TROMPE:
From the Past Will Come the Future

Summary Final Report

Cooperative Agreement S11AC2033
Applied Science Program
Office of Surface Mining, Reclamation & Enforcement

Submitted to:
U.S. Department of the Interior
Office of Surface Mining, Appalachian Region
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September 2015

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Dedication

This report is dedicated to the memory of Bruce R. Leavitt who is the man who not only had the idea of using trompes for the treatment of mine drainage, but also had the creativity, knowledge and passion to make his dreams a reality. We are thankful for the opportunity to have worked with such an amazing human being and look forward to seeing his legacy bear fruit by continuing to make a positive impact on the world.

INTRODUCTION

In order to enhance treatment of mine drainage, especially with passive systems that use no electricity, chemicals or moving parts, a method where air can be compressed using a simple, static device that can readily be assembled from widely-available components such as plastic pipe, has been developed through the resurrection of an ancient technology known as a trompe. The compressed air can be used to aerate mine water to increase dissolved oxygen and decrease dissolved carbon dioxide in order to improve the oxidation and precipitation of iron. In addition, compressed air generated by trompes can be used to power air-lift mixers in treatment systems where chemicals are used. Other sources of off-grid aeration are available including wind and solar; however, water power has the benefit of being available day or night in either windy or still conditions and when the water power is derived from the mine discharge itself then the available energy for aeration is proportional to the amount of water to be aerated.

A trompe uses falling water to compress air and has no moving parts. Originally discovered in 17th century Italy, it became the defining component of the Catalan Forge. In the early 20th century, prior to the wide-spread distribution of electricity, large trompes were built to provide compressed air for raising bridges and to power pneumatic rock drills in hard rock mines worldwide.

In order to develop and demonstrate the technology, a test trompe was constructed and evaluated with subsequent installation of a fully functional trompe at the North Fork Montour Run Passive Treatment System site located in Findlay Township, Allegheny County, Pennsylvania, USA (NFPTS).

Please see the Glossary for a definition of terms used in this report.

TROMPE TESTING – RESULTS & DISCUSSION

Trompes of two-, three-, and four-inch diameters were built and tested to determine the operating configuration that yielded the most efficient air compression measured as cubic feet per minute of “free air” (CFM) per gallon per minute (gpm) of water. The overall “trompe efficiency” is summarized as CFM per 100 gpm (CFM/100gpm).

The nominal pipe size of the downpipe is used to describe the size of the trompe: 2” downpipe = 2” trompe; 3” downpipe = 3” trompe; 4” downpipe = 4” trompe; etc. The available flow will determine which size trompe is needed. Note that at NFPTS, a triple-downpipe configuration was successfully developed and deployed with a total of three separate trompes installed in series. By using multiple downpipes with separate headpieces, a larger range of flow rates may be utilized in a single trompe installation. Through the serial installation of multiple trompes, additional compressed air can be generated by the reuse of the water.

Test Trompe Evaluation Variables:

- Flow rate
- Trompe size (2”, 3”, 4”)
- Air inducer position (relative to the top of the downpipe)
- Air inducer configuration (single air tube, multiple air tube, etc.)
- Driving head

Test Trompe Measurements:

- Volume of air compressed (measured as “free air” at the trompe inlet)
- Maximum pressure (measured by closing the air line – controlled by height of uppipe)
- Air in the outlet (if bubbles were not being effectively captured by the trompe)

Variables were adjusted in order to optimize the air trompe efficiency, generally speaking, it was found that about 1 CFM can be compressed by 25 gpm of water (e.g., 4 CFM/100gpm).

The driving head was adjusted by lowering the outlet (top of the uppipe) to increase the driving head raising the outlet to decrease driving head. It was found that the optimal driving head was about 4.0’ based on the range of driving head conditions evaluated; however, successful air compression was achieved with as little as 2.9’ driving head.

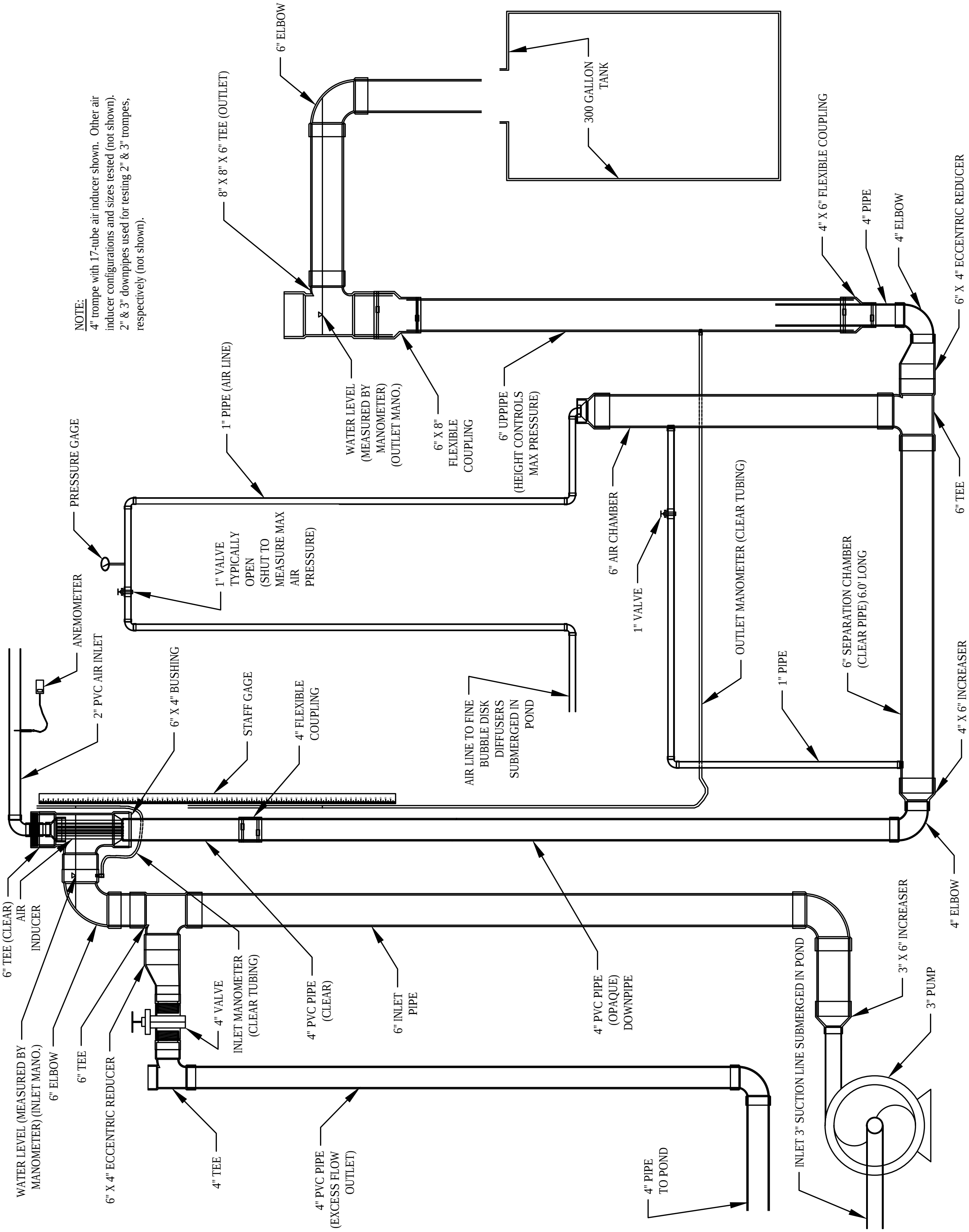
The maximum pressure that can be generated by a trompe is controlled by the height of the uppipe. The taller the uppipe, the higher the pressure that is generated. As an illustration, if the practitioner desires to place a diffuser at the bottom of a 10’-deep pond for aeration purposes, the uppipe will need to be at least 10’ tall. Typically the height of the uppipe will be constructed 1-2’ higher than the height of the water column under which a diffuser head is to be placed. This additional uppipe height provides a safety factor and accounts for potential backpressure from the diffuser heads and friction loss in the air line between the trompe and the point of use.

During initial testing it was observed that there was a significant “standing air bubble” in the separation chamber and the single air chamber installed near the outlet end of the separation chamber did not appear to effectively capture the air. A 1” diameter pipe was installed near the inlet end of the separation chamber and plumbed to the 6” diameter vertical air chamber. It was found that the majority of the air was captured by the 1” pipe with the remainder being collected by the 6” vertical air chamber. This observation resulted in the recommended trompe design including two air chambers.

The North Fork Montour Run Passive Treatment System was selected as the field demonstration site due to the ease of accessibility, and the proximity to both a major metropolitan area (Pittsburgh) and the OSM Appalacian Regional Office. NFPTS has been included in numerous OSM-sponspored activities including several passive treatment classess as well as the highly-sucessful technology transfer event in 2013. Participants at these OSM-sponsored events include private industry as well as state and federal personnel from throughout the county. Numerous other tours have been given by watershed groups and private organizations with attendees from Korea, Wales, Canada, and New Zeland as well as the Secretary of the PADEP among others.

Data generated using the test trompe installed at Bruce Leavitt’s farm is presented in the Appendix A through Appendix G and is summarized in the table below. Air measurement data collected at NFPTS are presented in Appendix H. Water monitoring data collected at NFPTS are provided in Appendix I. Parts lists for the 2”, 3” and 4” trompes are provided in Appendix J. Detailed drawings of all three trompe sizes tested are provided in Appendix K.

Test Trompe Diagram



Test Trompe Results Summary Table

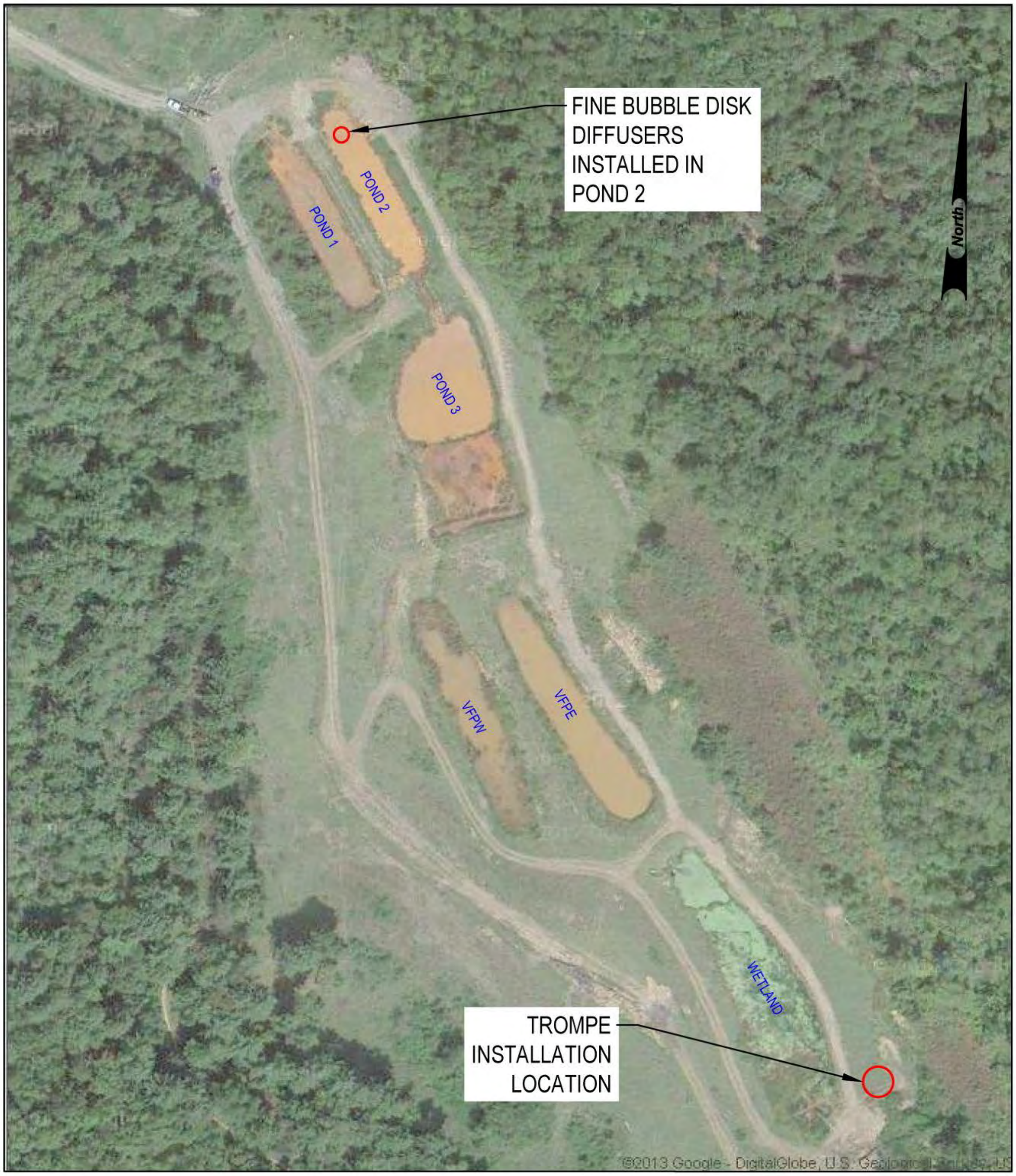
Trompe Size (in.)	Inducer Tube Configuration (Tube Material)	Tube Cover-age %	Inducer Position (in.)	Driving Head (avg.) (in.)	Water Flow Range (gpm)		Efficiency (CFM/100gpm)	
					Min	Max	Min	Max
4	Single 2” (SCH40-PVC)	35	+1.000	38	100	181	2.11	2.37
4	Single 2” (SCH40-PVC)	35	0.000	39	97	174	2.25	2.51
4	Single 2” (SCH40PVC)	35	-0.500	38	103	185	1.92	2.82
4	Nine 3/8” Hex (PVC)	NA	-1.250	38	99	208	1.89	2.16
4	Nine 3/8” Hex (PVC)	NA	-0.500	38	91	205	2.21	2.88
4	Nine 3/8” Hex (PVC)	NA	0.000	38	90	203	2.23	2.62
4	Seventeen 1/2" (CTS-CPVC)	42	-0.375	39	92	141	2.37	3.24
4	Seventeen 1/2" (CTS-CPVC)	42	-0.125	50	92	140	3.33	4.31
4	Seventeen 1/2" (CTS-CPVC)	42	-0.125	43	94	143	3.01	4.08
4	Seventeen 1/2" (CTS-CPVC)	42	-0.125	38	94	142	3.04	3.85
4	Single 2.5” (SCH40-PVC)	52	-0.125	50	94	128	3.79	4.16
4	Single 2.5” (SCH40-PVC)	52	-0.125	44	84	126	2.94	4.19
4	Single 2.5” (SCH40-PVC)	52	-0.125	40	84	127	3.02	3.95
4	Single 2.5” (SCH40-PVC)	52	-0.125	35	85	123	2.82	3.24
4	Eight 3/4" (CTS-CPVC) + One 1.25” (SCH40-PVC)	56	-0.125	50	88	109	3.30	4.19
4	Eight 3/4" (CTS-CPVC) + One 1.25” (SCH40-PVC)	56	-0.125	44	88	117	3.20	3.91
3	Eight 1/2" (CTS-CPVC)	34	0.000	50	49	91	3.89	4.58
3	Eight 1/2" (CTS-CPVC)	34	0.000	43	48	80	3.08	3.68
3	Eight 1/2" (CTS-CPVC)	34	0.000	38	49	80	2.99	3.45
2	Eight 3/8" (1/2”O.D.-PEX)	48	0.000	51	17	24	5.30	6.32

- “Tube Coverage” is the total area (calculated using outside diameter) of all air tube or tubes divided by the inside area of the downpipe.
- During testing it was found that when the theoretical residence time in the separation chamber (based on a 6.0-inch inside diameter and chamber length of 6.0 feet and the water flow volume) was less than about 3.5 seconds, air bubbles were observed in the outlet.
- Please see glossary and appendix for additional information, explanation of terms, etc.

