

**COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH AND BOAT COMMISSION
DONEGAL LAKE REVOCABLE LICENSE
FOR WATER ACCESS**

THIS LICENSE FOR WATER ACCESS ("AGREEMENT") made this 13th day of April, 2011 ("Effective Date"), between the COMMONWEALTH OF PENNSYLVANIA, acting through the PENNSYLVANIA FISH AND BOAT COMMISSION, an independent administrative Commission of the Commonwealth of Pennsylvania, party of the first part, hereinafter called the "COMMISSION"

AND

WILLIAMS PRODUCTION APPALACHIA LLC, a Delaware limited liability company, and WILLIAMS MARCELLUS GATHERING LLC, a Delaware limited liability company, both with their principal offices located at One Williams Center, Suite 2500, Tulsa, OK 74172 and with Pennsylvania offices located at 1000 Town Center, Suite 130, Canonsburg, PA 15317-5834, collectively the party of the second part, hereinafter called the "COMPANY."

W I T N E S S E T H:

WHEREAS, the COMMISSION owns property known as Donegal Lake that contains an 80-acre lake in Donegal Township, Westmoreland County, Commonwealth of Pennsylvania, hereinafter called the Premises; and

WHEREAS, the COMPANY has entered into gas exploration and production leases on properties adjacent to the Premises; and

WHEREAS, the COMPANY desires to use of a portion of the Premises, hereinafter called Project Area and further described in the Project Plan, attached hereto and incorporated herein as Exhibit A, to facilitate its activities associated with these gas leases; and

WHEREAS, under section 745 of the Fish and Boat Code, 30 Pa. C.S. §745, the COMMISSION, through its Executive Director, may grant revocable licenses for the use of its properties and may further grant water rights when these grants shall not adversely affect fish protection and propagation; and

WHEREAS, the COMMISSION has determined that it is in the best interest of the Commonwealth to allow the COMPANY to use its property for water withdrawal because such use will eliminate or reduce truck traffic and the resulting damage to local roads; and

WHEREAS, the COMMISSION has further determined that it can grant water rights to the COMPANY in a manner that will not adversely affect fish protection and propagation or the public's use of the Premises for fishing and boating.

NOW, THEREFORE, the COMMISSION and the COMPANY, agreeing to be legally bound, in consideration of the mutual covenants hereof and the mutual benefits hereby conferred, do mutually agree as follows:

1. PRIVILEGES GRANTED.

a. The COMMISSION hereby grants the COMPANY the non-exclusive privilege of utilizing the Project Area and of withdrawing water from Donegal Lake subject to the following conditions:

- i. The COMPANY shall comply with the Project Plan set forth in Exhibit A.
- ii. The COMPANY shall comply with its Water Management Plan for Marcellus Shale Gas Well Development that has been approved by the Pennsylvania Department of Environmental Protection (DEP) Southwest Region, which is incorporated herein by reference.
- iii. The COMPANY shall comply with its Drawdown Permit issued by the COMMISSION, which is incorporated herein by reference.

b. This Agreement does not grant to the COMPANY any rights to the oil, gas and minerals underlying the Premises.

2. TERM. The initial term of this Agreement shall be for a period of five (5) years ("Initial Term") from the date of the full execution hereof. COMPANY shall have the option, but not the obligation, to extend the term of the Agreement for an additional five (5) years ("Secondary Term") upon written notice to COMMISSION at least sixty (60) days prior to the end of the Initial Term and subject to the agreement of the COMMISSION.

3. LICENSE FEES.

a. Upon full execution of this Agreement, the COMPANY shall make an initial payment of Ten Thousand (\$10,000) Dollars to the COMMISSION and shall make the following annual payments to the COMMISSION during the Initial Term on or before the anniversary of the Effective Date each year: \$10,000 for year two; \$10,300 for year three; \$10,600 for year four; and \$10,900 for year five. In the event this Agreement is extended at COMPANY'S option, the annual payments for the Secondary Term shall be \$11,300 for year six; \$11,600 for year seven; \$11,950 for year eight; \$12,300 for year nine; and \$12,700 for year ten, and such payments shall be due on or before the anniversary of the Effective Date each year.

