental health regulations, employee job descriptions, and policies.

Project Manager — **September 1985 to March 1987**
Federated Medical Resources — **Honey Brook, PA**

Manage breeding colony of approximately 550 African Green monkeys. Supervise 30+ employees. Responsible for overseeing daily medical care of monkeys, ordering supplies, monitoring blood pressure and maintaining records for research project.

Research Instructor — **March 1982 to September 1985**
Hahnemann University Medical School — **Philadelphia, PA**

Conduct blood pressure monitoring of 30-50 African Green monkeys as part of long-term research project funded by the National Institute of Health. Conduct blood chemistry analysis and maintain records. Lecture on selected topics in the School of Allied Health.

EDUCATION:

Indiana University of Pennsylvania
Bachelor of Arts in Anthropology/Archaeology — 1981

West Chester University
Master of Arts in Physical Science-Earth Science — 2009
Graduate Assistant in Department of Geology and Astronomy — **2007-2009**
Research Focus:

- Soil genesis
- Anthropogenic influences on soil development
- Paleo-geomorphology
- Indicators of seasonal high water tables

University of Delaware
Graduate Coursework in Soil Science — 1995-96

Delaware Valley College
Coursework in Soil Science — 1992-93

Temple University
Coursework in Plant Science — 1996-97

Gloucester County College
Coursework in Chemistry — 1983-84

Glassboro State College (now Rowan University)
Graduate Coursework in Genetics — 1985

Cecil Community College — 2001
Coursework in AutoCAD

CREDENTIALS:

SSSA Certified Professional Soil Scientist — #22586

Pennsylvania Professional Geologist — #PG004953

Delaware Department of Natural Resources
And Environmental Control
Class 'A' Percolation Tester License — #2202

Class ‘B’ Sewage System Designer License — #2202

Class 'D' Site Evaluator License — #2202
(Soil Scientist) License

Pennsylvania Department of Environmental Resources Certified Sewage Enforcement Officer	#01941
Pennsylvania Registered Sanitarian	#255
Pennsylvania Nutrient Management Program Certified Commercial Nutrient Management Consultant	#1714-NMC

PROFESSIONAL AFFILIATIONS:

Member – Sigma Gamma Epsilon – National Honor Society for Earth Sciences – Beta Zeta Chapter

Pennsylvania Association of Professional Soil Scientists
Associate Member 1994 to 1997
Professional Member 1997 to Present
Board of Directors Member 2003 to 2012
Vice President 2004, 2012
President 2005, 2006
Chairman of Committee to review Best Management Practices in Stormwater Management - 2004 to 2009
Chairman of Committee to Draft a State Manual for Standardized Soil Investigations - 2008 to Present
Chairman of Licensing Committee – 2010 to 2015

Soil Science Society of America / American Society of Agronomy
Member 1994 to Present
Member of SSSA S493 Hubert J. Byrd Sr. Scholarship Committee 2012-Present
Chair of SSSA S493 Hubert J. Byrd Sr. Scholarship Committee 2012-2014

Pennsylvania Council of Professional Geologists
Member 2008 to Present
Board of Directors Member 2015 to present
Member of Education Committee 2012 to present

National Society of Consulting Soil Scientists (Now part of SSSA)
Affiliate Member 1995 to 1997
Professional Member 1997 to Present

Pennsylvania Association of Sewage Enforcement Officers
Member 1988 to 2008
Director-At-Large for Delaware and Philadelphia Counties
February 1993 to February 1997

Geological Society of America
Member 2006 to Present

Pennsylvania Stormwater Technical Working Group
Charter Member 2009 to Present
Board of Directors Member 2009 to Present
Chair of Subgroup for Infiltration and Site Evaluation 2009 to Present
Chair of Subgroup for Karst 2015 to Present

DISTINCTIONS AND ACHIEVEMENTS:

Awarded 2015 United States Environmental Protection Agency Scientific and Technological Achievement Award – Honorable Mention for Research on Understanding the Nature of Urban Soils and Their Role in Stormwater and Sewer Management

Member of Soil Certification Task Force to Develop New Soil Credentialing Program for the Soil Science Society of America, 2016

Associate Editor Soil Survey Horizons
2008 to 2012

Member of West Chester University of Pennsylvania
Professional Science Master's Program Advisory Board

Assistant Coach of West Chester University of Pennsylvania Soil Judging Team 2010 & 2014

Member of Advisory Committee to Develop Performance Objectives for Soil Scientist Examinees – Soil Science Society of America, 2012

Nominated for the Gould Award for Teaching Excellence at Delaware County Community College – 2012

1993 Northeast Regional Collegiate Soil Judging Contest
Individual High Score - 10th Place

Proficient in following computer applications:

- MS Excel
- MS Word
- MS Powerpoint
- AutoCAD 2007
- Corel Paint Shop Pro X
- DraftSight
- WebStudy Certified

SELECTED PUBLICATIONS:

Shuster, W., Burkman, C., Grosshans, J., Dadio, S., and Losco, R. (2015). **Green Residential Demolitions: Case Study of Vacant Land Reuse in Storm Water Management in Cleveland.** J. Constr. Eng. Manage., 141(3), 06014011. March 2015.

Shuster, W.D., Dadio, S. Drohan, P. Losco, R. and Shaffer, J. **Residential demolition and its impact on vacant lot hydrology: Implications for the management of stormwater and sewer system overflows.** Landscape and Urban Planning, Volume 125, May 2014, Pages 48–56

Helmke, M.F. and Losco, R.L. **Soil, Water and Human Health,** a chapter in **Soil and Human Health**, ed. E. Brevik & L. Burgess, 2013 published by CRC Press.

Barkasi, A., Dadio, S., Losco, R., and Shuster, W. (2012) **Urban Soils and Vacant Land As Stormwater Resources**. World Environmental and Water Resources Congress 2012: pp. 569-579.
doi: 10.1061/9780784412312.061

D. Nikitina, L. Remizove, and R. Losco; **A Preliminary Investigation of the Soils and Geomorphology of a Portion of the Madre de Dios Region, Peru.** Soil Survey Horizons, Volume 52, Number 2, Summer 2011.

W.D. Shuster, A. Barkasi, P. Clark, S. Dadio, P. Drohan, T. Gerber, T. Houser, A. Kelty, R. Losco, K. Reinhold, J. Shaffer and J. Wander; **Moving Beyond the Udorthent, a Proposed Protocol for Surveying Urban Soils to Service Data Needs for Contemporary Urban Ecosystem Management** Soil Survey Horizons, Volume 52, Number 1, Spring 2011.

Losco, R.L., Whitman, C., Drohan, P. and Cronce, R.; **The Manual for Site Specific Soil Investigation in Pennsylvania.** September 19, 2010 A publication of the Pennsylvania Association of Professional Soil Scientists.

Losco, R.L. , Stephens, W., and Helmke, M. F.; **Periglacial Features and Landforms in the Subsurface of the Delmarva Peninsula,** Southeastern Geology, Volume 47, No. 2, p. 85-94, May 2010.

Losco, R.L. and Helmke, M. F.; **Tillage-Enhanced Argillic Horizon Development in Piedmont Soils,** Soil Survey Horizons, Volume 51, Number 2, p. 53-55, Summer 2010.

Losco, R.L.; **Soil Science and Martial Arts,** Soil Survey Horizons, Volume 49, Number 4, Winter 2008.

Losco, R.L.; **Soil Science on Vacation…Or Soil Science with a (Minor) Language Barrier** Soil Survey Horizons, Volume 49, Number 3, Fall 2008.

Losco, R.L.; **Soil Science on Vacation – North to Alaska** Soil Survey Horizons, Volume 49, Number 2, Summer 2008.

Losco, R.L.; **Soil Science on Vacation** Soil Survey Horizons, Volume 48, Number 2, Summer 2007.

Losco, R.L.; **Soil Science and Antique Houses or Where Have All the Albic Horizons Gone?** Soil Survey Horizons, Volume 48, Number 1, Spring 2007.

Losco, R.L.; **Soil Science and Antique Houses or Where Have All the Albic Horizons Gone?** Pennsoils, Fall 2005.

Losco, R.L.; Losco, C.T.; Ibach, J.R. Jr.; and Green, A.A. **A Report of Existing On-Lot Sewage Systems in Sadsbury Township**, Chester County. 1996.

Kelly, J.C.; Losco, R.L.; Ibach, J.R. **Official Sewage Facilities (Act 537) Plan for Upper Providence Township, Delaware County (Draft)**. 1993.

Kelly, J.C.; Sech, K.R.; Losco, R.L.; Morrison, L.B. **Official Sewage Facilities (Act 537) Plan for Birmingham Township, Delaware County**. 1991.

SELECTED PRESENTATIONS:

Losco, R.L. **Soil Science: A Brief Introduction to the Stuff Underfoot** Guest lecture at Bryn Mawr College March 26, 2015.

Losco, R.L. **Morphological Soil Investigations, A Guide for Sewage Enforcement Officers** PADEP Approved Training Course for Sewage Enforcement Officers ID# 110-00005, Presented 7 times to Sewage Enforcement Officers 2014-2016.

Losco, R.L. **Biochar: An Ancient Solution To The New Problems of Climate Change and Food Security,** Delaware County Community College STEM Speaker Series, November 26, 2013.

Losco, R.L., Kribbs, G., and Witouski, B. **Soil Science: Basic and Practical Field Methodologies and Applications,** Professional Development Course for the Pennsylvania Council of Professional Geologists, July 23, 2013 & June 20, 2014.

Losco, R.L., Dadio, S. & Barkasi, A. **Urban Soil Survey to Facilitate Green Infrastructure to Alleviate Combined Sewer Overflows in Urban Settings,** Presentation to the 2013 Association for Environmental Studies & Sciences Meeting, June 19-22, 2013.

Losco, R.L. and Dadio, S. **A Contrasting Study of Ohio Urban Soils – Cleveland Vs. Cincinnati,** Poster Presentation to the 2012 Agronomy Society of America, Crop Science Society of America, Soil Science Society of America Meeting, October 22-24, 2012.
S. Brown, S. Cannon, R. Losco and J. Sturniolo **The Good, the Bad and the Ugly – A panel discussion on Stormwater Best Management Practices**, 20th Annual Pennsylvania Housing and Land Development Conference, Pennsylvania Housing Research Council, Penn State University, February 22, 2012.

Field trainer at 2011 PAPSS Army Corps of Engineers Wetland Delineation Training Conference, June 27-28, 2011 at Raystown Lake, Huntingdon County, PA.

R. Losco, **Determination of Seasonal High Water Tables.** A Webinar presented to the Soil Science Society of America, April 27, 2011.

S. Dadio, A. Barkasi, R. Losco and W.D. Shuster; **Urban Soil Investigations for Ecosystem Management: Vacant Lots, Soils and the Sustainable Management of Stormwater.** Poster Presentation to the Brownfields 2011 Conference, Philadelphia, PA. April 3-5, 2011.

Losco, R.L.; **Soil Evaluation for Effective Stormwater Infiltration and Management.** Educational Seminar presented to the Pennsylvania Society of Professional Engineers, September 24, 2010.

Losco, R.L.; **Critical Aspects of Stormwater Infiltration: Getting it Right From the Ground Up**. Educational Seminar presented to the Adams County Conservation District, May 5, 2010.

Losco, R.L.; **Critical Aspects of Stormwater Infiltration: Getting it Right From the Ground Up**. Educational Seminar presented to the Chester County Engineers, March 24, 2010.

Losco, R.L.; **Critical Aspects of Stormwater Infiltration: Starting From the Ground Up**. Educational Seminar presented to the Pennsylvania Department of Environmental Protection and the Staffs of the County Conservation Districts of Southeastern Pennsylvania, December 10, 2009.

Losco, R.L., Whitman, C., Drohan, P. and Cronce, R.; **A Manual for Site Specific Soil Investigation in Pennsylvania.** Poster Presentation to the 2009 Agronomy Society of America, Crop Science Society of America, Soil Science Society of America Meeting, November 3, 2009.

Losco R. L. and Helmke, M. F.; **Drip Irrigation for On-Site Disposal of Wastewater in Serpentine Derived Soil.** Oral Presentation to the 2009 Agronomy Society of America, Crop Science Society of America, Soil Science Society of America Meeting, November 4, 2009.

Helmke, M. F, Losco R. L. and Reed, A.M.; **Application of Soil Physics to Improve Efficiency of Ground-Source Heat Pumps in Fractured Saprolite.** Poster Presentation to the 2009 Agronomy Society of America, Crop Science Society of America, Soil Science Society of America Meeting, November 2, 2009.

Losco, R.L.; **Critical Aspects of Stormwater Infiltration: Getting it Right from the Start**. Presentation to the 2009 Pennsylvania Stormwater Management Symposium, Villanova University, October 14, 2009.

Losco, R.L.; **Perspectives From Another State – Drip Irrigation Installations in Delaware**. Presentation to the 2009 Pennsylvania Association of Professional Soil Scientists Summer Technical Session, July 9, 2009.

Losco R. L. and Helmke, M. F.; **Tillage as a Mechanism for Enhancement of Clay Translocation and Argillic Horizon Development,** Oral Presentation to the 2008 Joint Geological Society of America, Agronomy Society of America, Crop Science Society of America, Soil Science Society of America, Gulf Coast Association of Geological Societies and Houston Geological Society Meeting, October 6, 2008.

Losco R. L., Helmke, M. F. and Stephens, W. J., Jr; **Correlation of Redoximorphic Features with Seasonal Water Tables in the Coastal Plain of Delaware,** Poster Presentation to the 2008 Joint Geological Society of America, Agronomy Society of America, Crop Science Society of America, Soil Science Society of America, Gulf Coast Association of Geological Societies and Houston Geological Society Meeting, October 7, 2008.

Stephens, W. J., Jr and Losco R. L.; **Late Pliocene (?) Landforms in the Subsurface, Sussex County Delaware,** Oral Presentation to the 2008 Joint Geological Society of America, Agronomy Society of America, Crop Science Society of America, Soil Science Society of America, Gulf Coast Association of Geological Societies and Houston Geological Society Meeting, October 8, 2008.

Field Trip 20, **"New Frontiers of Soil Science"** at 18th World Congress of Soil Science, co-presenter.

Losco, R.L.; Neiley, M.; **The Four Year Fill Fiasco or I Spent Four Years Waiting and All I Have to Show For It is This Pile of Dirt.** Presentation to the 2005 Pennsylvania Association of Sewage Enforcement Officers Conference. February 28, 2005. Re-presented as an instructional seminar to the Chester County Health Department, Bureau of Environmental Protection May 2, 2005.

Losco, R.L.; **The Sewage Enforcement Officer's Role in the Morphological Assessment Process**. Presentation to the 2004 Pennsylvania Association of Sewage Enforcement Officers Conference March 2, 2004.

Losco, R.L.; Valentine, J.A. **Stormwater Infiltration and the Soil-Landscape Connection**. Pennsylvania Stormwater Management Symposium, Villanova University. 2003.

Losco, R.L.: **Fear of Pressure Dosing**. Instructional seminar on evaluation of pressure-dosed sewage system designs presented to the Chester County Health Department, Bureau of Environmental Protection. June 5, 1996.

Losco, R.L. **Community On-Lot Sewage Disposal, Beyond the Written Regulations**. Presentation to Seventh Annual On-Site Sewage Treatment Conference, Penn State University, 2/15/93.

PERSONAL:

Married with two step-children and one grandchild

Nidan (Second Degree Black Belt) in Shotokan Karate

Hobbies: Fishing
Hiking
History & Archaeology

Member:
International Shotokan Karate Federation
Chester County Shotokan Karate Club
West Chester University Shotokan Karate Club

Co-Advisor of West Chester University Shotokan Karate Club

Curriculum Vitae

James D. Fisher, M.Sc. Soil Science, CPSS

P.O. Box 203 Birchrunville, PA 19421 fisher.soils@gmail.com 610-656-2936

SUMMARY

Accomplished soil scientist, pedologist, agronomist. Experienced field program officer and agricultural advisor with proficiency mapping soils and working in USAID programs. Experienced project manager of vineyard design, vineyard establishment, and vineyard management. Skilled communicator – both written and oral.
Currently holds Secret security clearance (USA).
Field experience in Afghanistan, Panamá, Ecuador, Brasíl, North America, Australia.

AGRIBUSINESS OVERVIEW

- Focus on agricultural value chain activities, soil conservation, and sustainable irrigation techniques.
- Language skills in order of increasing proficiency: Portuguese, French, Spanish.
- Agronomic and environmental consultation to viticulture, irrigation, forage, grains, livestock, cover-cropping, pomegranate, pistachio, almond, apricot, and general agriculture.
- International development focusing on environmentally sustainable methods.

ACADEMIC DEGREES

M.Sc., Soil science, University of Delaware
B.Sc., Plant science, University of Delaware

PROFESSIONAL CERTIFICATIONS

- Certified Professional Soil Scientist, Certified Professional Agronomist, Certified Nutrient Consultant, Certified Pesticide Applicator, Certified Irrigation Evaluator, Cal-Poly Tech.
- Secret Security Clearance.
- Field training for Afghanistan: RS415, AR421, Civ-Mil RS510, FACT OT610, ADAPT

RESEARCH FIELDWORK

- Mornington Peninsula Vigneron Association, Victoria, Australia. Viticultural consultant and lead trainer in soil benchmark program.
- Kandahar Province, Afghanistan. Lead project designer of soil salinization assessment.
- Zhari District, Afghanistan. Developed low-volume / high-frequency irrigation management program to mitigate soil salinization, and improve crop production.
- IDIAP, Piriati, Panama, 2005. Participant in hydrogeology project providing fresh water to community of 700 people.
- Zapallo Grande Medical Center, Ecuador, 2002-2003. Participant in onchocerciasis research, location of the vector *Simuliides exiguum*.
- Yasuni Research Station, Amazon jungle, 2003. Participant in research of forest ecology and ethnobotany.
- Research cruise with USNS H.H. Hess, OCUNIT 6, Merchant Seaman, US Merchant Marines, 1988.

James D. Fisher, M.Sc. Soil Science, CPSS

PROFESSIONAL EXPERIENCE

2015:

Soil Scientist / Agronomist: Soil Solutions, LLC – Malvern PA

- Viticultural pedologist, soil mapping, agronomic consultant.

2014:

Viticultural consultant: MPVA - Victoria, Australia

- Lead trainer in soil benchmark program. Viticultural consultation to 42 individual vineyards.

2012-2013:

Agricultural advisor: USDA-FAS-OFSO, Washington, DC

- Agricultural advisor in Zhari District, Kandahar Province, Afghanistan.
- Developed sustainable irrigation methodologies to mitigate the effects of soil salinization, crop loss, and desertification.
- Developed counternarcotics program by promoting cultivation of licit crops, improving productivity, and enhancing associated ag value chains.
- Provided technical expertise to entire Southern Regional Platform (pomegranate, livestock, vineyard, irrigation, pistachio, agricultural value chain operations, post-harvest processing, livelihood augmentation, and general agriculture).
- Skilled communicator (written and oral). Experience working extensively with USAID programs, proficiency with reporting, monitoring, and evaluation.

2005-2012:

Soil Scientist / Agronomist: Soil Solutions, LLC – Malvern PA

- Viticultural consultant specializing in pedology, soil chemistry, irrigation, soil biology, soil physics, hydrogeology, geospatial mapping via electromagnetic induction (EMI), integrated pest management, crop quality, soil potential index.
- Client base in California, Washington, New York, Maryland, Pennsylvania

2003-2005:

Soil Consultant, Self-employed

- Specializing in pedology, forensic agronomy, fertility programs, irrigation design.

2002- 2003:

Field researcher, Amazon Forest and Zapallo Grande Medical Center

- Conducted field research locating nesting sites of *Simuliides exiguum,* vector for onchocerciasis.

AWARDS

- Non-Article 5 NATO Medal for civilian service for ISAF Operations
- Certificate of excellence from Afghanistan Regional Platform South
- Medal of excellence from 3rd BAT, 41st ID, OEF 2013, for Civ-Mil collaboration on agricultural development and counternarcotics programs
- Medal of excellence USDA soil salinization project southern Afghanistan

James D. Fisher, M.Sc. Soil Science, CPSS

INDUSTRY HIGHLIGHTS

November 4, 2013: Presented an oral presentation at the SSSA annual meeting in Tampa, FL, entitled "Promoting Food Security and Environmental Quality in Afghanistan;" and a research poster entitled "Uniting cross-cutting objectives with capacity-building in Afghanistan" – both of which depicted the use of sound soil science as a foundational tool in capacity building.
October 17-19, 2011: Presented research entitled "Using NASA Data for Viticulture: Measuring *Terroir* from Space" at NASA's presentation in the Crop Science Society of America's annual meetings in San Antonio, TX, highlighting remote sensing techniques which are both rapid and effective in viticultural site selection.
February 23, 2011: Presented research entitled "Mapping Vineyard *Terroir*" to a joint meeting of Maryland Association of Professional Soil Scientists (MAPSS) and Maryland Wineries Association (MWA), highlighting soil mapping techniques which are both rapid and effective in viticultural site selection.
November 4, 2010: Presented research entitled "Pedogenetic Indicators of *Terroir*" at the Soil Science Society of America annual meeting at Long Beach, CA.
August 6, 2010: Presented research "Geospatial mapping of vineyard soils via electromagnetic induction and scaling of terroir" at the 19th World Congress of Soil Science, Brisbane, Australia.
April 15, 2010: Presented in session entitled "Sustainable wine: Carbon neutrality, organic, biodynamic production and *terroir*" to American Association of Geographers, entitled "Assessing vineyard *terroir* via geospatial mapping"
November 19, 2009: Leading speaker at Congressional Soils Caucus briefing, entitled "Pedogenesis & *Terroir*," addressing the issues of winegrowing to 500 Congressional staff members in the Gold Room at Rayburn House Office Building, Washington, D.C.
November 4, 2009: Two (2) oral presentations to Soil Science Society of America (SSSA) annual meeting in Pittsburgh PA, entitled "Orogeny and Pedogenesis of Southeastern Pennsylvania Viticultural *Terroir*" and "*Terroir* of Southeastern Pennsylvania Viticulture: An Analytical Hierarchy in a Udic Soil Moisture Regime", and poster presentation "Electromagnetic induction (EMI) methods for Geospatial Mapping of Vineyard Soils".
January 15, 2009: Oral presentations in educational seminar hosted by Penn State University Viticultural Program, co-hosted by Cornell University Dept. of Viticulture at the annual Pennsylvania Association of Winegrowers (PAW) meeting, entitled "Soil Chemistry in Viticulture" (A case study using adjustments of soil chemistry to initiate chemical reaction mechanisms favorable to the deprotonation of previously unavailable nutrients.), and "Hydrogeology in Viticulture" (A discussion of hydrologic flux within the soil-plant-atmospheric continuum using a mathematical treatment to illustrate the association of solar flux and soil water flux.)
July 1998: Authored article on equine nutrition published in national publication: Rocky Mountain Horse entitled, "Equine Nutrition."

ACTIVITIES & HOBBIES

- Horsemanship, Kitesurfing, Cooking, Snowkiting, Rock climbing ("trad-style" lead-climber), Paragliding (advanced P-4 paragliding license), SCUBA (open-water certification), Watercolors, Rugby (University of Delaware Rugby Club, USARU-sanctioned Brandywine Rugby), Sailing, Gardening, Fitness, Fishing, Nature hiking.

James D. Fisher, M.Sc. Soil Science, CPSS

REFERENCES

- Daryl Brehm, USDA Coordinator for Agriculture, Embassy of the USA, Kabul, Afghanistan. Email: daryl.brehm@usda.gov
- Donald L. Sparks, Ph.D., Professor of Plant and Soil Sciences, Chemistry and Biochemistry, 531 South College Ave., 152 Townsend Hall, University of Delaware, Newark, DE 19716-2170. Phone: (302) 831-6378. Email:dlsparks@udel.edu
- Hugo Rodriguez, U.S. Department of State, Division Chief, Room 4113, 2100 Pennsylvania Ave., N.W., Washington, DC 20037. 202-736-4996. Email: hugorodriguezjr@yahoo.com
- Adam Smith, USAID Field Program Officer, 14018 Flying Feather Court, Gainesville, VA 20155. 203-503-4508. Email: pdt110@gmail.com
- Mark L. Chien, State-wide Viticulture Extension Educator, Penn State Cooperative Extension, College of Agricultural Sciences, 1383 Arcadia Road, Lancaster, PA 17601, Tel: 717-394-6851. Email: mlc12@psu.edu
- Tim Powers, Director Strategic Operations, Office of Civilian Deployment Operations, U.S. Department of Agriculture - Foreign Agricultural Service, 1400 Independence Ave, SW, Washington, D.C. 20250, Tel: (540) 273-2769. Email: Timothy.Powers@fas.usda.gov
- Tina Kaarsberg, PhD., Policy Analyst, US Department of Energy, Washington, D.C., Tel: 240-205-3948, Email: TINA.KAARSBERG@hq.doe.gov

John C. Roberts, LSS

Soil Scientist

General Qualifications

Education

M.S., Soil Science, North Carolina State University, 2005

B.S., Natural Resources - Soil Science, North Carolina State University, 2001

Licenses/Certifications/Affiliations

North Carolina Licensed Soil Scientist #1292

South Carolina Professional Soil Classifier #97

NCDWR/NCSU Surface Water Identification and Training Class (SWITC) version 4.11. 06/2012

Stormwater BMP Inspection & Maintenance Certification (NCSU Biological & Ag. Engineering) 05/2012

NCDOT/NCSU Level I: Certified Erosion and Sediment Control/Stormwater Installer 06/2013

NCDOT/NCSU Level II: Certified Erosion and Sediment Control/Stormwater Site Manager 06/2013

Previous Work History

09/10-Present. Soil Scientist, The Catena Group/Three Oaks Engineering, Hillsborough, NC

04/10 – 09/10 Research Technician, NC Department of Agriculture – Agronomics Division. Raleigh, NC

07/05 – 4/10. Soil Scientist, Hal Owen & Associates, Inc. – Soil and Environmental Scientists. Lillington, NC

7/02-5/15. Research Assistant, North Carolina State University. Raleigh, NC

Experience & Qualifications

John is a Licensed Soil Scientist/Project Manager for Three Oaks Engineering. His primary duties include managing soil and site investigations using knowledge in soil classification and morphology throughout the mountain, piedmont and coastal plain regions of North Carolina. His soil investigation experience includes determining suitable areas for surface/subsurface wastewater systems, stormwater structures, wetland delineations and hydric soil determinations. John is proficient in interpreting soil and landscape relationships crucial for creating detailed soil suitability maps. He is experienced in designing and permitting on-site septic systems and performing saturated hydraulic conductivity tests. He is also knowledgeable in Nutrient Management Planning and is certified for NuMASS software and the Phosphorus Loss Assessment Tool.

Project Experience

Midlands Tract - Soil & Site Evaluation, Cabarrus County, North Carolina. Served as Project Manager; conducted a detailed Soil & Site Evaluation on the 640+ acre project site to map soil units suitable for subsurface wastewater disposal.

Elm City Wastewater Treatment Plant - Receiving Fields, Elm City, Nash and Wilson Counties, North Carolina. Served as Project Manager; conducted a detailed Soil & Site Evaluation on 250+ acres of the existing wastewater receiving fields and potential expansion fields; collected soil data (physical and chemical) to determine appropriate wastewater application rates and cover crops.

Shepherds Tree Mitigation Site - Hydric Soil Delineation and Classification, Iredell County, North Carolina. Served as Project Manager, delineated hydric soil units within 160+ acres of an existing wetland mitigation site in the close-out in order to more accurately determine mitigation credits; created a site specific hydric soil indicator using onsite groundwater gage data and soil characteristics.

Michael G. Wood, LSS

Principal and Soil Scientist

General Qualifications

Education

M.S. Soil Science, 1996, University of Rhode Island at Kingston

B.S. Recreation Management, 1986, University of Vermont

Licenses/Certifications/Affiliations

North Carolina Licensed Soil Scientist #1219

North Carolina Freshwater Mussel Survey and Collection Permit - NC-2011 ES 34

USACE Wetland Delineation Training

Soil Science Society of North Carolina

National Society for Consulting Soil Scientists

Michael is a principal and soil scientist at Three Oaks Engineering, with over 20 years experience working in both the public and private sector. He worked for the North Carolina Division of Coastal Management and the North Carolina Department of Transportation before founding The Catena Group. At Three Oaks Engineering, Michael's responsibilities include environmental permitting, wetland delineation and mitigation, evaluation of hydric soils, detailed soil mapping and interpretation, groundwater modeling, threatened and endangered species surveys (Permit NC-2010 ES 34), as well as project oversight/compliance. A former permit coordinator for NCDOT, Michael has garnered every type of roadway permit, including federal 404 permits, state 401 certifications, and CAMA Major Permits. As project manager, he has demonstrated the ability to work with both regulatory personnel and project designers on methods to avoid and minimize impacts to significant natural areas while still meeting the purpose and needs of the project. Michael has taken projects from the early design phase to final submission of permit applications and provided environmental monitoring throughout construction to ensure compliance with project commitments and permit conditions. He is well versed in the NEPA Merger Process, as well as the unique challenges posed by Design-Build projects.

Project Experience

USACE Regional Supplement – Eastern Mountains and Piedmont Region.

Michael Wood of Three Oaks was selected by the U.S. Army Corps of Engineers (USACE) to be part of the part of the peer review team for the Regional Supplement to the Corps of Engineers Wetland Delineation Manual. The supplement is part of a nationwide effort to address regional wetland characteristics and improve the accuracy and efficiency of wetland delineation procedures. Michael was selected particularly for his years of experience in wetland delineations combined with his knowledge of soils with regards to wetland delineations, especially problem wetland sites.

Monroe Bypass: 22-miles of new location in Union County, North Carolina. *North Carolina Department of Transportation.* Michael performed the wetland and stream delineations on approximately half the project (11 miles), and obtained necessary environmental permits and monitored compliance during the development and construction of a new toll road extending from Mecklenburg County to Union County; provided assistance to federal and state agencies during permit reviews and modifications.

Mitigation Site Monitoring, Throughout North Carolina. *North Carolina Department of Mitigation Services.* Provided yearly vegetation and hydrologic monitoring of multiple DMS (formerly Ecosystem Enhancement Program) stream and wetland mitigation sites. Work included development of recommendations to enhance/improve site performance relative to compliance success criteria.

White Irisette Soil Mapping, Polk County, **North Carolina**. *North Carolina Department of Transportation*. In an effort to find appropriate relocation sites for the federally Endangered white irisette (*Sisyrinchium dichotomum*) due to a roadway project, Michael investigated, mapped, and rated over 80 acres. Each site was rated based upon soil texture, horizon depths, and parent material.

Previous Work History

08/96 – 08/01	North Carolina Department of Transportation, Environmental Specialist, Soils Rover
03/95 – 08/96	North Carolina Division of Coastal Management, Soil Scientist

Stephen G. Carpenter

304-906-8260

The Nicholas Putnam Group, LLC
P.O. Box 4611
Morgantown, WV 26504
npgsoils.com

Objectives

Provide Consulting Services on Soil and Soil-related Issues for Industry, Forestry, and Agriculture

Education

May 1977 | BS West Virginia University, College of Agriculture and Forestry
May 1999 | MS West Virginia University, Eberly College, Division of Geology and Geography

Experience

June 1977 – January 2011 | Soil Scientist
U.S. Department of Agriculture | Natural Resources Conservation Service

January 2011 – Present | Soil Scientist

The Nicholas Putnam Group, LLC

Positions held: Field Soil Scientist, Survey Project Leader, GIS Specialist, State Soil Scientist, MLRA Regional Staff Leader/Technical Staff Supervisor

Skills and Affiliations

- Detailed Soil Mapping
- Soil Interpretation for Agriculture and Industry
- Soil Classification and Genesis
- Forest Soils
- Geomorphology
- Soil Monolith Extraction and Finishing
- GIS and Remote Sensing
- American Society of Agronomy and Soil Science Society of America Affiliate

CHARLES H. DELP

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THE NICHOLAS PUTNAM GROUP, LLC
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MORGANTOWN, WV 26504
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Objectives
Provide Consulting Services on Soil and Soil-related Issues for Industry, Forestry, and Agriculture

Education
May 1969 – BS Soil Science West Virginia University, College of Agriculture and Forestry
May 1975 – MS Soil Genesis and Classification, West Virginia University, College of Agriculture and Forestry

Experience

May 1968 to December 2011 – Soil Scientist
U.S. Department of Agriculture – Natural Resources Conservation Service

December 2011 to Present –Soil Scientist
The Nicholas Putnam Group, LLC

Positions Held – Field Soil Scientist, Survey Project Leader, Assistant State Soil Scientist, Supervisor Map Compilation and Finishing Unit

Skills
- Detailed Soil Mapping
- Soil Interpretation for Agriculture and Industry
- Soil Genesis and Classification
- Forest Soils
- Geomorphology
- Soil Forensics
- GIS and Remote Sensing
- Soil Geography
- Soil Monolith Extraction and Finishing
- Soil Map Compilation and Finishing
- Technical Staff Supervision

Attachment 3
Laboratory Methodologies

Laboratory Procedures

Virginia Tech
Soil Testing Laboratory

Rory O. Maguire, Extension Nutrient Management Specialist, Virginia Tech

Steven E. Heckendorn, Manager, Soil Testing Laboratory, Virginia Tech

Publication 452-881

Virginia Cooperative Extension

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Table of Contents

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Produced by Communications and Marketing, College of Agriculture and Life Sciences,
Virginia Polytechnic Institute and State University, 2011

Introduction

Most of the procedures for soil analysis used in the Soil Testing Laboratory were established in the early 1950s*. Although the chemical principles have not changed, procedures have been revised over the years to utilize advances in instrumentation which allow more accurate and rapid chemical determinations.

A routine test, consisting of eleven analyses, is performed on all samples. In addition, two separate tests are offered on a request basis. These tests are applicable only under certain conditions for which research and calibration work has been conducted. The routine and special tests consist of the following:

Routine Test

- soil/water pH (WpH)
- buffer index/ pH (BpH)
- phosphorus (P)
- potassium (K)
- calcium (Ca)
- magnesium (Mg)
- zinc (Zn)
- manganese (Mn)
- copper (Cu)
- iron (Fe)
- boron (B)

Special Tests

- soluble salts
- organic matter

*Rich, C.I., 1955. Rapid soil testing procedures used at Virginia Polytechnic Institute. Virginia Agriculture Experiment Station. Bull. 475, p. 8.

Sample Preparation

Soil samples arrive in 1/2-pint cardboard cartons. Generally, Soil Sample Information Sheets (SSIS) are packaged with the samples. The cartons are opened in a separate preparation area and placed in drying trays. Twenty-eight unknown samples plus two control samples are placed in each drying tray. The two control samples are one known internal reference sample and either a blank or replicate sample. At this time, each sample is assigned a laboratory number which, along with the year, is stamped on the SSIS. The samples are numbered consecutively each calendar year, beginning with 1 on January 1.

The trays of samples are placed in a cross-flow forced-air drying cabinet through which room-temperature filtered air is drawn. The air can be heated 5° to 8°C above the ambient temperature for drying extremely wet samples. Samples remain in the drying cabinet overnight or until air dry.

Air-dried (at 20° to 40°C) samples are crushed with a stainless steel hammer mill-type crushing machine and passed through a 10-mesh (2-mm opening) stainless steel sieve. The samples are then returned to the original sample boxes until the various subsamples are measured out.

Water pH (WpH) Determination

Buffer Solutions: Color-coded buffer solutions of pH 4.0, 7.0, and 10.0 are purchased from commercial sources.

Electrode Internal Filling Solution: Use Thermo Orion's 3 M KCl, (with no silver), Ross™ Sure-Flow® Internal Filling Solution, Cat. No. 810007.

Procedure:

Daily, do a two-point calibration of the pH meter using fresh buffer solutions of pH 4 and 7, and ensure the calibration before starting every batch of samples.

Scoop 10 cm^3 of soil from the prepared sample into a 50-ml beaker. With an automatic pipetting machine add 10 ml of distilled water for a 1:1 (vol/vol) ratio. Thoroughly mix the solution with a glass/plastic rod or mechanical stirrer and allow it to sit for a minimum of 10 minutes and a maximum of 2 hours.

The automated pH analyzer is set to stir solutions for a 5-second equilibration delay before starting to take pH readings. It then continues to stir the soil suspension while the software waits for 10 readings to be stable within 0.02 pH units. Probes are automatically washed after a pH reading greater than 8.0 or less than 4.0. Readings are electronically recorded to the 0.01 pH unit. The pH readings of quality-control soil samples are manually checked before uploading the sample data to verify that they are within current expected values.

Notes:

- For fine-textured soils containing a high level of organic matter, it may be necessary to add an additional 10 ml of distilled water to make a suspension.
- The TPS pH meter has a temperature sensor for automatic temperature compensation (ATC). This ATC probe should sit in a flask of ambient temperature water within the LabFit pH Analyser next to the soil samples being measured.
- If a pH probe's reading becomes sluggish, unstable, or not reproducible (possibly indicating that the liquid reference junction has become clogged), depress the electrode's top cap to flush the junction.

Buffer Index/ pH (BpH) Determination

Mehlich Buffer Preparation:

Using a 4-liter volumetric flask, add:

~ 2 liters of distilled water (DW);

10 ml of glacial acetic acid, CH3COOH, 99.5%, 17.4N;

39 ml of 50% triethanolamine (1 TEA : 1 DW);

72.0 g of sodium glycerophosphate, hydrate, $C_3H_5(OH)_2PO_4Na_2 \cdot xH_2O$, FW=216.04(anhy.); or 1,2,3-Propanetiol mono (dihydrogen phosphate) disodium salt, $(HOCH_2)_2CHOPO_3Na_2$; or Glycerol phosphate Disodium salt Hydrate, $C_3H_7O_6PNa_2$, CAS #: 154804-51-0 or 1555-56-2 for alpha structure {Gallard-Schlesinger's 50 kg GSODGLYERO via Doe & Ingalls, or City Chemical's 2.5 kg S8040, or Sigma's 1 kg G 6501};

172.0 g of ammonium chloride (NH_4Cl);

48.0 g of calcium chloride dihydrate ($CaCl_2 \cdot 2H_2O$); {or alternatively use 80.0 g $BaCl_2 \cdot 2H_2O$}.

Stir using a stir-bar and stir-plate until all salts are dissolved and allow the solution to warm up to room temperature.

Bring to the 4-liter volume with distilled water.

Adjust to pH 6.60 ±0.04 when diluted 1:1 with distilled water. Use drops of acetic acid to lower the pH or drops of 1:1 aqueous TEA to raise the pH.

Use an acid standard to check the preparation of the buffer mixture as follows: combine 10 ml of buffer, 10 ml of distilled water, and 10 ml of commercially prepared 0.05N HCl solution. This mixture should drop the initial buffer pH by 1.40±0.1 units. If the pH is not within these limits, check the preparation of the buffer reagent to make certain that all ingredients were added properly.

Make only what will be needed for a week to prevent microbial growth in storage. When calcium chloride is used instead of barium chloride, containers and dispensers may need to be disinfected with dilute (10%) chlorine bleach (sodium hypochlorite) between batches of solution. Rinse very well with distilled water.

Procedure:

On samples with a WpH ≤6.94, add 10 ±0.2 ml of the Mehlich buffer solution using the 1:1 (vol/vol) soil-water mix from the water pH determination. Thoroughly mix the solution with a glass/plastic rod and allow it to sit for a minimum of 30 minutes. Stir the solution again immediately before reading and while the pH probe is equilibrating in the soil suspension. Record the first stable pH reading to the nearest 0.01 unit. Verify calibration of pH electrodes before measuring buffer pH's. Check the pH of the buffer solution on the daily blank sample. A rise in its pH indicates fungal growth in the buffer.

Determination of P, K, Ca, Mg, Zn, Mn, Cu, Fe, B, and Al

Extracting Solution (Mehlich 1, 0.05N HCl in 0.025N H_2SO_4):

Measure approximately 15 liters of distilled water into a 20-liter plastic container. Add 14.0 ml of concentrated sulfuric acid (H_2SO_4), 82.0 ml of concentrated hydrochloric acid (HCl), and distilled water to make a 20-liter volume and mix thoroughly.

Extraction Procedure:

Measure one 4-cm^3 scoop of prepared soil into a 60-ml straight-walled plastic extracting beaker, and add 20 ml of the Mehlich 1 extracting solution with an automatic pipetting machine. The samples are shaken on a reciprocating shaker with a stroke length of 3.8 cm for 5 minutes at 180 oscillations per minute and filtered through Whatman No. 2 (or equivalent), 11-cm filter paper soon after the shaking stops.

Analysis Procedure:

All elements are analyzed in the same extract by an ICP (inductively coupled plasma atomic emission spectrometer). Transfer filtrate from the extraction beaker to an ICP autosampler cup by using a disposable polyethylene pipette. The transfer is a two-step procedure with the first aliquot being a rinse and the second aliquot for the actual transfer. Pipette 4 ml of filtrate and discard into a waste beaker. Pipette another 4 ml of the same filtrate into the autosampler rack's polystyrene sample cups.

Once all sample filtrates have been transferred, cover the autosampler rack with plastic wrap to prevent air-borne contaminants (dust, lint, etc.) from getting into the solutions. This is important to prevent ICP nebulizer clogging and contamination.

Samples may be stored overnight by covering them with plastic wrap, parafilm, or capping and placing them in a refrigerator. After refrigeration, allow the samples to equilibrate to room temperature before ICP analysis.

Elemental Analysis by ICP:

An ICP instrument, equipped with an autosampler, is set up to analyze 30 samples for 10 elements in about 20 minutes. Each sample has a 24 second preflush with a 10 second integration time to read the element and background spectral lines, and there is approximately a 10 second rinse that mainly occurs during the integration time. A quality control solution is read and verified after every tray of 30 samples.

ICP Working Standards:

The ICP is calibrated with the following series of standards (Note: atomic absorption standards are not sufficiently pure for ICP standards; use only spectrally pure, plasma-quality standards).

Soil #1: Final solution concentration: 0.05 N HCl and 0.025 N H_2SO_4.

Use the Mehlich 1 (M1) extracting solution or to approximately 250 ml of deionized water in a half-liter volumetric flask, add 2 ml of concentrated reagent grade HCl, and 0.35 ml of concentrated reagent grade H_2SO_4, dilute to volume with deionized water and mix well.

Soil #2: Final elemental concentration in solution: 30 $\mu g\ ml^{-1}$ P, 2 $\mu g\ ml^{-1}$ Zn, 2 $\mu g\ ml^{-1}$ B.

> To approximately 250 ml of M1 extracting solution in a half-liter volumetric flask, add 15 ml of 1000 $\mu g\ ml^{-1}$ P calibration standard, 1 ml of 1000 $\mu g\ ml^{-1}$ Zn calibration standard, 1 ml of 1000 $\mu g\ ml^{-1}$ B calibration standard and dilute to volume with extracting solution and mix.

Soil #3: Final elemental concentration in solution: 300 µg ml^{-1} Ca, 100 µg ml^{-1} K, 50 µg ml^{-1} Mg, 10 µg ml^{-1} Al, 10 µg ml^{-1} Mn.

Add to a half-liter volumetric flask with approximately 250 ml of M1 extracting solution 15 ml of 10,000 µg ml^{-1} Ca calibration standard, 5 ml of 10,000 µg ml^{-1} K calibration standard, 2.5 ml of 10,000 µg ml^{-1} Mg calibration standard, 5 ml of 1,000 µg ml^{-1} Al calibration standard, and 5 ml of 1000 µg ml^{-1} Mn calibration standard; dilute to volume with extracting solution and mix.

Soil #4: Final elemental concentration in solution: 10 µg ml^{-1} Cu, 25 µg ml^{-1} Fe.

Add to a half-liter volumetric flask with approximately 250 ml of M1 extracting solution 5 ml of 1000 µg ml^{-1} Cu calibration standard and 12.5 ml of 1000 µg ml^{-1} Fe calibration standard; dilute to volume with extracting solution and mix.

ICP Quality Control Standard:

The quality control solution is prepared with spectrally pure, ICP-quality, calibration stock solutions. (Note: For the elements P, K, Ca, and Mg, use standard stock solutions from a manufacturing source other than the one used to prepare the working standards.) Add to a half-liter volumetric flask with approximately 250 ml of Mehlich 1 extracting solution the following amounts of each stock solution then dilute to volume with extracting solution and mix well:

Element	Final Concentration (µg ml^{-1})	High Purity Reference Solution
P	10	5 ml of 1,000 µg ml^{-1}
K	30	1.5 ml of 10,000 µg ml^{-1}
Ca	200	10 ml of 10,000 µg ml^{-1}
Mg	20	1 ml of 10,000 µg ml^{-1}
Zn	1	0.5 ml of 1,000 µg ml^{-1}
Mn	1	0.5 ml of 1,000 µg ml^{-1}
Cu	1	0.5 ml of 1,000 µg ml^{-1}
Fe	5	2.5 ml of 1,000 µg ml^{-1}
B	1	0.5 ml of 1,000 µg ml^{-1}

Calculation of Elemental Concentrations:

For each element, the calculation for ppm in soil is as follows:
ppm in solution x 5 = ppm in soil on a volume basis (mg/dm3)
ppm in solution x 4 = ppm in soil on a weight basis (mg/kg)
where 4 is the dilution factor assuming a soil scoop density of 1.25 g/cm3.

To convert from ppm (wt. basis) to lbs/acre the equation is:
ppm in soil x 2 = lbs/acre
where weight of an acre furrow slice (6 2/3-inch depth) is assumed to be 2 million pounds.

Estimation of CEC by Summation

Theory:

The Cation Exchange Capacity (CEC) can be reasonably estimated by summation of the Mehlich 1 extractable bases, or non-acid generating cations (Ca, Mg and K), plus the acidity estimated from the Mehlich soil-buffer pH after conversion of all analytical results to meq/100 cm^3 or cmol(+)/kg.

This calculated method is closer to an Effective CEC, which is measured at the present pH of the soil, than it is to the soil's potential CEC, which is measured in solutions buffered at pH 7.0 or higher.

This method is inappropriate for soils with a high soluble salts level or for alkaline soils because these soils may be over-fertilized, calcareous, gypsiferous, or relatively unweathered and could result in an erroneously high CEC value by the release of nonexchangeable cations.

Calculation:

Estimated Soil CEC = Acidity + Ca + Mg + K (in the units of meq/100 g soil or cmol/kg)

Acidity (meq/100 g of soil) = 37.94 - (5.928 x BpH)
where BpH = Mehlich soil-buffer pH reading for an individual soil sample.

meq Ca/100 g = lb Ca per Acre ÷ 401

meq Mg/100 g = lb Mg per Acre ÷ 243

meq K/100 g = lb K per Acre ÷ 782

Sodium is not included in the equations since it is not routinely determined in the Mehlich 1 extract in routine analysis. Since exchangeable Na is usually at a very low concentration, its omission is not considered to be a cause of error in the calculated CEC. If sodium was included , then the calculation would be meq Na/100 g = lb Na per Acre ÷ 460.

The commonly used unit of meq/100 g is equivalent to the SI accepted unit of cmol/kg.
1 meq/100 g = 1 cmol(+)/kg

Soluble Salts

Conductivity Standard:

Use a commercially prepared NIST traceable conductivity standard of 1,000 or 1,420 µsiemens/cm.

or

Prepare potassium chloride standard solution (0.01 N KCl): Dissolve 0.7456 g of potassium chloride (KCl) in deionized water in a 1-liter volumetric flask. Mix well and dilute to volume. The conductivity of this solution at 25°C is 1,412 µsiemens/cm.

Procedure:

Measure one 20-cm^3 scoop of prepared soil into a 50-ml beaker, add 40 ml of distilled water for a soil:water ratio of 1:2 (vol/vol). Include at least one internal soil reference ("test") sample per batch of unknown soil samples. Stir the solution and allow the suspension to settle for at least 1 hour. Check the conductivity meter's calibration against the conductivity standard. At 25°C, the standard has an electrical conductivity of 1.00 or 1.41 mmho/cm (or mS/cm). Set the meter in the Temperature Compensation Conductivity mode, and cell constant (C) to 1.00/cm. The electrical conductivity (EC) of the supernatant liquid of the soil-water solution is determined with the meter set on the µS/cm scale. Use the bulb to draw the supernatant into the cell. Dispose of this aliquot into a waste beaker. Draw a second aliquot of the sample into the cell and when the meter stabilizes, record the EC as one tenth of the meter's reading, (move the decimal one place to the left on the meter's display), in order to give the results in mhos x 10^{-5} units. The ppm soluble salts in the soil are calculated from the following equation:

$$\text{ppm soluble salts in soil} = EC \times 6.4 \times 2$$

In this equation, EC represents the conductivity reading in mhos x 10^{-5}, 6.4 is the factor for converting the conductivity measurement to ppm soluble salts, and 2 represents the water volume dilution factor. Report as ppm soluble salts in soil.

Useful Equations:

$$EC\ (\text{mho} \times 10^{-5}/\text{cm}) / 100 = \text{mmho/cm}$$

$$\text{ppm (mg salt/liter)} / 1280 = \text{mmho/cm}$$

$$0.1\ \text{S/m} = 1\ \text{dS/m} = 1\ \text{mS/cm} = 1\ \text{mmho/cm}$$

Resistance of a solution is the reciprocal of the electrical conductivity; therefore,

$$0.1\ \mu\text{mho} = 10.0\ \text{Mohm}.$$

Soil Organic Matter (SOM) by Walkley-Black (WB)

Reagent A: Sodium dichromate solution (0.67M): Dissolve 500 g of reagent grade sodium dichromate ($Na_2Cr_2O_7 \cdot 2H_2O$) in tap water to a volume of 2 1/2 liters.

Reagent B: Concentrated reagent grade sulfuric acid (H_2SO_4).

Procedure:

The procedure is a modified Walkley-Black method. Measure one 1.5-cm^3 scoop of prepared soil into a 200-ml test tube. Under a hood, add 20 ml of Reagent A to the soil followed by 20 ml of Reagent B. Allow the solution to cool at least 40 minutes. After cooling, add 100 ml of tap water, mix the solution, and allow to stand overnight (or at least 8 hours). After incubation, withdraw an aliquot of the supernatant using a syringe-type pipette and transfer it to a colorimeter vial. Take readings using a colorimeter set to a 645 nm wavelength. The percentage of organic matter is determined by reference to the following table.

Colorimeter readings and percent organic matter.

Colorimeter Reading	Organic Matter, %	Colorimeter Reading	Organic Matter, %	Colorimeter Reading	Organic Matter, %
100	0.0	56	2.6	30	6.4
99-95	0.1	55	2.7	29	6.6
94-91	0.2	54	2.8	28	6.8
90-88	0.3	53	2.9	27	7.0
87-86	0.4	52	3.0	26	7.2
85	0.5	51	3.1	25	7.4
84-83	0.6	50	3.2	24	7.6
82	0.7	49	3.3	23	7.8
81-80	0.8	48	3.4	22	8.0
79	0.9	47	3.5	21	8.3
78-77	1.0	46	3.6	20	8.7
76	1.1	45	3.7	19	9.0
75-74	1.2	44	3.8	18	9.4
73	1.3	43	3.9	17	9.7
72-71	1.4	42	4.0	16	10.1
70	1.5	41	4.2	15	10.4
69-68	1.6	40	4.4	14	10.8
67	1.7	39	4.6	13	11.1
66-65	1.8	38	4.8	12	11.5
64	1.9	37	5.0	11	11.8
63-62	2.0	36	5.2	10	12.2
61	2.1	35	5.4	9	12.5
60	2.2	34	5.6	8	13.0
59	2.3	33	5.8	7	13.5
58	2.4	32	6.0	6	14.0
57	2.5	31	6.2	5-1	15.0

Soil Organic Matter (SOM) by Weight Loss On Ignition (LOI)

Procedure:

Tare balance and weigh 50-mL beakers. Scoop 5 cm^3 of air-dried, 2-mm sieved soil into a beaker. Dry for a minimum of two hours at 150°C ±5°C. Maintain at 100°C until weighing. Record the weight of the beaker plus the warm soil sample to ±1 mg. Heat at 360°C for two hours after the temperature reaches 360°C ±5°C. Cool to 105°C and maintain at 105°C until weighing. Weigh the beaker and warm ash in a draft-free environment to ±1 mg. Calculate and report %LOI as percent organic matter to the nearest tenth of a percent.

Calculations:

Dried Soil ($Soil_d$) = (Wt of Beaker + Wt of Soil at 150°C) - Wt of Beaker

Ashed Soil ($Soil_a$) = (Wt of Beaker + Wt of Soil at 360°C) - Wt of Beaker

Percent weight loss on ignition (%LOI):

$$\text{LOI (\%)} = \frac{Soil_d - Soil_a}{Soil_d} \times 100$$

Note:

The LOI (a gravimetric, dry oxidation) method is used to estimate the soil organic matter content for all samples except for those coming from commercial farmland in the Piedmont counties of Virginia. The Walkley-Black (a wet, chemical oxidation) method is used in those cases, due to the presence of gibbsite ($Al_2O_3 \bullet 3H_2O$) in the clay fraction of soil material in that area of the state. Gibbsite has been reported to lose substantial amounts of water at around 300°C.

Instruments for Soil Analyses

Analysis	Instrument
Soil Drying	Cross-flow forced-air soil drying cabinet, developed at Virginia Tech
Soil Grinding	Agvise soil grinder
pH Auto-analyzer	LabFit Pty Ltd, model AS-3000 Automated Dual pH Analyser
pH Meter	TPS Pty Ltd, model WP-80D, Dual pH-mV and temp. meter
pH Electrode	Thermo Orion model 8165BNWP, Ross™ combination pH electrode, Sure-Flow®, with epoxy body and BNC connector
Nutrient Extraction	Eberbach Reciprocating, Variable Speed Shaker No. 6000
Elemental Analysis of P, K, Ca, Mg, Zn, Mn, Cu, Fe, B & Al	ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectrometer), CirOS VISION model with a SOP (radial) view of the plasma, made by Spectro Analytical Instruments and equipped with a CETAC ASX520-HS autosampler.
Soluble Salts	YSI 3100 Conductivity Instrument with a YSI 3254 Pyrex 5-ml Fill Cell
Organic Matter - WB	Thermo Scientific Genesys 20 Colorimete
Organic Matter – LOI	Blue M Electric High Temperature (up to 704°C), Ultra-Temp, forced-air drying oven, model CW-6680F, with Pro 550 microprocessor-based controller.
Organic Matter – LOI	PG503-SDR Mettler Toledo (MT) analytical balance controlled by MT's BalanceLink software (v2.20).

ICP Parameters

The ICP is housed in an instrument room maintained at 21°C (70°F) ± 1°C (2°F). Extreme swings in both temperature and humidity can affect the analytical results. Solutions are introduced to a cross flow nebulizer and Scott spray chamber with a peristaltic pump.

The following analytical lines are used:

Element	Wavelength (nm)
P	178.287
K	766.491
Ca	373.690
Mg	279.079
Zn	213.856
Mn	257.610
Cu	324.754
Fe	259.940
B	249.678
Al	308.215

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1 Scope and Application

1.1 This method is for the determination of volatile solids on solids and waters and also volatile suspended solids. Volatile solids, when measured in mg, is the weight of material combustible at 550ºC.

Applicable matrices include drinking, surface, and saline waters, domestic and industrial wastes, as well as soils, sludges, solid waste samples, river and lake sediments, and sludge cakes.

1.2 This method is adapted from the U.S. EPA Method 160.4 1971, “Residue, Volatile (Gravimetric, Ignition at 550ºC)”, Standard Methods for the Examination of Water and Wastewater Method 2540E 2011, “Fixed and Volatile Solids Ignited at 550ºC,” and 2540G 2011, “Total, Fixed and Volatile Solids in Solid and Semisolid Samples.”

1.3 This document states the laboratory’s policies and procedures established in order to meet the requirements of all certifications/accreditations currently held by the laboratory, including the most current standards in effect for the National Environmental Laboratory Accreditation Program (NELAP).

1.4 Individual project requirements may override criteria listed in this SOP.

2 Summary of Method

2.1 The residue obtained from the determination of TDS, TS, or TSS is ignited at 550ºC in a muffle furnace. The loss of weight on ignition is reported as volatile residue. Volatile residue is a combination of organic matter and volatile inorganic salts.

2.2 The remaining solids represent the fixed total, dissolved, or suspended solids. The determination is useful in control of wastewater treatment plant operation because it offers a rough approximation of the amount of organic matter present in the solid fraction of wastewater, activated sludge, and industrial wastes.

3 Interferences

3.1 The principal source of error in the determination is failure to obtain a representative sample. When running this test, the analyst shall do their best to obtain as representative a sample as possible.

3.2 The test is subject to errors due to loss of water of crystallization, loss of volatile organic matter prior to combustion, incomplete oxidation of certain complex organics, and decomposition of mineral salts during combustion. Therefore, the results shall not be considered an accurate measure of organic carbon in the sample, but may be useful in the control of plant operations.

3.3 Determination of low concentrations of volatile solids in the presence of high fixed solids concentrations may be subject to considerable error. In such cases, measure for suspect volatile components by another test, for example, total organic carbon.

4 Safety

4.1 ALS-Middletown maintains Safety Data Sheets (SDSs) on all chemicals used in this procedure. ALS-Middletown recommends that all individuals performing this SOP familiarize themselves with the SDSs associated with the procedure prior to SOP performance. SDSs are available to all staff and are located in hard copy in the QA reference library and electronically on the ALS-Middletown server in the Common>Health & Safety>SDS folder.

4.2 All possible steps shall be taken to limit the analyst contact with chemicals and samples. The minimum personal protective equipment (PPE) requirements are appropriate chemical resistant gloves, safety glasses and a fully buttoned lab coat. This PPE shall reduce the possibility of contact to a safe level, but the analyst shall not limit themselves to these PPE minimums. Refer to SOP 90-PPE-PROTOCOL for detailed PPE information.

4.3 Injuries from glass cuts are a serious concern in the laboratory. Several types of cut-resistant gloves are available in all the laboratory work areas. Wells Lamont part# Y1700 or equivalent should be worn as an under glove to provide cut protection when nitrile, latex or vinyl gloves are worn for chemical protection. The use of cut-resistant gloves is mandatory throughout the entire laboratory when handling glass sample containers and reusable labware constructed of glass. The handling of VOA and extract vials does not require cut-resistant gloves unless a cut hazard is evident. For example, loading capped vials unto an instrument does not require the use of cut-resistant gloves, but capping extract vials does.

4.4 In addition to the PPE minimums required above, a face shield shall be worn at all times while dispensing, diluting or handling any quantity of concentrated acid.

4.5 Analysts should always exercise caution when handling samples since the chemical and biological composition of the samples is unknown.

4.6 The health hazards of each substance used in this method may not have been fully established. Each substance shall be regarded as a potential health hazard and exposure shall be as low as reasonably achievable.

5 Apparatus and Materials

5.3 Muffle furnace, operation temperature 550ºC ± 50ºC- Vulcan, serial #3-1750 NEY, or equivalent.

5.4 Wax pencils- Fisher Scientific #S45652, or equivalent.

5.5 Tongs, extra long- VWR scientific # 62452-045, or equivalent.

5.4 Evaporating dishes, porcelain, 125-mL- VWR Scientific #25310-132, or equivalent. Vycor or platinum dishes may be substituted and smaller size dishes may be used if required. Dishes must be cooked for a minimum of one hour at 550ºC and stored in a desiccator prior to use.

5.5 Analytical Balance, capable of weighing to 0.0001g– OHaus Adventurer AR 2140, or equivalent.

5.6 Desiccator– VWR #24982-000, or equivalent.

5.7 Aluminum weighing dishes- VWR #25433-008, or equivalent.

5.8 Pre-weighed 47 mm volatile fiber filters- Environmental Express #F93447VOL, or equivalent.

5.9 Computer software capable of processing all associated tasks- Microsoft Excel and Access, or equivalent; Horizon LIMS, version 11, or equivalent.

5.10 Computer hardware capable of processing all associated software- Dell Dimension 8800, or equivalent.

6 Reagents

6.1 Not applicable.

7 Instrument Calibration

7.1 The balances must be calibrated daily. See the appropriate balance SOP for procedures regarding balance calibrations and verifications. The balances must be calibrated by an outside source annually.

8 Quality Control

8.1 All policies and procedures in the most current revision of the ALS-Middletown QA Manual shall be followed when performing this procedure.

8.2 Demonstration of Capability (DOC)

8.2.1 Initial Demonstration of Capability (IDOC): Each analyst shall complete a successful IDOC to become a qualified analyst and work independently to conduct this method.

8.2.1.1 Select four representative samples for the type of analysis being performed (total volatile solids aqueous, total volatile solids non-aqueous, volatile suspended solids, or volatile dissolved solids). Analyze these samples and compare the results with the results for the same samples obtained by an experienced analyst who has already completed the demonstration of capability requirements for the selected analysis.

8.2.1.2 Acceptance Criterion
Precision: Each RPD shall be ≤10%.

If this acceptance criterion is met, performance is judged acceptable and independent sample analysis may begin. If data is not acceptable, find and correct the source of the problem, then repeat the analysis. The DOC must be acceptable before independent analysis begins.

8.2.2 Continuing DOC (DOC): Each qualified analyst shall perform an annual DOC for ongoing proficiency or when significant changes in instrumentation are made.

8.2.2.1 Use the same procedure and acceptance criterion as the IDOC or the successful analysis of a blind performance sample (PT).

If this acceptance criterion is met, performance is judged acceptable and independent sample analysis may continue. If data is not acceptable, analyst shall work under supervision of a qualified analyst, find and correct the source of the problem, then repeat the analysis. The DOC must be acceptable before independent analysis begins.

8.3 Quality Control Requirements

Quality Control Requirements

(Specific Project Requirements may override these requirements)

Parameter	Concentration	Frequency	Control Limits	Corrective Action
Method Blank (Aqueous Samples Only)	---	One per twenty samples with a minimum of one per batch	<Reporting Limit (5 mg/L)	Reanalyze the blank and any associated samples. If reanalysis is not possible report with a qualifying statement.
Duplicate	---	1 per 10 samples with a minimum of one per batch	RPD ≤ 5%	Reanalyze once. If reanalysis is not possible or if RPD is still unacceptable report with a qualifying statement.

8.4 Method Blank- Analysis required with aqueous samples only.

8.4.1 If the Method Blank concentration is greater than or equal to the reporting limit AND is greater than $^1/_{10}$ the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected samples reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.

8.5 Duplicate

8.5.1 Samples selected for duplicate analysis shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a duplicate or spike may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

8.6 Acceptance limits were developed based on the reference methods and control charts.

9 Sample Collection, Preservation and Handling

9.1 Sample collection, preservation, and handling is performed according to SOP-20 Field Services Plan for Sample Collection.

9.2 Samples shall be collected in glass or plastic containers. A minimum of 200 mL is required for aqueous samples and a minimum of 25 grams is required for solid samples.

9.3 Preserve samples by storing above the freezing point of water up to 6 ˚C.

9.4 The maximum holding time is seven days.

10 Procedure

10.1 Prepare the solids by following the appropriate procedure for TS, TDS or TSS. The same dish can be used for both analyses.

10.2 Volatile Total Solids on Solids:

10.2.1 Transfer the dish containing the dried residue to a cool muffle furnace.

10.2.2 Heat the furnace to 550ºC ± 50ºC allowing the sample to come up to temperature at the same speed as the furnace and ignite the sample for one hour after the furnace first reaches 550 ºC.

NOTE: On the first burn, place a watch glass over the dish to contain particles that may pop out of the dish due to the expansion of air trapped in the sample matrix. After temperature of 550 ºC is achieved and 15 minutes have passed, the watch glass can be removed. Let the dish cool partially in air until most of the heat has dissipated and then transfer to a desiccator.

10.2.3 Weigh the dish as soon as it has cooled to room temperature.

10.2.4 Repeat igniting (1 hour), cooling, desiccating, and weighing steps until the weight change is less than 4% or 50 mg, whichever is less.

10.3 Volatile Total Solids on Waters & Volatile Suspended Solids:

10.3.1 Preheat muffle furnace to 550ºC ± 50ºC.

10.3.2 Place the sample in the preheated oven and ignite for 15 minutes.

10.3.3 Let the dish cool partially in air until most of the heat has dissipated and then transfer to a desiccator.

10.3.4 Weigh the dish as soon as it has cooled to room temperature, which takes approximately 2 hours.

10.3.5 Repeat igniting (15 minutes), cooling, desiccating, and weighing steps until the weight change is less than 4% or 0.5 mg, whichever is less.

10.4 Record the appropriate sample information from the original procedure for TS, TDS or TSS to the appropriate Volatile Solids spreadsheet, see Appendices.

11 Calculations

11.1 mg/L Volatile Solids (Aqueous) = $\frac{(A-B) \times 10^6}{\text{mL sample}}$

mg/L Fixed Solids (Aqueous) = $\frac{(B-C) \times 10^6}{\text{mL sample}}$

where: A = weight of residue and dish before ignition (grams)
B = weight of residue and dish after ignition (grams)
C = weight of dish (grams)

11.2 % Volatile Solids (Solids) = $\frac{(A-D)}{(A-B)} \times 100$

% Fixed Solids (Solids) = $\frac{(D-B)}{(A-B)} \times 100$

where: A = weight of dried residue and dish (grams)
B = weight of dish
C = weight of wet sample and dish (grams)
D = weight of residue and dish after ignition (grams)

11.3 Precision, Relative Percent Difference (RPD):

$$RPD = \frac{\text{Difference between results}}{\text{Average}} \times 100$$

12 Reporting Results

12.1 All raw data used for reporting results must be dated and initialed by the qualified laboratory personnel performing first and second review.

12.2 When entering data into Horizon LIMS do not round off results: Horizon will automatically perform rounding appropriate to the method. Horizon LIMS results are reported to three significant figures but limited to the number of decimal places in the reporting limit for the individual compound or analyte.

12.3 Report the actual result, even if it is less than the reporting limit. Any sample with a result less than the reporting limit is reported as ND (non-detectable); LIMS will automatically report the appropriate detection limit.

13 Waste Management

13.1 Refer to ALS-Middletown SOP 19-Waste Disposal

14 Pollution Prevention

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operations. Management shall consider pollution prevention a high priority. Extended storage of unused chemicals increases the risk of accidents. The laboratory shall consider smaller quantity purchases which will result in fewer unused chemicals being stored and reduce the potential for exposure by employees. ALS-Middletown tracks chemicals when received by recording their receipt in a traceable logbook. Each chemical is then labeled according to required procedures and stored in assigned locations for proper laboratory use.

15 Definitions

15.1 Refer to ALS-Middletown QA Manual for general definitions.

16 Maintenance and Troubleshooting

16.1 Refer to maintenance logs and instrument manuals for guidance in troubleshooting specific problems related to the instrumentation used in this method.

Appendix A

Appendix A

TOTAL SOLIDS

Sample	Weight of dish and sample (g) or Volume of sample (ml)	Dish Wt. (g)	1st Dish + Sample Wt. (g)	2nd Dish + Sample Wt. (g)	TS (%) or (mg/L)	Date/Tech	1st Time in	1st Temp In (C)	1st Time Out	1st Temp Out (C)	2nd Time In	2nd Temp In (C)	2nd Time Out	2nd Temp Out (C)

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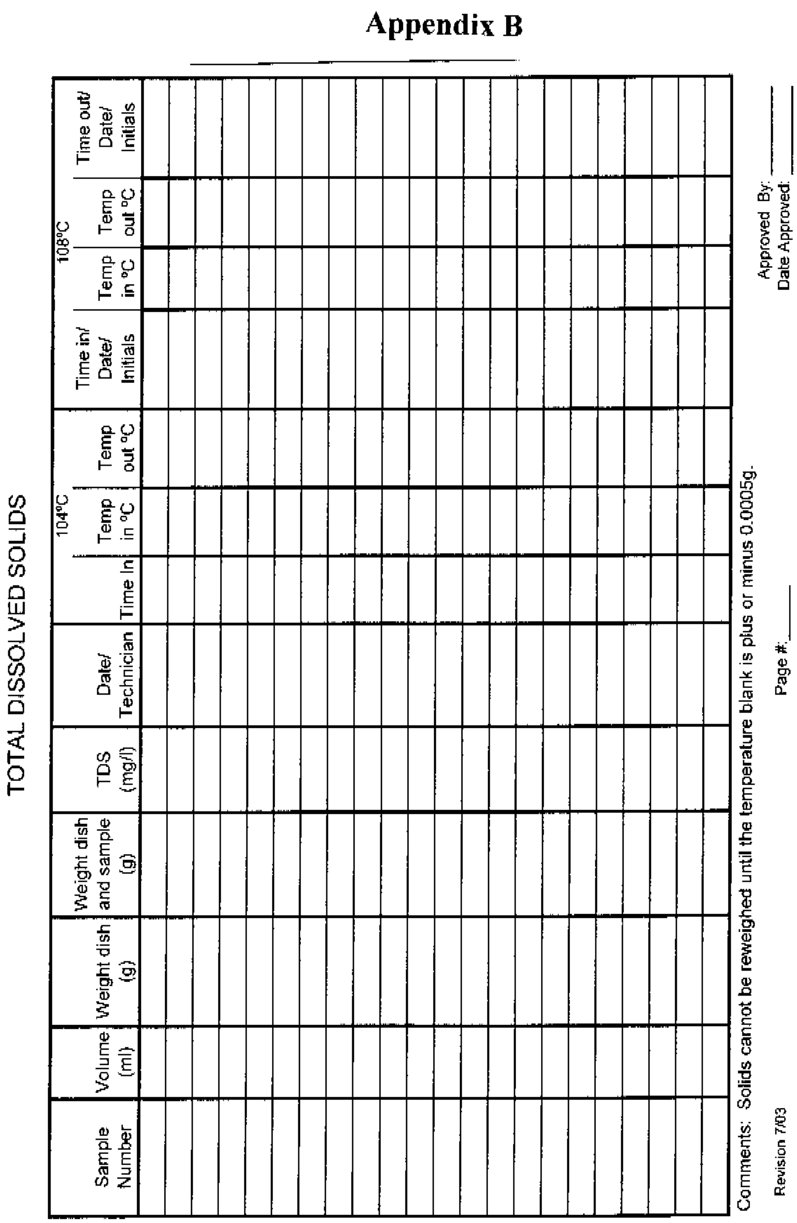
Appendix B



Appendix B

TOTAL DISSOLVED SOLIDS

Sample Number	Volume (ml)	Weight dish (g)	Weight dish and sample (g)	TDS (mg/l)	Date/ Technician	104°C Time In	Temp in °C	Temp out °C	Time in/ Date/ Initials	108°C Temp in °C	Temp out °C	Time out/ Date/ Initials

Comments: Solids cannot be reweighed until the temperature blank is plus or minus 0.0005g.

Revision 7/03 Page #:____ Approved By: ______ Date Approved: ______

Appendix C

Appendix C

TOTAL SUSPENDED SOLIDS

Sample	Vol (mL)	Initial Wt. (g)	1st Final Wt. (g)	2nd Final W. (g)	Final Net Wt. (g)	TSS (mg/L)	Date/Tech	1st Time In	1st Temp In (C)	1st Time Out	1st Temp Out (C)	2nd Time In	2nd Temp In (C)	2nd Time Out	2nd Temp Out (C)

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Page____

Appendix D

Volatile Total Solids on Solids

Queue:	WETC
Rule:	S2540GSVTS
Batch:	
HBN:	
VTSS Analyst:	
Date:	

1st		2nd		3rd	
Time In:		Time In:		Time In:	
Temp (°C):		Temp In (°C):		Temp In (°C):	
Time Out:		Time Out:		Time Out:	
Temp Out (°C):		Temp Out (°C):		Temp Out (°C):	
Analysts:		Analysts:		Analysts:	

Sample	Dish Wt. (g)	Final Wt. 104 (g)	1st Wt. 550 (g)	2nd Wt. 550 (g)	3rd Wt. 550 (g)	VTSS (%)	TS Date/Time	TS Tech	3rd Wt? (Y/N)

Comments:

Reviewed By: ______
Reviewed Date: ______
Approved By: ______
Approved Date: ______

Rev 12/10 Volatile Total Solids on Solids Template for sop.xls Val 0076

Appendix E

Volatile Total Solids on Waters

Queue:	WETC
Rule:	VTSW
Batch:	
HBN:	
VTSW Analyst:	
Date:	

1st		2nd		3rd	
Time In:		Time In:		Time In:	
Temp (°C):		Temp In (°C):		Temp In (°C):	
Time Out:		Time Out:		Time Out:	
Temp Out (°C):		Temp Out (°C):		Temp Out (°C):	
Analyst:		Analyst:		Analyst:	

Sample	Volume (mL)	Final Wt. 104 (g)	1st Wt. 550 (g)	2nd Wt. 550 (g)	3rd Wt. 550 (g)	VTSW (%) or (mg/L)	TSW Date/Time	TSW Tech	3rd Wt? (Y/N)

Comments:

Reviewed By: ________
Reviewed Date: ________
Approved By: ________
Approved Date: ________

Rev. 12/10 Volatile Total Solids on Waters Template for sop.xls Val 0094

Appendix F

Volatile Suspended Solids

Queue:	WETC
Rule:	VSS
Batch:	
HBN:	
VSS Analyst:	
Date:	

1st		2nd		3rd	
Time In:		Time In:		Time In:	
Temp (°C):		Temp In (°C):		Temp In (°C):	
Time Out:		Time Out:		Time Out:	
Temp Out (°C):		Temp Out (°C):		Temp Out (°C):	
Analysts:		Analysts:		Analysts:	

Sample	Volume (mL)	Final Wt. 104 (g)	1st Wt. 550 (g)	2nd Wt. 550 (g)	3rd Wt. 550 (g)	VSS (mg/L)	TSS Date/Time	TSS Tech	3rd Wt? (Y/N)

Comments:

Reviewed By: ______
Reviewed Date: ______
Approved By: ______
Approved Date: ______

Rev 12/10 Volatile Suspended Solids Template for sop.xls Val 0095

Summary of Changes

Revision 7

Section Number	Section	Description of Change
Spelling, grammar, and formatting changes may have been made throughout SOP for clarity, correctness, and conformity.		
	Footer	Updated to Corporate format
	Signature page	Updated Validator, QA Manager
1.2	Scope & Application	Added reference method years
4.1-.6	Safety	Updated Safety standard verbiage
5.8	Apparatus and Materials	Updated filters
5.9	Apparatus and Materials	Updated LIMS version
8.2	Quality Control	Added DOC standard verbiage
	Concurrence Form	Removed due to change in procedure

Concurrence Form

I acknowledge that I have read, undersood, and I concur with the standard operating procedure (SOP) listed below.

Employee Name ____________________

SOP 04-vs

Revision 7

E-mail ____________________

Date Concurred ____________________

Submit

DOCUMENT TITLE:	*DETERMINATION OF TOTAL & DISSOLVED ORGANIC CARBON AND TOTAL CARBON IN WATER*
SOP ID:	*07-TOC*
REVISION NUMBER:	*14*
REVISION DATE:	*05/11/20105*
INSTITUTED DATE:	*09/03/2015*
DOC. CONTROL#:	*______________*
ARCHIVAL DATE:	

SOP Title: The Determination of Total & Dissolved Organic Carbon and Total Carbon in Water

SOP ID: 07-TOC Revision #: 14

Approved By: Patrick A. Glaser Date: 9-3-15
Validator- Patrick Glaser

Approved By: Jason Badman Date: 7/20/15
Wet Chemistry Supervisor- Jason Badman

Approved By: Anna Milliken Date: 8/25/2015
Quality Assurance Manager- Anna Milliken

Annual Review:

Reviewed By: ______________________ Date: __________

Reviewed By: ______________________ Date: __________

Reviewed By: ______________________ Date: __________

Reviewed By: ______________________ Date: __________

Reviewed By: ______________________ Date: __________

Reviewed By: ______________________ Date: __________

TABLE OF CONTENTS

1 Scope and Application

1.1 This method is used to estimate the total amount of non-purgeable organic carbon present in drinking, surface, and saline waters, as well as domestic and industrial wastes. This method can be modified to estimate the dissolved organic carbon of a sample. This method also outlines steps to be performed to determine total carbon and inorganic carbon.

This TOC method is independent of the oxidation state of the organic matter and does not measure other organically bound elements, such as nitrogen and hydrogen, and inorganics that can contribute to the oxygen demand measured by BOD and COD.

1.2 This method is adapted from the U.S. EPA Method 415.1 1974, "Organic Carbon, Total (Combustion or Oxidation)", and Standard Methods for the Examination of Water and Wastewater, Method 5310 B 2011. The quality control requirements specified in Standard Methods for the Examination of Water and Wastewater, 5310B 2011 are implemented for drinking water samples. This method, when analyzed in quadruplicate, is adapted from U.S. EPA SW-846, Method 9060A rev 1 2004, Total Organic Carbon.

1.3 This document states the laboratory's policies and procedures established in order to meet requirements of all certifications/accreditations currently held by the laboratory, including the most current standards in effect for the National Environmental Laboratory Accreditation Program (NELAP).

1.4 This method is restricted for use by or under the supervision of analysts experienced in the use of the total organic carbon analyzer.

1.6 Individual project requirements may override criteria listed in this SOP.

2 Summary of Method

2.1 Combustion (as performed by the Elementor Vario TOC Cube) - Initially any inorganic carbon compounds present are removed from the sample by purging with oxygen. The sample is then injected into a heated reaction chamber packed with an oxidative catalyst and vaporized. The organic carbon is then oxidized to CO_2 and H_2O. The CO_2 is transported in the carrier gas stream and measured by means of a non-dispersive infrared analyzer specifically tuned to the absorptive wavelengths of CO_2. The instrument calculates the area of the peaks produced by the analyzer, compares them to the peak area of the calibration standards, and prints out a calibrated organic carbon value in mg/L. The amount of CO_2 is directly proportional to the concentration of carbonaceous material in the sample.

2.2 Carbon measurement assesses the potential oxygen- demanding load of organic material on a receiving stream. This statement applies whether the carbon measurement is made on a sewage plant effluent, industrial waste, or on water taken directly from the stream. In this light, carbonate and bicarbonate carbon are not a part of the oxygen demand in the stream and therefore shall be discounted in the final calculation or removed prior to analysis. The manner of preliminary treatment of the sample and instrument settings defines the types of carbon which are measured. Instrument manufacturer's instructions shall be followed.

3 Interferences

3.1 Carbonate and bicarbonate carbon represent an interference under the terms of this test and must be removed or accounted for in the final calculation. Removal of carbonates and bicarbonates by acidification and purging with purified gas may result in the loss of volatile organic substances.

3.2 Volatiles can also be lost during sample blending, particularly if the temperature is allowed to rise.

3.3 A loss can occur if large carbon-containing particles fail to enter the syringe used for injection.

3.4 Chloric acids and salines will omit chlorine when injected into the combustion tube. If these components are contained in a very high concentration, they may not be removed completely by the IC solution in the reaction vessel. These samples shall be diluted.

3.5 Contamination during sample handling and treatment is a likely source of interference. Extreme care shall be taken when sampling, handling, and analyzing, particularly for trace analysis of samples below 1 mg TOC/L.

3.6 The carbonaceous analyzer measures all of the carbon in a sample. Because of various properties of carbon-containing compounds in liquid samples, preliminary treatment of the sample prior to analysis dictates the definition of the carbon as it is measured. Forms of carbon that are measured by the method are:

3.6.1 Soluble, nonvolatile organic carbon; for instance, natural sugars.

3.6.2 Soluble, volatile organic carbon; for instance, mercaptans.

3.6.3 Insoluble, partially volatile carbon; for instance, oils.

3.6.4 Insoluble, particulate carbonaceous materials; for instance, cellulose fibers.

3.6.5 Soluble or insoluble carbonaceous materials absorbed or entrapped on insoluble inorganic suspended matter; for instance, oily matter absorbed on silt particles.

4 Safety

4.1 ALS-Middletown maintains Safety Data Sheets (SDSs) on all chemicals used in this procedure. ALS-Middletown recommends that all individuals performing this SOP familiarize themselves with the SDSs associated with the procedure prior to SOP performance. SDSs are available to all staff and are located in hard copy in the QA reference library and electronically on the ALS-Middletown server in the Common>Health & Safety>SDS folder.

4.2 All possible steps shall be taken to limit the analyst contact with chemicals and samples. The minimum personal protective equipment (PPE) requirements are appropriate chemical resistant gloves, safety glasses and a fully buttoned lab coat. This PPE shall reduce the possibility of contact to a safe level, but the analyst shall not limit themselves to these PPE minimums. Refer to SOP 90-PPE-PROTOCOL for detailed PPE information.

4.3 Injuries from glass cuts are a serious concern in the laboratory. Several types of cut-resistant gloves are available in all the laboratory work areas. Wells Lamont part# Y1700 or equivalent should be worn as an under glove to provide cut protection when nitrile, latex or vinyl gloves are worn for chemical protection. The use of cut-resistant gloves is mandatory throughout the entire laboratory when handling glass sample containers and reusable labware constructed of glass. The handling of VOA and extract vials does not require cut-resistant gloves unless a cut hazard is evident. For example, loading capped vials unto an instrument does not require the use of cut-resistant gloves, but capping extract vials does.

4.4 In addition to the PPE minimums required above, a face shield shall be worn at all times while dispensing, diluting or handling any quantity of concentrated acid.

4.5 Analysts should always exercise caution when handling samples of unknown composition.

4.6 The health hazards of each substance used in this method may not have been fully established. Each substance shall be regarded as a potential health hazard and exposure shall be as low as reasonably achievable.

5 Apparatus and Materials

5.1 Total Organic Carbon Analyzer- Elementar TOC Vario Cube, or equivalent.

5.2 Syringe, 5 mL- Hamilton Gastight Syringe, Elementar #38.00-0068, or equivalent.

5.3 Assorted Class A pipets and volumetric flasks.

5.4 Filters, 0.45-μm glass fiber syringe filters- Whatman #6894-2504, or equivalent.

5.5 10-mL interchangeable syringe- Micro-Mate, or equivalent.