Select Typical Pipe Dimensions Table

Nominal Size (in.)	Type	Outside Diameter (in.)	Inside Diameter (in.)
3/8	PEX	0.500	0.375
1/2	CTS-CPVC	0.625	0.469
3/4	CTS-CPVC	0.875	0.695
1.25	SCH40-PVC	1.660	1.360
2.00	SCH40-PVC	2.375	2.047
2.50	SCH40-PVC	2.875	2.445
3	SCH40-PVC	3.500	3.042
4	SCH40-PVC	4.500	3.998

Overview Image – North Fork Montour Run Demonstration Site



Additional information regarding North Fork Montour Run site is available through Datashed: http://www2.datashed.org/north-fork-montour-run

RELATED PUBLICATIONS AND INFORMATION

A number papers have been prepared and presentations given regarding the use of trompes in the treatment of mine drainage. Below is a select list of links to publications as well as other published information:

Remembering Bruce Leavitt
http://www.osmre.gov/resources/newsroom/Stories/2013/trompe.shtm

Aeration of Mine Water Using a Trompe
http://www.wvmdtaskforce.com/proceedings/2011.cfm (Downloadable paper and presentation)

Bruce Leavitt Presentation on Trompe Technology
https://www.youtube.com/watch?v=TuaxjR3TQkQ

Trompe a 'Super Charger' for AMD Cleanup
http://www.alleghenyfront.org/story/trompe-super-charger-amd-cleanup

Passive Mixing to Improve Calcium Oxide Dissolution
http://wvmdtaskforce.com/proceedings/12/13-Leavitt-2012-Passive-Mixing.pdf

Rediscovered Technology Makes Mine Drainage Treatment More Effective, Less Costly
http://www.paenvironmentdigest.com/newsletter/default.asp?NewsletterArticleID=26855

Trompe Technology for Mine Drainage Treatment
http://issuu.com/delcomminc/docs/asmr_fall_2013_web/31

A 16th-Century Method may Revolutionize Mine Drainage Treatment
http://www.post-gazette.com/news/state/2013/06/24/A-16th-century-method-may-revolutionize-mine-drainage-treatment/stories/201306240124

Passive Aeration Using a Trompe
http://www.asmr.us/Meetings/2013/Abstracts%20and%20papers/0172-Leavitt-PA.pdf

en. PermaCultureScience.org
http://en.permaculturescience.org/english-pages/4-energy-ecotechnology/9-10-ecoscience/cooling-science/trompe

US Patent No. 892772 (07/07/1908) – Hydraulic Air Compressor
http://pdfpiw.uspto.gov/.piw?docid=00892772&SectionNum=1&IDKey=054C49DE5FD3&HomeUrl=http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO1%2526Sect2=HITOFF%2526d=PALL%2526p=1%2526u=%25252Fnetahtml%25252FPTO%25252Fsrchnum.htm%2526r=1%2526f=G%2526l=50%2526s1=0892772.PN.%2526OS=PN/0892772%2526RS=PN/0892772






An experimental demonstration trompe was built, tested, & optimized to generate compressed air for use in passive treatment (top left). The test trompe used clear PVC components to show the interaction of the air and water during testing (middle right). Testing was performed at Bruce Leavitt's Candle Tree Farm, Washington, PA. Multiple designs and congifurations were tested to assess for maximum airflow & efficiency. Data collected from this preliminary testing was used to develop the demonstration trompe system installed at the North Fork Montour Run passive treatment site.

Test trompe (top) function overview: Water pumped from pond to headpiece (middle center) through 6” excess flow tee; 4”, brass, gate valve (middle right) controls excess flow outlet to pond; Water falling from headpiece through air inducer to downpipe creates low pressure that draws air into water via air inducer tubes (middle left and center); Water and air travel through downpipe and enter 6” clear separation chamber (bottom right); Bubbles rise and enter 6” vertical air chamber via 1” pipe near inlet and 6” tee near outlet of separation chamber (bottom); Compressed air travels via 1” pipe to bubble disk diffusers submerged in pond; Water exits trompe via the uppipe and outlet (bottom left); Discharge of outlet directed to 300 gallon tank to measure flow (bottom left); Uppipe can be adjusted to raise outlet (bottom left).

In order to demonstrate and disseminate the trompe technology by Bruce Leavitt at his farm (upper right), in addition to presentations given by the project team at local, regional, and national events and confereneces, a full-scale trompe was installed at the North Fork Passive Treatment System (NFPTS) (See http://www2.datashed.org/north-fork-montour-run.) (middle left). OSM personnel visited the NFPTS during installation of the system by BioMost, Inc. The NFPTS treats abandoned mine drainage (AMD) issuing from an underground mine on the Pittsburgh coalbed (bottom left & right).

The trompe at the NFPTS site was installed at the effluent of system to provide a water source with low metals in order to reduce potential maintenance issues (middle). The trompe is constructed of PVC pipe and other readily-available components. OSM interns gain a "hands-on" appreciation of the work required to install a trompe (bottom left). An intake pool was dug and a trompe inlet pipe was installed into the NFPTS wetland (middle left). A hole approximately 14 ft deep was dug for placement of the trompe (bottom right). Three 2.5" PVC downpipes were installed to accommodate a design flow rate of abouth 50 – 150 gpm (e.g., ~50 gpm each) are connected to a single, 6" separation chamber with two 6" air chambers. Compressed air from the trompe is directed back to Pond 2 located near the beginning of the system.

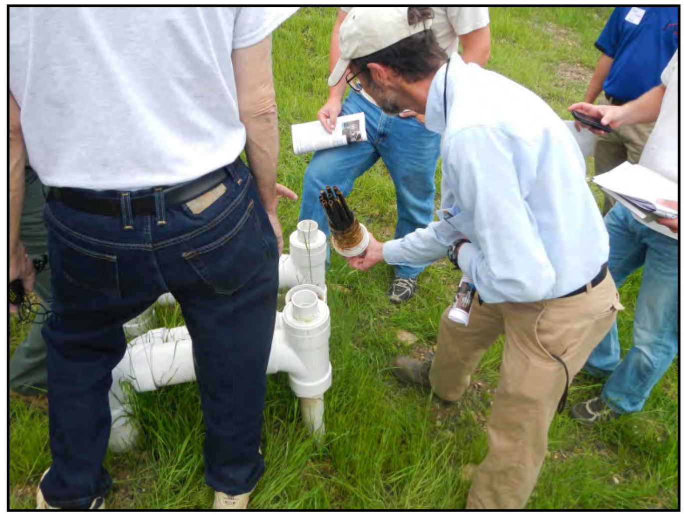
A trench was dug for the airline using a skid loader attachment (top left). Air line installation included two condensate traps at low points in the line to relieve trapped water (top right). Trompe 1 installation included assembling trompe on surface and lowing into excavation (middle). After initial tests, it was decided that more aeration could be accomplished at NFPTS. Trompes 2 and 3 were installed by using shoring and assembling the trompes in the excavation (bottom). It was found that backfilling with aggregate to avoid compaction and settling issues was beneficial.






Trompe 1 was installed first (top) with Trompes 2 and 3 added later. Trompes 1, 2, and 3 are installed in series in order to generate compressed air, each trompe requires about 4 ft of drop from inlet to outlet (middle). Bruce Leavitt and BioMost, Inc. personnel installing Trompes 2 and 3 (middle). Dye testing (bottom left) illustrates improved dispersal of AMD in an aerated pond (bottom left). Inpection of Trompe 1 air inducers (bottom right).



Trompe installation dedication celebration June 18, 2013 with over 80 attendees. Live demonstration of dye test (top left). Aeration test demonstration (top right). Condensate trap demonstration (middle left). Air inducer inspection (middle right). Trompe component explanation by Bruce Leavitt (bottom).

GLOSSARY

(Defined terms are capitalized.)

Air Chamber – Pipe connected to the Separation Chamber with a tee and extending vertically to which the Air Line is connected.

Air Flow – [cubic feet per minute (CFM)] – The calculated volumetric flow rate of "free air" entering the trompe. Calculated by multiplying the Air Velocity Average (AV Avg.) by the inside cross sectional area of a 2 inch Schedule 40 PVC pipe.

Air Inducer – The apparatus that is used to entrain air into the water consisting of Air Tubes suspended by an assembly attached to the top of the Headpiece.

Air Inducer Position – [inches (")] – The position of the bottom of the Air Tubes relative to the top of the Downpipe.

Air in Outlet – Yes (Y), No (N), or Questionable (?) – Indicates the presence of air bubbles in the Outlet.

Air Line – Pipe extending from Air Chamber to point of use.

Air Tube – Pipe or tubing portion of the Air Inducer assembly used to convey water from the atmosphere to the water.

Air Pressure – [inch water column (wc)] – With the trompe in a set configuration, and the Air Line open to the Diffuser Head, the maximum pressure measured in the Air Line during operation. (This pressure is controlled by the combined depth of water above the Diffuser Heads and any friction losses or back pressure in the Air Line and Diffuser Heads.)

Air Velocity – [feet per minute (fpm)] – Measured rate of "free air" entering the Headpiece. (Typically, one measurement was taken every five seconds for a total of ten measurements.)

AV Avg. – (Air Velocity Average) – [feet per minute (fpm)] – The calculated average of the Air Velocity measurements.

CFM/100gpm – Measure of trompe efficiency expressed as cubic feet per minute (CFM) of "free air" compressed per 100 gallons per minute (gpm) of water flowing through the trompe.

Diffuser Head –Diffusers submerged in a column of water (In the case of trompe testing, fine bubble disk-type diffusers were submerged in a farm pond at a depth of about 3-4 feet.)

Driving Head – [inches (in)] – The difference in water elevation calculated from the inlet manometer to the outlet manometer.

Downpipe – Vertical pipe extending from Headpiece to Separation Chamber. The diameter of Downpipe is used to define the "size" of the trompe (i.e. 3" trompe, 4" trompe etc.).

Headpiece – The inlet apparatus that houses the Air Inducer thatis connected to the Inlet and Downpipe. (Nominal size of Headpiece is defined by the diameter of the Downpipe and actual diameter of pipe fitting will be greater than the nominal size.)

I.D. – Inside diameter of a pipe which varies based nominal pipe size, material, and type.

Inlet – The pipe or other device that supplies water to the Headpiece.

Inlet Mano. (Inlet Manometer) – Elevation (staff gage with arbitrary datum) of water in the Inlet to the Headpiece measured in inches. The manometer was placed on the bottom of the inlet pipe prior to entering the headpiece. (The same staff gage with arbitrary datum is used for Inlet Mano., Outlet Mano., and Inlet Visual elevation measurements.)

Inlet Visual – Elevation (staff gage with arbitrary datum) of water visible in the Inlet immediately before entering the Headpiece measured in inches. Not used in calculations, but included to describe water flow condition within the Headpiece. (The same staff gage with arbitrary datum is used for Inlet Mano., Outlet Mano., and Inlet Visual elevation measurements.)

Max Air Pressure – [inch water column (wc)] – With the trompe in a set configuration, and the air discharge turned off, the maximum pressure generated in the air line. (Note: The maximum pressure is controlled by the elevation difference between the separation chamber and the Outlet.)

O.D. – Outside diameter of a pipe of a given nominal size.

Outlet – Conveyance (usually a pipe, but could be a fitting such as a tee or elbow) extending from the Uppipe to a receiving body of water (channel, pond, stream, etc.).

Outlet Mano. – [Outlet Manometer] – Elevation (staff gage with arbitrary datum) of waterin the Outlet measured in inches. (The same staff gage with arbitrary datum is used for Inlet Mano., Outlet Mano., and Inlet Visual elevation measurements.)

Separation Chamber – Horizontal pipe at bottom of trompe to which the Downpipe, Air Chamber(s), and Uppipe are connected.

Tank Time – [seconds (s)] – The amount of time for the discharge of the trompe to fill a 300-gallon tank, used to calculate the Water Flow.

Uppipe – Pipe (typically vertical, but not necessarily) extending from Separation Chamber to the Outet.

Water Flow – [gallons per minute (gpm)] – The calculated flow of water passing through the trompe.

Appendix A – Air Inducer Configuration: 2" SCH40-PVC Air Tube with 4" Downpipe

A.1 – AIR INDUCER POSITION +1.00" - MAX AIR PRESSURE 72 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	46.250	37.750	N	56.0	114	84	102	100	92	102	-	-	-	-	99	2.26	2.99	100	2.26
8.000	8.750	45.688	37.688	N	57.0	112	122	132	126	132	126	-	-	-	-	125	2.86	2.40	125	2.29
7.500	8.000	45.000	37.500	N	57.0	156	166	166	158	146	156	-	-	-	-	158	3.61	1.97	152	2.37
7.000	7.000	44.875	37.875	?	57.0	162	154	160	146	148	148	-	-	-	-	153	3.50	1.84	163	2.14
6.500	6.250	44.750	38.250	Y	57.0	168	152	150	154	168	150	-	-	-	-	157	3.59	1.78	169	2.12
6.000	5.125	44.750	38.750	Y	57.0	186	156	168	154	152	162	-	-	-	-	163	3.73	1.70	177	2.11
5.500	4.375	44.750	39.250	Y	57.0	168	160	172	162	168	172	-	-	-	-	167	3.82	1.66	181	2.11

Note: During initial testing fewer Air Velocity measurements were taken.