b. During the Initial Term of this Agreement, the COMPANY shall make an additional payment to the COMMISSION on a monthly basis at a rate of \$5.00 for each 1,000 gallons of water that it withdraws from the Premises. This additional payment shall be based on the amount metered onsite and reported monthly to DEP and the COMMISSION under this Agreement. During the Secondary Term of the Agreement, the COMPANY shall pay the COMMISSION on a monthly basis \$6.00 for each 1,000 gallons of water that it withdraws as metered onsite and reported monthly to DEP and the COMMISSION. The monthly payments, unless disputed in good faith by COMPANY, shall be due on the 15th day of the month following

the withdrawal and shall be accompanied by a report on a form prescribed by the COMMISSION.

c. The COMMISSION shall invoice the COMPANY for all payments required under subparagraph (a) above, and the COMPANY shall send the payments in accordance with the instructions and to the address contained in the COMMISSION's invoice. The COMPANY shall send all payments required under subparagraph (b) above along with the required supporting documentation to the COMMISSION, c/o NWGA Program Coordinator, P.O. Box 67000, Harrisburg, PA 17106-7000.

d. In the event the COMMISSION determines that the COMPANY is in default in the payment of any sum of money payable under this paragraph, the COMMISSION shall notify COMPANY of such default in writing and COMPANY shall have a period of thirty (30) days within which to cure such default. If such default is not cured at the expiration of the thirty (30) days, the COMPANY agrees to pay an additional 6% annual interest on the defaulted amount calculated from the time of such default. This provision in no way constitutes a waiver of the requirement to pay on time.

4. EXCEEDANCE PENALTY. In the event the COMMISSION determines that the COMPANY exceeded the daily maximum withdrawal rates set forth in Exhibit A, the COMPANY shall pay a penalty of \$5,000 to the COMMISSION for each day that the COMPANY exceeded the approved rate. The COMPANY shall make payment under this paragraph within thirty (30) days of being notified in writing by the COMMISSION.

5. COMPLIANCE WITH LAWS. In connection with its activities under this Agreement, the COMPANY shall comply with all laws, ordinances, orders, rules, regulations, standards and licensing requirements of all federal, state, municipal or local authorities or agencies, now in effect or that may be passed, enacted, issued, revised, required or promulgated at a later date. The COMPANY shall avoid environmental impacts and prevent pollution and shall strictly comply with all applicable environmental laws and regulations. In the event that any action by the COMPANY under this Agreement results in environmental damage to the Premises, the COMPANY shall take corrective action in accordance with paragraph 9 and shall immediately cease all water withdrawals until the damage is mitigated in accordance with paragraph 9 to the reasonable satisfaction of the PFBC. The COMPANY's corrective action shall be in accordance with best management practices.

6. PERMITS. The COMPANY shall secure, at its sole expense, all necessary local, state, federal and regulatory permits, licenses and other regulatory approvals and notices incidental to its activities under this Agreement. Upon written request, the COMPANY shall provide copies of all permits, licenses and approvals to the COMMISSION except as otherwise provided in Exhibit A.

7. COMMISSION USE. The COMMISSION reserves the right to use the Premises in any and all respects not specifically limited by the terms of this Agreement.

8. PUBLIC ACCESS. The COMPANY shall not restrict or inhibit access by the COMMISSION or the public over and through the Premises or interfere or obstruct the public's use of the Premises for fishing and boating during any term of this Agreement. In the event that any action by the COMPANY under this Agreement results in diminished access to the Premises by the COMMISSION or the public, the COMPANY shall take immediate corrective action upon written notice from the COMMISSION.

9. RESTORATION.

a. In addition to the requirements in the Project Plan, the COMPANY shall restore any portion of the Premises adversely impacted by the COMPANY's activities under this Agreement, including any drainage courses, swales, roadways, parking areas, lawn areas and wooded areas, to a condition equal to their condition prior to the execution hereof. Restoration may be required periodically and upon termination of this Agreement as directed by the COMMISSION. Restoration activities under this Agreement shall be performed in accordance with the Pennsylvania Department of Transportation Construction Specification Publication 408 and the COMPANY's approved Erosion and Sedimentation Control Plan.