5.6 Sample Vials, 40 mL precleaned amber- Scientific Specialties, or equivalent.

5.7 Automatic Pipets- various sources. If an automatic pipet is used, it must be calibrated monthly according to the protocol listed SOP 99-AP for calibration checks for Autopipetters and Dispensers.

5.8 Computer software-
5.8.1 Microsoft Excel, or equivalent
5.8.2 Horizon LIMS, version 11, or equivalent
5.8.3 Vario TOC Software V2.2.3(ef16cd0),2012-06-18, or equivalent.

5.9 Computer hardware- Dell Dimension 9200, or equivalent.

6 Reagents

NOTE: Unless otherwise noted in this section all chemicals are stored at room temperature and labeled with an expiration date of five years from receipt. Manufacturer's labeled expiration dates, when provided, take precedent over all other expiration dates.

6.1 Reagent Water - ALS-MIDDLETOWN uses a Filson Water Purification System which provides analyte-free, greater than 16.0 megohm-cm DI water on demand. Ion exchanged waters are not recommended because of possible contamination with organics from resin materials.

6.2 Potassium biphthalate (KHP), ACS grade- VWR catalog #JT2958-0, or equivalent.

6.2.1 Total Carbon Standard (1000 mg/L) – Dissolve 2.1254 g KHP into 1 L of reagent water. Store above the freezing point of water up to 6 ˚C for up to 2 weeks.

6.3 Hydrochloric acid (HCl), Reagent Grade- Baker, VWR catalog #JT9535-33, or equivalent.

6.4 Stock Standard Solution (1000 mg carbon/L) – NIST Traceable purchased from Lab Chem Catalog #LC12910-1 or equivalent. Store refrigerated above the freezing point of water up to 6 ºC.

6.5 Working Standard Solutions (7) – Prepare 7 Working Standard Solutions according to the directions below in reagent water. Acidify with HCl to pH < 2 and store above the freezing point of water up to 6 ºC for up to one month.

- Solution 1 (100 mg/L) – 50 mL Stock Standard Solution in 500-mL volumetric flask.
- Solution 2 (10 mg/L) – 50 mL Working Standard Solution 1 in 500-mL volumetric flask.
- Solution 3 (5 mg/L) – 25 mL Working Standard Solution 1 in 500-mL volumetric flask.

- Solution 4 (1 mg/L) – 5 mL Working Standard Solution 1 in 500-mL volumetric flask.
- Solution 5 (0.5 mg/L) – 2.5 mL Working Standard Solution 1 in 500-mL volumetric flask.

6.6 Second Source Stock Standard Solution (1000 mg/L) – NIST Traceable purchased from Lab Chem catalog #LC12910-1. NOTE: must be a separate lot number from section 6.4.

6.6.1 Second Source Check Standard #1 (100 mg/L) - Pipet 50 mL of Second Source Stock Standard Solution into a 500-mL volumetric flask and acidify with HCl to pH < 2. Dilute to volume with reagent water. Store refrigerated above the freezing point of water up to 6 ºC for up to one month.

6.6.2 Second Source Check Standard #2 (1 mg/L) - Pipet 5 mL of Second Source Check Standard #1 (6.8.1) into a 500-mL volumetric flask and acidify with HCl to pH < 2. Dilute to volume with reagent water. Store refrigerated above the freezing point of water up to 6 ºC for up to one month.

6.6.3 Second Source QC Sample (5 mg/L) – Pipet 25 mL of Second Source Check Standard #1 (6.8.1) into a 500-mL volumetric flask and acidify with HCl to pH < 2. Dilute to volume with reagent water. Store refrigerated above the freezing point of water up to 6 ºC for up to one month.

6.6.4 Second Source QC Sample (8 mg/L) – Pipet 40 mL of Second Source Check Standard #1 (6.8.1) into a 500-mL volumetric flask and acidify with HCl to pH < 2. Dilute to volume with reagent water. Store refrigerated above the freezing point of water up to 6 ºC for up to one month.

6.7 Carrier Gas - Purified oxygen or air, CO_2 free and containing less than 1 ppm hydrocarbon (as methane). All gases are purchased from Airgas or equivalent. The oxygen used is UHP oxygen. A standard 220 cubic foot cylinder will provide continuous operation for approximately fifty days of manual operation, based on eight-hour daily usage. Consistent pressure of 30 psig is necessary for proper operation.

7 Instrument Calibration

7.1 Calibrate the instrument once per month, after instrument catalyst changeout or as necessary. The instrument is capable of generating a 4-point calibration curve. The r value must be 0.995 or greater for each curve. The calibration curve is validated with a Second Source 1.0 QC Standard that must be within +/- 15% of the true value.

7.2 Calibration curve- Place the following standards in the appropriate hole positions on the carousel autosampler:

7.3.1 10 mg/L (Working Standard Solution 2)

7.3.2 5 mg/L (Working Standard Solution 3)

7.3.3 1 mg/L (Working Standard Solution 4)

7.3.4 0.5 mg/L (Working Standard Solution 5)

7.3 Calibration for Total Inorganic Carbon – TIC is typically determined by calculation (see section 11.5).

8 Quality Control

8.1 All policies and procedures in the most current revision of the ALS-Middletown QA Manual shall be followed when performing this procedure.

8.2 Method Detection Limit (MDL)

8.2.1 For this method, the MDL study must be conducted and evaluated annually according to SOP 99-MDL.

8.2.2 Analyze seven (7) replicates of the MDL standard according to the sample preparation and analysis procedure. The spiking level can be adjusted to achieve optimal results. The MDL (for each analyte) shall be calculated from the collected results.

8.2.3 The analytical department shall provide the MDL study to the QA Department. The detection limit for a specific sample may differ from those listed due to the nature of interferences in a particular sample matrix.

8.3 Demonstration of Capability (DOC)

8.3.1 Each analyst shall complete a successful Initial Demonstration of Capability (IDOC) before working independently to conduct this method. Each qualified analyst shall perform an annual DOC for ongoing proficiency as specified in the QA Manual, Technical Training.

8.3.2 Analyze four replicates of the 1 mg/L Working Standard Solution (6.6.2) according to the sample preparation and analysis procedure. Calculate the recovery and the relative standard deviation (RSD) for each analyte.

8.3.3 Acceptance Criteria:

Accuracy: All four results shall be within ± 15% of the true value.
Precision: RSD shall be <15% for all analytes.

If this acceptance criteria is met, performance is judged acceptable and sample analysis may begin. If the results do not meet these requirements, the DOC shall be repeated before independent analysis of samples begins. If for recertification, this process is repeated until the DOCs are completed successfully.

8.4 Quality Control Requirements:
(Specific project requirements may override these requirements.)

Parameter	Concentration	Frequency	Control Limits	Corrective Action
Method Blank	---	Beginning of the run, every 10 samples, and at the end of the run	<0.5 mg/L DoD samples: <1/2 the LOQ	If the method blank concentration is greater than or equal to the reporting limit AND is greater than $^{1}/_{10}$ the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected samples reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.
Second Source Check Standard	1.0 mg/L	After each applicable calibration curve	± 15% of true value.	Rerun. If it fails again, recalibrate and rerun.
Check Standard	0.5 mg/L	When reporting DEP samples, After each applicable calibration curve	± 20% of true value.	Rerun. If it fails again, recalibrate and rerun.
Second Source QC Sample	5.0 mg/L or 8.0 mg/L	Every ten samples (or 10 quadruplicates). Alternate between 5.0 mg/L and 8.0 mg/L standards.	± 10% of true value.	If fails, reanalyze all samples run since last acceptable QC Sample. DoD: Recalibrate, and reanalyze all affected samples since the last acceptable SS QC Sample OR Immediately analyze two additional consecutive SS QC Samples. If both pass, samples may be reported without re-analysis. If either fails, take corrective action and re-calibrate; then re-analyze all affected samples since the last acceptable SS QC Sample.

Parameter	Concentration	Frequency	Control Limits	Corrective Action
Matrix Spike	6.0 mg/L	Every ten samples (or 10 quadruplicates), minimum 1 per batch.	± 15% of true value.	Rerun. If fails again, report with a comment indicating matrix interference. If the LCS is acceptable and the specific matrix interference is identified, report with a qualifying statement. If the specific matrix interference is unknown, reanalyze the sample and matrix spike to determine matrix effect or analytical error.
Matrix Spike Duplicate	6.0 mg/L	Every ten samples (or 10 quadruplicates), minimum 1 per batch.	RPD ≤ 15%	Rerun. If fails again, report with a comment.
Filtered Blank	---	Every 20 DOC samples, minimum 1 per DOC batch.	<0.5 mg/L	Rerun. If fails again, refilter. Also refilter all samples in the batch with acceptable filter.

8.5 Samples selected for MS and MSD analysis shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a duplicate or spike may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

8.6 To prepare a MS/MSD, pipet 300 µL of the Stock Standard Solution (6.4) into a 50-mL volumetric flask containing the sample to be spiked, shake well. This is the sample to be analyzed as the spike.

8.6.1 To prepare a Total Carbon MS/MSD, pipet 300 µL of the Total Carbon Standard (6.2.1.) into a50-mL volumetric flask containing the sample. Shake well. This is the sample to be analyzed as the spike.

8.7 DoD accreditation requires the quarterly verification of the LOD and a LOQ.

9 Sample Collection, Preservation and Handling

9.1 Refer to SOP 20-Field Services Sampling Plan for sampling information.

9.2 Sampling and storage of samples in amber glass bottles is preferred. All bottles for TOC analysis shall be preserved to a pH <2 with HCl. The minimum sample required shall be two 40 mL vials filled to zero headspace. Do not preserve samples submitted for total carbon, inorganic carbon, or dissolved carbon determination.

9.3 Because of possibility of decomposition of some components of aqueous samples, the lapse of time between collection and analysis shall be kept to a minimum. Samples shall be kept refrigerated above the freezing point of water up to 6 °C and protected from sunlight and atmospheric conditions. Analyze preserved samples within 28 days. Unpreserved samples submitted for total carbon and inorganic carbon shall be analyzed within 7 days.

10 Procedure

10.1 Start-up and calibration of the Elementar Vario TOC Cube.

10.1.1 Turn on the power switch located on the right side of the analyzer.

10.1.2 Activate the Vario TOC software by clicking the icon on the computer desktop. After communication is established between the software and the instrument, wait until the furnace reaches set temperature of 850º C and the IR detector reaches stabilization. This is indicated when the "IR" icon stops flashing on the desktop.

10.1.3 Confirm the oxygen carrier gas is set at 1100 to 1200 mbar on the software desktop. Adjust if necessary at the valve on top of the oxygen cylinder. Since peak area varies inversely to carrier gas flow rate, do not change the flow rate during measurement.

10.1.4 After initialization and the calibration standards have been placed on the autosampler carousel, click MATH on the top toolbar followed by COEFFICIENTS. Pick an old curve from the list on the left side of the window. Rename the curve in the lower left box with the current date followed by an underscore and the word "CAL". Example: 022613_CAL. Type the required run-in, liquid blanks, standard names, qc checks, and initial calibration blank onto the software run sheet. Click the green "START ANALYSIS" button on the top toolbar and calibration will proceed automatically.

10.1.5 After calibration is completed, Click MATH followed by CALIBRATE. Click the NEXT button and then click NPOC and "OK". Print the calibration curve. Click MATH and then click STATISTICS. Print the statistics page for the calibration run. Click the open new file button followed by MATH and then COEFFICIENTS. Select the DEFAULT curve in the box on the left of the window. Click NPOC and then click the COPY button. Select the calibration curve with the current date in the left window that was set up earlier.Click paste and then "OK". The calibration curve is now designated for the current date.

10.1.6 For specific start –up and calibration procedures please see the Vario TOC Cube operating instructions available on the computer desktop.

10.2 Measurement of samples

10.2.1 Place samples to be analyzed in the appropriate hole positions on the autosampler carousel. Type the run-in, liquid blanks, initial qc checks, initial calibration blanks, sample numbers, matrix spikes and continuing calibration verification standards and blanks onto the software run-sheet. Designate the required method from the drop-down menu in the middle column of the run sheet. Select the current applicable calibration curve from the drop-down menu on the right hand column. Click FILE and then SAVE AS. Designate the sample batch with the current date followed by an underscore and the word "RUN". Example: 022613_RUN. Click the green START ANALYSIS button and sample analysis will proceed automatically.

10.2.2 For specific analysis procedures please refer to the Vario TOC Cube operating instructions available on the computer desktop.

10.2.3 Each standard and sample is analyzed in triplicate or quadruplicate as required by client request. A replicate value can be rejected if mis-injection is obvious. A minimum of two injections must be usable and all usable injections must yield a relative standard deviation of less than 10%. If a deviation less than 10% cannot be obtained, the standard or sample must be rerun. The average of all acceptable injections is reported as the result.

10.2.4 All standards and samples are sparged with O_2 for 10 minutes prior to TOC Analysis.

10.2.5 All samples shall be diluted so that results fall within calibration range.

10.3 Total Carbon is determined using the same working standards that are utilized for Total Organic Carbon and following the steps listed in sections 10.1 and 10.2, except that all samples requiring Total Carbon analysis shall be submitted without HCl acid preservative and the samples shall not require sparging with oxygen during the analysis procedure.

10.4 Total Inorganic Carbon shall be determined, as necessary, by subtracting the TOC result from the TC result; see section 11.5.

10.5. To prepare dissolved samples, filter an un-acidified sample through a 0.45-µm glass microfiber syringe filter. Prepare filtered blanks at a frequency of one per 20 samples with a minimum of one per batch using reagent water. Acidify with HCl to a pH below 2 and keep refrigerated above the freezing point of water up to 6 ºC

11 Calculations

11.1 If a dilution was performed, the sample result and RL must be multiplied by the dilution factor.

11.2 LCS Recovery

$$\% R = \frac{C_m}{C_n} x\ 100$$

Where: C_m = measured concentration of LCS
C_n = spiking concentration

11.3 Spike Recovery

$$\% \text{ Recovery} = \frac{(C_s - C_u)}{C_n} x\ 100$$

Where: C_s = measured concentration of spiked sample aliquot
C_u = measured concentration of unspiked sample aliquot
C_n = spiking concentration

11.4 Precision (RPD)

$$\% \text{ RPD} = \frac{|(R_1 - R_2)|}{(R_1 + R_2) \div 2} \ x\ 100$$

Where: R_1 = sample or spike result
R_2 = duplicate or spike duplicate result

11.5 Total Inorganic Carbon

Total Inorganic Carbon = Total Carbon – Total Organic Carbon

12 Reporting Results

12.1 All raw data used for reporting results must be initialed and dated by the qualified laboratory personnel performing first and second review.

12.2 When entering data into Horizon LIMS, do not round off results: Horizon will automatically perform rounding appropriate to the method. Horizon LIMS results are reported to three significant figures but limited to the number of decimal places in the reporting limit for the individual compound or analyte.

12.3 Report the actual result, even if it is less than the reporting limit. Any sample with a result less than the reporting limit is reported as ND (non-detectable); LIMS will automatically report the appropriate detection limit.

13 Waste Disposal

13.1 Refer to SOP 19 – Waste Disposal

14 Pollution Prevention

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operations. Management shall consider pollution prevention a high priority. Extended storage of unused chemicals increases the risk of accidents. The laboratory shall consider smaller quantity purchases which will result in fewer unused chemicals being stored and reduce the potential for exposure by employees. ALS-MIDDLETOWN tracks chemicals when received by recording their receipt in a traceable logbook. Each chemical is then labeled according to required procedures and stored in assigned locations for proper laboratory use.

15 Definitions

15.1 Refer to ALS-MIDDLETOWN QA Manual for general definitions.

16 Maintenance and Troubleshooting

16.1 Refer to maintenance logs and instrument manuals for guidance regarding general maintenance and troubleshooting specific problems related to instrumentation used in this method.

Appendix A

Run Log

Document: 020215_CAL (varioTOC) from: --.--.-- (modified)

analytic functional testing
varioTOC cube
serial number: 38133026

Statistic report

No. Name	NPOC [mg/l]	TC [mg/l]
1 RUN IN 1	0.660	~~0.000~~
2 RUN IN 1	0.434	~~0.000~~
3 RUN IN 1	0.360	~~0.000~~
4 RUN IN 1	0.230	~~0.000~~
Mean value	0.421	0.000
Deviation, abs.	0.180	-1.#IO
Deviation, rel. [%]	42.849	0.000
5 RUN IN 2	0.362	~~0.000~~
6 RUN IN 2	0.337	~~0.000~~
7 RUN IN 2	0.319	~~0.000~~
8 RUN IN 2	0.269	~~0.000~~
Mean value	0.322	0.000
Deviation, abs.	0.039	-1.#IO
Deviation, rel. [%]	12.171	0.000
9 RUN IN 3	0.244	~~0.000~~
10 RUN IN 3	0.136	~~0.000~~
11 RUN IN 3	0.172	~~0.000~~
12 RUN IN 3	0.176	~~0.000~~
Mean value	0.182	0.000
Deviation, abs.	0.045	-1.#IO
Deviation, rel. [%]	24.768	0.000
13 RUN IN 4	0.239	~~0.000~~
14 RUN IN 4	0.088	~~0.000~~
15 RUN IN 4	0.093	~~0.000~~
16 RUN IN 4	0.093	~~0.000~~
Mean value	0.128	0.000
Deviation, abs.	0.074	-1.#IO
Deviation, rel. [%]	57.554	0.000
17 RUN IN 5	0.216	~~0.000~~
18 RUN IN 5	0.116	~~0.000~~

Name: eassuperuser, Access: varioTOC superuser 2/2/2015 2:41:51 PM

vario TOC V3.0.7 (987e28c)2013-07-11, Liquid Mode, Ser. No.: 38133026
Elementar Analysensysteme GmbH

Page 1 (of 70)

Summary of Changes

Revision 14

Section Number	Section	Description of Change
Spelling, grammar, and formatting changes may have been made throughout SOP for clarity, correctness, and conformity.		
5	Apparatus and Materials	Added 'or equivalent' in places
5.6	Apparatus and Materials	Changed jars to 40 mL vials
5.8.2	Apparatus and Materials	Updated LIMS version
6.5	Reagents & Standards	Changed Solution 2 to Solution 1
7.1	Instrument Calibration	Added validation with Second Source
8.4	Quality Control	Added DoD requirement
8.7	Quality Control	Added DoD LOD LOQ verification requirement
9.2	Sample Coll, Pres, Hand	Added minimum sample amount requirement; added dissolved organic carbon
10.1.3	Procedure	Changed gas setting
10.1.3	Procedure	Clarified injection evaluation, RSD requirement and reporting procedure
	Appendix A	Removed General Conditions, Added Run Log

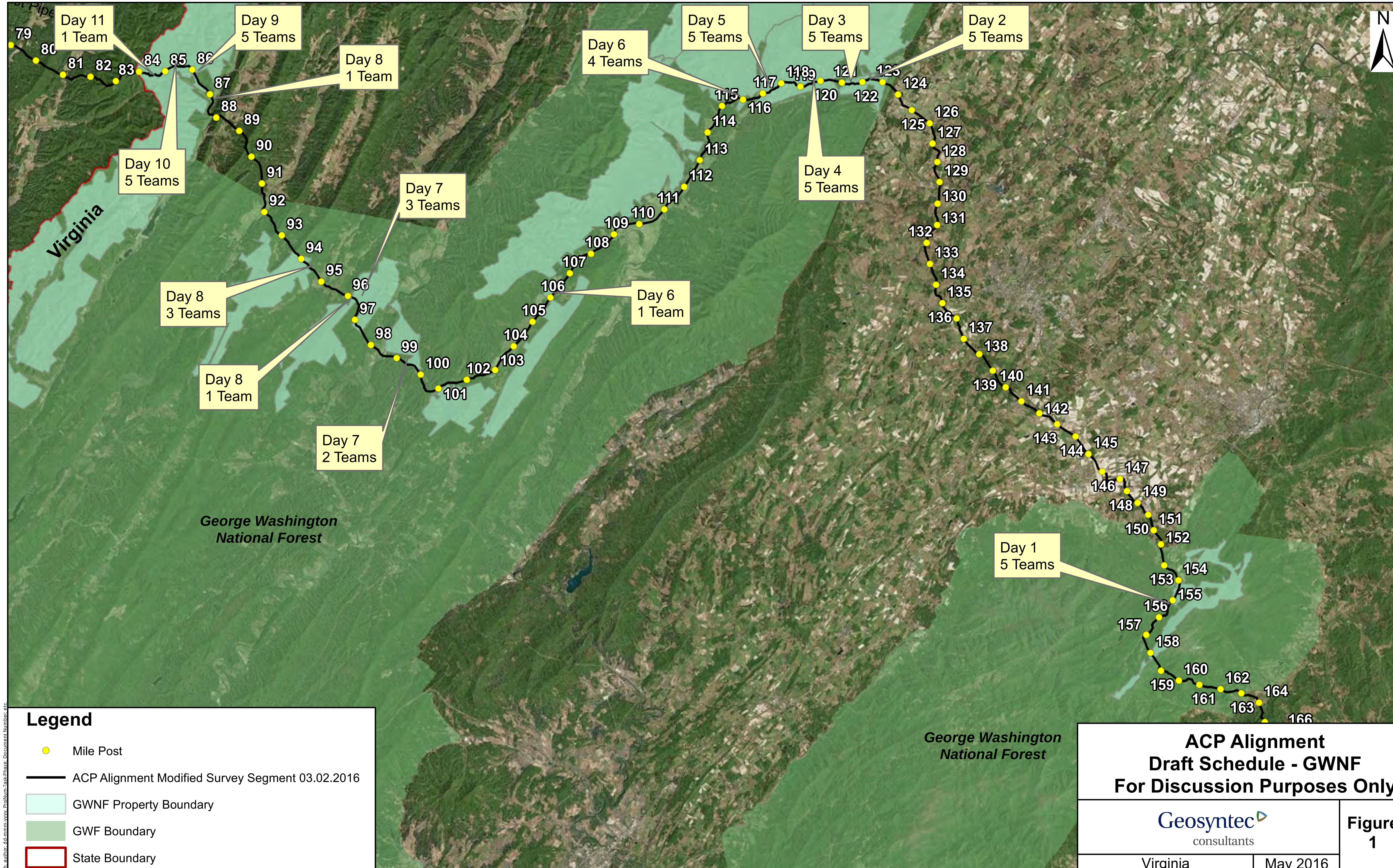
Concurrence Form

I acknowledge that I have read, undersood, and I concur with the standard operating procedure (SOP) listed below.

Employee Name	
SOP	04-vs
Revision	7
E-mail	
Date Concurred	

Submit

Attachment 4
Figures



Day 11
1 Team
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5 Teams
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Day 10
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Day 7
2 Teams
Day 6
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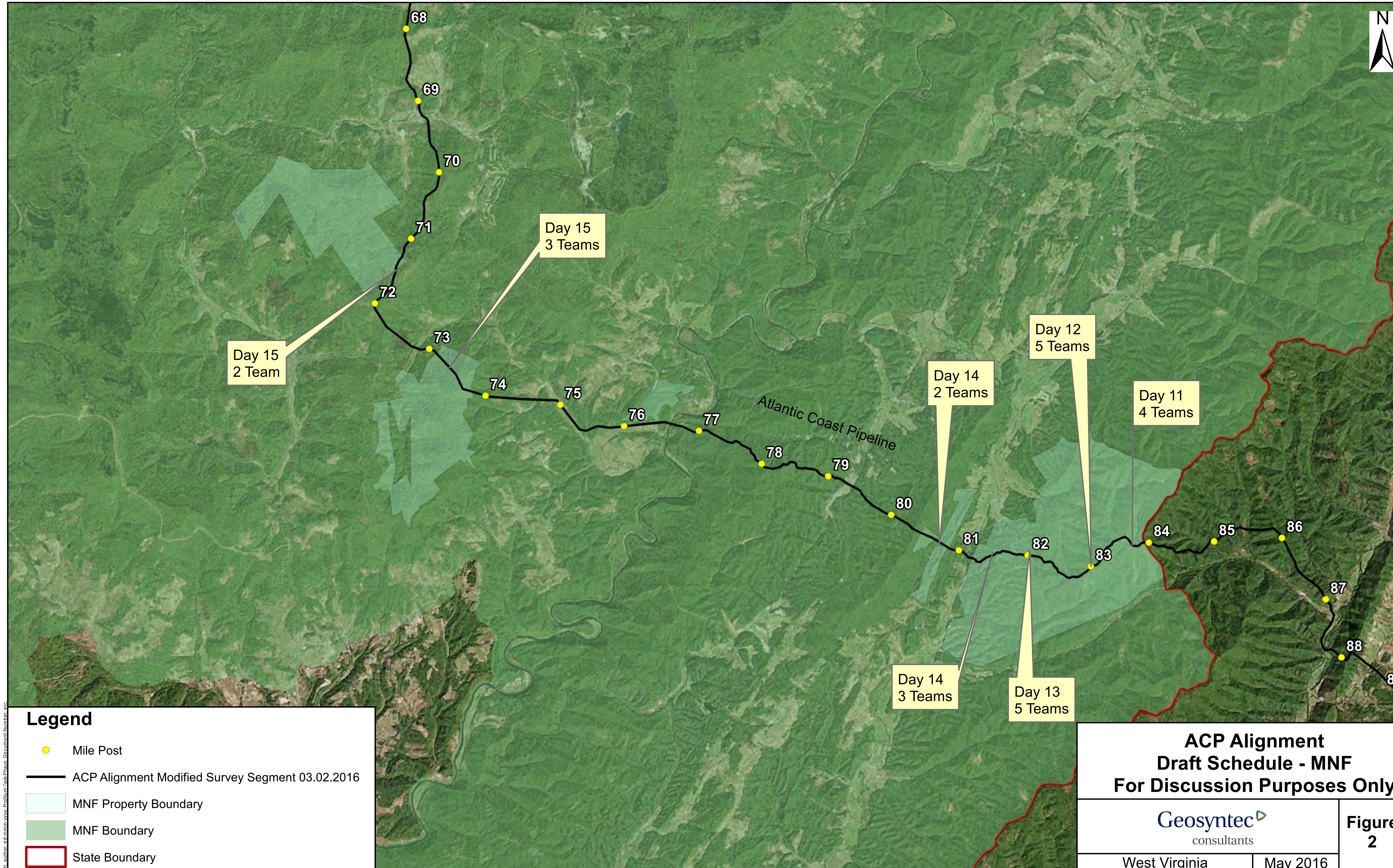
Day 5
5 Teams
Day 3
5 Teams
Day 4
5 Teams
Day 2
5 Teams
Day 1
5 Teams
Virginia
George Washington National Forest
George Washington National Forest
N
Legend
Mile Post
ACP Alignment Modified Survey Segment 03.02.2016
GWNF Property Boundary
GWF Boundary
State Boundary
ACP Alignment
Draft Schedule - GWNF
For Discussion Purposes Only
Geosyntec consultants
Figure 1
Virginia
May 2016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Day 15
3 Teams
Day 15
2 Team
Atlantic Coast Pipeline
Day 14
2 Teams
Day 12
5 Teams
Day 11
4 Teams
Day 14
3 Teams
Day 13
5 Teams
Legend
Mile Post
ACP Alignment Modified Survey Segment 03.02.2016
MNF Property Boundary
MNF Boundary
State Boundary
ACP Alignment
Draft Schedule - MNF
For Discussion Purposes Only
Geosyntec
consultants
Figure
2
West Virginia
May 2016

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT H

Karst Terrain Assessment,
Construction, Monitoring and Mitigation Plan

Karst Terrain Assessment Construction, Monitoring and Mitigation Plan

Atlantic Coast Pipeline

Randolph and Pocahontas Counties in West Virginia, Highland, Augusta, and Nelson Counties in Virginia, and Westmoreland County, Pennsylvania

September 27, 2017

GeoConcepts Engineering, Inc.

19955 Highland Vista Drive, Suite 170 ◆ Ashburn, Virginia 20147 ◆ 703-726-8030

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Ashburn, Virginia 20147
(703) 726-8030
www.geoconcepts-eng.com

September 27, 2017

Ms. Brittany Moody
Dominion Energy Transmission, Inc.
925 White Oaks Blvd
Bridgeport, West Virginia 26330

Subject: **Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan, Atlantic Coast Pipeline, Randolph and Pocahontas Counties in West Virginia, Highland, Augusta, and Nelson Counties in Virginia, and Westmoreland County, Pennsylvania (Our 15200)**

Dear Ms. Moody:

Per your request, GeoConcepts Engineering, Inc. (GeoConcepts) has completed a REVISED Karst Terrain Assessment, Construction Monitoring, and Mitigation Plan in support of the development of the Atlantic Coast Pipeline in areas of Randolph and Pocahontas Counties, West Virginia Highland, Augusta, and Nelson Counties, Virginia, and Westmoreland County, PA.

We appreciate the opportunity to serve as your geotechnical consultant on this project. Please do not hesitate to contact me if you have any questions or want to meet to discuss the findings and recommendations contained in the report.

Sincerely,

GEOCONCEPTS ENGINEERING, INC.

Tadeusz W. Lewis, PE
Principal
tlewis@geoconcepts-eng.com

GeoConcepts Engineering, Inc.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket No. PF15-6-000

and

DOMINION ENERGY TRANSMISSION, INC
SUPPLY HEADER PROJECT
Docket No. PF15-5-000

Karst Terrain Assessment, Construction, Monitoring, and Mitigation Plan
REV04

Prepared by
GeoConcepts Engineering, Inc.
August 2017

GeoConcepts Engineering, Inc.

Table of Contents

Plan Outline

At the request of Atlantic Coast Pipeline, LLC (Atlantic), and Dominion Energy Transmission, Inc. (DETI), GeoConcepts has developed a plan describing the assessment, monitoring, and mitigation activities for the proposed Atlantic Coast Pipeline (ACP) and the Dominion Energy Supply Header Project (SHP) routes through areas of karst terrain. The requested plan is outlined as follows:

Definitions

This section provides a summary of karst-specific terms used in the plan.

Geological Overview

This section provides a brief discussion of karst terrain and features and the overall regional karst geology in the general area of the project. It is of note that the plan as written is a "generic" document due to possible changes that may occur in the specific project alignment. However, regardless of reroutes the alignment will need to pass across each of the provinces discussed in the geological overview section of the plan.

Pre-Construction Assessment and Field Survey

This section describes in detail the pre-construction database and remote sensing review, as well as field survey methods and procedures which are currently being completed.

Construction Monitoring Protocols

This section describes the methods and procedures to be utilized during the construction phase of the ACP/SHP. It includes:

- a description of the pre-excavation electrical resistivity investigation (ERI) methods and procedures, and the manner in which the ERI data will be analyzed, summarized, and presented; and
- a description of the activities to be conducted by the field geologist during excavation and trenching activities, including how the observations will be made and the reporting format and frequency.

Karst Mitigation and Conservation Procedures

This section discusses the best management practices (BMPs) to be utilized for mitigating, remediating, and minimizing impacts to karst features that may be encountered during construction activities. This includes features that either are within or receive drainage from the pipeline right-of-way, or features that are intercepted during the excavation and trenching process, as well as access roads, additional temporary workspace areas, or any other areas where land disturbance necessary for pipeline construction is planned. It is noted that these mitigation and conservation procedures will not apply for existing access roads that do not require land disturbance. The format and manner in which the mitigation and remedial activities will be undertaken and reported are addressed in this section of the plan. The intent is to provide agreed upon solutions to the karst features that may be encountered prior to the start of construction so that those features can be protected. However, in some cases, the actual remedial measure employed may be customized to the specific karst features identified.

Definitions

Karst Specialist (KS) – A Licensed and/or Certified Professional Geologist (PG or CPG) engaged in the practice of engineering geology (or) a Virginia Registered Professional Engineer engaged in the practice of Geotechnical Engineering, with a minimum of 5 years of experience in karst geology characterization and remediation. Practice experience shall be demonstrated by a statement of qualifications.[1]

[1]Adapted from the VA Cave Board Karst Assessment and Survey Guidelines (and) Denton, et al. 2016.

Karst Field Geologist (KFG) – A geologist with training and not less than 2 years' experience in karst geology, working under direct supervision of the KS.

(The following definitions adapted from Field, 2002.)

Allogenic Recharge – Recharge derived from runoff of adjacent or overlying non-karstic and generally impermeable rocks that drains into a karst aquifer.

Cave – A natural hole in the ground, large enough for human entry. This covers the enormous variety of caves that do occur, but eliminates the many artificial tunnels and galleries incorrectly named caves. The size criterion is arbitrary and subjective, but practical, as it eliminates narrow openings irrelevant to explorers but very significant hydrologically, that may be better referred to as *proto-caves*, *sub-conduits*, or *fissures*. A cave may be a single, short length of accessible passage, or an extensive and complex network of tunnels as long as hundreds of kilometers.

Doline; Sinkhole – A basin- or funnel-shaped hollow or depression in limestone, dolostone or other soluble bedrock, ranging in diameter from a few meters up to a kilometer and in depth from a few to several hundred meters. Some dolines are gentle grassy hollows or depressions; others are rocky cliff-bounded basins. A distinction may be made by direct solution of the limestone surface zone (solution dolines), and those formed by collapse over a cave (collapse dolines), but it is generally not possible to establish the origin of individual examples. Generally referred to as a "sinkhole" in the United States, the term doline is more widely accepted by the international geology community.

Throat – An opening within a sinkhole leading into the subsurface through which material passes or has passed from the sinkhole into underlying solutional voids and conduits, which is generally too small to qualify as a cave and often called a *proto-cave*, *sub-conduit*, or *fissure*. Throats may be "open" (i.e. air-filled or water-filled), or "closed/clogged" (filled with debris including but not limited to: loose-soil; gravel; rock; dead-fall wood or brush; or trash).

Parapet – The outer edge or perimeter of a doline (sinkhole).

Ponor – a) Hole or opening in the bottom or side of a depression where a surface stream or lake flows either partially or completely underground into the karst groundwater system. b) Hole in the bottom or side of a doline through which water passes to or from an underground channel. Also known as a swallow hole or swallet.

Solution Cavity – A natural cavity or depression formed by the dissolution of soluble bedrock, typically not large enough to allow the entry of a human being and, therefore, not classified as a cave.

Breccia – Angular fragments of rock commonly, but not always, cemented by finer-grained materials including silica, iron minerals, and calcite to form a new rock. Many fault planes are marked by zones of broken rock, either loose or re-cemented, forming a fault breccia.

Non-Karst Closed Depression – A natural or non-natural topographic depression that is not formed by karst processes and is not floored by bedrock. Examples include (but are not limited to) construction-related soil subsidence, silage pits, farm ponds, scour pools, animal wallows, large animal burrows, and pits created by removal of tree stumps.

Sinking Stream/Swallet – A perennial or intermittent stream whose bed and bank disappear entirely underground, usually through an open throat sinkhole or cave entrance.

Losing Stream – A perennial or intermittent stream which loses flow volume into its bed due to the presence of sub-channel (hyporheic) solution cavities or conduits.

Geological Overview of the Karst Terrain Sections of the Proposed ACP/SHP

Overview of regional karst terrain within the project area

The term "karst" refers to a type of landform or terrain, just like "desert", "marsh", "tundra", "steppe" or "montane". It was named for a province in Slovenia where it was first described in the late 17th and early 18th century by geologists of the former Austro-Hungarian Empire. Simply stated, karst terrain is characterized or diagnosed by the presence of sinkholes, caverns, an irregular "pinnacled" bedrock surface, and many large springs; however, the development of karst terrain is a result of the presence of soluble bedrock such as limestone, dolomite, marble or gypsum. Any landscape that is underlain by soluble bedrock has the potential to develop a karst terrain landform.

As in any region where soluble bedrock is present, a karst landform regime has developed in three known regions of the proposed ACP/SHP. Folding and faulting of the local carbonate rocks has opened up numerous fractures both parallel with the axis of the geologic structures, as well as perpendicular to them. Surface fractures and joints weather differentially, producing a pinnacled or "saw-tooth" profile at the bedrock/soil interface (referred to as the "epikarst" zone). In contrast, rock-enclosed fractures can be secondarily enlarged by the action of carbon dioxide charged groundwater, in some cases forming water-filled or air-filled conduits. As the regional terrain is "mature" karst, nearly all the fractures have undergone successive cycles of sediment filling and flushing. In areas such as the ACP project area, where there is little topographic relief and a relatively minimal groundwater gradient, the great majority of solution fissures are sediment-filled.

The most prevalent type of karst features in the project area are dolines or sinkholes, and these features comprise the greatest potential geohazard risk to any type of construction in karst terrain. Sinkholes fall into two broad categories, "vault-collapse" sinkholes, and "cover-collapse" sinkholes. Vault-collapse type sinkholes (i.e., where a cavern "vault" or roof has failed catastrophically) are rare in the ACP/SHP Project area (Campbell, et al., 2006). Cover-collapse sinkholes, which are common in the ACP project area, develop by the raveling of fines from the soil overburden into solution channels within the bedrock mass, in which water is the transport medium for the movement of the soil fines. The natural raveling process is generally a very slow one, such that sinkhole development generally occurs over a very long time span. However, various changes at a site can sometimes lead to the very sudden development of sinkholes. The most common changes that will exacerbate sinkhole development are:

1. Increase or redirection of overland or subsurface water flow paths, which accelerates the raveling of soil fines;
2. Removal of vegetation cover and topsoil (i.e., stripping and grubbing), which can reduce the cohesive strength of the soils overlying a conduit; and
3. Sudden changes in the elevation of the water table (such as drought, over-pumping of wells, or quarry dewatering), which removes the neutral buoyancy of the water supporting a conduit's soil plug, and can often result in rapid and catastrophic soil collapse.

Geological Setting

The proposed ACP/SHP will cross three distinct regional provinces of karst geology, from east to west:

1. The **Great Valley subsection of the Valley and Ridge physiographic province**, encompassing the portion of Augusta County, Virginia from the Blue Ridge on the east to Little North Mountain on the west.
2. The **Folded Appalachian subsection of the Ridge and Valley province**, encompassing the westernmost section of Augusta County, and all of Bath County and Highland County, Virginia and extending from the North Mountain area on the east to the Allegheny Mountain on the west.

3. The **Allegheny Front and Appalachian Plateau** provinces of West Virginia, encompassing Pocahontas and Randolph Counties, West Virginia, and the karst section of the SHP located in Westmoreland County, Pennsylvania.

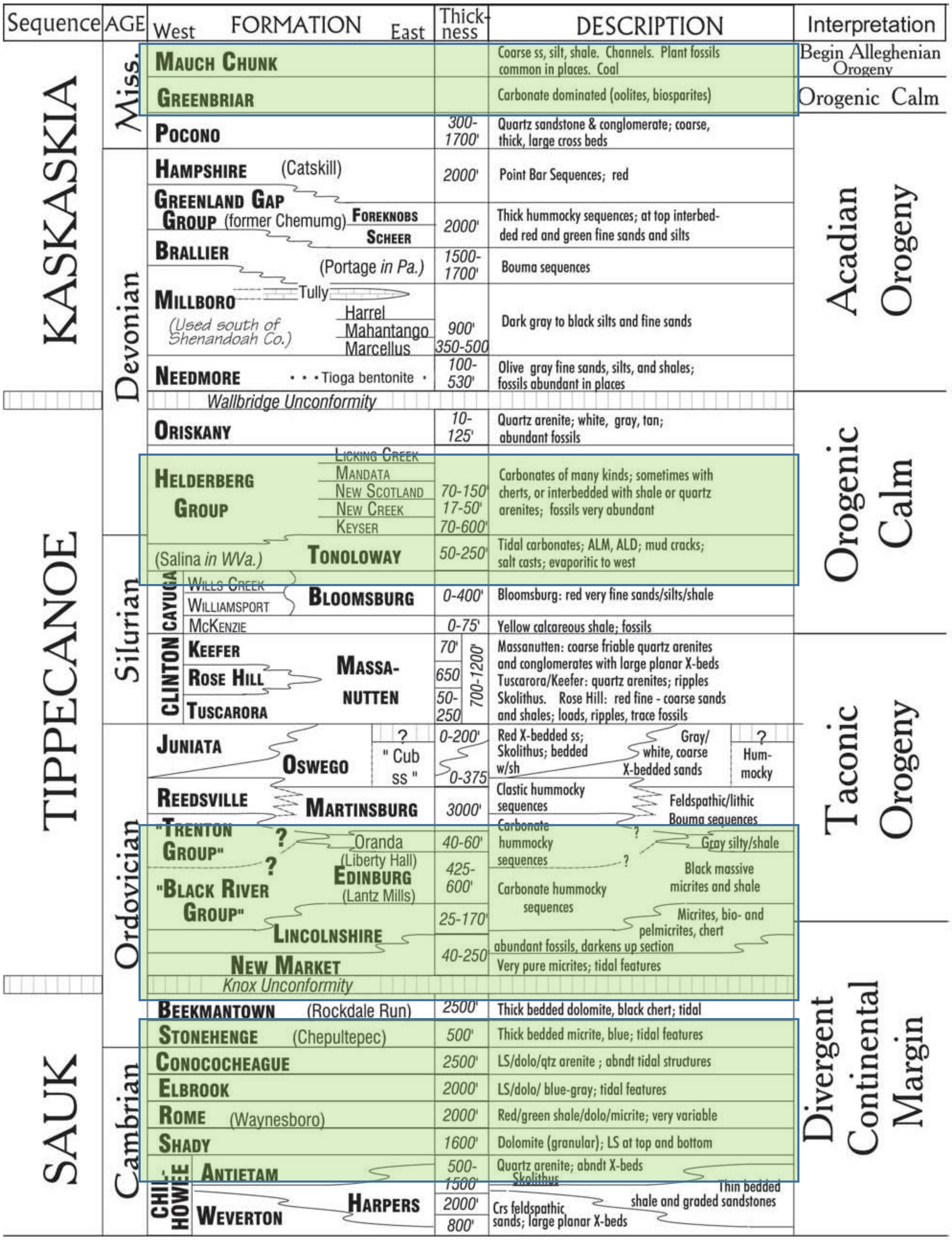

Figure 1. Stratigraphic Column of the central Virginia Great Valley, Folded Appalachians, and eastern Allegheny Front of west central Virginia and eastern West Virginia (Fichter, 2010). (The karst forming units are highlighted in green.)

The Great Valley (Augusta County, VA)

The Great Valley section is a generally downwarped trough (synclinorium) of Paleozoic limestones, shales, and sandstones that lie between the Blue Ridge Massif on the east and the Allegheny Mountains to the west. The Valley extends between the two mountain uplands from northeast to southwest, parallel with the average strike of the bedrock.

The karst terrain of the Great Valley section of the ACP project area is characterized by numerous circular to oval-shaped sinkholes, ranging in size from a few feet to several hundred feet in diameter, the majority of which are completely vegetated and lack any opening to the subsurface ("throat") at their base. Sinkhole depths can vary, but are usually controlled by the angle of repose of the sediments lining their walls. Steep, rock-walled sinkholes are rare in this section, but generally occur in the small hills and uplands that are erosional remnants of the prior valley floor.

The Great Valley section contains large karst springs in the region. It is also characterized by sinkholes called "estavelles", which are insurgences for water during dry periods, and flood or act as springs (resurgences) during wet seasons. There are also numerous caves (i.e., air-filled voids large enough to permit the entry of a human being and that have an entrance to the surface) and subsurface caverns (air-filled voids large enough for human entry with no connection to the surface) in the region. Most of the caves and caverns range in length from a few feet to several miles; however, the average length rarely exceeds 2,500 feet. This is in contrast to the Folded Appalachian and Appalachian Plateau provinces to the west, where some of the longest caves in the region have been surveyed, many of which are more than 10 miles in length. Nevertheless, though not of great length, some of the most voluminous underground chambers in the region occur in the Great Valley section.

A unique type of karst terrain has developed in the eastern portion of Augusta County along the base of the Blue Ridge Mountains. Here, the characteristic karst terrain has been buried beneath a mantle of alluvial material which was shed off the mountains to the east. This alluvium ranges in age from less than 1 million years (Quaternary Period) to over 50 million years (Paleogene Period). The alluvium thins towards the west, and disappears completely west of Waynesboro, Virginia. Although the primary karst terrain is mantled by the alluvium, numerous shallow broad sinkholes are present and indicate the presence of large karst features in the underlying bedrock.

Bedrock Geology

Specifically, the proposed ACP project area in the Great Valley section has been extensively studied and mapped as being underlain by a series of karst-forming carbonate and calcareous clastic rocks (Campbell et al., 2006; DMME, 1993; Rader & Gathright, 2001; Rader & Wilkes, 2001; Hubbard, 1988; Southworth, et al., 2013) ranging in age from the Lower Cambrian to Middle Ordovician geological periods as follows:

Ordovician Period

Martinsburg Formation (Om)

The upper 100 to 200 feet of this formation is a brown, medium-to coarse-grained, fossiliferous sandstone. An olive-green silty shale and dark-gray siltstone comprises the middle portion of this formation, along with a medium-to coarse-grained, locally pebbly sandstone. The Stickley Run Member exists as the lower 400 to 900 feet of the formation. This is a medium-gray to grayish-black, very fine-grained (aphanitic), very thin- to thin-bedded, argillaceous limestone with interbedded medium- to dark-gray, calcareous shale.

Edinburg Formation (Oeln)

A black, fine-grained to aphanitic limestone with layered black shale that commonly contains pyrite, and medium- to light-gray, fine- to coarse-grained, nodular limestone with thin partings of black shale. This formation lies in thicknesses ranging from 450 to 1,000 feet throughout the three subject areas.

Lincolnshire Limestone (Oeln)

Gradational contact with the overlying Edinburg. A light- to very dark-gray, fine- to coarse-grained, medium to very thick-bedded limestone with black chert nodules. The Murat Limestone Member, generally found at the top of the formation, is a light colored, coarse-grained limestone composed of fossil fragments. Thicknesses throughout the subject areas range from 50 to 250 feet.

New Market Limestone (Oeln)

Unconformable upper contact with the Lincolnshire. The upper unit of this formation is a medium-gray, aphanitic, thick-bedded, limestone with scattered calcite crystals. The lower unit is a medium- to dark-gray, fine-grained, thin-bedded, argillaceous, bioturbated limestone that is dolomitic in parts, with its base being a carbonate pebble conglomerate. Formation thicknesses throughout the subject areas range from 100 to 250 feet.

Pinesburg Station Dolomite* (Ob)

This formation is a medium-to light gray, fine-grained, medium- to thick-bedded dolostone, with sparse fossils. When weathered, this dolomite is very light-gray, and exhibits a "butcher-block" structure. A medium-gray, fine-grained limestone exists as the base of this unit. The formation's average thickness is 400 feet.

Rockdale Run Formation* (Ob)

The upper contact with the overlying Pinesburg Station is unconformable. This formation is comprised of a medium-gray, fine-grained, fossiliferous limestone and a light- to medium-gray, fine-grained, laminated dolomitic limestone and dolostone with mottled beds. Thin lenses of gray chert are common near the base of the formation. Formation thickness ranges from 1,500 to 2,400 feet.

Stonehenge Limestone* (Ob)

Upper contact with the Rockdale Run Formation is gradational. The upper 400 to 500 feet is comprised of a medium- to dark-gray and black, fine- to medium-grained limestone, with thin beds of macerated fossil debris. The lower 50 to 150 feet (Stoufferstown Member) is a dark-gray to black, fine-grained limestone with thin sheet-like, crinkly partings due to cleavage, and thin beds of coarse-grained, bioclastic limestone.

***Beekmantown Group (Note – This unit consists of the Pinesburg Station Dolomite, Rockdale Run Formation, and the Stonehenge Limestone)**

Cambrian Period

Conococheague Formation (OCco)

The upper contact with the Stonehenge Limestone of the Beekmantown Group is unconformable. The upper 2,000 feet of this formation is a light- to dark-gray, fine-grained, laminated limestone, dolomitic limestone, and dolostone with flat-pebble conglomerate beds. Some cross laminated sandstone beds occur in the uppermost part of this unit. The Lower 200 to 500 feet (Big Spring Station Member) consists of a light-gray, fine-grained dolostone, medium- to dark-gray, fine-grained laminated limestone and dolomitic limestone, and gray, coarse-grained sandstone and dolomitic sandstone. Beds of flat-pebble conglomerate occur in the dolomite.

Elbrook Formation (Ce)

This unit's thickness ranges from 2,000 to 2,500 feet. The formation is a dark- to medium-gray, fine- to medium-grained limestone, dolomitic limestone, dolostone, and dolomitic shale. These lithologies commonly occur as erosion-surface-bounded sequences of algal limestone overlain by laminated dolomite. Decalcified, ocherous shale-like chips on the ground surface characterize this unit. The lower 300 to 400 feet is green to greenish-gray, fine-grained dolostone, dolomitic limestone, and shale.

Waynesboro Formation (Cw)

The upper contact with the Elbrook Formation is gradational. A dusky-red to olive-gray, fine- to medium-grained sandstone and dusky-red to gray shale exists as the upper 300 feet. The middle 400 feet is a medium- to dark-gray, saccharoidal dolomite and fine-grained limestone. The lower 500 feet is dusky-red, olive-gray, and dark-gray shale and dusky-red to brownish-gray, fine- to medium-grained sandstone. Overall thickness is approximately 1,200 feet.

Tomstown Dolomite/Shady Dolomite (Ct/Cs)

The upper 600 feet is light- to dark-gray, fine- to coarse-grained, medium- to thick-bedded, locally laminated dolostone with white chert rosettes and nodules in the upper 50 feet. The middle unit (about 210 feet) is very light- to medium-gray, medium-grained, very thick-bedded dolostone and high-magnesium dolostone. The lower unit (about 325 feet) is dark-gray to black, very fine-grained, thin- to very thin-bedded limestone and dolomitic limestone with argillaceous laminations. The overall unit thickness ranges from 1,100 to 1,200 feet. The Shady Dolomite is the homologous unit in the southeastern Great Valley at the base of the western edge of the Blue Ridge Mountains.

The Folded Appalachians (Augusta County, Bath County, Highland County, VA and Eastern Pocahontas County, WV)

The western edge of the Great Valley is demarcated by the North Mountain Fault, and the ridges of Little North and Great North Mountain. The rocks underlying this section are younger than those of the Great Valley, dating primarily from the Late Ordovician through the Devonian periods in age. In general, the mountain ridges are underlain by sandstone and siltstone, clastic rocks which are insoluble and not prone to karst terrain development. In contrast, the intervening deep valleys are often floored by carbonate rocks, and a characteristic karst landscape characterized by sinkholes, caves and springs has developed in many cases along the axis and flanks of these valleys (Hubbard, 1988; Rader & Wilkes, 2001; DMME, 1993).

In many areas of this province, the development of karst terrain has been influenced by the effects of relatively acidic surface and ground water originating from acid-forming bedrock, and acting upon adjacent carbonate units (*see definitions*: Allogenic Recharge). The primary regional acid-forming rocks are the middle Paleozoic shales, in particular the Ordovician age Martinsburg Formation (pyritic only in specific areas), and the Devonian age shales of the Hamilton Group (includes the Mahantango, Marcellus and Needmore formations all of which can be pyritic). The only place where these shales occur along the ACP in WV near the carbonate units is in eastern Pocahontas County, on the eastern slope of Michael Mountain, and they are at a lower elevation than the Devonian and Silurian carbonate units further up the slope. Thus, the drainage would be away from the carbonates and towards the acid-forming shales.

Bedrock Geology

The regional geology of the Folded Appalachians in the project area has been mapped (DMME, 1993) as being underlain by a series of karst-forming carbonate rocks ranging in age from the Lower Ordovician to Lower Devonian geological periods as follows:

Devonian – Silurian Periods

Helderberg Group (Dh)

This group consists of thick- to massive-bedded, dark gray/black micritic limestone with reef structures. The limestone shows some degree of recrystallization. The uppermost Helderberg is typically silicified near its contact with the overlying Oriskany sandstone. In many areas the Helderberg gives off a distinct petroliferous odor when freshly broken. The contact with the overlying Oriskany Sandstone is poorly exposed regionally, but the contact with the underlying Tonoloway Formation is distinct and often unconformable, where the massive bedding of the Helderberg gives way to the thin-bedding of the Tonoloway Formation. The contact can be identified in places by a lag deposit consisting of flat, packstone rip-ups and pebble conglomerate.

The group is a major cave forming unit of the Folded Appalachian section, however, it is of note that the stratigraphy of this unit has been the subject of a much detailed study in recent years (Haynes, et al., 2014). The Helderberg Group consists of a series of individual formations, from oldest to youngest, respectively: the Keyser Limestone, New Creek Limestone, Corriganville Limestone, and Licking Creek Limestone formations. It should be noted that based on biostratigraphic analysis the Keyser Limestone, the basal formation of the Helderberg Group, is considered to straddle the boundary of the Silurian and Devonian periods (Denkler and Harris, 1988a).

The entire Helderberg Group varies regionally, ranging from 85 feet to over 400 feet in thickness. The Keyser is considered the thickest of the individual formations comprising the group, ranging from 50 to 230 feet in thickness.

Silurian Period

Tonoloway Limestone (Sto)

This formation consists of extremely thin-bedded (0.5 inches or less) dark gray micritic limestone interbedded with fissile, calcareous shale. The formation gives off a distinct petroliferous odor when freshly broken. The contact with the overlying Keyser Limestone is distinct; however, it grades into the underlying Wills Creek Limestone. The Tonoloway Formation varies from 150 to 600 feet in thickness.

Wills Creek Limestone (Swc)

This formation consists of thin-bedded (less than 5 inches) dark gray calcareous shale and fossiliferous micrite, which is poorly exposed in the ACP project area. The thickness is variable, ranging from 3 feet to 230 feet.

Ordovician Period

Juniata, Oswego, Reedsville, Dolly Ridge, and Eggleston Formations (Oun)

Karst forming unit present only in the westernmost Valley and Ridge section of the ACP alignment (Highland and Bath Counties). The Dolly Ridge and Eggleston Formations are the only karst-forming units and consist of a medium-gray, fine-grained, thin-bedded, argillaceous limestone with interbedded olive-gray calcareous claystone, silt argillaceous limestone, gray shale, and K-bentonite beds. Thickness is about 400 feet in Bath and Highland Counties. The unit is laterally equivalent to the Middle Ordovician ("Trenton Group") limestones and part of the lower Martinsburg Formation.

Middle Ordovician Limestones, Undivided (Olm)

These limestones consist of the Edinburg Formation, the Lincolnshire Formation, and the New Market Limestone. The Edinburg is a black, fine-grained to aphanitic limestone with layered black shale that commonly contains pyrite, and medium- to light-gray, fine- to coarse-grained, nodular limestone with thin partings of black shale. Thickness is 400 feet to 500 feet. The Edinburg grades downward into the Lincolnshire Formation, a light- to very dark-gray, fine- to coarse-grained, medium- to very thick-bedded limestone with black chert nodules. Thicknesses throughout the ACP project area range from 25 to 250 feet. This unit is underlain by the New Market Limestone. The upper contact with the Lincolnshire is generally unconformable. The upper unit of this formation is a medium-gray, aphanitic, thick-bedded, limestone with scattered calcite crystals. The lower unit is a medium- to dark-gray, fine-grained, thin-bedded, argillaceous, bioturbated limestone that is dolomitic in parts, with its base being a carbonate pebble conglomerate. Formation thicknesses throughout the ACP project area range from 0 to 150 feet.

Beekmantown Formation (Ob)

This formation is a medium- to light-gray, fine-grained, medium- to thick-bedded dolostone, with sparse fossils. When weathered, this dolomite is very light-gray, and exhibits a "butcher-block" structure. A medium-gray, fine-grained limestone exists as the base of this unit. This formation is comprised of a medium-gray, fine-grained, fossiliferous limestone and a light- to medium-gray, fine-grained, laminated dolomitic limestone and dolostone with mottled beds. Thin lenses of gray chert are common near the base of the formation. Formation thickness ranges from 1,500 to 2,400 feet. The Beekmantown Formation typically consists of three members, which although distinct in the Great Valley region are hard to distinguish in the Folded Appalachian province.

The Allegheny Front & Appalachian Plateau (Pocahontas County and Randolph County, WV)

The last section of the folded Appalachian karst is located in eastern Pocahontas County. To the west occurs the relatively flat-bedded geology of the Allegheny Front and Appalachian Plateau provinces. The karst terrain in this area is formed almost exclusively by the carbonate rocks of the Mauch Chunk and Greenbrier Groups.

In general, the Mauch Chunk and Greenbrier Group carbonates exhibit a high density of caves relative to the other two karst sections along the pipeline. There are several factors that contribute to this, the main one being that the units act as a drain system for groundwater infiltrating downward through the fractured clastic rocks above them. Where they are exposed along the mountain flanks, the steep groundwater gradients have enhanced this cavern development. In many places surface water plunges directly into the carbonates via steep-walled, open throat sinkholes (swallets). Most of the caves are linear networks, and exhibit conduit flow, capturing surface streams upgradient which then emerge as springs at the downgradient end.

Bedrock Geology

The Appalachian Plateau section has been mapped (Cardwell, et al., 1968; Davies, 1958) as being underlain by the karst-forming carbonate rocks of the Greenbrier and Mauch Chunk Groups, exclusively. The geology is described from youngest to oldest as follows:

Mississippian Period

Mauch Chunk Group – Includes the Bluestone and Princeton Formations (Mbp), Hinton Formation (Mh), and Bluefield Formation (Mbf). The group is predominantly red, green and medium-gray shale and sandstone, with a few thin limestone lenses in each formation. Although the limestone strata in the unit are considered secondary, the topographic position of the Mauch Chunk along the edges of the eroded upland of the Allegheny Plateau where there is a relatively steep downward hydraulic gradient has enhanced water flow through the carbonate lenses, forming karst conduit networks with high transmissivity (Kozar & Mathes, 2001), thus from a karst hydrology viewpoint this unit is significant.

Greenbrier Group (Mg) – In the project area the Greenbrier Group (or "Big Lime" as it is known locally) is up to 400 feet in thickness. It is primarily a gray to dark gray, massively bedded marine limestone, with interbeds of red and green marine and nonmarine shale and thin discontinuous beds of sandstone. The Group is divided into six stratigraphic units; from oldest to youngest they are: the Denmar Limestone, Taggard Shale, Pickaway Limestone, Union Limestone, Greenville Shale, and Alderson Limestone. The principle cave forming units are the Pickaway and Union limestones.

Pre-Construction Assessment and Field Survey

The proposed ACP/SHP involves the installation of a gas pipeline extending through West Virginia, Virginia, and into southern North Carolina. The currently proposed pipeline construction alignment information shows that the primary route being considered for the pipeline passes across approximately 32.5 miles of karst terrain located in Randolph and Pocahontas Counties in West Virginia, and Highland, Bath, and Augusta Counties in Virginia, based on regional geological mapping.

The "Karst Review Area" (hereinafter referred to as the "KRA") assessed by data desktop review generally extended 0.25-mile from either side of the centerline of the proposed pipeline and alternate routes, and a 300 foot "study corridor" (300FC) extending 150 feet from either side of the centerline for field review. However, if observed or mapped karst features received drainage from the proposed pipeline work area then these features were delineated to the extent possible, and included in the assessment, even if they were outside of these perimeters.

Thus, the pre-construction assessment and field survey scope can be summarized as follows:

- Located and delineated surface karst features (e.g., sinkholes and karst related subsidence, cave entrances, closed depressions, and sinking and losing streams) within the KRA, with particular emphasis on features that had a direct connection with the phreatic zone such as "open-throat" sinkholes, karst windows, cave entrances, abandoned wells, sinking streams, and areas that could affect the integrity of the pipeline, such as actively forming cover-collapse sinks, areas of soil subsidence, or caves which have passages that extend below the proposed right-of-way at elevations less than 15 feet below the surface. Direct field observations were made by conducting a site reconnaissance over the entire 300FC where access was available.
- Delineated zones of karst terrain, subsidence, and drainages based on the surface karst features assessment.
- Prepared a report summarizing the methods and findings of the assessment.

Methods and Procedures

The above scope of services was accomplished by the following means:

Existing Data Review and Analysis

Potential karst features were identified remotely and/or by database review, and then their presence was confirmed in the field. This process helped to focus the actual field location and survey tasks. The following sources were reviewed:

1. The (proprietary) Cave Databases of the Virginia Speleological Survey (VSS) and the West Virginia Speleological Survey (WVSS);
2. Caves of Virginia (Douglas, 1961);
3. Description of Virginia Caves (Holsinger, 1975);
4. Caverns of West Virginia (Davies, 1965);
5. Maps of selected karst features (sinkholes, caves, springs) available from the Virginia Division of Mines and Mineral Resources and the United State Geological Survey (USGS);
6. 2-foot and 4-foot contour interval maps for the KRA (to determine the presence of surface karst features not included in the above listed databases based on the presence of closed, descending contours or other suspect karst "fingerprint" features);
7. LIDAR data (where available);
8. Aerial photographs (both recent and historical);
9. USGS Topographic 7.5-minute topographic quadrangles;
10. Sinkhole and depression locations available from the US Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) soil studies for the Counties through which the ACP will pass.
11. Weary, D.J. and D.H. Doctor. 2014. Karst in the United States: A digital map compilation and database, USGS open-file report 2014-1156, 23p

In addition, the survey team reviewed the readily available geological literature for bedrock and structural characteristics, relying upon the closest resolution mapping that existed for the particular KRA being examined.

Field Reconnaissance

Upon completion of the existing data review activities for a specific area, GeoConcepts undertook field reconnaissance and survey activities. Specifically, the field reconnaissance entailed:

1. Location and verification of surface karst features identified in the database review;
2. Location of uncatalogued or previously unidentified surface karst features, specifically sinkholes, cave entrances, dry runs and sinking streams.

The field reconnaissance placed particular emphasis on locations where pathways existed to phreatic groundwater such as open-throat sinkholes, cave entrances, karst "windows", and sinking streams. Potential reroutes were identified based on the field observation of sensitive karst features, such as significant caves, sinking streams, or open throat sinkholes.

The 300FC was delineated and the path of the 300FC was examined for karst features (both catalogued and previously unidentified) by field survey. This entailed conducting a site reconnaissance over the 300FC (i.e., the proposed pipeline route) in a systematic manner, to observe any existing surface karst features that fit the criteria. The locations and outlines of all relevant features were recorded using a sub-meter accurate Global Positioning System (GPS) device. For the purpose of this study, the outline (parapet) of sinkholes were defined by the last closed descending contour at mapping interval available for the area under study. Cave entrances were identified as single points, unless the entrance was located within a larger sinkhole structure, in which case the cave entrance was indicated as a point within the sinkhole's parapet. Sinking streams were located as points of entry into the subsurface; however, losing streams were identified as linear features. Each karst feature was assigned a unique identifier based on the parcel number and an integer as shown in the following example:

E083-001
where
"E083" = Parcel Number and
"001" = the first feature identified within that parcel.

All digital data was transmitted in the Universal Transverse Mercator (UTM) Coordinate system. The horizontal datum of reference is NAD83.

Summary Report

The results of the data review and field survey has been summarized in a final report. The report details the methods and findings, and contains an inventory and contained a delineation of karst features and terrain. The frequency and density of karst features was also correlated with the encompassing geological unit at the formational level (e.g., Elbrook Formation, etc.). The report is accompanied by a data set containing the attributed digital points and polygon data as shapefiles with metadata (maps and/or tables). The results of the karst survey work was used during routing and workspace design. In addition, these data will be used during the construction phase to assist in the pre-construction inspection tasks described in the following sections.

Construction Monitoring

The purpose of this section of the plan is to establish a standard set of monitoring protocols for karst features encompassed by the proposed ACP pipeline right-of-way and adjacent areas. The intent of these protocols is to minimize impact to the subterranean environment, ensure water quality, and protect the integrity of the pipeline (Burden, 2012).

I. Geophysical Survey

To obtain more information about the subsurface conditions, and possible karst development along the proposed ACP pipeline alignment, an electrical resistivity investigation (ERI) will be conducted in the areas that are mapped with limestone bedrock. The ERI will be performed along the entire length of the pipeline centerline in karst terrain prior to any earth-disturbance and/or excavation activity.

Instrumentation

The geophysical survey instrument which will be used during this survey is an electrical resistivity meter that maps the resistivity changes in the earth. Resistivity refers to the electrical resistance of a material. The ERI survey will be conducted by introducing a measured current into the earth through two electrodes and measuring the resultant voltage (i.e., potential) across two different electrodes. At the low currents used, voltage is proportional to the current. The meter measures the voltage/current ratio or resistance in Ohms.

The ERI survey will be conducted using an earth resistivity meter which measures the apparent conductivity of the subsurface employing an artificial source that is introduced through point electrodes. The automatic electrode system is designed to optimize survey efficiency by gathering maximum information with a minimum of electrodes. The instrument also uses redundancies in the data set to reduce the effects of lateral heterogeneities in the earth and to calculate uncertainties in the data. The survey will be conducted automatically using a dipole-dipole array system.

Interpretation Method

The ERI data will be converted into a resistivity depth model using a Rapid 2D resistivity inversion model and the least-squares method (RES2DINV). Soundings from each line will be modeled to produce the measured apparent resistivity pseudo-sections. The model will calculate the apparent resistivity pseudo-sections using finite-difference forward modeling. The least-squares optimization technique will be used for the inversion routine that calculates the modeled resistivity section. The generated profiles will include cross-sections that consist of the inverse model resistivity cross-section. The horizontal and vertical scales will be in meters.

The cross-section is the inverse model resistivity pseudo-section. The ER data will be converted into a resistivity depth model (RES2DINV) using a resistivity inversion model by the least-squares method, which will be topographically corrected. RES2DINV will confirm the model reliability by calculating the modeled data into empirical data or the calculated resistivity pseudo-section. The difference between the measured and calculated data is the percent error. The modeled calculated error will be calculated within the five percent range, which is considered very accurate.

Low resistive materials can be caused by certain conductive soils, such as clay, wet silts, and sands, or ionized water. High resistive materials are caused generally by porous soils (i.e., poorly consolidated gravels), laminated bedrock with interstitial clay-filled voids, wood, or large, air-filled cavities. Lower ER anomalies are generally associated with soil-filled voids, saturated sinkhole soils, and water-bearing fractures. High ER anomalies are frequently associated with caverns, buried air filled structures, or weathered, laminated bedrock with air filled cavities.

Resistivity values can vary widely as the geology, mineralogy, and stratigraphy changes from site to site. Therefore, it is important to correlate resistivity results with boring logs for equivalent sections at a specific locality. Typical values are:

Subsurface Material	**Resistivity Range (Ωm)**
Topsoil	1 – 10
Clays	10 – 100
Sands and Gravels (unconsolidated)	600 – 10,000
Fresh Water	3 – 100
Limestone	100 – 10,000

Subsurface Material	Resistivity Range (Ωm)
Sandstone	100 – 1,000
Igneous and Metamorphic Rocks	100 – 1,000,000
Open Voids (i.e. caverns, solution conduits)	>10,000

Although the above values are characteristic of various subsurface materials, the absolute resistivity ranges will vary considerably depending on the local geology. Therefore, it is required that the ERI survey is calibrated using soil test/air track borings. In addition, if high ER anomalies are detected, their locations will need to be documented and further investigated. The specific type of investigation will be dictated by the characteristics of each anomaly identified, but typically air track borings will be used to verify anomalies observed during an ERI survey.

It should be noted that The ERI will be conducted prior to tree clearing where conditions allow and on the parcels where access permission has been granted. The ERI is part of the construction phase, and is intended to be conducted prior to any earth disturbance. If the ERI indicates a significant subsurface void is present within the first 10-feet of bedrock, and the trench will intercept that feature as planned (i.e. where the bedrock is less than 10 – 12 feet below the existing surface, or the void will be intercepted by the trench under any circumstances) the centerline may be adjusted from 8 to 10 degrees depending on pipe classification. However, in some cases it may be impossible to avoid the feature (such as a linear solution conduit running perpendicular to the trench), and in that case the ERI serves as an "early warning" to allow ACP to prepare for remedial actions.

II. Inspection Protocols

Inspection protocols will be provided to the contractor and will be reviewed at a pre-construction meeting led by the Karst Specialist (KS). In addition, all geologist or engineering staff utilized during construction will have received training from the KS prior to mobilization to the site regarding the identification and mitigation of karst features that have been previously identified within the project boundaries, or that may be identified during construction.

Pre-Construction Inspection

Prior to the commencement of any earth disturbance activity, the area of the pipeline that will be affected by the planned activities will be inspected by the karst specialist (KS) or the karst field geologist (KFG) as follows:

a. The KS/KFG will inspect the entire section of the pipeline ROW (right-of-way) in the designated work area, and note any suspect karst features including sinkholes, caves, areas of soil subsidence, or closed depressions.

b. The KS/KFG shall conduct a final preconstruction field assessment of seeps and springs within 500 feet of construction workspaces in karst terrain. The KS shall subsequently determine if construction activities could have an impact on the seeps and/or springs, and provide construction alternatives to avoid or mitigate impacts where practical.

c. The locations of observed features will be noted on site drawings and flagged for surveying and/or recorded using sub-meter accuracy GPS instrumentation.

d. The KS/KFG will issue a report summarizing the findings of the inspection. Findings will supplement the summary report and shall include an inventory of feature type(s), drainages, and potential impact to the feature by the planned activities, and recommendations to limit impacts if they are expected. This inspection is intended to supplement the aforementioned pre-construction karst assessment and field survey report, as new features may have developed, or existing features described in identified in the original assessment may have changed.

e. Features that are considered to have potential impacts are: caves, sinkholes with open throats, ponors, open solution cavities, abandoned wells, and sinking streams. (Note – If a sinkhole throat is filled, the type of fill, i.e. rock, soil, flood debris, etc., will be described in detail).

f. Features that are not considered to have a potential impact are: soil-bottomed (stable) sinkholes (i.e., no evidence of recent soil raveling or tension cracks along the parapet), karst springs, or non-karst closed depressions. However, it is of note that land disturbance to stable sinkholes can render them unstable. Not structurally unstable in general, but strictly in terms of raveling of surface materials (sediment) and associated contaminants into the subsurface.

g. The pre-construction inspection will have a "shelf-life" of 1 year from the day of the inspection. If work does not commence within 1 year, a new inspection will need to be completed prior to any earth disturbing activities.

h. The pre-construction inspection report shall be delivered to Atlantic/DETI no later than 1-month after the completion of the field survey.

Monitoring of Pre-Identified Features During Construction

Features identified during the pre-construction inspection will be monitored as follows:

a. If an identified feature with potential impact to the subterranean environment falls within the area designated for earth disturbing activities and cannot be avoided, the feature will be documented by field location and photographs, and then assessed for pre-construction remediation by Atlantic/DETI staff with input and guidance to be provided by the KS. Remediation will be in compliance with the USDA-NRCS's Conservation Practice Standard Code 527 "Karst Sinkhole Treatment" (2010) and the West Virginia Department of Environmental Protection Division of Water and Waste Management Ground Water Protection Program Sinkhole Mitigation Guidance, August 8, 2005. (see Appendix A)

b. If a feature that has potential impact falls within the right-of-way but is not intercepted by the excavation, that feature will be monitored during the work by Atlantic/DETI staff for changes such as:

    1. soil subsidence;
    2. rock collapse;
    3. sedimentation;
    4. increased surface water infiltration;
    5. flooding;
    6. clogging; and/or other changes in morphology or function that might indicate potential impact to the epikarst stratum caused by the work.

c. All features, whether remediated or left in an undisturbed natural state, will be monitored by Atlantic/DETI staff, or their designee, for any changes in appearance, drainage, siltation, etc., at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If changes in the features are observed, Atlantic/DETI staff will report the condition to the KS who will provide consultation on potential impacts to the karst environment and possible remedial actions.

Monitoring of Features that are Intercepted During Construction

Features that are intercepted during construction shall be monitored as follows:

<u>Level 1 Inspection of Features Intercepted During Construction</u>

If any feature is intercepted during work activities including borings, blasting, and excavation or trenching, the onsite geologist will conduct an initial assessment of the feature to determine if further inspection (Level 2) by the KS or KFG will be required. Suspect features shall include:

1. Bedrock enclosed conduits, cave entrances[2] and voids;
2. Solution pockets that extend beyond visual examination range (and therefore may be open);
3. Areas of soft soils;
4. Soil voids;
5. Highly fractured bedrock;
6. Areas of breccia enclosed within the surrounding bedrock.

Level 2 Inspection of Features Intercepted During Construction

If any of the aforementioned features are observed during the Level 1 inspection, work will stop within a 100-foot radius of the feature, and then the KS will conduct a Level 2 inspection as follows:

a. The KS will examine the feature and determine if it has potential impact to the subterranean environment based on potential connectivity with the phreatic aquifer via the epikarst stratum (Moore, et al, 2013). The choice of characterization methods will be determined by the KS, and will include any combination of (but not be limited to):
   1. visual assessment;
   2 geophysical survey;
   3 track drill probes;
   4. infiltration or dye trace testing; or
   5. other techniques utilized to facilitate subsurface characterization of karst features.

b. If the feature is determined to have potential impact to the subterranean environment, the KS will advise Atlantic/DETI staff regarding appropriate remedial actions.

c. If the feature is determined to not have potential impact to the subterranean environment, work will resume as planned.

d. All features that are intercepted during construction and subsequently remediated will be located by project surveyors exclusively, and monitored by Atlantic/DETI staff, or their designee, for any changes in appearance, drainage, siltation, etc., at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If any changes are observed, the KS will provide consultation on potential impact and recommend remedial actions, if necessary.

e. All Level 2 inspections, findings, and remedial activity will be summarized in a report by the KS, to be delivered to Atlantic/DETI after the completion of the field work.

Monitoring of Features That Form During Construction

Features that form during construction will be monitored as follows:

Level 1 Inspection of Features That Form During Construction

If any feature forms during work activities including hydrostatic testing, drilling, blasting, and excavation or trenching, Atlantic/DETI staff will conduct an initial assessment of the feature to determine if further inspection (Level 2) by the KS or KFG will be required. Suspect features will include:

a. Cave entrances[3]

b. SinkholesSoil subsidence areas; and/or

c. Rock collapses.

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[2]If an opening to a cave is intercepted during construction activities, there should be immediate coordination with the US Fish and Wildlife Service, US Forest Service (if within Forest Service ownership land), Virginia DCR-NHP Karst Program (if in VA), or West Virginia DNR and West Virginia DEP (if in WV), for investigation.

[3]If an opening to a cave forms during construction activities, there should be immediate coordination with the US Fish and Wildlife Service, US Forest Service (if within Forest Service ownership land), Virginia DCR-NHP Karst Program (if in VA), or West Virginia DNR and West Virginia DEP (if in WV), for investigation.

This will apply to any of the above features that may form either within the work area, whether located along the proposed disturbance section or anywhere within a 300-foot radius of the work area.

Level 2 Inspection of Features That Form During Construction

If any of the aforementioned features are observed during the Level 1 inspection, work will stop in the area of the feature based on the observed site conditions, and then the KS will conduct a Level 2 Inspection as follows:

a. The KS will examine the feature and determine if it has potential impact to the subterranean environment based on potential hydraulic connectivity with the karst aquifer via the epikarst stratum.

b. The choice of characterization methods will be determined by the KS, and will include any combination of (but not be limited to) the following:

    1. visual assessment;
    2. electrical resistivity survey;
    3. track drill probes;
    4. infiltration testing; and/or
    5. other techniques utilized to perform subsurface characterization of karst features.

c. If the feature is determined to have potential impact to the subterranean environment, the KS will consult with Atlantic/DETI staff regarding appropriate remedial actions.

d. If the feature is determined to not have potential impact to the subterranean environment, work will commence as planned.

e. All features that form during construction, whether remediated or left in an undisturbed natural state, will be located on the site plans by the project surveyors, and will be monitored for any changes in appearance, drainage, siltation, etc. by visual observation and LiDAR at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If any changes are observed, the KS will provide consultation on potential impact to the karst environment and remedial actions, if necessary. This monitoring will be carried out on all features that form during work activities, regardless of whether they have a potential impact to the karst environment or not.

III. Notification and Consultation

Notification of, and consultation with State and Federal regulatory and administrative agencies will be completed for the following:

1. Any planned invasive subsurface exploration, including: geotechnical soil borings; rock coring; air track borings; test pits; or other invasive investigative measures that have the potential for intercepting subsurface voids, conduits, or caverns.

2. Any karst features that were identified and located prior to construction that will require remediation or mitigation.

3. Any karst features that were identified and located prior to construction that will require periodic monitoring, whether remediated or left in an undisturbed natural state. The results of the monitoring shall be documented and reported to the appropriate agencies.

4. Any karst features that are intercepted during construction. Notification and consultation will take place after the performance of the Level I inspection.

5. Any karst features that form during construction. Notification and consultation will take place after the performance of the Level I inspection.

6. Any karst features that form following construction which are observed during the post-construction karst feature monitoring (*see* Level 2 Inspection of Features that form during construction, part e).

7. In West Virginia, If a geologically sensitive feature is discovered during construction, by the ERI or other means and it is determined that the ACP pipeline alignment will be within 150' of any features, a formal modification (Form M) will be submitted with 30 days of identifying the feature.

<u>Federal Agencies to be Notified</u>

United States Fish and Wildlife Service (USFWS)
Federal Energy Regulatory Agency (FERC)
United States Forest Service (USFS)[4]

<u>State Agencies to be Notified (Virginia)</u>

Virginia Department of Conservation and Recreation – Natural Heritage Program (DCR-NHP)
Virginia Department of Environmental Quality (VDEQ)

<u>State Agencies to be Notified (West Virginia)</u>

West Virginia Division of Natural Resources (WVDNR)
West Virginia Department of Environmental Protection (WVDEP)

Karst Mitigation and Conservation Procedures

The following procedures will be used to avoid and minimize any impact of pipeline construction and/or O&M activity which might present a risk to environmental receptors, in particular obligate subterranean taxa. Please note that other resource protection measures that may be implemented for the ACP may provide redundancy with regard to the karst mitigation and conservation procedures detailed herein.

Measures to Avoid Impact to the Karst Aquifer and Environment

These measures shall apply to any karst feature which allows the unfiltered and unimpeded flow of surface drainage into the subsurface environment, including (but not limited to): open throat sinkholes, caves which receive surface drainage, sinking streams, and losing stream segments. These avoidance measures were derived from the NiSource Habitat Conservation Plan, Madison Cave Isopod Avoidance and Minimization Measures, and the Columbia Pipeline Group HCP and non-HCP species Best Management Practices Guidance Document. They are intended to prevent impact to the karst aquifer and the subsurface habitat of obligate stygobiont species through protection of groundwater quantity and quality (Burden, 2012).

1. Protect known and/or future mapped recharge areas of cave streams and other karst features by following relevant conservation standards, specifically the FERC 2013 Upland Erosion Control, Revegetation and Maintenance Plan, the FERC 2013 Wetland and Waterbody Construction and Mitigation Procedures, and the ACP Spill Prevention, Containment, and Control (SPCC) plan.
2. Anywhere that the ACP Alignment is within 150 feet of a geologically sensitive karst feature in West Virginia, the WVDEP will be provided with the feature name based on the unique identifier nomenclature described in the survey methods section of this plan, the latitude and longitude of the feature, photographs of the feature, a karst description sheet (KDS) detailing the feature's estimated size and characteristics (i.e. drainage, vegetation, presence or absence of an open throat, etc.),.
3. Buffers of 300 feet around karst features in all work areas (within and off-ROW including discharge areas) must be clearly marked in the field with signs and/or highly visible flagging until construction related ground disturbing activities are completed. If a karst feature or its 300-ft buffer falls within the 125-ft wide workspace the following steps should be taken:
   a. The workspace should be narrowed (if practicable) to impact as little of the buffer as possible.
   b. No spraying of insecticides or herbicides shall be allowed within the 300-ft buffer.

[4] Only if within USFS lands.

c. No refueling, repair or maintenance of vehicle or equipment shall be allowed within the 300-ft buffer.

d. Soil disturbance within the buffer (i.e. trenching) shall be performed in a manner which prevents sediment from entering the subsurface through the use of carefully designed and continuously maintained sediment and erosion control measures, and shall follow the procedures and BMPs specified in the FERC plans and procedures mentioned in section 1, above.

e. If the karst feature is located downgradient from the area of soil disturbance, drainage shall be directed away from the karst feature and its 300-ft buffer through the use of diversion trenches, water breaks, or other engineered methods. This shall apply even if the feature itself is located outside of the 125-ft workspace, but the workspace intercepts the 300-ft buffer.

f. No activity of any kind shall be allowed within the parapet of a sinkhole or within a 25-ft buffer around the parapet, which should remain in an undisturbed, natural state. The sinkhole and the 25-ft parapet buffer should be delineated using temporary fencing. For the purposes of this plan, "undisturbed natural state" shall be defined as the feature and its 25-ft buffer shall remain in the condition it was found in prior to any activity related to project construction including stripping and grubbing, soil disturbance of any kind, redirection of drainage or any other activity that would modify the characteristics of the feature from its physical condition as documented in the pre-construction survey.

4. Earth disturbing activities will be conducted in a manner that minimizes alteration of existing grade and hydrology of existing surficial karst features. Pre-existing flow channels will be stabilized but will not otherwise be altered. Concentrated flow caused by construction activities will be dispersed with a suitable spreading or diversion technique. Surface water flow volume will be maintained at historic (or predevelopment) levels as changes to the volume of surface water flow can disturb the subsurface hydrology.

5. Any open-throat sinkholes and cave entrances within 300 feet of the workspace, located downgradient from the centerline which receives drainage from the workspace will be carefully protected using silt fences, diversion trenches, constructed temporary berms around the parapet, or water breaks. If the feature receives flow via a discreet drainage channel, the channel will be equipped with absorptive boom and a double row of silt fences.