A.2 – AIR INDUCER POSITION 0.00" - MAX AIR PRESSURE 73 wc - AVERAGE DRIVING HEAD 39"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	46.750	38.250	N	54.0	116	110	96	84	102	92	112	86	102	122	102	2.34	3.09	97	2.41
8.000	8.500	46.250	38.250	N	55.0	134	120	118	130	136	134	140	140	144	138	133	3.05	2.46	122	2.50
7.500	8.000	45.875	38.375	N	55.0	152	152	144	144	150	146	146	140	138	146	146	3.33	2.04	147	2.27
7.000	7.000	45.875	38.875	?	55.0	160	188	182	158	164	148	158	184	180	180	170	3.89	1.93	155	2.51
6.500	6.125	45.750	39.250	Y	55.0	176	180	162	156	150	158	166	160	148	144	160	3.66	1.87	161	2.27
6.000	5.125	45.000	39.000	Y	55.0	180	172	158	168	172	160	168	170	162	170	168	3.84	1.76	171	2.25
5.500	4.375	45.000	39.500	Y	55.0	186	174	186	162	174	180	176	170	180	172	175	4.00	1.72	174	2.29

A.3 – AIR INDUCER POSITION -0.50" - MAX AIR PRESSURE 73 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm) 1	2	3	4	5	6	7	8	9	10	AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
8.500	8.875	46.625	38.125	N	55.0	118	112	112	110	114	118	114	112	122	106	114	2.60	2.92	103	2.53
8.000	8.625	46.375	38.375	N	55.0	132	146	136	146	154	150	162	138	144	144	145	3.32	2.55	118	2.82
7.500	7.875	45.875	38.375	N	55.0	130	136	132	142	142	134	154	158	152	146	143	3.26	1.98	151	2.15
7.000	6.750	45.500	38.500	?	55.0	146	142	152	154	144	168	160	162	164	158	155	3.54	1.81	166	2.14
6.500	5.750	44.625	38.125	Y	55.0	172	180	176	174	172	170	168	170	158	164	170	3.89	1.74	172	2.26
6.000	4.750	44.625	38.625	Y	55.0	174	162	186	178	172	172	170	176	182	174	175	3.99	1.66	181	2.20
5.500	4.325	44.250	38.750	Y	55.0	150	170	166	`58	138	164	146	152	160	154	156	3.56	1.62	185	1.92

Appendix B – Air Inducer Configuration: 9 – 3/8 PVC Hex Air Tubes with 4" Downpipe

B.1 – AIR INDUCER POSITION -1.25" - MAX AIR PRESSURE 74 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	8.750	46.875	38.375	N	54.0	104	86	110	106	88	82	90	76	100	80	92	2.11	3.03	99	2.12
8.000	8.250	46.375	38.375	N	55.0	134	116	122	128	136	136	112	124	122	124	125	2.87	2.27	132	2.16
7.500	7.375	44.625	37.125	Y	55.0	152	156	166	156	144	134	150	150	146	142	150	3.42	1.68	178	1.92
7.000	5.500	44.750	37.750	Y	55.0	174	172	166	170	180	174	178	160	170	178	172	3.94	1.44	208	1.89

B.2 – AIR INDUCER POSITION -0.50" - MAX AIR PRESSURE 74 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	8.875	47.000	38.500	N	54.0	104	102	106	112	106	104	118	108	106	104	107	2.45	3.29	91	2.68
8.000	8.500	46.500	38.500	N	55.0	152	140	152	142	150	156	142	148	156	160	150	3.42	2.53	119	2.88
7.500	7.625	45.250	37.750	Y	56.0	168	166	174	182	178	168	176	166	170	170	172	3.93	1.84	163	2.40
7.000	5.500	44.500	37.500	Y	56.0	216	220	198	202	206	182	180	190	196	196	199	4.54	1.46	205	2.21

B.3 – AIR INDUCER POSITION 0.00" - MAX AIR PRESSURE 74 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	8.750	47.000	38.500	N	54.0	106	104	122	98	108	76	96	104	100	94	101	2.30	3.32	90	2.55
8.000	8.375	46.375	38.375	N	55.0	148	136	152	134	138	134	134	146	154	158	143	3.28	2.40	125	2.62
7.500	7.500	45.375	37.875	Y	56.0	174	164	174	184	192	164	186	162	176	174	175	4.00	1.76	171	2.34
7.000	5.875	44.500	37.500	Y	57.0	206	210	204	194	202	202	198	192	178	196	198	4.53	1.48	203	2.23

Appendix C – Air Inducer Configuration: 17 – ½" CTS-CPVC Air Tubes with 4" downpipe

C.1 – AIR INDUCER POSITION -0.375" - MAX AIR PRESSURE 74 wc - AVERAGE DRIVING HEAD 39"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	8.688	46.875	38.375	N	54.0	124	74	98	88	90	96	98	84	112	92	96	2.18	3.26	92	2.37
8.000	8.313	46.625	38.625	N	55.0	142	156	146	164	160	176	158	144	152	162	156	3.57	2.65	113	3.15
7.500	7.438	46.438	38.938	N	55.0	186	168	172	170	174	158	168	178	174	166	171	3.92	2.47	122	3.22
7.000	6.625	46.375	39.375	N	56.0	180	186	182	176	174	188	174	184	176	178	180	4.11	2.37	127	3.24
6.500	5.750	46.250	39.750	N	56.0	180	180	178	180	176	176	182	176	176	182	179	4.08	2.29	131	3.11
6.000	5.125	46.125	40.125	?	56.0	210	192	206	194	186	194	188	194	190	172	193	4.40	2.21	136	3.24
5.500	5.000	46.063	40.563	Y	57.0	196	194	196	188	204	192	190	196	192	196	194	4.44	2.13	141	3.15

C.2 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 67 wc - AVERAGE DRIVING HEAD 50"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	57.500	49.000	N	55.0	146	128	130	164	120	156	137	112	116	128	134	3.06	3.27	92	3.33
8.000	8.500	57.375	49.375	N	56.0	200	206	194	190	208	192	196	190	178	218	197	4.51	2.63	114	3.96
7.500	7.750	57.250	49.750	N	57.0	228	242	252	248	216	210	246	216	240	210	231	5.27	2.45	122	4.31
7.000	6.750	57.000	50.000	N	57.0	240	230	244	238	228	234	224	226	232	216	231	5.28	2.34	128	4.13
6.500	6.000	56.875	50.375	N	57.5	252	258	262	242	252	266	242	250	224	228	248	5.66	2.28	131	4.30
6.000	5.250	56.750	50.750	N	57.5	254	262	256	252	240	246	248	244	234	246	248	5.67	2.22	135	4.19
5.500	5.000	56.750	51.250	N	58.0	252	244	250	268	262	246	242	246	244	244	250	5.71	2.14	140	4.07

C.3 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 71 wc - AVERAGE DRIVING HEAD 43"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (ACFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	8.875	50.625	42.125	N	59.0	110	132	120	122	112	116	140	122	122	138	123	2.82	3.20	94	3.01
8.000	8.500	50.500	42.500	N	60.0	198	190	198	182	198	196	184	180	184	186	190	4.33	2.59	116	3.74
7.500	7.500	50.375	42.875	N	61.0	230	234	228	212	218	216	212	222	218	214	220	5.04	2.43	123	4.08
7.000	6.625	50.250	43.250	N	61.0	236	222	222	218	220	220	224	230	244	222	226	5.16	2.30	130	3.96
6.500	5.875	50.250	43.750	N	61.0	240	254	234	254	236	230	220	238	234	228	237	5.41	2.24	134	4.03
6.000	5.000	50.125	44.125	N	61.5	254	226	262	248	230	242	248	228	240	230	241	5.50	2.15	139	3.95
5.500	4.750	50.125	44.625	N	61.5	242	242	226	252	246	234	236	238	234	240	239	5.46	2.10	143	3.82

C.4 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 78 wc - AVERAGE DRIVING HEAD 38"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	44.875	36.375	N	59.5	144	130	128	138	120	110	128	132	92	122	124	2.84	3.21	94	3.04
8.000	8.500	44.625	36.625	N	60.0	190	190	192	186	188	196	202	206	202	196	195	4.45	2.60	115	3.85
7.500	7.500	44.625	37.125	N	60.0	202	200	202	198	178	170	192	196	210	200	195	4.45	2.40	125	3.56
7.000	6.500	44.625	37.625	N	60.5	230	220	212	212	212	216	200	204	206	196	211	4.82	2.31	130	3.71
6.500	6.000	44.500	38.000	N	60.5	222	230	220	194	200	204	200	192	200	208	207	4.73	2.24	134	3.54
6.000	5.375	44.500	38.500	N	60.5	194	190	204	186	186	192	196	202	206	192	195	4.45	2.16	139	3.20
5.500	4.750	44.500	39.000	N	60.5	236	228	216	216	206	216	222	216	230	204	219	5.01	2.11	142	3.52

Appendix D – Air Inducer Configuration: 2.5" SCH40-PVC Air Tube with 4" Downpipe

D.1 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 67 wc - AVERAGE DRIVING HEAD 50"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	57.750	49.250	N	54.0	144	170	164	142	170	158	148	144	150	174	156	3.57	3.18	94	3.79
8.000	8.250	57.500	49.500	N	54.5	198	186	192	198	166	202	206	176	194	194	191	4.37	2.81	107	4.10
7.500	7.500	57.375	49.875	N	54.5	210	206	212	198	210	204	202	198	190	202	203	4.64	2.69	112	4.16
7.000	7.000	57.250	50.250	N	54.5	208	202	196	202	192	186	188	192	196	192	195	4.47	2.60	115	3.87
6.500	6.250	57.125	50.625	N	55.0	218	214	228	218	220	220	216	212	192	218	216	4.93	2.51	120	4.11
6.000	5.750	57.125	51.125	N	55.0	230	230	214	210	220	228	224	224	220	218	222	5.07	2.41	125	4.07
5.500	5.250	57.000	51.500	N	55.0	226	228	224	220	222	222	224	224	216	220	223	5.09	2.34	128	3.97

D.2 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 70 wc - AVERAGE DRIVING HEAD 44"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	51.063	42.563	N	50.0	106	106	102	100	112	112	110	106	110	118	108	2.47	3.57	84	2.94
8.000	8.375	50.750	42.750	N	51.0	166	170	158	164	144	168	200	158	160	186	167	3.83	2.97	101	3.78
7.500	7.625	50.625	43.125	N	51.0	186	178	188	196	206	184	180	176	184	168	185	4.22	2.78	108	3.92
7.000	7.000	50.625	43.625	N	52.0	200	206	198	194	182	204	200	220	220	224	205	4.68	2.65	113	4.13
6.500	6.375	50.563	44.063	N	52.0	224	226	178	216	212	224	200	216	220	200	212	4.84	2.60	115	4.19
6.000	5.750	50.500	44.500	N	52.0	238	232	218	234	240	208	200	226	180	196	217	4.96	2.47	122	4.08
5.500	5.000	50.500	45.000	N	52.0	230	220	196	212	216	240	182	222	208	206	213	4.87	2.38	126	3.86

D.3 – AIR INDUCER POSITION -0.125” - MAX AIR PRESSURE 74 wc - AVERAGE DRIVING HEAD 40”

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	47.125	38.625	N	50.0	144	108	108	130	122	120	104	110	116	120	118	2.70	3.57	84	3.21
8.000	8.250	46.563	38.563	N	51.0	164	154	164	156	160	178	162	156	172	162	163	3.72	2.89	104	3.58
7.500	7.500	46.875	39.375	N	52.0	194	210	192	208	186	160	176	164	190	180	186	4.25	2.78	108	3.95
7.000	6.875	46.875	39.875	N	52.0	184	180	180	186	178	178	180	188	190	190	183	4.19	2.69	112	3.76
6.500	6.250	46.875	40.375	N	52.0	168	174	174	184	174	168	176	178	182	174	175	4.00	2.58	116	3.45
6.000	5.625	46.875	40.875	N	52.0	192	194	184	178	188	174	184	182	174	192	184	4.21	2.46	122	3.45
5.500	5.000	46.875	41.375	N	52.0	176	166	172	164	168	174	166	164	164	164	168	3.83	2.36	127	3.02

D.4 – AIR INDUCER POSITION -0.125 - MAX AIR PRESSURE 78 wc - AVERAGE DRIVING HEAD 35”

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	41.563	33.063	N	51.0	108	112	108	104	106	102	108	92	110	106	106	2.41	3.51	85	2.82
8.000	8.375	41.813	33.813	N	51.0	148	150	140	142	140	138	138	142	138	132	141	3.22	2.87	105	3.08
7.500	7.500	41.750	34.250	N	51.0	144	156	148	146	146	148	156	148	144	140	148	3.37	2.68	112	3.02
7.000	7.000	41.750	34.750	N	51.0	162	160	154	170	162	160	162	156	158	158	160	3.66	2.65	113	3.24
6.500	6.125	41.875	35.375	N	51.0	146	154	138	152	144	142	144	146	144	136	145	3.30	2.57	117	2.83
6.000	5.500	42.125	36.125	N	51.0	166	162	152	156	156	158	152	152	142	164	156	3.57	2.50	120	2.97
5.500	5.000	42.500	37.000	N	51.0	154	158	148	150	144	150	158	158	148	146	151	3.46	2.45	123	2.82

Appendix E – Air Inducer Configuration: 8 – 3/4" CTS-CPVC + 1.25" PVC Air Tubes with 4" Downpipe

E.1 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 67 wc - AVERAGE DRIVING HEAD 50"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	57.750	49.250	N	51.5	130	122	124	108	134	128	134	136	134	118	127	2.90	3.41	88	3.30
8.000	8.125	57.625	49.625	N	52.0	136	164	154	136	132	172	128	138	190	156	151	3.44	3.19	94	3.66
7.500	7.500	57.375	49.875	N	52.0	160	150	174	140	176	154	198	154	196	160	166	3.80	3.07	98	3.89
7.000	7.000	57.375	50.375	N	52.5	166	176	148	164	152	152	140	166	154	194	161	3.68	3.03	99	3.72
6.500	6.250	57.250	50.750	N	52.5	180	182	164	192	202	200	208	166	160	190	184	4.21	2.92	103	4.10
6.000	5.500	57.250	51.250	N	52.5	204	198	180	228	176	200	186	184	186	202	194	4.44	2.83	106	4.19
5.500	5.000	57.250	51.750	N	53.0	208	170	180	202	206	210	190	192	166	206	193	4.41	2.76	109	4.05

E.2 – AIR INDUCER POSITION -0.125" - MAX AIR PRESSURE 71 wc - AVERAGE DRIVING HEAD 44"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
8.500	9.000	51.625	43.125	N	50.0	122	118	120	130	124	116	120	126	126	128	123	2.81	3.41	88	3.20
8.000	8.250	51.563	43.563	N	50.5	132	148	156	138	140	132	138	136	144	148	141	3.23	3.27	92	3.51
7.500	7.500	51.438	43.938	N	50.5	152	158	150	156	140	156	182	162	138	132	153	3.49	3.14	96	3.64
7.000	6.750	51.375	44.375	N	50.5	198	154	156	198	168	156	148	168	198	182	173	3.94	2.93	103	3.85
6.500	6.125	51.375	44.875	N	50.5	180	172	160	172	174	176	178	180	158	160	171	3.91	2.92	103	3.81
6.000	5.375	51.250	45.250	N	51.0	194	184	186	176	176	194	206	190	180	182	187	4.27	2.75	109	3.91
5.500	5.000	51.250	45.750	N	51.5	214	198	194	200	184	178	204	202	194	206	197	4.51	2.56	117	3.85

Appendix F – Air Inducer Configuration: 8 – ½" CTS-CPVC Air Tubes with 3" Downpipe

F.1 – AIR INDUCER POSITION 0.000" - MAX AIR PRESSURE 65 wc - AVERAGE DRIVING HEAD 50"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
9.000	9.375	57.625	48.625	N	60.0	94	84	78	94	74	94	80	64	88	78	83	1.89	6.16	49	3.89
8.500	8.875	57.375	48.875	N	60.3	110	138	100	104	116	118	122	98	110	120	114	2.60	5.01	60	4.33
8.000	8.125	57.250	49.250	N	60.5	138	134	138	130	134	130	106	126	114	128	128	2.92	4.60	65	4.48
7.500	7.500	57.188	49.688	N	60.5	138	128	144	138	138	140	134	146	120	140	137	3.12	4.40	68	4.58
7.000	6.875	57.125	50.125	N	60.5	152	144	140	148	128	134	136	140	142	142	141	3.21	4.25	71	4.55
6.500	6.250	57.125	50.625	N	60.5	142	148	138	148	128	124	140	136	136	140	138	3.15	4.09	73	4.30
6.000	5.750	57.125	51.125	N	60.5	146	146	148	142	146	150	144	146	146	140	145	3.32	3.96	76	4.39
5.500	5.000	57.063	51.563	N	60.5	144	148	144	138	136	140	154	148	150	152	145	3.32	3.84	78	4.25
5.000	4.750	57.625	52.625	N	60.5	144	156	156	156	160	152	150	152	154	152	153	3.50	3.71	81	4.33