b. The COMPANY shall replace, as the COMMISSION so directs, all COMMISSION boundary and warrant markers, corners, monuments and surveying control points along with any fences, gates, appurtenances, and improvements moved, destroyed or damaged in any work incident to the COMPANY's activities under this Agreement. The COMPANY shall maintain the Project Area in a condition equal to its original Pre-Project condition during any term of this Agreement.

c. In the event the COMMISSION determines that the COMPANY must take nonemergency corrective action under this Agreement, including but not limited to subsidence repairs, pavement repairs, drainage maintenance and repairs and reseeding, the COMMISSION shall notify COMPANY, in writing, of the corrective action to be taken, and the COMPANY shall have twenty (20) business days, or a longer period of time if requested by the COMPANY and as agreed upon by the COMMISSION in its sole discretion, to take such action from receipt of such notice from the COMMISSION stating that corrective action is required. The COMPANY shall take immediate corrective action in the case of an emergency upon receiving oral notice from the COMMISSION that emergency corrective action is required. An "emergency" for purposes of this Agreement includes but is not limited to an event involving personal injury or death, significant damage to property or equipment or a spill of hazardous material, frac water or petroleum based products.

d. In the event the COMPANY does not take corrective action within the period specified in subparagraph (c) above, the COMMISSION shall perform the necessary work and bill the COMPANY for all costs related to the work. The COMPANY shall have twenty (20) business days from the bill's receipt date to pay the COMMISSION for any corrective work taken by the COMMISSION under this paragraph. In the event the COMPANY does not pay the billed amount within the required time frame, the COMMISSION shall give written notice terminating this Agreement for noncompliance. Any action taken by the COMPANY hereunder shall not be construed to limit the COMPANY's liability under this Agreement.

10. INDEMNITY. The COMPANY shall at all times hereafter indemnify, save harmless and defend the Commonwealth of Pennsylvania, the COMMISSION and their members, officers and employees from and against any and all detriment, damage, loss, claim, demands, suits, costs, and expenses which the Commonwealth, the COMMISSION and their members, officers and employees may suffer, sustain or be subjected to directly or indirectly by reason of or arising out of the COMPANY's activities under this Agreement but in no event shall COMPANY be liable for the foregoing if such events were caused by the COMMISSION or its members, officers, employees or agents. This provision shall survive the termination of the Agreement.

11. INSURANCE. The COMPANY shall maintain insurance coverage as set forth in Exhibit B, attached hereto and incorporated herein, or other insurance coverage approved in advance by the COMMISSION, which shall name the COMMISSION as an Endorsed Additional Insured to the extent of liability assumed under this Agreement. Prior to exercising its privileges under this Agreement, the COMPANY shall provide the COMMISSION with certificates of insurance evidencing this coverage.

12. NOTICE. The COMPANY shall separately give oral and electronic notice to the COMMISSION's Chief of Construction and Maintenance (814-359-5184; jsinclair@state.pa.us; 450 Robinson Lane, Bellefonte, PA 16823) and its Southwest Regional Law Enforcement Manager (814-445-8974; tqualters@state.pa.us; 236 Lake Road, Somerset, PA) not less than five (5) business days prior to its intention to commence activities under this Agreement and immediately in the event of an emergency. The COMPANY shall provide the COMMISSION a point of contact and telephone number that the COMMISSION may contact 24 hours a day seven days a week.

13. VEGETATION CONTROL. The COMPANY may control vegetation on the Project Area only by mechanical or manual cutting. The COMPANY shall not use, or permit to be used by anyone under its control, any pesticide, chemical weed or vegetation killer, on the Project Area without the prior written approval of the COMMISSION. The COMPANY may make written request for such use by applying to the COMMISSION's Division of Environmental Services at 450 Robinson Lane, Bellefonte, Pennsylvania, 16823-9620. The COMPANY agrees to comply with the guidelines provided by the COMMISSION at the time of the request.

14. DEFAULT. If the COMPANY shall fail or refuse to pay any license fee due under the terms of this Agreement within thirty (30) days after demand in writing by the COMMISSION, the COMMISSION shall have the right to terminate the Agreement immediately. Either party may terminate this Agreement for default if the other party materially fails to perform its obligations under the Agreement and does not cure such failure within thirty (30) days or, if a cure within such period is not practical, commence a good faith effort to cure such failure to perform within the specified period (or such longer period as the aggrieved party may specify in writing) after receipt of written notice from the aggrieved party specifying such failure.