6. In addition to the aforementioned requirements, the following will be implemented in construction workspace areas:

   a. If a new open throat, cover-collapse sinkhole forms within the ROW or construction work space, work in that area will stop and the sinkhole will be isolated from the rest of the work area with sandbags or other suitable materials. The sinkhole will be inspected by the KS and appropriate action taken (e.g., pipeline relocated, sinkhole remediated, etc.) to ensure pipeline integrity and protection of the aquatic resource and subterranean habitat. The preferred method for remediation will be the graded/inverted filter method (Ralstein and Oweis, 1999). This technique involves excavation and cleaning out collapsed, soft soils in the weakened zone to limit further soil raveling, and placing rocks or boulders large enough to bridge the bedrock conduit or "throat" at the bottom of the excavation. Progressively finer rock and gravel are then placed and compacted above the base course, above which is placed a layer of permeable geotextile fabric and soil to the final grade which is then seeded. The advantage of this method is that it allows surface water to continue to infiltrate into the subsurface, but prevents further soil raveling (which is the root cause of cover-collapse sinkholes). The vegetated soil stratum and underlying gravel acts as a natural filter for the water infiltrating to the underlying solution enlarged conduits and fracture system. (see Appendix A).

   b. If a subsurface void or conduit should open or be intersected in the process of excavation and/or trenching, work in that area will stop and the void will be isolated from the rest of the work area with sandbags or other suitable materials. The void will be inspected by the KS and the most appropriate remedial method will be determined on a case-by-case basis. Soil voids will be backfilled using the graded filter method as described above. Small conduits (< 1 foot in diameter) may be closed with low mobility grout and/or flowable fill. Large conduits (>1 foot in diameter) will require specific remedial actions (capping, void bridging, or plugging) based on the location and geometry of the conduit (i.e. whether the conduit is located at the bottom, one side, or both sides of the trench).

c. If a subsurface void or conduit should open or be intersected in the process of excavation and/or trenching through which water is flowing (i.e. an underground stream) work in that area will stop, and the void will be isolated from the rest of the work area with sandbags or other suitable materials. The void will be inspected by the KS, and the most appropriate remedial method will be determined on a case-by-case basis. All efforts will be made to ensure that the existing flow path is not interrupted by isolating the stream using trench breakers, and backfilling the location of the saturated karst feature or stream with permeable material such as well-graded stone or other material which will not interfere with the continued flow of water from one side of the trench to the other.

d. In linear excavations adjacent to karst features, spoils will be placed on the upgradient side of the excavation so that if any erosion takes place the stockpiled soil will flow back into the excavation and not downgradient towards the karst feature.

e. Surface water control measures, including, but not limited to: diversion (direct water flow into trench or off right-of-way areas past the area of concern), detention or collection and transportation, will be utilized to prevent construction-influenced surface water from free flowing into open throated surface karst features, and eventually into the subsurface.

f. Open throat surface karst features will not be utilized for the disposal of water. This shall include, but not be limited to: hydrostatic test water, water from trench dewatering, or any other water generated by, or utilized in, construction activities.

7. Blasting will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of known or inferred subsurface karst structures. If blasting or hammering is deemed necessary then the following parameters will be adhered to:

   a. The excavation will be carefully inspected for any voids, openings or other tell-tale signs of solution activity.

   b. If the rock removal intercepts an open void, channel, or cave, the work in that area will be stopped until a remedial assessment can be carried out by a qualified geologist or engineer with experience in karst terrain.

   c. All use of explosives will be limited to low-force charges that are designed to transfer the explosive force only to the rock which is designated for removal (e.g., maximum charge of 2 inches per second ground acceleration).

   d. If the track drill used to prepare the hole(s) for the explosive charge(s) encounters a subsurface void larger than 6 inches within the first 10 feet of bedrock, or a group of voids totaling more than 6 inches within the first 10 feet of bedrock, then explosives should not be used (or) a subsurface exploration should be conducted to determine if the voids have connectivity with a deeper structure. The subsurface exploration can be carried out with track drill probes, coring drill, electrical resistivity, or other techniques capable of resolving open voids in the underlying bedrock. If a track drill or coring rig is used, then all open holes will be grouted shut after the completion of the investigation.

8. Horizontal Directional Drilling (HDD) will not be used in karst terrain.

9. If authorized by the landowner, block (e.g. gate) all access roads and ROWs leading to cave entrances or open throat sinkhole structures to prevent unauthorized access.

10. Comply with requirements of project SPCC plan.

11. A Spill Prevention, Control, and Countermeasures Plan (SPCC) has been developed for the proposed ACP/SHP which will further avoid and minimize potential impact of spills by implementing the following measures:
    g. equipment refueling will not be performed within flagged or marked buffer areas of streambeds, sinkholes, fissures, or areas draining into these or other karst features, except by hand-carried cans (5 gallon maximum capacity) when necessary;
    h. equipment servicing and maintenance areas will be sited outside of flagged or marked buffer areas of streambeds, sinkholes, fissures, or areas draining into these or other karst features;
    i. prevent runoff resulting from construction equipment washing operations to directly enter any karst feature by locating these operations outside of the buffer area;
    j. construction equipment vehicles, materials, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products will not be parked, stored, or serviced within 300 feet of any karst feature;
    k. all equipment will be checked by a construction inspector daily for leaks prior to beginning work in karst areas; damaged or defective equipment will be removed or repaired; and
    l. if a reportable spill has impacted a karst feature:
        i. follow the SPCC Plan and
        ii. call the National Response Center (800-424-8802) and the Virginia Department of Environmental Quality (800-469-8892) or the West Virginia Department of Environmental Protection (304-558-5938), as appropriate.
12. Hydrostatic test water will not be obtained from karst features (only free-flowing streams).
13. Hydrostatic testing water from new pipe installations shall not be discharged into flagged or marked buffer areas of sinkholes, fissures, or other karst features or channels or surface features that flow towards those features. Discharging of hydrostatic testing water shall be performed in the following manner (in order of priority and preference):
    a. Discharge hydrostatic test water downgradient of flagged or marked buffer areas of sinkholes, fissures, or other karst features unless on-the-ground circumstances (e.g., man-made structures, terrain, or other sensitive resources) prevent such discharge.
    b. If water cannot be discharged downgradient as described in 12a, discharge water into uplands greater than 300 feet from flagged or marked buffer areas of sinkholes, fissures, or other karst features unless on-the-ground circumstances (e.g. man-made structures, terrain, other sensitive resources) prevent such discharge.
    c. If the conditions listed in either 12a or 12b are not practicable, discharge water as far from flagged or marked sinkholes, fissures, or other karst features as is practical and utilize additional sediment and water flow control devices to minimize effects.

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Appendix A – Sinkhole Mitigation Guidance Documents

Appendix A – Sinkhole Mitigation Guidance Documents

West Virginia Department of Environmental Protection
Division of Water and Waste Management
Groundwater Protection Program

Sinkhole Mitigation Guidance

August 8, 2005

Purpose:

These sinkhole mitigation designs serve to allow the filling of sinkholes while maintaining recharge to the aquifer, reducing potential contamination threats to groundwater, and eliminating safety hazards at sinkhole entries.

General:

Consideration should be given to the method used for removing contaminated materials from sinkholes and reducing or eliminating direct inflow of surface water into sinkholes. Land treatment methods that improve the filtration and infiltration of surface water before it enters the sinkhole should be used along with the mitigation of the sinkhole.

Before selecting a treatment option the following should be considered:

- Land use
- Existing and planned land treatment
- Sinkhole drainage area
- Dimensions of the sinkhole opening
- Safe outlet for diverted surface water
- Environmentally safe disposal of sinkhole "clean out" material
- Availability and quality of filter material
- Safety of equipment and operators and laborers during installation

Treatment selection should be based on the dimensions of the sinkhole drainage area and include direct sinkhole treatment with surface water control measures and filter strips. Whichever treatment option is chosen, it should avoid surface water ponding or the creation of high soil moisture conditions in excess of 72 hours.

Treatment designs apply to sinkholes with excavated depths of 5 to 25 feet and with drainage areas up to 15 acres. Excavations up to 5 feet are sufficient for most sinkholes. Sinkholes with excavation depths of greater than 25 feet or with uncontrolled drainage areas greater than 15 acres may require adjustments to the treatment measure(s) and/or surface water control measure(s). In these cases, geologic and engineering assistance must be obtained and a site-specific treatment design prepared.

Treatment for Sinkholes with Drainage Areas Less than 5 Acres

Treat the sinkhole using the mitigation design in Figure 1 of this guidance document. The treatment site should be inspected after periods of heavy precipitation because some material may run into adjacent sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface. The existing land use or practice may continue over the treated sinkhole as long as the treatment is maintained.

Treatment for Sinkholes with Drainage Areas of 5 Acres or More and Having a Safe Outlet

The following additional treatment criteria are applicable to sinkholes with drainage areas of 5 acres or more where a safe outlet can be provided to divert surface water away from the sinkhole. A safe outlet is one that does not erode, divert surface water to another sinkhole or injection well, or cause flood damage to crops, property, buildings, or highways/roads.

Surface water control measures should be situated to reduce the internal drainage area around the sinkhole to less than 5 acres. The choice of surface water control measures is generally based on site-specific conditions.

Treatment for Sinkholes with Drainage Areas of 5 to 15 acres and Having No Safe Outlet

Treat the sinkhole using the mitigation design in Figure 2 of this guidance document. The site should be inspected after periods of heavy precipitation because some material may run into adjacent sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface. The sinkhole should remain as unused land.

Vegetated Buffer Area

A vegetated buffer area should be installed around the sinkhole to improve runoff water quality by filtration and adsorption of contaminants. The vegetated buffer area should be installed within the sinkhole drainage area and should begin at the treated sinkhole.

The minimum width (in feet) of the vegetated buffer area is determined by multiplying the sinkhole drainage area (in acres) by seven. This width should provide beneficial filtering for some distance outside the sinkhole because surface water runoff may be temporarily held before reaching the treated sinkhole.

Appropriate vegetation should be used for the buffer area. Use native vegetation as much as possible. **DO NOT** use noxious plants or weeds. It is recommended that a plant nursery be consulted for the appropriate vegetation.

Acceptable Materials

Engineering fabric - must meet the applicable requirements of AASHTO M-288.

Aggregates – fine aggregates, gravel, or rock rip rap that conforms to the West Virginia Department of Highways, Standard Specifications for Roads and Bridges, Sections 702, 703, and 704.

Specifications

Use the following guidance for installing a mitigation design for sinkholes and sinkhole areas with drainage areas of less than 5 acres:

1. Remove and properly dispose of materials dumped in and around the sinkhole in accordance with applicable federal, state, and local laws.

2. Excavate loose material from the sinkhole and try to expose the solution void(s) in the bottom. Enlarge the sinkhole, as necessary, to allow for installation of the filter material.

3. Select stone that is approximately 1.5 times larger than the solution void(s). Place the stone into the void(s) forming a competent bridge. Stone used for the bridge should have rock strength equal to, at least, moderately hard (*e.g.*, resistant to abrasion or cutting by a knife blade but can be easily dented or broken by light blows with a hammer). Shale or similar soft and non-durable rock is not acceptable.

4. Place a layer of filter material over the bridge to a minimum thickness of 24 inches. Approximately 35 percent of the material should be larger than the opening between the bridge and the void(s). There should be no discernable large openings around the bridge. The material should be either gabion stone, stone for rip rap, or stone for special rock fill that conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Section 704.

5. Place a layer of smaller size filter material over the previous layer to a minimum thickness of 10 inches. The size of the material should be ¼ to ½ the size of that used in the previous layer. The material should be No. 57 aggregate, which conforms to West Virginia Department of Highways, *Standard Specifications Roads and Bridges*, Sections 703.1.1, 703.1.2, 703.1.3, 704.1.4, and 703.2.1. Unacceptable filter material consists of pea gravel or slags (steel, electromagnetic, or power plant).

6. Place a layer of sand-sized filter material over the previous layer ~~at~~ to a minimum thickness of 10 inches. The sand must be compatible in size with the previous layer to prevent piping. The material should be fine aggregate that conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Sections 702.1.1, 702.1.2, and 702.1.3.

7. Engineering fabric conforming to AASHTO M 288 may be substituted for the stone and sand filter materials discussed in 5 and 6.

8. Backfill over the top filter layer or engineering fabric with soil material to the surface. This should be mineral soil with at least 12 percent fines. Reuse soil material excavated from the sinkhole as much as possible and place any available topsoil over the backfill. Overfill by about 5 percent to allow for settling.

9. Establish vegetation on the mitigated sinkhole and other disturbed areas of the site.

Use the following guidance for installing a mitigation design for sinkholes and sinkhole areas with drainage areas of 5 to 15 acres:

1. Remove and properly dispose of materials dumped in and around the sinkhole.

2. Excavate loose material from the sinkhole.

3. Place a layer of filter material into the sinkhole, allowing the stone to fill the void(s) below the bottom of excavated sinkhole. The size should be ¼ to ½ the size of the void(s). This material can be WVDOH gabion stone, rip rap stone, or special rock fill stone.

4. Place a layer of the same size filter material to a thickness of about ¾ TD (TD = total depth) above the sinkhole bottom.

5. Place a layer of smaller size filter material over the previous layer to a thickness of about ¼ D. Bring this layer to surface level. The size should be ¼ to ½ the size of the previous layer. The material should be No. 57 aggregate, which conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Sections 703.1.1, 703.1.2, 703.1.3, 703.2.1, and 704.1.4. Unacceptable stone consists of pea gravel or slags (steel, electrometallurgical, or power plant).

6. Shale or similar soft and non-durable rock is not acceptable.

7. Establish vegetation on the mitigated sinkhole and disturbed areas of the site.

Engineering Fabric Requirements for Subsurface Drainage

Engineering fabric used in the mitigation of sinkholes should meet the applicable requirements of AASTHO M 288, Section 7.2

Engineering Fabric Installation

Proper construction and installation techniques are essential to ensure that the intended function of the engineering fabric is fulfilled.

When sewn seams are necessary, the seam strength must be equal to or greater than 90 percent of the specified grab strength, as measured in accordance with ASTM D 4632.

When sewn seams are used for the seaming of the engineering fabric, the thread must be high strength polypropylene, or polyester. Nylon thread is unacceptable.

For Sinkhole Mitigation Design A, place the engineering fabric loosely, with no wrinkles or folds, and with no void spaces between the fabric and the bridge. Overlap successive sheets of engineering fabric a minimum of 12 inches, with the upstream sheet overlapping the downstream sheet.

Prior to covering, the engineering fabric should be inspected to ensure that it has not been damaged (*e.g.* holes, tears, rips) during installation. An engineer or the engineer's designated representative should conduct the inspection. The designated representative should be a certified field inspector.

Damaged fabric must be repaired immediately. Cover the damaged area with an engineered fabric patch that overlaps to 12 inches beyond the damaged area.

Any damaged engineering fabric that cannot be repaired shall be replaced as directed by the engineer.

Place material over the engineering fabric in such a manner as to avoid stretching and subsequently tearing the fabric. Do not drop stone and soil placement from a height greater then one meter. Do not allow stone with a mass of more than 100 kg to roll down the slope of the sinkhole.

Grading the sinkhole slope is not permitted if the grading will result in the movement of the stone directly above the engineering fabric.

Operation and Maintenance

The owner/operator is responsible for maintaining the mitigated sinkhole and sinkhole area. At a minimum, the following maintenance practices should be performed:

1. Mow grass and plantings as necessary to promote vigorous growth.

2. Inspect mitigation measures at least twice a year and after all major rain events. Repairs to the sinkhole mitigation measures should be made promptly were warranted.

References:

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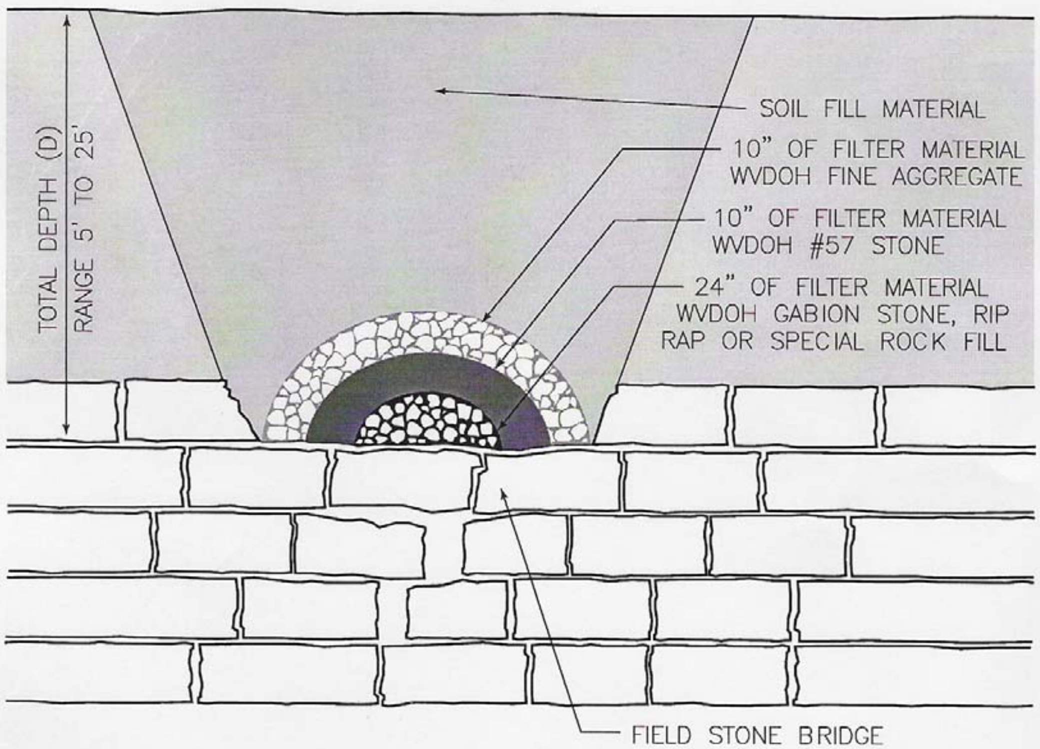
WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SINKHOLE MITIGATION GUIDANCE

FIGURE 1



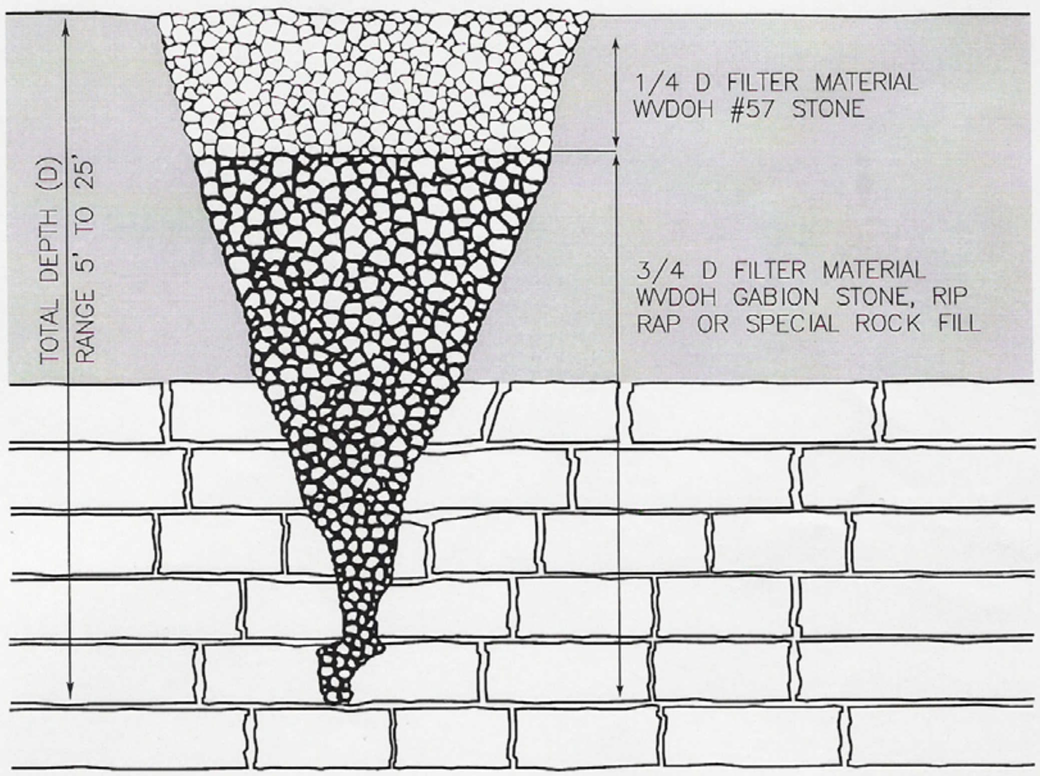
NOTE:
A NONWOVEN GEOTEXTILE MEETING AASHTO M288, SECTIONS 7.1+7.2 MAY BE SUBSTITUTED FOR THE WVDOH #57 STONE AND WVDOH FINE AGGREGATE

SINKHOLE MITIGATION

(DRAINAGE AREA LESS THAN 5 ACRES)

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SINKHOLE MITIGATION GUIDANCE

FIGURE 2



SINKHOLE MITIGATION

(DRAINAGE AREA 5 TO 15 ACRES)

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

KARST SINKHOLE TREATMENT

(No.)

CODE 527

DEFINITION

The treatment of sinkholes in karst areas to reduce contamination of groundwater resources, and/or to improve farm safety.

PURPOSE

This practice may be applied as part of a conservation management system in karst topography, which is an area underlain by solutioned carbonate bedrock with sinkholes and caverns. The practice supports one or more of the following purposes:

- Improve water quality
- Improve farm safety

CONDITIONS WHERE PRACTICE APPLIES

On any land surface or in conjunction with any existing practice where the soils and geologic conditions are characterized by sinkholes or karst topography.

This practice does not apply to erosional or collapse features caused by failure or leakage of underground pipes or constructed surface drainage features (e.g., canals), or due to piping of unstable soil materials, or due to poorly compacted or poorly constructed features.

This practice does not apply to sinkholes that may appear in or beneath structures or in flowing streams. Treatment of sinkholes in these areas will be determined through engineering investigations and structural design solutions.

CRITERIA

General Criteria Applicable to all Purposes

The installation and operation of karst sinkhole treatment(s) will comply with all Federal, State, and local laws, rules, and regulations.

A geologic investigation of the potential impact of the treatment on groundwater, surface water run-in, and the karst features will be conducted by a qualified geologist.

Trash and other material will be removed from the sinkhole and disposed of in an environmentally sound manner.

Excess surface water caused by construction activities will be diverted from the sinkhole area.

Nutrient and pest management plans will be developed for the drainage area of the sinkhole controlled by the landowner.

Vegetative Treatment. All sinkholes treated will have a vegetated buffer established and/or maintained. The buffer will be a minimum of 25-feet wide measured from the rim of the sinkhole. The buffer area may be extended to prevent concentrated flow channels from occurring and entering the sinkhole. The width of the vegetated buffer will be established and maintained in accordance with the type of buffer chosen. The sinkhole and surrounding buffer area will be fenced.

Livestock will be excluded from the vegetative buffer except when grazing would be beneficial to maintenance of the buffer.

Nutrients, herbicides, pesticides, and animal waste will not be applied within an established buffer area. Only mechanical treatments shall be used for weed control.

Appropriate erosion and sediment control measures will be used to reduce the amount of sediment entering sinkhole openings during the establishment of the vegetative buffer.

Surface Water Control. Changes to the volume of surface water that enters a sinkhole may disturb the underground hydrology. To the extent possible, the surface water flow should be maintained at historic (or predevelopment) volumes.

Pre-existing concentrated flow channels will be stabilized but should not otherwise be altered. If a plug or inverted filter is used, the area to be protected will be characterized by a qualified Geologist to enable a suitable design. Concentrated flow caused by construction activities will be dispersed with a suitable spreading or diversion technique.

Sinkhole Treatment/Closing. Adequate protection of most sinkhole and sinkhole areas can be achieved by the use of vegetative buffers and livestock exclusion. However, if an open sinkhole is a safety hazard, it may be treated with a rock filter, gabions, or other methods approved by the State Conservation Engineer or delegated authority.

Sinkholes to be treated or closed via a reverse filter or plug shall be excavated to stable, unweathered bedrock, if possible, prior to construction.

Sinkholes that open into caves shall not be filled under any circumstances. Gated openings may be used for safety reasons.

CONSIDERATIONS

Current and planned land use should be considered. In particular, structures, septic drain fields, wells, feedlots, ponds, and animal waste storage systems should not be located over a sinkhole site or within the impact area.

Sinkholes may be natural conveyances of organic material and nutrients important to cave fauna.

For a sinkhole receiving contaminated overland flow, every effort should be made to first treat the source of the contamination. Although it is important to maintain the hydrology of the karst system, it may be more beneficial to the groundwater quality to divert the contaminated water away from the sinkhole. In some cases, it may be necessary to completely plug a sinkhole with sealing materials rather than treat it with an inverted filter. Acceptable sealing materials are provided in ASTM D 5299, part 6.4. An example of this would be a sinkhole in a feedlot or a site that is difficult to protect by any other method.

The sinkhole treatment should not result in excessive surface water ponding or high soil moisture conditions over an extended period of time.

When filling a sinkhole, mounding of the fill material may be needed to offset future settlement due to consolidation and migration of the fill material into subsurface voids. Additional fill may be required as treatment ages.

Treatment of one sinkhole may have an effect on other sinkholes or solution features in the vicinity.

The use of a conservation easement for the buffer and sinkhole should be considered.

PLANS AND SPECIFICATIONS

Plans and specifications for Sinkhole and Sinkhole Area Treatment will be in keeping with this standard and will describe the requirements for applying the practice to achieve its intended purpose.

Plans and specifications shall include the following:

- Plan view showing sinkhole and sinkhole area Include topographic information and photographs
- The geologic investigation will include a study of potential impacts on the karst resource
- Depth to stable, unweathered bedrock
- Description of planned treatment measures
- The drainage area of sinkhole delineated on a topographic map
- Availability of safe outlet for surface water, if applicable
- Operation and Maintenance requirements
- Special safety requirements

OPERATION AND MAINTENANCE

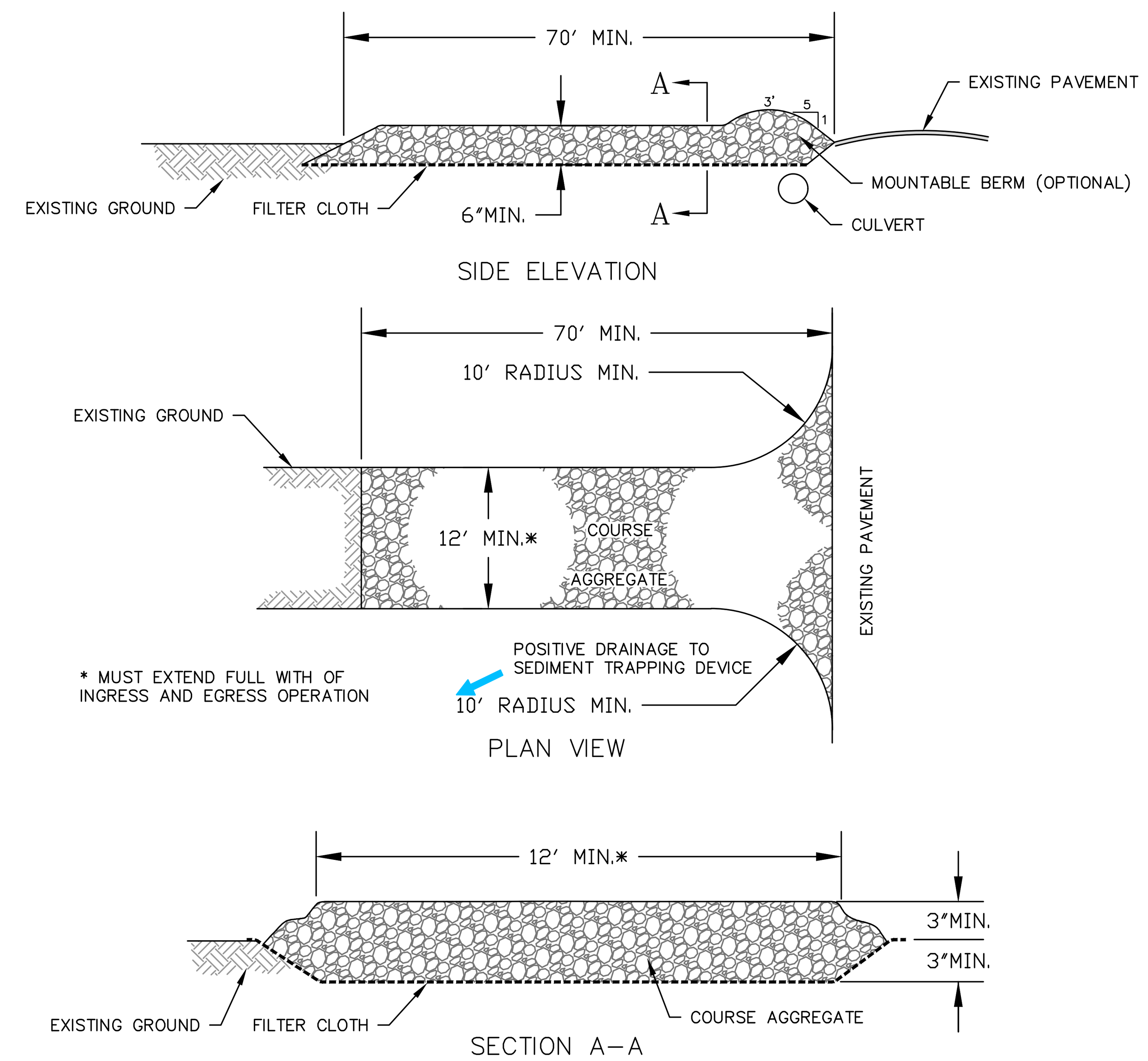
An operation and maintenance (O&M) plan will provide specific instructions for maintaining the sinkhole and sinkhole area treatment, including reference to periodic inspections and the prompt repair and/or replacement of damaged components.

ATLANTIC COAST PIPELINE, LLC ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

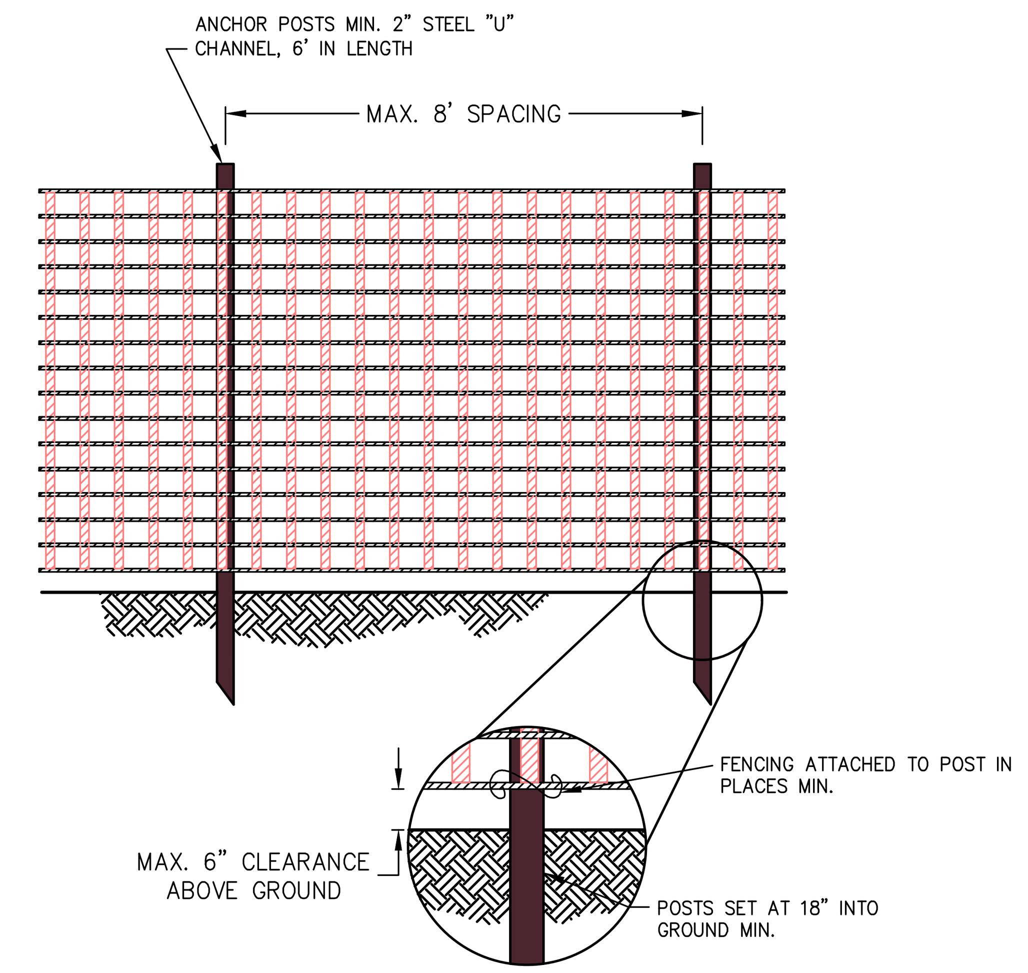
ATTACHMENT I-1

Typical Erosion & Sedimentation Control Details - West Virginia



STONE CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE



NOTES:
1. PROTECTION BARRIER SHALL BE 4' HIGH, CONSTRUCTED OF DURABLE AND HIGHLY VISIBLE MATERIAL (PLASTIC ORANGE CONSTRUCTION FENCE AND SNOW FENCE MAY BE USED).
2. PROTECTION BARRIERS SHALL BE MAINTAINED THROUGHOUT THE DURATION OF THE WORK AT THE SITE.
3. ADDITIONAL WARNING SIGNS SHOULD ALSO BE PLACED ON THE FENCING AND IN APPROPRIATE AREAS NEAR THE WORK ZONE.

CONSTRUCTION FENCE DETAIL

NOT TO SCALE

INTRODUCTION

1. PROTECTIVE FENCING SHOULD BE INSTALLED TO PREVENT ACCESS TO POTENTIALLY HAZARDOUS AREAS OF A CONSTRUCTION SITE.

CONDITIONS WHERE PRACTICE APPLIES

1. APPLICABLE TO ANY CONTROL MEASURE OR SERIES OF MEASURES, WHICH CAN BE CONSIDERED UNSAFE BY VIRTUE OF POTENTIAL FOR ACCESS BY THE PUBLIC. THE DESIGNER, DEVELOPER, AND CONTRACTOR SHOULD ALWAYS BE SURE THAT THE MOST APPROPRIATE TYPE OF FENCE IS UTILIZED FOR A PARTICULAR NEED.

CONSTRUCTION SPECIFICATIONS

1. SAFETY FENCES SHOULD BE LOCATED SO AS TO CREATE A FORMIDABLE BARRIER TO UNDESIRED ACCESS, WHILE ALLOWING FOR THE CONTINUATION OF NECESSARY CONSTRUCTION OPERATIONS.
2. SAFETY FENCES ARE MOST APPLICABLE TO THE CONSTRUCTION OF TRAPS AND DAMS. IN USE WITH THOSE STRUCTURES, SAFETY FENCES SHOULD BE LOCATED FAR ENOUGH BEYOND THE OUTER TOE OF THE EMBANKMENT TO ALLOW FOR THE PASSAGE OF MAINTENANCE VEHICLES. FENCES SHOULD NOT BE INSTALLED ACROSS THE SLOPE OF A DAM OR DIKE.
3. SIGNS NOTING POTENTIAL HAZARDS SUCH AS 'DANGER' OR 'HAZARDOUS AREA – KEEP OUT' SHOULD BE POSTED AND EASILY SEEN BY ANYONE APPROACHING THE PROTECTED AREA.
4. PLASTIC (POLYETHYLENE) FENCE MAY BE USED AS SAFETY FENCING, PRIMARILY IN SITUATIONS WHERE THE NEED IS FOR A TEMPORARY BARRIER. THE FENCE SHOULD MEET THE PHYSICAL REQUIREMENTS NOTED IN TABLE 3.04.1.
5. SAFETY FENCES SHOULD BE INSTALLED PRIOR TO THE SEDIMENT CONTROL MEASURE BECOMING ACCESSIBLE.
6. APPLICABLE WARNING SIGNS NOTING HAZARDOUS CONDITIONS MUST BE INSTALLED IMMEDIATELY UPON INSTALLATION OF SAFETY FENCE.
7. CHAIN LINK FENCE SHOULD BE USED FOR PERMANENT STRUCTURES (GREATER THAN ONE YEAR).

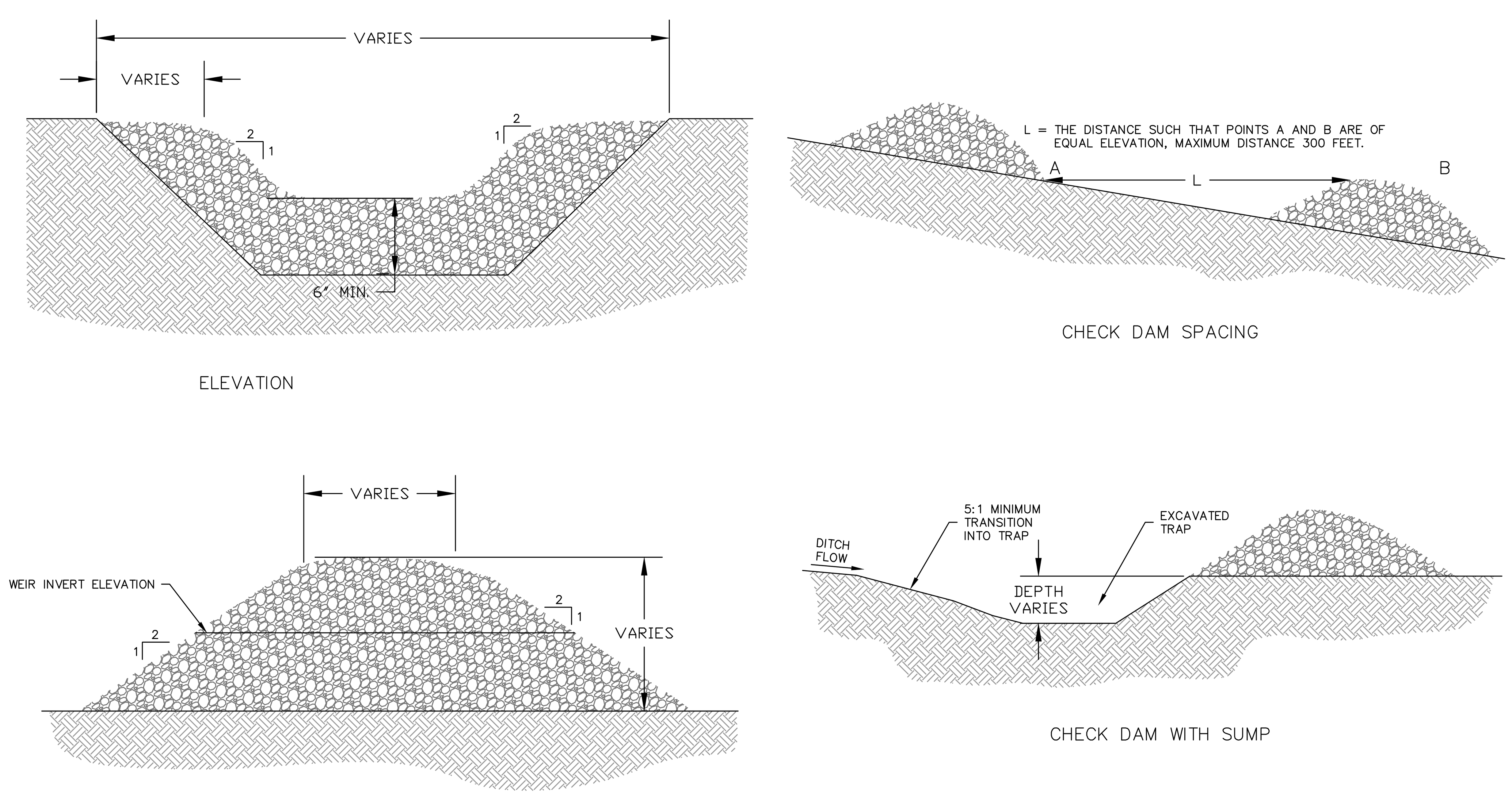
MAINTENANCE

1. SAFETY FENCE SHALL BE CHECKED REGULARLY FOR WEATHER-RELATED OR OTHER DAMAGE. ANY NECESSARY REPAIRS MUST BE MADE IMMEDIATELY.
2. CARE SHOULD BE TAKEN TO SECURE ALL ACCESS POINTS (GATES) AT THE END OF EACH WORKING DAY. ALL LOCKING DEVICES MUST BE REPAIRED OR REPLACED AS NECESSARY.

TABLE 3.04.1 PHYSICAL PROPERTIES OF PLASTIC SAFETY FENCE

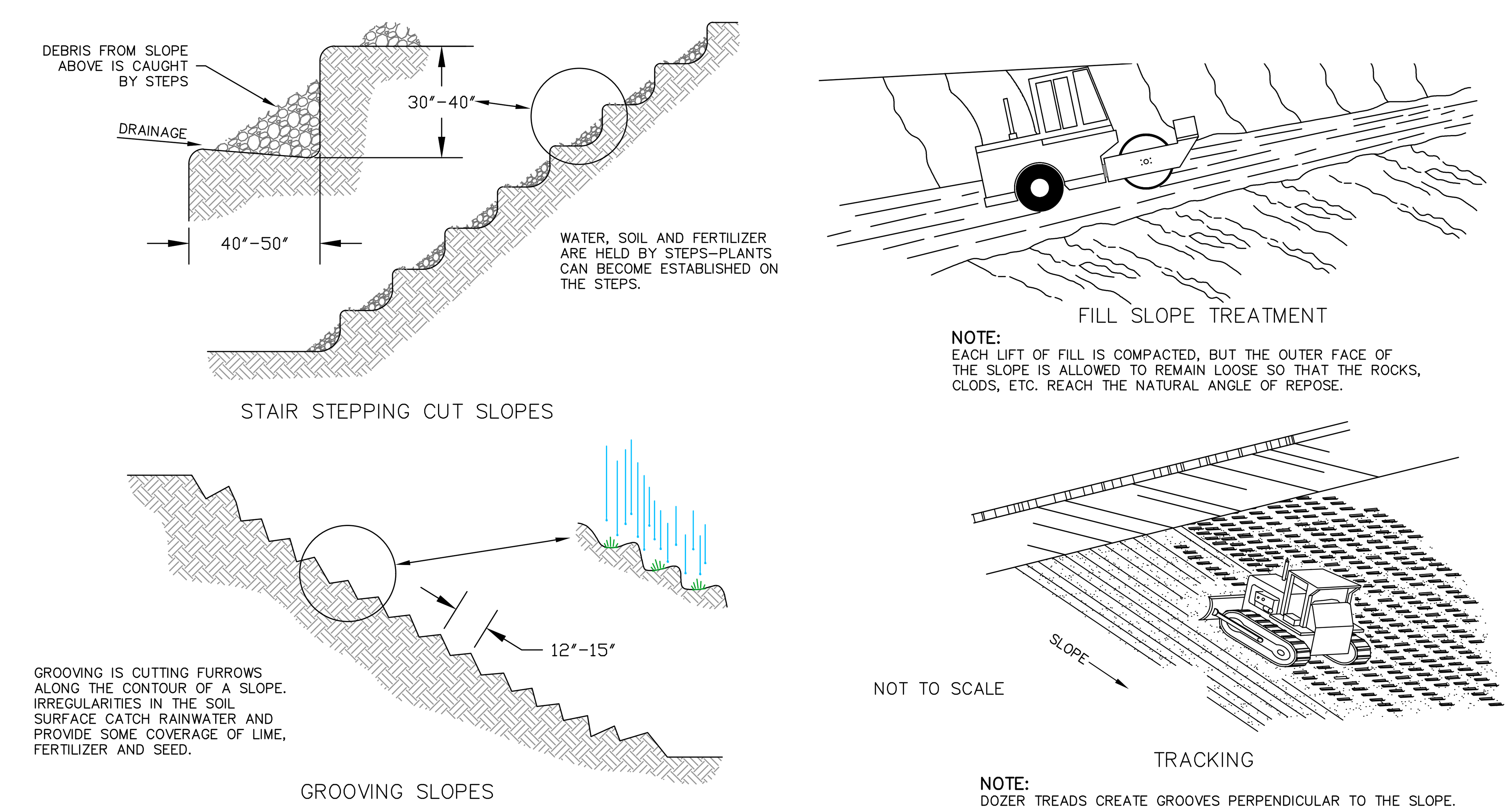
PHYSICAL PROPERTY	TEST	REQUIREMENTS
RECOMMENDED COLOR	N/A	INTERNATIONAL ORANGE
TENSILE YIELD	ASTM D638	AVERAGE 2,000 lbs.
ULTIMATE TENSILE STRENGTH	ASTM D638	AVERAGE 2,000 lbs. per 4FT. WIDTH
ELONGATION AT BREAK(%)	ASTM D638	GREATER THAN 1000%
CHEMICAL RESISTANCE	N/A	INERT TO MOST CHEMICALS/ACIDS

SAFETY FENCE SPECIFICATIONS



ROCK CHECK DAM DETAIL

NOT TO SCALE



SURFACE ROUGHENING DETAIL

NOT TO SCALE

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925 White Oaks Blvd. Bridgeport, West Virginia 26330 / 681-842-8000

TITLE: ATLANTIC COAST PIPELINE EROSION AND SEDIMENT CONTROL DETAILS

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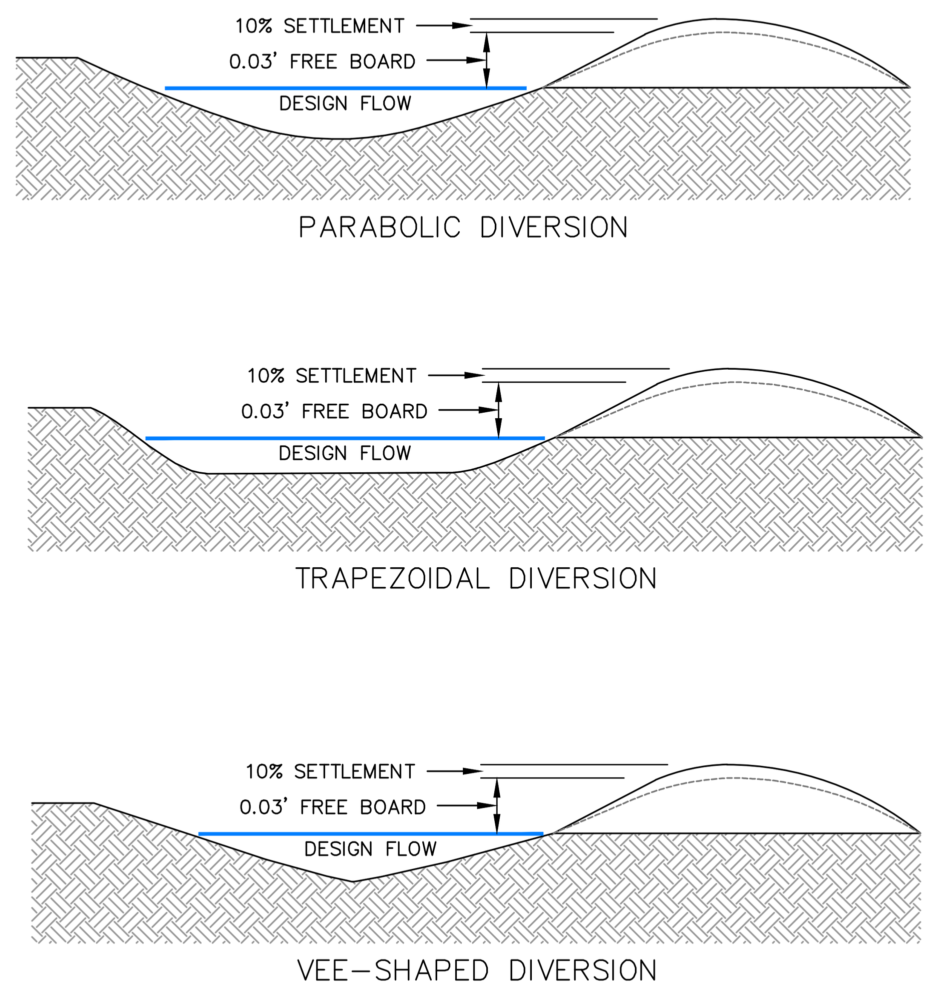


Table 3.15.1 CHANNEL CROSS SECTION REQUIREMENTS	A	B
Drainage area	< 5 acres	5 – 10 acres
Bottom width flow channel	4 feet	6 feet
Depth of flow channel	1 foot	1 foot
Side slopes	2:1 or flatter	2:1 or flatter
Grade	0.5% minimum	0.5% minimum

DIVERSION DETAIL

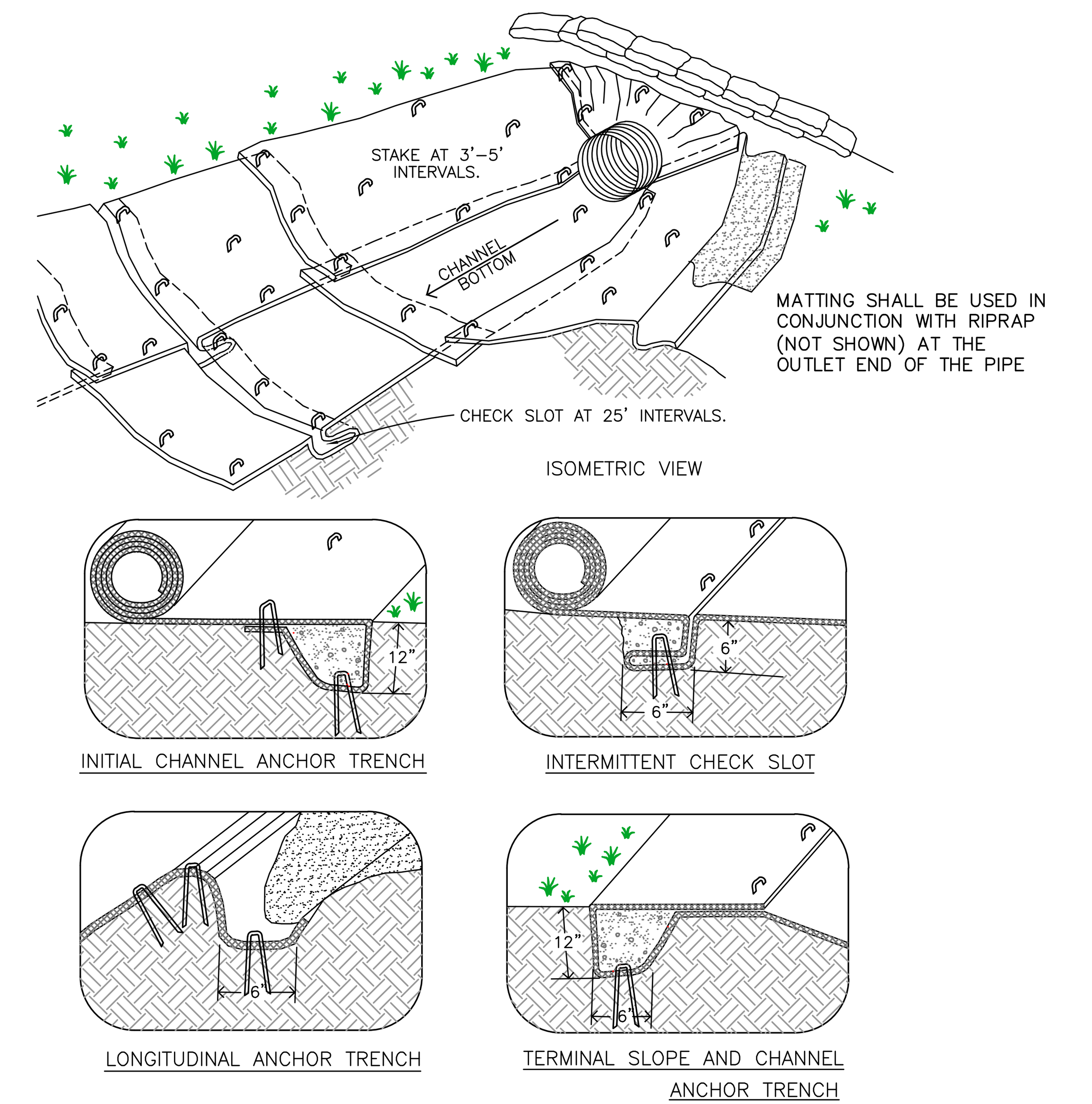
NOT TO SCALE

SOIL AMENDMENT	PERMANENT SEEDING APPLICATION RATE PER ACRE	PER 1,000 SQ. FT.	PER 1,000 SQ. YD.	NOTES
AGRICULTURAL LIME	7.5 TONS	300 LB.	3,100 LB.	OR AS PER SOIL TEST; MAY NOT BE REQUIRED IN AGRICULTURAL FIELDS
10-10-20 FERTILIZER	1,000 LB.	25 LB.	210 LB.	OR AS PER SOIL TEST; MAY NOT BE REQUIRED IN AGRICULTURAL FIELDS

MULCH TYPE	APPLICATION RATE (MIN.) PER ACRE	PER 1,000 SQ. FT.	PER 1,000 SQ. YD.	NOTES
STRAW	3 TONS	140 LB.	1,240 LB.	EITHER WHEAT OR OAT STRAW, FREE OF WEEDS, NOT CHOPPED OR FINELY BROKEN
HAY	3 TONS	140 LB.	1,240 LB.	TIMOTHY, MIXED FLOVER AND TIMOTHY OR OTHER NATIVE FORAGE GRASSES
WOOD CHIPS	4 - 6 TONS	185 - 275 LB	1,650 - 2,500 LB.	MAY PREVENT GERMINATION OF GRASSES AND LEGUMES
HYDROMULCH	1 TON	47 LB.	415 LB.	SEE NOTE 1

NOTES:
1. SHREDDED PAPER HYDROMULCH SHOULD NOT BE USED ON SLOPES STEEPER THAN 5%. WOOD FIBER HYDROMULCH MAY BE APPLIED ON STEEPER SLOPES PROVIDED TACKIFIER IS USED. THE APPLICATION RATE FOR ANY HYDROMULCH SHOULD BE 2,000 LB./ACRE AT MINIMUM.

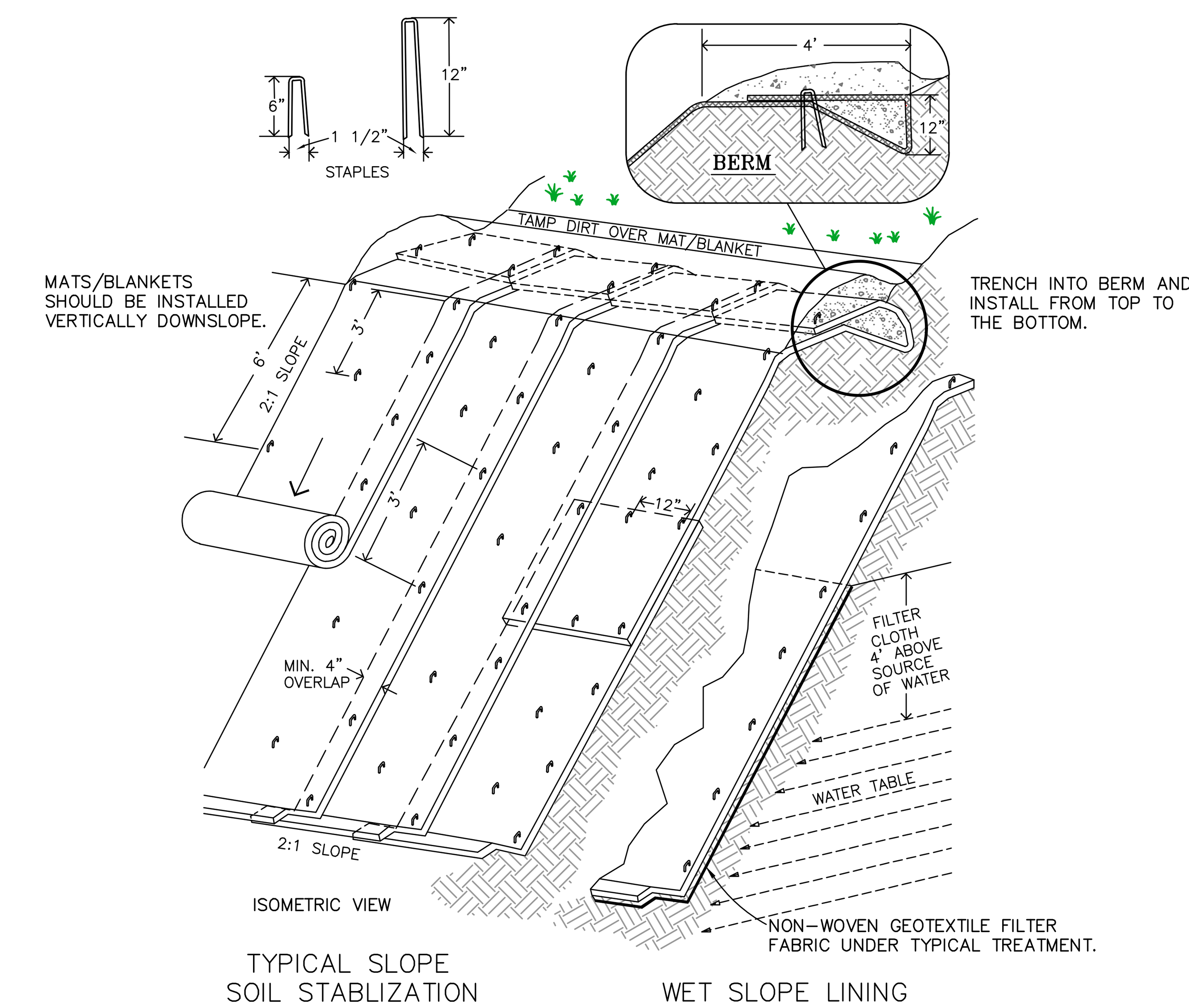
MULCH AND FERTILIZER



NOTES:
1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

TYPICAL RECP CHANNEL INSTALLATION DETAIL

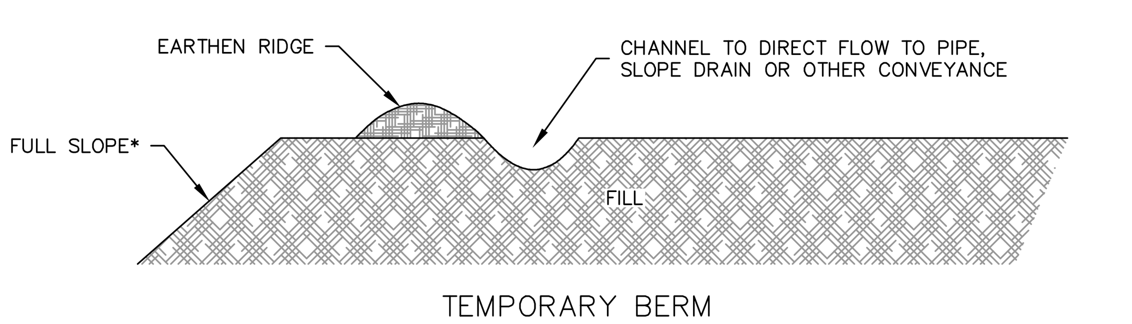
NOT TO SCALE



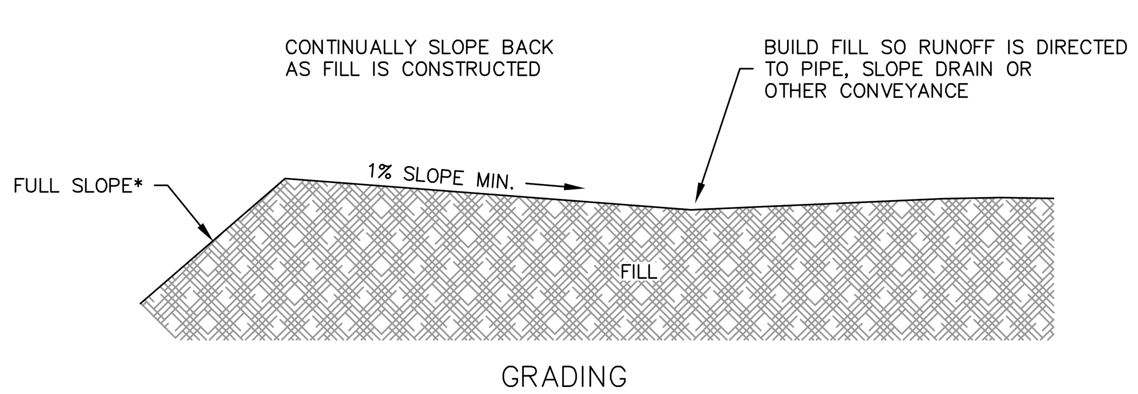
NOTES:
1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

ROLLED EROSION CONTROL DETAIL

NOT TO SCALE



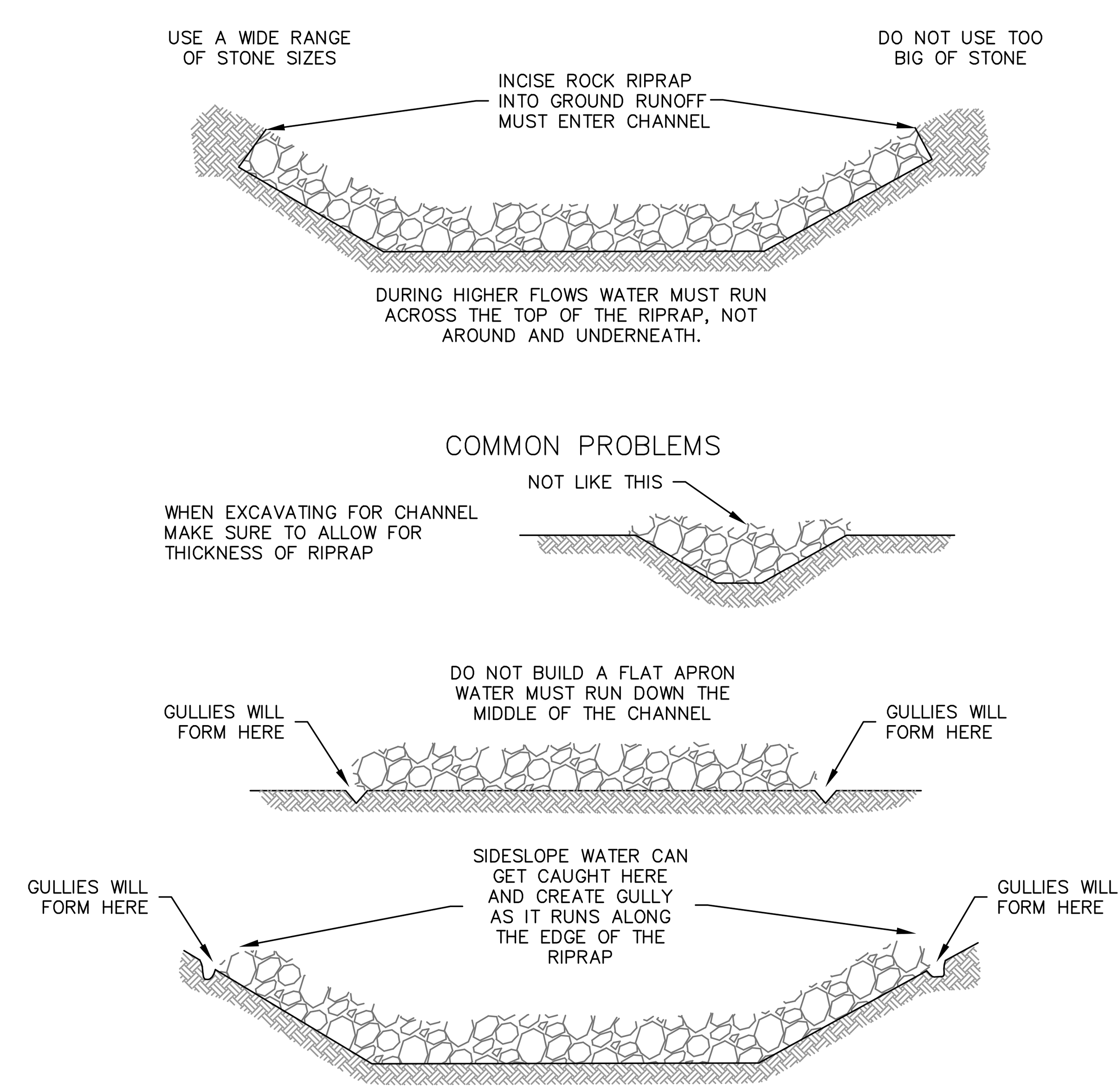
* SEED AND MULCH FILL SLOPE EVERY 10 FEET OF FILL OR EVERY 7 DAYS, WHICHEVER COMES FIRST



channel Grade (%)	Table 3.15.2 STABILIZATION RREQUIREMENTS A < 5 acres	B 5 – 10 acres
0.5 – 3.0	Seed & straw mulch	Seed & straw mulch
3.1 – 5.0	Seed & straw mulch	Seed & cover /RECP; sod; or line with riprap
5.1 – 8.0	Seed & cover w/ RECP; sod;or line with riprpa	Line with riprap
8.1 – 20.0	Line with riprap	Engineering design

TEMPORARY FILL DIVERSION DETAIL

NOT TO SCALE

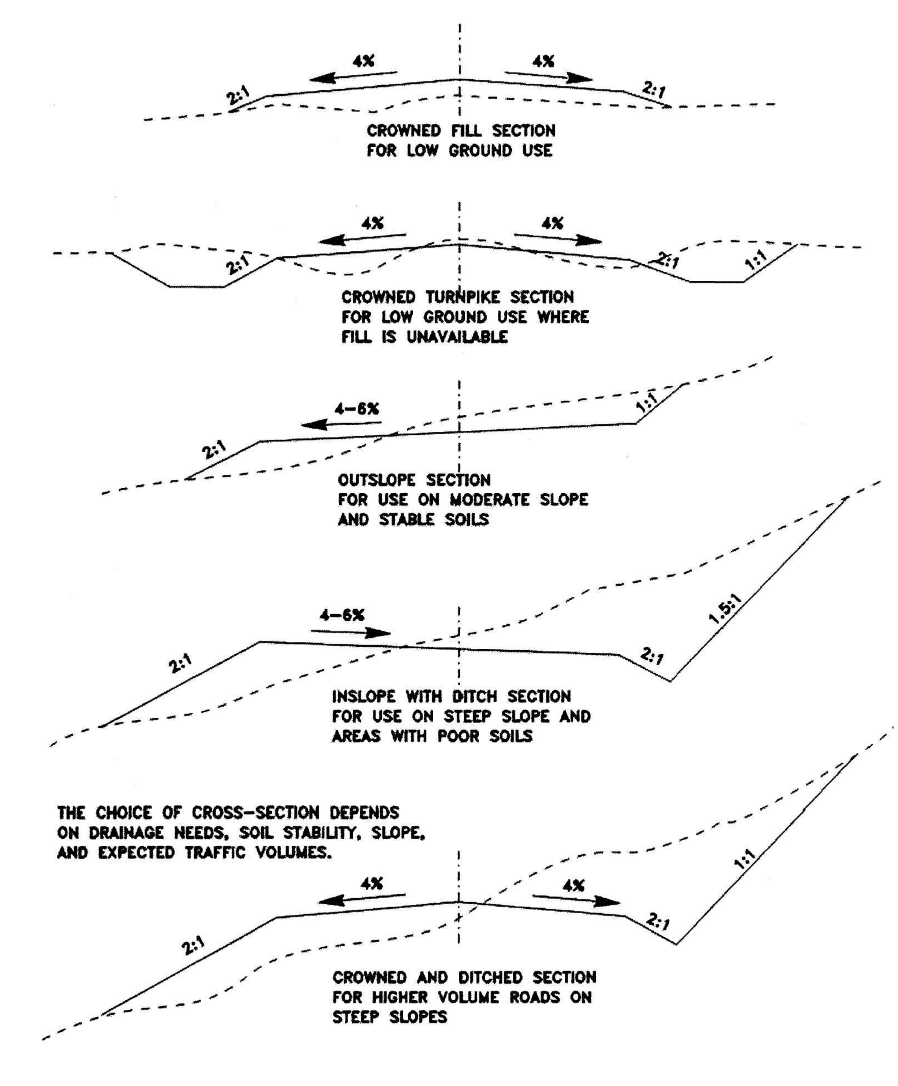


RIPRAP DIVERSION DETAIL

NOT TO SCALE

FIGURE 3.35.1

TYPES OF ROAD CROSS-SECTIONS



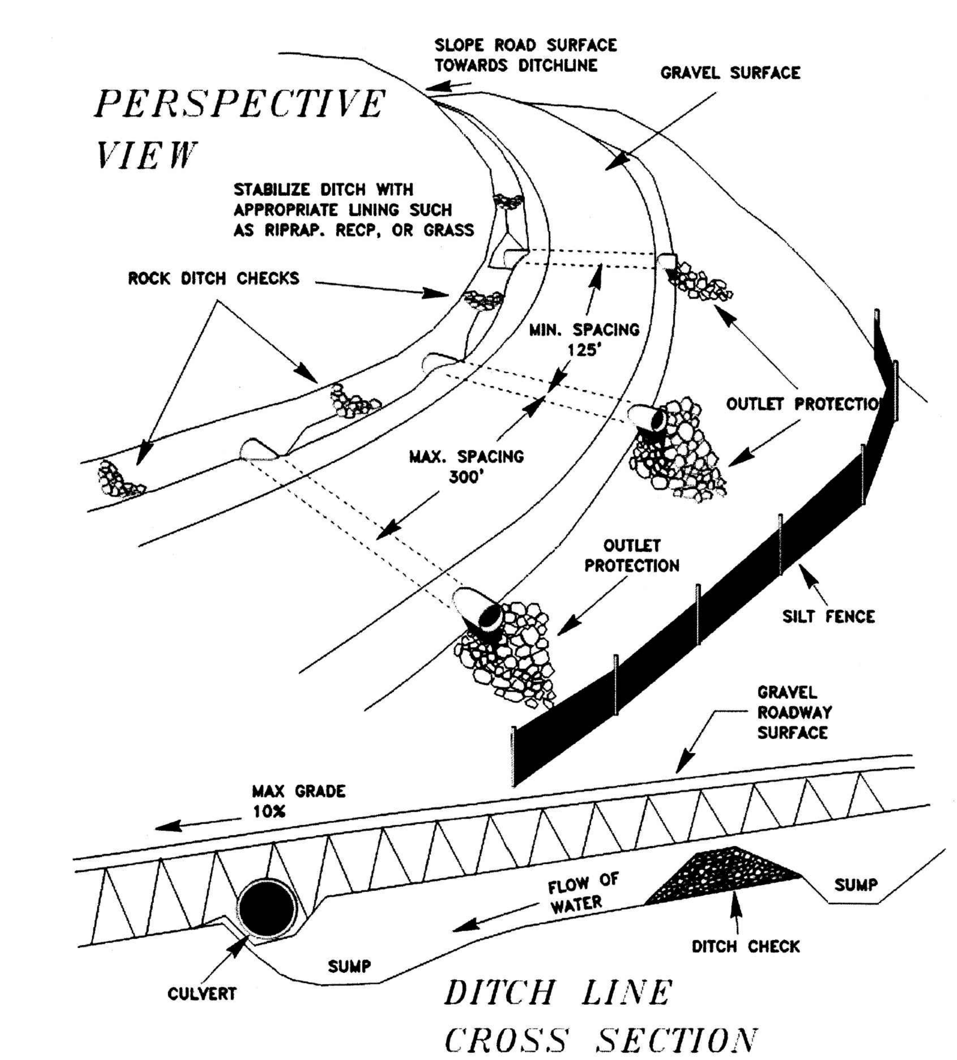
FROM: US FOREST SERVICE AND MICHIGAN DNR

TYPES OF ROAD CROSS-SECTIONS

NOT TO SCALE

FIGURE 3.35.2

SEDIMENT AND EROSION CONTROL FOR ACCESS ROADS AND DRIVEWAYS



SEDIMENT AND EROSION CONTROL FOR ACCESS ROADS AND DRIVEWAYS

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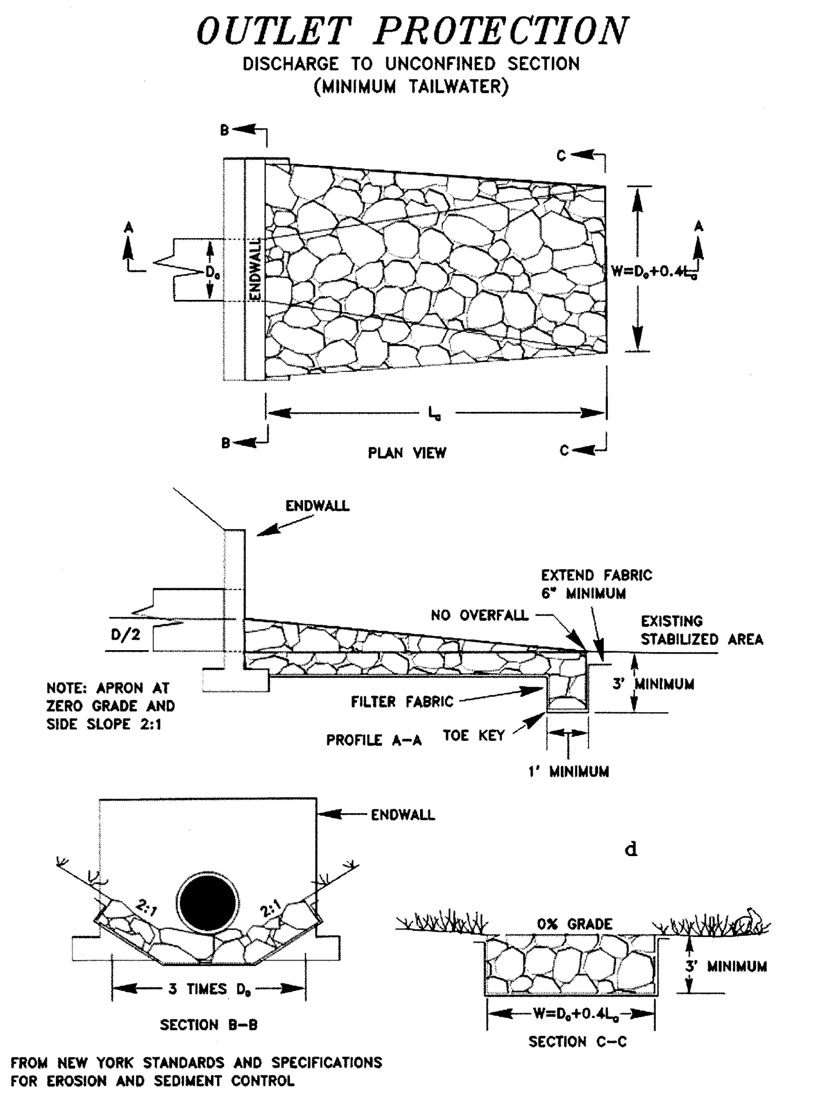
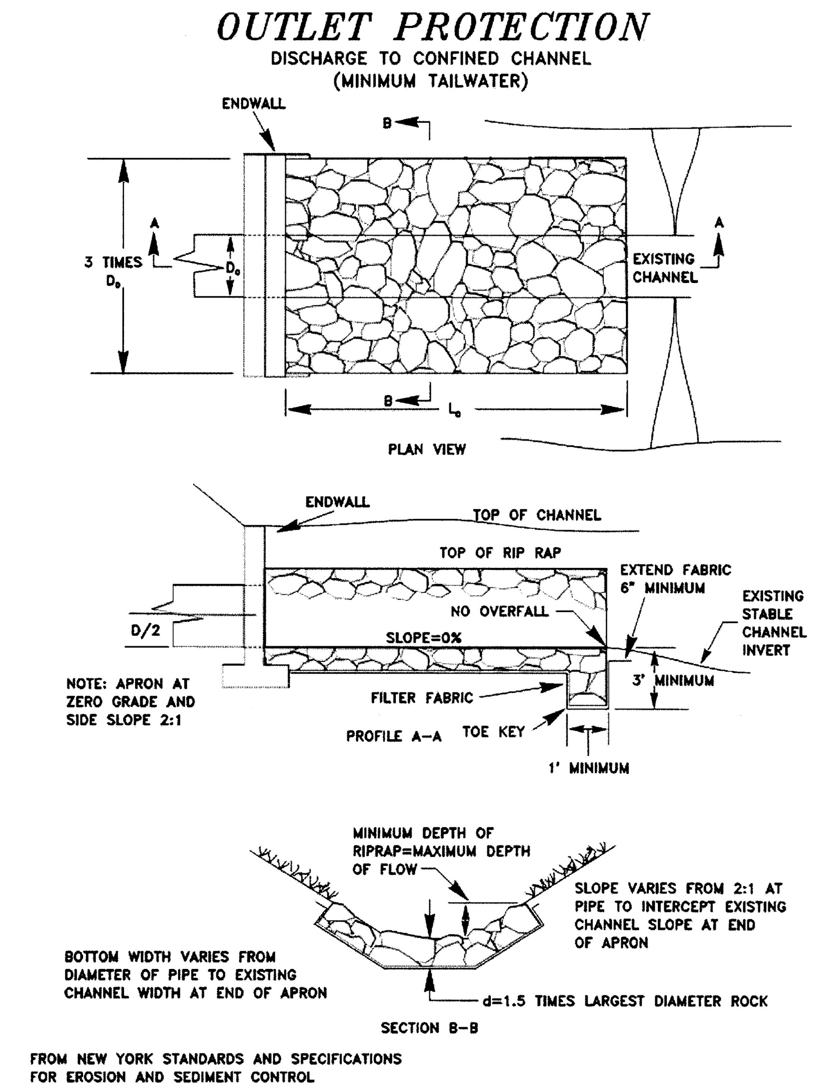
FIGURE 3.17.1



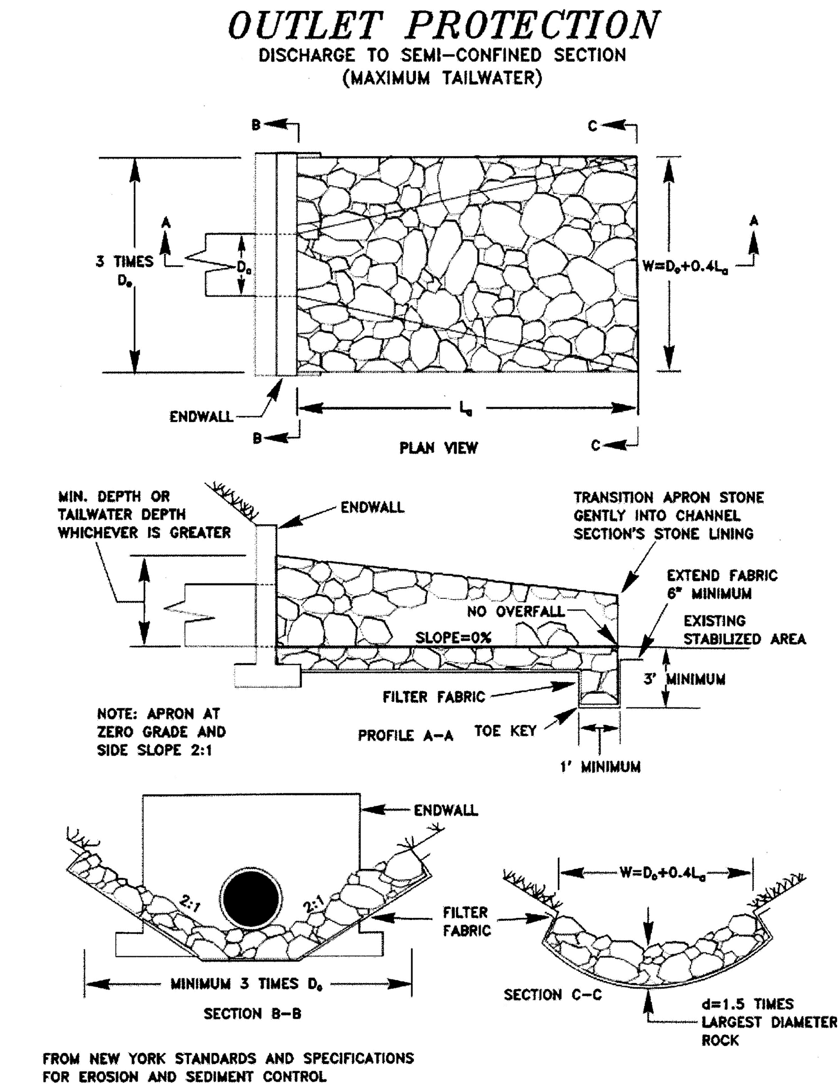
OUTLET PROTECTION UNCONFINED
NOT TO SCALE