F.2 – AIR INDUCER POSITION 0.000" - MAX AIR PRESSURE 70 wc - AVERAGE DRIVING HEAD 43"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
9.000	11.000	50.500	41.500	N	60.0	56	82	58	66	64	68	66	60	66	60	65	1.48	6.25	48	3.08
8.500	9.000	50.250	41.750	N	60.5	104	96	102	100	78	96	86	88	98	98	95	2.16	5.10	59	3.68
8.000	8.250	50.125	42.125	N	60.5	102	102	104	88	104	106	84	86	102	98	98	2.23	4.62	65	3.43
7.500	7.500	50.000	42.500	N	60.5	106	104	106	102	108	100	102	102	104	106	104	2.38	4.41	68	3.49
7.000	7.000	50.000	43.000	N	60.5	108	114	110	116	112	106	112	118	118	112	113	2.57	4.27	70	3.66
6.500	6.250	50.000	43.500	N	60.8	114	112	116	120	114	114	114	122	118	114	116	2.65	4.12	73	3.64
6.000	5.750	49.875	43.875	N	60.8	120	116	118	118	122	116	114	124	122	120	119	2.72	3.99	75	3.61
5.500	5.000	49.875	44.375	N	60.8	122	118	118	124	114	112	118	122	118	122	119	2.72	3.87	78	3.50
5.000	4.500	49.875	44.875	N	60.8	114	116	114	118	114	118	116	114	114	118	116	2.64	3.76	80	3.31

F.3 – AIR INDUCER POSITION 0.000” - MAX AIR PRESSURE 73 wc - AVERAGE DRIVING HEAD 38”

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm) 1	2	3	4	5	6	7	8	9	10	AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
9.500	11.000	45.875	36.375	N	61.0	70	72	50	56	60	72	74	70	58	54	64	1.45	6.17	49	2.99
9.000	8.625	45.625	36.625	N	61.0	92	96	88	96	102	92	90	96	98	96	95	2.16	4.75	63	3.42
8.500	7.750	45.563	37.063	N	60.5	96	82	90	88	76	92	88	90	84	88	87	2.00	4.55	66	3.03
8.000	7.250	45.500	37.500	N	60.5	90	100	92	92	94	88	100	92	76	92	92	2.09	4.39	68	3.06
7.500	6.625	45.375	37.875	N	61.0	104	98	102	104	102	96	100	96	98	94	99	2.27	4.19	72	3.17
7.000	6.125	45.375	38.375	N	60.8	96	102	94	102	92	92	100	92	100	96	97	2.21	4.08	74	3.00
6.500	6.250	45.375	38.875	N	60.5	110	116	112	106	104	106	108	110	112	102	109	2.48	4.17	72	3.45
6.000	5.750	45.313	39.313	N	60.5	118	112	112	112	104	106	110	108	108	106	110	2.50	4.02	75	3.36
5.500	5.000	45.250	39.750	N	60.5	114	106	120	114	116	114	116	116	112	112	114	2.61	3.87	78	3.36
5.000	4.750	45.250	40.250	N	60.5	116	106	112	104	108	108	108	110	110	108	109	2.49	3.75	80	3.11

Appendix G – Air Inducer Configuration: 8 – 1/2" O.D. PEX Air Tubes with 2" Downpipe

G.1 – AIR INDUCER POSITION 0.000" - MAX AIR PRESSURE 64 wc - AVERAGE DRIVING HEAD 51"

Inlet Mano. (in)	Inlet Visual (in)	Outlet Mano. (in)	Driving Head (in)	Air in Outlet	Air Pressure (wc)	Air Velocity (fpm)										AV Avg. (fpm)	Air Flow (CFM)	Tank Time (min)	Water Flow (gpm)	CFM / 100gpm
						1	2	3	4	5	6	7	8	9	10					
10.000	10.125	58.875	48.875	N	50.0	28	38	42	44	42	42	42	44	44	42	41	0.93	17.43	17	5.42
9.500	9.625	58.750	49.250	N	50.0	48	48	48	48	48	48	46	48	48	48	48	1.09	15.96	19	5.81
9.000	9.000	58.750	49.750	N	50.0	54	54	54	54	56	52	50	52	48	54	53	1.21	15.20	20	6.11
8.500	8.500	58.750	50.250	N	50.0	52	50	48	42	44	44	48	48	50	48	47	1.08	14.67	20	5.30
8.000	8.000	58.750	50.750	N	50.0	58	56	54	54	54	56	52	56	58	56	55	1.27	14.96	20	6.32
7.500	7.500	58.625	51.125	N	50.0	60	56	62	62	62	62	60	58	54	52	59	1.34	13.78	22	6.17
7.000	7.000	58.625	51.625	N	50.0	62	60	60	60	60	58	60	62	62	60	60	1.38	13.52	22	6.22
6.500	6.500	58.625	52.125	N	50.0	64	64	64	62	58	58	62	60	60	62	61	1.40	13.09	23	6.12
6.000	6.000	58.625	52.625	N	50.0	68	64	70	66	66	60	60	64	70	62	65	1.49	12.67	24	6.27
5.500	5.500	58.750	53.250	N	50.0	62	58	64	60	60	52	56	56	58	56	58	1.33	12.30	24	5.45

Appendix H – North Fork Trompe Air Flow Data

H.1 – NORTH FORK TROMPE AIR FLOW DATA

Date	Location	Air Velocity (fpm)										Average
		1	2	3	4	5	6	7	8	9	10	CFM
09/06/12	T1	48	48	46	48	40	48	46	44	46	44	1.0
	T2	0	0	0	0	0	0	0	0	0	0	0.0
	T3	0	0	0	0	0	0	0	0	0	0	0.0
11/06/12	T1	56	68	58	62	64	64	64	62	66	70	1.4
	T2	70	80	78	62	80	76	78	84	72	74	1.6
	T3	46	64	56	56	56	52	56	54	58	58	1.2
11/12/12	T1	52	48	50	58	46	50	50	50	48	46	1.1
	T2	54	56	54	56	54	58	52	52	54	54	1.2
	T3	0	0	0	0	0	0	0	0	0	0	0.0
11/19/12	T1	68	72	50	60	64	66	62	60	60	60	1.4
	T2	70	80	72	70	72	74	68	68	70	72	1.6
	T3	0	0	0	0	0	0	0	0	0	0	0.0
12/14/12	T1	86	76	86	84	84	82	68	78	68	70	1.7
	T2	78	86	88	84	80	86	84	78	80	74	1.8
	T3	0	0	0	0	0	0	0	0	0	0	0.0
12/20/12	T1	52	42	50	48	46	44	48	42	52	50	1.0
	T2	52	54	54	58	58	58	58	58	56	60	1.2
	T3	22	20	20	20	14	20	22	20	26	24	0.5
1/17/13	T1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
	T2	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
	T3	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
1/22/13	T1	52	52	52	54	46	46	38	56	44	54	1.1
	T2	58	64	54	52	52	48	52	48	48	60	1.2
	T3	54	46	58	52	46	46	46	48	44	44	1.1
3/10/13	T1.1	44	42	44	48	46	50	44	44	48	52	1.0
	T1.2	46	48	48	50	44	48	48	44	48	46	1.0
	T1.3	0	0	0	0	0	0	0	0	0	0	0.0
	T2.1	54	56	52	54	56	52	54	56	56	64	1.2
	T2.2	68	58	66	66	68	70	72	66	66	66	1.5
	T2.3	50	42	38	38	50	54	48	48	44	46	1.0
	T3.1	52	50	58	50	58	52	58	54	56	56	1.2
	T3.2	62	66	74	74	76	68	72	74	74	74	1.6
	T3.3	34	48	50	40	50	48	52	48	50	48	1.0
03/17/13	T1.1	52	60	58	54	56	58	52	56	54	50	1.2
	T1.2	70	66	70	68	68	68	66	68	68	62	1.5
	T1.3	0	0	0	0	0	0	0	0	0	0	0.0
	T2.1	64	64	62	64	68	66	68	66	72	68	1.4
	T2.2	82	88	86	90	86	82	82	84	90	96	1.9
	T2.3	0	0	0	0	0	0	0	0	0	0	0.0
	T3.1	72	70	66	68	68	64	64	68	74	72	1.5
	T3.2	84	70	68	64	64	64	62	68	62	60	1.5
	T3.3	12	0	14	0	0	18	20	12	18	0	0.2
06/18/13	T1.1	50	46	44	48	52	56	54	48	48	50	1.1
	T1.2	0	0	0	0	0	0	0	0	0	0	0.0
	T1.3	0	0	0	0	0	0	0	0	0	0	0.0
	T2.1	36	38	34	36	36	38	38	36	34	36	0.8
	T2.2	50	46	46	50	48	48	46	50	48	52	1.1
	T2.3	0	0	0	0	0	0	0	0	0	0	0.0
	T3.1	34	32	32	36	36	34	34	32	34	38	0.7
	T3.2	68	70	66	68	66	66	66	66	70	74	1.5
	T3.3	0	0	0	0	0	0	0	0	0	0	0.0

Appendix I – North Fork Water Sample Data

I.1 – Sample Data - November 11, 2012

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: November 27, 2012
General Description: North Fork Pond 2 and Pond 3 Samples

			s.u.	mg/L	uS/cm	Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	TDS	Conductivity	Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20125602	NORTH FORK POND 2 INLET	11/12/12	5.85	1368	2248	1.79	175	83.1	64.3	5.43	12.0	69.1	9.16	0.037	727	116	20.7	18.4	1254	1.09	0.56	-5.86	5.87
20125605	NORTH FORK POND 2 INLET-FILTERED	11/12/12				0.46	175	81.7	64.1	5.40	11.9	69.6	10.7	0.037	727								
20125603	NORTH FORK POND 2 OUTLET	11/12/12	5.97	1342	2238	0.76	175	66.9	63.8	5.27	11.7	70.5	8.30	0.037	717	119	20.0	18.3	1230	1.09	0.55	-4.38	4.46
20125606	NORTH FORK POND 2 OUTLET-FILTERED	11/12/12				0.13	178	67.2	65.0	5.38	12.0	71.2	10.4	0.037	727								
20125604	NORTH FORK POND 3 OUTLET	11/12/12	6.16	1272	2183	0.31	181	45.1	65.4	5.21	11.9	74.1	7.69	0.037	714	123	19.8	18.3	1220	1.04	0.56	-3.68	3.77
20125607	NORTH FORK POND 3 OUTLET-FILTERED	11/12/12				0.02	182	41.5	65.8	5.24	12.0	74.7	9.21	0.037	716								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

I.2 - Sample Data - November 19, 2012

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: November 27, 2012
General Description: North Fork Pond 2 and Pond 3 Samples

			s.u.	mg/L as CaCO3	mg/L	uS/cm	Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS	Conductivity	Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20125682	NORTH FORK POND 2 INLET	11/19/12	6.27		1232	2172	1.7	172	81.2	63.2	5.61	12.5	67.7	10.7	0.015	738	111	20.4	18.5	1253	0.98	0.58	-4.70	4.76
20125685	NORTH FORK POND 2 INLET-FILTERED	11/19/12					0.24	164	85.5	60.1	5.32	11.9	68.1	10.1	0.015	705								
20125683	NORTH FORK POND 2 OUTLET	11/19/12	6.31		1274	2182	0.77	172	79.9	63.1	5.53	12.4	69.0	10.2	0.015	740	112	20.2	18.6	1254	1.02	0.57	-4.16	4.23
20125686	NORTH FORK POND 2 OUTLET-FILTERED	11/19/12					0.09	166	74.9	60.9	5.34	11.9	67.8	9.70	0.015	710								
20125684	NORTH FORK POND 3 OUTLET	11/19/12	6.45		1148	2127	0.26	178	59.0	64.6	5.61	12.4	70.5	9.43	0.015	747	114	19.9	18.8	1252	0.92	0.59	-2.89	2.97
20125687	NORTH FORK POND 3 OUTLET-FILTERED	11/19/12					0.03	171	53.3	62.1	5.40	11.8	67.9	8.89	0.015	725								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

I.3 - Sample Data - December 14, 2012

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: December 27, 2012
General Description: North Fork Pond 2 and Pond 3 Samples

			s.u.	mg/L as CaCO3	mg/L	uS/cm	Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS	Conductivity	Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20126144	NORTH FORK POND 2 INLET	12/14/12	6.22		1238	1595	1.63	173	64.4	63.2	4.73	11.4	75.2	10.8	0.037	688	104	20.1	17.3	1186	1.04	0.74	-7.45	7.47
20126147	NORTH FORK POND 2 INLET-FILTERED	12/14/12					0.23	166	60.6	60.8	4.54	11.0	71.1	10.2	0.037	657								
20126145	NORTH FORK POND 2 OUTLET	12/14/12	6.27		1226	1619	0.57	174	54.7	63.7	4.68	11.3	75.6	10.4	0.037	691	104	19.7	17.3	1180	1.04	0.73	-6.29	6.37
20126148	NORTH FORK POND 2 OUTLET-FILTERED	12/14/12					0.05	167	50.3	61.0	4.48	10.9	72.0	9.80	0.037	668								
20126146	NORTH FORK POND 3 OUTLET	12/14/12	6.50		1138	1589	0.16	171	27.7	61.4	4.66	11.1	72.8	8.65	0.037	677	102	18.2	17.0	1128	1.01	0.71	-3.33	3.50
20126149	NORTH FORK POND 3 OUTLET-FILTERED	12/14/12					0.02	169	34.3	60.2	4.55	10.9	71.6	8.70	0.037	665								

20126146	NORTH FORK POND 3 OUTLET	12/14/12	6.50		1138	1589	0.17	174	28.8	64.8	4.69	11.1	72.8	8.65	0.037	718	102	18.7	17.8	1176	0.97	0.74	-2.21	2.32
20126149	NORTH FORK POND 3 OUTLET-FILTERED	12/14/12					0.02	169	34.3	61.9	4.55	10.9	71.6	8.70	0.037	665								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

I.4 - Sample Data - December 20, 2012

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: January 4, 2013
General Description: North Fork Pond 2 and Pond 3 Samples

			s.u.	mg/L as CaCO3	mg/L		Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS		Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20126221	NORTH FORK POND 2 INLET	12/20/2012	6.08		1178		2.12	163	65.4	60.1	4.58	9.81	60.3	10.6	0.015	697	90	18.7	17.1	1152	1.02		-4.32	4.48
20126224	NORTH FORK POND 2 INLET-FILTERED	12/20/2012					0.53	165	66.1	61.6	4.66	10.1	64.3	10.7	0.015	716								
20126222	NORTH FORK POND 2 OUTLET	12/20/2012	5.99		1064		1.26	170	61.2	62.4	4.73	10.2	61.8	10.3	0.015	722	89	19.0	17.6	1182	0.90		-3.92	4.05
20126225	NORTH FORK POND 2 OUTLET-FILTERED	12/20/2012					0.24	164	58.6	60.6	4.63	9.86	59.9	10.5	0.015	700								
20126223	NORTH FORK POND 3 OUTLET	12/20/2012	6.27		1074		0.37	168	42.8	60.2	4.61	10.1	61.6	9.43	0.015	685	92	18.0	16.9	1125	0.95		-3.04	3.21
20126226	NORTH FORK POND 3 OUTLET-FILTERED	12/20/2012					0.04	164	40.6	59.4	4.54	9.95	60.1	9.30	0.015	679								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

I.5 - Sample Data - January 29, 2013

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: January 29, 2013
General Description: North Fork Pond 2 and Pond 3 Samples

			s.u.	mg/L as CaCO3	mg/L		Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS		Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20130731	NORTH FORK POND 2 INLET	1/29/13 10:51	5.88		1242		2.37	160	86.4	57.2	5.10	11.0	73.1	10.5	0.015	667	127	19.7	17.5	1190	1.04		-5.87	5.96
20130734	NORTH FORK POND 2 INLET-FILTERED - Reanalyzed	1/29/13 10:51					0.97	158	82.3	56.3	5.01	10.9	71.6	9.66	0.22	669								
20130732	NORTH FORK POND 2 OUTLET	1/29/13 10:30	5.88		1202		1.43	158	77.6	56.2	4.96	10.9	73.5	10.0	0.015	657	128	19.1	17.3	1167	1.03		-4.71	4.85
20130735	NORTH FORK POND 2 OUTLET-FILTERED - Reanalyzed	1/29/13 10:30					0.39	155	75.2	55.0	4.89	10.9	71.3	9.13	0.21	647								
20130733	NORTH FORK POND 3 OUTLET	1/29/13 10:14	6.19		1140		0.63	148	57.3	51.7	4.68	10.0	61.4	8.68	0.015	611	107	16.8	15.7	1051	1.08		-3.14	3.38
20130736	NORTH FORK POND 3 OUTLET-FILTERED - Reanalyzed	1/29/13 10:14					0.10	148	62.5	52.0	4.70	10.1	60.9	8.36	0.19	615								
Iron concentrations originally reported for samples below are are incorrect																								
20130734	NORTH FORK POND 2 INLET-FILTERED	1/29/13 10:51					0.14	161	32.2	57.4	5.15	11.0	72.6	9.26	0.015	671								
20130735	NORTH FORK POND 2 OUTLET-FILTERED	1/29/13 10:30					0.05	159	31.7	56.7	5.05	10.9	74.0	8.89	0.015	663								
20130736	NORTH FORK POND 3 OUTLET-FILTERED	1/29/13 10:14					0.02	151	26.3	52.9	4.77	10.2	62.9	7.61	0.015	623								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

I.6 - Sample Data - May 10, 2013

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: May 10, 2013
General Description: North Fork Pond 2-4 Samples

			s.u.	mg/L as CaCO3	mg/L	uS/cm	Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS	Conductivity	Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/IS	IS/Cond	Ion Balance	Ion Imbalance
20134663	NORTH FORK POND 2 INLET	5/10/2013	3.69		1106	1503	1.93	153	83.4	53.7	5.04	10.4	59.9	10.1	0.23	627		18.3	13.1	994	1.11	0.66	-16.98	16.73
20134670	NORTH FORK POND 2 INLET-FILTERED	5/10/2013					0.54	151	81.1	53.2	5.00	10.0	60.8	9.95	0.037	625								
20134664	NORTH FORK POND 2 OUTLET	5/10/2013	5.33		1184	1525	0.68	155	68.3	54.5	5.10	10.4	59.9	9.78	0.16	630		17.8	13.1	984	1.20	0.64	-14.99	15.04
20134671	NORTH FORK POND 2 OUTLET-FILTERED	5/10/2013					0.08	154	65.6	54.2	5.08	10.2	60.0	9.59	0.037	633								
20134665	NORTH FORK POND 3 OUTLET	5/10/2013	5.83		1006	1513	0.18	157	45.4	53.7	4.99	10.1	58.9	8.96	0.23	620		16.9	12.9	950	1.06	0.63	-12.99	13.36
20134672	NORTH FORK POND 3 OUTLET-FILTERED	5/10/2013					0.02	156	42.3	54.2	5.03	10.1	61.5	8.83	0.037	628								
20134666	NORTH FORK POND 4 OUTLET	5/10/2013	7.14		1228	1652	0.02	211	4.25	54.7	4.59	10.4	63.2	8.71	0.29	602	106	18.4	15.5	1056	1.16	0.64	-8.14	8.34
20134673	NORTH FORK POND 4 OUTLET-FILTERED	5/10/2013					0.02	209	4.12	54.4	4.57	10.1	63.7	8.73	0.090	603								
20134669	NORTH FORK RAW	5/10/2013	3.81		1088	1504	2.71	155	88.8	54.8	5.16	10.9	59.4	10.5	0.21	640		18.7	13.3	1016	1.07	0.68	-17.28	16.87
20134676	NORTH FORK RAW-FILTERED	5/10/2013					1.35	152	85.7	53.6	5.05	10.4	59.5	10.2	0.037	626								
20134667	NORTH FORK TROMPE INLET	5/10/2013	7.36		1208	1620	0.03	199	0.93	52.4	5.42	9.90	60.4	8.00	0.24	584	104	17.4	15.1	1016	1.19	0.63	-6.68	7.00
20134674	NORTH FORK TROMPE INLET-FILTERED	5/10/2013					0.02	205	0.11	54.0	5.55	9.79	62.6	8.16	0.037	603								
20134668	NORTH FORK TROMPE OUTLET	5/10/2013	7.48		1158	1619	0.02	201	0.90	52.9	5.60	9.75	60.0	8.01	0.22	588	104	17.5	15.2	1023	1.13	0.63	-6.71	7.03
20134675	NORTH FORK TROMPE OUTLET-FILTERED	5/10/2013					0.02	205	0.13	53.7	5.67	9.74	61.5	8.10	0.037	604								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L)

I.7 - Sample Data - May 17, 2013

CONSOL ENERGY

Submitter: T. Danehy - BioMost
Date: May 17, 2013
General Description: North Fork Pond 2-4 Samples

			s.u	mg/L as CaCO3	mg/L	uS/cm	Concentration of Elements (mg/L)										mg/L							
Analytical Number	Description	Date	pH	Alkalinity	TDS	Conductivity	Al	Ca	Fe	Mg	Mn	K	Na	Si	P	SO_4	Cl	Cation Sum	Anion Sum	Ion Sum	TDS/ IS	IS/ Cond	Ion Balance	Ion Imbalanc
20134911	NORTH FORK MP1	5/17/13	7.72		1344	2202	0.99	223	1.34	72.3	2.6	7.3	70.4	9.93	0.26	744	123							
20134910	NORTH FORK NFMU6	5/17/13	7.37		1172	1956	0.59	200	0.88	54.4	3.01	8.03	52.2	10.6	0.27	648	93							
20134898	NORTH FORK POND 2 INLET	5/17/13	5.47		1122	1869	2.05	152	86.0	54.8	5.23	10.8	62.0	10.5	0.26	631	101	18.6	16.0	1105	1.02	0.59	-7.23	7.42
20134904	NORTH FORK POND 2 INLET-FILTERED	5/17/13					0.46	148	81.8	53.2	5.11	10.9	59.9	11.1	0.015	615								
20134899	NORTH FORK POND 2 OUTLET	5/17/13	5.79		1098	1855	0.54	153	69.8	54.8	5.23	10.7	61.5	10.1	0.23	633	102	17.8	16.1	1091	1.01	0.59	-4.99	5.23
20134905	NORTH FORK POND 2 OUTLET-FILTERED	5/17/13					0.14	148	63.8	53.2	5.08	10.7	59.3	10.8	0.015	608								
20134900	NORTH FORK POND 3 OUTLET	5/17/13	6.09		1094	1805	0.11	147	44.3	51.5	4.86	9.94	56.9	8.71	0.21	588	101	16.1	15.1	1004	1.09	0.56	-2.86	3.13
20134906	NORTH FORK POND 3 OUTLET-FILTERED	5/17/13					0.06	152	42.5	53.4	5.08	10.7	59.0	10.1	0.015	608								
20134901	NORTH FORK POND 4 OUTLET	5/17/13	7.02		1104	1940	0.02	199	4.69	54.5	4.57	9.72	58.6	8.36	0.33	580	102	17.5	15.0	1013	1.09	0.52	-7.64	7.96
20134907	NORTH FORK POND 4 OUTLET-FILTERED	5/17/13					0.02	198	4.72	54.4	4.59	9.99	58.4	9.57	0.074	576								
20134903	NORTH FORK RAW	5/17/13	5.76		1164	1976	2.87	143	87.2	51.5	4.87	10.2	57.2	10.1	0.21	591	101	17.7	15.2	1048	1.11	0.53	-7.38	7.67
20134909	NORTH FORK RAW-FILTERED	5/17/13					1.44	148	90.1	53.5	5.12	11.0	59.4	12.3	0.015	618								
20134902	NORTH FORK TROMPE OUTLET	5/17/13	7.55		1138	1915	0.02	195	0.48	54.1	4.95	9.22	57.3	7.80	0.24	591	98	17.1	15.1	1010	1.13	0.53	-5.97	6.31
20134908	NORTH FORK TROMPE OUTLET-FILTERED	5/17/13					0.02	197	0.05	54.6	5.02	9.75	58.1	8.99	0.015	597								

Notes:
1. Anion sum and ion sum do not account for the alkalinity and are therefore biased low.
2. Results in red font are method detection limits. (i.e. The phosphous concentration is <0.037 mg/L).

Appendix J – Parts Lists

J.1 – 2" TROMPE

Quantity	Part
2	6" tee
1	4" flush cleanout plug
1	4" tee
1	4" elbow
1	2" female adapter (thread x thread)
1	2" male adapter (spigot x thread)
5	2" street elbow
1	2" tee
2	6"x4" coupling (spigot)
1	4"x2" coupling (spigot)
4	6"x4"bushing (spigot)
3	4"x2" bushing (spigot)
8	0.325" pex tubing
2 cups	fiberglass resin
min 15' *	6" pipe
min 10' *	4" pipe
min 10' *	2" pipe

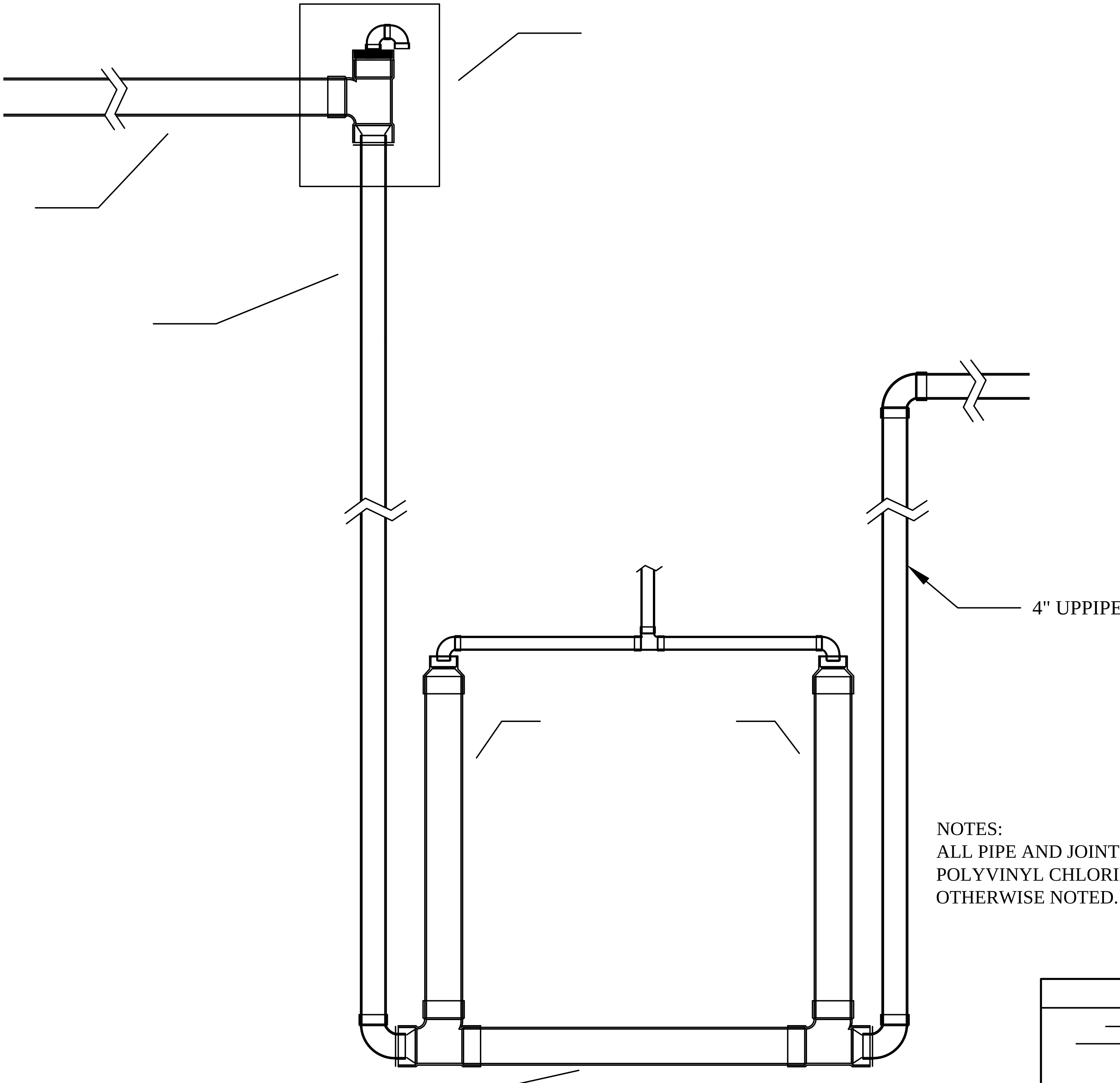
J.2 – 3" TROMPE

Quantity	Part
2	6" tee
1	4" street elbow
1	4" tee
1	4" elbow
1	4" flush cleanout plug
1	3" street elbow
4	2" street elbow
1	2" tee
1	2" male adapter (thread x spigot)
1	2.5" female adapter (thread)
2	6"x4" coupling (spigot)
2	4"x3" bushing (spigot)
2	4"x2" bushing (spigot)
2	6"x4"bushing (spigot)
1	2.5"x2" bushing (thread)
8	0.5" CPVC tubing
2 cups	fiberglass resin
min 15' *	6" pipe
min 15' *	4" pipe
min 15' *	3" pipe
min 10' *	2" pipe