FIGURE 3.17.2



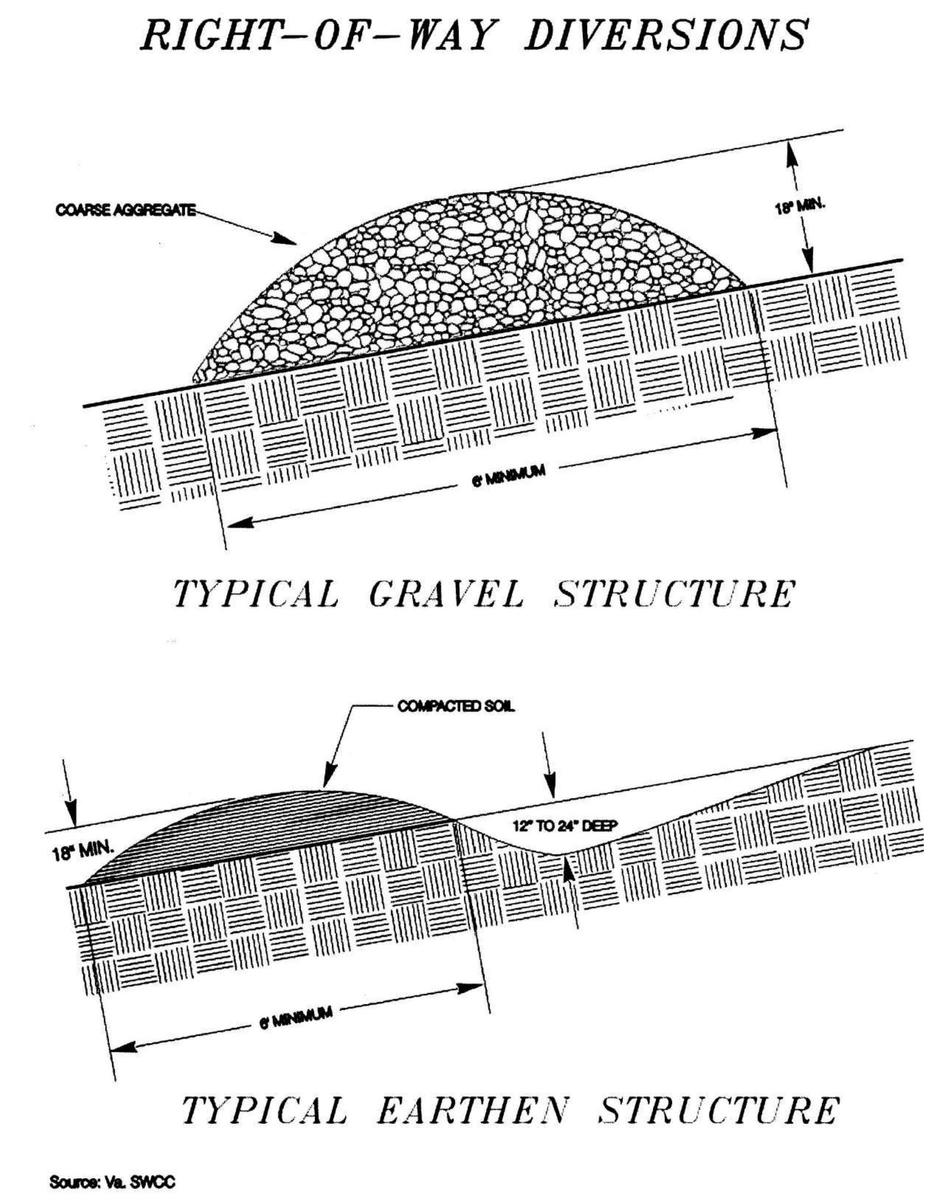
OUTLET PROTECTION CONFINED
NOT TO SCALE

FIGURE 3.17.3



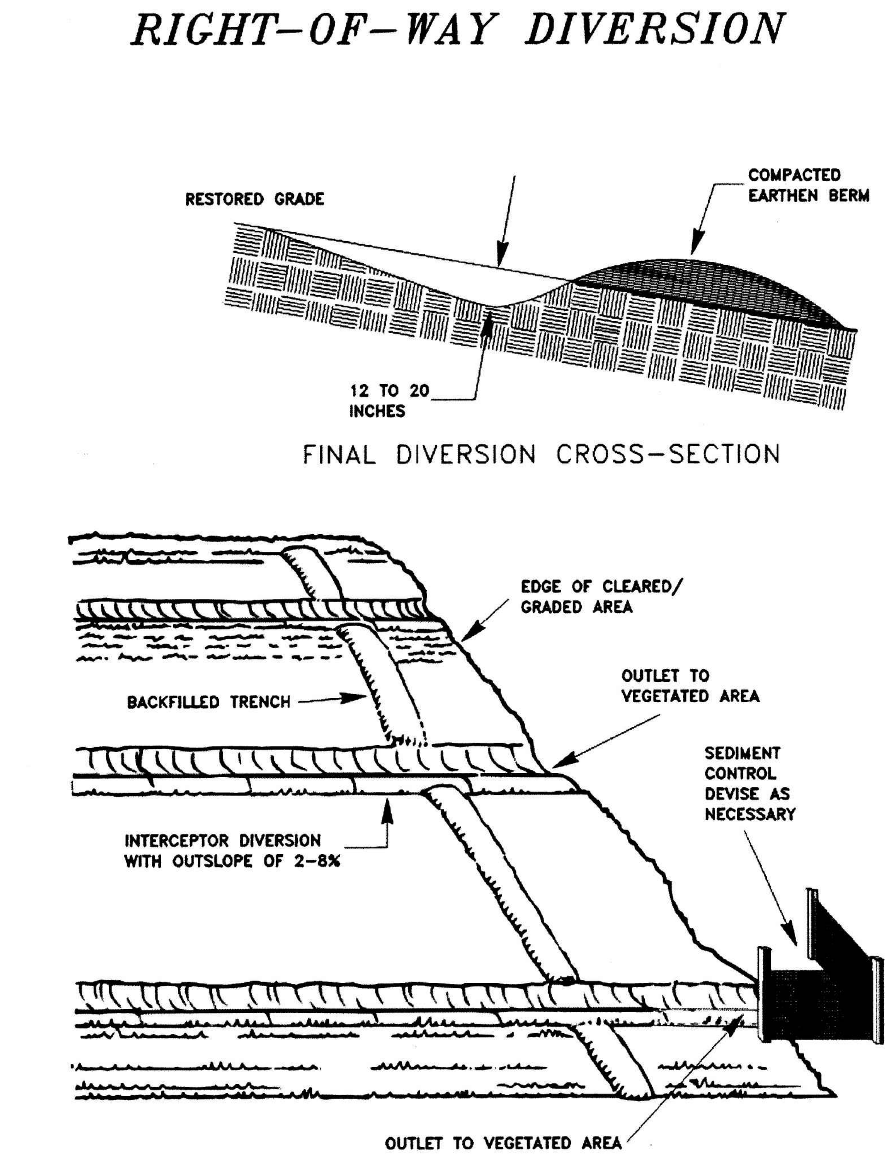
OUTLET PROTECTION SEMI–CONFINED
NOT TO SCALE

FIGURE 3.18.1

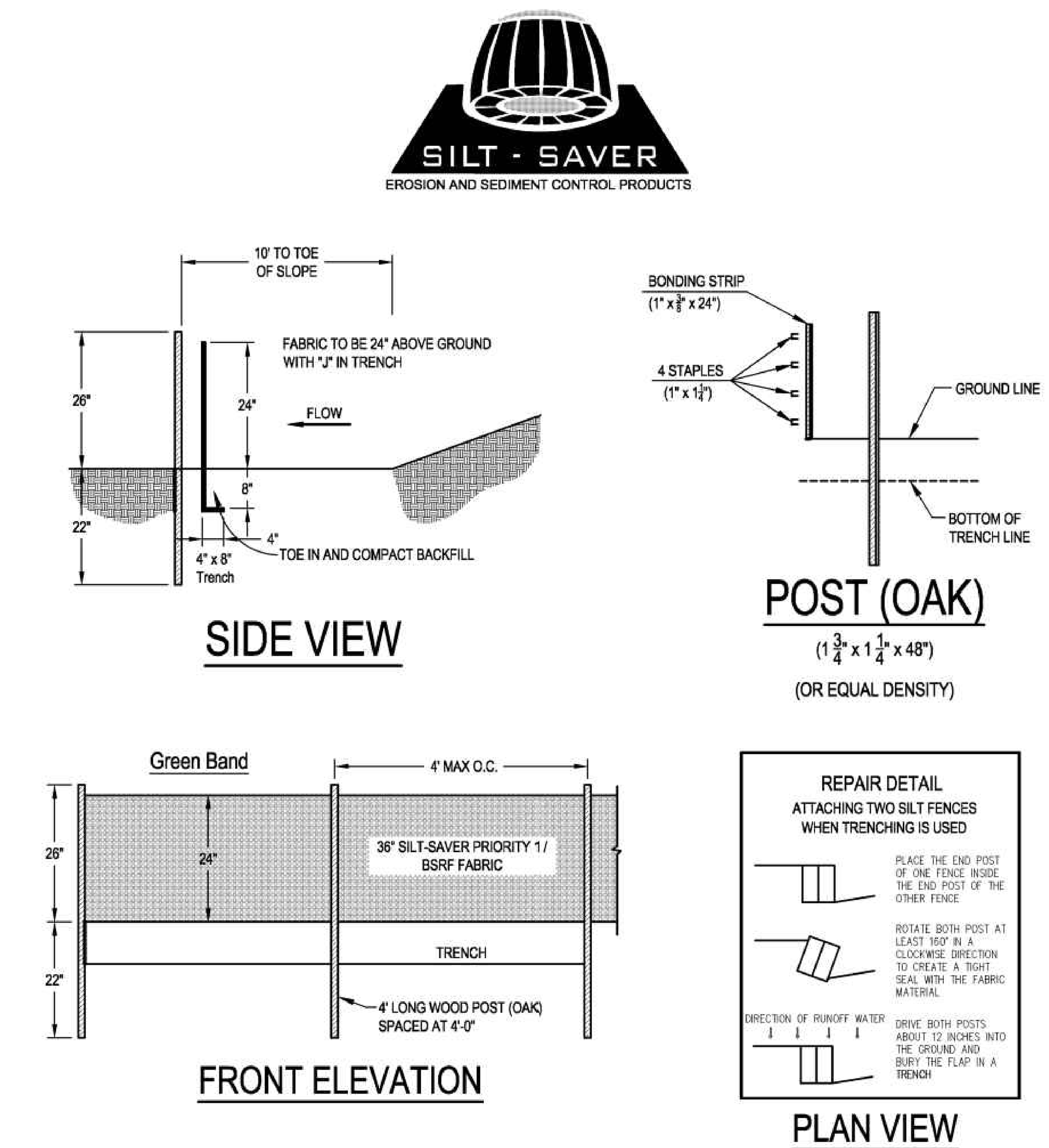


RIGHT–OF WAY DIVERSIONS
NOT TO SCALE

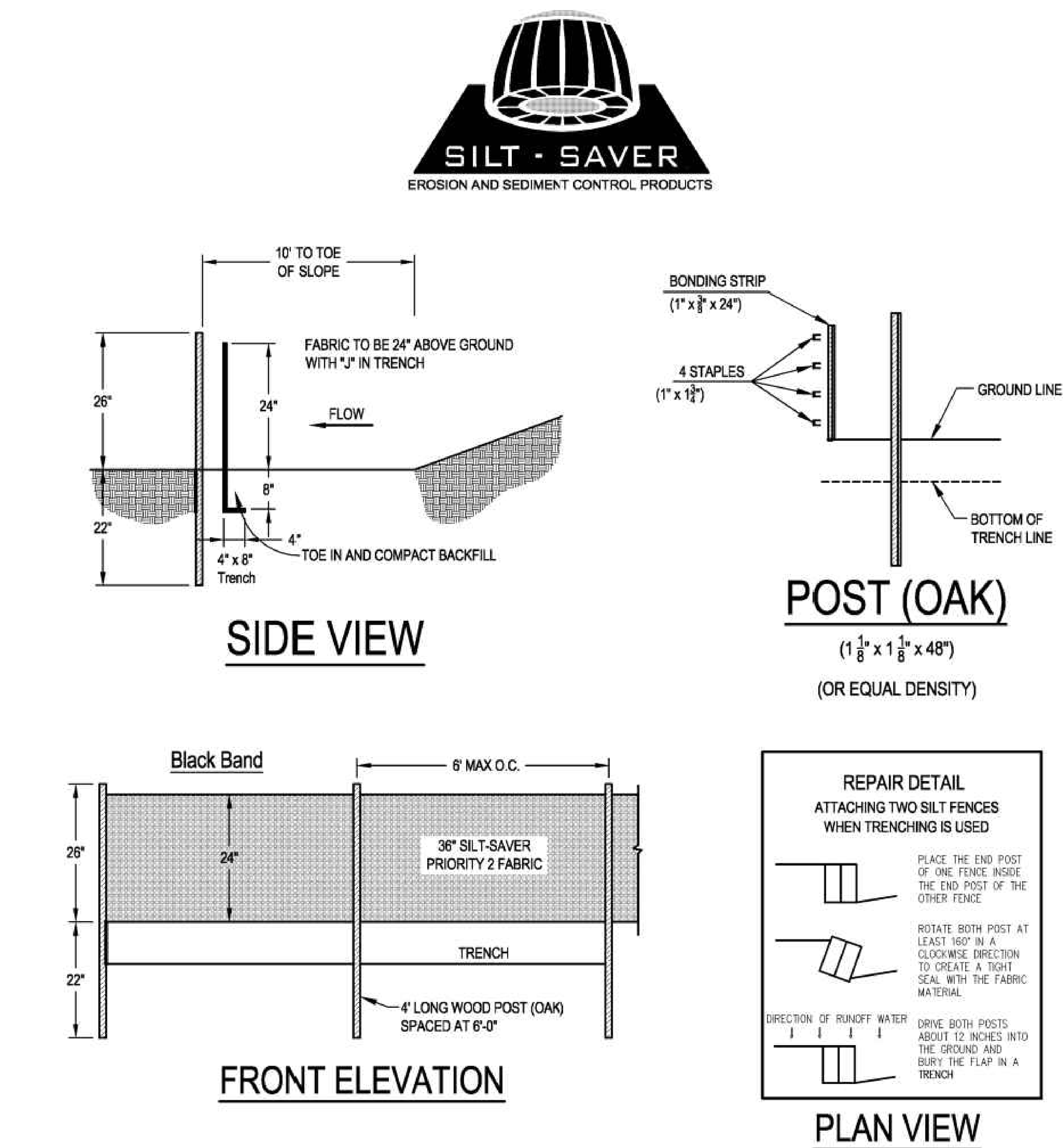
FIGURE 3.18.2



RIGHT–OF WAY DIVERSION
NOT TO SCALE

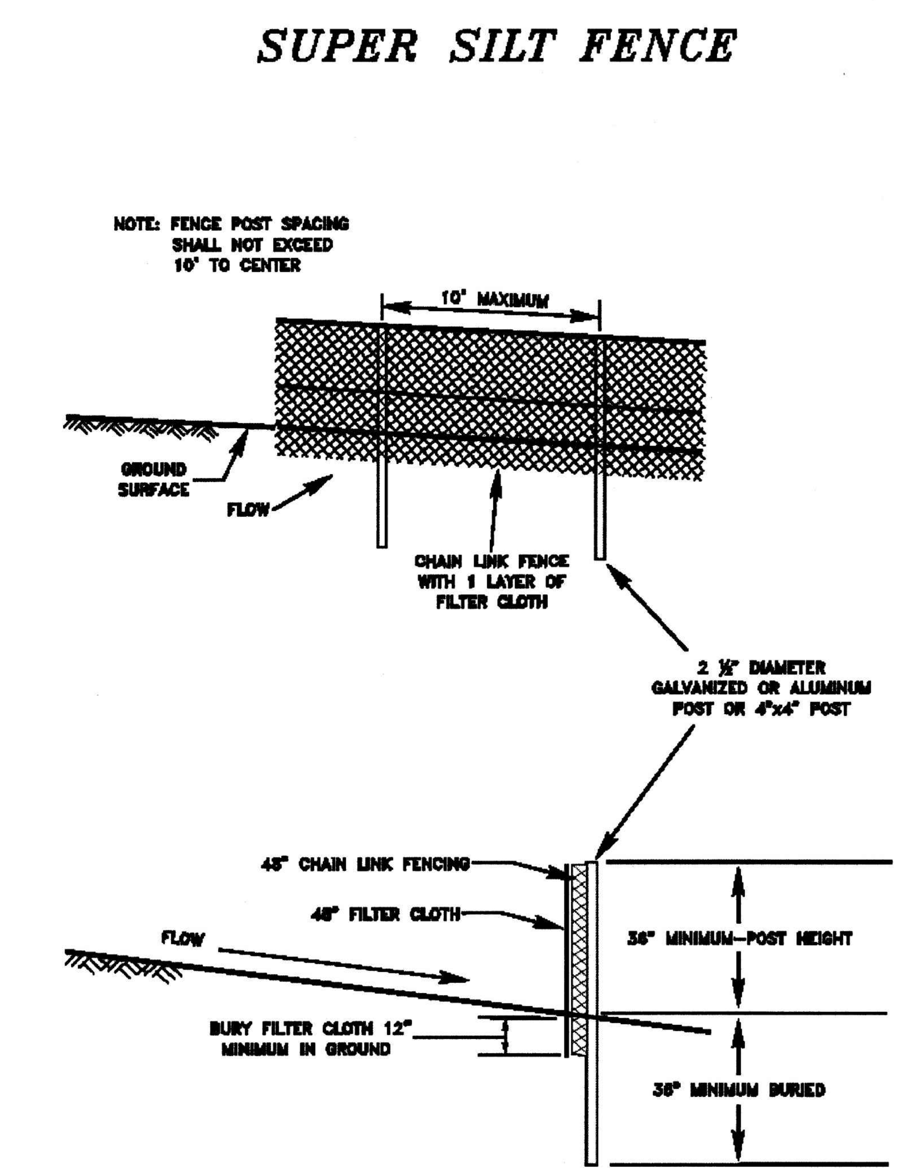


BELTED SILT RETENTION FENCE (BSRF)
PRIORITY 1 – GREEN BAND



BELTED SILT RETENTION FENCE (BSRF)
PRIORITY 2

FIGURE 3.28.1



SUPER SILT FENCE
NOT TO SCALE

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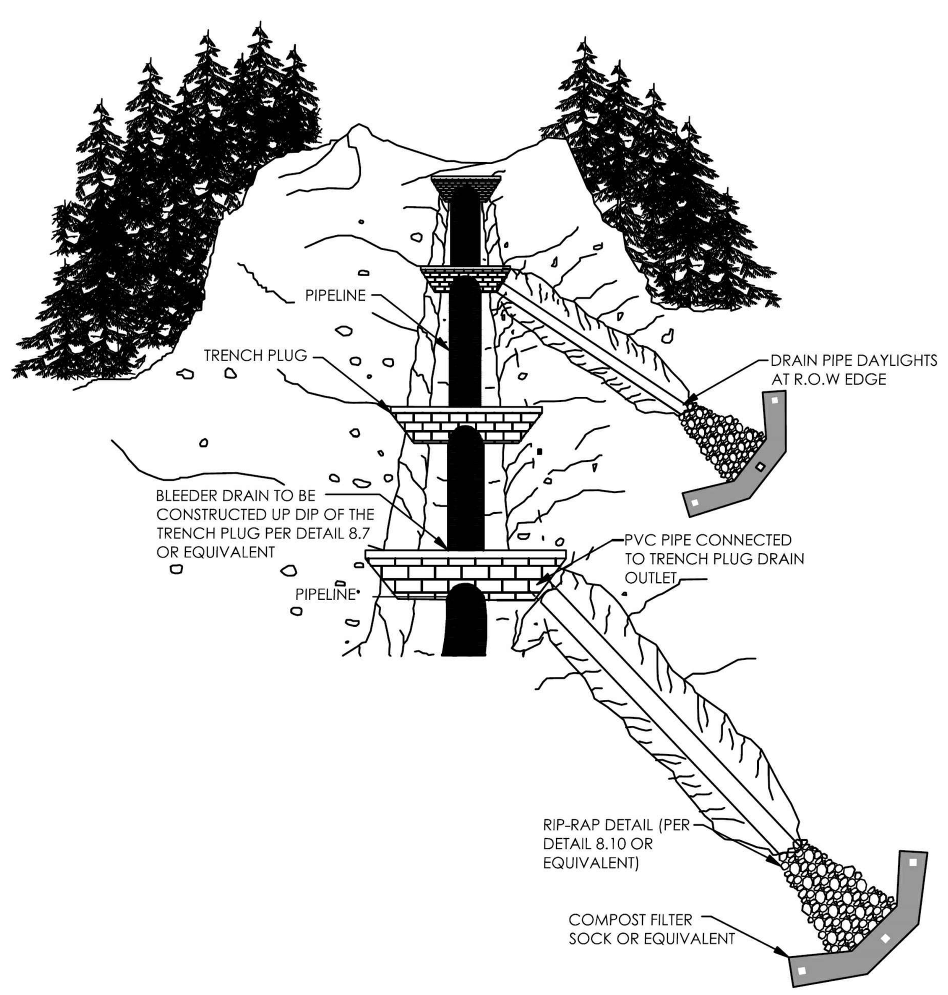
Where trenching activities are proposed in high slip potential soils and in areas where existing ground slopes are greater than 3:1, bleeder drains shall be installed to passively drain water from the trench area. The following illustration shows a drain placed at every second trench plug.

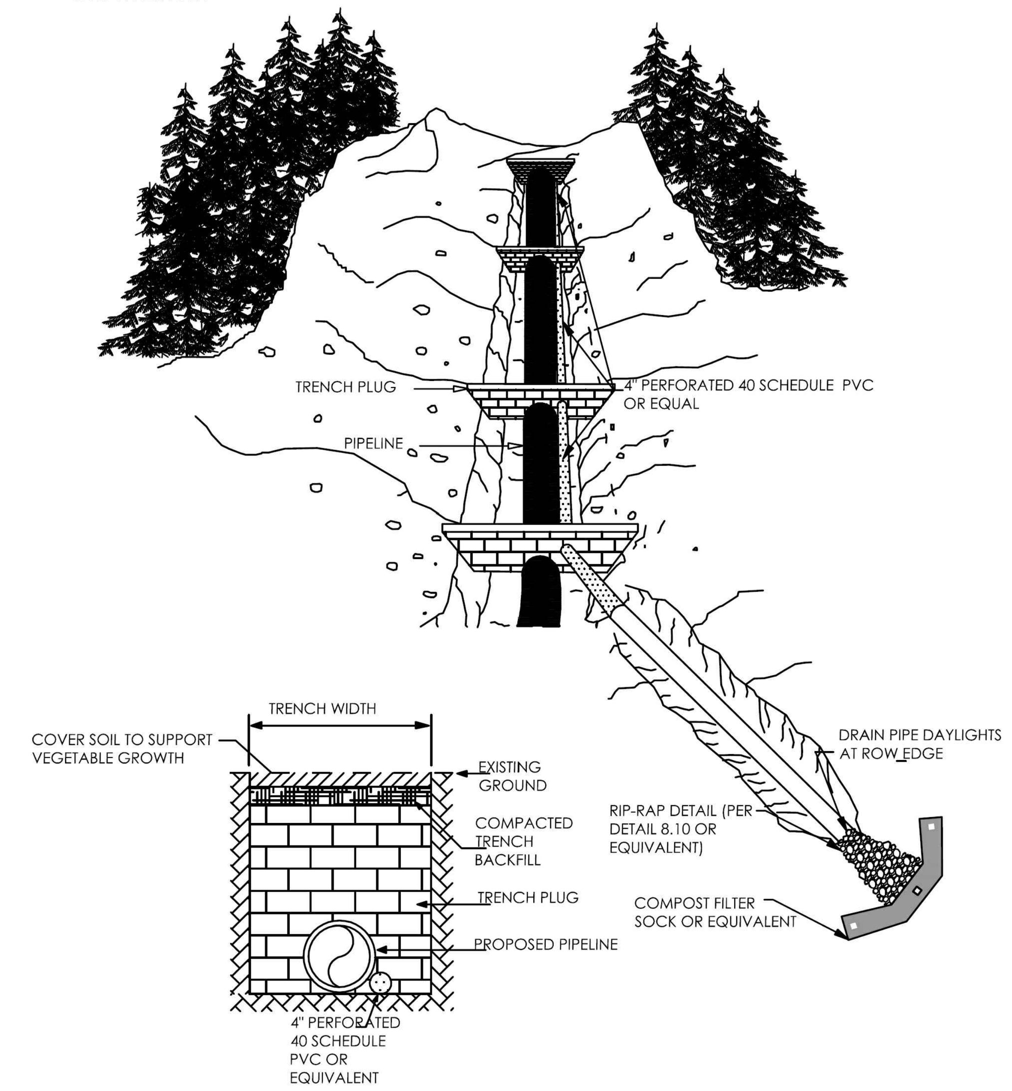


SLIP PREVENTION: BLEEDER DRAIN AND OUTLET DETAIL 8.4

SLIP PREVENTION: BLEEDER DRAIN AND OUTLET DETAIL

NOT TO SCALE

A bleeder drain placed parallel along the pipeline is an effective way to passively drain water from the backfilled trench area. This technique will reduce the number of outlets and control the placement of outlets. The following illustration shows this method.

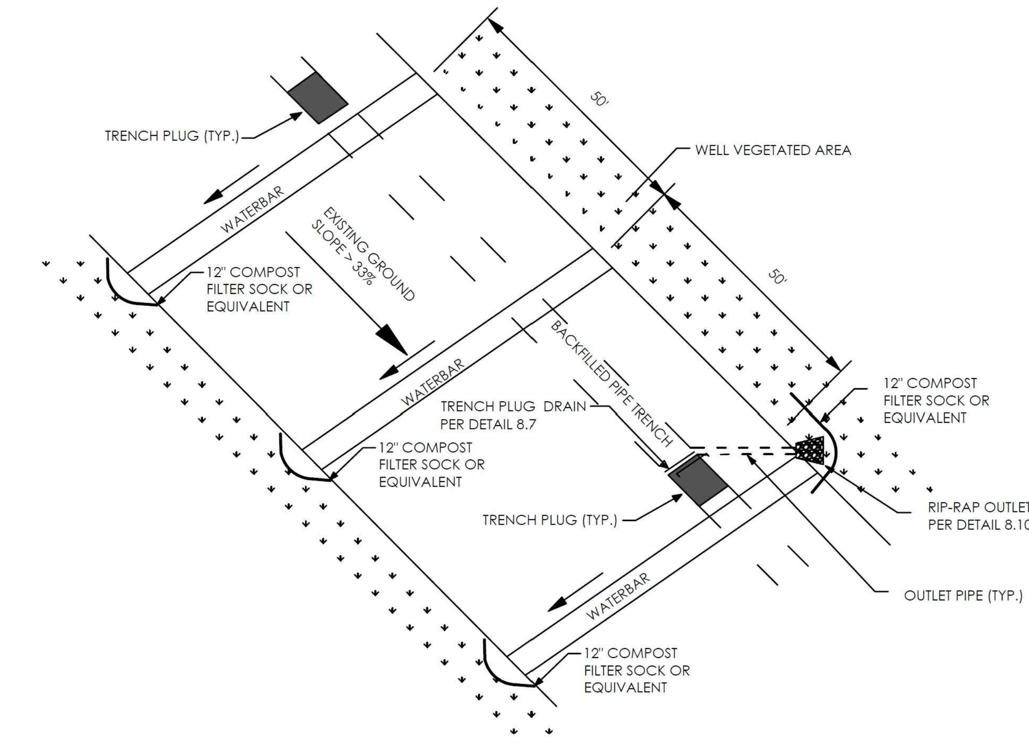


SLIP PREVENTION: BLEEDER DRAIN PARALLEL TO PIPELINE 8.5

SLIP PREVENTION: BLEEDER DRAIN PARALLEL TO PIPELINE

NOT TO SCALE

The outlets associated with pipeline trench drains are typically used in conjunction with right-of-way diversions. Used in this manner, additional outlets and sediment filter controls will not be needed. Spacing for trench plugs in high slip potential soils is related to the severity of the ROW slopes. Trench plug drains shall be installed at every other trench plug on slopes that are 30% or greater.



Spacing of Trench Plugs (Drains to be installed at every other Plug)

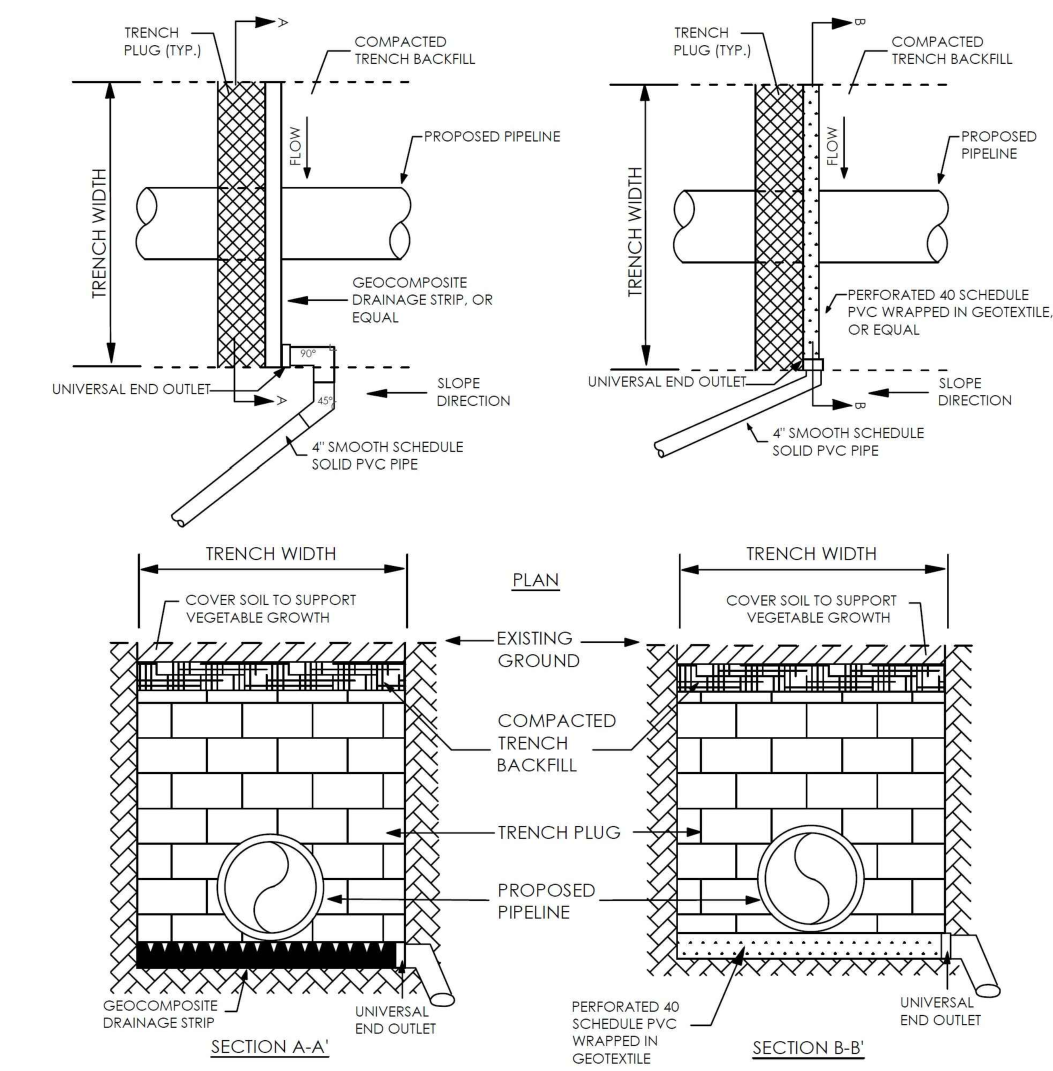
Percent Slope	Spacing in Feet
<5	*
5 - 15	500
15 - 25	300
25 - 35	200
➤ 35	100

NOT TO SCALE

SLIP PREVENTION: TRENCH PLUG DRAIN OVERVIEW 8.6

SLIP PREVENTION: TRENCH PLUG DRAIN OVERVIEW

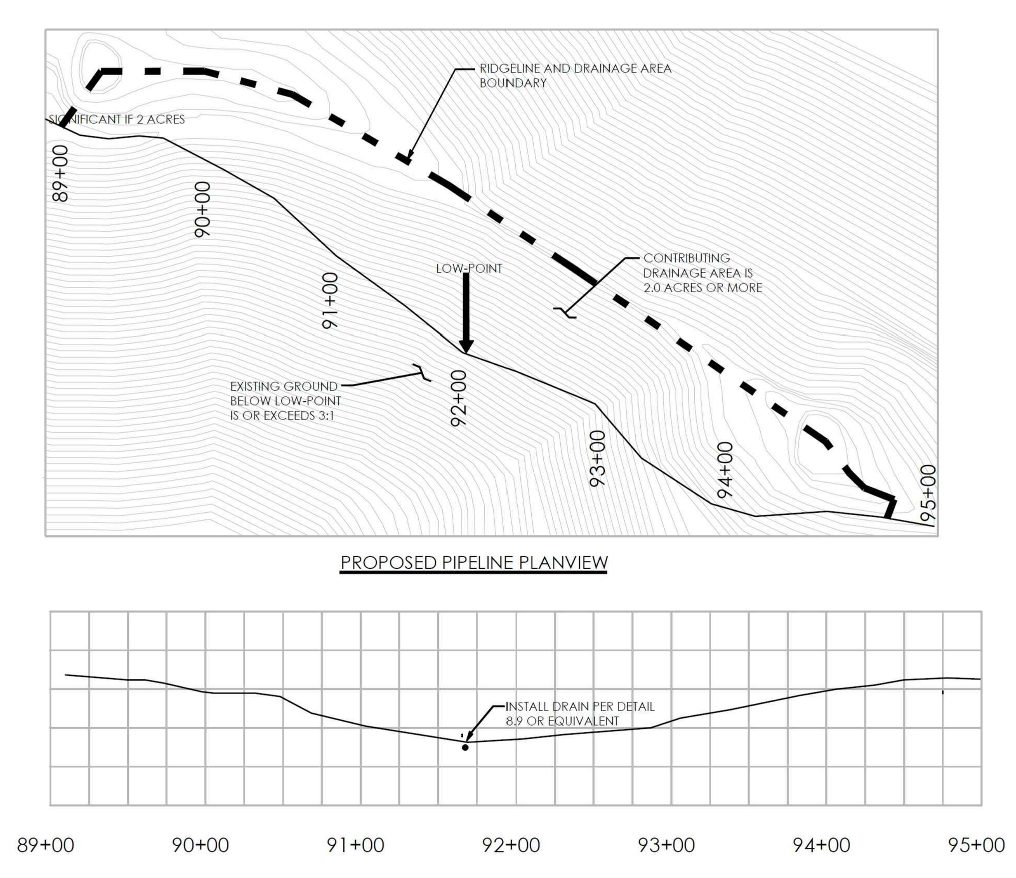
Two (2) types of trench plug drains are illustrated below. Geocomposite Drainage Strips or Perforated Schedule 40 PVC placed behind the trench plug and below the pipeline are effective ways to passively drain water. Both methods show Schedule 40 PVC discharge pipe at a minimum of a 2% grade.



SLIP PREVENTION: TRENCH PLUG DRAIN DETAILS 8.7

SLIP PREVENTION: TRENCH PLUG DRAIN DETAILS

Bleeder drains will sometimes be required at low points associated with side hill construction activities in high slip potential soils. Drainage from the undisturbed profile can infiltrate the backfilled soil within the trench and drain to a low point with the potential of saturating the soil. A drain shall be installed at low topographical areas where the existing ground slopes perpendicular to the ROW are greater than 3:1 and with significant contributing drainage area two (2) acres or more. Unusual conditions will be reviewed on a case by case basis.

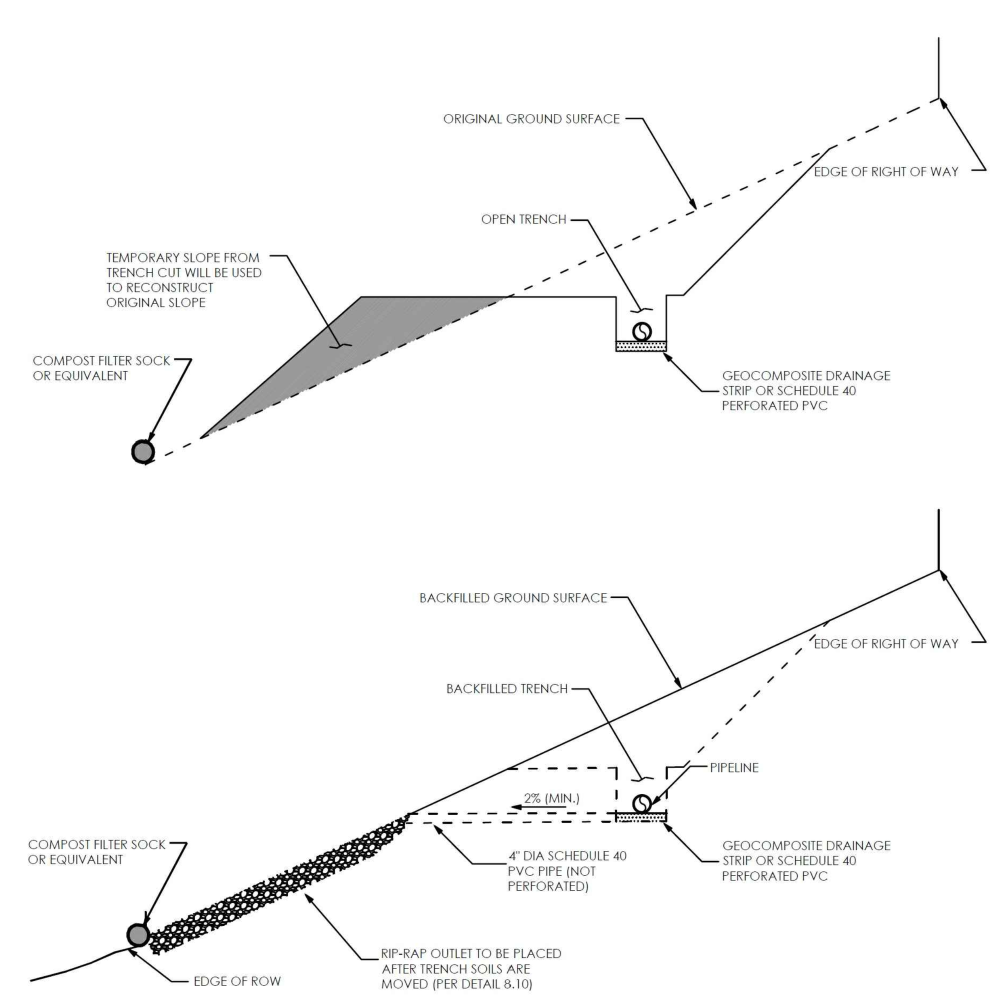


SLIP PREVENTION: SIDE HILL CONSTRUCTION 8.8

SLIP PREVENTION: SIDE HILL CONSTRUCTION

NOT TO SCALE

Two (2) types of low point drains are illustrated below. Geocomposite Drainage Strips or Perforated Schedule 40 PVC placed below the pipeline are effective ways to passively drain water. Both methods show Schedule 40 PVC discharge pipe at a minimum of a 2% grade.

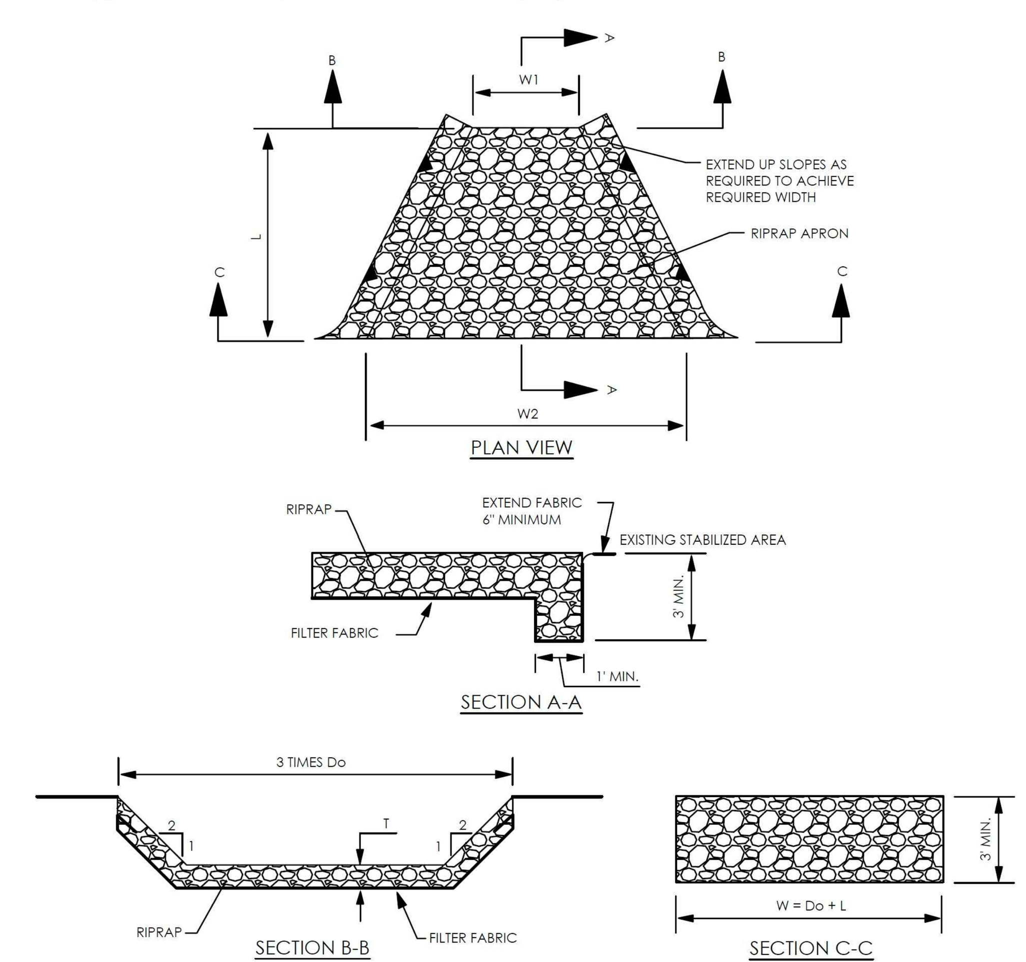


SLIP PREVENTION: SIDE HILL CONSTRUCTION DRAIN 8.9

SLIP PREVENTION: SIDE HILL CONSTRUCTION DRAIN

NOT TO SCALE

Outlet protection structures prevent scour and erosions at discharge outlets by dissipating the energy and reducing velocities. The illustration below show a typical application of an apron lined with rock riprap.



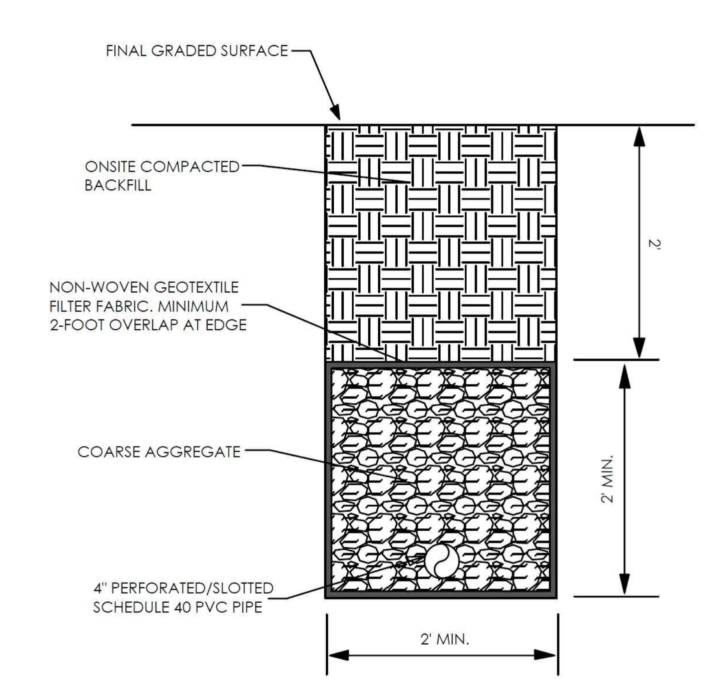
APRON ID	L* (FT)	W1 (FT)	W2 (FT)	D50 (IN)	T (FT)	RIPRAP	CY OF STONE
DRAIN OUTLET	4	2	6	3	1	R - 3	2.00

SLIP PREVENTION: DRAIN OUTLET RIP-RAP OUTLET 8.10

SLIP PREVENTION: DRAIN OUTLET RIP-RAP OUTLET

NOT TO SCALE

French drains can be constructed to passively drain water away from the trench area. These drains can be installed at seepage areas encountered during construction. These drains should be sloped at a minimum of 2% to the outlet locations

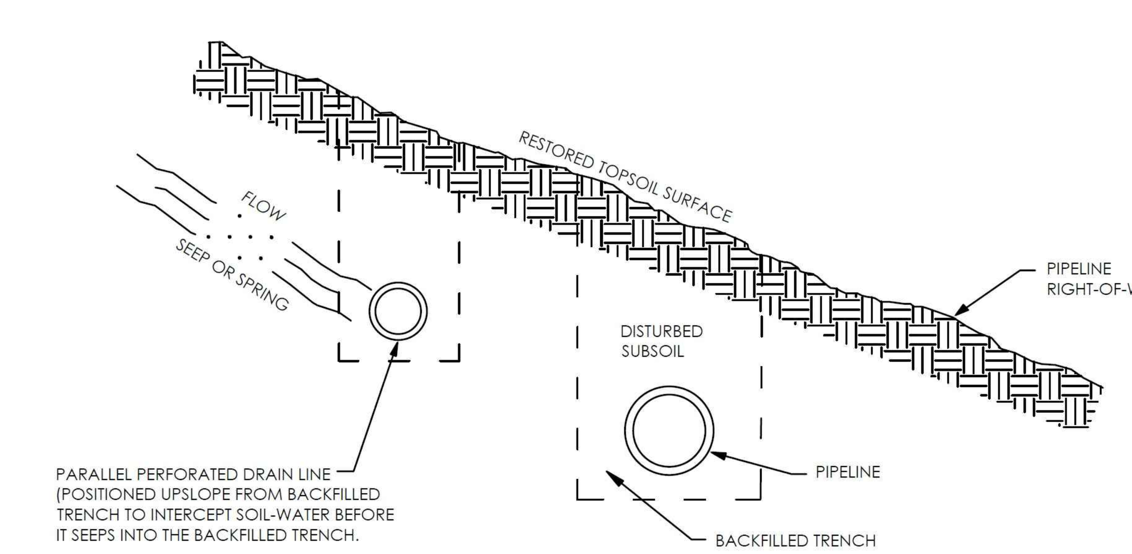


SLIP PREVENTION: SUBSURFACE DRAIN (FRENCH DRAIN) 8.11

SLIP PREVENTION: SUBSURFACE DRAIN (FRENCH DRAIN)

NOT TO SCALE

Parallel drainage tiles can be installed at seepage areas encountered during construction. The drains may be perforated PVC or geocomposite drain strips placed between the seepage area and the pipeline to intercept soil-water before it seeps into the open or backfilled trenchline. These drains should be sloped at a minimum of 2% to the outlet locations.



SLIP PREVENTION: SEEP INTERCEPT DRAIN PARALLEL TO TRENCH 8.12

SLIP PREVENTION: SEEP INTERCEPT DRAIN PARALLEL TO TRENCH

NOT TO SCALE

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ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT I

Typical Erosion & Sedimentation Control Details - Virginia

The following construction details are taken from the Virginia Erosion and Sediment Control Handbook (VESCH), Third Edition, 1992, as amended. Specific details and guidelines are covered more completely in Chapter 3 of the VESCH.

The Contractor must go to the VESCH to reference practices that are covered in the specification but not listed below.

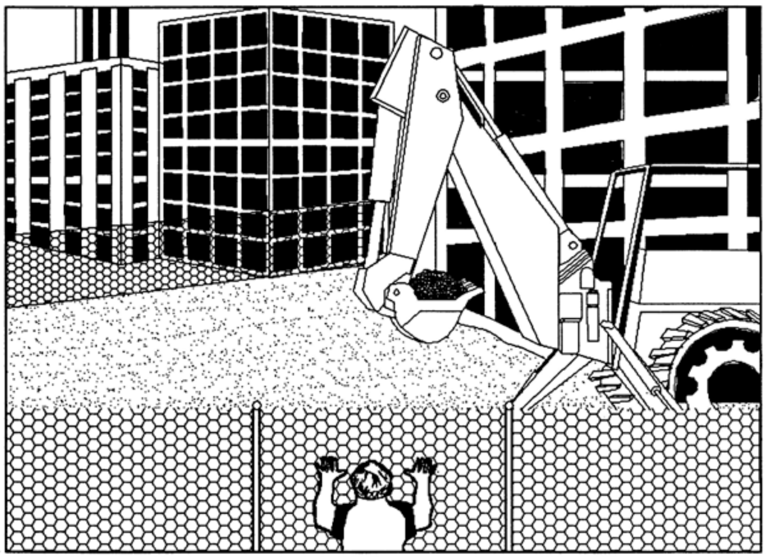
Practice	**Title**	**Key**
3.01	Safety Fence……………………………………………	SAF
3.02	Temporary Stone Construction Entrance..................	CE
3.04	Straw Bale Barrier...	STB
3.05	Silt Fence	SF
3.07	Storm Drain Inlet Protection.....................................	IP
3.09	Temporary Diversion Dike	DD
3.10	Temporary Fill Diversion	FD
3.11	Temporary Right-Of-Way Diversion.........................	RWD
3.12	Diversion..	DV
3.18	Outlet Protection	OP
3.19	RipRap	RR
3.20	Rock Check Dams...	CD
3.24	Temporary Vehicular Stream Crossing	SC
3.25	Utility Stream Crossing..	USC
3.26	Dewatering Structure………………………………..	DS
3.36	Soil Stabilization Blankets & Matting………………	B/M

The following items are specific to the practices within this document and are not found in the VESCH manual. Details for these items are located at the end of this appendix following the items listed above.

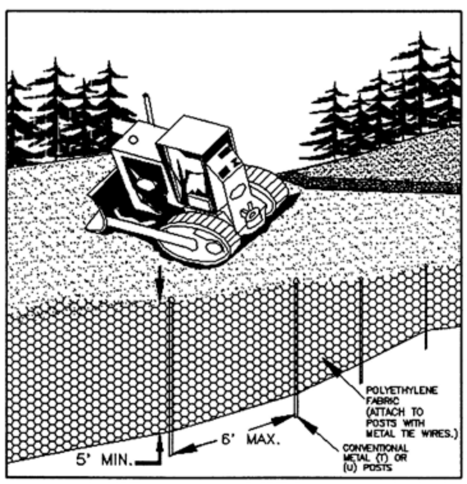
Timber Mat Stabilization	TM
Geotextile Bag/Dewatering Bag	GB

1992 3.01

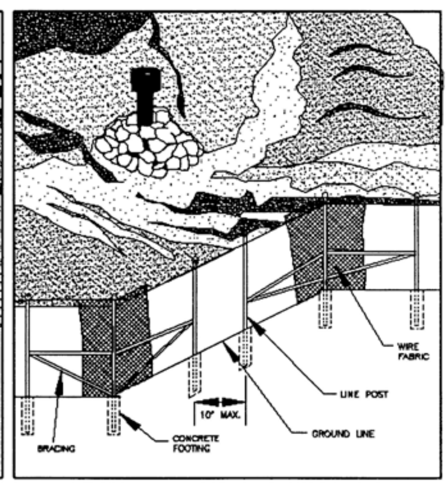
SAFETY FENCE



PERSPECTIVE VIEW



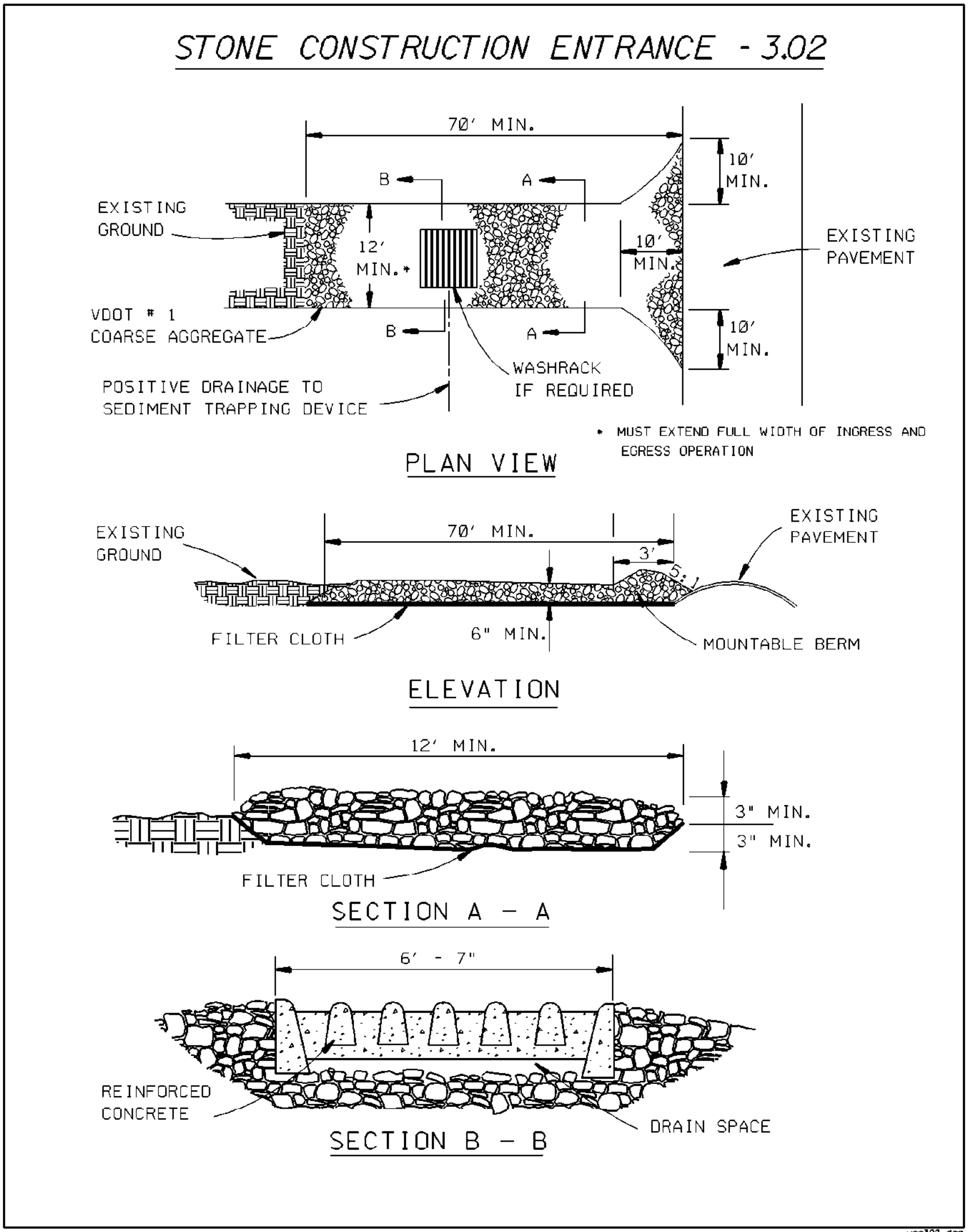
PERSPECTIVE VIEW
PLASTIC FENCE

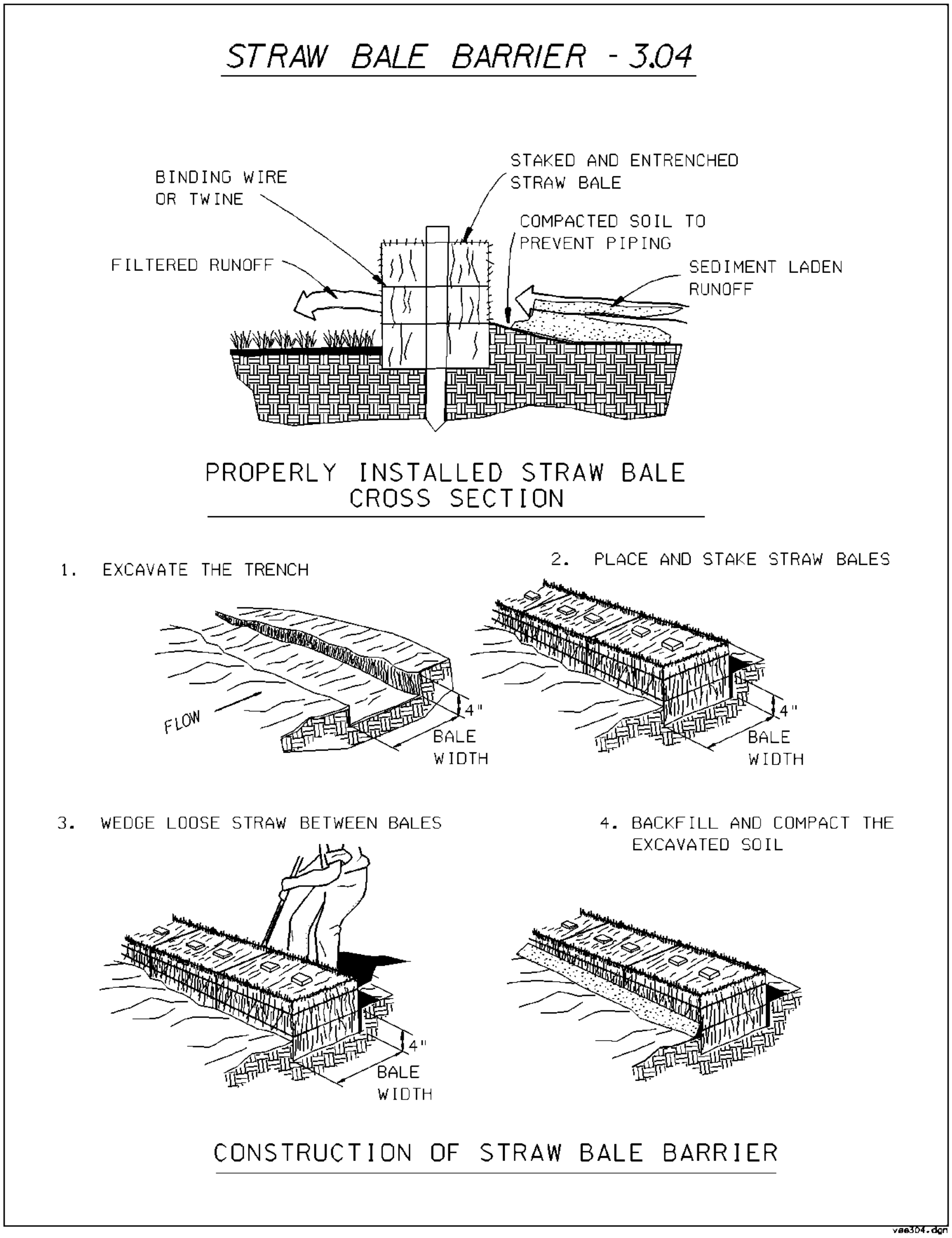


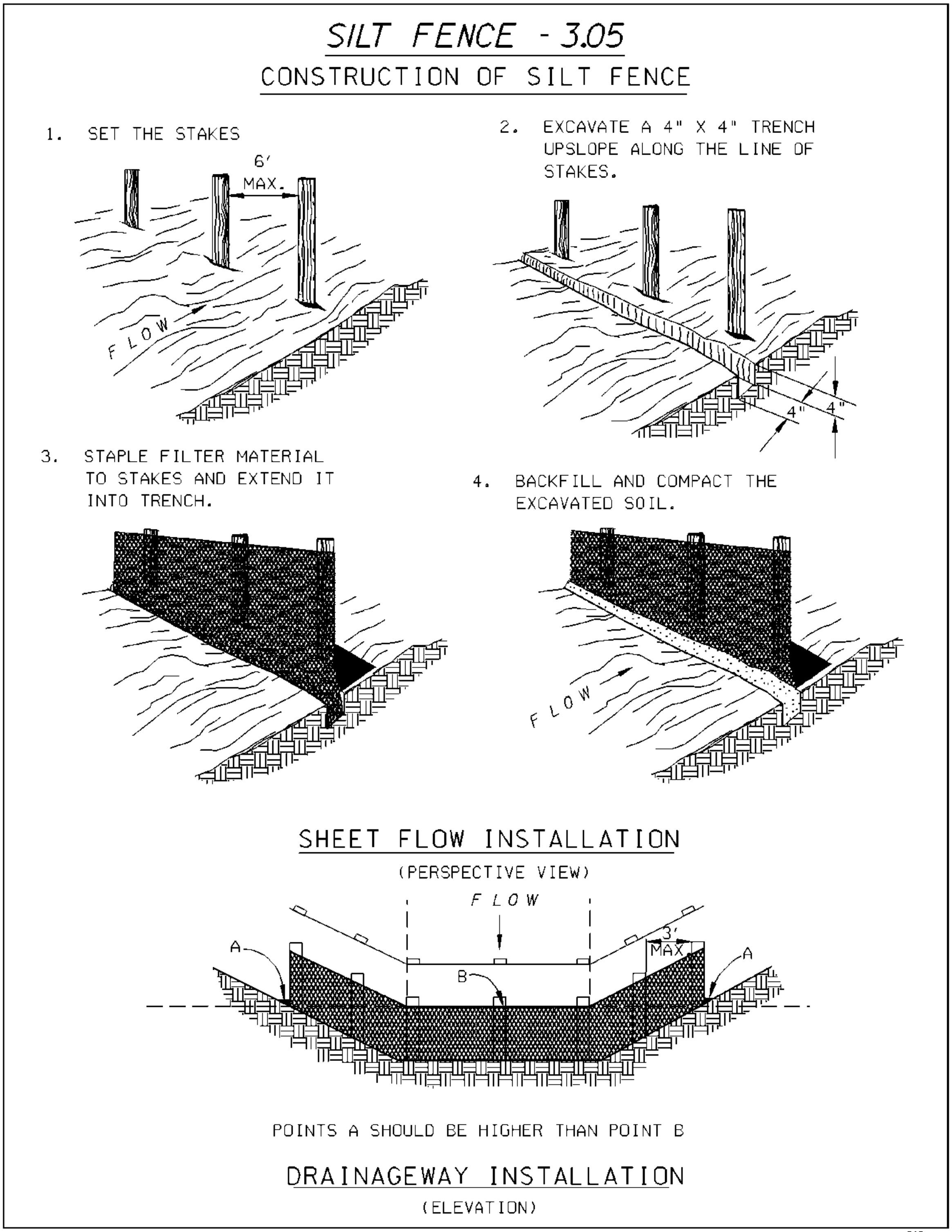
PERSPECTIVE VIEW
METAL FENCE

Source: Adapted from Conwed Plastics and VDOT Road and Bridge Standards

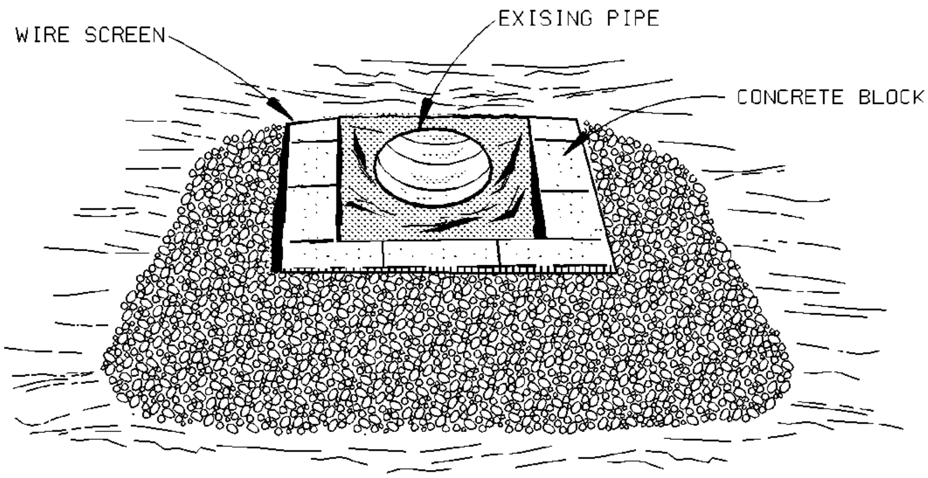
Plate 3.01-1

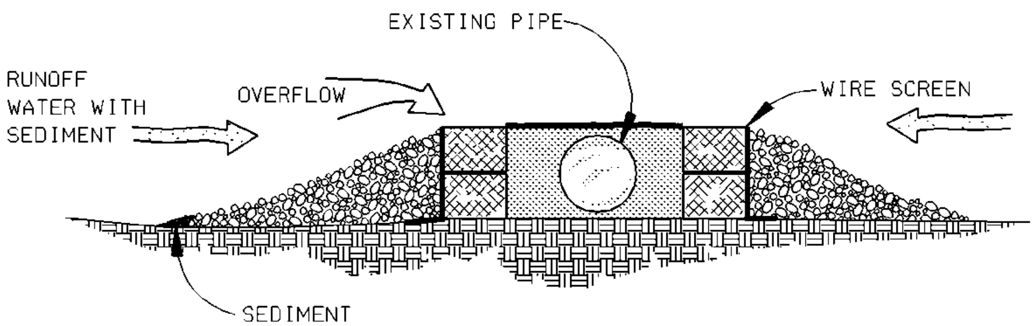

STONE CONSTRUCTION ENTRANCE - 3.02
70' MIN.
10' MIN.
B
A
EXISTING GROUND
12' MIN.*
10' MIN.
EXISTING PAVEMENT
VDOT # 1 COARSE AGGREGATE
WASHRACK IF REQUIRED
POSITIVE DRAINAGE TO SEDIMENT TRAPPING DEVICE
* MUST EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION
PLAN VIEW
EXISTING GROUND
70' MIN.
3'
5:1
EXISTING PAVEMENT
FILTER CLOTH
6" MIN.
MOUNTABLE BERM
ELEVATION
12' MIN.
3" MIN.
3" MIN.
FILTER CLOTH
SECTION A - A
6' - 7"
REINFORCED CONCRETE
DRAIN SPACE
SECTION B - B
vee302.dgn


STRAW BALE BARRIER - 3.04
BINDING WIRE
OR TWINE
STAKED AND ENTRENCHED
STRAW BALE
COMPACTED SOIL TO
PREVENT PIPING
FILTERED RUNOFF
SEDIMENT LADEN
RUNOFF
PROPERLY INSTALLED STRAW BALE
CROSS SECTION
1. EXCAVATE THE TRENCH
FLOW
4"
BALE
WIDTH
2. PLACE AND STAKE STRAW BALES
4"
BALE
WIDTH
3. WEDGE LOOSE STRAW BETWEEN BALES
4"
BALE
WIDTH
4. BACKFILL AND COMPACT THE
EXCAVATED SOIL
CONSTRUCTION OF STRAW BALE BARRIER
vas304.dgn


SILT FENCE - 3.05
CONSTRUCTION OF SILT FENCE
1. SET THE STAKES
6' MAX.
FLOW
2. EXCAVATE A 4" X 4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.
4"
4"
3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO TRENCH.
4. BACKFILL AND COMPACT THE EXCAVATED SOIL.
FLOW
SHEET FLOW INSTALLATION
(PERSPECTIVE VIEW)
FLOW
A
B
3' MAX
A
POINTS A SHOULD BE HIGHER THAN POINT B
DRAINAGEWAY INSTALLATION
(ELEVATION)
vaa305.dgn

INLET PIPE PROTECTION - 3.07

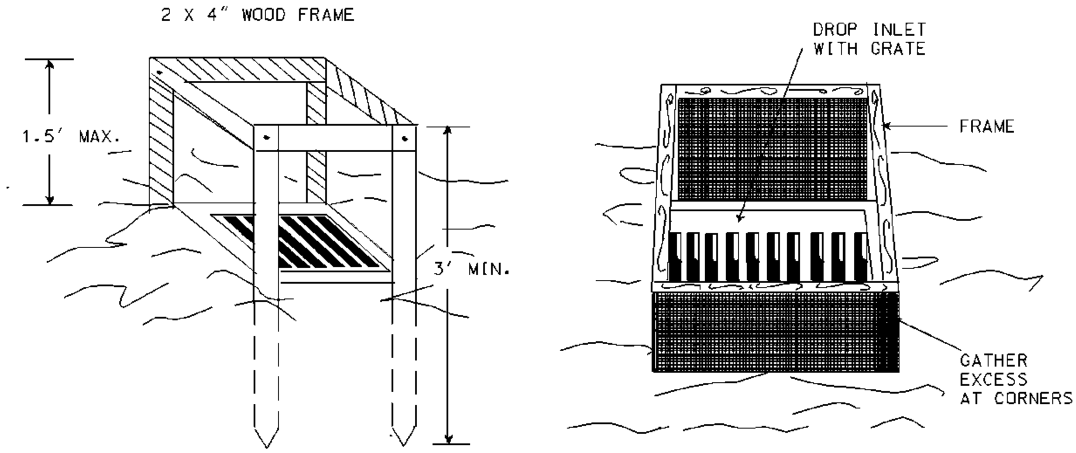




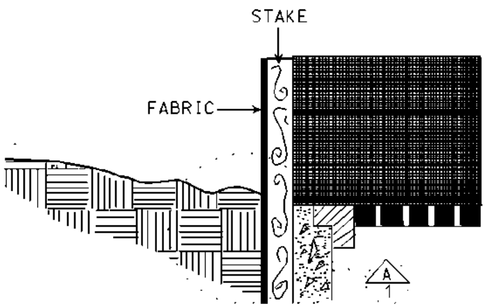
BLOCK AND GRAVEL PIPE INLET SEDIMENT FILTER

THIS METHOD OF INLET PROTECITON IS APPLICABLE WHERE HEAVY FLOWS ARE EXPECTED, AND WHERE AN OVERFLOW CAPACITY IS NECESSARY TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

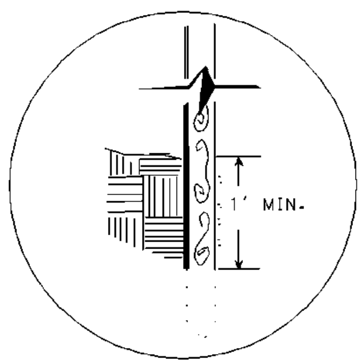
SILT FENCE DROP INLET PROTECTION - 3.07-I



PERSPECTIVE VIEWS



ELEVATION OF STAKE AND FABRIC ORIENTATION

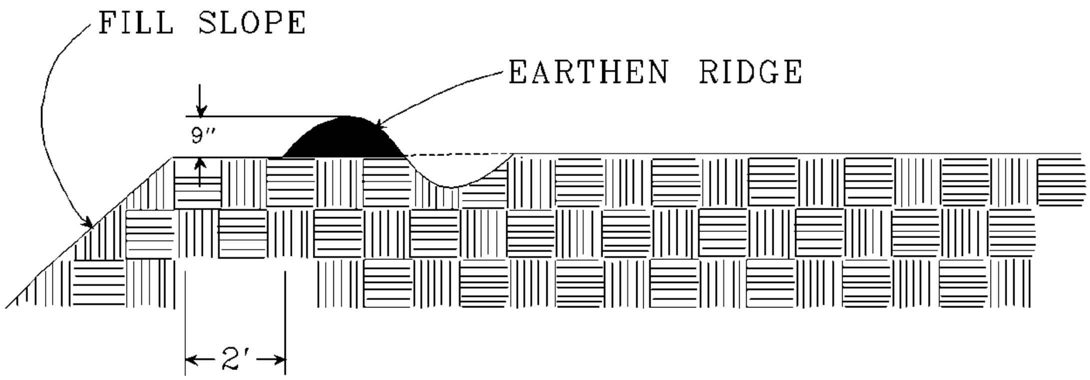


DETAIL A

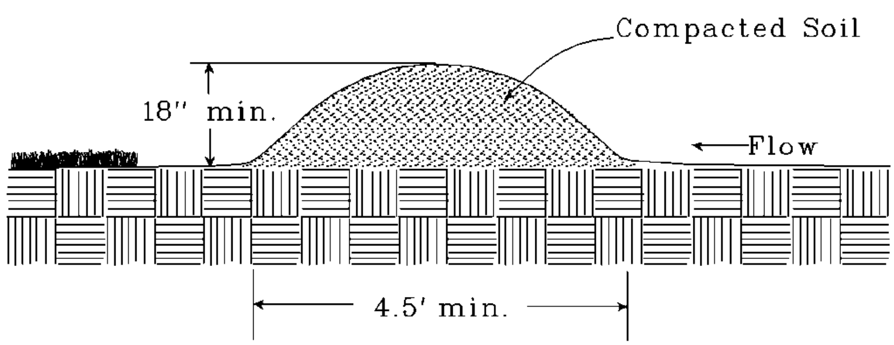
SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE THE INLET DRAINS A RELATIVELY FLAT AREA (SLOPE NO GREATER THAN 5%) WHERE THE INLET SHEET OR OVERLAND FLOWS (NOT EXCEEDING 1 C.F.S.) ARE TYPICAL. THE METHOD SHALL NOT APPLY TO INLETS RECEIVING CONCENTRATED FLOWS, SUCH AS IN STREET OR HIGHWAY MEDIANS.