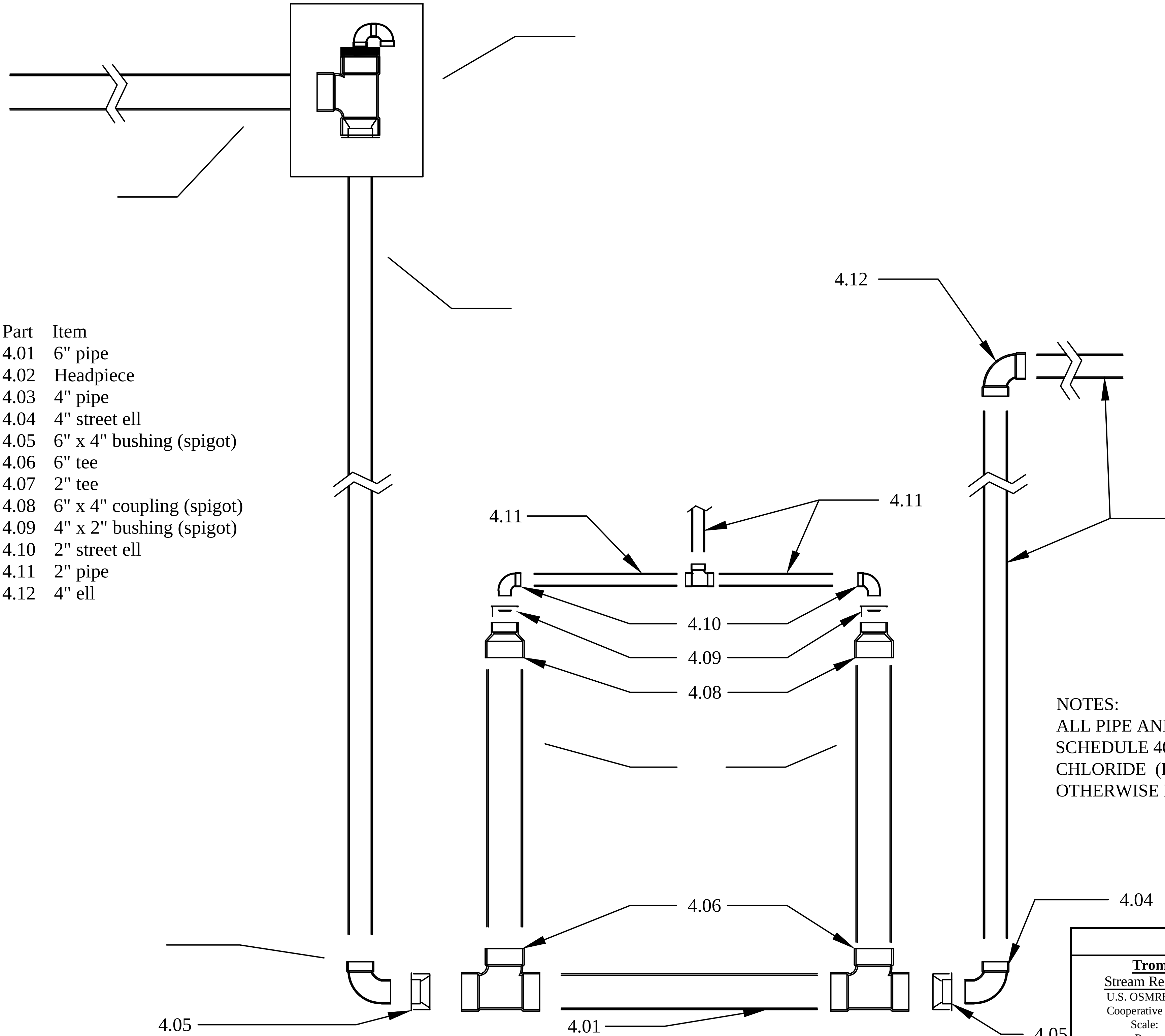
J.3 – 4" TROMPE

Quantity	Part
3	6" tee
1	6" clean out
1	6" flush cleanout plug
1	4" elbow
2	4" street ebowl
1	2" tee
4	2" street elbow
1	2" female adapter (thread x spigot)
1	2" male adapter (thread x spigot)
2	6"x4" coupling (spigot)
1	4"x2" coupling (spigot)
3	6"x4"bushing (spigot)
2	4"x2" bushing (spigot)
17	0.5" CPVC tubing
2 cups	fiberglass resin
min 15' *	6" pipe
min 20' *	4" pipe
min 10' *	2" pipe

* actual lengths will vary depending on site conditions



NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) UNLESS OTHERWISE NOTED.



Part	Item
4.01	6" pipe
4.02	Headpiece
4.03	4" pipe
4.04	4" street ell
4.05	6" x 4" bushing (spigot)
4.06	6" tee
4.07	2" tee
4.08	6" x 4" coupling (spigot)
4.09	4" x 2" bushing (spigot)
4.10	2" street ell
4.11	2" pipe
4.12	4" ell

NOTES:
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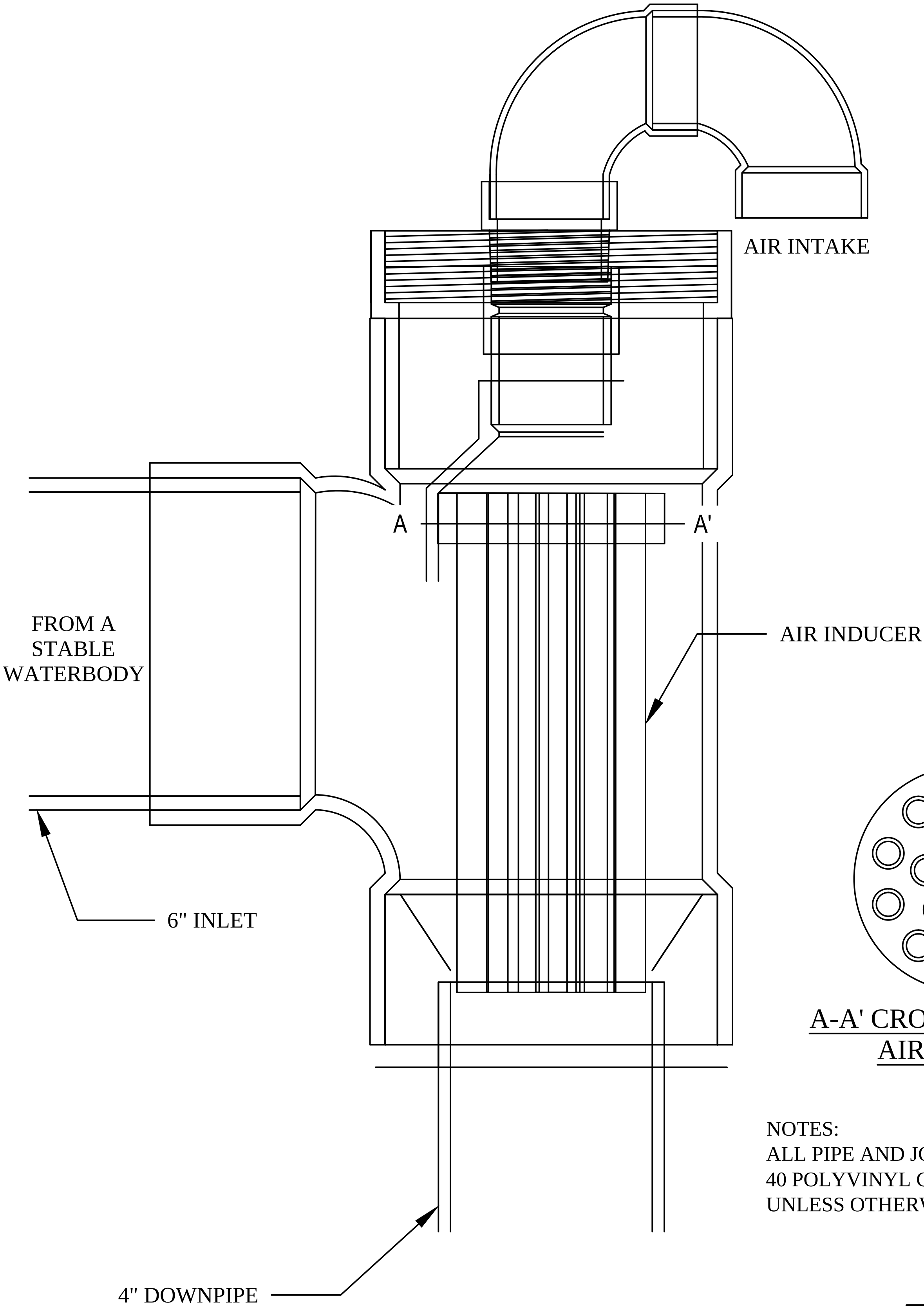

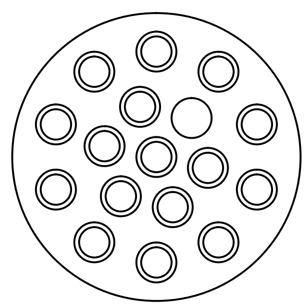

A-A' CROSS SECTION OF AIR INDUCER

NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) UNLESS OTHERWISE NOTED.

K.3 - 4" HEADPIECE LAYOUT
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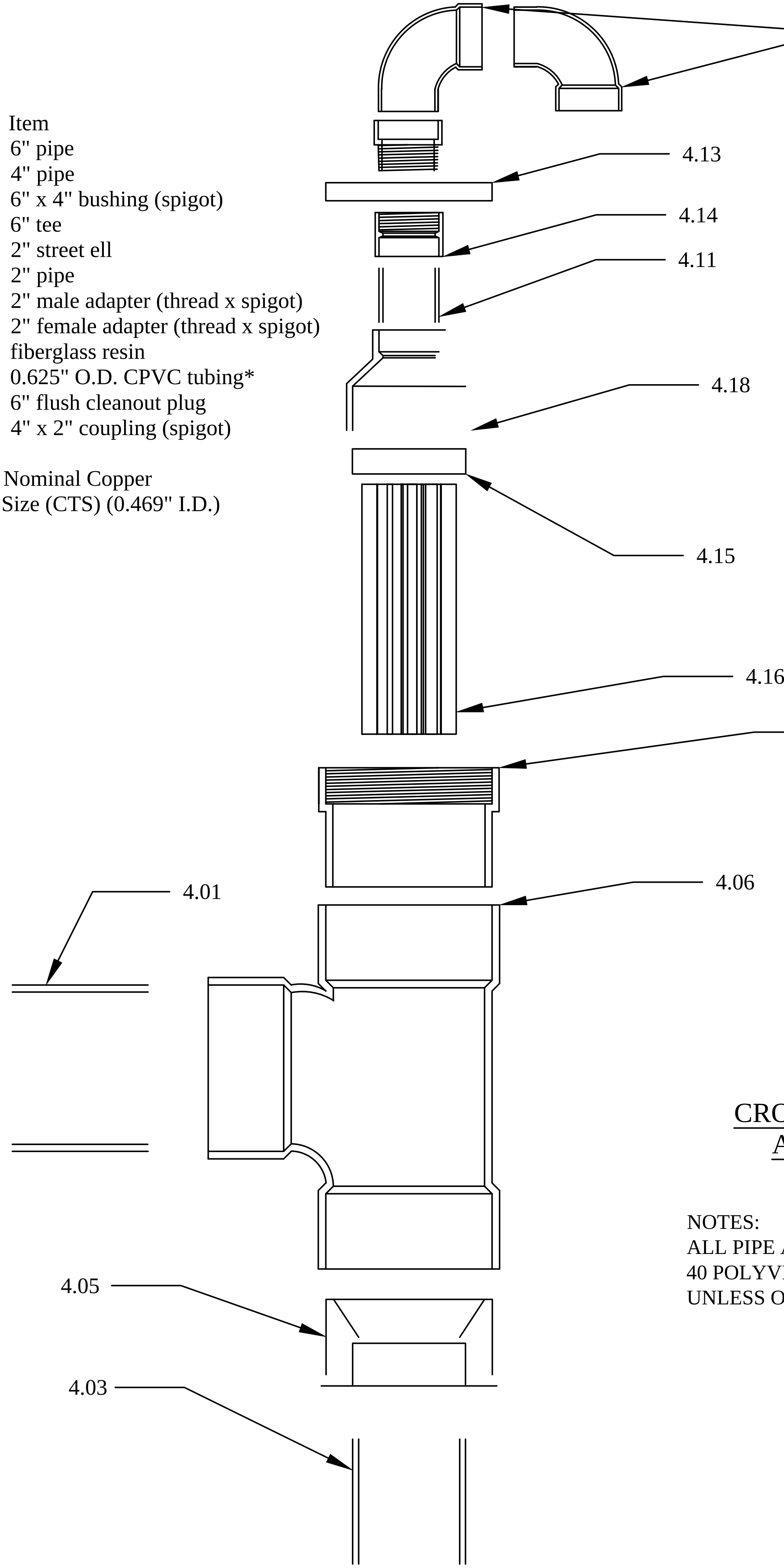
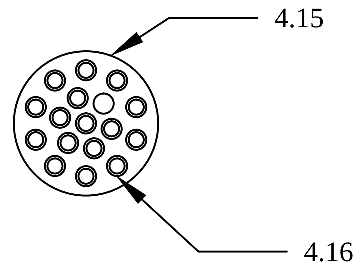
Part	Item
4.01	6" pipe
4.03	4" pipe
4.05	6" x 4" bushing (spigot)
4.06	6" tee
4.10	2" street ell
4.11	2" pipe
4.13	2" male adapter (thread x spigot)
4.14	2" female adapter (thread x spigot)
4.15	fiberglass resin
4.16	0.625" O.D. CPVC tubing*
4.17	6" flush cleanout plug
4.18	4" x 2" coupling (spigot)

*1/2" Nominal Copper
Tube Size (CTS) (0.469" I.D.)





CROSS SECTION OF
AIR INDUCER

NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE
40 POLYVINYL CHLORIDE (PVC)
UNLESS OTHERWISE NOTED.

K.4 - 4" HEADPIECE PARTS

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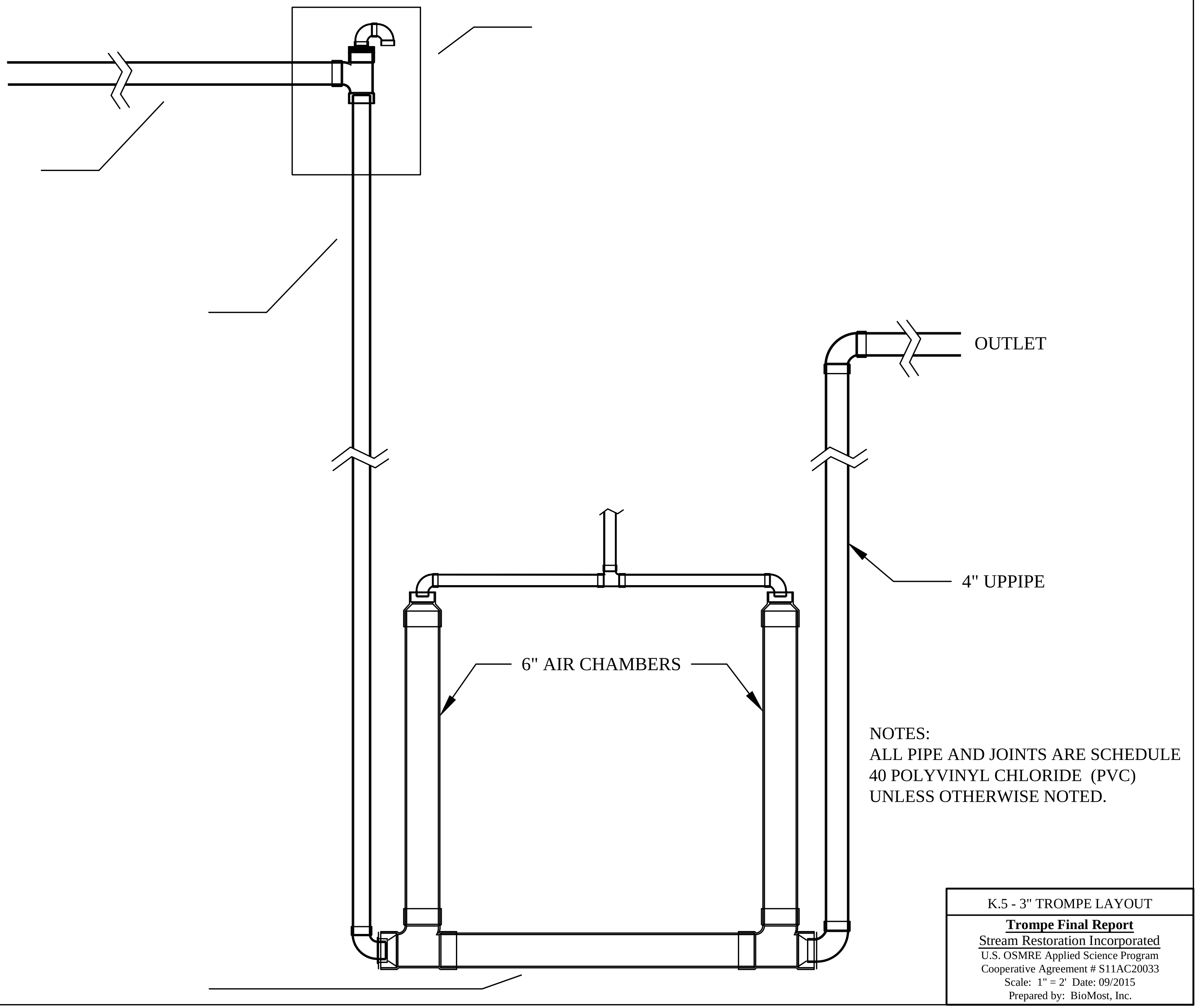
OUTLET
4" UPPIPE
6" AIR CHAMBERS
NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE
40 POLYVINYL CHLORIDE (PVC)
UNLESS OTHERWISE NOTED.
K.5 - 3" TROMPE LAYOUT
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Scale: 1" = 2' Date: 09/2015
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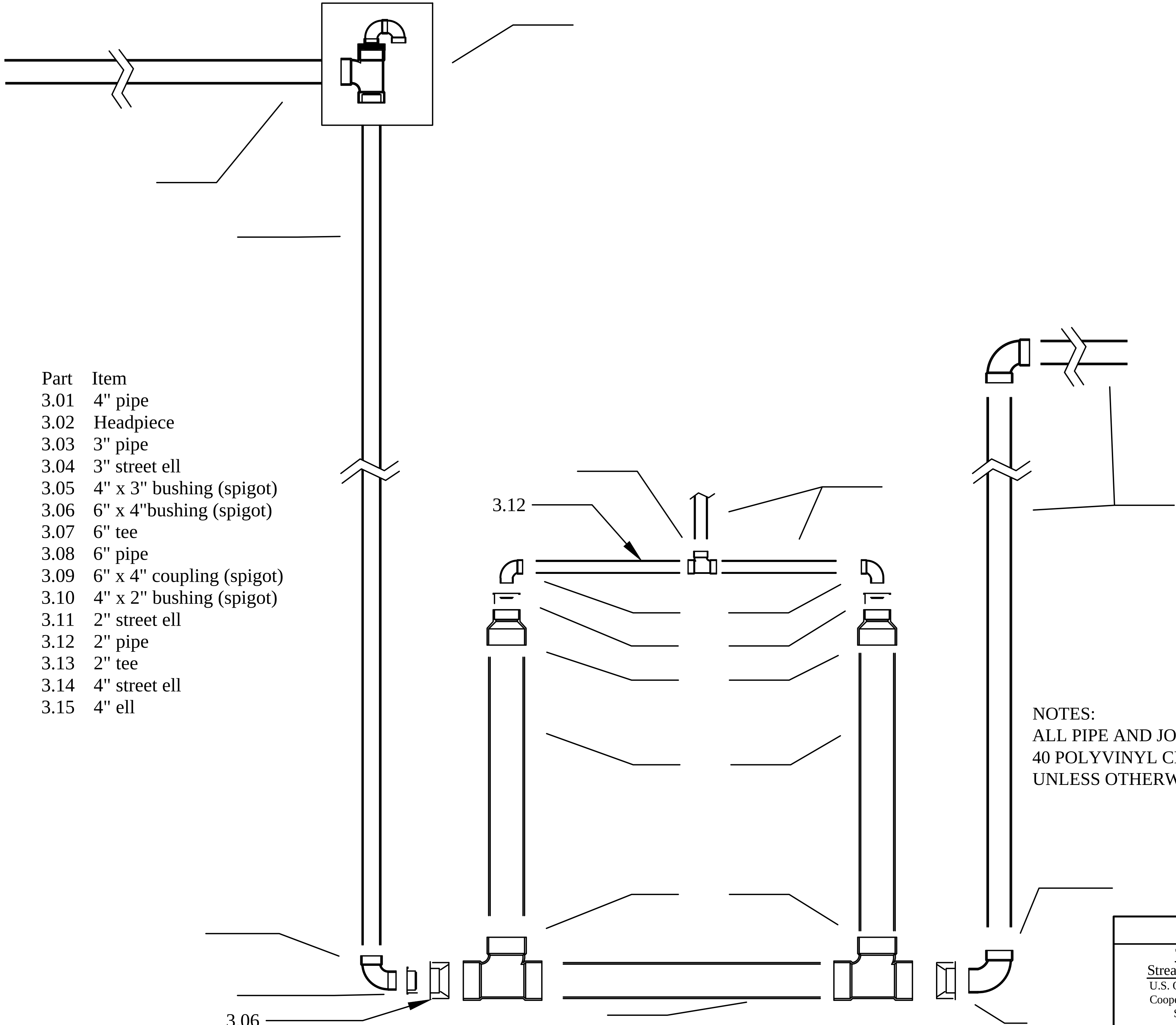

Part	Item
3.01	4" pipe
3.02	Headpiece
3.03	3" pipe
3.04	3" street ell
3.05	4" x 3" bushing (spigot)
3.06	6" x 4"bushing (spigot)
3.07	6" tee
3.08	6" pipe
3.09	6" x 4" coupling (spigot)
3.10	4" x 2" bushing (spigot)
3.11	2" street ell
3.12	2" pipe
3.13	2" tee
3.14	4" street ell
3.15	4" ell

NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) UNLESS OTHERWISE NOTED.

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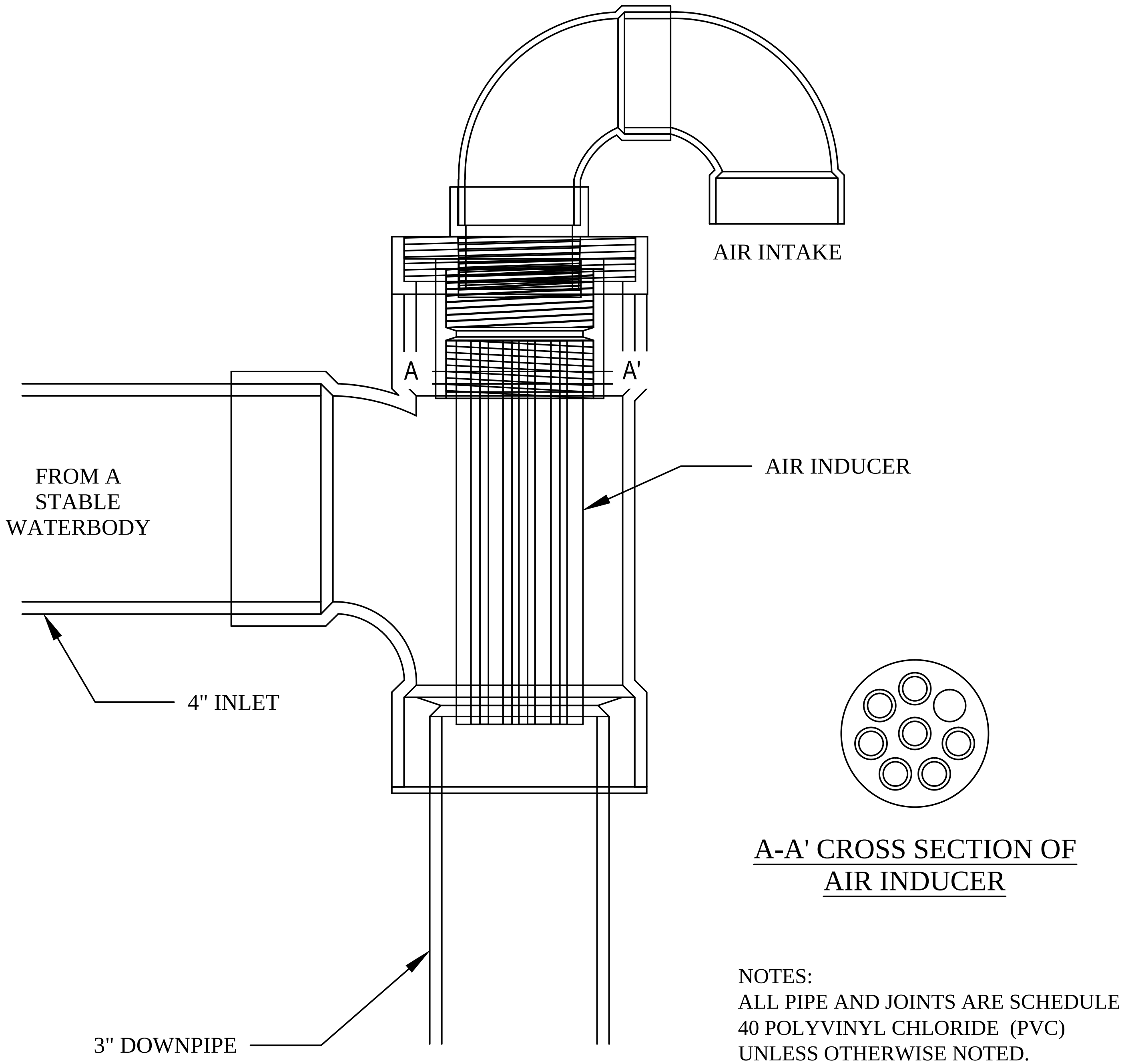

NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) UNLESS OTHERWISE NOTED.

K.7 - 3" HEADPIECE LAYOUT
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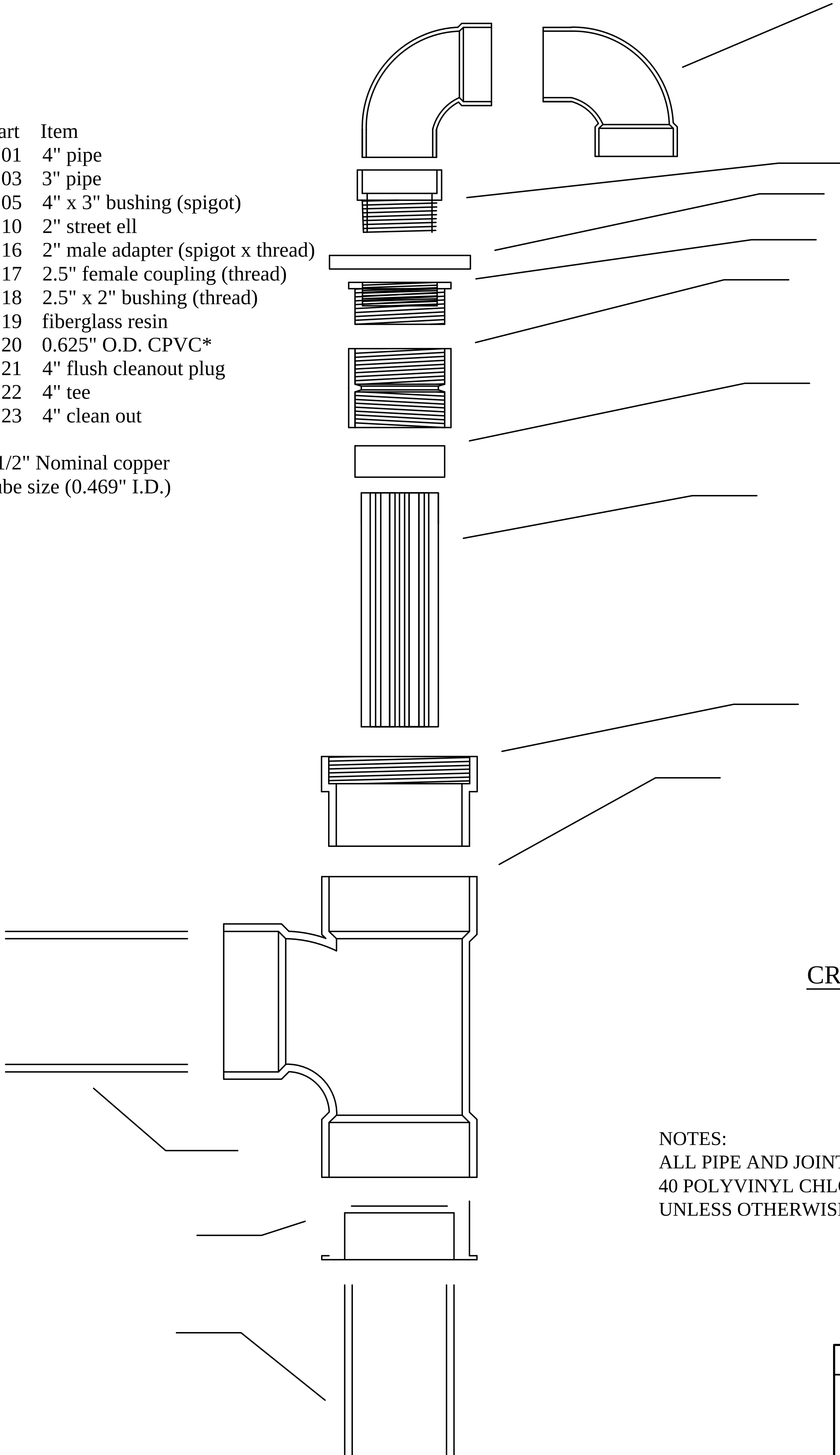
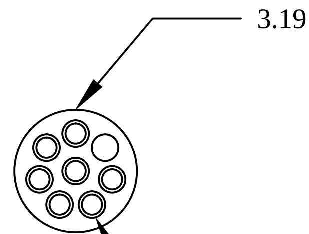
Part	Item
3.01	4" pipe
3.03	3" pipe
3.05	4" x 3" bushing (spigot)
3.10	2" street ell
3.16	2" male adapter (spigot x thread)
3.17	2.5" female coupling (thread)
3.18	2.5" x 2" bushing (thread)
3.19	fiberglass resin
3.20	0.625" O.D. CPVC*
3.21	4" flush cleanout plug
3.22	4" tee
3.23	4" clean out

*1/2" Nominal copper tube size (0.469" I.D.)