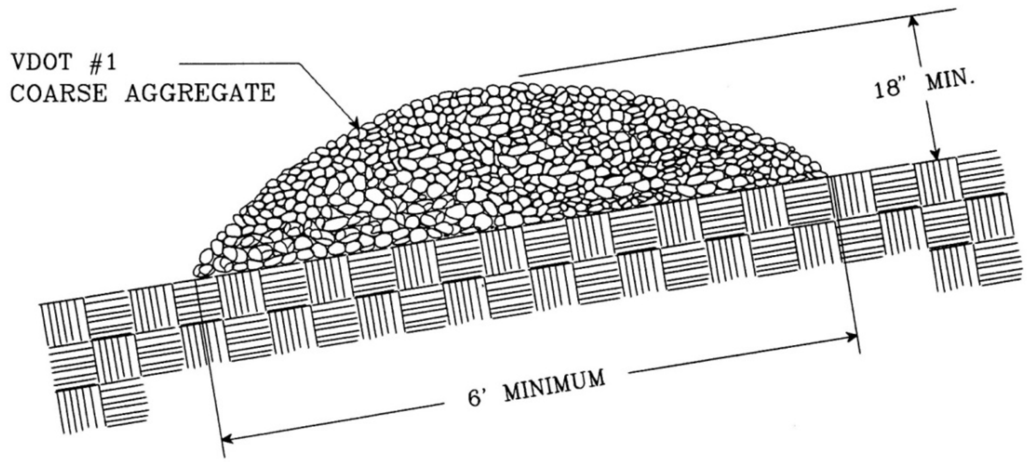
TEMPORARY FILL DIVERSION - 3.10



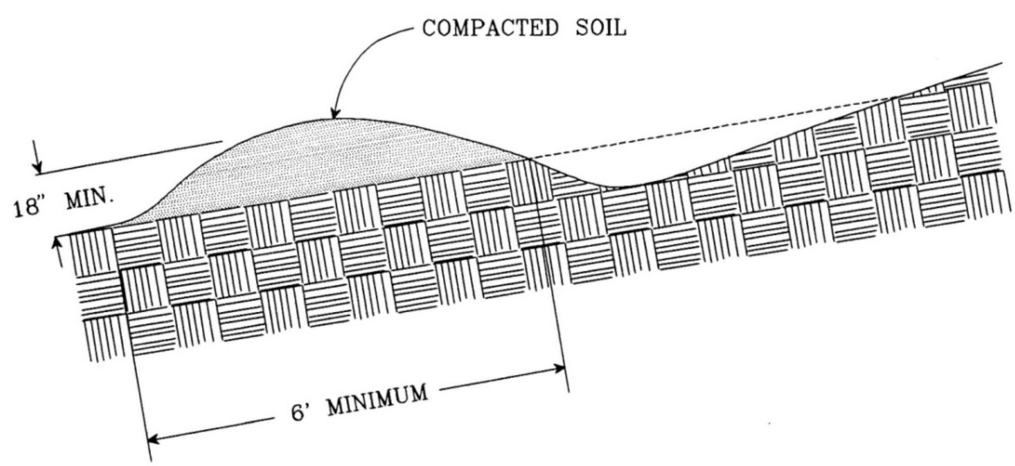
TEMPORARY DIVERSION DIKE - 3.09



TEMPORARY RIGHT–OF–WAY DIVERSIONS

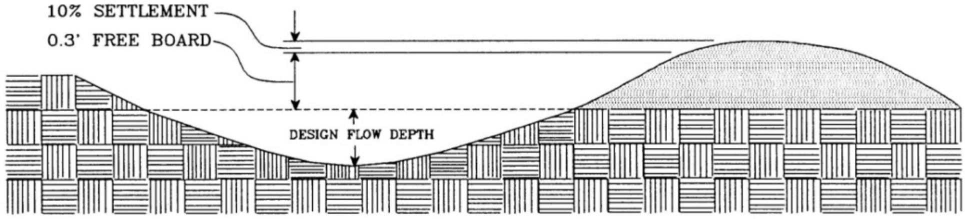


TYPICAL GRAVEL STRUCTURE

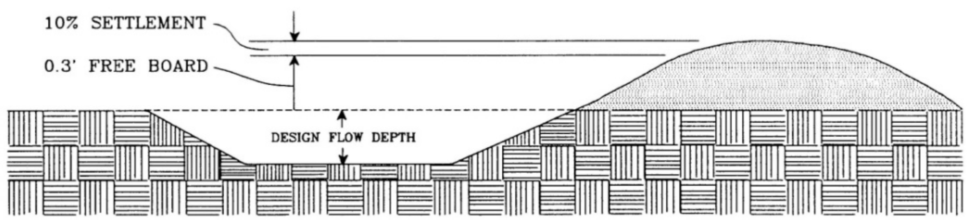


TYPICAL EARTHEN STRUCTURE

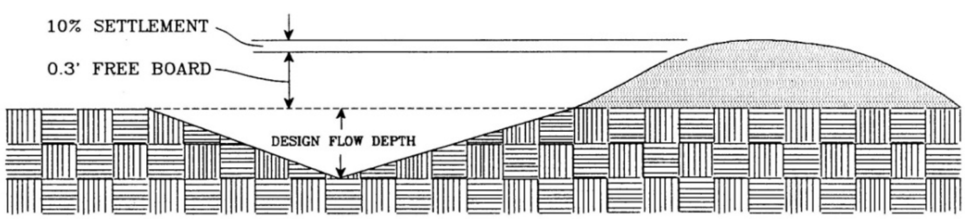
DIVERSIONS



TYPICAL PARABOLIC DIVERSION

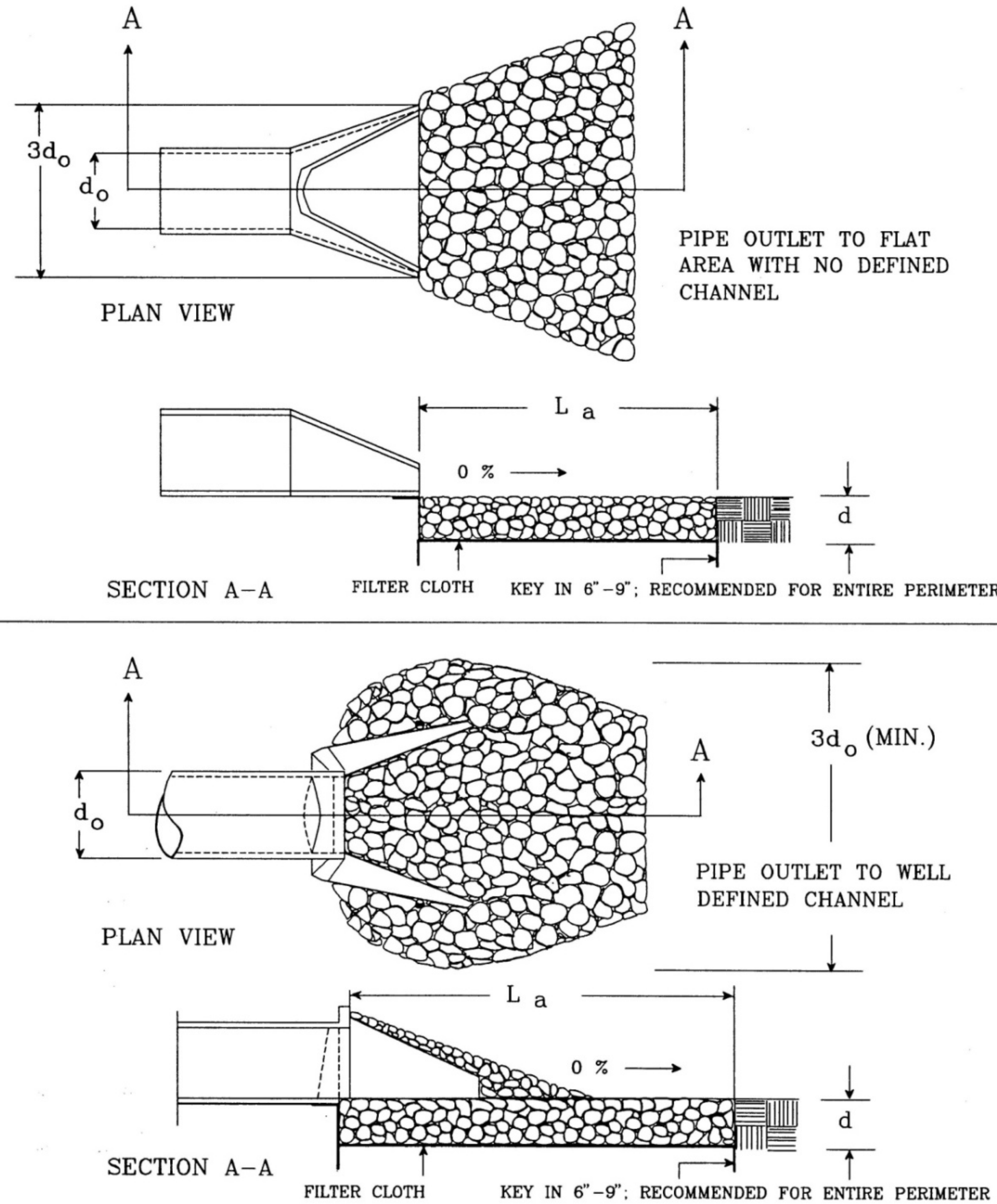


TYPICAL TRAPEZOIDAL DIVERSION



TYPICAL VEE-SHAPED DIVERSION

PIPE OUTLET CONDITIONS

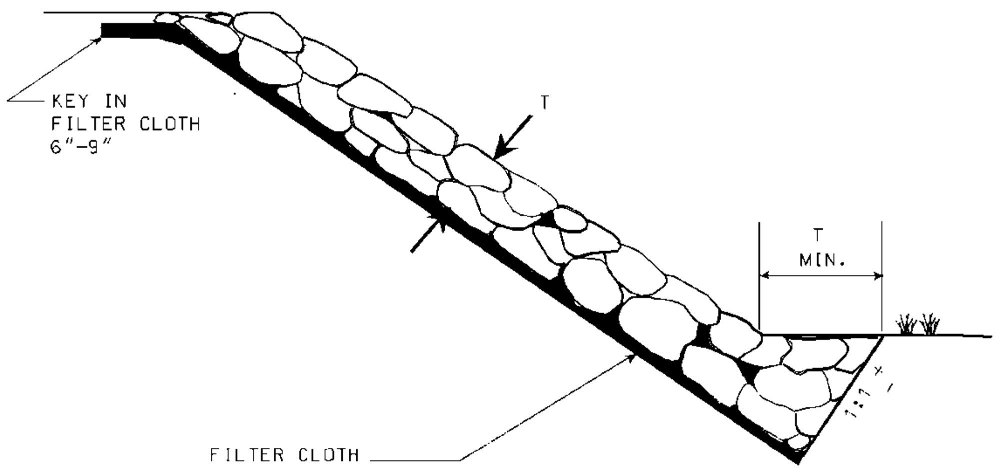


NOTES:
1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18–3 AND 3.18–4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

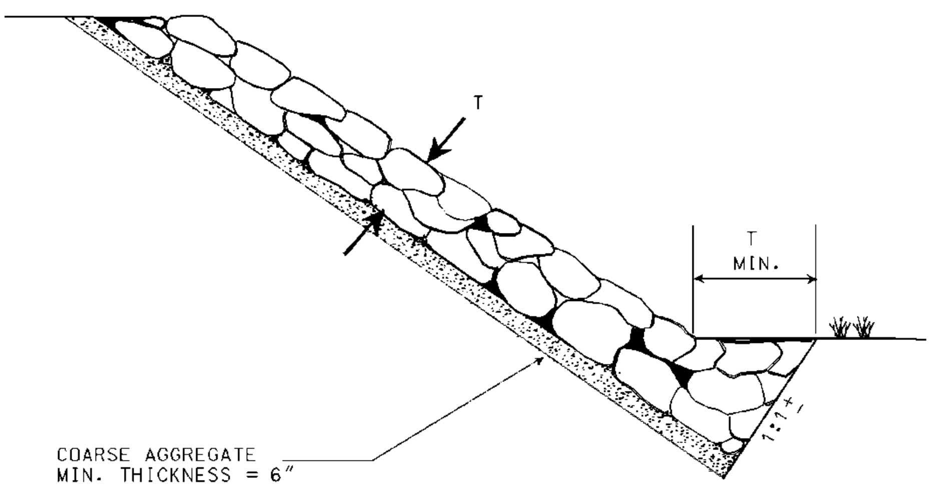
TOE REQUIREMENTS FOR BANK STABILIZATION - 3.19

FILTER CLOTH UNDERLINER

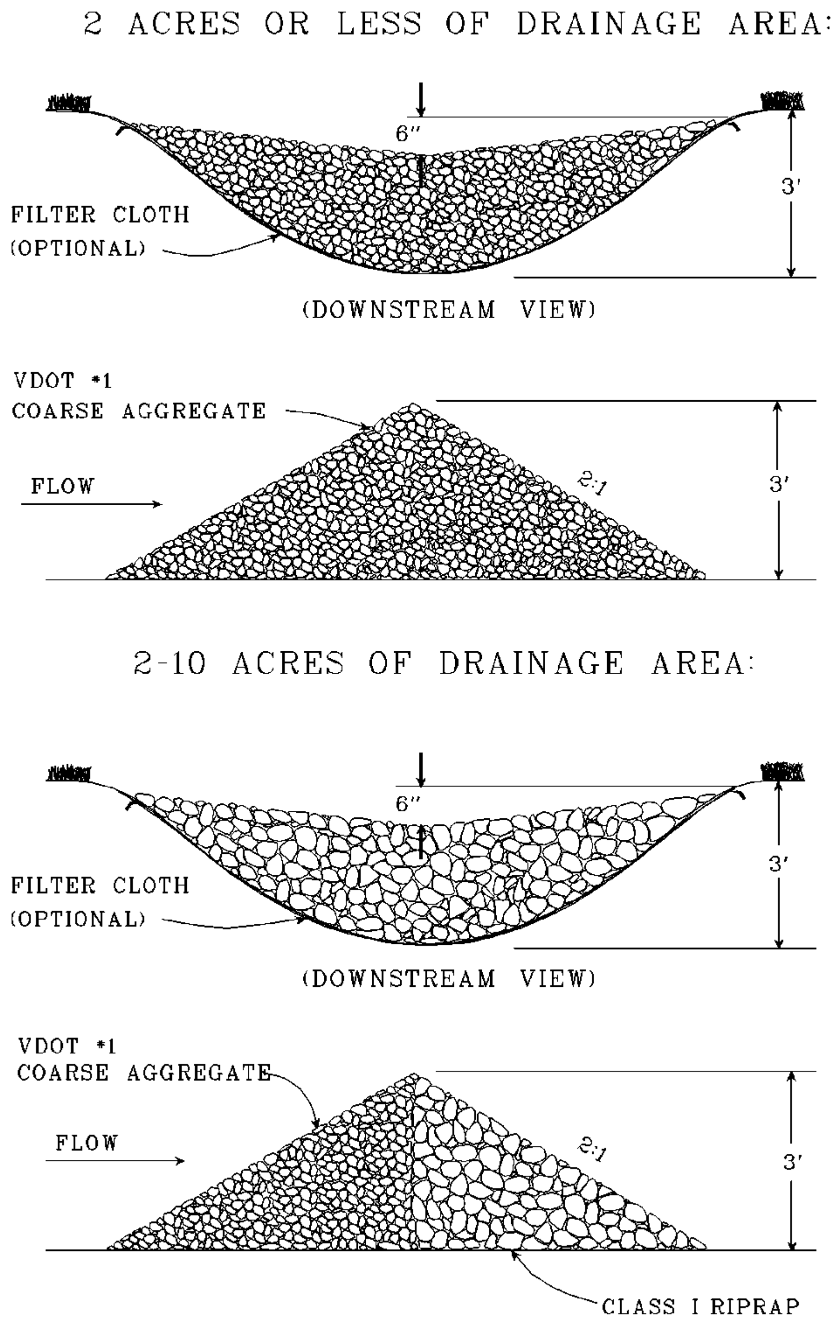
(PREFERRED)



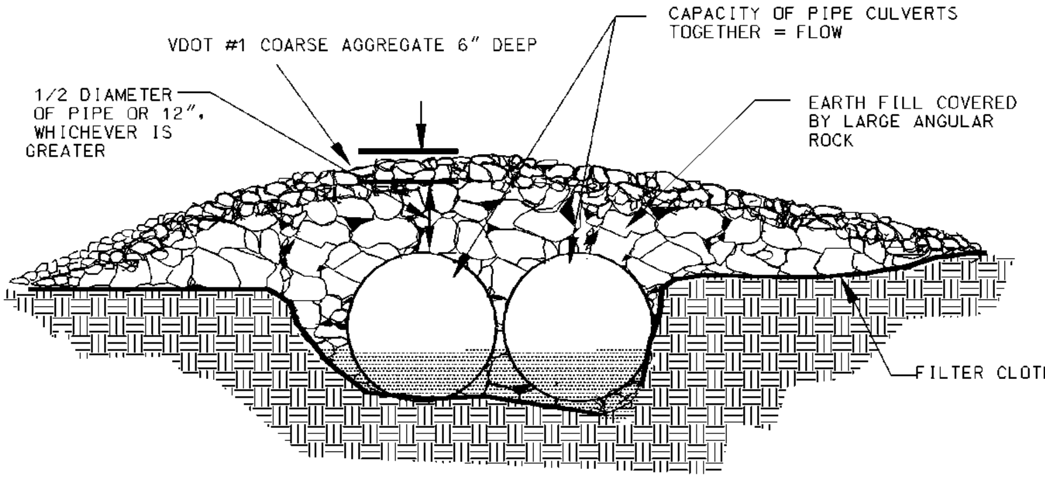
GRANULAR FILTER



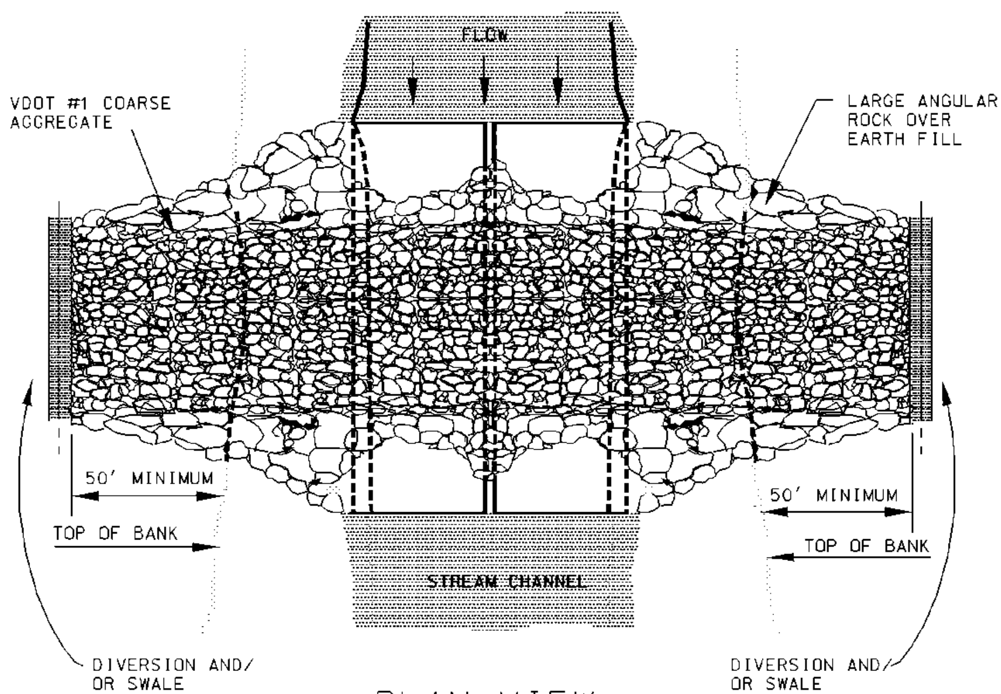
ROCK CHECK DAM - 3.20



TEMPORARY CULVERT CROSSING - 3.24

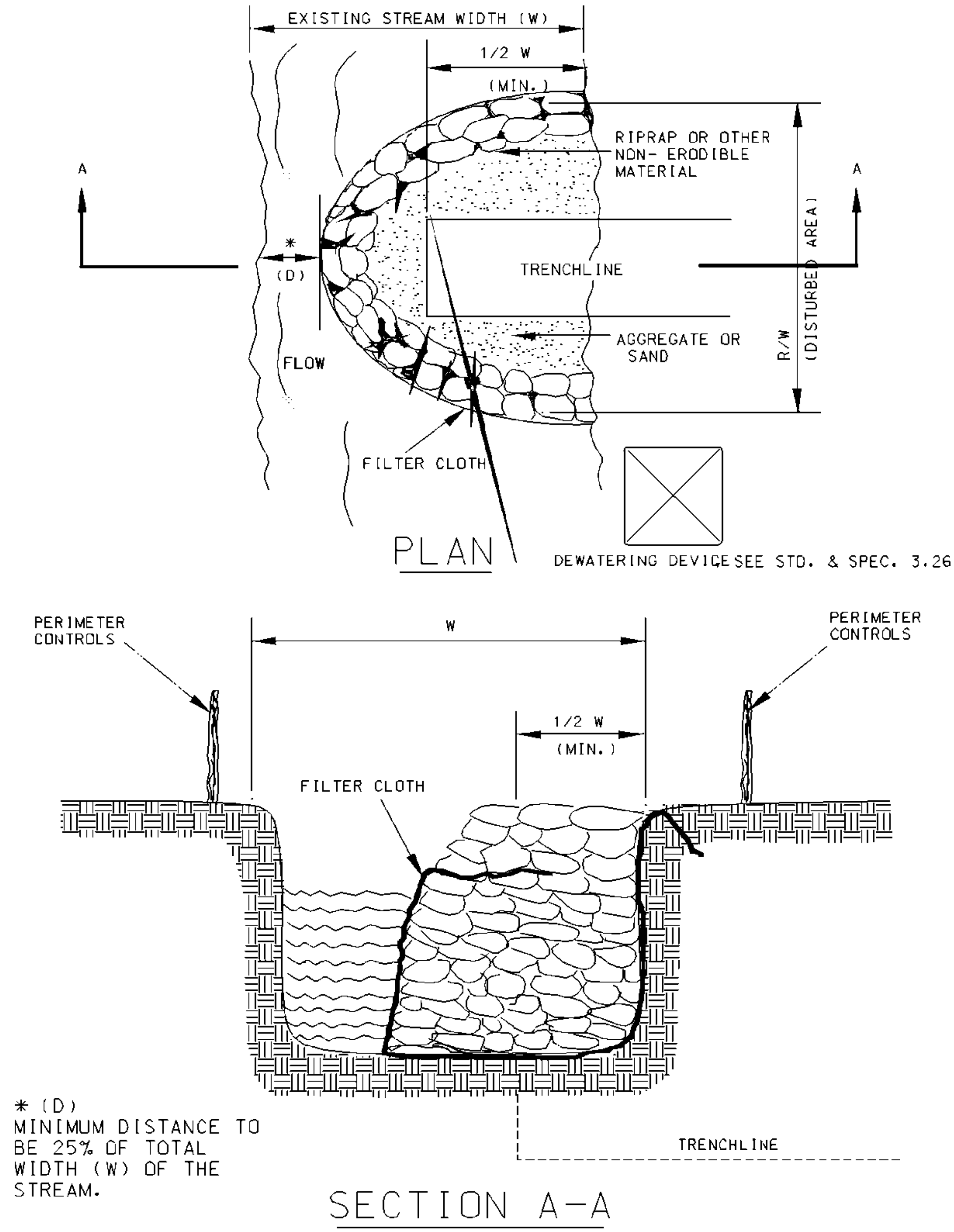


ELEVATION

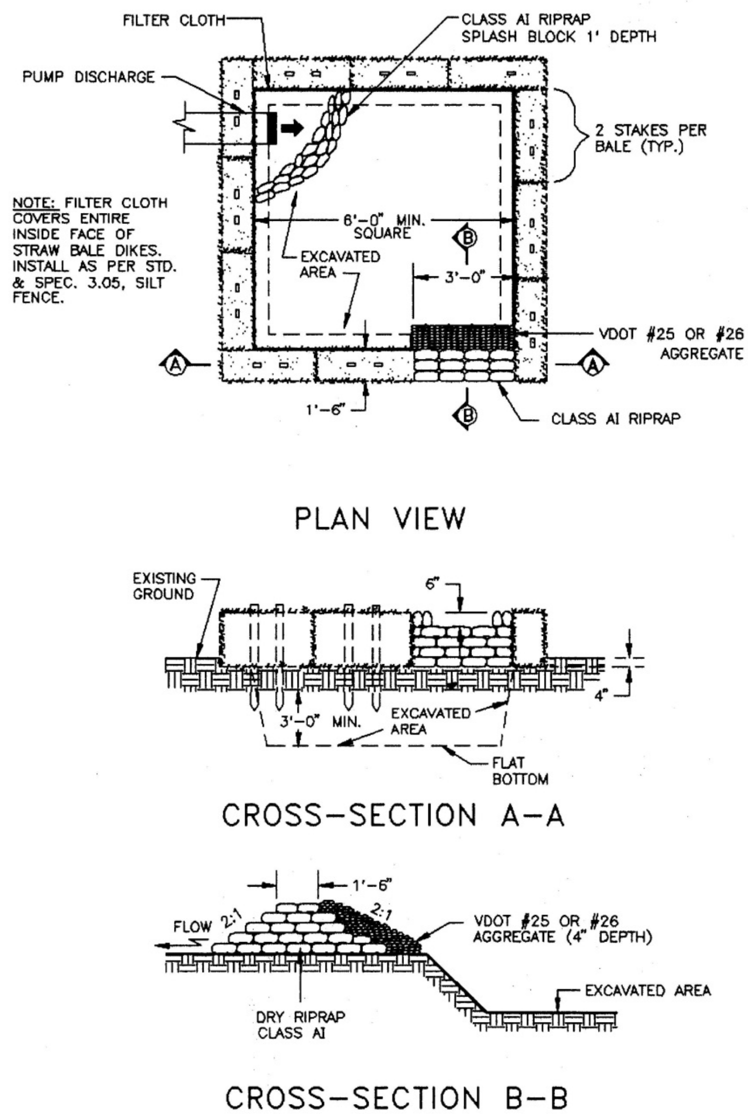


PLAN VIEW

COFFERDAM CROSSING - 3.25

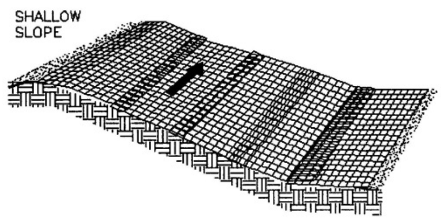


STRAW BALE/SILT FENCE PIT



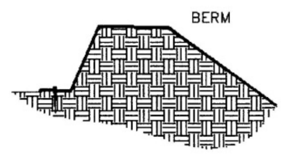
1992 3.36

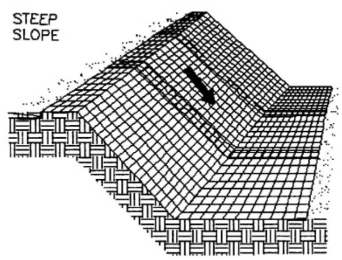
TYPICAL ORIENTATION OF TREATMENT – 1 (SOIL STABILIZATION BLANKET)



ON SHALLOW SLOPES, STRIPS OF NETTING PROTECTIVE COVERINGS MAY BE APPLIED ACROSS THE SLOPE.

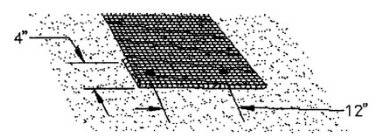
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE MATERIAL OVER THE BERM AND ANCHOR IT BEHIND THE BERM.

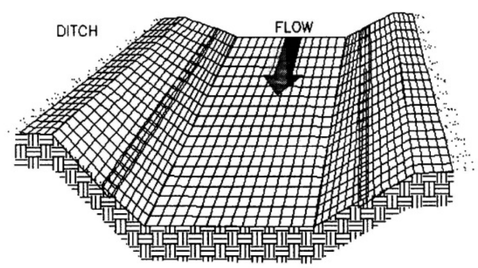




ON STEEP SLOPES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

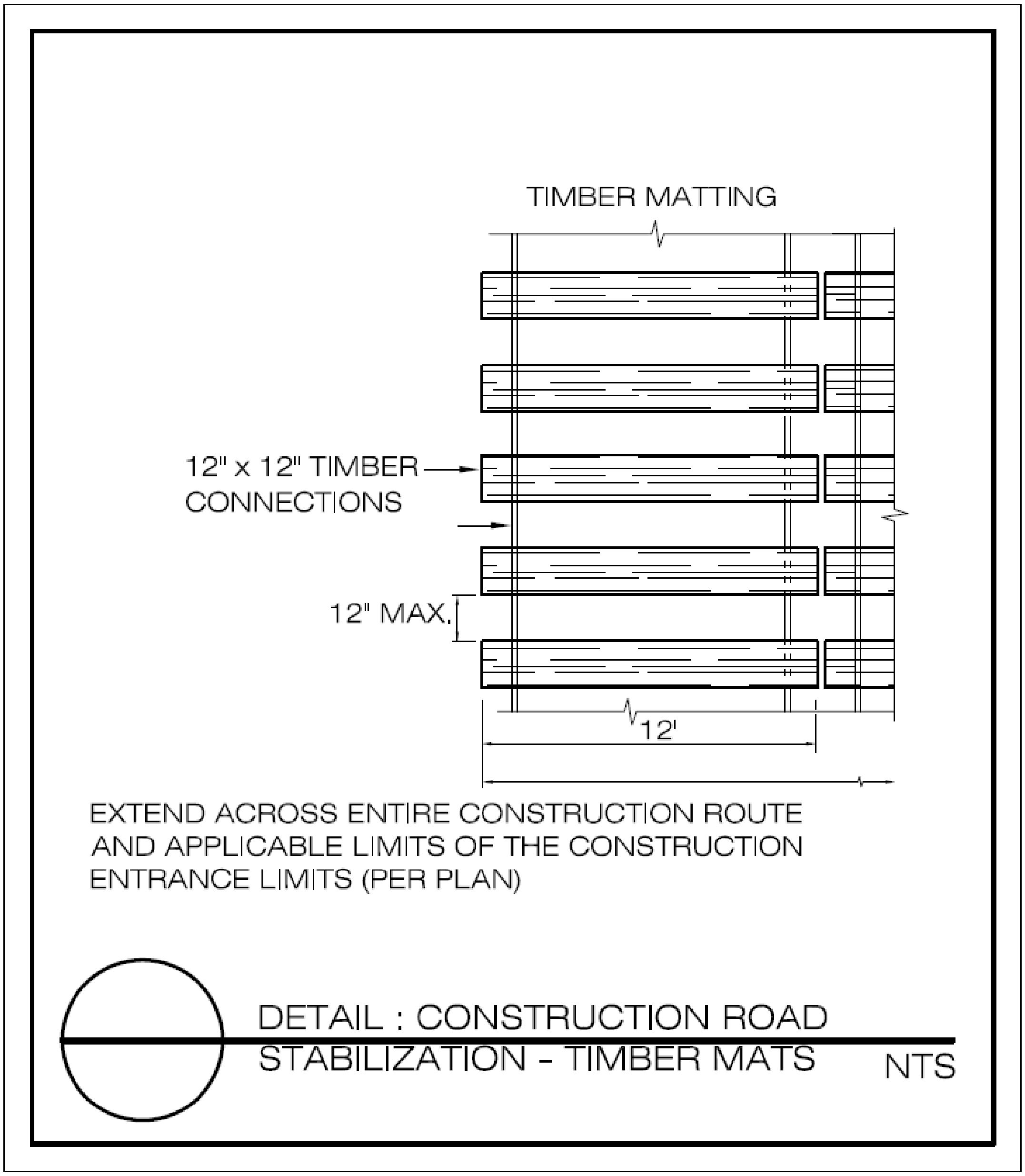
BRING MATERIAL DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 4" AND STAPLE AT 12" INTERVALS.





IN DITCHES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS AS REQUIRED. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH IF AT ALL POSSIBLE.

TIMBER MAT STABILIZATION



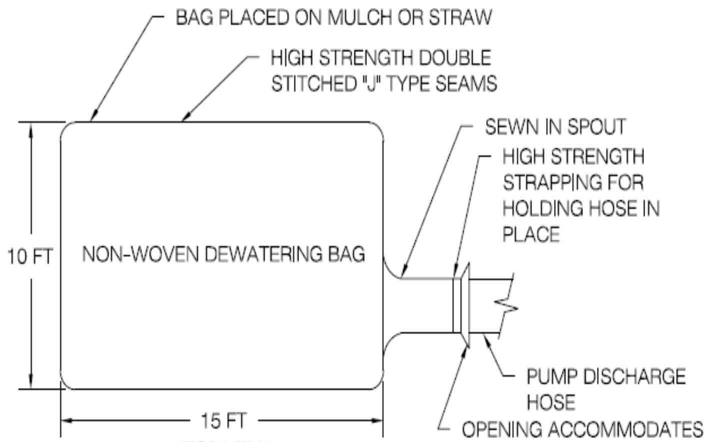
GEOTEXTILE/DEWATERING BAG

THE DEWATERING BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MIN. SURFACE AREA OF 225 SQUARE FEET PER SIDE. ALL STRUCTURAL SEEMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD. THE SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D-4884 TEST METHOD. THE DEWATERING BAG SHALL HAVE A NOZZLE LARGE ENOUGH TO ACCOMMODATE A FOUR INCH DISCHARGE HOSE. THE NOZZLE SHALL BE SEALED TIGHTLY AROUND THE DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE TO PREVENT UNTREATED WATER FROM ESCAPING. THE GEOTEXTILE FABRIC SHALL BE A NON-WOVEN FABRIC WITH THE FOLLOWING PROPERTIES;

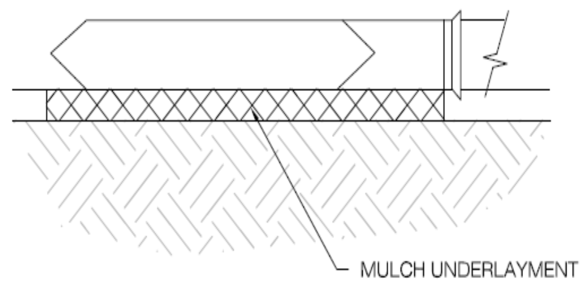
GEOTEXTILE FABRIC FOR DEWATERING BAG			
PROPERTIES	TEST METHOD	UNITS	DEWATERING BAG 12 OZ
WEIGHT	ASTM D-3776	OZ/YD	12
GRAB TENSILE	ASTM D-4632	LBS.	300
PUNCTURE	ASTM D-4833	LBS.	175
FLOWRATE	ASTM D-4491	GAL/MIN/FT2	70
PERMITIVITY	ASTM D-4491	1,3 SEC-1	1
MULLEN BURST	ASTM D-3786	LBS.IN2	580
UV RESISTANT	ASTM D-4355	%	70
AOS % RETAINED	ASTM D-4751	0.40-0.80 MM	100

NOTE:
ALL PROPERTIES ARE MINIMUM AVERAGE ROLL VALUE EXCEPT THE WEIGHT OF THE FABRIC WHICH IS GIVEN FOR INFORMATION ONLY.

CONSTRUCTION:
THE DEWATERING BAG SHALL BE INSTALLED OVER A 3 INCH GRAVEL BASE TO PROMOTE INFILTRATION AND DEWATERING OF THE BAG.



TOP VIEW



SIDE VIEW

DETAIL: GEOTEXTILE BAG (DEWATERING BAG)

NTS

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT I -2

Typical Erosion & Sedimentation Control Details - Virginia

The following construction details are taken from the Virginia Erosion and Sediment Control Handbook (VESCH), Third Edition, 1992, as amended. Specific details and guidelines are covered more completely in Chapter 3 of the VESCH.

The Contractor must go to the VESCH to reference practices that are covered in the specification but not listed below.

Practice	Title	Key
3.01	Safety Fence	SAF
3.02	Temporary Stone Construction Entrance	CE
3.04	Straw Bale Barrier	STB
3.05	Silt Fence	SF
3.07	Storm Drain Inlet Protection	IP
3.09	Temporary Diversion Dike	DD
3.10	Temporary Fill Diversion	FD
3.11	Temporary Right-Of-Way Diversion	RWD
3.12	Diversion	DV
3.18	Outlet Protection	OP
3.19	RipRap	RR
3.20	Rock Check Dams	CD
3.24	Temporary Vehicular Stream Crossing	SC
3.25	Utility Stream Crossing	USC
3.26	Dewatering Structure	DS
3.36	Soil Stabilization Blankets & Matting	B/M

The following items are specific to the practices within this document and are not found in the VESCH manual. Details for these items are located at the end of this appendix following the items listed above.

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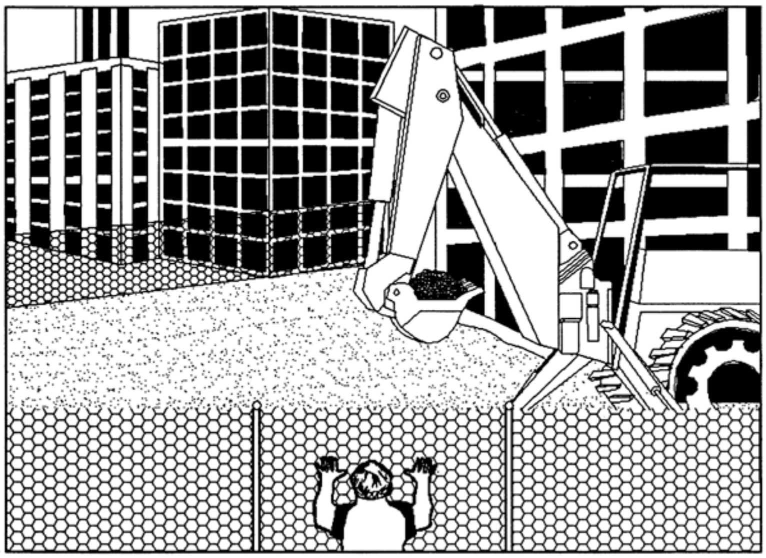
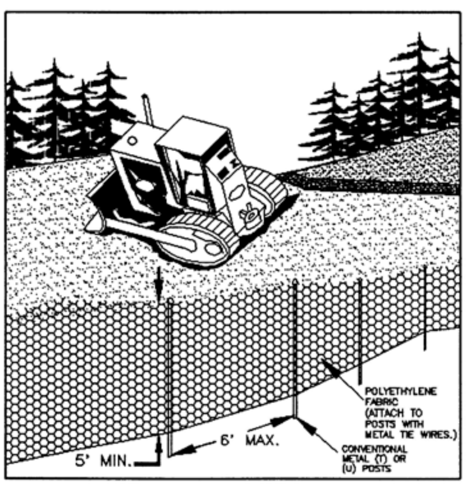
Geotextile Bag/Dewatering Bag	GB

1992 3.01

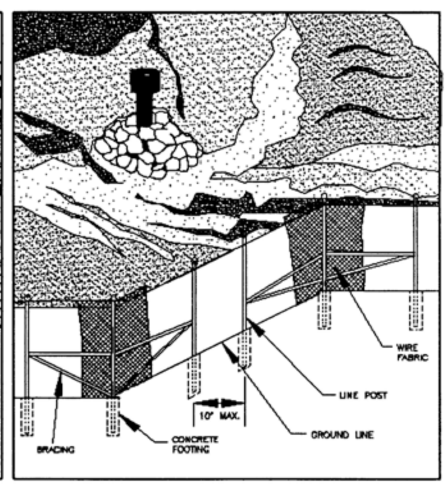
SAFETY FENCE



PERSPECTIVE VIEW



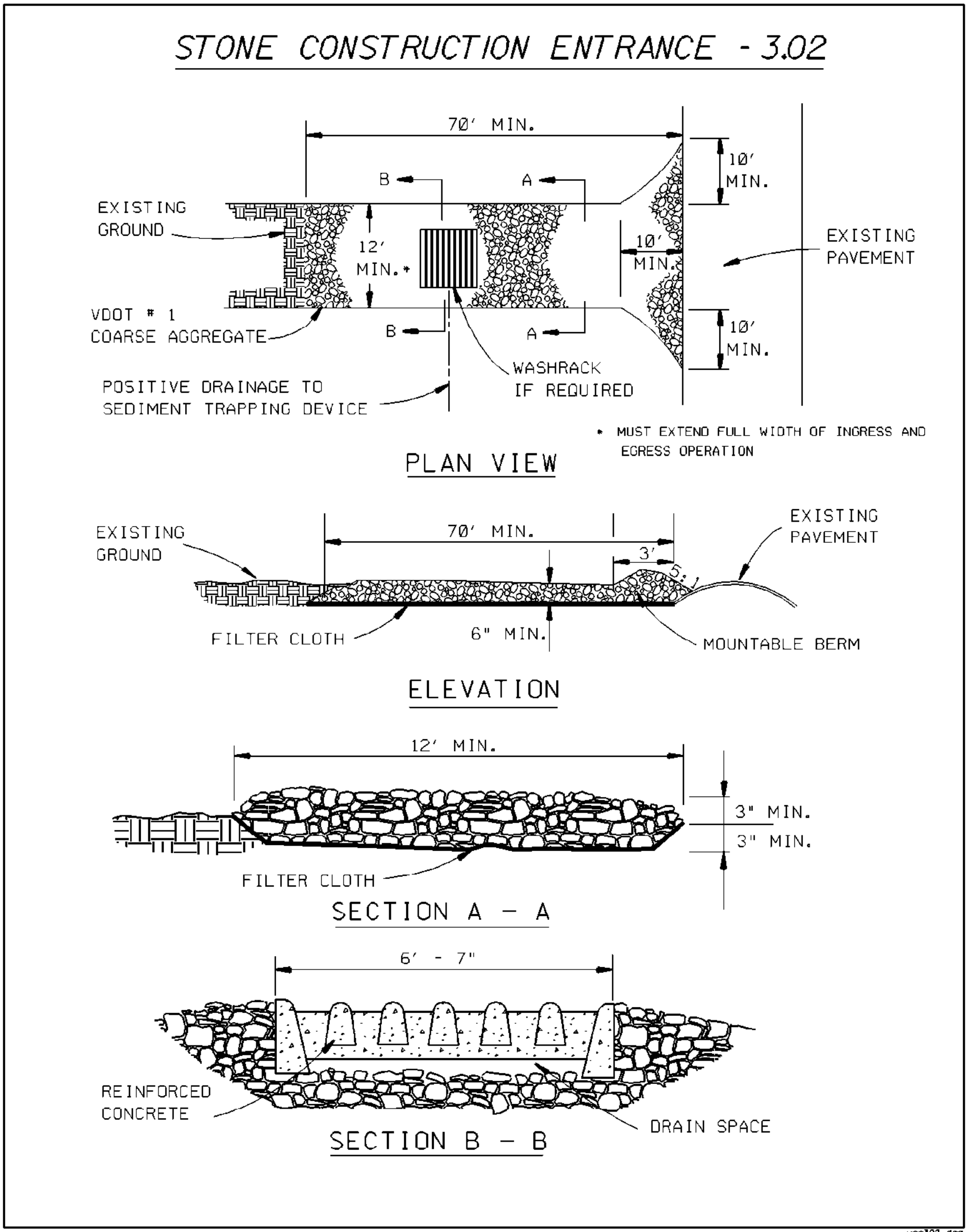
PERSPECTIVE VIEW
PLASTIC FENCE



PERSPECTIVE VIEW
METAL FENCE

Source: Adapted from Conwed Plastics and
VDOT Road and Bridge Standards

Plate 3.01-1


STONE CONSTRUCTION ENTRANCE - 3.02
70' MIN.
B
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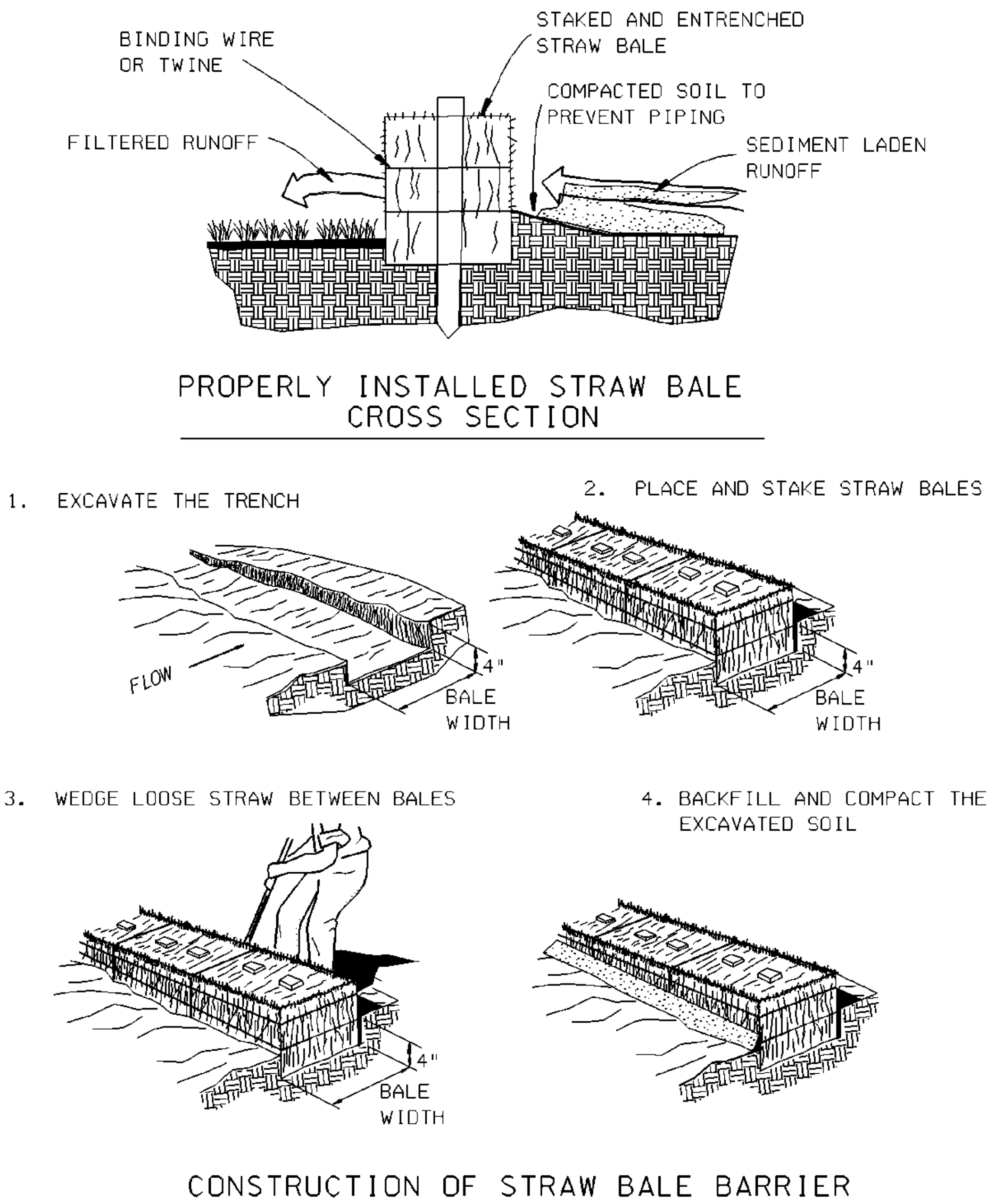
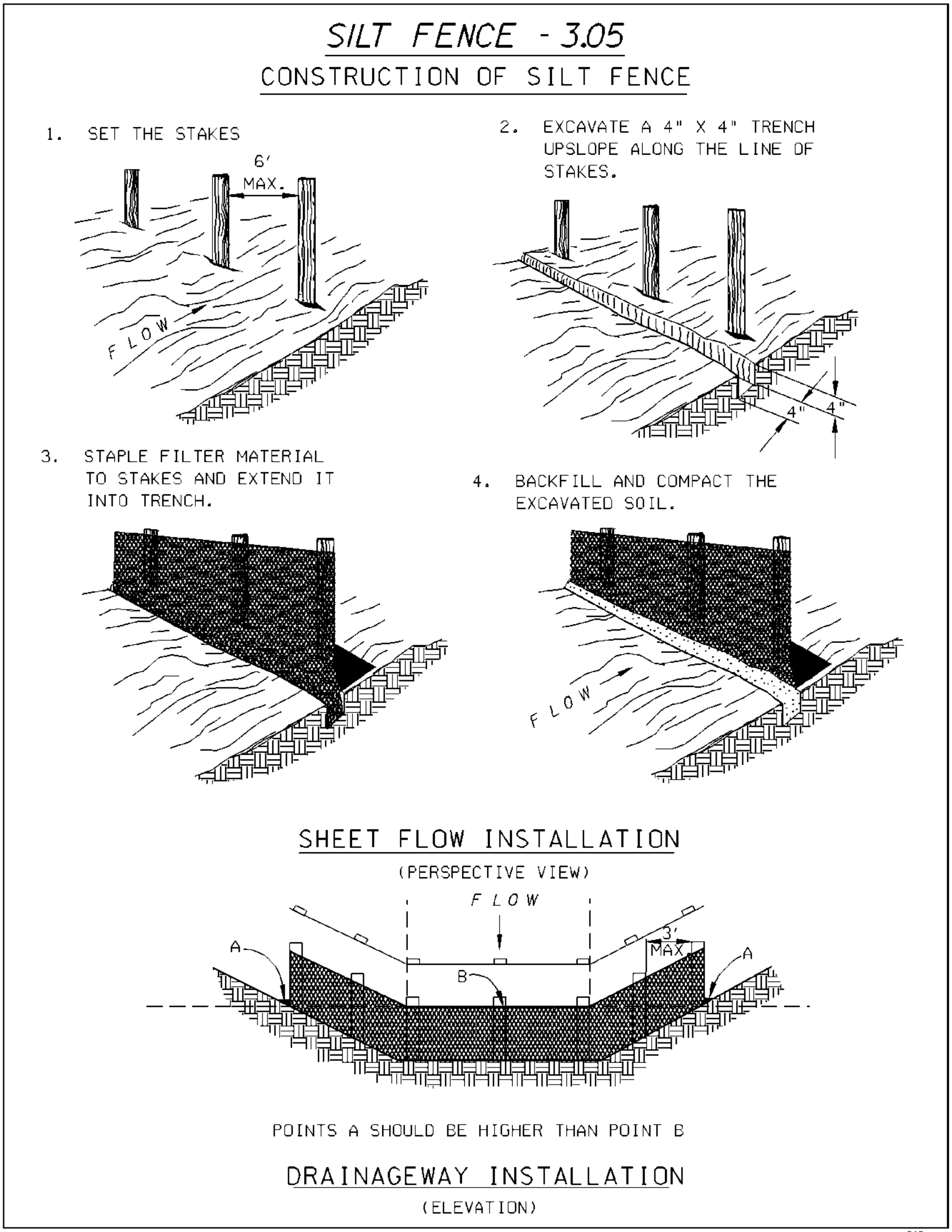
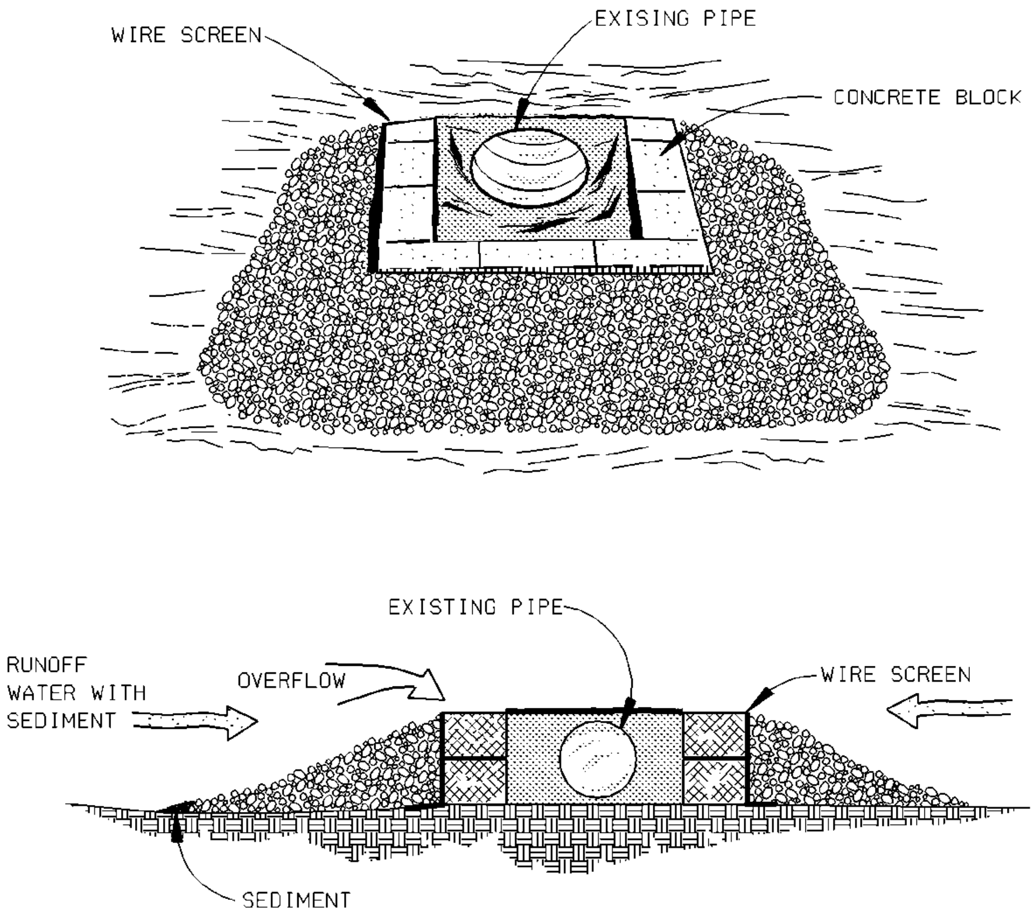
10' MIN.
EXISTING GROUND
12' MIN.*
10' MIN.
EXISTING PAVEMENT
VDOT # 1 COARSE AGGREGATE
WASHRACK IF REQUIRED
POSITIVE DRAINAGE TO SEDIMENT TRAPPING DEVICE
* MUST EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION
PLAN VIEW
EXISTING GROUND
70' MIN.
3'
5:1
EXISTING PAVEMENT
FILTER CLOTH
6" MIN.
MOUNTABLE BERM
ELEVATION
12' MIN.
3" MIN.
3" MIN.
FILTER CLOTH
SECTION A - A
6' - 7"
REINFORCED CONCRETE
DRAIN SPACE
SECTION B - B
vse302.dgn

STRAW BALE BARRIER - 3.04




SILT FENCE - 3.05
CONSTRUCTION OF SILT FENCE
1. SET THE STAKES
6' MAX.
FLOW
2. EXCAVATE A 4" X 4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.
4"
4"
3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO TRENCH.
4. BACKFILL AND COMPACT THE EXCAVATED SOIL.
FLOW
SHEET FLOW INSTALLATION
(PERSPECTIVE VIEW)
FLOW
A
B
3' MAX
A
POINTS A SHOULD BE HIGHER THAN POINT B
DRAINAGEWAY INSTALLATION
(ELEVATION)
vaa305.dgn

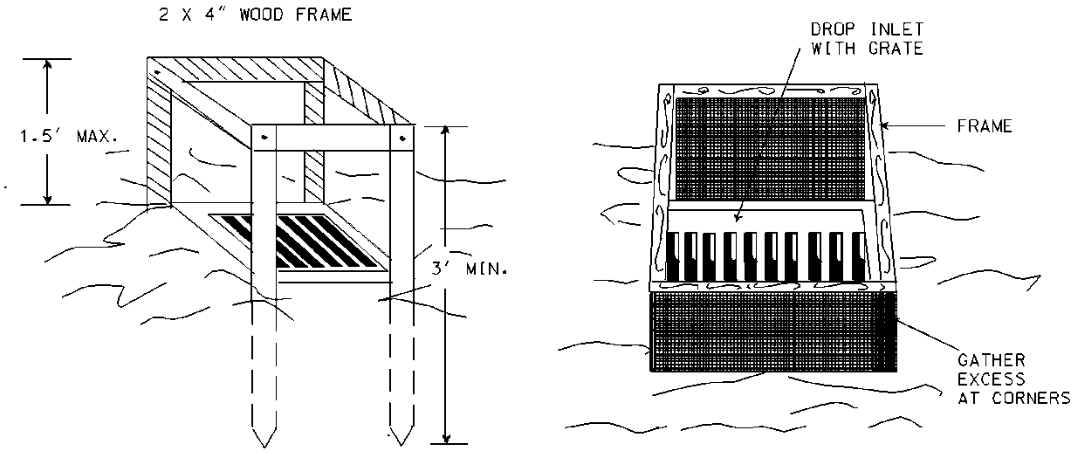
INLET PIPE PROTECTION - 3.07



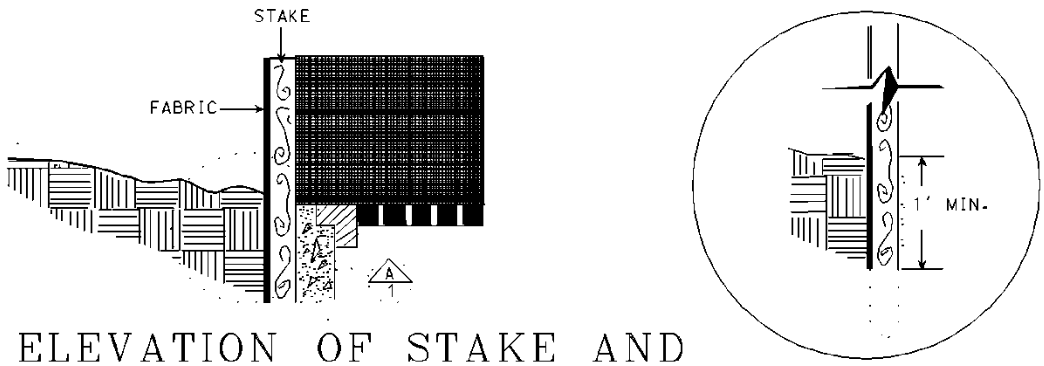
BLOCK AND GRAVEL PIPE INLET SEDIMENT FILTER

THIS METHOD OF INLET PROTECITON IS APPLICABLE WHERE HEAVY FLOWS ARE EXPECTED, AND WHERE AN OVERFLOW CAPACITY IS NECESSARY TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

SILT FENCE DROP INLET PROTECTION - 3.07-1



PERSPECTIVE VIEWS



ELEVATION OF STAKE AND FABRIC ORIENTATION

DETAIL A

SPECIFIC APPLICATION

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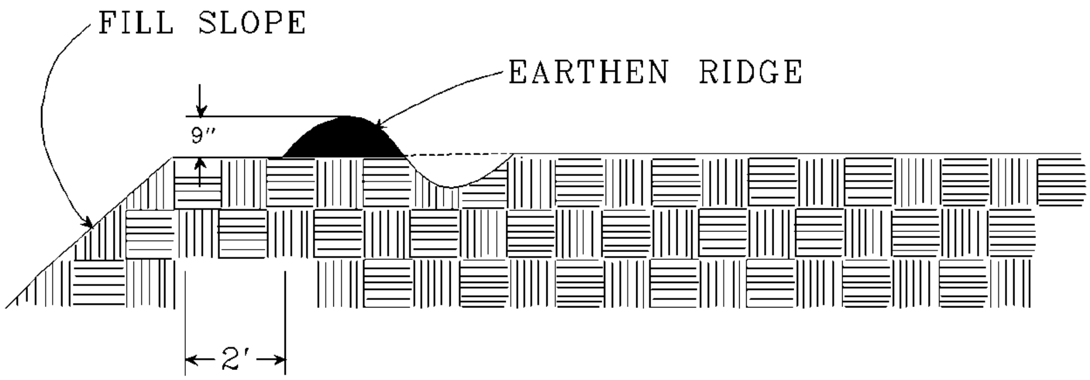
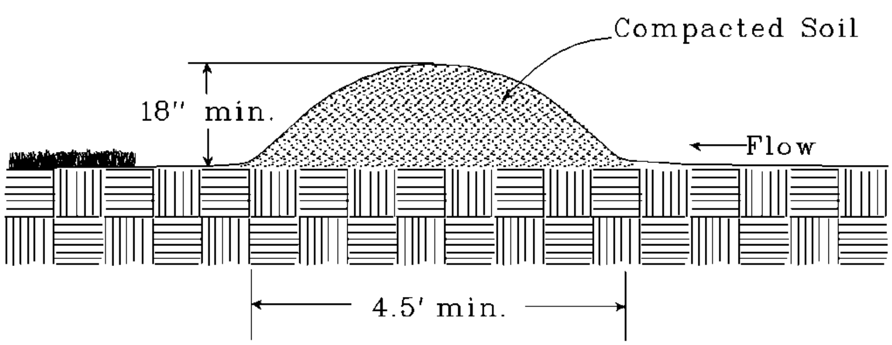
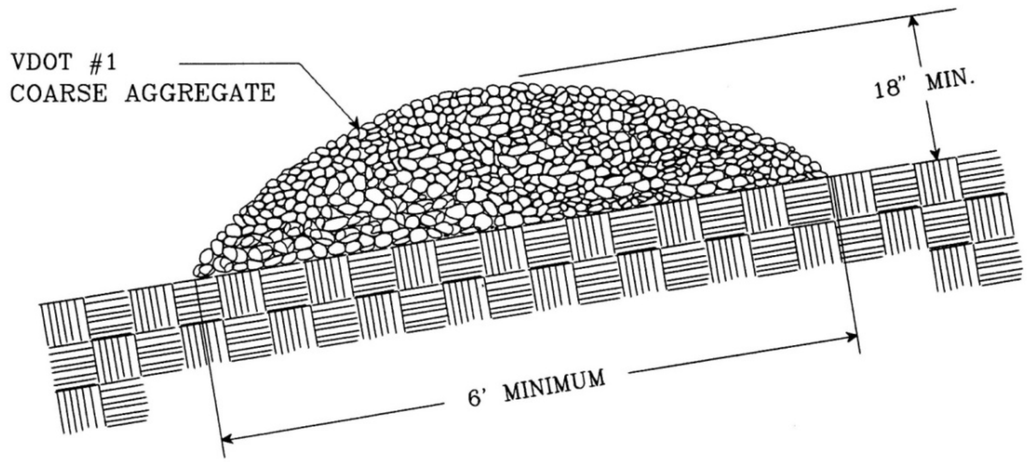
TEMPORARY FILL DIVERSION - 3.10



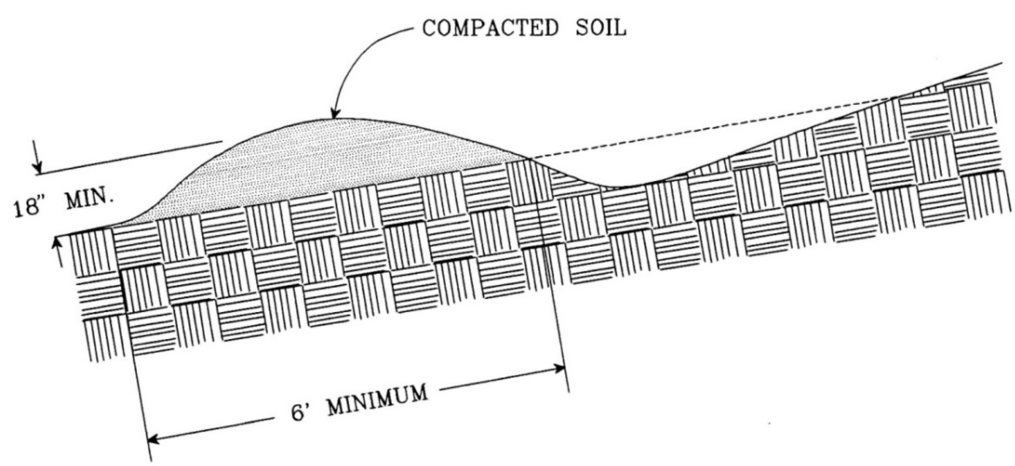
TEMPORARY DIVERSION DIKE - 3.09



TEMPORARY RIGHT-OF-WAY DIVERSIONS

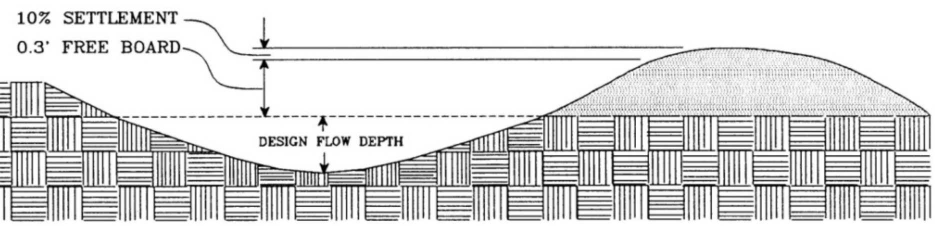


TYPICAL GRAVEL STRUCTURE

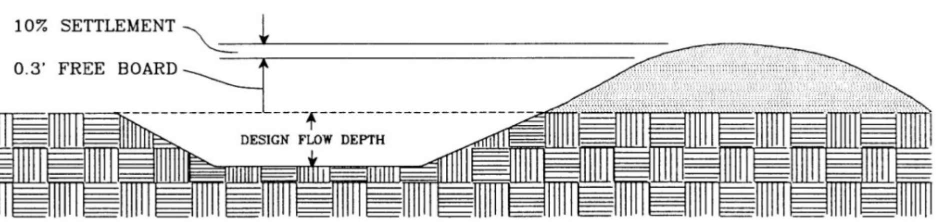


TYPICAL EARTHEN STRUCTURE

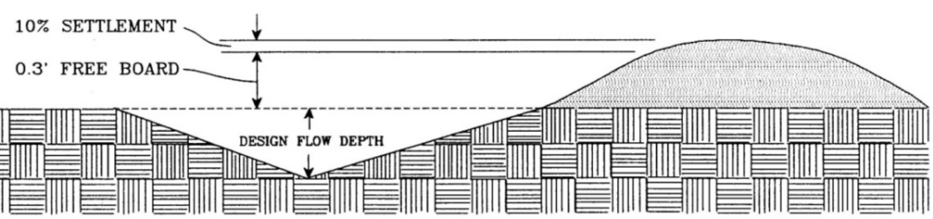
DIVERSIONS



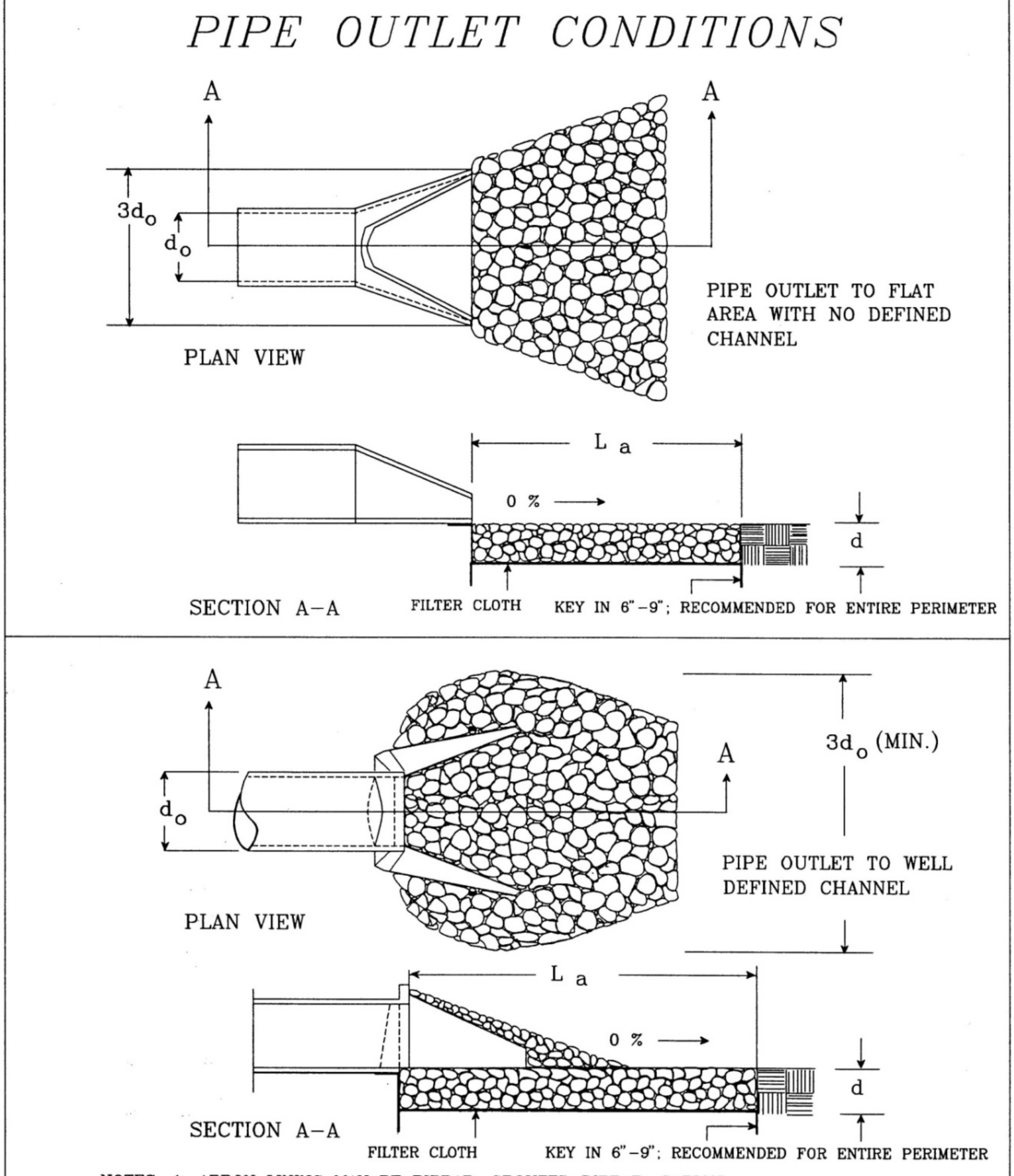
TYPICAL PARABOLIC DIVERSION



TYPICAL TRAPEZOIDAL DIVERSION



TYPICAL VEE–SHAPED DIVERSION

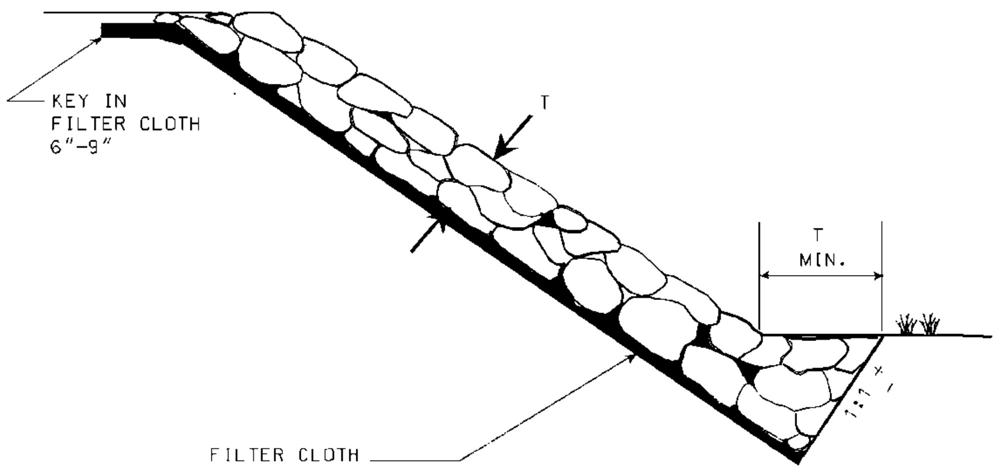


NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18–3 AND 3.18–4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

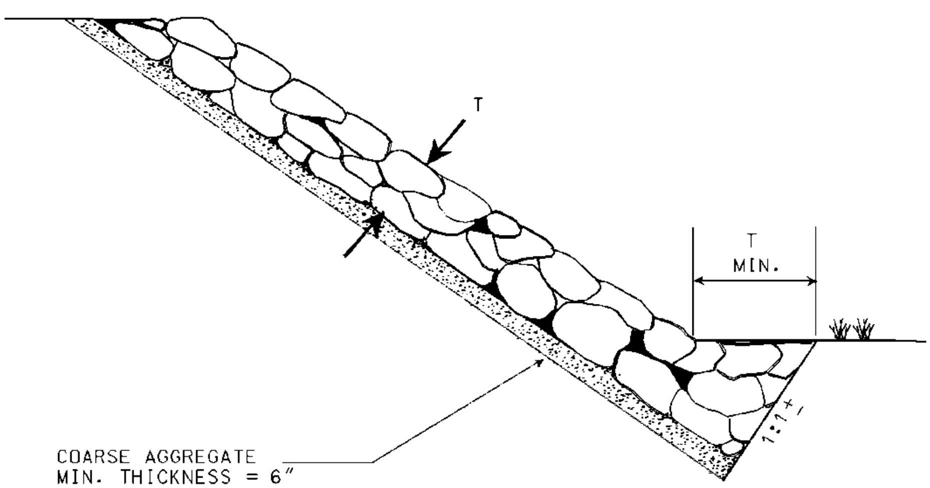
TOE REQUIREMENTS FOR BANK STABILIZATION - 3.19

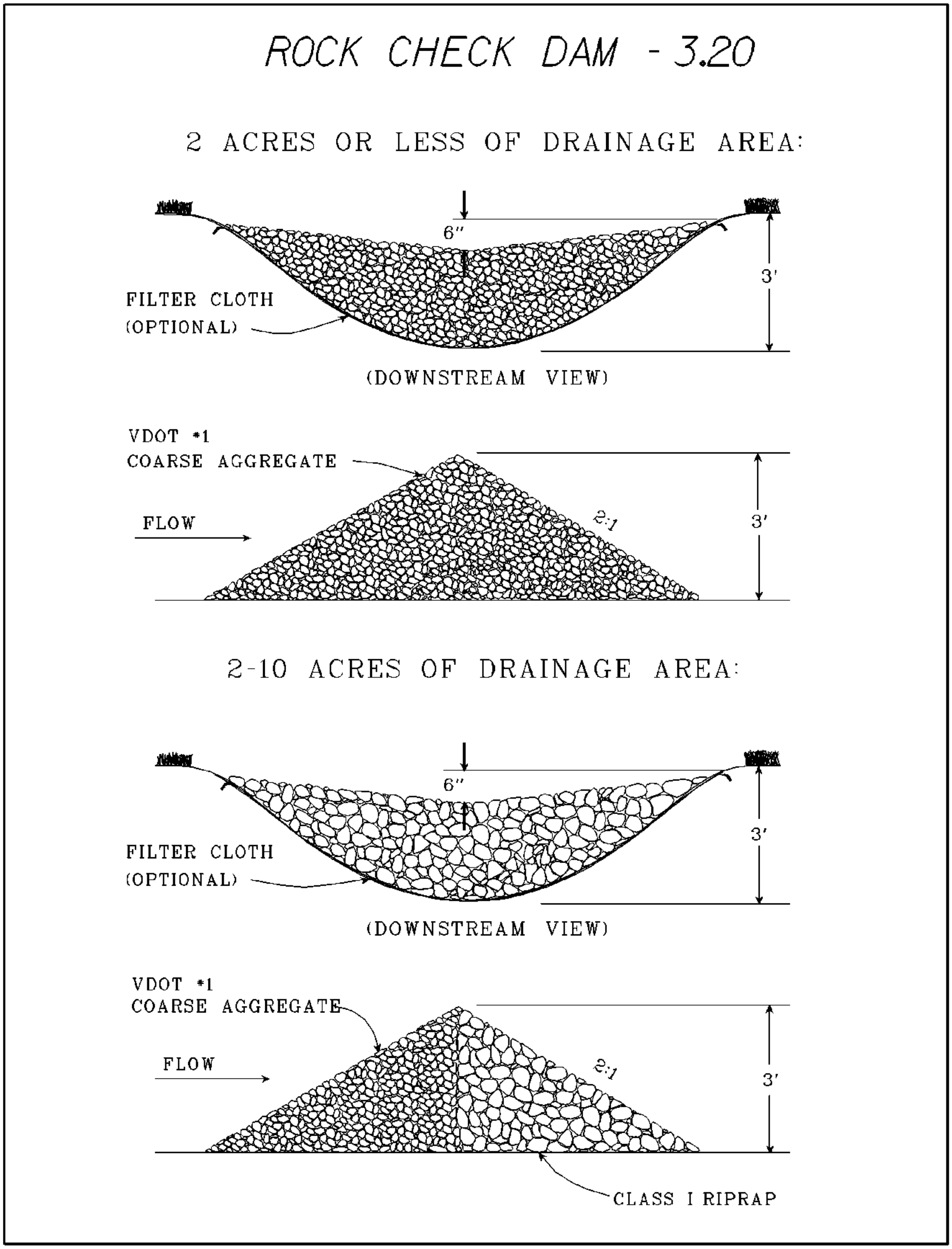
FILTER CLOTH UNDERLINER

(PREFERRED)

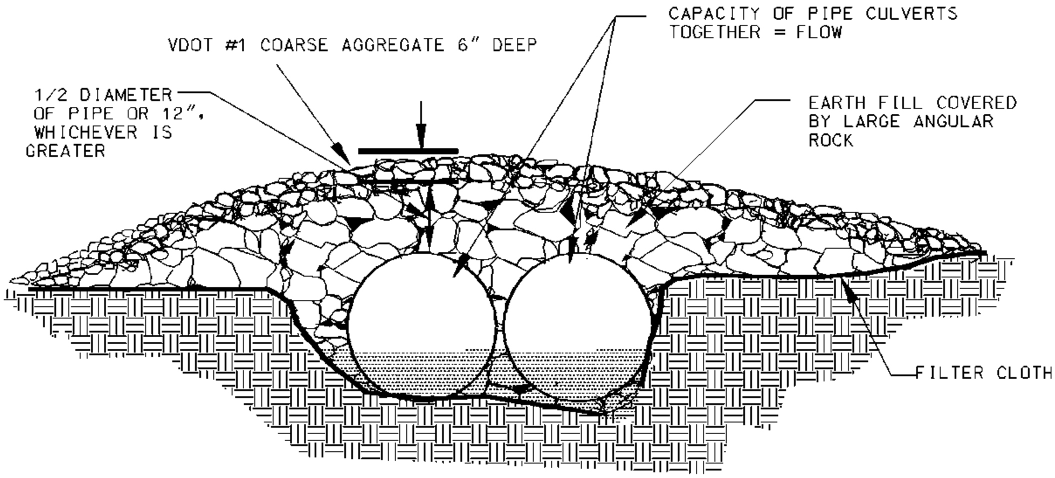


GRANULAR FILTER

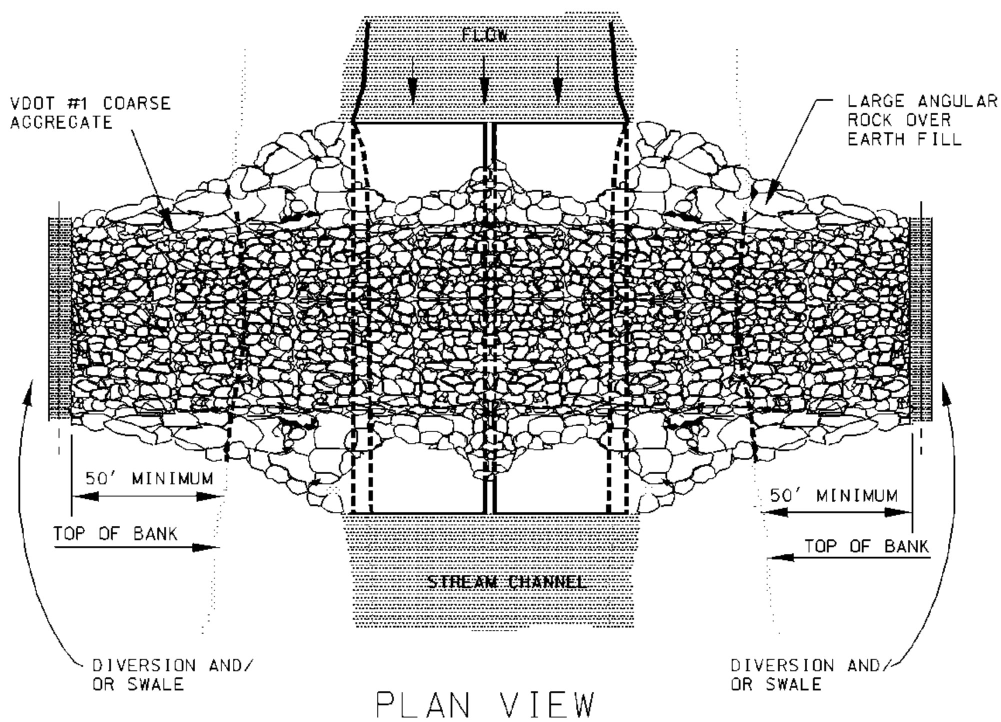



ROCK CHECK DAM - 3.20
2 ACRES OR LESS OF DRAINAGE AREA:
6"
3'
FILTER CLOTH
(OPTIONAL)
(DOWNSTREAM VIEW)
VDOT #1
COARSE AGGREGATE
FLOW
2:1
3'
2-10 ACRES OF DRAINAGE AREA:
6"
3'
FILTER CLOTH
(OPTIONAL)
(DOWNSTREAM VIEW)
VDOT #1
COARSE AGGREGATE
FLOW
2:1
3'
CLASS I RIPRAP

TEMPORARY CULVERT CROSSING - 3.24

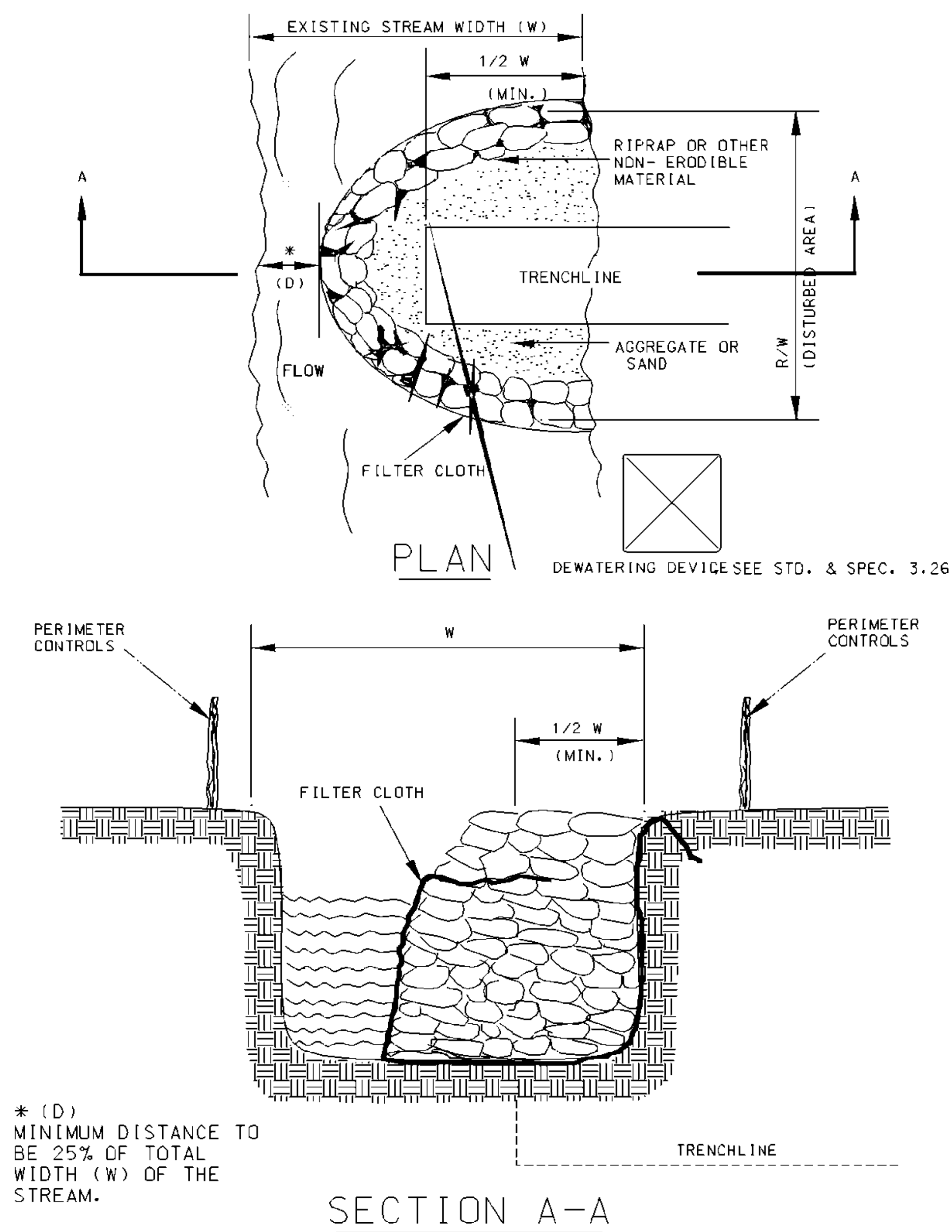


ELEVATION

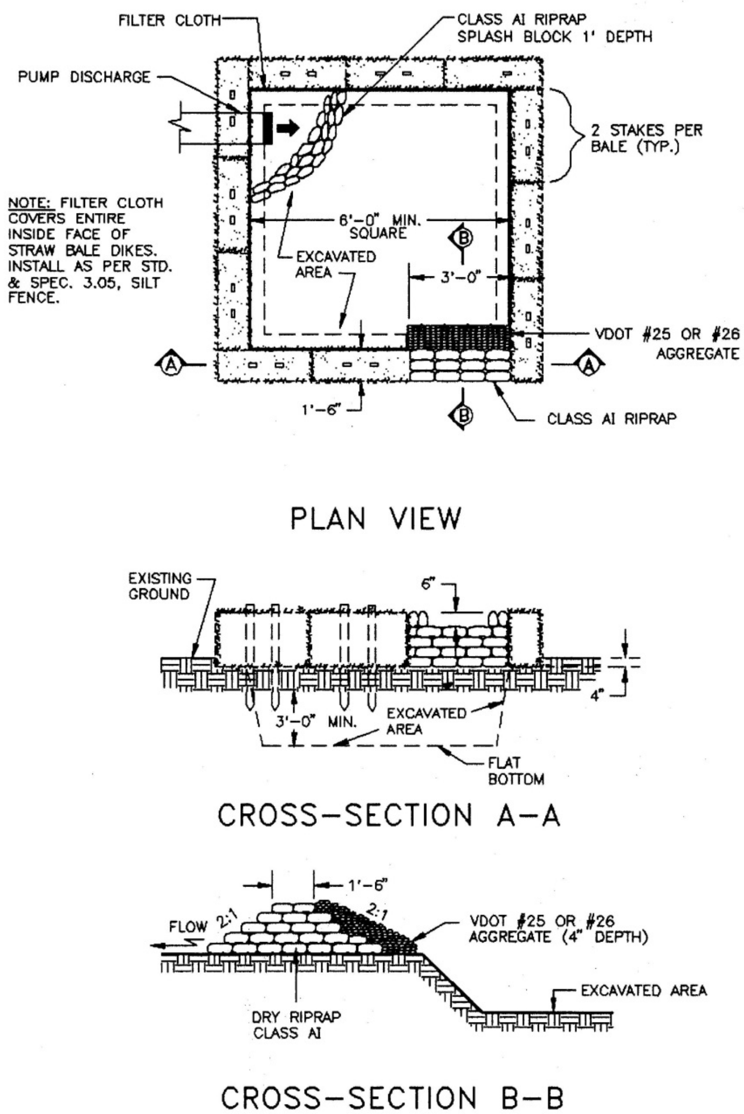


PLAN VIEW

COFFERDAM CROSSING - 3.25

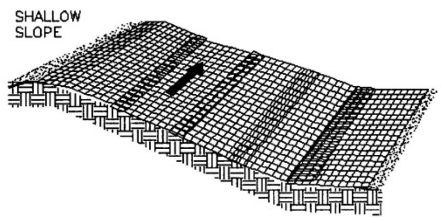


STRAW BALE/SILT FENCE PIT



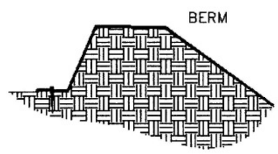
1992 3.36

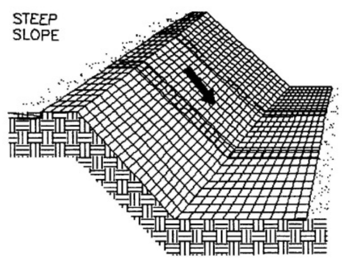
TYPICAL ORIENTATION OF TREATMENT – 1 (SOIL STABILIZATION BLANKET)



ON SHALLOW SLOPES, STRIPS OF NETTING PROTECTIVE COVERINGS MAY BE APPLIED ACROSS THE SLOPE.

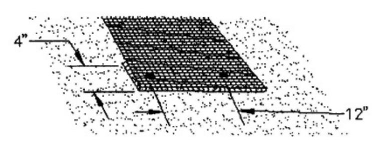
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE MATERIAL OVER THE BERM AND ANCHOR IT BEHIND THE BERM.