CROSS SECTION OF AIR INDUCER

NOTES:
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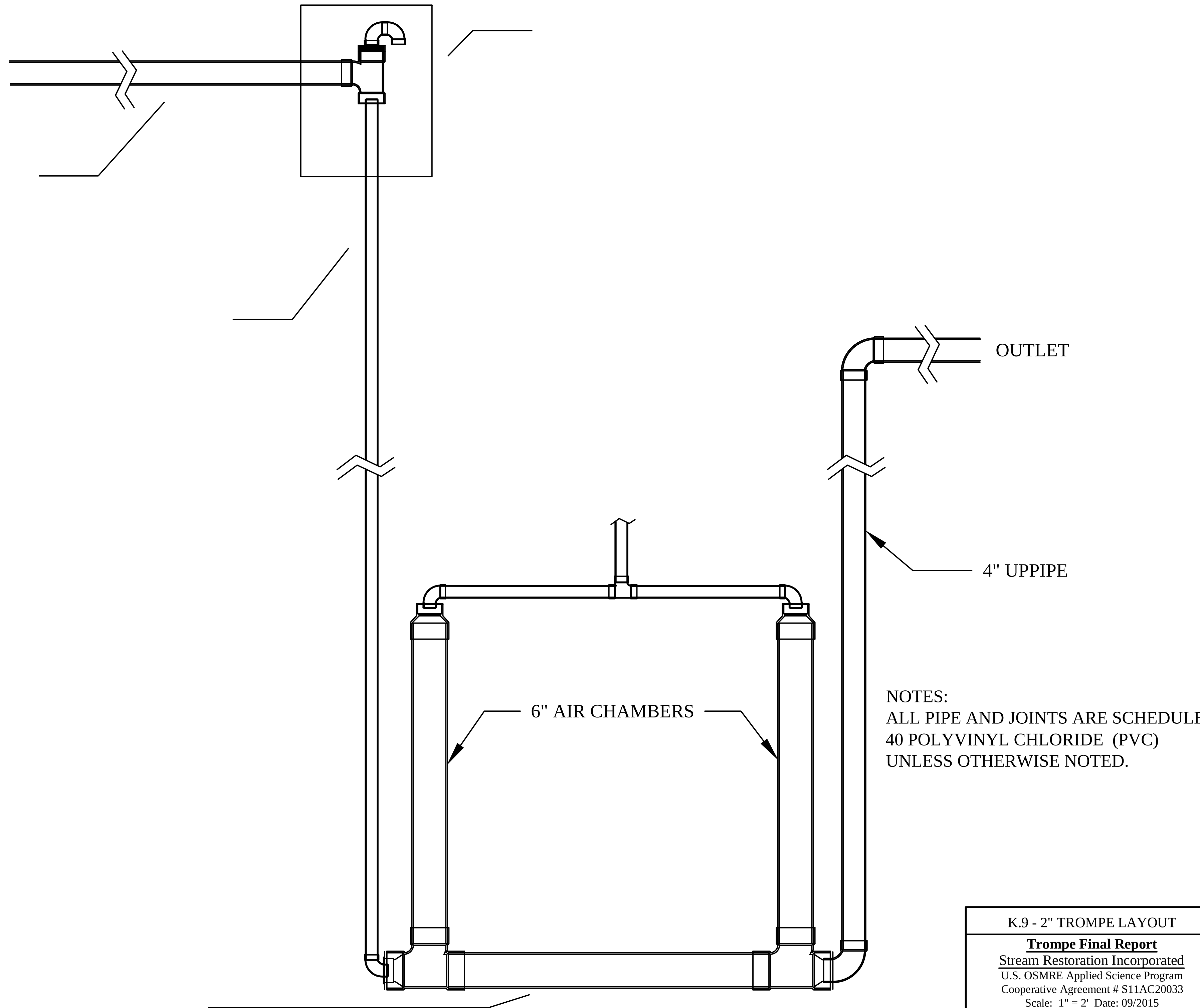

K.9 - 2" TROMPE LAYOUT

Trompe Final Report

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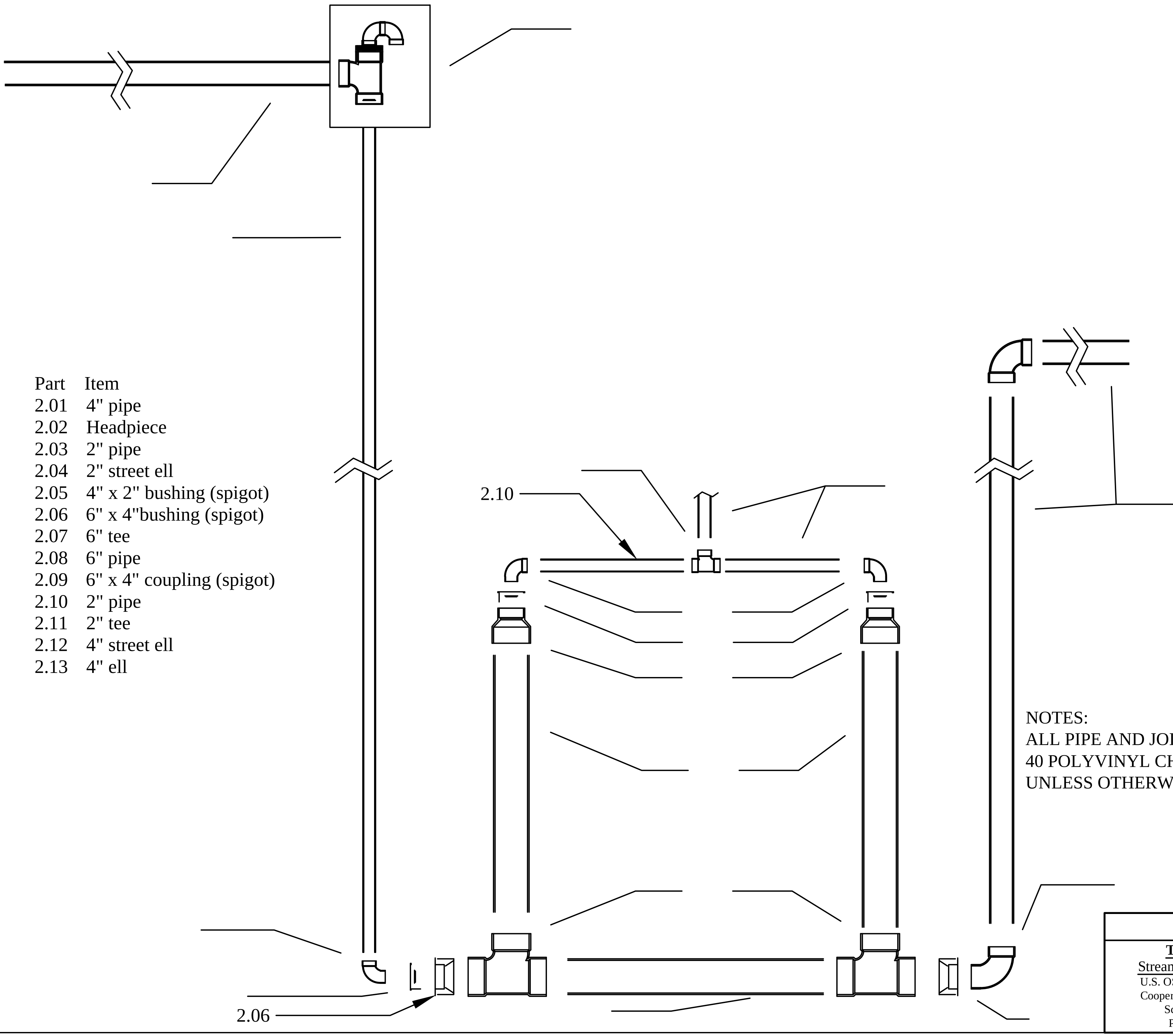

Part	Item
2.01	4" pipe
2.02	Headpiece
2.03	2" pipe
2.04	2" street ell
2.05	4" x 2" bushing (spigot)
2.06	6" x 4"bushing (spigot)
2.07	6" tee
2.08	6" pipe
2.09	6" x 4" coupling (spigot)
2.10	2" pipe
2.11	2" tee
2.12	4" street ell
2.13	4" ell

NOTES:
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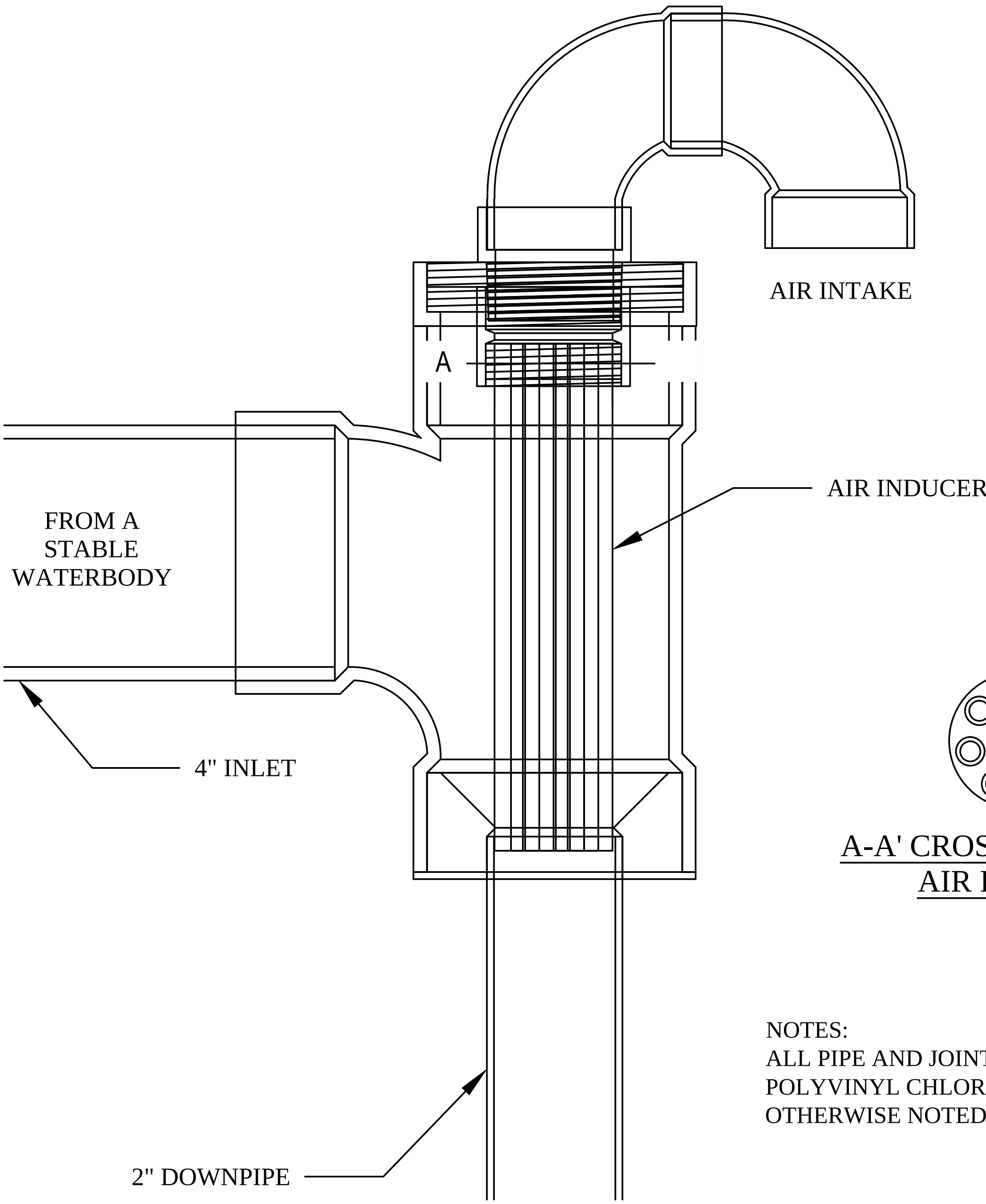

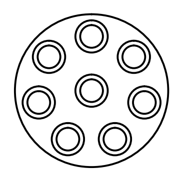

A-A' CROSS SECTION OF AIR INDUCER

NOTES:
ALL PIPE AND JOINTS ARE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) UNLESS OTHERWISE NOTED.

K.11 - 2" HEADPIECE LAYOUT

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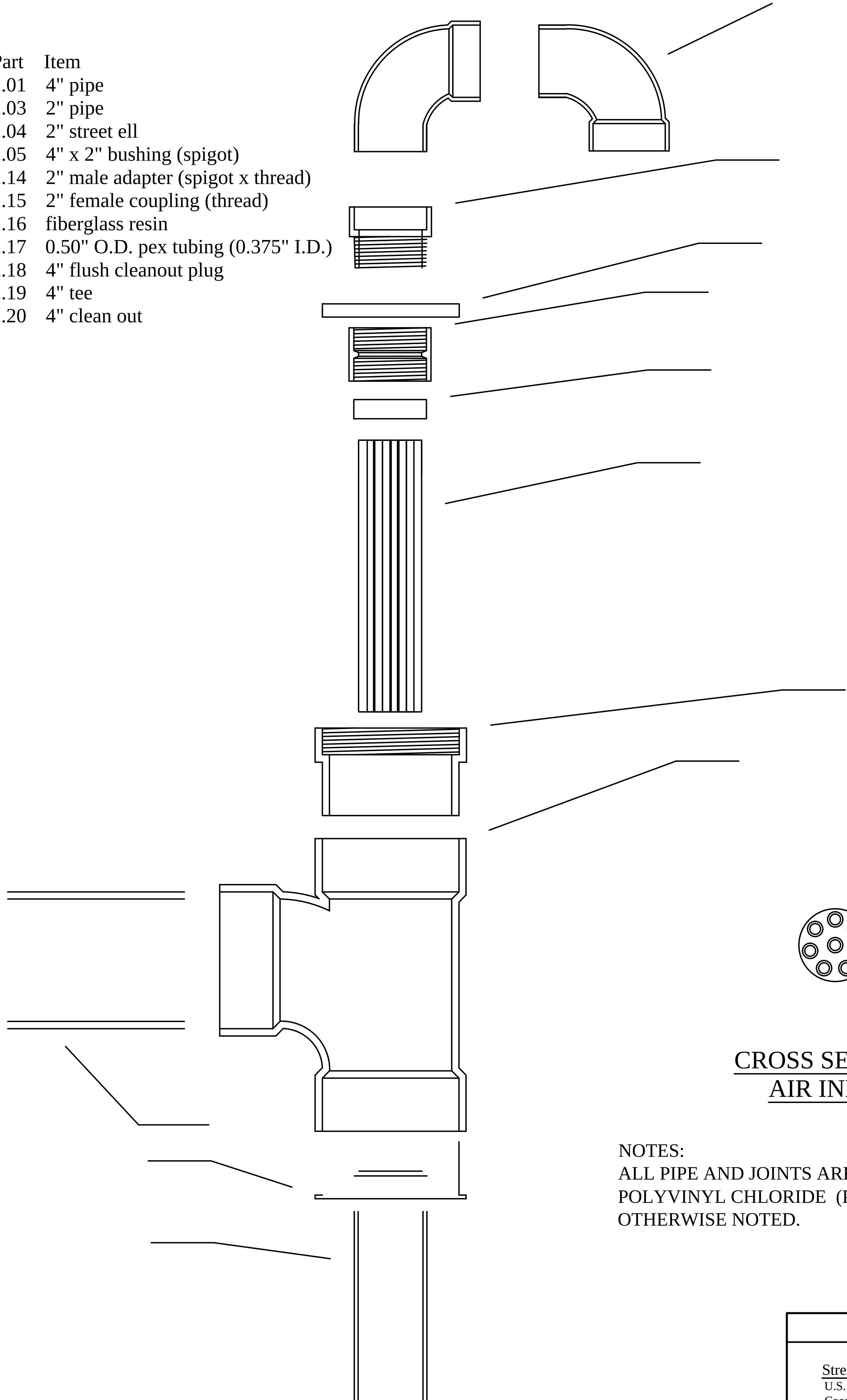
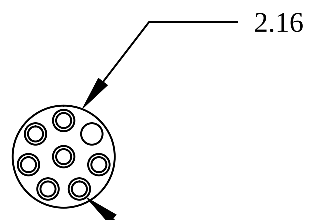
Part	Item
2.01	4" pipe
2.03	2" pipe
2.04	2" street ell
2.05	4" x 2" bushing (spigot)
2.14	2" male adapter (spigot x thread)
2.15	2" female coupling (thread)
2.16	fiberglass resin
2.17	0.50" O.D. pex tubing (0.375" I.D.)
2.18	4" flush cleanout plug
2.19	4" tee
2.20	4" clean out





CROSS SECTION OF AIR INDUCER

NOTES:
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