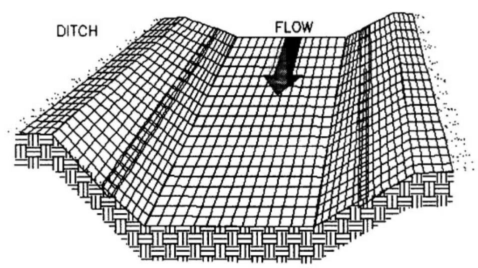




ON STEEP SLOPES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

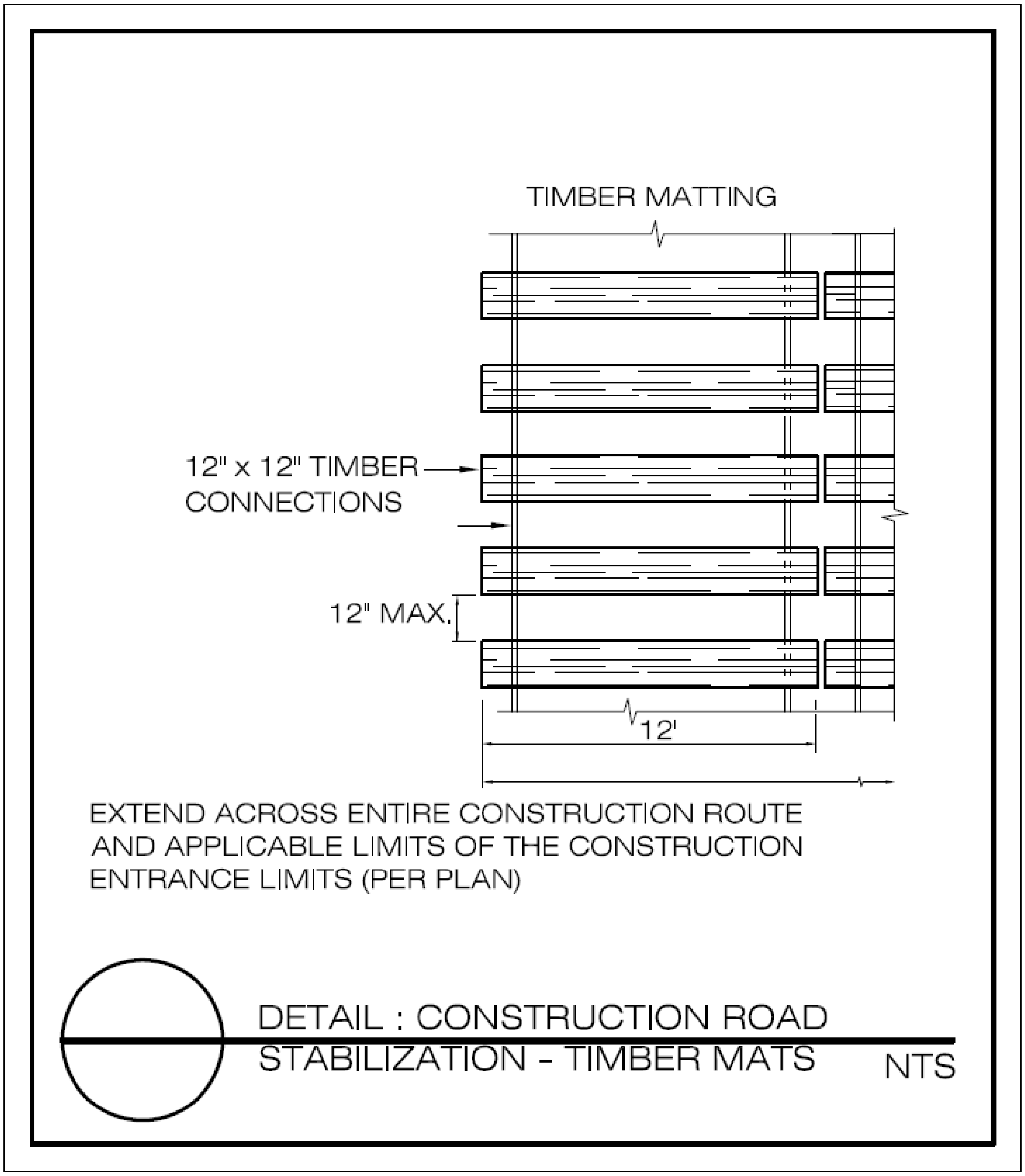
BRING MATERIAL DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 4" AND STAPLE AT 12" INTERVALS.





IN DITCHES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS AS REQUIRED. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH IF AT ALL POSSIBLE.

TIMBER MAT STABILIZATION



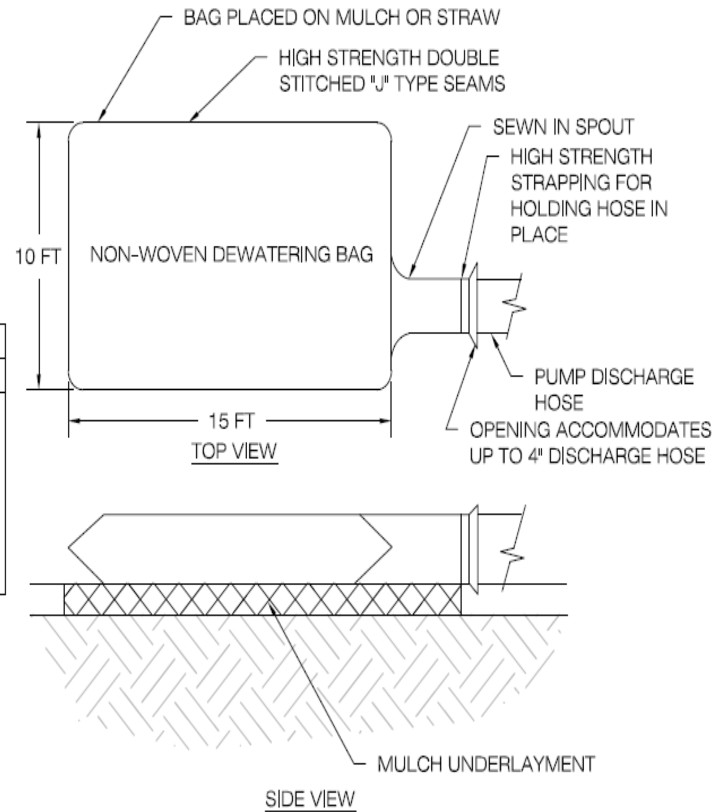
GEOTEXTILE/DEWATERING BAG

THE DEWATERING BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MIN. SURFACE AREA OF 225 SQUARE FEET PER SIDE. ALL STRUCTURAL SEEMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD. THE SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D-4884 TEST METHOD. THE DEWATERING BAG SHALL HAVE A NOZZLE LARGE ENOUGH TO ACCOMMODATE A FOUR INCH DISCHARGE HOSE. THE NOZZLE SHALL BE SEALED TIGHTLY AROUND THE DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE TO PREVENT UNTREATED WATER FROM ESCAPING. THE GEOTEXTILE FABRIC SHALL BE A NON-WOVEN FABRIC WITH THE FOLLOWING PROPERTIES;

GEOTEXTILE FABRIC FOR DEWATERING BAG			
PROPERTIES	TEST METHOD	UNITS	DEWATERING BAG 12 OZ
WEIGHT	ASTM D-3776	OZ/YD	12
GRAB TENSILE	ASTM D-4632	LBS.	300
PUNCTURE	ASTM D-4833	LBS.	175
FLOWRATE	ASTM D-4491	GAL/MIN/FT2	70
PERMITIVITY	ASTM D-4491	1,3 SEC-1	1
MULLEN BURST	ASTM D-3786	LBS.IN2	580
UV RESISTANT	ASTM D-4355	%	70
AOS % RETAINED	ASTM D-4751	0.40-0.80 MM	100

NOTE:
ALL PROPERTIES ARE MINIMUM AVERAGE ROLL VALUE EXCEPT THE WEIGHT OF THE FABRIC WHICH IS GIVEN FOR INFORMATION ONLY.

CONSTRUCTION:
THE DEWATERING BAG SHALL BE INSTALLED OVER A 3 INCH GRAVEL BASE TO PROMOTE INFILTRATION AND DEWATERING OF THE BAG.



DETAIL: GEOTEXTILE BAG (DEWATERING BAG)

NTS

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT J

Invasive Plant Species Management Plan

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket Nos. CP15-554-000
CP15-554-001

and

DOMINION ENERGY
TRANSMISSION, INC.
SUPPLY HEADER PROJECT
Docket No. CP15-555-000

Invasive Plant Species Management Plan

Updated, Rev. 5

Prepared by

ERM

August 2017

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
DETI	Dominion Energy Transmission, Inc.
EI	Environmental Inspector
FERC	Federal Energy Regulatory Commission
HDD	horizontal directional drill
NCDACS	North Carolina Department of Agriculture and Consumer Services
OHV	off-highway vehicle
PDA	Pennsylvania Department of Agriculture
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
Projects	Atlantic Coastline Pipeline and Supply Header Project
SHP	Supply Header Project
SPCC Plan	Spill Prevention, Control, and Countermeasures Plan
VDACS	Virginia Department of Agriculture and Consumer Services

1.0 INTRODUCTION

Atlantic Coast Pipeline, LLC (Atlantic) – a company formed by four major energy companies – Dominion Energy; Duke Energy Corporation; Piedmont Natural Gas Co., Inc.; and Southern Gas Company – proposes to construct and operate approximately 600 miles of natural gas transmission pipelines and associated aboveground facilities in West Virginia, Virginia, and North Carolina. This Project, referred to as the Atlantic Coast Pipeline (ACP), will deliver up to 1.5 million dekatherms per day of natural gas from supply areas in the Appalachian region to demand areas in Virginia and North Carolina. Atlantic has contracted with Dominion Energy Transmission, Inc. (DETI), a subsidiary of Dominion Energy, Inc., to construct and operate the ACP on behalf of Atlantic.

In conjunction with the ACP, DETI proposes to construct and operate approximately 37.5 miles of pipeline loop and modify existing compression facilities in Pennsylvania and West Virginia. This Project, referred to as the Supply Header Project (SHP), will enable DETI to provide firm transportation service to various customers, including Atlantic.

2.0 PURPOSE

Noxious weeds are plant species designated by Federal, State/Commonwealth, or County/City governments as injurious to public health, agriculture, recreation, wildlife, or property (Sheley et al., 1999). The more general term "invasive species" is used for species that are non-native to an ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Invasive plants include not only noxious weeds but other plants that are not native to an area. Both noxious weeds and non-native invasive plants are considered opportunistic species that flourish in disturbed areas and prevent native plants from establishing successive communities.

The areas crossed by the ACP and SHP (collectively, the Projects) contain widespread populations of many noxious weeds and other invasive plant species. The purpose of this *Invasive Plant Species Management Plan* is to describe methods to prevent and control the introduction or spread of invasive plant species during and following construction of the Projects. Atlantic and DETI and their Contractors[1] will be responsible for implementing the procedures described in this plan.

3.0 TRAINING

Prior to the start of construction, Atlantic and DETI will conduct environmental training for Company and Contractor personnel. The training program will focus on the Federal Energy Regulatory Commission's (FERC's) *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures); other construction, restoration, and mitigation plans, including this *Invasive Species Management Plan*; and applicable permit conditions. In addition, Atlantic and DETI will provide large-group

[1] Contractor refers to the company or companies retained by Atlantic/DETI or another contractor to construct the proposed facilities.

training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

4.0 JURISDICTION

Under Executive Order 13112, a Federal agency shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize the risk of harm will be implemented.

4.1 West Virginia

The West Virginia Noxious Weed Act (Chapter 19, Section 12D of the Code of West Virginia), which is administered by the West Virginia Department of Agriculture, prohibits persons, including corporations, from moving, transporting, delivering, shipping, or offering for shipment noxious weeds into or within the State without a permit from the State Secretary of Agriculture. West Virginia adopts the Federal Noxious Weed List in addition to its own State noxious weed list, and both lists are regulated by the West Virginia Noxious Weed Act. The invasive plant species identified in West Virginia are listed in Table 4-1.

4.2 Virginia

Virginia's Noxious Weed Law is administered by the Virginia Department of Agriculture and Consumer Services (VDACS). The Noxious Weed Law allows the VDACS to list weeds to be regulated; enforce quarantines to regulate the movement of listed weeds; and eradicate and/or suppress weed populations to prevent dissemination. The law defines a 'noxious' weed as a plant not widely disseminated that is determined to be detrimental to crops, surface waters, or other desirable plant, livestock, land, or other property, or to be injurious to the public health or the economy (Code of Virginia § 3.2-800 thru 809).

The Regulations for the Enforcement of the Noxious Weed Law (Virginia Administrative Code 2VAC5-317-20), which became effective in January 2015, list eight noxious weeds. European wand loosestrife was previously listed under the Noxious Weed Law and therefore was included in the survey list for Virginia. These nine species are consistent with those identified during correspondence with the program manager for the VDACS Plant Industry Services (VDACS, 2014). The invasive plant species identified in Virginia are listed in Table 4-1.

4.3 North Carolina

North Carolina noxious weed laws are regulated by the North Carolina Department of Agriculture and Consumer Services (NCDACS). The State Noxious Weed Regulations (North Carolina Administrative Code 48 §1700), adopted under the authority of the North Carolina Plant Pest Law, were enacted to prevent the widespread establishment of harmful non-native plants that are placed on a Noxious Weed List. Plants on the Noxious Weed List are prohibited entry into the State without a permit. Noxious weeds already present in the State are contained by prohibiting movement of the plant outside of regulated areas. In addition to the plant itself, articles that could contain noxious weed propagules, such as soil or hay, are also regulated. Regulated areas are usually defined by County boundaries and must be described by no more than 20 counties.

TABLE 4-1

Invasive Plant Species Identified Along the Atlantic Coast Pipeline and Supply Header Project

Common Name	Latin Name	Atlantic Coast Pipeline	Supply Header Project
West Virginia [a]			
Tree of heaven	*Ailanthus altissima*	X	X
Marijuana	*Cannabis sativa*		
Nodding plumeless thistle	*Carduus acanthoides*		
Curled thistle	*Carduus crispus*		X
Musk thistle	*Carduus nutans*	X	
Poison hemlock	*Conium maculatum*		
Autumn olive	*Elaeagnus umbellata*	X	X
Morrow’s honeysuckle	*Lonicera morrowii*	X	X
Tatarian honeysuckle	*Lonicera tatarica*		X
Purple loosestrife	*Lythrum salicaria*	X	
Japanese stiltgrass	*Microstegium vimineum*	X	X
Opium poppy	*Papaver somniferum*		
Japanese knotweed	*Polygonum cuspidatum*	X	X
Mile-a-minute vine	*Polygonum perfoliatum*		
Kudzu	*Pueraria montana*	X	
Multiflora rose	*Rosa multiflora*	X	X
Johnsongrass	*Sorghum halepense*	X	
Virginia [b]			
Giant hogweed	*Heracleum mantegazzianum*		
Cogongrass	*Imperta cylindrica*		
Water spinach	*Ipomoea aquatic*		
Purple loosestrife	*Lythrum salicaria*		
Wand loosestrife	*Lythrum virgatum*		
Wavyleaf basketgrass	*Oplismenus hirtellus*		
Giant salvinia	*Salvinia molesta*		
Tropical soda apple	*Solanum viarum*		
Beach vitex	*Vitex rotundifolia*		
North Carolina [c]			
Curled thistle	*Carduus crispus*		
Musk thistle	*Carduus nutans*		
Giant hogweed	*Heracleum mantegazzianum*		
Cogongrass/Japanese blood grass	*Imperta cylindrical*		
Water spinach	*Ipomoea aquatic*		
Purple loosestrife	*Lythrum salicaria*		
Wand loosestrife	*Lythrum virgatum*		
Wavyleaf basketgrass	*Oplismenus hirtellus*		
Common reed	*Phragmites australis*		
Mile-a-minute vine	*Polygonum perfoliatum*		
Giant salvinia	*Salvinia molesta*		
Tropical soda apple	*Solanum viarum*		
Witchweed	*Striga* (all species)		
Puncturevine	*Tribulus terrestris*		

TABLE 4-1 (continued)

Invasive Plant Species Identified Along the Atlantic Coast Pipeline and Supply Header Project

Common Name	Latin Name	Atlantic Coast Pipeline	Supply Header Project
Beach vitex	*Vitex rotundifolia*		
Itchgrass	*Rottboellia cochinchinensis*		
Pennsylvania [d]			
Marijuana	*Cannabis sativa*		
Musk thistle/ Nodding thistle	*Carduus nutans*		
Canadian thistle	*Cirsium arvense*		
Bull thistle/ Spear thistle	*Cirsium vulgare*		
Jimsonweed	*Datura stramonium*		
Goatsrue	*Galega officinalis*		
Giant hogweed	*Heracleum mantegazzianum*		
Purple Loosestrife	*Lythrum salicaria*		
Mile-a-minute	*Polygonum perfoliatum*		
Kudzu-vine	*Pueraria lobate*		
Multiflora rose	*Rosa multiflora*		X
Shattercane	*Sorghum bicolor*		
Johnsongrass	*Sorghum halepense*		

[a] Obtained from Article 12D of the West Virginia Noxious Weed Act of 1976, Title 61 Legislative Rules West Virginia Department of Agriculture, Series 14A Rules and additional U.S. Department of Agriculture listed species occurring in the State (U.S. Department of Agriculture, 2014).

[b] Obtained from the Regulations for the Enforcement of the Noxious Weed Law (Virginia Administrative Code 2VAC5-317-20) and correspondence with the Plant Industries Services Program Manager with the Virginia Department of Agriculture and Consumer Services (VDACS, 2014).

[c] Provided by the Plant Pest Administrator with the North Carolina Department of Agriculture and Consumer Services – Plant Industry Division (NCDACS, 2014).

[d] Obtained from the Pennsylvania Noxious Weed Control List (PDA, 2015).

Although North Carolina has outlined 19 noxious weeds on the Noxious Weed List, Atlantic contacted the State Plant Pest Administrator with the NCDACS Plant Industry Division to discuss this list and to confirm what species should be documented during survey efforts (NCDACS, 2014). During this consultation, Atlantic was provided a list of 16 noxious weed species of concern as well as all species of the genus *Striga*. The invasive plant species identified by the NCDACS are listed in Table 4-1.

4.4 Pennsylvania

In Pennsylvania, the Noxious Weed Control Law and Noxious Weed Control List are administered by the Pennsylvania Department of Agriculture (PDA). The PDA is responsible for implementing Federal and Commonwealth eradication and control programs for suppression, control, or eradication of noxious weeds. Under the Noxious Weed Control Law, it is a violation to “sell, transport, plant, or otherwise propagate that weed within the Commonwealth” (PDA, 1997). The Secretary of Agriculture retains the right to designate weed control areas when necessary and to require affected landowners to comply with the control measures required within 30 days of the designation. The invasive plant species identified by the PDA are listed in Table 4-1.

5.0 INVASIVE PLANT SPECIES SURVEYS

Atlantic and DETI are conducting a field survey for State/Commonwealth listed invasive plant species within a 300-foot-wide corridor along the proposed ACP and SHP pipeline routes. A list of the invasive plant species identified through June 2016 in the ACP and SHP survey corridors (approximately 98 percent of the Projects) is provided in Table 4-1. This table and attachment will be updated periodically as surveys are completed. The milepost locations of invasive plant species identified through June 2016 are provided in Attachment A. Table 5-1 identifies invasive species that are adjacent to threatened and endangered plant species along the proposed route. Because this table includes location information for federally listed species, it has been filed under separate cover. The table is marked "Contains Privileged Information – Do Not Release."

6.0 INVASIVE PLANT SPECIES MANAGEMENT

The invasive plant species management program for the ACP and SHP is designed to:

- identify areas supporting invasive plants prior to construction;
- prevent the introduction and spread of invasive plants from construction equipment moving along the right-of-way;
- contain invasive plant propagules by preventing segregated topsoil from being spread to adjacent areas along the construction right-of-way; and
- address invasive plant infestations that develop during restoration and operation of the Projects.

Attachment A identifies the primary and alternative treatment methods for invasive species identified during survey in the ACP Project area and SHP Project area. The primary and/or alternative treatment method will be used based on the growing stage and prevalence of the invasive species. Methods may vary based on proximity to environmental features (e.g., wetlands, open water, sensitive species locations, and agricultural fields), in accordance with State/Commonwealth regulations.

6.1 Identification of Problem Areas

As noted above, Atlantic and DETI are conducting surveys for invasive plant species within the ACP Project area and SHP Project area. Additional areas supporting invasive plant species may be identified during preconstruction inspections by Atlantic and DETI's Environmental Inspectors (EI).[2] Prior to construction, the EIs will mark areas of invasive plant infestations by using color-coded flagging, staking, and/or signs on the construction rights-of-way. Identification of existing invasive plant locations will alert EIs and construction personnel to implement control measures during construction.

[2] The role and responsibilities of an EI are defined in the FERC's Plan.

6.2 Treatment Measures

6.2.1 Pre-Treatment

Prior to clearing and grading operations, pre-treatment of invasive plant infestations may be conducted if it will aid in controlling the spread of invasive plant species during construction. The control measures to be implemented may include the application of herbicide or mechanical measures such as mowing. The control measure chosen will be the best method available for the time, place, and species, as determined through consultation with the appropriate State/Commonwealth or Federal agency.

Herbicide application is an effective means of reducing the size of invasive plant species populations. Herbicide treatment methods will be based on species-specific and area-specific conditions (e.g., annual vs. perennial species; proximity to wetlands, open water, riparian areas, or agricultural areas; and time of year), and will be coordinated, as necessary, with State/Commonwealth and/or Federal agencies. Hand application methods (e.g., backpack spraying) will be used to treat occurrences of invasive species within the right-of-way and in other work areas. Preconstruction treatment of infestation areas will be controlled, as described in Section 7.0, to minimize impacts on surrounding vegetation. Aerial spraying will not be used for invasive plant species control along the rights-of-way.

Application of herbicides will be completed in accordance with applicable chemical contact times (as specified by the manufacturer) in advance of clearing and grading within the construction right-of-way. Treatment may be restricted in areas that are not readily accessible (e.g., difficult topography, saturated/inundated soils) or where there are documented occurrences of protected species that could be adversely impacted by herbicide applications. No herbicides will be applied within 25 feet of known occurrences of federal-listed threatened or endangered plant species. No use of herbicides (or pesticides) will be allowed within 100 feet of a wetland or waterbody, except where allowed by State/Commonwealth or Federal agencies.[3] No spraying of herbicides (or insecticides) will be allowed within a 300-foot karst feature buffer, except where allowed by State/Commonwealth or Federal agencies.

Atlantic and DETI will continue to work with applicable State/Commonwealth and Federal agencies to address invasive plant species control options where protected species and their habitats occur along the ACP and SHP. Mitigation measures to avoid impacts on these species could include hand pulling or spot herbicide treatment (for state-protected species) using a five gallon bucket or tarps to cover the sensitive plants during treatments. No herbicides will be applied within 25 feet of known occurrences of federally-listed threatened and endangered species.

In accordance with 18 CFR 380.15(f)(3), herbicides will not be used as a treatment unless authorized by the landowner or land managing agency. Atlantic and DETI will obtain

3 Rodeo® Aquatic, for example, is a water-friendly herbicide approved by the PDA, WVDA, VDACS, and NCDACS.

permission from landowners or land managing agencies prior to applications of herbicides within the right-of-way or other work areas. Additionally, Atlantic and DETI will use products which are approved by the U.S. Environmental Protection Agency (EPA) for use as herbicides, and applications of these products will be in accordance with applicable regulations.

In addition to complying with 18 CFR 380.15(f)(3), Atlantic and DETI will: 1) use herbicides which are registered with the EPA; 2) apply herbicides according to specifications of the *Federal Insecticide, Fungicide, and Rodenticide Act*; and 3) use only certified applicators to apply herbicides.

Mechanical control (e.g., mowing or disking) can also be an effective control measure for annual species. The efficacy of mechanical control measures are dependent upon proper timing to cut the vegetation prior to the maturation of seed and may require multiple treatments during the growing season.

6.2.2 Preventive Measures during Construction

The following measures will be implemented to prevent the spread of invasive plant species during construction activities.

- Atlantic and DETI will direct its Contractors to clean equipment and vehicles prior to initial arrival at contractor yards and staging areas.

- All equipment (including timber mats) will be cleaned prior to arriving on the construction site. The equipment will be inspected by the Contractor and an EI to verify that it is clean of soil and debris, which are capable of transporting invasive plant propagules, prior to working on the Projects.

- Atlantic/DETI will install cleaning and washing stations at contractor yards and other locations along the pipeline routes as listed in Table 6.6.2-1. The locations for the stations were selected based on the results of field surveys and other mitigating factors (such as accessibility), the prevalence of invasive plants, the locations of sensitive resources (e.g., wetlands), landowner requirements, and recommendations from State/Commonwealth or Federal agencies.

- The wash stations will be installed prior to construction and removed during/following the restoration of the right-of-way.

- Cleaning will be conducted using high pressure washing equipment, compressed air, and/or manually to remove excess soil and debris from the tracks, tires, and blades of equipment.

- Wash water will be managed on site at the wash station. The water will be allowed to infiltrate into upland soils within the work area. Debris which collects around the work area will be collected and disposed of at an approved facility.

TABLE 6.2.2-1

Proposed Wash Stations along the Atlantic Coast Pipeline and Supply Header Project

Project/Segment	Approximate Milepost	Description
Atlantic Coast Pipeline		
AP-1	73.1	Entry to the Monongahela National Forest
AP-1	83.9	Exit to the Monongahela National Forest
AP-1	76.9	Entry to the Seneca State Forest
AP-1	80.5	Exit to the Seneca State Forest
AP-1	83.9	Entry to the George Washington National Forest
AP-1	158.1	Exit to the George Washington National Forest
AP-1	141.8	Entry to certified organic farm
AP-1	142.4	Exit to certified organic farm
AP-1	183.3	Entry to the James River WMA
AP-1	184.7	Exit to the James River WMA
AP-1	300.0	Entry to North Carolina
AP-3	12.0	Exit to North Carolina
AP-2	118.8	Entry to a certified organic farm
AP-2	118.9	Exit to a certified organic farm
Contractor Yard Spread 01-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 02-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 02A-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 02A-B	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 02-D	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 03-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 03-B	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 03-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 04-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 04-A-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 03A-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 03A-B	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 05-C	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard – GWNF – 6 Spread 04-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 06-C	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 07-B	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 08-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 09-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 10-A	offline	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard Spread 11-C	offline	Equipment cleaning prior to mobilizing to the right-of-way
Supply Header Project		
TL-635	23.7	Entry to the Lewis Wetzel WMA
TL-635	27.3	Exit to the Lewis Wetzel WMA
TL-635	27.6	Entry to the Lewis Wetzel WMA
TL-635	27.7	Exit to the Lewis Wetzel WMA
Contractor Yard 9	5.7	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard 10	10.7	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard 8	18.6	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard 7	19.0	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yard 4	0.3	Equipment cleaning prior to mobilizing to the right-of-way
Contractor Yards 1, 2, 3	0.4	Equipment cleaning prior to mobilizing to the right-of-way

- The Contractor and EI will maintain logs documenting the cleaning history of each piece of equipment. The EI will use stickers or other visual marking to identify that equipment has been cleaned and an inspection has been completed.

- Topsoil will be segregated, or buried if approved, in all infested areas, including the spoil-side and working-side portions of the construction right-of-way as a method to prevent equipment and workers from transporting and spreading invasive species.

- Cleared vegetation and segregated topsoil from areas with invasive plant infestations will be maintained adjacent to the areas from which they were removed to eliminate the transport of soil-borne propagules to other areas. The stockpiles will be identified as invasive plant species stockpiles with signs. The Contractor will install sediment barriers (e.g., silt fence) around the stockpiles to ensure the material is not transported to adjacent areas. During reclamation, the materials will be returned to the areas from which they were obtained.

- Equipment required for initial vegetation clearing and/or topsoil segregation in areas with invasive plant infestation will be cleaned prior to leaving the area. Once topsoil has been segregated, subsequent equipment will not require cleaning as it will not come into contact with invasive plant species or topsoil potentially containing propagules. Equipment required for topsoil replacement during restoration will also be cleaned prior to moving out of an area of infestation.

- All equipment which comes in contact with soils potentially contaminated with invasive species will be cleaned prior to being transported from ACP or SHP work sites to other job sites.

Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free.

6.2.3 Post-Construction Treatment Methods

Atlantic's and DETI's objective is to comply with regulatory and Project-specific requirements to prevent the spread of invasive plant species and treat areas of the rights-of-way where invasive plant species form a significant portion of the vegetation community in comparison to adjacent areas. Atlantic and DETI will utilize established restoration procedures to prevent the establishment of invasive plant species in areas disturbed by construction.

In non-frozen soil conditions, the construction Contractor will implement restoration procedures on disturbed lands immediately following construction. In frozen soil conditions, restoration activities will be delayed until the Spring or Summer following construction. In either case, ongoing revegetation and monitoring efforts will ensure adequate vegetative cover to discourage the establishment of invasive plant species.

Following construction, the ACP Project area and SHP Project area will be monitored in accordance with the Plan and Procedures. In the event that invasive plant species become established in the right-of-way, Atlantic and DETI will implement measures (e.g., mowing or treatment with herbicides) to control invasive plants within the right-of-way and prevent the spread of invasive plants to adjacent lands which do not contain invasive species. In addition, Atlantic and DETI will implement control measures at the aboveground facility sites to prevent the spread of invasive plant species onto adjacent properties. Weed infestations that develop during operations as a result of construction will be treated using approved herbicides or mechanical methods (e.g., mowing) as appropriate for the species and in accordance with applicable laws and regulations. The method selected will be the best available for the time, place, and species as determined through consultation with the appropriate State/Commonwealth or Federal agency and with the landowner.

Post-construction herbicide applications will be conducted prior to seed maturation where possible and where necessary. Applications will be controlled, as described in Section 7.0, to minimize impacts on surrounding vegetation. Herbicide treatment methods will be based on species-specific and area-specific conditions as described above and will be coordinated with State/Commonwealth and Federal agencies as applicable. Hand application methods (e.g., backpack spraying) will be used to treat occurrences of invasive species within the right-of-way and in other work areas. Following the treatment, a seeding program will be implemented in accordance with the *Restoration and Rehabilitation Plan*. The timing of subsequent revegetation efforts will be based on the persistence of the herbicide.

Mechanical methods entail the use of equipment to mow or disk invasive plant species populations. Mechanical treatments will be conducted prior to seed maturation where required. If such a method is used, subsequent seeding will be conducted, if necessary, to re-establish a desirable vegetative cover that will stabilize the soils and slow the potential reoccurrence of invasive plant species.

Where warranted, Atlantic and DETI will consult with the appropriate State/Commonwealth or Federal agency regarding the use of biological and alternative invasive plant control methods. The implementation of these measures will require approval from the landowner or land managing agency.

Increased accessibility of lands along the proposed pipeline rights-of-way, particularly during operations, could lead to off-highway vehicle (OHV) use into previously restricted or inaccessible areas. Atlantic and DETI will take steps to limit OHV use on the proposed pipeline rights-of-way to avoid issues with revegetation efforts or erosion problems to address landowner concerns or preferences, and to complete additional operational and maintenance activities that may require the use of an OHV. To extent practicable, the use of Atlantic and DETI OHVs will only be on an as needed basis to complete these tasks. In addition to these operational issues, OHV use along the pipeline rights-of-way could allow unintended access to sensitive wildlife habitats, species, or culturally sensitive areas and lead to adverse impacts on these resources.

To avoid OHV access along the pipeline rights-of-way and additional roads opened up for construction equipment and vehicles, Atlantic and DETI will implement measures, as appropriate, to restrict OHV access along the right-of-way. This could include installation of OHV barriers at appropriate locations along the rights-of-way. Barriers may consist of signs, fences, vegetation, or boulders. Atlantic and DETI will coordinate with the appropriate land managing agencies to identify locations where unauthorized OHV access to Federal and State/Commonwealth lands via the pipeline right-of-way is most likely. At these key crossing locations, site-specific OHV blocking measures will be developed in consultation with the land managing agencies.

7.0 MONITORING

Following construction, invasive plant infestations will be monitored as part of Atlantic's and DETI's restoration monitoring activities as described in the *Restoration and Rehabilitation Plan*. Atlantic/DETI will inspect disturbed areas after the first and second growing seasons, at a minimum, to determine the success of revegetation. Revegetation shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar to adjacent undisturbed lands. Atlantic and DETI will continue revegetation efforts and monitoring until successful revegetation is achieved. Following successful revegetation, Atlantic and DETI's operations staff will monitor and treat invasive plant species as part of its normal operations and maintenance activities in accordance with applicable State/Commonwealth or Federal regulations.

8.0 HERBICIDES

8.1 Herbicide Application and Handling

Herbicide application will be based on information gathered from field surveys and consultations with applicable State/Commonwealth or Federal agencies. Before application, Atlantic or DETI or its Contractors will obtain required State/Commonwealth or local permits and landowner approval. Herbicide application will be conducted in accordance with applicable laws and regulations by a licensed contractor. Additionally, the following protocols will be implemented:

- Atlantic and DETI will not use aerial spraying as a means of invasive plant species control along the right-of-way;
- Atlantic and DETI will not use herbicides within 25 feet of known occurrences of federally-listed endangered or threatened plant species;
- Atlantic and DEIT will not use herbicides (or pesticides) within 100 feet of a waterbody or wetland, except where allowed by State/Commonwealth or Federal agencies;
- Atlantic and DETI will not use spraying of herbicides (or insecticides) within a 300-foot karst feature buffer, except where allowed by State/Commonwealth or Federal agencies.

Hand application methods (e.g., backpack spraying) will be used to treat occurrences of invasive species within the right-of-way and in other work areas. Calibration checks of equipment will be conducted at the beginning of spraying and periodically to ensure proper application rates.

Herbicides will be transported to the site with the following provisions:

- on-site herbicide quantities will be limited where practical;
- concentrate will be transported in approved containers only, in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment;
- mixing will be conducted in an upland area and at a distance greater than 100 feet from waterbodies or wetlands; greater than 200 feet from private wells; greater than 300 feet from karst features; and greater than 400 feet from public wells. The property owner will be consulted about the presence and location of wells prior to herbicide application;
- storage and handling of all herbicides and equipment will be in accordance with all applicable regulations; and
- all herbicide equipment and containers will be maintained as needed and inspected for leaks on a daily basis.

8.2 Herbicide Spills

Atlantic and DETI have prepared and will implement a *Spill Prevention, Control, and Countermeasures Plan* (SPCC Plan) to avoid or minimize the potential impact of hazardous material spills during construction and operation of the Projects. In accordance with this plan, herbicide contractors will be responsible for keeping spill kits in their vehicles and in herbicide storage areas to allow for quick and effective response to spills. Response to an herbicide spill will vary depending on the material spilled and the size and location of the spill. The order of priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and conduct cleanup and remediation activities.

All herbicide contractors will obtain and have readily available copies of the appropriate Safety Data Sheets (formally known as Material Safety Data Sheets) and labels for the herbicides used. All herbicide spills will be reported in accordance with applicable laws and requirements. Further information regarding spill response and reporting is provided in the SPCC Plan.

9.0 FEDERALLY MANAGED LANDS

The ACP crosses approximately 20.0 miles of U.S. Forest Service lands in the Monongahela and George Washington National Forests. For these crossings, Atlantic has prepared a *Construction, Operations, and Maintenance Plan*, which identifies construction procedures and mitigation measures to be implemented on these federally managed lands. The results of the invasive plant species surveys and proposed control measures on Federal lands are included in this plan.

The ACP also crosses approximately 0.1 mile of National Park Service land along the Blue Ridge Parkway. Atlantic will be using the horizontal directional drill (HDD) construction method to install the proposed pipeline under the Blue Ridge Parkway. The HDD method will avoid direct impacts on the parkway, including impacts on vegetation immediately adjacent to the parkway. This will limit the potential for the spread of invasive species or propagules along the parkway.

10.0 REFERENCES

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ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

and

DOMINION TRANSMISSION, INC.
SUPPLY HEADER PROJECT

Invasive Species Management Plan

ATTACHMENT A
Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project

ATTACHMENT A

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method	Secondary Treatment Method
ATLANTIC COAST PIPELINE					
AP-1					
West Virginia					
Harrison	0.0	*Rosa multiflora, Elaeagnus umbellata, Microstegium vimineum*	0-10, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Harrison	0.7	*Elaeagnus umbellata, Lonicera morrowii*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Harrison	0.8	*Ailanthus altissima*	25-50	Ground herbicide application	Spot herbicide application
Harrison	1.0	*Elaeagnus umbellata*	25-50	Ground herbicide application	Spot herbicide application
Lewis	1.1	*Elaeagnus umbellata, Rosa multiflora*	25-50, 25-50	Ground herbicide application	Spot herbicide application
Lewis	1.3	*Ailanthus altissima*	25-50	Ground herbicide application	Spot herbicide application
Lewis	3.8	*Elaeagnus umbellata, Rosa multiflora, Lonicera morrowii*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	6.8	*Carduus nutans*	0-10	Ground herbicide application	Spot herbicide application
Lewis	8.2	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Lewis	8.3	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Lewis	11.3	*Sorghum halepense*	10-25	Ground herbicide application	Spot herbicide application
Lewis	11.6	*Carduus nutans*	10-25	Ground herbicide application	Spot herbicide application
Lewis	12.6	*Lonicera morrowii, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	12.8	*Lonicera morrowii, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	13.4	*Ailanthus altissima, Rosa multiflora, Microstegium vimineum*	0-10, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Lewis	13.6	*Lonicera morrowii, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 10-25	Ground herbicide application	Spot herbicide application
Lewis	13.8	*Rosa multiflora, Elaeagnus umbellata*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	13.9	*Lonicera morrowii, Rosa multiflora, Elaeagnus umbellata*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	14.0	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	14.3	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Lewis	14.4	*Lonicera morrowii*	0-10	Ground herbicide application	Spot herbicide application
Lewis	14.5	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	14.8	*Lonicera morrowii, Rosa multiflora, Ailanthus altissima, Elaeagnus umbellata*	0-10, 0-10, 0-10, 10-25	Ground herbicide application	Spot herbicide application
Lewis	14.9	*Lonicera morrowii, Elaeagnus umbellata, Rosa multiflora*	0-10, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	15.3	*Microstegium vimineum, Ailanthus altissima*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	15.4	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	0-10, 10-25, 0-10	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Lewis	15.5	*Ailanthus altissima*	50-75	Mechanical	Ground herbicide application
Lewis	16.0	*Elaeagnus umbellata, Microstegium vimineum, Ailanthus altissima, Rosa multiflora*	10-25, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	16.1	*Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora, Ailanthus altissima, Lonicera morrowii*	10-25, 0-10, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	16.5	*Elaeagnus umbellata, Microstegium vimineum, Ailanthus altissima*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	17.0	*Ailanthus altissima, Elaeagnus umbellata, Lonicera morrowii, Microstegium vimineum, Rosa multiflora*	0-10, 10-25, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	17.1	*Ailanthus altissima, Elaeagnus umbellata, Lonicera morrowii, Microstegium vimineum, Rosa multiflora*	0-10, 10-25, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	17.3	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	17.4	*Elaeagnus umbellata, Rosa multiflora, Lonicera morrowii*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	17.6	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	18.6	*Microstegium vimineum, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	18.7	*Elaeagnus umbellata, Microstegium vimineum*	0-10, 25-50	Ground herbicide application	Spot herbicide application
Lewis	18.8	*Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora*	10-25, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	19.0	*Lonicera morrowii, Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora, Ailanthus altissima*	0-10, 0-10, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	20.2	*Lonicera morrowii, Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora*	0-10, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	20.6	*Lonicera morrowii, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	20.9	*Elaeagnus umbellata, Microstegium vimineum, Ailanthus altissima, Lonicera morrowii*	0-10, 10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	21.1	*Microstegium vimineum, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Lewis	21.4	*Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Lewis	21.9	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	23.2	*Elaeagnus umbellata, Lonicera morrowii*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	23.3	*Polygonum cuspidatum*	0-10	Ground herbicide application	Spot herbicide application
Upshur	24.4	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	24.8	*Ailanthus altissima, Elaeagnus umbellata*	0-10, 50-75	Mechanical	Ground herbicide application
Upshur	25.1	*Elaeagnus umbellata, Rosa multiflora*	25-50, 10-25	Ground herbicide application	Spot herbicide application
Upshur	25.2	*Microstegium vimineum, Elaeagnus umbellata*	75-100, 10-25	Ground herbicide application	Spot herbicide application
Upshur	26.1	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	26.2	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Upshur	26.5	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Upshur	27.4	*Carduus nutans*	0-10	Ground herbicide application	Spot herbicide application
Upshur	27.7	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	28.3	*Elaeagnus umbellata, Rosa multiflora, Microstegium vimineum*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	28.9	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	29.0	*Carduus nutans*	0-10	Ground herbicide application	Spot herbicide application
Upshur	29.1	*Lonicera morrowii, Rosa multiflora*	25-50, 25-50	Ground herbicide application	Spot herbicide application
Upshur	29.3	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Upshur	29.6	*Elaeagnus umbellata, Rosa multiflora, Lonicera morrowii*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	29.8	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	10-25, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Upshur	30.1	*Carduus nutans*	0-10	Ground herbicide application	Spot herbicide application
Upshur	30.6	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii, Microstegium vimineum*	0-10, 0-10, 0-10, 10-25	Ground herbicide application	Spot herbicide application
Upshur	31.1	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii, Microstegium vimineum*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	31.2	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	10-25, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Upshur	31.6	*Elaeagnus umbellata, Lonicera morrowii*	0-10	Ground herbicide application	Spot herbicide application
Upshur	31.7	*Polygonum cuspidatum*	10-25	Ground herbicide application	Spot herbicide application
Upshur	32.0	*Ailanthus altissima, Elaeagnus umbellata*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	32.1	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	32.3	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Upshur	32.4	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii, Ailanthus altissima*	10-25, 10-25, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Upshur	32.5	*Lonicera morrowii, Rosa multiflora, Ailanthus altissima*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	32.7	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Upshur	33.6	*Lonicera morrowii, Rosa multiflora*	0-10, 10-25	Ground herbicide application	Spot herbicide application
Upshur	34.4	*Polygonum cuspidatum, Elaeagnus umbellata, Rosa multiflora*	50-75, 0-10, 0-10	Mechanical	Ground herbicide application
Upshur	36.0	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Upshur	36.2	*Microstegium vimineum, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	36.4	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Upshur	36.7	*Microstegium vimineum, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	36.8	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Upshur	37.1	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Upshur	37.4	*Rosa multiflora, Microstegium vimineum, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	37.5	*Rosa multiflora, Elaeagnus umbellata*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Upshur	37.7	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	37.9	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	39.5	*Rosa multiflora*	75-100	Mechanical	Ground herbicide application
Upshur	39.7	*Elaeagnus umbellata*	10-25	Ground herbicide application	Spot herbicide application
Upshur	40.6	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Upshur	43.6	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	10-25, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Randolph	44.8	*Rosa multiflora, Lonicera morrowii, Elaeagnus umbellata, Lythrum salicaria, Microstegium vimineum*	10-25, 10-25, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	49.3	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Randolph	49.5	*Carduus nutans, Sorghum halepense, Rosa multiflora*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	49.9	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Randolph	50.4	*Microstegium vimineum, Rosa multiflora*	25-50, 0-10	Ground herbicide application	Spot herbicide application
Randolph	50.9	*Rosa multiflora, Elaeagnus umbellata, Microstegium vimineum*	0-10, 10-25, 50-75	Mechanical	Ground herbicide application
Randolph	51.1	*Rosa multiflora, Ailanthus altissima, Elaeagnus umbellata*	10-25, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Randolph	51.5	*Elaeagnus umbellata, Rosa multiflora*	0-10, 10-25	Ground herbicide application	Spot herbicide application
Randolph	51.6	*Elaeagnus umbellata, Rosa multiflora*	0-10, 10-25	Ground herbicide application	Spot herbicide application
Randolph	52.0	*Elaeagnus umbellata, Rosa multiflora*	10-25, 0-10	Ground herbicide application	Spot herbicide application
Randolph	52.3	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	10-25, 0-10, 10-25	Ground herbicide application	Spot herbicide application
Randolph	52.4	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	10-25, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Randolph	52.6	*Rosa multiflora, Elaeagnus umbellata*	0-10, 10-25	Ground herbicide application	Spot herbicide application
Randolph	52.9	*Elaeagnus umbellata, Rosa multiflora*	10-25, 10-25	Ground herbicide application	Spot herbicide application
Randolph	53.5	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	54.0	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Randolph	54.1	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Randolph	54.4	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	56.2	*Elaeagnus umbellata*	0-10	Ground herbicide application	Spot herbicide application
Randolph	56.4	*Elaeagnus umbellata*	25-50	Ground herbicide application	Spot herbicide application
Randolph	57.1	*Elaeagnus umbellata*	10-25	Ground herbicide application	Spot herbicide application
Randolph	57.3	*Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	57.6	*Elaeagnus umbellata*	10-25	Ground herbicide application	Spot herbicide application
Randolph	57.7	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Randolph	58.3	*Pueraria montana*	10-25	Ground herbicide application	Spot herbicide application
Randolph	58.4	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Randolph	59.5	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Randolph	59.6	*Elaeagnus umbellata, Polygonum cuspidatum, Rosa multiflora*	25-50	Ground herbicide application	Spot herbicide application
Randolph	60.2	*Polygonum cuspidatum*	75-100	Mechanical	Ground herbicide application
Randolph	60.7	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Randolph	61.0	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Randolph	63.5	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Randolph	63.9	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Randolph	64.5	*Rosa multiflora*	25-50	Ground herbicide application	Spot herbicide application
Randolph	64.6	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Randolph	65.0	*Rosa multiflora, Elaeagnus umbellata, Lonicera morrowii*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	65.1	*Lonicera morrowii, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	65.2	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Randolph	65.4	*Elaeagnus umbellata, Rosa multiflora*	10-25, 25-50	Ground herbicide application	Spot herbicide application
Randolph	65.5	*Rosa multiflora, Elaeagnus umbellata*	25-10, 0-10	Ground herbicide application	Spot herbicide application
Randolph	65.7	*Rosa multiflora, Lonicera morrowii, Microstegium vimineum, Rosa multiflora*	0-10, 0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Pocahontas	67.4	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Pocahontas	67.7	*Rosa multiflora*	25-50	Ground herbicide application	Spot herbicide application
Pocahontas	68.6	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Pocahontas	69.0	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Pocahontas	69.1	*Elaeagnus umbellata*	10-26	Ground herbicide application	Spot herbicide application
Pocahontas	69.2	*Elaeagnus umbellata, Carduus ntans, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Pocahontas	69.3	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Pocahontas	70.3	*Elaeagnus umbellata, Rosa multiflora*	0-10, 0-10	Ground herbicide application	Spot herbicide application
Pocahontas	70.5	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
Virginia					
None Identified					
AP-2					
North Carolina					
None identified					

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
AP-3					
None Identified					
SUPPLY HEADER PROJECT					
TL-636					
Pennsylvania					
Westmoreland	0.5	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Westmoreland	0.7	*Microstegium vimineum, Lonicera tartarica*	25-50, 50-75	Mechanical	Ground herbicide application
Westmoreland	2.2	*Lonicera tartarica*	50-75	Mechanical	Ground herbicide application
Westmoreland	3.2	*Rosa multiflora*	0-10	Ground herbicide application	Spot herbicide application
TL-635					
West Virginia					
Harrison	0.1	*Elaeagnus umbellata*	25-50	Ground herbicide application	Spot herbicide application
Harrison	0.2	*Elaeagnus umbellata, Rosa multiflora*	50-75, 25-50	Mechanical	Ground herbicide application
Harrison	0.3	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Harrison	0.4	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Harrison	0.5	*Elaeagnus umbellata, Microstegium vimineum*	0-10, 25-50	Ground herbicide application	Spot herbicide application
Harrison	0.6	*Elaeagnus umbellata, Microstegium vimineum*	25-50, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	0.8	*Elaeagnus umbellata, Microstegium vimineum*	50-75, 50-75	Mechanical	Ground herbicide application
Doddridge	0.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	1.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	2.1	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	2.3	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	2.4	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	2.5	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	2.8	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	3.1	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	3.9	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	4.0	*Ailanthus altissima, Elaeagnus umbellata, Microstegium vimineum,*	0-10, 25-50, 50-75	Ground herbicide application	Spot herbicide application
Doddridge	4.1	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	4.2	*Microstegium vimineum, Rosa multiflora*	75-100, 75-100	Mechanical	Ground herbicide application
Doddridge	4.4	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	4.5	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	4.6	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Doddridge	5.9	*Elaeagnus umbellata, Lonicera morrowii, Microstegium vimineum*	25-50, 25-50, 50-75	Ground herbicide application	Spot herbicide application
Doddridge	6.0	*Elaeagnus umbellata, Microstegium vimineum*	25-50, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	6.2	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	6.3	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	6.4	*Rosa multiflora*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	6.6	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	7.0	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	7.3	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	7.4	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	7.6	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	7.7	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	7.8	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	7.9	*Lonicera tatarica*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	8.1	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	8.2	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	8.4	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	8.7	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	8.8	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	8.9	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	9.0	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	9.3	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Doddridge	9.5	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	9.6	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	9.7	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	9.8	*Microstegium vimineum, Rosa multiflora*	75-100, 25-50	Mechanical	Ground herbicide application
Doddridge	10.0	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	10.7	*Rosa multiflora*	10-25	Ground herbicide application	Spot herbicide application
Doddridge	11.2	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Doddridge	11.3	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	11.4	*Microstegium vimineum, Rosa multiflora*	25-50, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	11.5	*Carduus crispus, Microstegium vimineum*	10-25, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	11.6	*Microstegium vimineum*	25-50	Mechanical	Ground herbicide application
Doddridge	11.7	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Doddridge	11.8	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	11.9	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	12.2	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	12.4	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	12.7	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	12.9	*Elaeagnus umbellata, Microstegium vimineum*	50-75, 50-75	Mechanical	Ground herbicide application
Doddridge	13.3	*Elaeagnus umbellata*	50-75	Mechanical	Ground herbicide application
Doddridge	13.8	*Elaeagnus umbellata*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	13.9	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	14.0	*Elaeagnus umbellata, Microstegium vimineum, Rosa multiflora*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Doddridge	14.2	*Elaeagnus umbellata*	10-25	Mechanical	Ground herbicide application
Doddridge	14.4	*Elaeagnus umbellata*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	14.6	*Elaeagnus umbellata*	50-75	Mechanical	Ground herbicide application
Doddridge	15.1	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	15.4	*Elaeagnus umbellata*	10-25	Ground herbicide application	Spot herbicide application
Doddridge	15.6	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	16.7	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	16.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	17.1	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	17.3	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	25-50, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Doddridge	17.4	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	17.5	*Microstegium vimineum, Rosa multiflora*	25-50, 50-75	Ground herbicide application	Spot herbicide application
Doddridge	17.8	*Ailanthus altissima, Microstegium vimineum*	0-10, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	18.0	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Doddridge	18.5	*Polygonum cuspidatum, Rosa multiflora, Elaeagnus umbellata*	10-25, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Doddridge	18.6	*Elaeagnus umbellata, Fallopia japonica*	50-75, 25-50	Mechanical	Ground herbicide application
Doddridge	19.0	*Ailanthus altissima, Rosa multiflora, Polygonum cuspidatum, Microstegium vimineum*	0-10, 0-10, 0-10, 25-50	Ground herbicide application	Spot herbicide application
Doddridge	19.8	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	19.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	20.0	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	20.1	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	20.5	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application

ATTACHMENT A (cont'd)

Invasive Plant Species Identified along the Atlantic Coast Pipeline and Supply Header Project [a]

Facility, State/ Commonwealth, County/City	Approximate Milepost	Invasive Plant Species	Prevalence (percent)	Primary Treatment Method [b]	Secondary Treatment Method
Doddridge	20.7	*Fallopia japnoica*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	21.0	*Microstegium vimineum, Rosa multiflora, Elaeagnus umbellata*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Doddridge	21.3	*Microstegium vimineum*	75-100	Mechanical	Ground herbicide application
Doddridge	21.9	*Microstegium vimineum*	0-10	Ground herbicide application	Spot herbicide application
Doddridge	22.0	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Doddridge	22.5	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Doddridge	22.6	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Tyler	22.8	*Ailanthus altissima, Microstegium vimineum*	50-75, 75-100	Mechanical	Ground herbicide application
Tyler	22.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Tyler	23.1	*Rosa multiflora*	25-50	Ground herbicide application	Spot herbicide application
Tyler	23.4	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Tyler	23.5	*Ailanthus altissima, Microstegium vimineum, Rosa multiflora*	10-25, 25-50, 25-50	Ground herbicide application	Spot herbicide application
Wetzel	23.8	*Microstegium vimineum, Rosa multifora*	25-50, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	24.0	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Wetzel	25.6	*Microstegium vimineum, Rosa multiflora*	25-50, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	28.4	*Ailanthus altissima, Microstegium vimineum, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	28.8	*Microstegium vimineum*	50-75	Mechanical	Ground herbicide application
Wetzel	29.0	*Microstegium vimineum, Rosa multiflora, Ailanthus altissima*	25-50, 10-25, 10-25	Ground herbicide application	Spot herbicide application
Wetzel	29.4	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Wetzel	29.6	*Rosa multiflora, Elaeagnus umbellata, Microstegium vimineum, Ailanthus altissima*	25-50, 25-50, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	29.9	*Microstegium vimineum, Elaeagnus umbellata*	25-50, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	31.1	*Elaeagnus umbellata, Lonicera morrowii, Rosa multiflora*	0-10, 0-10, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	32.2	*Microstegium vimineum, Ailanthus altissima, Polygonum cuspidatum*	25-50, 10-25, 0-10	Ground herbicide application	Spot herbicide application
Wetzel	32.5	*Microstegium vimineum*	10-25	Ground herbicide application	Spot herbicide application
Wetzel	32.8	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Wetzel	32.9	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Wetzel	33.1	*Microstegium vimineum*	25-50	Ground herbicide application	Spot herbicide application
Wetzel	33.5	*Microstegium vimineum, Rosa multiflora, Polygonum cuspidatum, Lonicera tartarica,*	50-75, 0-10, 0-10, 25-50	Mechanical	Ground herbicide application

[a] Information related to invasive plant species within U.S. Forest Service lands is included in the *Construction, Operations, and Maintenance Plan*.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT K

Spill Report Form

Previously filed with the FERC on July 18, 2016 (Accession No. 20160718-5164)

Atlantic Coast Pipeline and Supply Header Project
Spill Report Form

Date of Spill:________________________________ Date of Spill Discovery:________________________

Time of Spill:________________________________ Time of Spill Discovery:________________________

Name and Title of Discoverer:____

Type of material spilled and manufacturer's name:____

Legal Description of spill location to the quarter section:____

Directions from nearest community:____

Estimated volume of spill:____

Weather conditions:____

Topography and surface conditions of spill site:____

Spill medium (pavement, sandy soil, water, etc.):____

Proximity of spill to surface waters: ____

Did the spill reach a waterbody? ________Yes ________No

If so, was a sheen present? ________Yes ________No

Describe the causes and circumstances resulting in the spill:____________________________________

____

____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5-foot radius to a depth of 1 inch): ____

____

____

Describe immediate spill control and/or cleanup methods used and implementation schedule: __________________

____

Current status of cleanup actions:____

Name and Company for the following:

Construction Superintendent:____

____

Spill Coordinator:____

____

Environmental Inspector:____

Person Who Reported the Spill:____

____

Environmental Inspector:____

Form completed by:_______________________________________Date:_______________________

Spill Coordinator must complete this for all spills, regardless of size, and submit the form to the Environmental Inspector within 24 hours of the occurrence.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT L

Unanticipated Discoveries Plan for Cultural Resources and Human Remains Policy on the George Washington National Forest

UNANTICIPATED DISCOVERIES PLAN FOR CULTURAL RESOURCES AND HUMAN REMAINS POLICY IN THE GEORGE WASHINGTON NATIONAL FOREST

Revision 3 – 9 May 2017

Prepared by:

GAI Consultants, Inc.
385 East Waterfront Drive
Homestead, Pennsylvania 15120

For:

Atlantic Coast Pipeline Project

Docket No.   CP15-554-000

UNANTICIPATED DISCOVERIES PLAN FOR CULTURAL RESOURCES AND HUMAN REMAINS POLICY IN THE GEORGE WASHINGTON NATIONAL FOREST

INTRODUCTION

In order to minimize the potential for accidental discovery of cultural resources, Atlantic Coast Pipeline, LLC (Atlantic) will complete or has completed a detailed archaeological survey of the Project's APE, which includes locations associated with the proposed undertaking where there will be alteration and disturbance of surface and subsurface soils that contain or have potential to contain archaeological sites, including proposed construction areas, access roads, staging areas, etc. That investigation will be conducted in accordance with: 16 U.S.C. 551; 36 CFR Part 251, Subpart B; 36 CFR Part 296; and, the National Historic Preservation Act (NHPA) of 1966.

This Unanticipated Discoveries Plan has been prepared for the Project in order for Atlantic to comply with the NHPA and the relevant state and federal regulations concerning the protection of cultural resources. The following procedures are designed to deal with unanticipated discovery of cultural resources encountered during construction. This plan was developed consistent with 36 CFR §800.13 (Post-Review Discovery clause), as well as *Guidelines for Conducting Historic Resources Survey in Virginia* (Virginia Department of Historic Resources [VDHR] 2011) and *Permit Required for Archaeological Excavation of Human Remains* (Code of Virginia 10.1-2305).

Inspectors have the responsibility to monitor altered and disturbed areas for potential archaeological remains throughout construction. Archaeological remains consist of man-made objects or features greater than 50 years of age. These remains include, but are not limited to, items such as artifacts (e.g., stone flakes, stone tools, ceramics, glass, architectural material), fire pits, building foundations, and human remains.

If required by the George Washington National Forest [GWNF], in areas considered to have a high likelihood for significant archaeological remains (as defined in consultation with the GWNF) an Archaeological Inspector (AI) will be present onsite during grading or trenching activities in those areas, and will monitor the areas for cultural and physical remains as grading or trenching occurs. The AI will meet the Secretary of the Interior professional qualifications standards for archaeology.

The Lead Environmental Inspector (LEI) and the AI will be responsible for advising the construction contractor's personnel on the procedures to follow in the event that an unanticipated discovery is made. A copy of this Unanticipated Discoveries Plan will be maintained by the Environmental Inspectors, the AI, and at the construction field office. Training will occur as part of the pre-construction on-site training program for foremen, company inspectors, and construction supervisors. The LEI will advise all operators of equipment involved in grading, stripping, or trenching activities to:

- Stop work immediately if they observe any indications of the presence of cultural materials or possibly human bone.
- Immediately contact the LEI (or the Construction Inspector [CI] if the LEI is not available).
- Treat human remains with dignity and respect.

CULTURAL RESOURCES

The following procedures are designed to deal with unanticipated discovery of potential cultural resources encountered during construction. Additional procedures for discovery of potential human remains are outlined under the next heading.

- The LEI or AI will immediately notify the Construction Supervisor who will immediately halt work in the vicinity of the potential find and notify Atlantic's Environmental Project Manager (PM).
- Reasonable effort must be made to protect and secure the discovery. At least a 100-foot buffer between the find and construction activity will be maintained to avoid further impact to the potential cultural resource.
- Atlantic's Environmental PM will immediately by telephone notify the GWNF Forest Supervisor and the GWNF Forest Archaeologist. Within 24 hours Atlantic's Environmental PM will follow-up with a written (via email) notification of the nature of the find to the GWNF Forest Supervisor, the GWNF Forest Archaeologist, and the GWNF Special Project Coordinator.
- If attempts to reach National Forest representatives are unsuccessful (e.g., during construction on weekends), construction in the area will immediately cease, and the area will be marked off with flagging with at least a 100-foot buffer between the find and the construction activity.
- It is the responsibility of the GWNF Forest Archaeologist to conduct the preliminary assessment of the find, as well as within 48 hours consult, as necessary, with the Federal Energy Regulatory Commission (FERC), the VDHR, and other consulting parties (e.g., appropriate tribal organizations).
- The GWNF Forest Archaeologist will by telephone notify Atlantic's Environmental PM regarding the results of the preliminary assessment.
- If the site is determined to be potentially eligible for inclusion in the National Register of Historic Places (NRHP), additional work, such as a Determination of Eligibility, avoidance, or Data Recovery will be performed as required/approved by the Forest Archaeologist. Further construction work at the site of the discovery will be temporarily suspended until applicable requirements of Section 106 of the NHPA and other related federal and state regulations have been successfully completed.

- Atlantic, in direct consultation with the GWNF Forest Archaeologist, will keep construction activities at least 100 feet from the find by installing flagging and/or temporary fencing with signage indicating “Environmentally Sensitive Area” or similar statement as approved by the GWNF.

- Atlantic, with consultation and authorization by the GWNF Forest Archaeologist, will direct their cultural resources consultant to perform necessary fieldwork and reporting to assist the GWNF Forest Archaeologist in determining the site’s eligibility for the NRHP.

- No archaeological excavations will be conducted prior to receiving a FS2700-32 Permit for Archaeological Investigations.

- If the unanticipated discovery does not contain human remains or funerary objects, and is determined by the Forest Archaeologist to be ineligible for inclusion in the NRHP (and the FERC and the VDHR concur), Atlantic may proceed with the Project only after receiving written authorization from the GWNF Forest Supervisor. A binding Data Recovery Plan signed by the Forest Service, the VDHR, the FERC, and affected tribal organizations (if any), may allow construction activities to resume sooner if those activities are also otherwise lawful.

HUMAN REMAINS

If the unanticipated discovery is determined to contain human remains or funerary objects, the following procedures will be followed.

- The LEI (or CI if LEI is not available) or AI will immediately halt work and notify by telephone the GWNF Patrol Captain and the GWNF Forest Archaeologist. The LEI will also follow-up with an email notice to the GWNF Forest Supervisor and the GWNF Special Project Coordinator.

- If the GWNF Patrol Captain is not available, the LEI will notify the local law enforcement.

- Reasonable effort must be made to protect and secure the discovery. The Construction Supervisor will ensure that human remains are protected from further damage, intrusion, or removal until proper examinations can be performed.

- Atlantic, in direct consultation with the GWNF Forest Archaeologist, will keep construction activities at least 100 feet from the find by installing flagging and/or temporary fencing with signage indicating “Environmentally Sensitive Area” or similar statement as approved by the GWNF.

- Discovery of human remains should not be made public, including but not limited to conversations with local residents, posting on social media, or communication with news outlets.

- Under no circumstances should human remains be removed from the site without completing all permitting and coordination processes with the GWNF and, as appropriate, local law enforcement, the medical examiner, the VDHR, affected tribal organizations, and the FERC.

- Further work at the site will be suspended until all applicable requirements of Section 106 of the NHPA and other related state and federal regulations have been successfully completed. Human remains identified on federal lands may be subject to the Native American Graves Protection and Repatriation Act (NAGPRA) and/or the Virginia Antiquities Act (Code of Virginia 10.1-2305).

- The GWNF Patrol Captain and the GWNF Forest Archaeologist, in consultation with other appropriate parties as necessary (e.g., county sheriff, coroner, VDHR), will assess whether the remains are historical or modern and/or part of a crime scene.

- If the remains are determined not to be of recent origin, the GWNF Forest Archaeologist and the FERC will consult appropriate parties (e.g., the VDHR and appropriate tribal representatives) regarding additional steps to be followed.

- If the remains are Native American, a reasonable effort will be made to determine and notify the affiliated tribal organization.

- If the remains are not Native American and not associated with a crime scene, the Forest Service will protect the remains until a plan for avoidance or removal is developed in consultation with the VDHR, the FERC, and interested parties. Actions will be consistent with guidance in National Register Bulletin 41: *Guidelines for Evaluating and Registering Cemeteries and Burial Places* (Potter and Boland 1992). A reasonable attempt will be made to identify the next of kin.

- In consultation with the GWNF (and as appropriate, the VDHR, affected tribal organizations, and interested parties), Atlantic will attempt to locate and survey alternate areas so the human remains can be avoided. Involved parties will be informed of the results before the alternate area is accepted. If more remains are discovered or if there is no feasible alternate area, involved parties will be consulted about the removal and/or reburial of the human remains. In the case of non-Native American burials, the GWNF should also notify the local municipality and discussions should occur with constituencies (such as descendants) regarding removal and reburial of the remains.

- No archaeological excavations will be conducted prior to receiving a FS2700-32 Permit for Archaeological Investigations.

- Archaeological removal of in situ placement of human remains and/or associated grave goods requires a permit from the VDHR in accordance with the Code of Virginia 10.1-2305.

- Construction in the area of the find will only continue after Atlantic receives written authorization from the Forest Service. Only after the human remains have been properly removed from the site, or sufficiently avoided, should construction in the site area be resumed.

REFERENCES

Potter E.W. and B.M. Boland. 1992. *National Register Bulletin 41: Guidelines for Evaluating and Registering Cemeteries and Burial Places*. U.S. Department of the Interior, National Park Service. Washington, D.C.

Virginia Department of Historic Resources (VDHR). 2011. *Guidelines for Conducting Historic Resources Survey in Virginia*. Virginia Department of Historic Resources, Richmond.

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Bath County Sheriff
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Warm Springs, VA 24484
540-839-2375

Highland County Sheriff
David Neil
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Monterey, VA 24465
540-468-2210

ATLANTIC COAST PIPELINE, LLC

ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT M

Unanticipated Discoveries Plan for Cultural Resources and Human Remains Policy in the Monongahela National Forest

UNANTICIPATED DISCOVERIES PLAN FOR CULTURAL RESOURCES AND HUMAN REMAINS POLICY IN THE MONONGAHELA NATIONAL FOREST

Revision 2 – 23 August 2016

Prepared by:

GAI Consultants, Inc.
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For:

Atlantic Coast Pipeline Project

Docket No. CP15-554-000

UNANTICIPATED DISCOVERIES PLAN FOR CULTURAL RESOURCES AND HUMAN REMAINS POLICY IN THE MONONGAHELA NATIONAL FOREST

INTRODUCTION

In order to minimize the potential for accidental discovery of cultural resources, Atlantic Coast Pipeline, LLC (Atlantic) will complete or has completed a detailed archaeological survey of the Project's APE, which includes locations associated with the proposed undertaking where there will be alteration and disturbance of surface and subsurface soils that contain or have potential to contain archaeological sites, including proposed construction areas, access roads, staging areas, etc. That investigation will be conducted in accordance with: 16 U.S.C. 551; 36 CFR Part 251, Subpart B; 36 CFR Part 296; and, the National Historic Preservation Act (NHPA) of 1966.

This Unanticipated Discoveries Plan has been prepared for the Project in order for Atlantic to comply with the relevant state and federal regulations concerning the protection of cultural resources. The following procedures are designed to deal with unanticipated discovery of cultural resources encountered during construction. This plan was developed consistent with 36 CFR §800.13 (Post-Review Discovery clause), as well as the West Virginia Division of Culture and History (WVDCH) *Guidelines for Phase I, II, and III Archeological Investigations and Technical Reports* (Trader 2001); and West Virginia Code §29-1-8a.

Inspectors have the responsibility to monitor altered and disturbed areas for potential archaeological remains throughout construction. Archaeological remains consist of man-made objects or features greater than 50 years of age. These remains include, but are not limited to, items such as artifacts (e.g., stone flakes, stone tools, ceramics, glass, architectural material), fire pits, building foundations, and human remains.

If required by the Monongahela National Forest [MNF], in areas considered to have a high likelihood for significant archaeological remains (as defined in consultation with the MNF) an Archaeological Inspector (AI) will be present onsite during grading or trenching activities in those areas, and will monitor the areas for cultural and physical remains as grading or trenching occurs. The AI will meet the Secretary of the Interior professional qualifications standards for archaeology.

The Lead Environmental Inspector (LEI) and the AI will be responsible for advising the construction contractor's personnel on the procedures to follow in the event that an unanticipated discovery is made. A copy of this Unanticipated Discoveries Plan will be maintained by the Environmental Inspectors, the AI, and at the construction field office. Training will occur as part of the pre-construction on-site training program for foremen, company inspectors, and construction supervisors. The LEI will advise all operators of equipment involved in grading, stripping, or trenching activities to:

- Stop work immediately if they observe any indications of the presence of cultural materials or possibly human bone.
- Immediately contact the LEI (or the Construction Inspector [CI] if the LEI is not available).
- Treat human remains with dignity and respect.

CULTURAL RESOURCES

The following procedures are designed to deal with unanticipated discovery of potential cultural resources encountered during construction. Additional procedures for discovery of potential human remains are outlined under the next heading.

- The LEI or AI will immediately notify the Construction Supervisor who will immediately halt work in the vicinity of the potential find and notify Atlantic's Environmental Project Manager (PM).
- Reasonable effort must be made to protect and secure the discovery. At least a 100-foot buffer between the find and construction activity will be maintained to avoid further impact to the potential cultural resource.
- Atlantic's Environmental PM will immediately by telephone notify the MNF Forest Supervisor and the MNF Heritage Program Manager and within 24 hours will follow-up with a written (via email) notification of the nature of the find.
- If attempts to reach National Forest representatives are unsuccessful (e.g., during construction on weekends), construction in the area will immediately cease, and the area will be marked off with flagging with at least a 100-foot buffer between the find and the construction activity.
- It is the responsibility of the MNF Heritage Program Manager to conduct the preliminary assessment of the find, as well as within 48 hours consult, as necessary, with the Federal Energy Regulatory Commission (FERC), the WVDCH, MNF Tribal partners, and other consulting parties (e.g., FERC records indicate the Delaware Nation asked to be notified in the event of an unanticipated discovery of archaeological sites during construction).
- The MNF Heritage Program Manager will by telephone notify Atlantic's Environmental PM regarding the results of the preliminary assessment.
- If the site is determined to be potentially eligible for inclusion in the National Register of Historic Places (NRHP), additional work, such as a Determination of Eligibility, avoidance, or Data Recovery will be performed as required/approved by the MNF Heritage Program Manager. Further construction work at the site of the discovery will be temporarily suspended until applicable requirements of Section 106 of the NHPA and other related federal and state regulations have been successfully completed.

- Atlantic, in direct consultation with the MNF Heritage Program Manager, will keep construction activities at least 100 feet from the find by installing flagging and/or temporary fencing with signage indicating “Environmentally Sensitive Area” or similar statement as approved by the MNF.

- Atlantic, with consultation and authorization by the MNF Heritage Program Manager, will direct their cultural resources consultant to perform necessary fieldwork and reporting to assist the MNF Heritage Program Manager in determining the site’s eligibility for the NRHP.

- No archaeological excavations will be conducted prior to receiving a FS2700-32 Permit for Archaeological Investigations.

- If the unanticipated discovery does not contain human remains or funerary objects, and is determined by the MNF Heritage Program Manager to be ineligible for inclusion in the NRHP (and the FERC and the WVDCH concur), Atlantic may proceed with the Project only after receiving written authorization from the MNF Forest Supervisor. A binding Data Recovery Plan signed by the Forest Service, the WVDCH, the FERC, and affected tribal organizations (if any), may allow construction activities to resume sooner if those activities are also otherwise lawful.

HUMAN REMAINS

If the unanticipated discovery is determined to contain human remains or funerary objects, the following procedures will be followed.

- The LEI (or CI if LEI is not available) or AI will immediately halt work and immediately notify by telephone Atlantic’s Environmental PM, who in turn will immediately notify by telephone the MNF Forest Supervisor, and the MNF Heritage Program Manager. Within 24 hours, Atlantic’s Environmental PM will follow up with written (via email) confirmation of the discovery to the MNF Forest Supervisor and the MNF Heritage Program Manager.

- If human remains are discovered, the Forest Service will promptly involve Forest Service Law Enforcement (or local law enforcement, as appropriate) and notify the WVDCH, MNF Tribal partners, and the FERC.

- Reasonable effort must be made to protect and secure the discovery. The Construction Supervisor will ensure that human remains are protected from further damage, intrusion, or removal until proper examinations can be performed.

- Atlantic, in direct consultation with the MNF Heritage Program Manager, will keep construction activities at least 100 feet from the find by installing flagging and/or temporary fencing with signage indicating “Environmentally Sensitive Area” or similar statement as approved by the MNF.

- Discovery of human remains should not be made public, including but not limited to conversations with local residents, posting on social media, or communication with news outlets.

- Forest Service Law Enforcement will control the situation until the nature of the remains is officially determined as being forensic or archaeological. If the remains are forensic, Forest Service Law Enforcement will maintain control of the situation.

- Under no circumstances should human remains be removed from the site without completing all permitting and coordination processes with the MNF and, as appropriate, local law enforcement, the medical examiner, the WVDCH, affected tribal organizations, and the FERC.

- Further work at the site will be suspended until all applicable requirements of Section 106 of the NHPA and other related state and federal regulations have been successfully completed. Human remains identified on federal lands may be subject to the Native American Graves Protection and Repatriation Act (NAGPRA) and/or West Virginia Code §29-1-8a or West Virginia Code §37-13.

- The MNF Heritage Program Manager, in consultation with other appropriate parties as necessary (e.g., county sheriff, coroner, WVDCH), will assess whether the remains are historical or modern and/or part of a crime scene.

- If the remains are Native American or if the discovery consists of funerary objects, sacred objects, or objects of cultural patrimony, the Forest Service will act in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA) Section 3 and 43 CFR 10.4 in consultation with MNF Tribal partners. The Forest Service shall uphold the responsibility to protect the remains until all questions regarding the status and custody of the remains and cultural objects have been resolved.

- For Native American remains, the activity that resulted in the unanticipated discovery may not resume until 30 days after the authorized officer certifies receipt of the written confirmation, if resumption of the activity is otherwise lawful, or at any time if a binding written agreement has been executed between the Forest Service and the affiliated Indian tribes that adopts a recovery plan for the human remains and objects.

- If the remains are not Native American and not associated with a crime scene, the Forest Service will protect the remains until a plan for avoidance or removal is developed in consultation with the WVDCH, the FERC, and interested parties. Actions will be consistent with West Virginia Code §37-13 and guidance in National Register Bulletin 41: *Guidelines for Evaluating and Registering Cemeteries and Burial Places* (Potter and Boland 1992). A reasonable attempt will be made to identify the next of kin.

- In consultation with the MNF (and as appropriate, the WVDCH, affected tribal organizations, and interested parties), Atlantic will attempt to locate and survey alternate areas so the human remains can be avoided. Involved parties will be informed of the results before the alternate area is accepted. If more remains are discovered or if there is no feasible alternate area, involved parties will be consulted about the removal and/or reburial of the human remains. In the case of non-Native American burials, the MNF should also notify the local municipality and discussions should occur with constituencies (such as descendants) regarding removal and reburial of the remains.

- No archaeological excavations will be conducted prior to receiving a FS2700-32 Permit for Archaeological Investigations.

- Archaeological removal of in situ placement of human remains and/or associated grave goods may require a permit from the WVDCH.

- Construction in the area of the find will only continue after Atlantic receives written authorization from the Forest Service. Only after the human remains have been properly removed from the site, or sufficiently avoided, should construction in the site area be resumed.

REFERENCES

Potter E.W. and B.M. Boland. 1992. *National Register Bulletin 41: Guidelines for Evaluating and Registering Cemeteries and Burial Places*. U.S. Department of the Interior, National Park Service. Washington, D.C.

Trader, Patrick. 2001. *Guidelines for Phase I, II, and III Archeological Investigations and Technical Reports*. West Virginia State Historic Preservation Office, Charleston, West Virginia.

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ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT N

Permit List

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
FEDERAL					
FERC	Certificate under Section 7(c) of the NGA and Authorization under Section 7(b) of the NGA	September 2015	October 2017	September 2015	October 2017
Federal Aviation Administration	Notice of Proposed Construction or Authorization	November 2016	*January 2018*	NA	NA
	Supplemental Notice	November 2016	*January 2018*	NA	NA
Federal Communications Commission	Application for Wireless Telecommunications Bureau Radio Service Authority	November 2016	*January 2018*	NA	NA
NOAA – NMFS	Consultation under Section 7 of the ESA and Section 305 of the Magnuson-Stevens Act	August 2014	September 2017	NA	NA
	Consultation under the Marine Mammal Protection Act	August 2014	July 2016	NA	NA
NPS – BRP	Right-of-Way Grant and Special Use Permit to cross the BRP	September 2015	*October 2017*	NA	NA
USACE	Department of the Army Permits under Section 404 of the CWA and Section 10 of the RHA				
Huntington District		September 2015	*November 2017*	September 2015	*November 2017*
Pittsburgh District		September 2015	*November 2017*	September 2015	*November 2017*
Norfolk District		September 2015	*November 2017*	NA	NA
Wilmington District		September 2015	*November 2017*	NA	NA
FWS	Consultation under Section 7 of the ESA				
West Virginia Ecological Field Services Office		August 2014	*October 2017*	October 2014	*October 2017*
Virginia Ecological Field Services Office		August 2014	*October 2017*	NA	NA
North Carolina Ecological Field Services Office		August 2014	*October 2017*	NA	NA
Pennsylvania Ecological Field Services Office		NA	NA	October 2014	*October 2017*

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
FS – GWNF including a crossing of the ANST	ROD to authorize the use of NFS lands on the GWNF ROD for GWNF LRMP amendments SUP for construction and operation of ACP on NFS lands in the GWNF	November 2015	*October 2017*	NA	NA
FS – MNF	ROD to authorize the use of NFS lands on the MNF ROD for MNF LRMP amendments if needed SUP for construction and operation of ACP on NFS lands in the MNF	November 2015	*October 2017*	NA	NA
Advisory Council on Historic Preservation	Consultation under Section 106 of the NRHP	See below			
STATE					
West Virginia					
West Virginia Department of Environmental Protection					
Division of Air Quality	Air Permit – New Source Review Permit (or other applicable permit)	September 2015	May 2017	September 2015	*March 2018*
Division of Water and Waste Management	General Water Pollution Control Permit for Construction Stormwater	March 2017	*November 2017*	March 2017	*November 2017*
Division of Water and Waste Management	Water Quality Certificate under Section 401 of the Clean Water Act	September 2015	*October 2017*	NA	NA
Division of Water and Waste Management	National Pollutant Discharge Elimination System – Water Pollution Control Permit for Hydrostatic Testing Water – WV0113069	*2Q 2018*	*3Q 2018*	*2Q 2018*	*3Q 2018*
Division of Water and Waste Management	Large Quantity User Water Use Registration	*November 2017*	*December 2017*	*November 2017*	*December 2017*
West Virginia Division of Culture and History	Consultation under Section 106 of the National Historic Preservation Act	June 2014	*October 2017*	October 2014	*October 2017*

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
West Virginia Division of Natural Resources					
Natural Heritage Program	Natural Heritage/Protected Species Consultation	August 2014	*October 2017*	October 2014	*October 2017*
Office of Land and Streams	Stream Activity Permit (Joint Application with the Public Lands Corporation)	*January 2018*	*January 2018*	*January 2018*	*January 2018*
West Virginia Public Lands Corporation	Stream Activity Permit (Joint Application with the Division of Natural Resources)	*January 2018*	*January 2018*	*January 2018*	*January 2018*
County/City/Local	Floodplain Permits (required for 3 of the 5 Counties along the ACP and 2 of the 4 Counties along SHP)	1 county submitted in August *Remaining 2 counties will be submitted in October 2017*	*November 2017*	*2 counties will be submitted in October 2017*	*November 2017*
Virginia					
Virginia Department of Conservation and Recreation					
	Protected Species Consultation (plant species)	April 2016	*October 2017*	NA	NA
	Virginia Scenic Rivers Clearance	July 2015	*October 2017*	NA	NA
Virginia Department of Environmental Quality					
Coastal Zone Management Program	Consistency Determination under the Virginia Coastal Zone Management Program	September 2015	June 2017	NA	NA
Air Division	Air Permit – New Source Review Permit (or other applicable permit)	September 2015	*March 2018*	NA	NA
Water Division	Water Quality Certificate under Section 401 of the Clean Water Act (Joint Permit Application for the Water Quality Certificate, Department of the Army Permit, Submerged Lands Permit, and Tidal Wetland Permit)	September 2015	*December 2017*	NA	NA

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
Water Division	General Permit for Discharges from Petroleum Contaminated Sites, Groundwater Remediation, and Hydrostatic Tests (VAG83)	*2Q 2018*	*3Q 2018*	NA	NA
Water Division	Soil and Erosion Plan and Variance for Open Trench Length	July 2017	*November 2017*	NA	NA
Office of Water Supply	Surface Water Withdrawal	NA	NA	NA	NA
Virginia Department of Game and Inland Fisheries	Natural Heritage/Protected Species Consultation (wildlife and aquatic species)	August 2014	October 2017	NA	NA
Virginia Department of Historical Resources	Consultation under Section 106 of the National Historic Preservation Act	June 2014	*October 2017*	NA	NA
Virginia Department of Transportation	Land Use Permit	*4Q 2017*	*4Q 2017 - 1Q 2018*	NA	NA
Virginia Marine Resources Commission	Submerged Lands Permit (Joint Permit Application for the Water Quality Certificate, Department of the Army Permit, Submerged Lands Permit, and Tidal Wetland Permit)	September 2015	*November 2017*	NA	NA
Local Wetland Boards	Tidal Wetland Permit (Joint Permit Application for the Water Quality Certificate, Department of the Army Permit, Submerged Lands Permit, and Tidal Wetland Permit)	September 2015	*November 2017*	NA	NA
County/City/Local	Floodplain Permit (required for 7 of the 14 Counties/Cities along the ACP)	7 counties submitted from July to September 2017	*November 2017*	NA	NA
County/City/Local	Special or Conditional Use Permit (where required)	*4Q 2017*	*4Q 2017 – 1Q 2018*	NA	NA

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
North Carolina					
North Carolina Department of Natural and Cultural Resources					
Division of Air Quality	Air Permit – Stationary Source Construction and Operation Permit	September 2015	*December 2017*	NA	NA
Division of Energy, Mineral, and Land Resources (or approved local government)	General Permit NCG 010000 to Discharge Stormwater under the National Pollutant Discharge Elimination System	December 2016	*November 2017*	NA	NA
Division of Water Resources	Water Quality Certificate under Section 401 of the Clean Water Act (including permission to use State-owned bottom lands)	May 2017	*November 2017*	NA	NA
Division of Water Resources	Isolated and Other Non-404 Jurisdictional Wetlands and Waters Permit (including permission to use State-owned bottom lands)	September 2015	NA	NA	NA
Division of Water Resources	Buffer Authorization (for riparian zone disturbance)	September 2015	*November 2017*	NA	NA
Natural Heritage Program	Natural Heritage/Protected Species Consultation	August 2014	*October 2017*	NA	NA
North Carolina State Historic Preservation Office	Consultation under Section 106 of the National Historic Preservation Act	June 2014	*October 2017*	NA	NA
North Carolina Wildlife Commission	Protected Species Consultation	October 2014	October 2017	NA	NA
County/City/Local	Floodplain Permit (required for 5 of the 8 Counties along the ACP)	5 counties submitted from July to September 2017	*November 2017*	NA	NA
County/City/Local	Special or Conditional Use Permit (where required)	4Q 2016 - 3Q 2017	2Q 2017- *4Q 2017*	NA	NA
Pennsylvania					
Pennsylvania Department of Environmental Protection					
Bureau of Air Quality	Air Quality Plan Approval	NA	NA	September 2015	*March 2018*

Major Environmental Permits, Licenses, Approvals, and Consultations for the Atlantic Coast Pipeline and Supply Header Project

October 19, 2017

		Atlantic Coast Pipeline		Supply Header Project	
Agency	Permit/Approval/Clearance	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*	Initial Submittal Date *(Anticipated)* [a]	Receipt Date *(Anticipated)*
Bureau of Waterways Engineering and Wetlands	Water Quality Certificate under Section 401 of the CWA (issued jointly with Chapter 105 Permit)	NA	NA	March 2017	*November 2017*
Bureau of Waterways Engineering and Wetlands	Chapter 105 Water Obstruction and Encroachment Permit	NA	NA	September 2015	*November 2017*
Bureau of Waterways Engineering and Wetlands	Submerged Land License Agreement (issued jointly with Chapter 105 Permit)	NA	NA	September 2015	*November 2017*
Bureau of Point and Non-Point Source Management	NPDES – Hydrostatic Testing Water Discharge General Permit – PAG-10	NA	NA	March 2017	September 2017
Bureau of Safe Drinking Water	Chapter 110 Water Withdrawal and Use Registration	NA	NA	NA	NA
Pennsylvania Department of Conservation and Natural Resources Pennsylvania Game Commission Pennsylvania Fish and Boat Commission	Natural Heritage/Protected Species Consultation	NA	NA	October 2014	September 2015
Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation	Consultation under Section 106 of the NHPA	NA	NA	October 2014	*November 2017*
Westmoreland Conservation District	Review of Erosion and Sediment Control Plan (required for Chapter105 Permit) and Issuance of ESCGP-2	NA	NA	March 2017	*November 2017*
Greene County Conservation District	Review of Erosion and Sediment Control Plan and Issuance of ESCGP-2	NA	NA	March 2017	*November 2017*
County/Local	Floodplain Management Act	NA	NA	NA	NA

[a] Date of Atlantic's and DETI's initial application submittals.

[b] Note: Since 1995, the GWNF in central western Virginia and the Jefferson National Forest in southwestern Virginia have been administratively combined as the single : George Washington and Jefferson National Forests, managed by a single Forest Supervisor.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT O

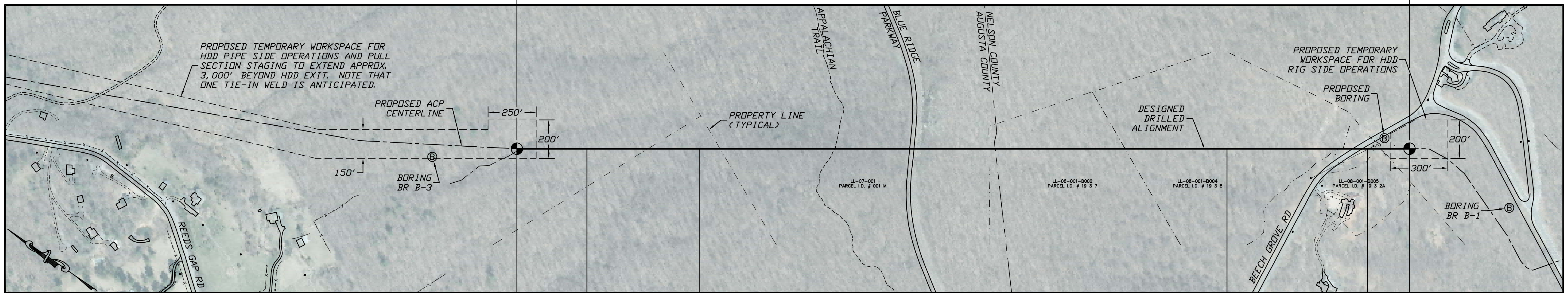
Appalachian National Scenic Trail HDD Plan and Profile Drawings

Blue Ridge Parkway

Supporting Information

- Plan & profile drawing presenting HDD crossing design (2 pages, 11x17)
- Installation stress analysis, with buoyancy control (4 pages)
- Installation stress analysis, without buoyancy control (4 pages)
- Hydrofracture evaluation (1 page)

HORIZONTAL DRILLED LENGTH = 4,639'
TRUE LENGTH = 4,652'



PLAN

SCALE: 1"=300'

EXIT POINT @ 8°
46+39.05, 2012.00
N 13773798.63, E 2223025.61

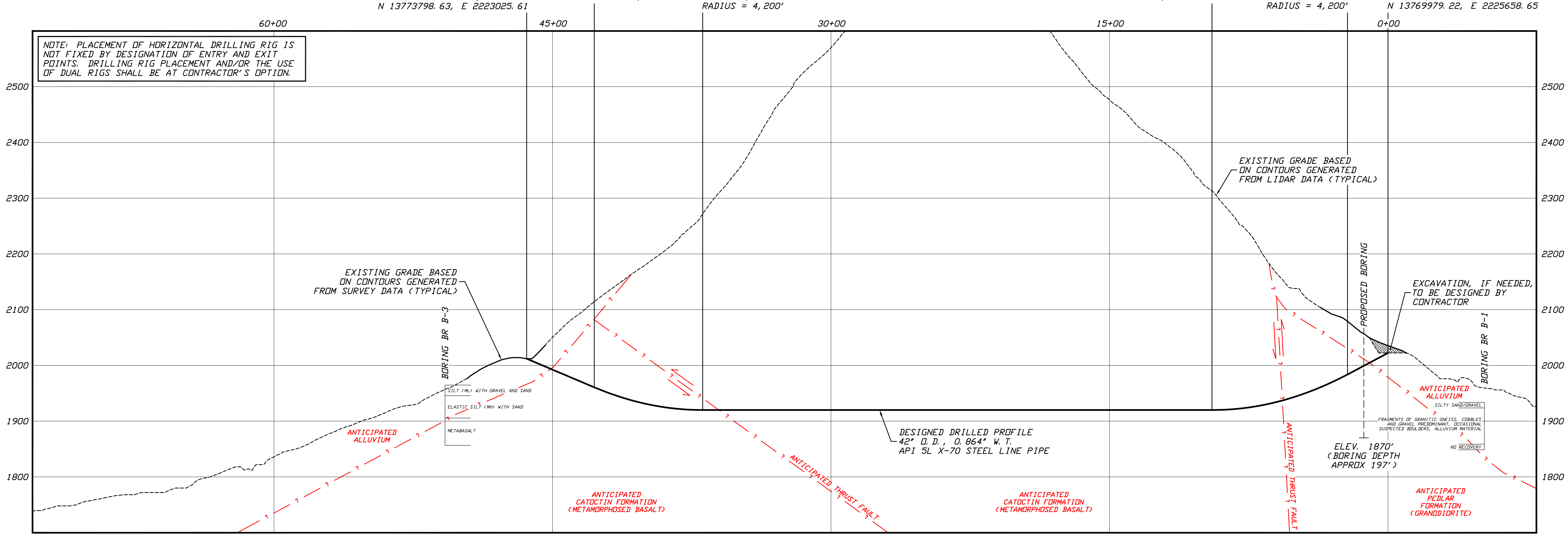
P.T. 8° SAG BEND
42+75.27, 1960.87

P.C. 8° SAG BEND
36+90.74, 1920.00
RADIUS = 4,200'

P.T. 10° SAG BEND
9+47.61, 1920.00

P.C. 10° SAG BEND
2+18.28, 1983.81
RADIUS = 4,200'

ENTRY POINT @ 10°
0+00.00, 2022.30
N 13769979.22, E 2225658.65



PROFILE

SCALE: 1"=300' HORIZONTAL
1"=100' VERTICAL

100 50 0
600 300 150 0

GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT
- BORING LOCATION

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.
2. STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES.
3. THE ANTICIPATED SUBSURFACE CONDITIONS SHOWN IN RED ARE BASED ON A GENERAL GEOLOGIC PROFILE INCLUDED IN THE GEOTECHNICAL SITE INVESTIGATION REPORT AS FIGURE 4.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 30 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 15 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,800 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA

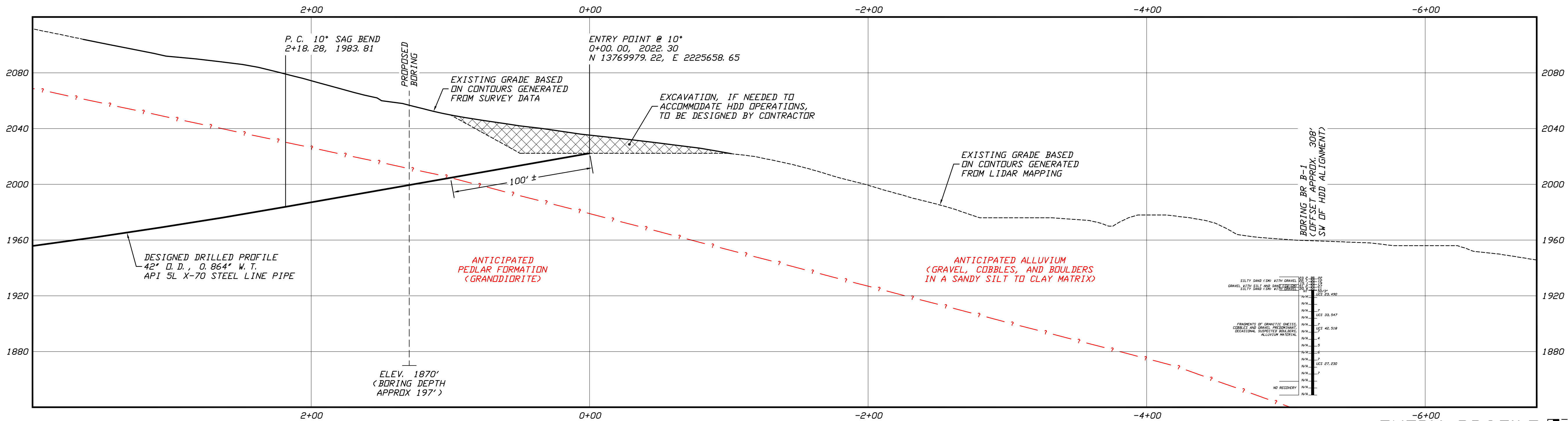
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
KMN	05/19/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	BR PARKWAY 1	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

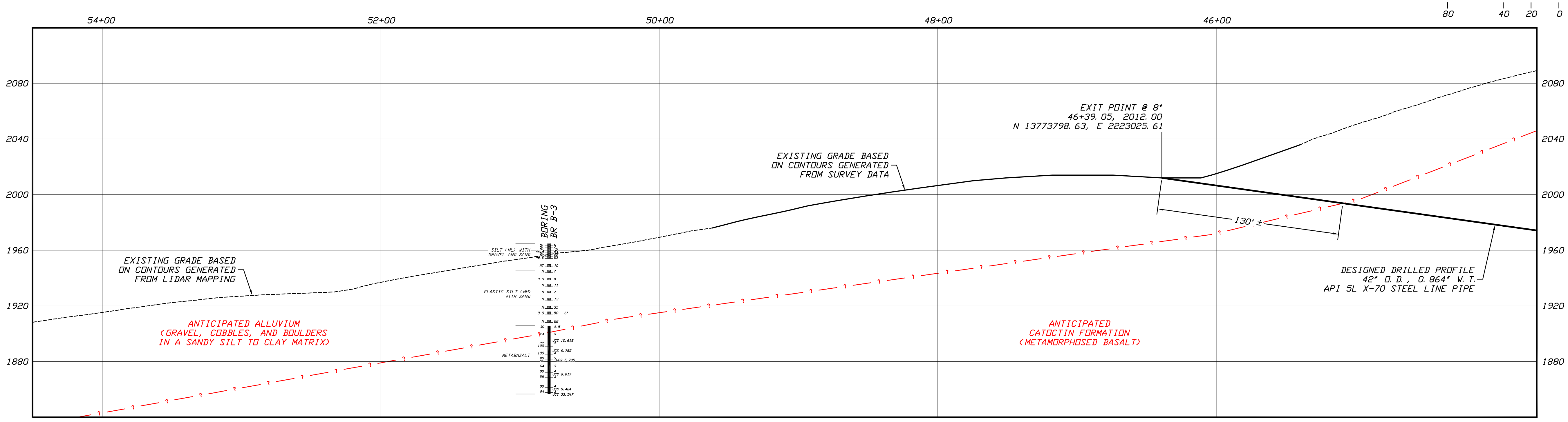
PROJECT NO.
Dominion\1508

MILE POST
AP1-158



ENTRY PROFILE

SCALE: 1"=40' HORIZONTAL
1"=40' VERTICAL



EXIT PROFILE

SCALE: 1"=40' HORIZONTAL
1"=40' VERTICAL

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

SPLIT SPOON SAMPLE

53 — 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES — PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 — 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

GEOTECHNICAL NOTES (CONTINUED)

4. STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES.
5. THE ANTICIPATED SUBSURFACE CONDITIONS SHOWN IN RED ARE BASED ON A GENERAL GEOLOGIC PROFILE INCLUDED IN THE GEOTECHNICAL SITE INVESTIGATION REPORT AS FIGURE 4.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

ENTRY/EXIT PROFILES - NATURAL SCALE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA

DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
KMN	05/19/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	BR PARKWAY 2	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

MILE POST
AP1-158

Blue Ridge Parkway R0 Installation Stress Analysis (worst-case) - with buoyancy.xlsm

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Project Information			
Project :	Dominion Atlantic Coast Pipeline	User :	KMN
Crossing :	42" Blue Ridge Parkway Crossing	Date :	2/9/2016
Comments :	Installation stress analysis based on worst-case drilled path per tolerances (40' longer and 30' deeper than design with a 2,800' radius) with 12 ppg mud with BC		

Line Pipe Properties			
Pipe Outside Diameter =	42.000	in	
Wall Thickness =	0.864	in	
Specified Minimum Yield Strength =	70,000	psi	
Young's Modulus =	2.9E+07	psi	
Moment of Inertia =	23617.82	in^4	
Pipe Face Surface Area =	111.66	in^2	
Diameter to Wall Thickness Ratio, D/t =	49		
Poisson's Ratio =	0.3		
Coefficient of Thermal Expansion =	6.5E-06	in/in/°F	
Pipe Weight in Air =	379.58	lb/ft	
Pipe Interior Volume =	8.85	ft^3/ft	
Pipe Exterior Volume =	9.62	ft^3/ft	

HDD Installation Properties			
Drilling Mud Density =	12.0	ppg	
=	89.8	lb/ft^3	
Ballast Density =	62.4	lb/ft^3	
Coefficient of Soil Friction =	0.30		
Fluid Drag Coefficient =	0.025	psi	
Ballast Weight =	551.97	lb/ft	
Displaced Mud Weight =	863.59	lb/ft	

Installation Stress Limits			
Tensile Stress Limit, 90% of SMYS, F_t =	63,000	psi	
For D/t <= 1,500,000/SMYS, F_b =	52,500	psi	No
For D/t > 1,500,000/SMYS and <= 3,000,000/SMYS, F_b =	44,508	psi	No
For D/t > 3,000,000/SMYS and <= 300, F_b =	45,636	psi	Yes
Allowable Bending Stress, F_b =	45,636	psi	
Elastic Hoop Buckling Stress, F_{he} =	10,800	psi	
For F_{he} <= 0.55*SMYS, Critical Hoop Buckling Stress, F_{hc} =	10,800	psi	Yes
For F_{he} > 0.55*SMYS and <= 1.6*SMYS, F_{hc} =	33,444	psi	No
For F_{he} > 1.6*SMYS and <= 6.2*SMYS, F_{hc} =	12,016	psi	No
For F_{he} > 6.2*SMYS, F_{hc} =	70,000	psi	No
Critical Hoop Buckling Stress, F_{hc} =	10,800	psi	
Allowable Hoop Buckling Stress, F_{hc}/1.5 =	7,200	psi	

Blue Ridge Parkway R0 Installation Stress Analysis (worst-case) - with buoyancy.xlsm

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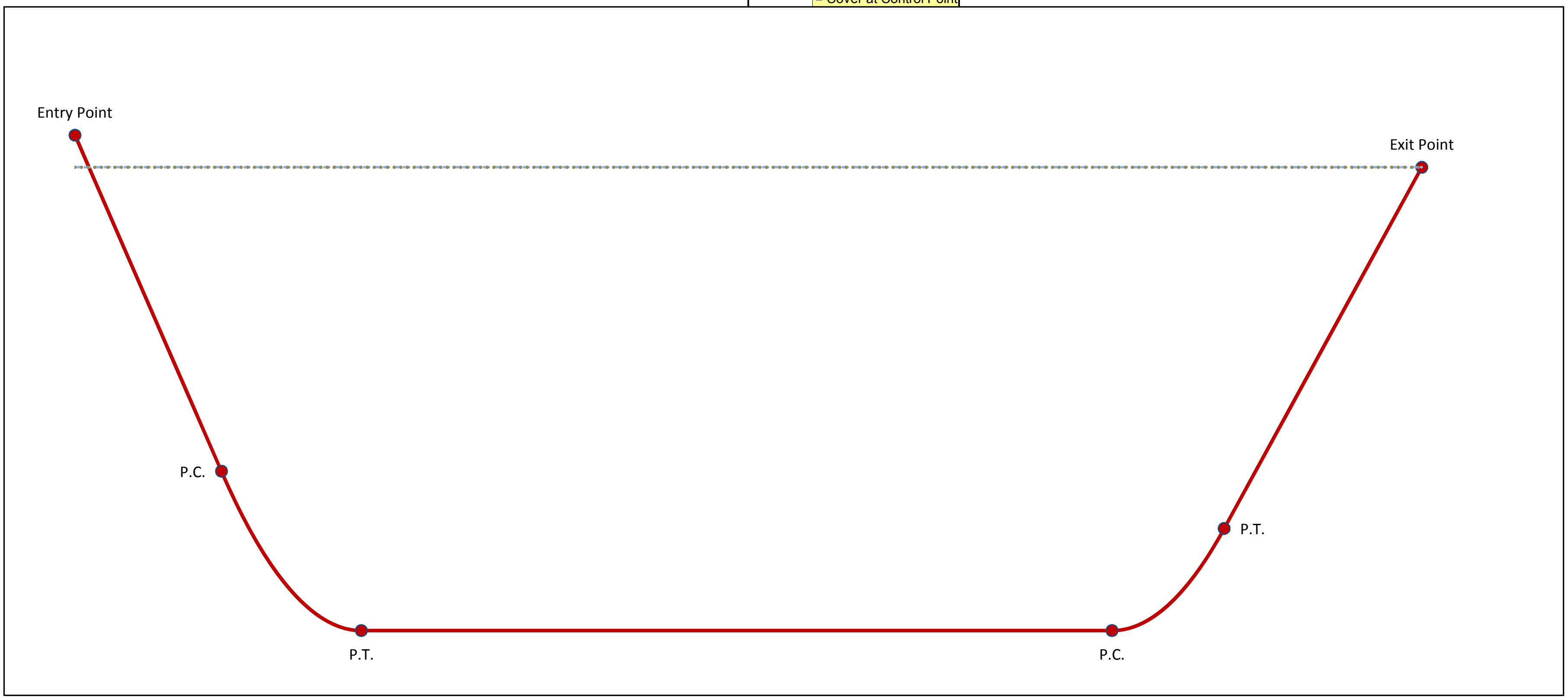
		Station	Elevation	Angle	Radius	Length	Average Tension	Total Pull
Entry Point		-10.00	2022.30	10.00				286,742
Entry Tangent						516.92		
Entry Sag Bend	PC	499.06	1932.54					249,800
	PI	740.31	1890.00	10.00	2800	488.69	231,351	
	PT	985.28	1890.00				0	212,902
Bottom Tangent				0.00		2607.73		
Exit Sag Bend	PC	3593.01	1890.00					56,508
	PI	3788.81	1890.00	8.00	2800	390.95	45,691	
	PT	3982.70	1917.25				0	34,874
Exit Tangent						693.10		
Exit Point		4669.05	2013.71	8.00	Above Ground Load			0
Drilling Mud			2013.71	(Graph =)				
Ballast			2013.71	(Graph =)				

No.	Station	Elevation	
1			Grade Elevation Points
2			
3			
4			
5			
6			
7			
8			
9			
10			
1			Control Point
		= Cover at Control Point	



Step 2, Drilled Path Input

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Blue Ridge Parkway R0 Installation Stress Analysis (worst-case) - with buoyancy.xlsm

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Pipe and Installation Properties

Based on profile design entered in 'Step 2, Drilled Path Input'.

Pipe Diameter, D =	42.000	in	Fluid Drag Coefficient, C_d =	0.025	psi	
PIpe Weight, W =	379.6	lb/ft	Ballast Weight / ft Pipe, W_b =	552.0	lb	(If Ballasted)
Coefficient of Soil Friction, μ =	0.30		Drilling Mud Displaced / ft Pipe, W_m =	863.6	lb	(If Submerged)
			Above Ground Load =	0	lb	

Exit Tangent - Summary of Pulling Load Calculations

Segment Length, L =	693.1	ft	Effective Weight, $W_e = W + W_b - W_m$ =	68.0	lb/ft
Exit Angle, θ =	8.0	°			

Frictional Drag = $W_e L \mu \cos\theta$ =	13,994	lb	
Fluidic Drag = $12 \pi D L C_d$ =	27,436	lb	
Axial Segment Weight = $W_e L \sin\theta$ =	-6,556	lb	Negative value indicates axial weight applied in direction of installation
Pulling Load on Exit Tangent =	**34,874**	**lb**	

Exit Sag Bend - Summary of Pulling Load Calculations

Segment Length, L =	391.0	ft	Average Tension, T =	45,691	lb
Segment Angle with Horizontal, θ =	-8.0	°	Radius of Curvature, R =	2,800	ft
Deflection Angle, α =	-4.0	°	Effective Weight, $W_e = W + W_b - W_m$ =	68.0	lb/ft

$h = R\,[1 - \cos(\alpha/2)]$ =	6.82	ft	$j = [(E\,I) / T]^{1/2}$ =	3,872	
$Y = [18\,(L)^2] - [(j)^2\,(1 - \cosh(U/2)^{-1}]$ =	3.7E+05		$X = (3\,L) - [\,(j / 2)\tanh(U/2)\,]$ =	125.16	
$U = (12\,L) / j$ =	1.21		$N = [(T\,h) - W_e \cos\theta\,(Y/144)] / (X / 12)$	13,353	lb
Bending Frictional Drag = $2\,\mu\,N$ =	8,012	lb			
Fluidic Drag = $12 \pi D L C_d$ =	15,476	lb			
Axial Segment Weight = $W_e L \sin\theta$ =	-1,853	lb	Negative value indicates axial weight applied in direction of installation		
Pulling Load on Exit Sag Bend =	**21,634**	**lb**			
Total Pulling Load =	**56,508**	**lb**			

Bottom Tangent - Summary of Pulling Load Calculations

Segment Length, L =	2607.7	ft	Effective Weight, $W_e = W + W_b - W_m$ =	68.0	lb/ft

Frictional Drag = $W_e L \mu$ =	53,170	lb
Fluidic Drag = $12 \pi D L C_d$ =	103,225	lb
Axial Segment Weight = $W_e L \sin\theta$ =	0	lb
Pulling Load on Bottom Tangent =	**156,395**	**lb**
Total Pulling Load =	**212,902**	**lb**

Blue Ridge Parkway R0 Installation Stress Analysis (worst-case) - with buoyancy.xlsm

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Entry Sag Bend - Summary of Pulling Load Calculations

Segment Length, L =	488.7	ft	Average Tension, T =	231,351	lb
Segment Angle with Horizontal, θ =	10.0	°	Radius of Curvature, R =	2,800	ft
Deflection Angle, α =	5.0	°	Effective Weight, $W_e = W + W_b - W_m$ =	68.0	lb/ft

$h = R\,[1 - \cos(\alpha/2)]$ =	10.65	ft	$j = [(E\,I) / T]^{1/2}$ =	1,721	
$Y = [18\,(L)^2] - [(j)^2\,(1 - \cosh(U/2)^{-1}]$ =	2.4E+06		$X = (3\,L) - [\,(j / 2)\tanh(U/2)\,]$ =	660.90	
$U = (12\,L) / j$ =	3.41		$N = [(T\,h) - W_e \cos\theta\,(Y/144)] / (X / 12)$ =	24,431	lb
Bending Frictional Drag = $2\,\mu\,N$ =	14,659	lb			
Fluidic Drag = $12\,\pi\,D\,L\,C_d$ =	19,344	lb			
Axial Segment Weight = $W_e\,L\sin\theta$ =	2,895	lb			
Pulling Load on Entry Sag Bend =	**36,898**	**lb**			
Total Pulling Load =	**249,800**	**lb**			

Entry Tangent - Summary of Pulling Load Calculations

Segment Length, L =	516.9	ft	Effective Weight, $W_e = W + W_b - W_m$ =	68.0	lb/ft
Entry Angle, θ =	10.0	°			

Frictional Drag = $W_e\,L\,\mu\cos\theta$ =	10,379	lb
Fluidic Drag = $12\,\pi\,D\,L\,C_d$ =	20,462	lb
Axial Segment Weight = $W_e\,L\sin\theta$ =	6,101	lb
Pulling Load on Entry Tangent =	**36,942**	**lb**
Total Pulling Load =	**286,742**	**lb**

Summary of Calculated Stress vs. Allowable Stress

	Tensile Stress		Bending Stress		External Hoop Stress		Combined Tensile & Bending		Combined Tensile, Bending & Ext. Hoop	
Entry Point	2,568	ok	0	ok	0	ok	0.04	ok	0.00	ok
	2,237	ok	0	ok	375	ok	0.04	ok	0.01	ok
PC										
	2,237	ok	18,125	ok	375	ok	0.43	ok	0.14	ok
	1,907	ok	18,125	ok	571	ok	0.43	ok	0.15	ok
PT										
	1,907	ok	0	ok	571	ok	0.03	ok	0.01	ok
	506	ok	0	ok	571	ok	0.01	ok	0.01	ok
PC										
	506	ok	18,125	ok	571	ok	0.41	ok	0.13	ok
	312	ok	18,125	ok	445	ok	0.40	ok	0.12	ok
PT										
	312	ok	0	ok	445	ok	0.00	ok	0.00	ok
Exit Point	0	ok	0	ok	0	ok	0.00	ok	0.00	ok

Blue Ridge Parkway R0 Installation Stress Analysis (worst-case).xlsm

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Project Information			
Project :	Dominion Atlantic Coast Pipeline	User :	KMN
Crossing :	42" Blue Ridge Parkway Crossing	Date :	2/9/2016
Comments :	Installation stress analysis based on worst-case drilled path per tolerances (40' longer and 30' deeper than design with a 2,800' radius) with 12 ppg mud and no BC		
Line Pipe Properties			
Pipe Outside Diameter =	42.000	in	
Wall Thickness =	0.864	in	
Specified Minimum Yield Strength =	70,000	psi	
Young's Modulus =	2.9E+07	psi	
Moment of Inertia =	23617.82	in^4	
Pipe Face Surface Area =	111.66	in^2	
Diameter to Wall Thickness Ratio, D/t =	49		
Poisson's Ratio =	0.3		
Coefficient of Thermal Expansion =	6.5E-06	in/in/°F	
Pipe Weight in Air =	379.58	lb/ft	
Pipe Interior Volume =	8.85	ft^3/ft	
Pipe Exterior Volume =	9.62	ft^3/ft	
HDD Installation Properties			
Drilling Mud Density =	12.0	ppg	
=	89.8	lb/ft^3	
Ballast Density =	62.4	lb/ft^3	
Coefficient of Soil Friction =	0.30		
Fluid Drag Coefficient =	0.025	psi	
Ballast Weight =	551.97	lb/ft	
Displaced Mud Weight =	863.59	lb/ft	
Installation Stress Limits			
Tensile Stress Limit, 90% of SMYS, F_t =	63,000	psi	
For D/t <= 1,500,000/SMYS, F_b =	52,500	psi	No
For D/t > 1,500,000/SMYS and <= 3,000,000/SMYS, F_b =	44,508	psi	No
For D/t > 3,000,000/SMYS and <= 300, F_b =	45,636	psi	Yes
Allowable Bending Stress, F_b =	45,636	psi	
Elastic Hoop Buckling Stress, F_{he} =	10,800	psi	
For F_{he} <= 0.55*SMYS, Critical Hoop Buckling Stress, F_{hc} =	10,800	psi	Yes
For F_{he} > 0.55*SMYS and <= 1.6*SMYS, F_{hc} =	33,444	psi	No
For F_{he} > 1.6*SMYS and <= 6.2*SMYS, F_{hc} =	12,016	psi	No
For F_{he} > 6.2*SMYS, F_{hc} =	70,000	psi	No
Critical Hoop Buckling Stress, F_{hc} =	10,800	psi	
Allowable Hoop Buckling Stress, F_{hc}/1.5 =	7,200	psi	

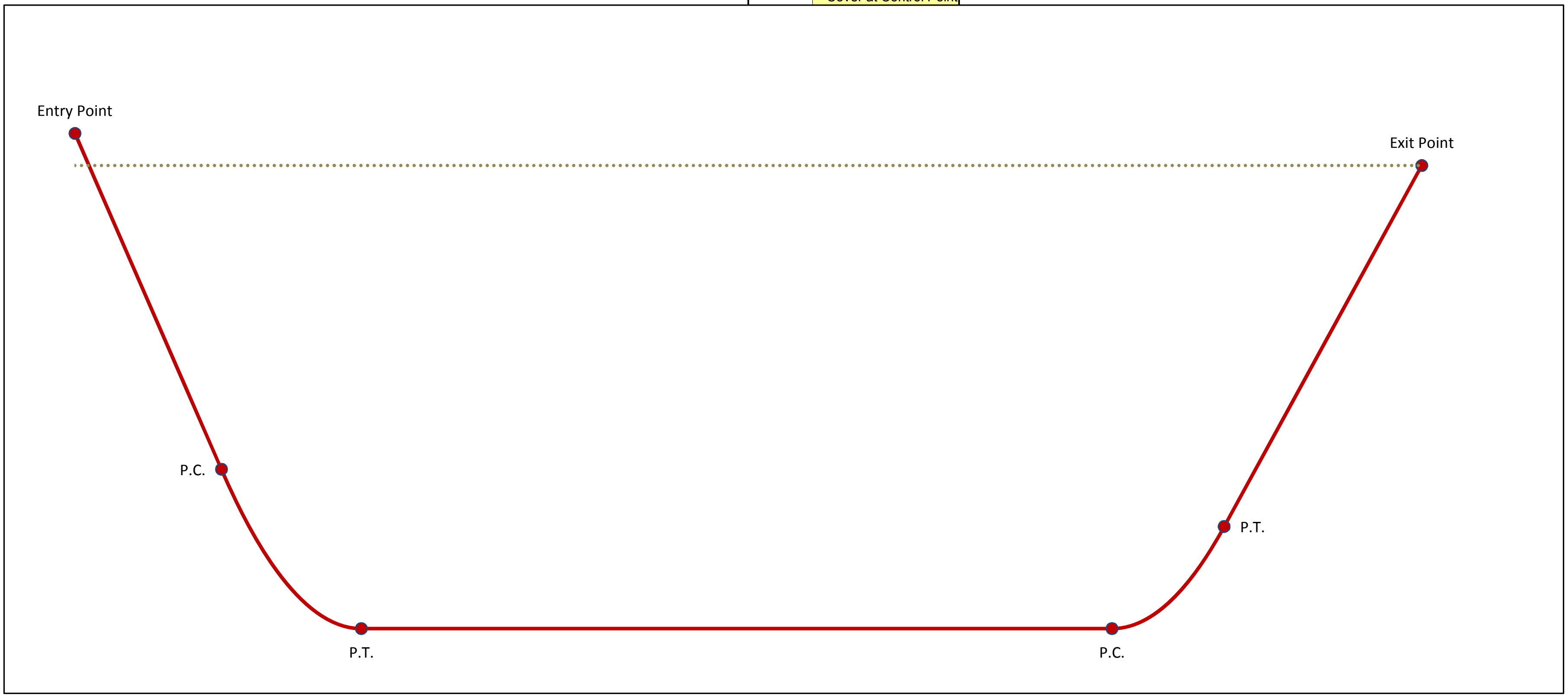
Blue Ridge Parkway R0 Installation Stress Analysis (worst-case).xlsm

J:\Dominion\1508 - Atlantic Coast\Working\Stress Analysis\

		Station	Elevation	Angle	Radius	Length	Average Tension	Total Pull
Entry Point		-10.00	2022.30	10.00				979,838
Entry Tangent						516.92		
Entry Sag Bend	PC	499.06	1932.54					928,905
	PI	740.31	1890.00	10.00	2800	488.69	855,318	
	PT	985.28	1890.00				0	781,730
Bottom Tangent				0.00		2607.73		
Exit Sag Bend	PC	3593.01	1890.00					299,856
	PI	3788.81	1890.00	8.00	2800	390.95	236,820	
	PT	3982.70	1917.25				0	173,784
Exit Tangent						693.10		
Exit Point		4669.05	2013.71	8.00	Above Ground Load			0
Drilling Mud			2013.71	(Graph =)				
Ballast				(Graph =)				

No.	Station	Elevation	
1			Grade Elevation Points
2			
3			
4			
5			
6			
7			
8			
9			
10			
1			Control Point

	= Cover at Control Point



Step 2, Drilled Path Input

Blue Ridge Parkway R0 Installation Stress Analysis (worst-case).xlsm

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Pipe and Installation Properties

Based on profile design entered in 'Step 2, Drilled Path Input'.

Pipe Diameter, D =	42.000	in	Fluid Drag Coefficient, C_d =	0.025	psi	
PIpe Weight, W =	379.6	lb/ft	Ballast Weight / ft Pipe, W_b =	552.0	lb	(If Ballasted)
Coefficient of Soil Friction, μ =	0.30		Drilling Mud Displaced / ft Pipe, W_m =	863.6	lb	(If Submerged)
			Above Ground Load =	0	lb	

Exit Tangent - Summary of Pulling Load Calculations

Segment Length, L =	693.1	ft	Effective Weight, $W_e = W + W_b - W_m$ =	-484.0	lb/ft
Exit Angle, θ =	8.0	°			

Frictional Drag = W_e L μ cosθ =	99,660	lb
Fluidic Drag = 12 π D L C_d =	27,436	lb
Axial Segment Weight = W_e L sinθ =	46,688	lb
Pulling Load on Exit Tangent =	**173,784**	**lb**

Exit Sag Bend - Summary of Pulling Load Calculations

Segment Length, L =	391.0	ft	Average Tension, T =	236,820	lb
Segment Angle with Horizontal, θ =	-8.0	°	Radius of Curvature, R =	2,800	ft
Deflection Angle, α =	-4.0	°	Effective Weight, $W_e = W + W_b - W_m$ =	-484.0	lb/ft

$h = R [1 - \cos(\alpha/2)]$ =	6.82	ft	$j = [(E\ I) / T]^{1/2}$ =	1,701	
$Y = [18 (L)^2] - [(j)^2 (1 - \cosh(U/2)^{-1}]$ =	1.2E+06		$X = (3\ L) - [(j / 2) \tanh(U/2)]$ =	423.90	
$U = (12\ L) / j$ =	2.76		$N = [(T\ h) - W_e \cos\theta\ (Y/144)] / (X / 12)$ =	162,328	lb
Bending Frictional Drag = 2 μ N =	97,397	lb			
Fluidic Drag = 12 π D L C_d =	15,476	lb			
Axial Segment Weight = W_e L sinθ =	13,200	lb			
Pulling Load on Exit Sag Bend =	**126,072**	**lb**			
Total Pulling Load =	**299,856**	**lb**			

Bottom Tangent - Summary of Pulling Load Calculations

Segment Length, L =	2607.7	ft	Effective Weight, $W_e = W + W_b - W_m$ =	-484.0	lb/ft

Frictional Drag = W_e L μ =	378,650	lb
Fluidic Drag = 12 π D L C_d =	103,225	lb
Axial Segment Weight = W_e L sinθ =	0	lb
Pulling Load on Bottom Tangent =	**481,875**	**lb**
Total Pulling Load =	**781,730**	**lb**

Entry Sag Bend - Summary of Pulling Load Calculations

Segment Length, L =	488.7	ft	Average Tension, T =	855,318	lb
Segment Angle with Horizontal, θ =	10.0	°	Radius of Curvature, R =	2,800	ft
Deflection Angle, α =	5.0	°	Effective Weight, $W_e = W + W_b - W_m$ =	-484.0	lb/ft

$h = R [1 - \cos(\alpha/2)]$ =	10.65	ft	$j = [(E\ I) / T]^{1/2}$ =	895	
$Y = [18 (L)^2] - [(j)^2 (1 - \cosh(U/2)^{-1}]$ =	3.6E+06		$X = (3 L) - [(j / 2) \tanh(U/2)]$ =	1019.92	
$U = (12 L) / j$ =	6.55		$N = [(T h) - W_e \cos\theta (Y/144)] / (X / 12)$ =	247,408	lb
Bending Frictional Drag = $2 \mu N$ =	148,445	lb			
Fluidic Drag = $12 \pi D L C_d$ =	19,344	lb			
Axial Segment Weight = $W_e L \sin\theta$ =	-20,615	lb	Negative value indicates axial weight applied in direction of installation		
Pulling Load on Entry Sag Bend =	**147,174**	**lb**			
Total Pulling Load =	**928,905**	**lb**			

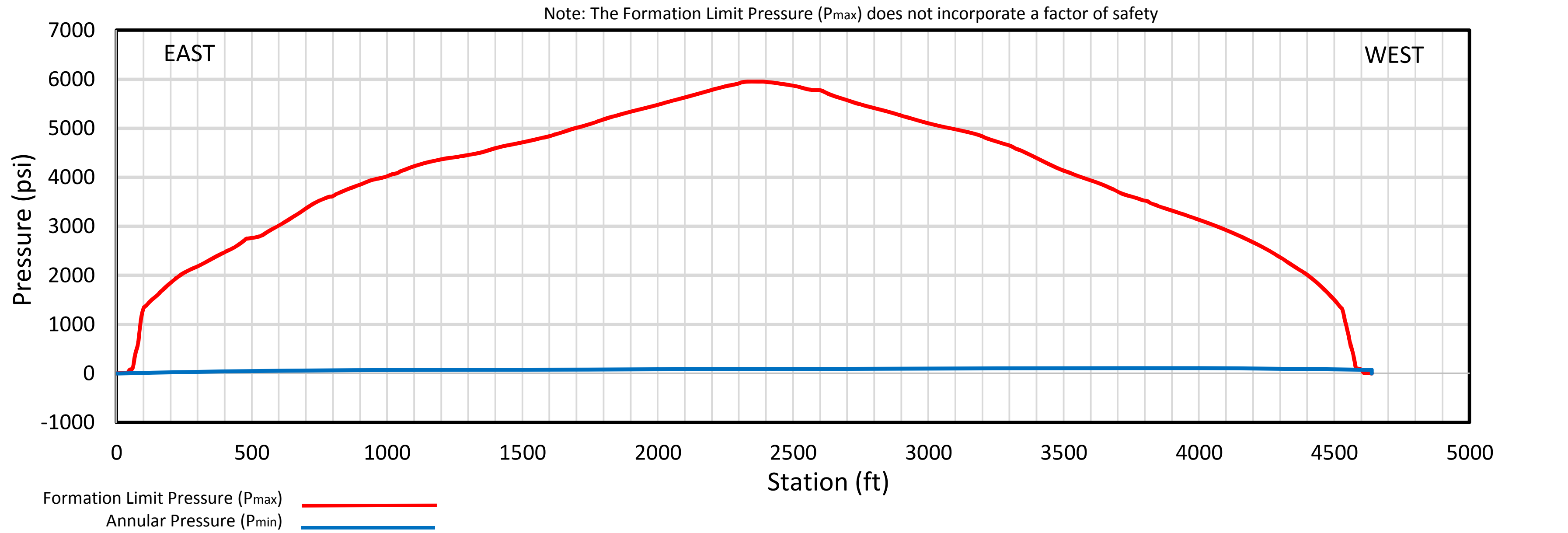
Entry Tangent - Summary of Pulling Load Calculations

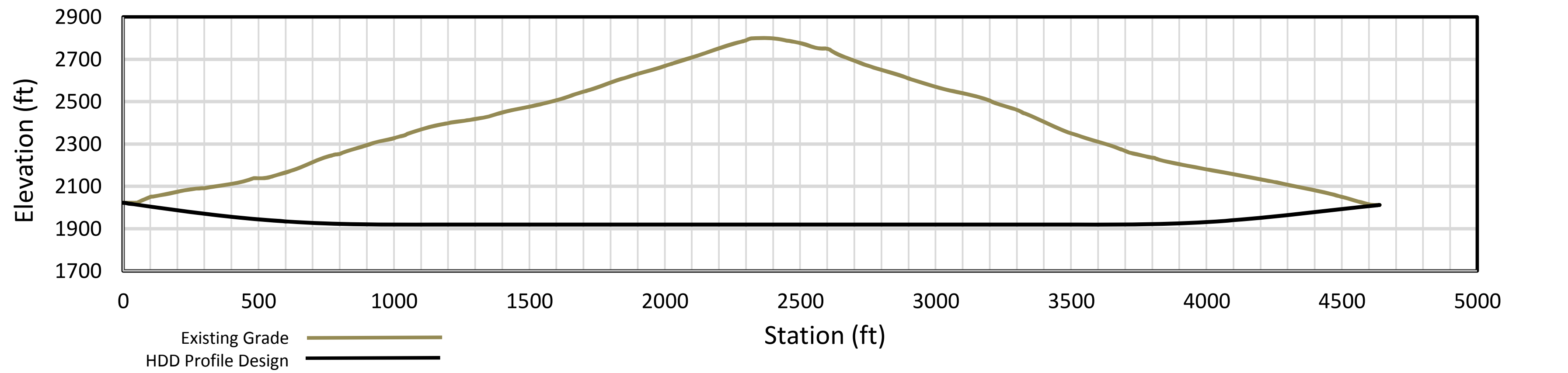
Segment Length, L =	516.9	ft	Effective Weight, $W_e = W + W_b - W_m$ =	-484.0	lb/ft
Entry Angle, θ =	10.0	°			

Frictional Drag = $W_e L \mu \cos\theta$ =	73,917	lb	
Fluidic Drag = $12 \pi D L C_d$ =	20,462	lb	
Axial Segment Weight = $W_e L \sin\theta$ =	-43,445	lb	Negative value indicates axial weight applied in direction of installation
Pulling Load on Entry Tangent =	**50,934**	**lb**	
Total Pulling Load =	**979,838**	**lb**	

Summary of Calculated Stress vs. Allowable Stress

	Tensile Stress		Bending Stress		External Hoop Stress		Combined Tensile & Bending		Combined Tensile, Bending & Ext. Hoop	
Entry Point	8,775	ok	0	ok	0	ok	0.14	ok	0.02	ok
	8,319	ok	0	ok	1230	ok	0.13	ok	0.06	ok
PC										
	8,319	ok	18,125	ok	1230	ok	0.53	ok	0.29	ok
	7,001	ok	18,125	ok	1874	ok	0.51	ok	0.32	ok
PT										
	7,001	ok	0	ok	1874	ok	0.11	ok	0.10	ok
	2,686	ok	0	ok	1874	ok	0.04	ok	0.07	ok
PC										
	2,686	ok	18,125	ok	1874	ok	0.44	ok	0.25	ok
	1,556	ok	18,125	ok	1461	ok	0.42	ok	0.20	ok
PT										
	1,556	ok	0	ok	1461	ok	0.02	ok	0.04	ok
Exit Point	0	ok	0	ok	0	ok	0.00	ok	0.00	ok





HYDROFRACTURE EVALUATION
FORMATION LIMIT PRESSURE VS. ANNULAR PRESSURE
42-INCH BLUE RIDGE PARKWAY CROSSING
BY HORIZONTAL DIRECTIONAL DRILLING

Date: 7/26/2016 Revision: 0

J.D.Hair&Associates, Inc.

ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT P

Contingency Plan for the Appalachian National Scenic Trail and the Blue Ridge Parkway Crossing

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket Nos. CP15-554-000 &
CP15-554-001

Contingency Plan for the Proposed Crossing of the Appalachian National Scenic Trail and Blue Ridge Parkway

Prepared by

ERM

June 2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
ANST	Appalachian National Scenic Trail
Atlantic	Atlantic Coast Pipeline, LLC
BRP	Blue Ridge Parkway
HDD	horizontal directional drill
NFS	National Forest System
NPS	National Park Service

1.0 INTRODUCTION

Atlantic Coast Pipeline, LLC (Atlantic) – a company formed by four major energy companies - Dominion Energy, Inc.; Duke Energy Corporation; Piedmont Natural Gas Co., Inc.; and Southern Company Gas – proposes to construct and operate the proposed Atlantic Coast Pipeline (ACP), an approximately 600-mile-long, interstate natural gas transmission pipeline system designed to meet growing energy needs in Virginia and North Carolina. Atlantic has contracted with Dominion Energy Transmission, Inc. (Dominion Energy), a subsidiary of Dominion, to permit, build, and operate the ACP on behalf of Atlantic.

2.0 PURPOSE

Atlantic has proposed to cross underneath the Blue Ridge Parkway (BRP), located on National Park Service (NPS) lands, and the Appalachian National Scenic Trail (ANST), located on National Forest System (NFS) lands, using horizontal directional drilling (HDD) and installation technology. Atlantic has completed geotechnical subsurface borings at the HDD crossing location and has confirmed its expectations that the drill path would be primarily through solid rock approximately 800 feet below the BRP and the ANST. Drilling through solid rock, while a time consuming process, significantly helps to ensure the success of the drill operation due to the avoidance of rock fragments and cobbles that can disrupt or block the drill pathway. As such, and in consultation with its drilling consultant, J. D. Hair & Associates, Atlantic is very confident in a successful HDD and pipeline installation at this location. In the unlikely event that the HDD procedure fails, however, Atlantic has identified the following steps to be implemented as part of a prudent contingency planning process. Selection of the correct contingency action would depend on the specific circumstances of the HDD failure and the stage of HDD operation when failure occurred and action halted.

3.0 CONDITIONS FOR CONTINGENCY

If insurmountable problems are encountered during the HDD process, Atlantic may decide to select a new drill path, abandon the drill hole, or consider alternate crossing methods. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting, regulatory, and land managing agencies, and required approvals will be obtained prior to implementing alternative crossing measures.

Adverse conditions most commonly encountered during the HDD process are associated with the loss of structural integrity of the drill path. This loss of integrity is generally the result of debris collapsing into the drill path opening. While this can generally occur at any point during an HDD drilling process (i.e., pilot hole, reaming, or pipe pull-back), because this drill will be primarily through solid rock, the likelihood of losing the structural integrity of the drill path is significantly lowered and localized to the drill path through the overburden near the entrance and exit points.

Regardless of when the adverse conditions are encountered, efforts will be made to retrieve the drilling tools from the hole and free the drill path of obstructions. If this cannot be accomplished, a new drill path will be established within the existing and approved HDD workspace. Development of a new drill path will be the default initial drill contingency plan.

4.0 INITIAL CONTINGENCY PLAN – NEW HDD PATHS

Efforts will be made to identify and assess the reason for the drill failure as this will be critical for selection of an appropriate alternate HDD pathway. In developing an appropriate alternate measure, consideration will be given to site conditions, such as surrounding topography. The proposed workspace and right-of-way planned for the HDD is adequately sized to allow for multiple attempts of a new drill path. That is, the entry/exit points can be relocated several times within the currently proposed limits of disturbance for the HDD.

Either a modified drill path or an all new drill path would be identified that mitigates or avoids the cause of the problem for the HDD failure. This could result in altering the existing path to utilize a deeper or more shallow vertical path, or a laterally expanded path, while retaining sections of the original drilled path that are not at risk to the problem. Alternatively, depending on the type of obstruction, the drill rig may need to be moved or slightly re-aligned to drill a completely new hole.

5.0 DRILL PATH ABANDONMENT

For any section of abandoned hole, the abandonment procedures identified below will apply to the abandoned section of the hole:

- Heavy drilling fluid or a cement mixture will be pumped into the hole as the drill assembly is extracted to seal the abandoned drill hole.
- The drill end points within approximately 5 feet of the surface will be filled with soil and the location will be graded to the original contour.

6.0 ALTERNATE CROSSING METHOD

In the event that all options outlined in the initial contingency plan result in failure, either by way of execution failure or it is determined that the schedule does not permit continued HDD efforts, alternative crossing methods will be initiated.

The alternative crossing would use both traditional open-trench construction as well as a 1,400-foot-long trenchless crossing installed using Direct Pipeline technology. The traditional open-trench section would lead up to the entry and exit locations of the Direct Pipeline trenchless crossing. At these points, surface disturbance would cease and the trenchless crossing would be used to cross beneath NFS and NPS land, the ANST, and the BRP simultaneously. The entry and exit points for the trenchless crossing would be on private land, approximately 600 feet south of the BRP and 400 feet north of the ANST, respectively. An approximately 200 X 200 foot temporary work space would be located at the entry point and used for drill operations and pipe fabrication (see attached figure).

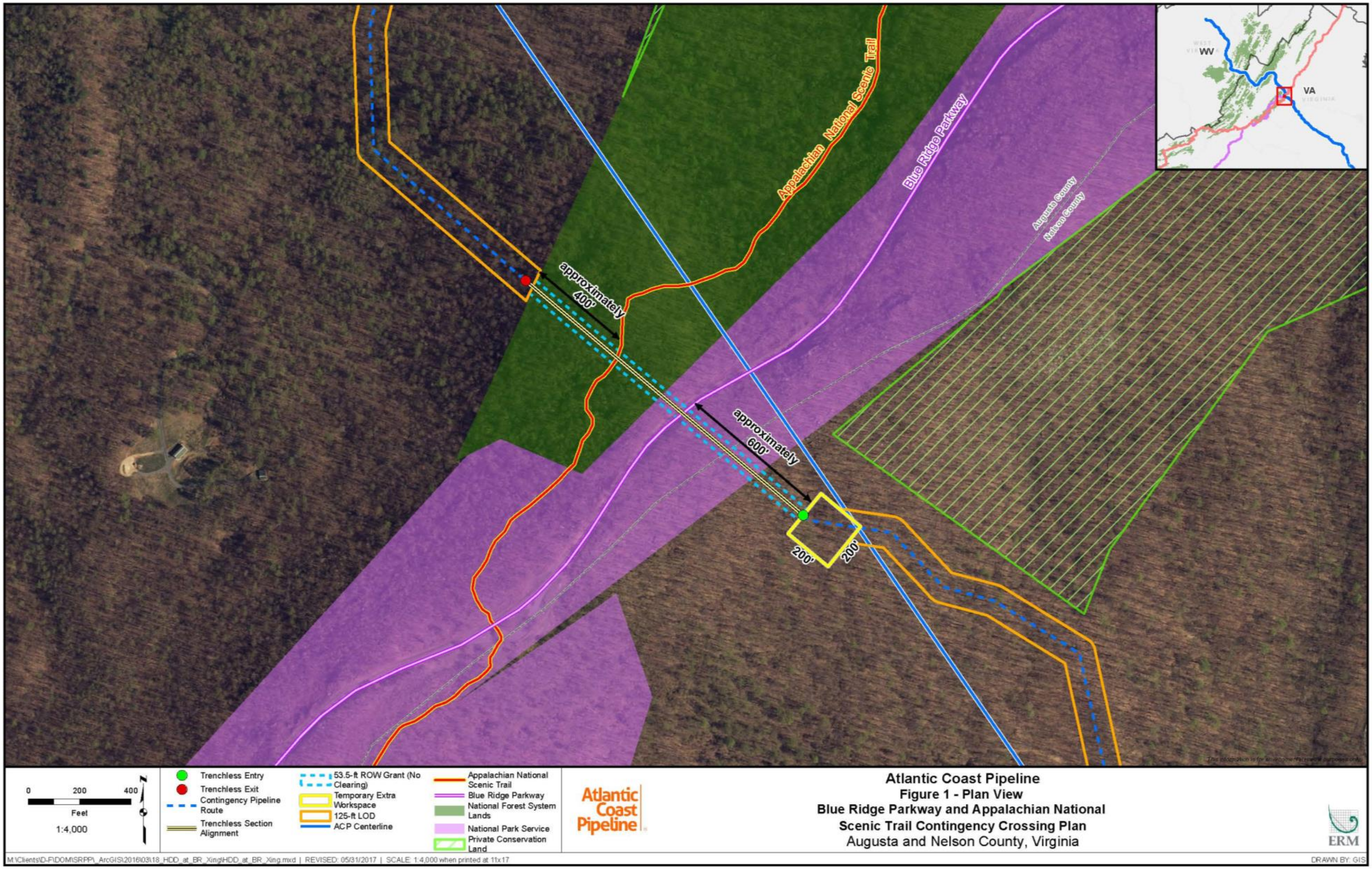
No ground disturbance or tree clearing would be required on NPS lands or within approximately 600 feet of the BRP. Similarly, no ground disturbance or tree clearing would be required on NFS lands or within approximately 400 feet of the ANST. The approximate limits of disturbance are identified in Figure 1 below.

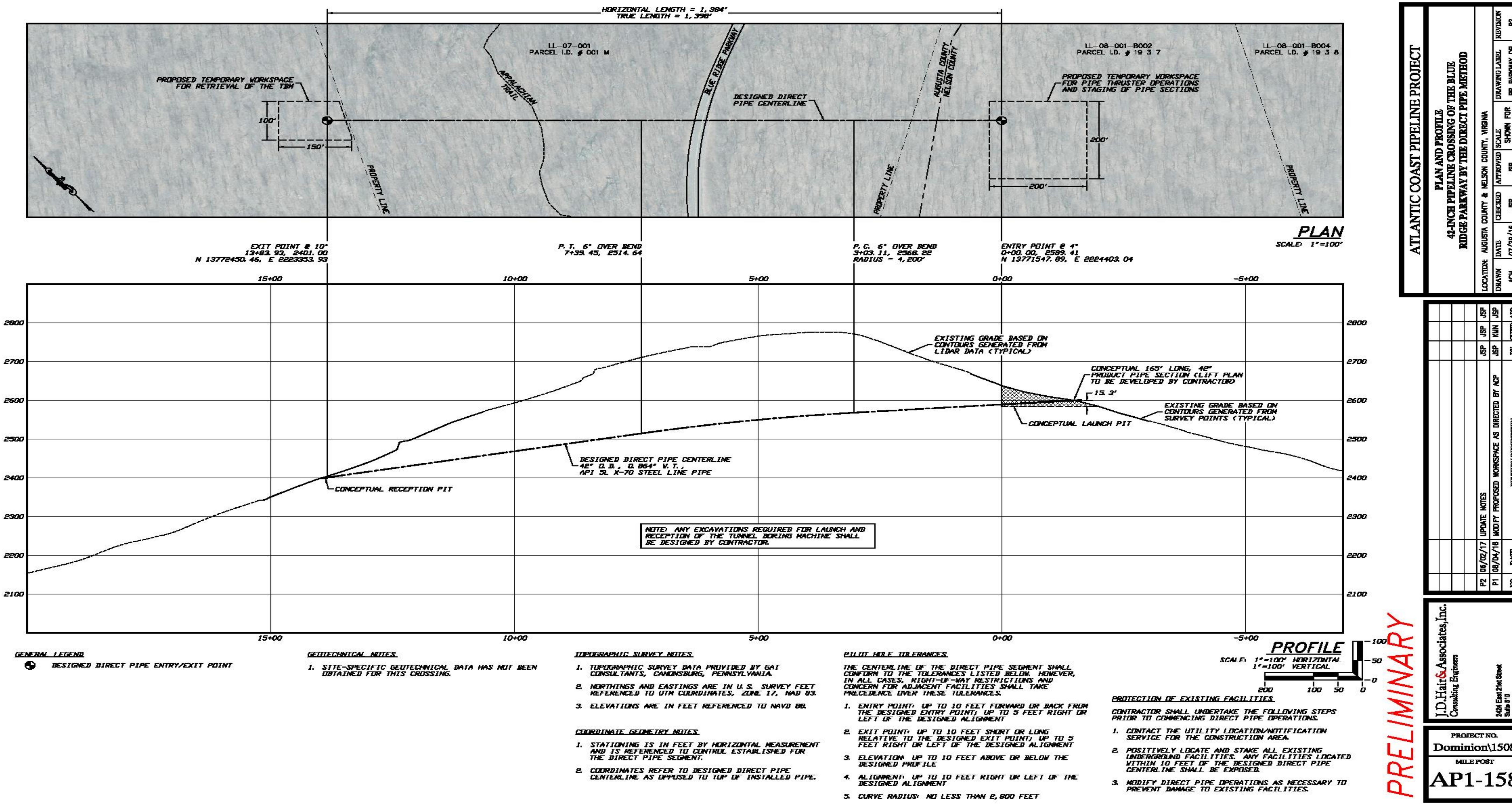
The Direct Pipe installation will require approximately 150,000 gallons of water for the mixing and use of bentonite drilling mud, which will be disposed of at an approved landfill following completion of the Direct Pipe installation. Additionally, the drilling activities will produce approximately 26,000 cubic feet of spoil which will be removed from the drilled path; this spoil will also be disposed of at an approved landfill.

Temporary access to the entry/rig side (south side) of the Direct Pipe installation would be accomplished through the improvement and use of an existing logging/access road off Beech Grove Road. Access to the exit side of the Direct Pipe installation (north side) would be accomplished using the cleared pipeline right-of-way.

The Direct Pipe installation and the traditional open-trench construction associated with the Alternate Crossing Method will occur simultaneously and together will take approximately 16 weeks to complete. Drilling operations associated with the Direct Pipe installation will take approximately 12 weeks to complete, assuming a 24-hour per day, 7-day per week schedule.

Restoration of access roads, workspace, and temporary construction easements would be restored to as near pre-existing conditions as practical.


Appalachian National Scenic Trail
Blue Ridge Parkway
Augusta County
Nelson County
approximately 400'
approximately 600'
200'
200'
WV
VA
0 200 400
Feet
1:4,000
Trenchless Entry
Trenchless Exit
Contingency Pipeline Route
Trenchless Section Alignment
53.5-ft ROW Grant (No Clearing)
Temporary Extra Workspace
125-ft LOD
ACP Centerline
Appalachian National Scenic Trail
Blue Ridge Parkway
National Forest System Lands
National Park Service
Private Conservation Land
Atlantic Coast Pipeline
Atlantic Coast Pipeline
Figure 1 - Plan View
Blue Ridge Parkway and Appalachian National Scenic Trail Contingency Crossing Plan
Augusta and Nelson County, Virginia
ERM
M:\Clients\D-F\DOM\SRPP_ArcGIS\2016\03\18_HDD_at_BR_Xing\HDD_at_BR_Xing.mxd | REVISED: 05/31/2017 | SCALE: 1:4,000 when printed at 11x17
DRAWN BY: GIS


HORIZONTAL LENGTH = 1,384'
TRUE LENGTH = 1,398'
LL-07-001 PARCEL I.D. # 001 M
LL-08-001-B002 PARCEL I.D. # 19 3 7
LL-08-001-B004 PARCEL I.D. # 19 3 8
PROPOSED TEMPORARY WORKSPACE FOR RETRIEVAL OF THE TBM
PROPOSED TEMPORARY WORKSPACE FOR PIPE THRUSTER OPERATIONS AND STAGING OF PIPE SECTIONS
APPALACHIAN TRAIL
BLUE RIDGE PARKWAY
DESIGNED DIRECT PIPE CENTERLINE
AUGUSTA COUNTY
NELSON COUNTY
PROPERTY LINE
PLAN
SCALE: 1"=100'
EXIT POINT @ 10° 13+83.93, 2401.00 N 13772450.46, E 2223353.93
P.T. 6° OVER BEND 7+39.45, 2514.64
P.C. 6° OVER BEND 3+03.11, 2568.22 RADIUS = 4,200'
ENTRY POINT @ 4° 0+00.00, 2589.41 N 13771547.89, E 2224403.04
EXISTING GRADE BASED ON CONTOURS GENERATED FROM LIDAR DATA (TYPICAL)
CONCEPTUAL 165' LONG, 42" PRODUCT PIPE SECTION (LIFT PLAN TO BE DEVELOPED BY CONTRACTOR)
15.3'
EXISTING GRADE BASED ON CONTOURS GENERATED FROM SURVEY POINTS (TYPICAL)
CONCEPTUAL LAUNCH PIT
DESIGNED DIRECT PIPE CENTERLINE 42" O.D., 0.864" W.T., API 5L X-70 STEEL LINE PIPE
CONCEPTUAL RECEPTION PIT
NOTE: ANY EXCAVATIONS REQUIRED FOR LAUNCH AND RECEPTION OF THE TUNNEL BORING MACHINE SHALL BE DESIGNED BY CONTRACTOR.
PROFILE
SCALE: 1"=100' HORIZONTAL 1"=100' VERTICAL
GENERAL LEGEND
DESIGNED DIRECT PIPE ENTRY/EXIT POINT
GEOTECHNICAL NOTES
1. SITE-SPECIFIC GEOTECHNICAL DATA HAS NOT BEEN OBTAINED FOR THIS CROSSING.
TOPOGRAPHIC SURVEY NOTES
1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.
COORDINATE GEOMETRY NOTES
1. STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DIRECT PIPE SEGMENT.
2. COORDINATES REFER TO DESIGNED DIRECT PIPE CENTERLINE AS OPPOSED TO TOP OF INSTALLED PIPE.
PILOT HOLE TOLERANCES
THE CENTERLINE OF THE DIRECT PIPE SEGMENT SHALL CONFORM TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.
1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 10 FEET ABOVE OR BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,800 FEET
PROTECTION OF EXISTING FACILITIES
CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DIRECT PIPE OPERATIONS.
1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DIRECT PIPE CENTERLINE SHALL BE EXPOSED.
3. MODIFY DIRECT PIPE OPERATIONS AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.
PRELIMINARY
ATLANTIC COAST PIPELINE PROJECT
PLAN AND PROFILE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY BY THE DIRECT PIPE METHOD
LOCATION: AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA
P2 06/02/17 UPDATE NOTES
P1 08/04/16 MODIFY PROPOSED WORKSPACE AS DIRECTED BY ACP
J.D. Hair & Associates, Inc. Consulting Engineers
PROJECT NO. Dominion\1508
MILE POST AP1-158

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT Q

Specifications for Cruising Timber, Marlington Ranger District, Monongahela National Forest

SPECIFICATIONS
For
CRUISING TIMBER

Atlantic Coast Pipeline Project

MARLINTON RANGER DISTRICT
MONONGAHELA NATIONAL FOREST

Prepared by: Jeff Kochenderfer

Monongahela National Forest

Date: 11/14/2016

Overview: This timber cruise is for the removal of all merchantable trees ($\geq$6 inches dbh) on National Forest lands that will have to be cut for the construction of the Atlantic Coast Pipeline.

- A sample tree cruising method will be used to estimate the standing timber volume that will need to be removed *(cruise method defined in FSH 2409.12 Chapter 30; 33.1)*.
- Prior to final NEPA decision, all boundaries associated with the pipeline corridor will be designated, with flagging before cruising timber. Once a final NEPA decision has been completed the boundaries shall be designated by painting three slash marks at DBH and a stump mark using orange marking paint containing Forest Service tracer element (provided by the Forest Service).
- Before contractor begins marking they must meet with Forest Service advanced cruiser to go over cruise standards, data collection and reporting, and paint accountability standards.
- Prior to final NEPA decision trees may be designated with nonpermanent marking methods such as lumber crayons or chalk paddles. All measured sample trees shall be identified using flagging wrapped completely around the tree.
- Before final acceptance of the cruise all boundaries must be marked with tracer paint, and all designated trees are verified to be within final marked boundary. Contractor will be responsible for verifying final painted boundaries and making any adjustments to the timber cruise to ensure designated trees are within said boundaries prior to Forest Service inspection and final acceptance.
- Contractor must abide by all Forest Service regulations pertaining to the use of tracer paint and will be responsible for security and accountability of paint while in contractor's possession.

Trees will be measured as follows: Refer to the minimum merchantability chart below for the minimum size standards for all trees.

- Diameter - All merchantable trees will be measured for diameter of the tree at breast height, 4 ½ feet from the ground up, from the uphill side of the tree. This will be done to the nearest tenth of an inch.

- Tree Heights – All trees in the plots will be measured for height. Heights are measured to different upper stem diameters depending on the tree species being measured. See the merchantability specifications chart below.
- Defect – All sawtimber trees will be examined for potential defect. A defect card will be provided that will guide the contractor in how to determine the percentage defect an individual tree has. Pulpwood is not to be defected.

Other Determinations Needed:

- Species – All trees will be identified by their appropriate species code. A list is attached.
- Sample Group – All trees will be identified by their appropriate sample group. This consist of the following:

No	Sample Group	Species	Frequency
1	Mixed Hardwood	Beech, birch, basswood, hickory	30
2	White Oak	White oak, chestnut oak	25
3	Red Oak	Red oak, black oak, Scarlett oak	15
4	Maple	Red maple and sugar maple	10
5	Mixed Softwoods	All Softwoods species	10
6	Pulpwood	All	50

All measured trees must have the measurements written on the flagging wrapped completely around the tree.

The required information on the flag will be similar to the following.

Sample Group, Tree#, Spp., DBH, 1st Hgt. (saw timber only), 2nd Hgt. (all products), Defect and Cruisers Initials

Sawtimber Example = 2-T2 – 131 – 18.2” – 70 – 70 – 0% - JK

Pulpwood Example = 5-T3 – 100 – 9.9” – 40 – JK

Data may be recorded on paper tally cards or by data recorder. In all cases, data will be entered by the Contractor in the current Forest Service timber cruising software prior to delivery to the Forest Service. Data may be turned in directly to one of the inspectors or in an electronic format by email. If paper tally sheets are used, all original copies must be turned into the Forest Service. The Forest Service may be able to provide a data recorder if needed.

MINIMUM MERCHANTIBILITY SPECIFICATION:

		Minimum Specifications				
		Merchantable Tree		Piece Required to be Removed		
Species	**Product**	**DBH (inches)**	**Pieces per Tree**	**Length (feet)**	**DOB Small End (inches)**	**Net Scale in % of Gross**
Hardwood	Sawtimber	11.0	1.0	8	9.6	60
Softwood	Sawtimber	9.0	1.0	8	7.6	60
Hardwood	Pulpwood	6.0	1.0	8	4.0	N/A
Softwood	Pulpwood	6.0	1.0	8	4.0	N/A

Sawtimber Stopper Specifications:

- 9.6” DOB
- or the last (highest) 8 foot bolt without 2, 2 foot clear sections of wood on the second worst face of the bolt without another 8 foot bolt above that with 2, 2 foot clear faces on the second worst face.
- Deformity – (sweep or crook) does not constitute a stopper and should be defected out.

Contractor Acceptable Performance Elements:

Performance Objective and Standard	Acceptable Quality Level Assessment	Method of Performance
Measure Trees	**$\geq$ 95% Accuracy of Measurements to Standard**	**Contractors Records and Reports and a Check Cruise done by Forest Service Personnel**

CHECK CRUISE:

This sale shall be check cruised for accuracy. The Forest Service will use the internal program known as “Check Mate” to determine accuracy. The tolerances of the program will be set to the following standards.

USDA Forest Service						
FIELD MEASUREMENT EVALUATION **FSH 2409.12,60**						
Check Cruise Elements	Tolerance	Total Possible Correct Answers (a)	Numbers of Incorrect Answers (b)	Error Weight (c)	Total Error (bxc) (d)	Percent Correct (1-(d/a))x100 (e)
Species	None			5		
Product	None			3		
DBH	≤0.2 in.			1		
Merch Ht Primary	± 1 (6’)			1		
Merch. Ht Secondary (4”)	± 1 (6’)					
Saw Defect	± 10%			1		

Note: To pass this check, each item checked must have at least 75 percent correct and the overall accuracy must be 80 percent. Failure of any given item or of overall score constitutes a need to check additional trees, and/or retraining, or loss of certification.

The “Total Possible Correct Answers” (a) is the number of trees measured by the check cruiser. For plot or point cruises, the “Total Possible Correct Answers” of “in/out trees” is the number of plots checked by the check cruiser. Number of “in” trees must be the same for cruiser’s count and check cruiser’s count for plot to be correct. For all other elements, it is the measurements on the number of correctly identified “in” trees.

In addition the cruise in its entirety must be within **±10% Error** within the 95% Confidence Interval. If the cruise does not meet this standard a re-work may be required including but not limited to, Changing Cruise Methods, Re-measuring all plots,

Species	Code
Eastern redcedar	068
Norway spruce	091
White spruce	094
Red spruce	097
Red pine	125
Pitch pine	126
Eastern white pine	129
Virginia pine	132
Hemlock	261
Red maple	316
Sugar maple	318
Yellow birch	371
Black birch	372
Hickory	400
Beech	531
White ash	541
Black Walnut	602
Yellow poplar	621
Cucumbertree	651
Fraser magnolia	654
Blackgum/sourwood/elm	694
Bigtooth aspen	743
Quaking aspen	746
Black cherry	762
White oak	802
Scarlet oak	806
Chestnut oak	832
Northern red oak	833
Black locust	901
Basswood	951

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT R

Plan for Discovery of Unanticipated Paleontological Resources on National Forest System Lands

TABLE OF CONTENTS

1.0 INTRODUCTION

This *Plan for Discovery of Unanticipated Paleontological Resources on National Forest System Lands* was prepared to identify procedures to be implemented in the event that significant paleontological resources are found during construction of the Atlantic Coast Pipeline Project (ACP) in National Forest System (NFS) lands.

2.0 POTENTIAL PALEONTOLOGICAL RESOURCES

Atlantic Coast Pipeline, LLC (Atlantic) consulted with the West Virginia Geological and Economic Survey (WVGES) and Virginia Department of Mines, Minerals, and Energy (VADMME) to identify areas and formations crossed by the ACP with the potential to contain significant paleontological resources.

In West Virginia, and northwestern Virginia, the geologic formations crossed by the ACP could contain fossiliferous remains of marine invertebrates, animals, and fragmentary plant specimens (Kochanov, 2015; McDowell, 2015; Heller, 2015). While the likelihood of encountering significant paleontological resources during pipeline construction is low, there have been instances in the region where shallow excavations uncovered rare specimens, such as the 2004 discovery of *Fedexia striglei* during construction near the Pittsburgh Airport (Carnegie Museum of Natural History, 2010).

3.0 TRAINING

Prior to the start of construction, Atlantic will conduct environmental training for Company and Contractor [1] personnel. The training program will focus on the Federal Energy Regulatory Commission's Certificate of Public Convenience and Necessity conditions, the COM Plan, including these paleontological discovery procedures, and other permit conditions and mitigation plans. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

4.0 UNANTICIPATED DISCOVERY OF PALEONTOLOGICAL RESOURCES

The following measures will be implemented if significant paleontological materials (i.e., fossilized vertebrate remains such as bones, teeth, etc.) are encountered on NFS lands during construction:

1. The Contractor will stop work in the area of the find (i.e., within 100 feet of the find or the outer perimeter of a group of finds) to protect the integrity of the find.

2. The Contractor will notify Atlantic's Environmental Inspector (EI) of the find.

[1] Contractor refers to the company or companies retained by Atlantic/DTI or another contractor to construct the proposed facilities.

3. The EI will notify Atlantic's Environmental Project Manager and the Forest Service (FS) Field Compliance/Monitoring Officer.

4. The Environmental Project Manager will notify the FERC and WVGES or VADMME, as appropriate.

5. Based upon consultation with the FS Field Compliance/Monitoring Officer, and the FERC, and with WVGES or VADMME as appropriate, Atlantic will undertake appropriate action, such as salvaging the discovery if it is determined to be a significant find. The Environmental Manager will inform the EI when consultation with the appropriate agencies is complete and work can resume in the area of the find.

6. The Contractor will not resume work within 100 feet of the find until the EI has granted clearance.

5.0 REFERENCES

Kochanov, W. 2015. Email communication with Pennsylvania Department of Conservation and Natural Resources. Communication on March 26, 2015.

McDowell, R. 2015. Email communication with West Virginia Geological and Economic Survey. Communication on March 23, 2015.

Heller, M. 2015. Email communication with Virginia Department of Mines, Minerals, and Energy. Communication on March 30, 2015.

Carnegie Museum of Natural History. 2010. Early Terrestrial Amphibian Described by Carnegie Museum of Natural History Scientists. March 15, 2010. Available online at http://www.carnegiemnh.org/press/pressrelease.aspx?id=18061. Accessed March 2015.

6.0 AGENCY CONTACTS

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TBD, George Washington National Forest

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ATLANTIC COAST PIPELINE, LLC
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Construction, Operations, and Maintenance Plans

ATTACHMENT 5

Road and Trail Open Cut Crossing Plans on the George Washington National Forest

October 2017

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1.0 INTRODUCTION

The ACP pipeline route crosses eleven Forest roads and four Forest trails on the GWNF [1]. Atlantic proposes to use the open-cut method to cross all these features.

This plan identifies how Atlantic will cross these features in a manner that minimizes the impact of the users of these trails and roads, keeps the public safe, and, with the GWNF, inform the public of closures and detours that may affect their activities. Table 1 provides a list of the trail and road crossings crossed on the GWNF. Site-specific maps are attached to this plan.

Because roads and trails will be crossed similarly, the two types of features are for the most part discussed together. For this plan, the more important distinction is whether the feature is crossed by the pipeline at a more-or-less perpendicular angle, or runs parallel to and within the construction right-of-way. The perpendicular crossings will be constructed in a manner to allow public use of the road or trail during construction except for a brief closure period during installation at the crossing. Parallel crossings will require that the road or trail in its current alignment be closed for a more extended period.

2.0 PERPENDICULAR CROSSINGS

Table 1 indicates which road/trail features are considered perpendicular crossings for purposes of the site-specific plans. All such features will be constructed in the following manner:

Pre-construction photos will be taken at trail and road crossings to document trail conditions and as an aid to restoring pre-construction conditions. Orange safety fencing or other barriers will be erected on either side of the travel way where it crosses the construction right-of-way. Spotters or flaggers will be employed to halt any traffic when equipment or vehicles are crossing over the road/trail as they move down the right-of-way.

Each road/trail will be kept open to traffic during construction, except during the period when traffic must be closed to excavate, lay, and bury the pipeline crossing section. This will be accomplished by leaving an unexcavated area where the trail crosses the right-of-way until the pipeline crossing section (approximately 40-80 feet long) is ready to be installed, either before or after the mainline pipeline is installed on either side of the road/trail. At that time, the trench across the road/trail will be excavated, the pipeline section lowered into the trench, and the trench immediately backfilled so that traffic can resume. Barring unforeseen complications, it is anticipated that the road/trail crossing will be completed in less than a day and the crossing area restored in a few days, using the same sub-bed and surface material as excavated from the crossing location.

At two separate locations (MPs 96.3 and 117.1), two or more perpendicular crossings lie within 400 feet of one another. At both these locations, the multiple perpendicular crossings will be crossed as part of a single installation effort, which will require closure of the roads/trails at these locations for approximately 3-4 days. Because of short duration of the traffic closures at perpendicular crossings, Atlantic does not anticipate the need for detours at these locations.

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[1] This does not include the Appalachian National Scenic Trail, which is the subject of its own crossing plan.

Atlantic will post signs at least five days ahead of the temporary road/trail closure alerting users to the planned timing on the closure. Signs will be posted on the road/trail adjacent to both sides of the work area, at the nearest crossroad on either side of the work area, or as directed by the GWNF. See COM Plan Attachment S for signage, flagging, and fencing protocols.

3.0 PARALLEL CROSSINGS

Table 1 indicates which road/trail features are considered parallel crossings for purposes of the site-specific plans. At these locations the pipeline right-of-way lies directly over the road/trail for distances of between 250 and 3000 feet. Construction equipment and vehicles will need to traverse this area of the right-of-way from right-of-way clearing until final clean-up and restoration, requiring closure or realignment of the road or trail for the duration of construction. Any realignments will be determined in consultation with the GWNF.

4.0 NOTIFICATION PROTOCOL

Atlantic will notify the GWNF at least 30 days in advance of commencing construction activities that will require a long-term trail or road closure and/or detour. Atlantic and the GWNF will prepare the content, maps, and layout for the signs and send notifications to the stakeholders listed below. Atlantic will be responsible for printing, erecting, and maintaining the signs while the detours are needed.

The GWNF will determine which venues to post notices regarding detours. Potential venues may include:

- GWNF website;
- local outfitter companies (especially those holding Special Use Permits in the vicinity);
- local newspapers; and
- potentially aired on National Public Radio.

Notices will provide a brief narrative and depict a map showing where the trail is under construction, as well as the detour route. Each notice will also describe the anticipated timeframe of construction (e.g., from week/month X to week/month Y).

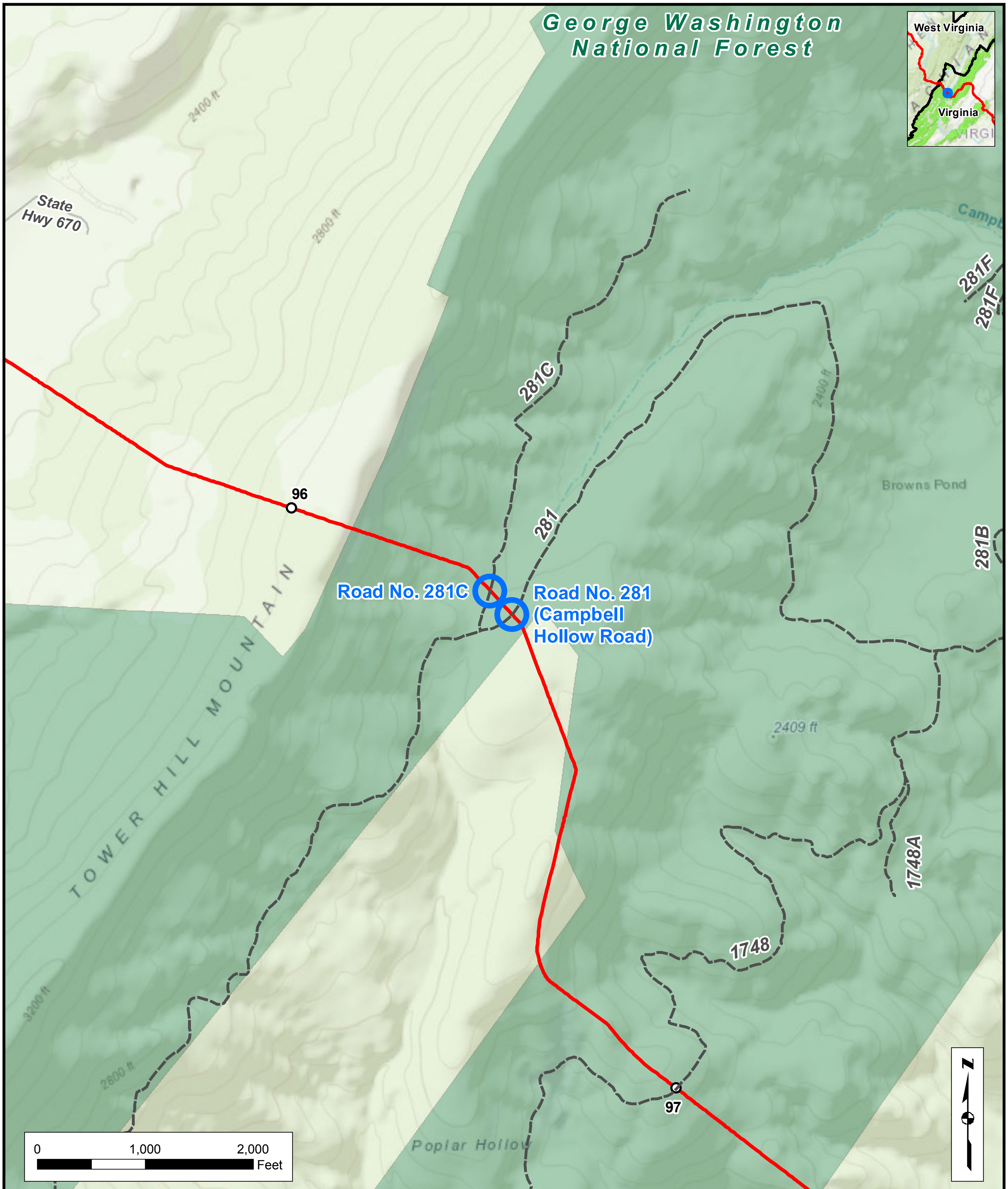
To the extent required, if portions of a trail system need to be closed to public use, Atlantic will coordinate with the GWNF to request a formal “Closure Order of the Forest Supervisor”, which will require Forest Service Law Enforcement patrols to enforce the order. If a formal “Closure Order of the Forest Supervisor” is necessary to ensure public safety, the Forest Service will need 30 days notice for processing the Order and for providing ample time for public notification.

TABLE 1

GWNF Roads and Trails Crossed by the Atlantic Coast Pipeline

Forest Road/Trail No.	Approximate Milepost	Crossing Configuration
GWNF Road 281C	96.3	Perpendicular – will be crossed with Road 281
GWNF Road 281 (Campbell Hollow Road)	96.3	Perpendicular – will be crossed with Road 281C
GWNF Road 1748	97.0	Perpendicular
GWNF Trail 447 (Shenandoah)	98.7	Parallel
GWNF Trail 718 (Brushy Ridge)	105.9	Parallel
GWNF Road 449	117.1	Perpendicular – will be crossed with Trail 650 and second crossing of Road 449
GWNF Trail 650 (Dowell's Draft)	117.1	Perpendicular – will be crossed with two crossings of Road 449
GWNF Road 449	117.1	Perpendicular – will be crossed with Trail 650 and second crossing of Road 449
GWNF Road 449A	118.7	Perpendicular
GWNF Road 449B	118.7 to 119.8	Parallel
GWNF Road 466A	120.2	Perpendicular
GWNF Road 466	120.4	Perpendicular – will be crossed with Trail 486
GWNF Trail 486 (White Oak)	120.4	Perpendicular – will be crossed with Road 466
GWNF Road 1755	121.2 to 121.8	Parallel
GWNF Road 1757	121.8 to 122.4	Parallel

Topographic Maps



Dominion Energy®

- Milepost
- Proposed Route
- USFS Trail
- USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 281C and Forest Road No. 281 (Campbell Hollow Road)

George Washington National Forest

ERM

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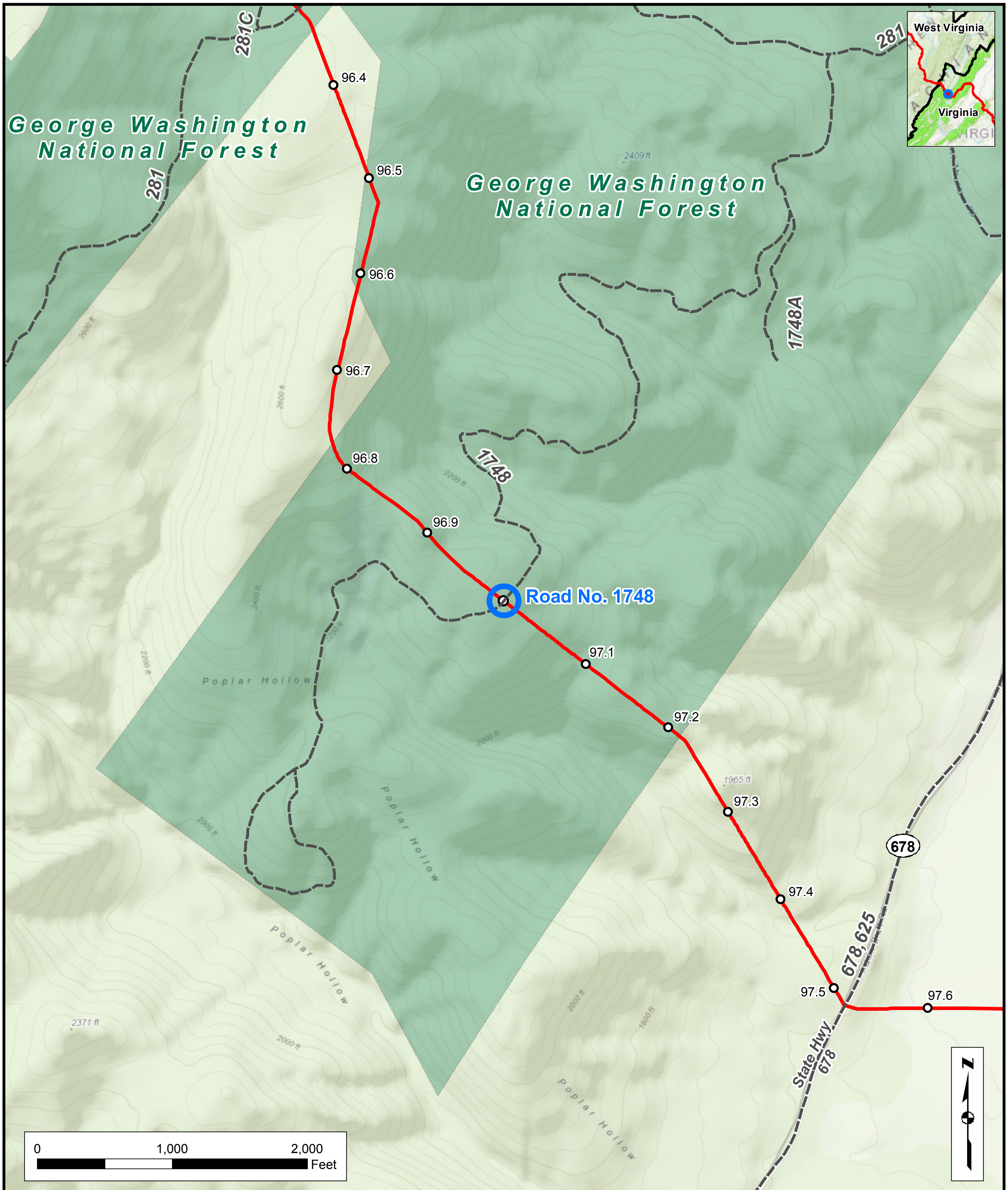

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Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 1748

George Washington National Forest

ERM

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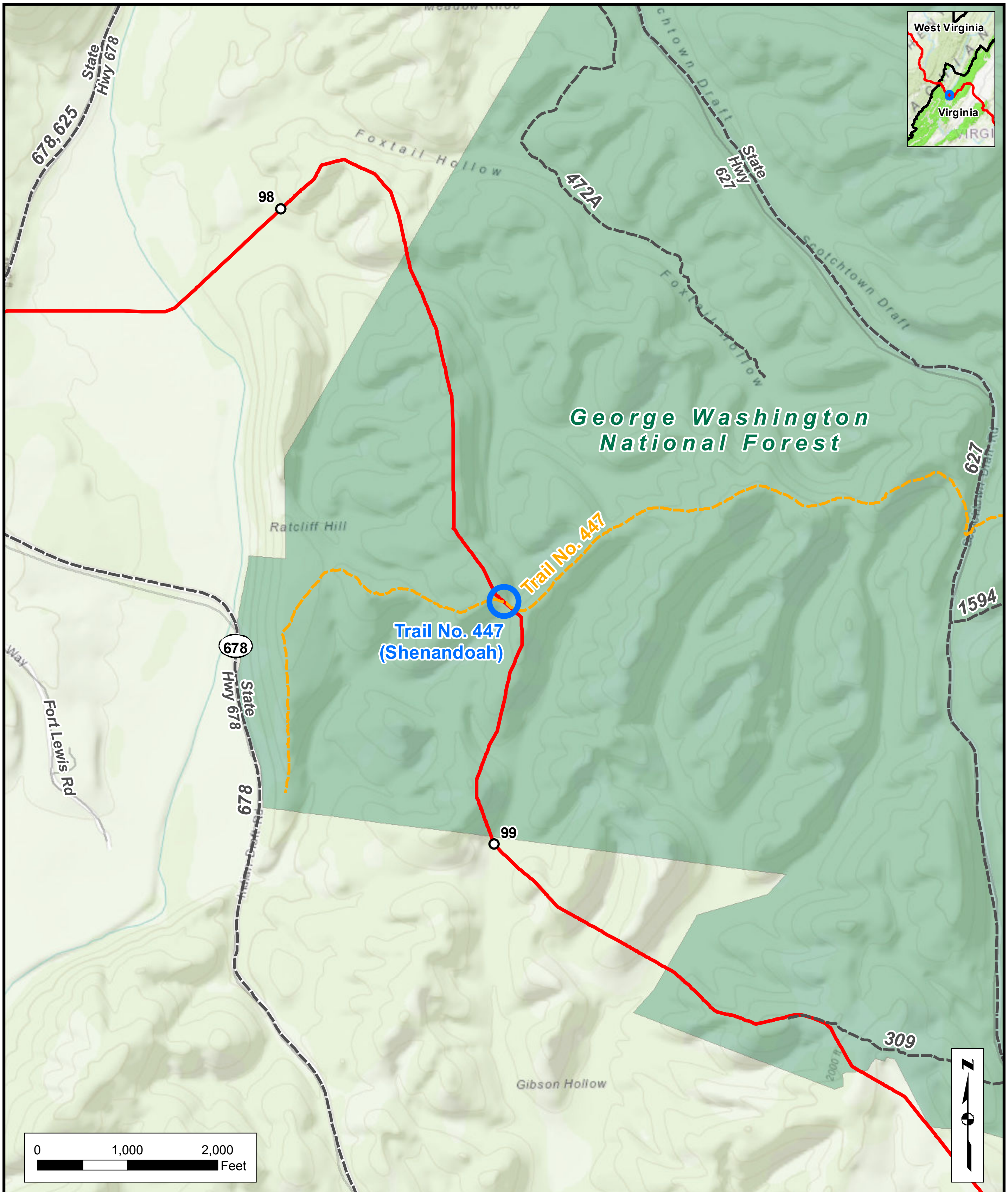

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Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline
Open Cut Crossing Plan
Forest Trail No. 447 (Shenandoah)
George Washington National Forest

ERM

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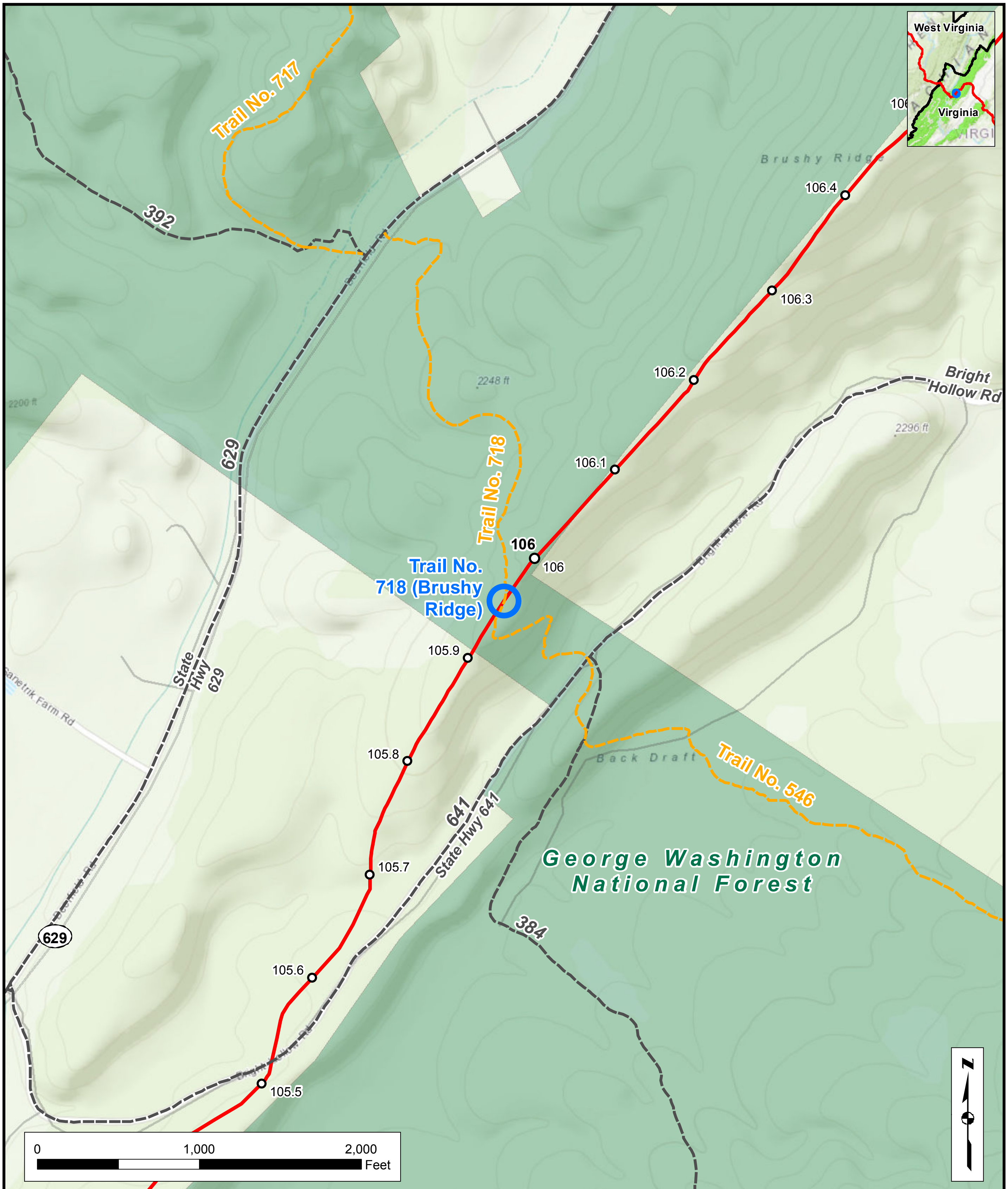

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Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Trail No. 718 (Brushy Ridge)

George Washington National Forest

ERM

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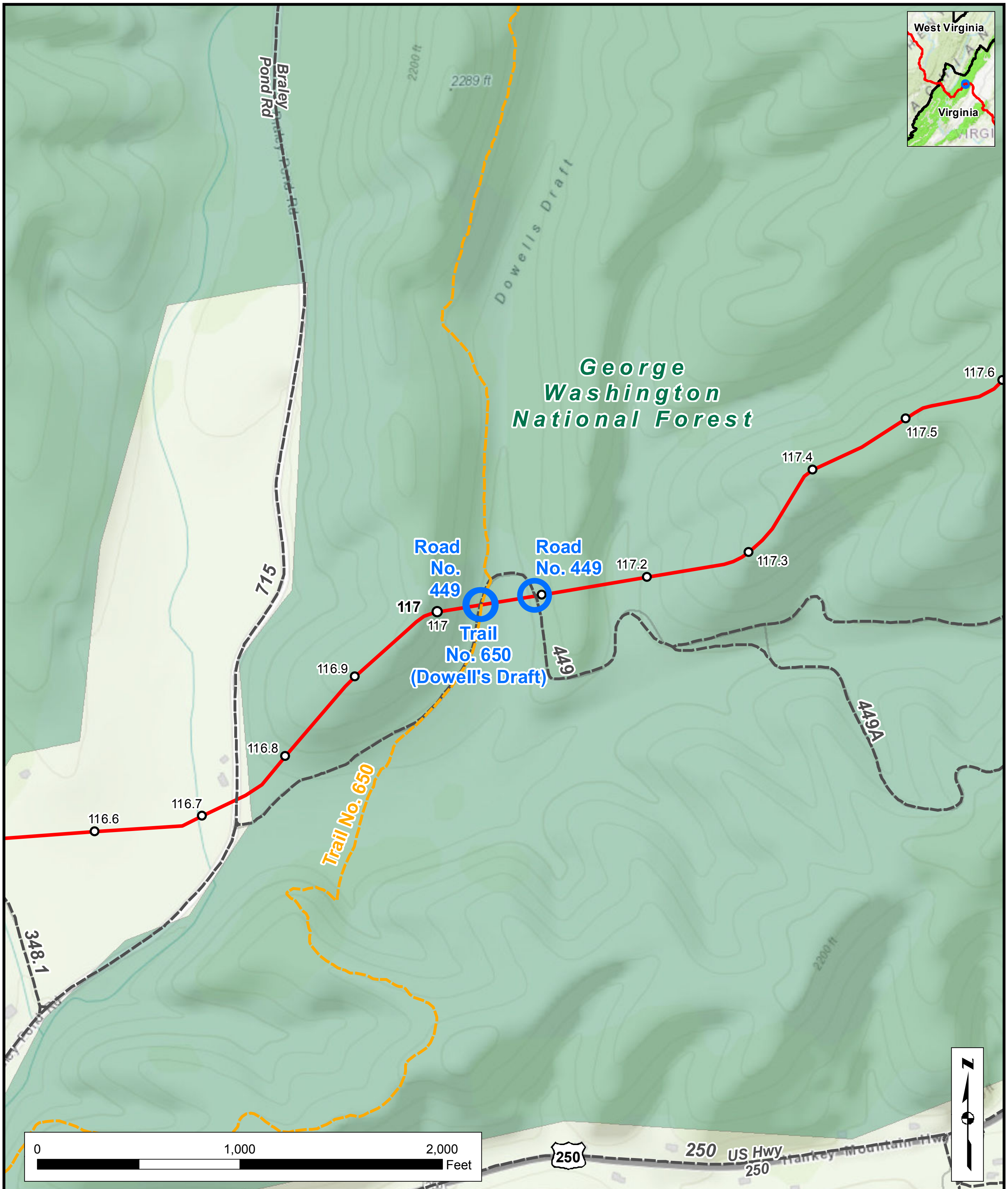

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Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline
Open Cut Crossing Plan
Forest Road No. 449 and Forest Trail No. 650 (Dowell's Draft)
George Washington National Forest

ERM

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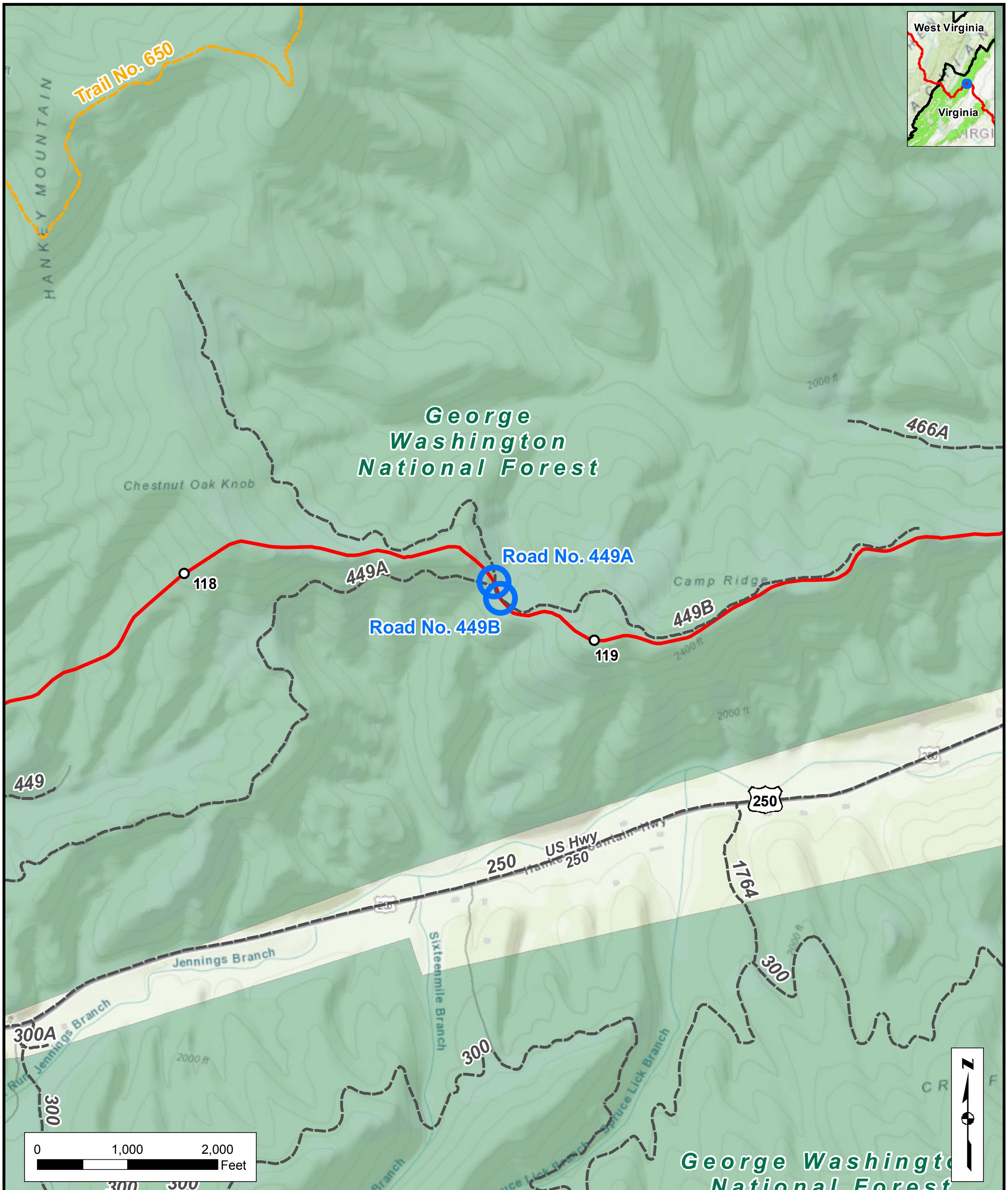

Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 449A and Forest Road No. 449B

George Washington National Forest

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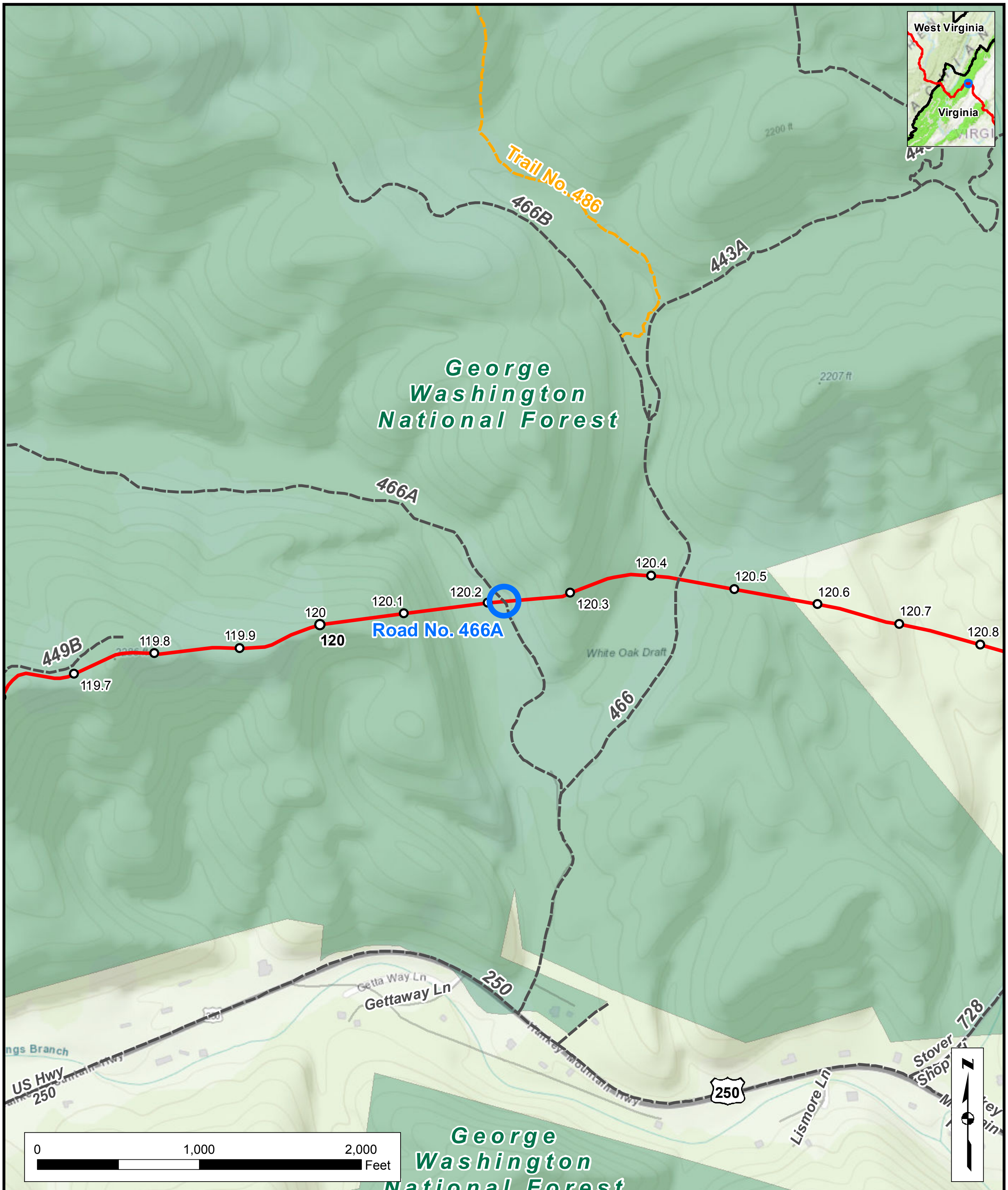

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Milepost
Proposed Route
USFS Trail
USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 466A

George Washington National Forest

ERM

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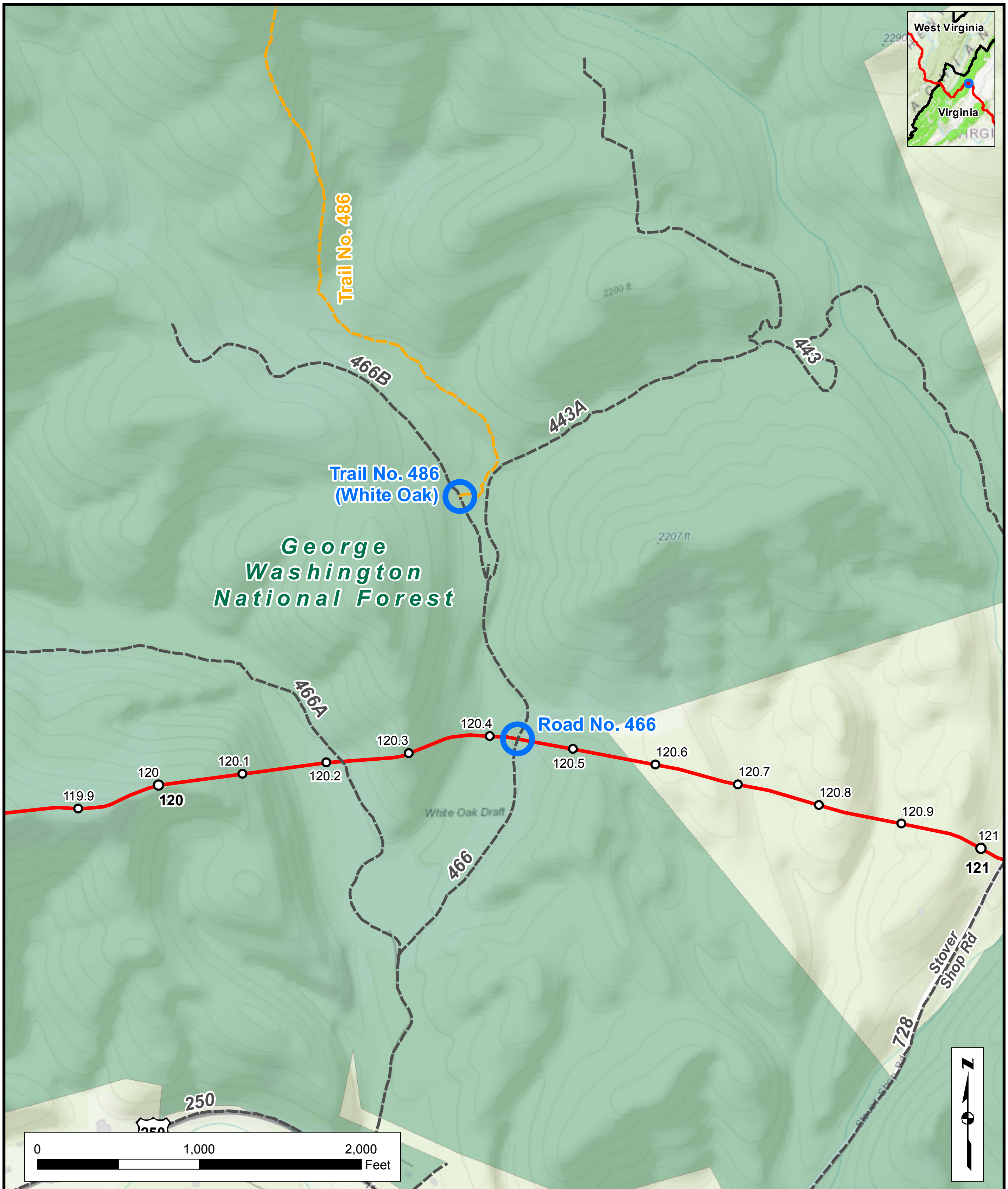

Dominion Energy

- Milepost
- Proposed Route
- USFS Trail
- USFS Road

Atlantic Coast Pipeline
Open Cut Crossing Plan
Forest Road No. 466 and Forest Trail No. 486 (White Oak)

George Washington National Forest

ERM

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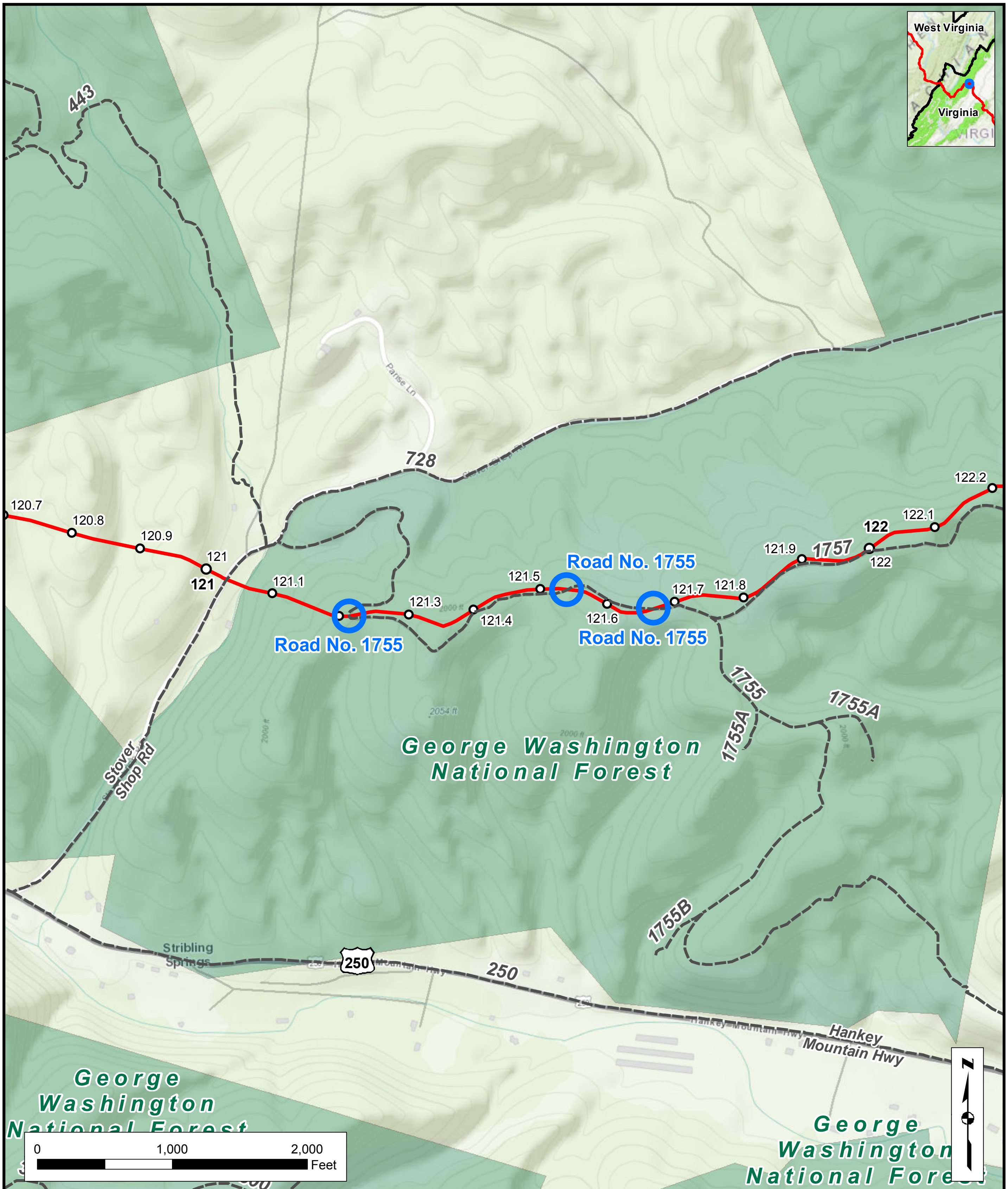

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Proposed Route

USFS Trail

USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 1755

George Washington National Forest

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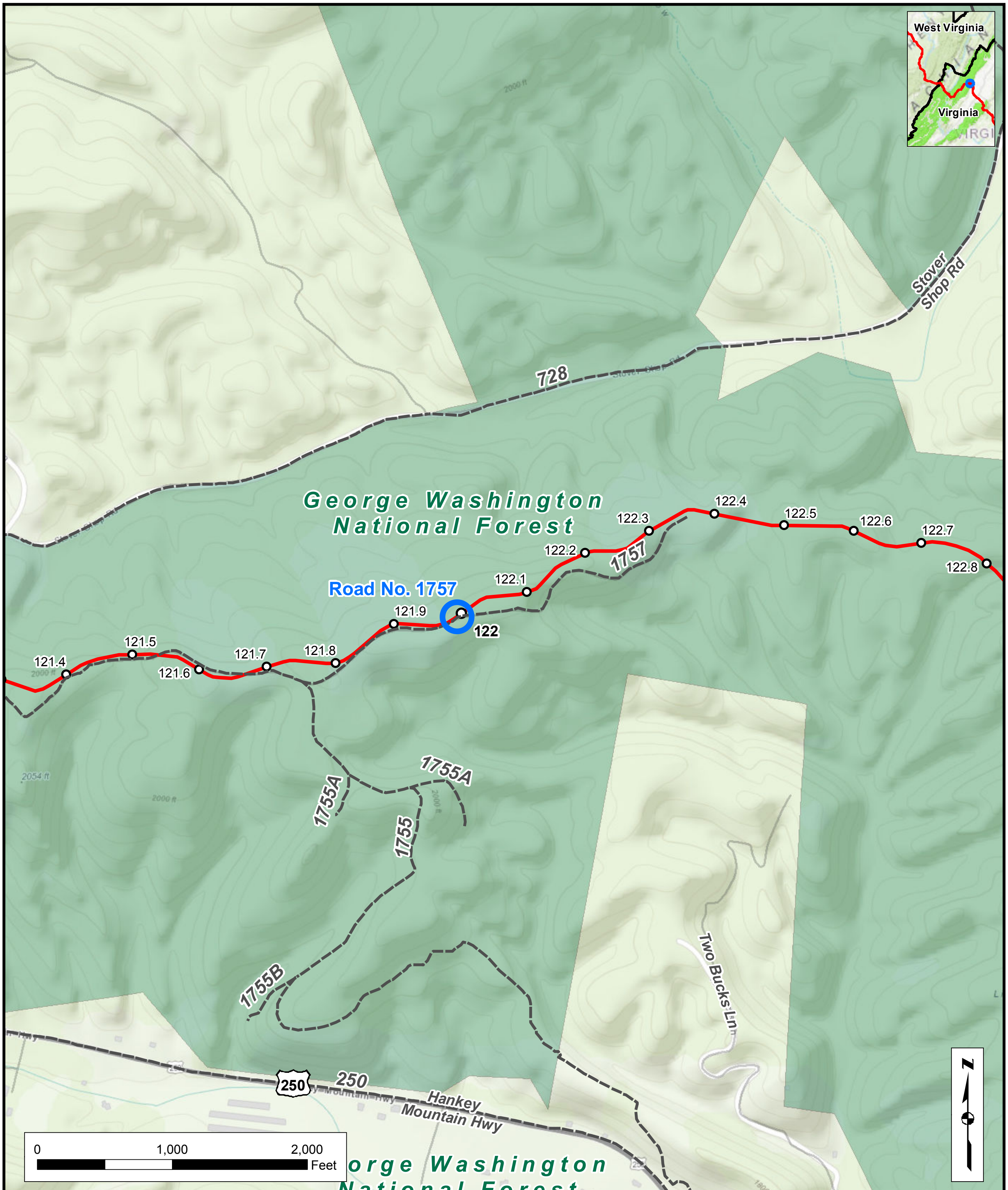

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Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 1757

George Washington National Forest

ERM

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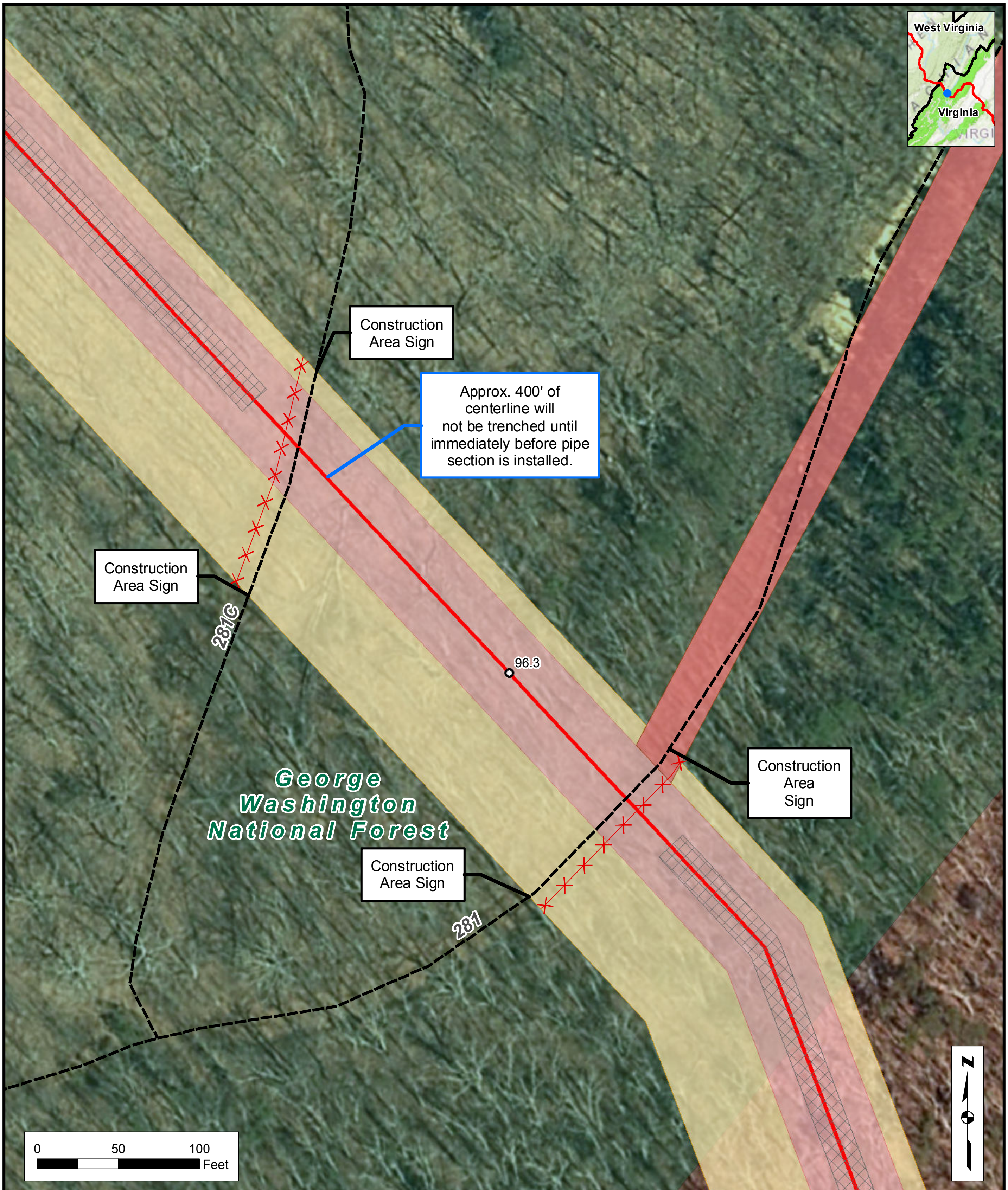
Aerial Maps



Dominion Energy

- Milepost
- Proposed Route
- Perm AR
- Perm ROW
- Temp ROW
- Safety Fencing
- Pipeline Trench (NTS)
- USFS Trail
- USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 281C and Forest Road No. 281 (Campbell Hollow Road)

George Washington National Forest

ERM

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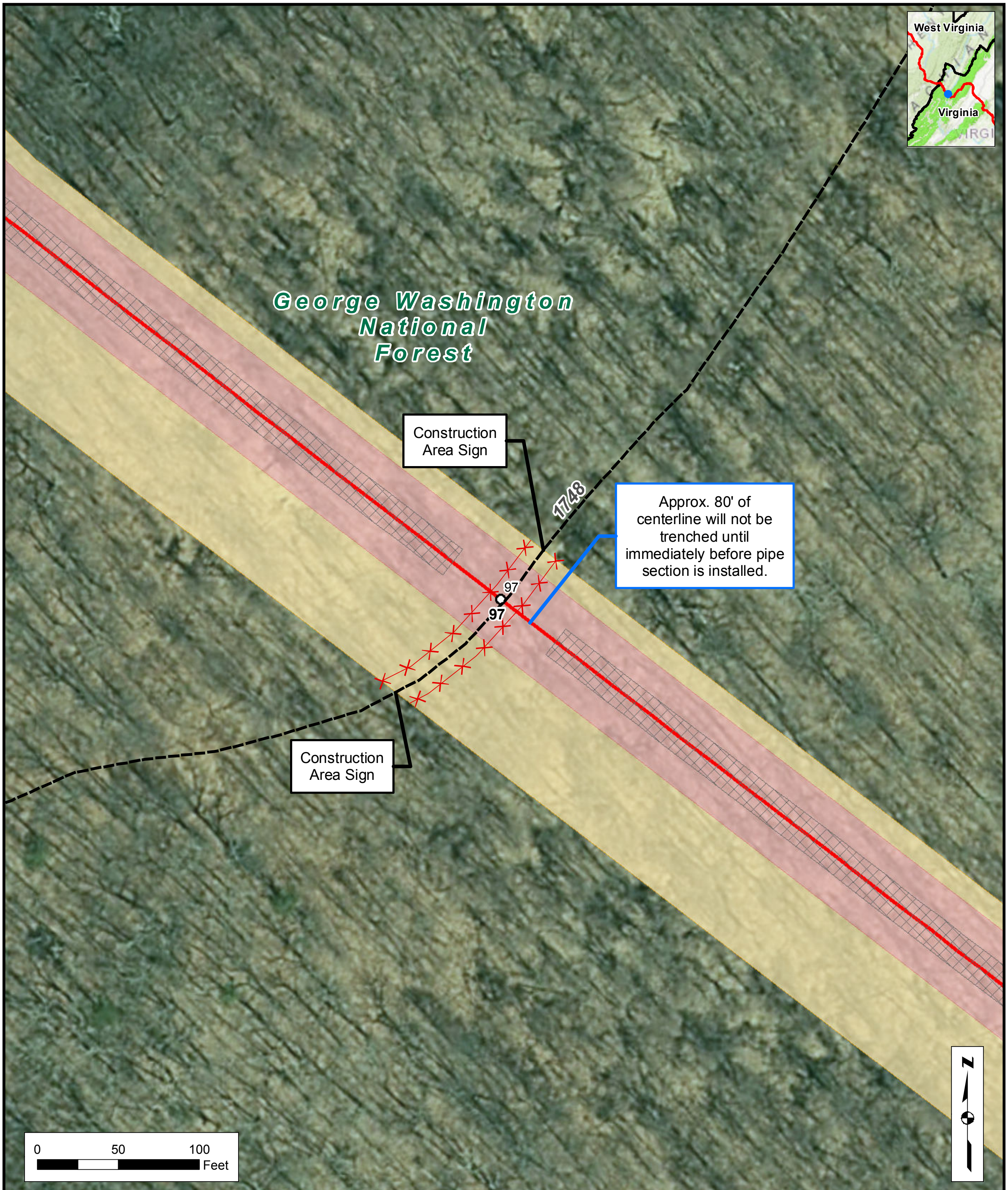

Milepost
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Dominion Energy

Atlantic Coast Pipeline
Open Cut Crossing Plan
Forest Road No. 1748
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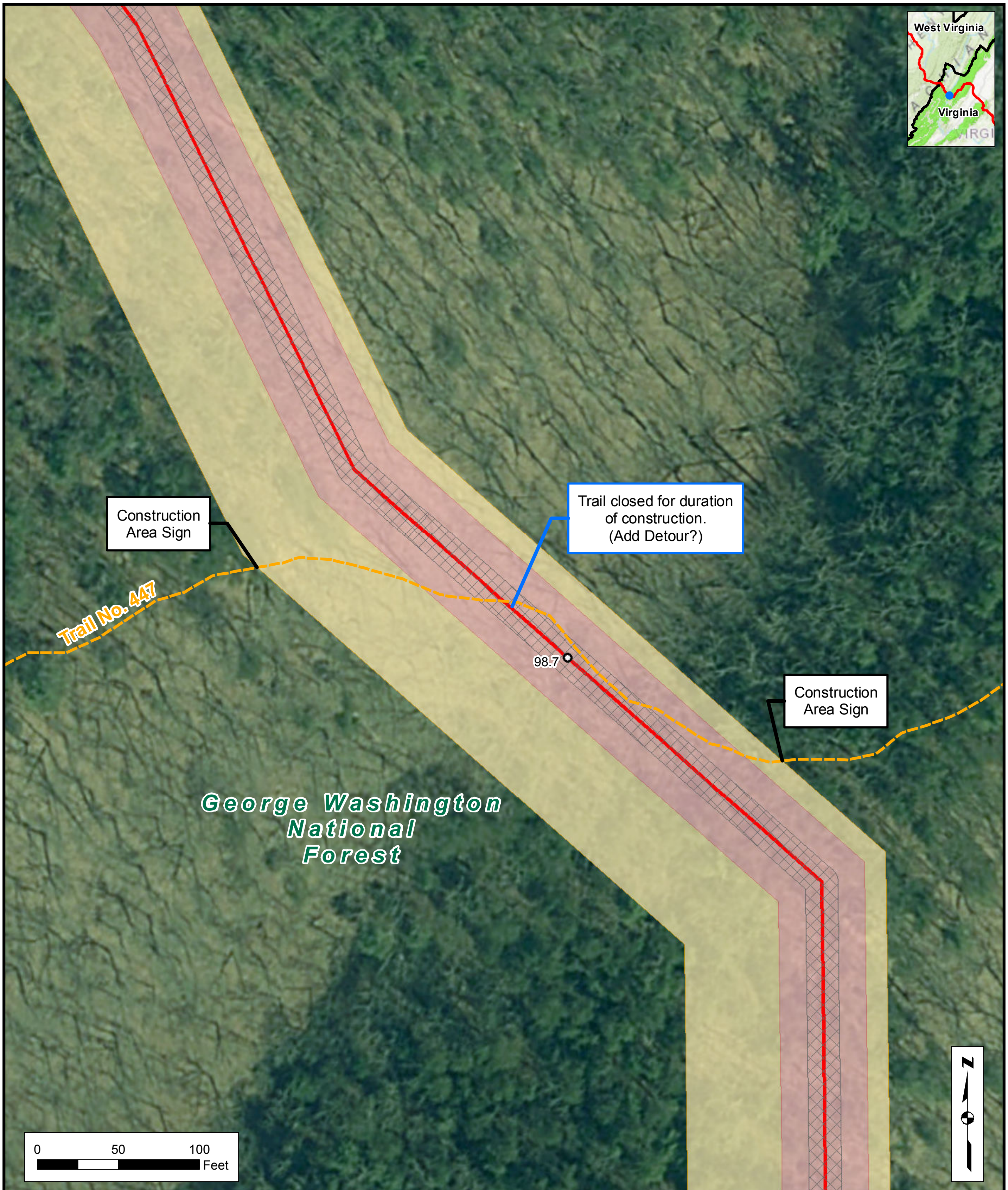

Dominion Energy

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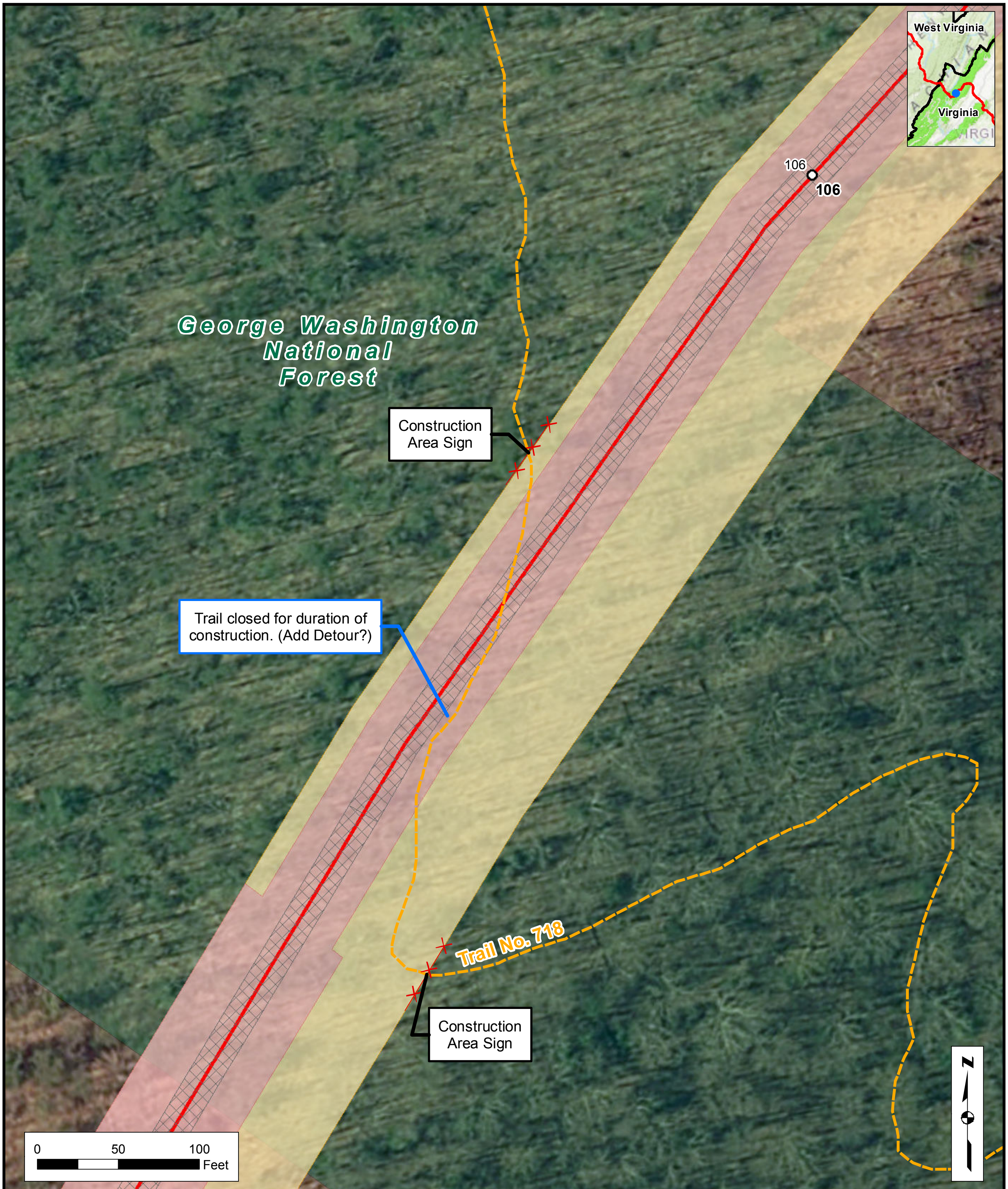

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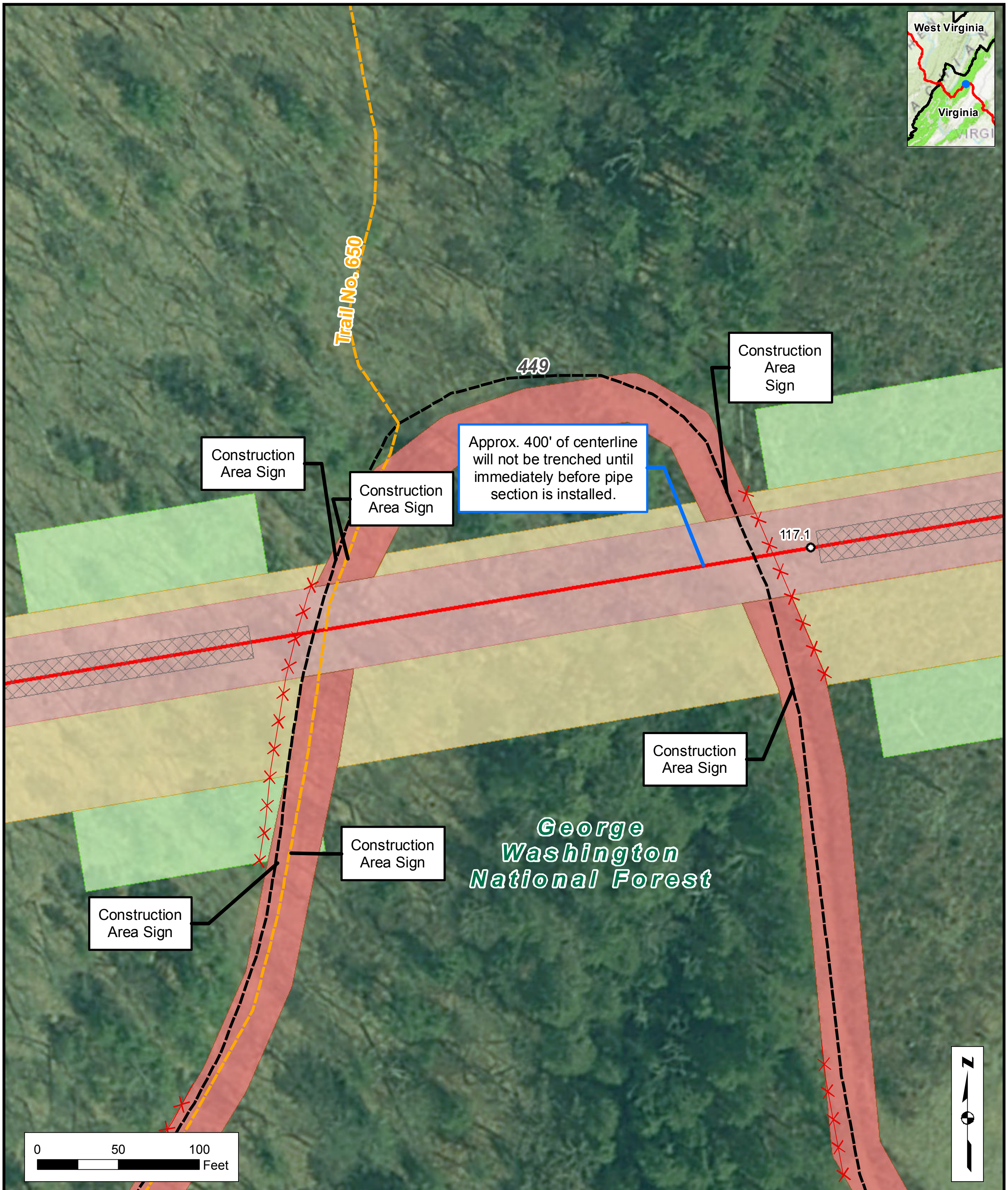

Dominion Energy

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Perm AR
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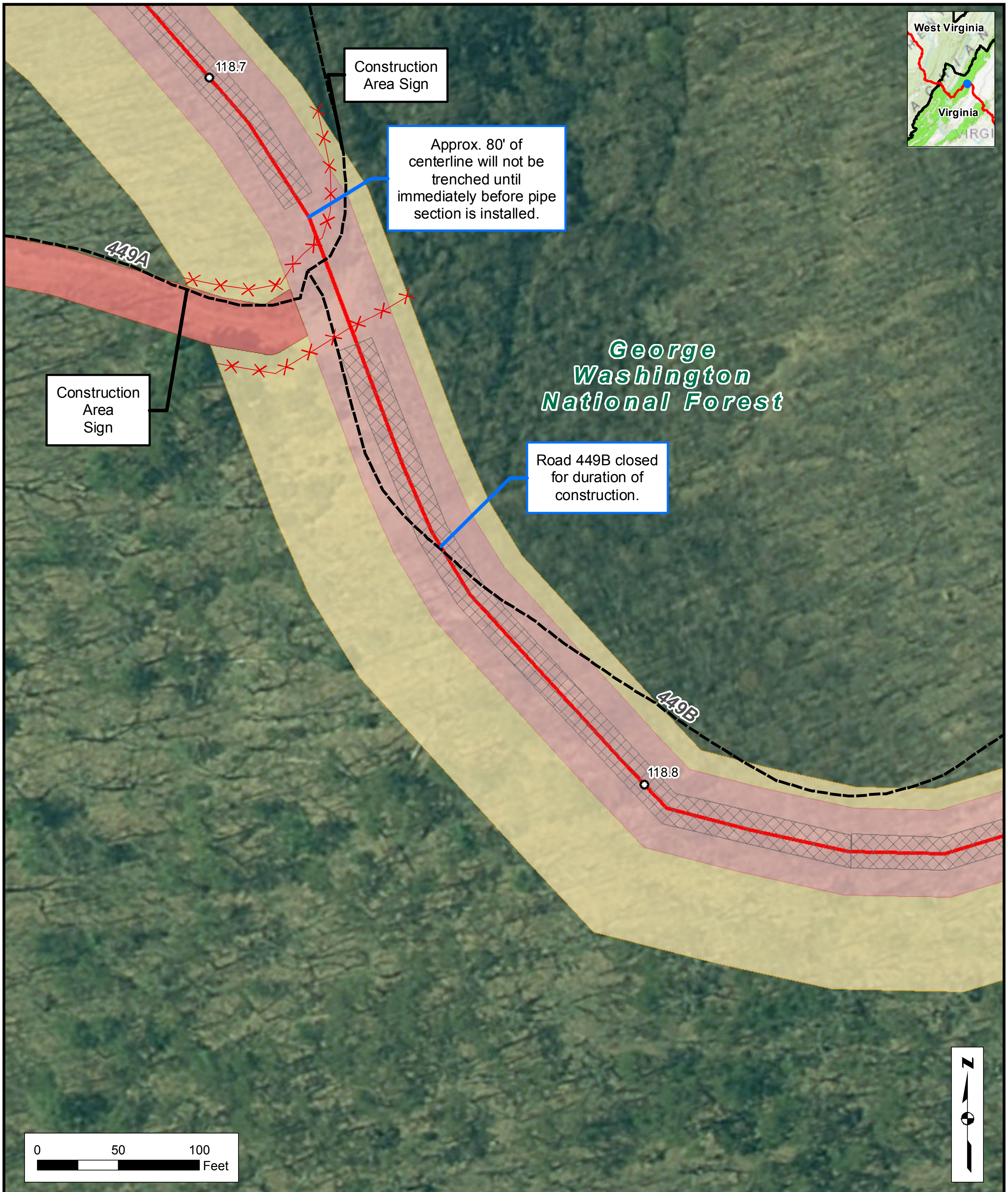

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Open Cut Crossing Plan

Forest Road No. 449A and Forest Road No. 449B

George Washington National Forest

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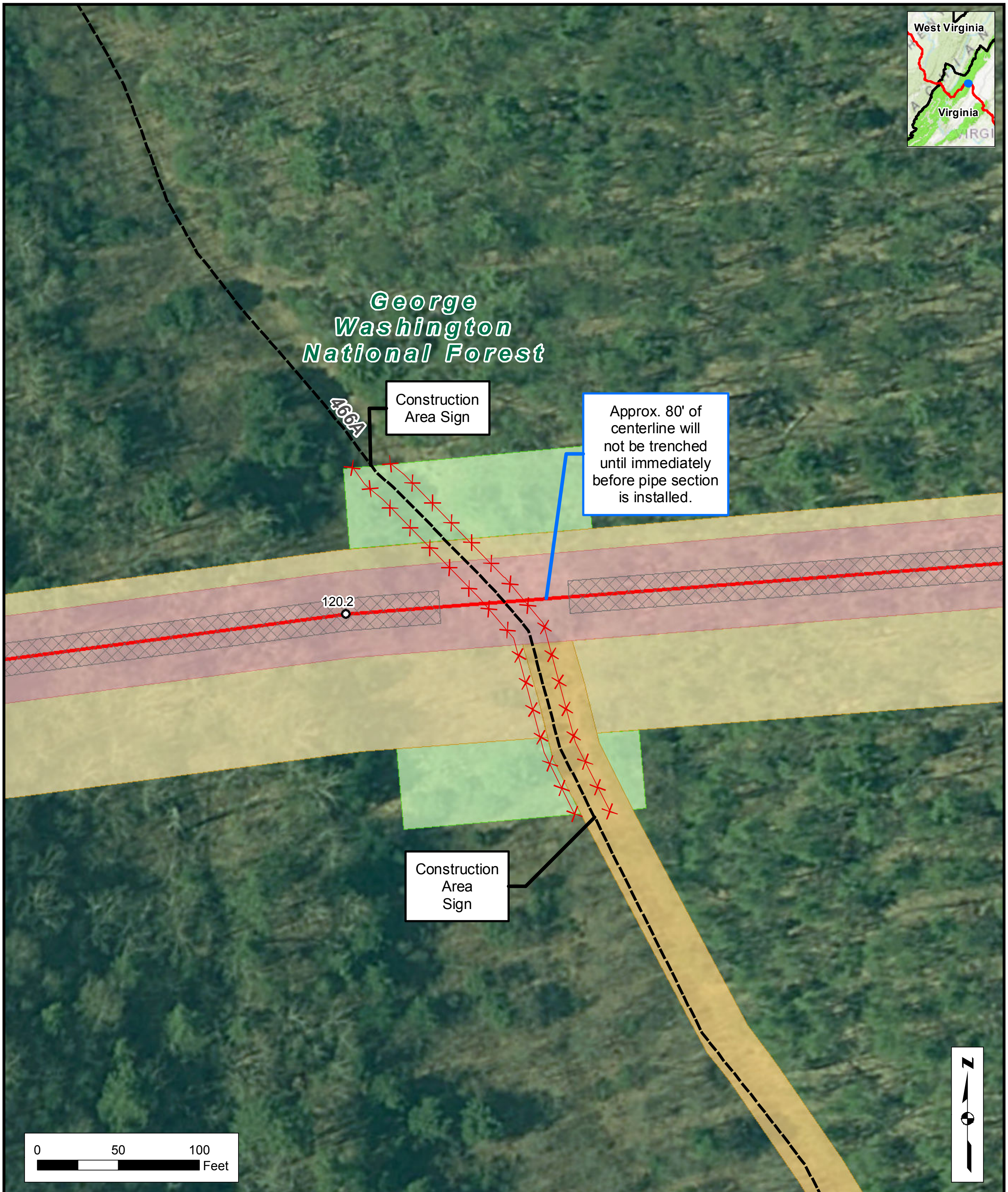

Milepost
Proposed Route
Perm ROW
Temp AR
Temp ATWS
Temp ROW
Safety Fencing
Pipeline Trench (NTS)
USFS Trail
USFS Road

Dominion Energy®

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 466A

George Washington National Forest

ERM

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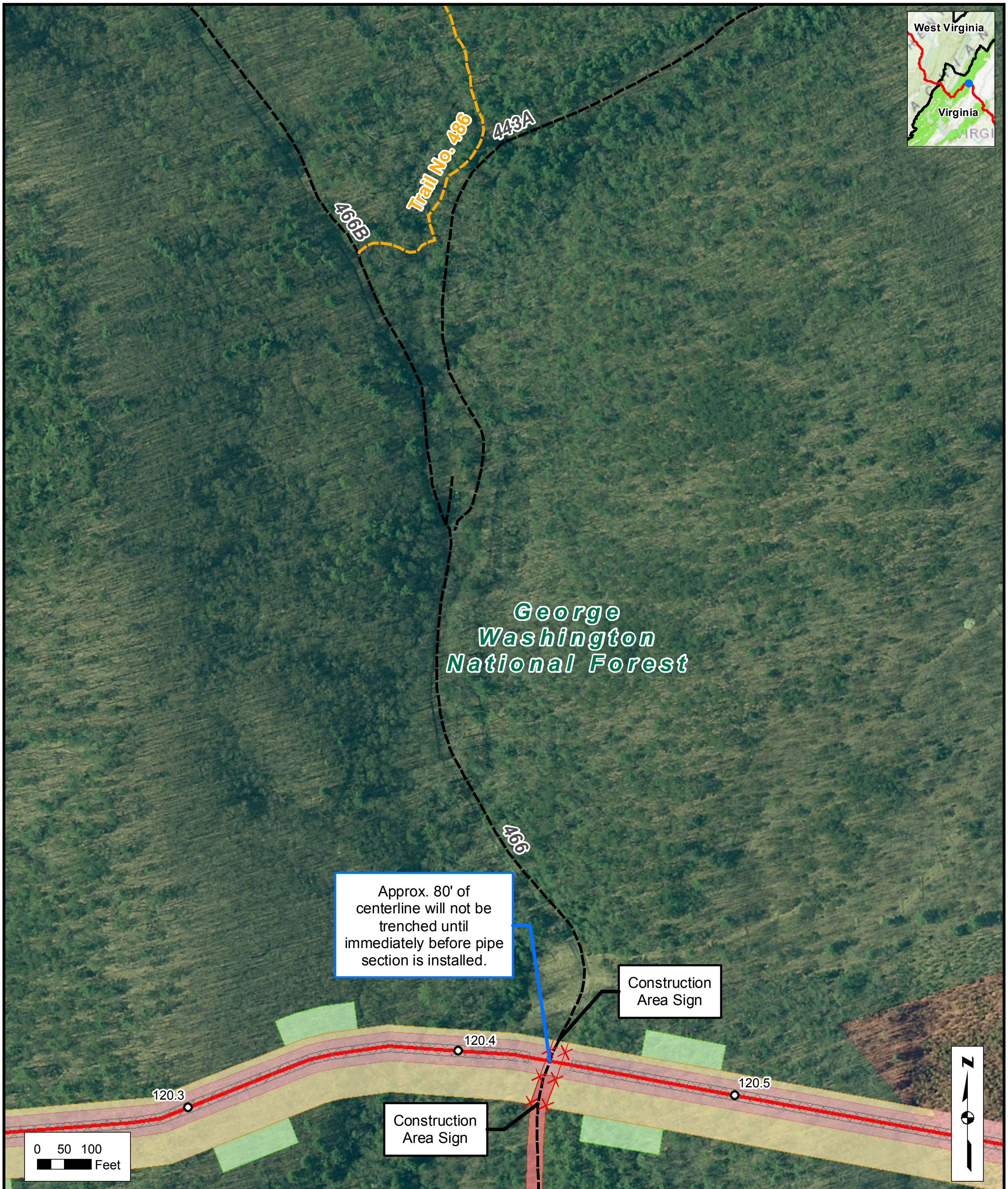

Milepost
Proposed Route
Perm AR
Perm ROW
Temp AR
Temp ATWS
Temp ROW
Safety Fencing
Pipeline Trench (NTS)
USFS Trail
USFS Road

Dominion Energy

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 466 and Forest Trail No. 486 (White Oak)

George Washington National Forest

ERM

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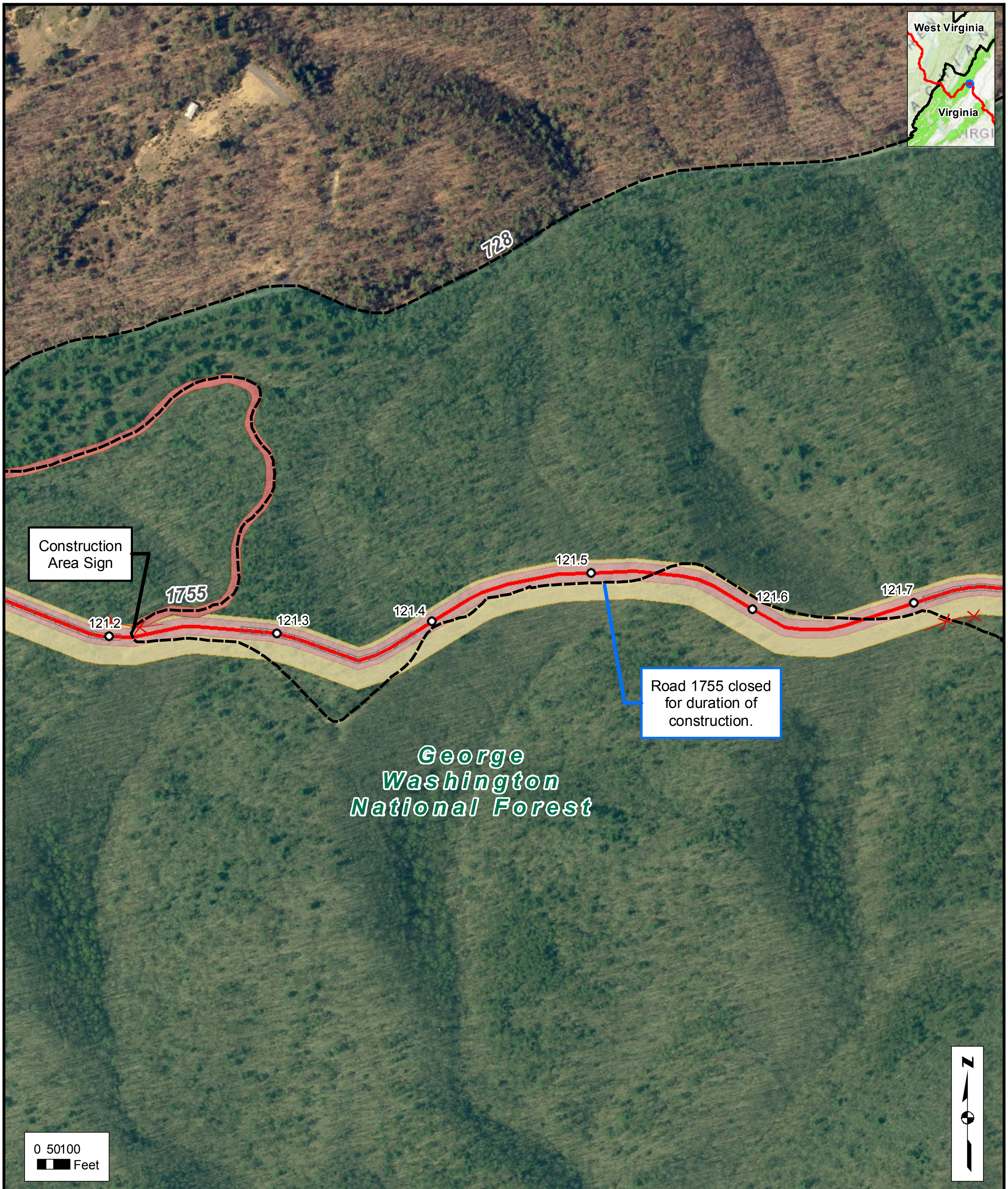


Dominion Energy

- Milepost
- Proposed Route
- Perm AR
- Perm ROW
- Temp ROW
- Safety Fencing
- Pipeline Trench (NTS)
- USFS Trail
- USFS Road

Atlantic Coast Pipeline

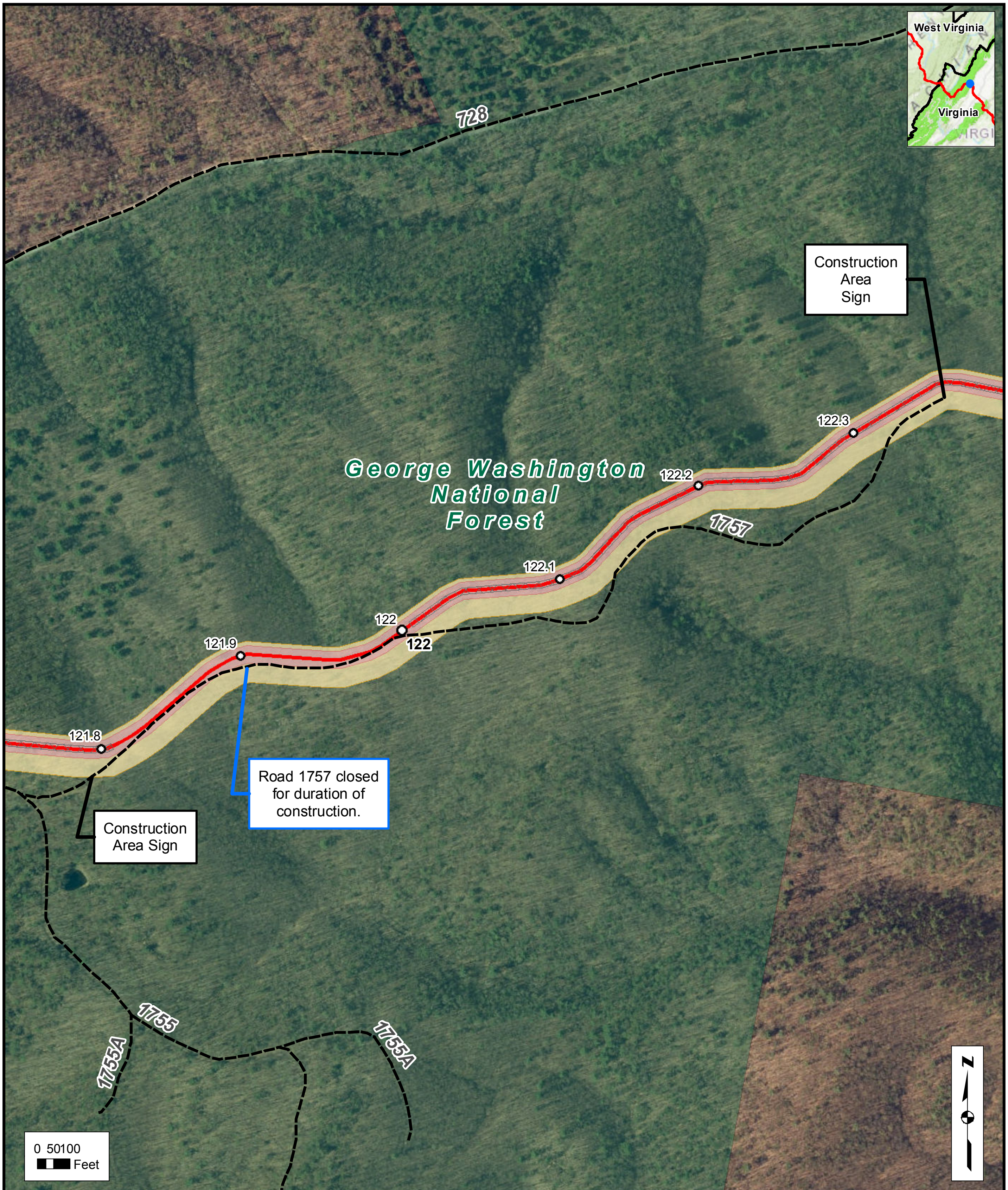
Open Cut Crossing Plan

Forest Road No. 1755

George Washington National Forest

ERM

FILE: M:\Clients\D-F\DOM\SRPP_ArcGIS\2017\08\29_COM_GWNF_Road_Crossings_acp_COM_GWNF_Road_Crossings_Aerials2.mxd, REVISED: 09/19/2017, SCALE: 1:5,000 DRAWN BY: LDS



Dominion Energy

- Milepost
- Proposed Route
- Perm ROW
- Temp ATWS
- Temp ROW
- Safety Fencing
- Pipeline Trench (NTS)
- USFS Trail
- USFS Road

Atlantic Coast Pipeline

Open Cut Crossing Plan

Forest Road No. 1757

George Washington National Forest

ERM

FILE: M:\Clients\D-F\DOM\SRPP_ArcGIS\2017\08\29_COM_GWNF_Road_Crossings_acp_COM_GWNF_Road_Crossings_Aerials2.mxd, REVISED: 09/19/2017, SCALE: 1:5,000 DRAWN BY: LDS

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

Construction, Operations, and Maintenance Plans

ATTACHMENT T

Flagging, Fencing and Signage Plan

October 2017

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LIST OF TABLES

1.0 INTRODUCTION

Section 18 of the COM Plan identifies measures for informing casual users of the MNF and GWNF about construction of the ACP, and measures to inform specific user groups whose activities may intersect ACP construction about any closures, detours, restrictions, alternative access routes, etc. associated with ACP construction.

Various other sections of the COM Plan incorporate flagging, fencing, and signage into measures designed to protect FS resources during construction. These measures are aimed at construction and inspection personnel rather than the public.

This Flagging, Fencing and Signage Plan addresses the specific flagging, fencing and signage standards and methods ACP will use in implementing those requirements on NFS lands. They are an integral component to resource protection, as well as maintaining public safety and minimizing inconvenience to recreational users of the Forests during construction.

2.0 METHODS AND STANDARDS

Table 2-1 provides standards for marking selected construction features and sensitive resource areas. Signs will be placed to achieve maximum visibility from all likely directions. With some exceptions for certain post-construction signage, all stakes, flagging, exclusion fencing, and signs will be removed upon completion of construction, or when no longer needed.

Signs will include the same information as the notices described above and will be posted at major trailheads. Signs would be about two feet by two feet and laminated to resist weather. Where kiosks are present at trailheads, the signs would be attached. Otherwise, Atlantic will install a temporary post to affix the sign.

TABLE 2-1

Flagging Standards for Selected Construction Features and Sensitive Resource Areas

Feature or Purpose	Flagging or Sign Colors	Sign Text	What to Do
Project access road	To be decided by construction contractor(s)	Project Access Road – Road # (e.g., AR-016-001) Atlantic Coast Pipeline Project	To be located at points of intersection, additional intermittent signs as needed.
Non-authorized access road	To be decided by construction contractor(s)	Do Not Enter - Not An Authorized Access Road	Do not drive vehicles or equipment on unauthorized roads.
Construction right-of-way work area limits	To be decided by construction contractor(s)	Not applicable	Stake/flag work area limits at perimeter of authorized work areas.
Additional temporary workspace and related construction staging areas.	To be decided by construction contractor(s)	Not applicable	Stake/flag perimeter areas.
Exclusion areas for sensitive resources		Sensitive Resource Area - Keep Out	Install exclusion barriers, with resource specialists' assistance, and ensure signs are prominently displayed.
Sensitive resource areas (non-exclusion areas such as wetlands or weed-contaminated soil, etc.)		Wetland Boundary Wetland/Waterbody Buffer Area- No refueling beyond this point Karst Feature- No construction equipment, vehicles, materials, hazardous materials, chemicals, fuels, lubricating oils, or petroleum products beyond this point Weed-Contaminated Material	
Restoration areas		Restoration in Progress – No Vehicle Traffic Allowed	Post signs as appropriate near entrances to ROW or restoration area.
Smoking areas		Designated Smoking Area	Post signs at designated smoking areas
No smoking areas		No Smoking	Post signs at gas and oil storage locations, refueling areas and other work areas where flammable materials are used, stored, or discarded.
Vehicle weed wash stations		Weed Wash Station	Post signs at entrances to wash stations.
Public warnings		Danger!-Keep Out Construction Area	Post signs with exclusion fencing at road and trail crossings. Post signs at 200 foot intervals or as dictated by terrain, at construction work area perimeters, facing outward
Road closures		Road (No.) Closed (detour info if applicable) Date	Post signs at crossroads and other locations as directed by FS.
Trail Closures		Trail (No.) Closed (detour info if applicable) Date	Post signs at trailheads, trail intersections, and crossroads and other locations as directed by FS.

TABLE 2-1

Flagging Standards for Selected Construction Features and Sensitive Resource Areas

Feature or Purpose	Flagging or Sign Colors	Sign Text	What to Do

NOTES:

- Staking and flagging will be done by construction contractor(s) and verified by Environmental Inspector, including sensitive resource areas and exclusion zones.
- Construction contractor(s) shall use staking intervals appropriate to the conditions observed in the field. For example, areas of rough terrain or dense vegetation may require staking intervals less than 500 feet. In all cases, field staking intervals shall be done at a frequency such that each adjacent stake can be easily discernible.
- Maintain (refurbish as necessary) staking over time as conditions require.

3.0 COMPILATION OF FLAGGING, FENCING AND SIGNING REQUIREMENTS

3.1 PROJECT FACILITY DEMARCATION

As part of the pre-construction civil survey effort, the limits of the authorized work limits will be staked at intervals appropriate to field conditions. This includes the limits of the construction right-f-way, additional temporary work areas, and other construction staging areas. Wooden lath stakes will be flagged with a unique color to distinguish it from other survey stakes within the work area and the stake's purpose will be written on it. Intervals will be shortened at locations where the nominal work limits change, such as at additional temporary workspace locations.

Authorized access roads will be demarcated with signs. "No Entry" signs will be posted as necessary to clearly signify roads that have not been authorized for Project use, with particular attention to locations where unauthorized roads intersect authorized access routes.

Weed wash stations will be demarcated with signs, and their perimeters will be staked and flagged.

3.2 RESOURCE AREA DEMARCATION

Some resources within the work limits are associated with special conditions, and so require signage for the benefit of construction personnel. These include wetlands, stream and wetland buffer areas, and karst features, each of which requires compliance with various special conditions. Areas where topsoil stripping is required will be staked in the field.

3.3 RESOURCE PROTECTION EXCLUSION FENCING

Avoidance of certain biological and cultural resources is accomplished in some areas by fencing off areas that would otherwise nominally be part of the construction work area. This will be accomplished by orange exclusion fencing, rope, or wire fencing. Associated signage will clearly prohibit entry by construction personnel or equipment, although the specific purpose for the exclusion will not be identified.

3.4 TIMBER MARKING

Timber marking for removal of commercial timber is done during the timber cruise, with paint provided by the FS. In areas where the right-of-way edge is to be “feathered,” additional flagging of timber will be done prior to felling to demarcate trees inside the nominal construction workspace that are not to be cut.

3.5 SIGNAGE/FENCING FOR THE PUBLIC

Section 18 of the COM Plan identifies the following areas where signage or other is required for purposes of informing the public of construction-related activity:

- Prior to ACP construction activity in any particular part of either Forest, ACP will post temporary signs on Forest roads used as construction access roads alerting road users to the presence of logging and construction vehicles on the roads.

- On roads and trails that cross the pipeline right-of-way, ACP will post temporary signs informing road and trail users of any closures, detours, or other restrictions associated with crossing the construction zone.

- On Forest trails that cross the pipeline right-of-way, ACP will post temporary signs at trailheads informing trail users of any closures, detours, or other restrictions associated with crossing the construction zone.

- On Forest trails that cross the pipeline right-of-way that remain open during construction, ACP will erect exclusion fencing on either side of such trails where they cross the construction zone, with appropriate signage warning hikers to stay on the trail.

- At portions of the construction right-of-way between road and trail crossings, ACP will post signs at or near the edge of the work area, at approximate 200 feet spacings or as dictated by terrain and visibility, warning the public that the construction right of way is closed to public entry.

- In areas of active blasting, signage and flaggers will be posted in accordance with the Blasting Plan. This includes providing 48-hour notice to surrounding residents and businesses, posting of warning signs at approaches to the blast area, with minimum 4-inch lettering on a contrasting background, and stationing of flaggers at roads and trails at least 1,000 feet from the entrance to any areas of active blasting.

3.6 POST-CONSTRUCTION SIGNAGE

Once construction is complete, signs will be posted as needed prohibiting entrance to areas newly seeded or planted. In accordance with Section 19 of the COM Plan (OHV Blocking Plan), signs may be posted at access points to the right-of-way warning the public that OHV use on the pipeline right-of-way is prohibited, if deemed a potentially effective measure by FS staff.

Pipeline markers will be installed after construction in compliance with federal standards, as described in Section 2.1.4.10 of the COM Plan.