15. PERFORMANCE SECURITY. To ensure faithful performance of its obligations under this Agreement, the COMPANY shall furnish a performance bond or other form of security acceptable to the COMMISSION in the amount of \$75,000.

16. TERMINATION.

a. In addition to termination at the end of any term, this Agreement may be terminated by (i) default/noncompliance as defined herein; or (ii) the COMPANY's filing for bankruptcy, in which case the termination shall be immediate upon the filing of bankruptcy; or (iii) the COMPANY's assignment of this Agreement without the prior written consent of the COMMISSION as defined herein.

b. Upon termination of this Agreement, the COMPANY shall have a period of thirty (30) calendar days after the termination date, weather permitting, in which to remove all personal property and fixtures from the Premises and restore it to its condition prior to the execution hereof. The COMMISSION shall not be required to refund to the COMPANY any portion of the payments made to the COMMISSION under this Agreement upon termination.

17. INSPECTIONS. The COMMISSION reserves the right to enter upon the Project Area at any time to conduct inspections of COMPANY's activities under this Agreement. The COMMISSION further reserves the right to inspect COMPANY's water withdrawal records during normal business hours.

18. ASSIGNABILITY. This Agreement shall extend to and be binding upon the parties' respective agents, successors and assigns. This Agreement may not be assigned by the COMPANY either in whole or in part without the prior written consent of the COMMISSION, which shall not be unreasonably withheld. If the COMPANY assigns this Agreement without the prior written consent of the COMMISSION, it shall terminate immediately. Notwithstanding the foregoing, the COMMISSION agrees that in the event COMPANY has a change in control of its parent corporation, through merger, transfer or otherwise, the foregoing prohibition of assignment shall not be triggered.

19. APPLICABLE LAW. This Agreement shall be governed by and interpreted and enforced in accordance with the laws of the Commonwealth of Pennsylvania (without regard to any conflict of law provisions) and the decisions of the Pennsylvania courts. The COMPANY consents to the jurisdiction of any court of the Commonwealth of Pennsylvania and any federal courts in Pennsylvania, waiving any claim or defense that such forum is not convenient or proper. The COMPANY agrees that any such court shall have in personam jurisdiction over it, and consents to service of process in any manner authorized by Pennsylvania law.

20. ENTIRE AGREEMENT. This Agreement constitutes the entire agreement between the parties. No modifications, alternations, changes, or waiver to this Agreement or any of its terms shall be valid or binding unless accomplished by a written amendment signed by both parties.

21. SEVERABILITY. In the event that one or more of the provisions of this Agreement shall be held to be in violation of or not enforceable because of any law, it is understood that said provisions shall be deemed modified to the extent necessary to comply with said law, or if such modification would be impracticable, shall be deemed deleted and none of the other rights or obligations in this Agreement shall be prejudiced or rendered unenforceable by reason thereof.

22. COMMISSION'S NAME. The COMPANY shall not use the COMMISSION's name in advertising, promotional materials or press releases without the prior written consent of the COMMISSION.

23. AUTHORITY TO SIGN. Each person executing this Agreement represents that the Party on whose behalf the person is executing the Agreement has duly authorized the execution of the Agreement and that such person is authorized to execute the Agreement on behalf of such Party.

24. EFFECTIVE DATE. This Agreement shall not be valid or enforceable against any Commonwealth party, including the COMMISSION, until it has been fully executed. Upon full execution, the COMMISSION will insert the date of the last signature as the Effective Date on page 1.

IN WITNESS WHEREOF, the parties hereto have signed on the lines below.

ATTEST:

COMMONWEALTH OF PA
PA FISH AND BOAT COMMISSION

Bert Beaman 4/7/11
Administrative Secretary (date)
(SEAL)

[Signature] 07 Apr 2011
Executive Director (date)

ATTEST:

WILLIAMS PRODUCTION
APPALACHIA LLC

Karen Sweeney 3/31/11
Title Assistant (date)
(SEAL)



Ron Deemwell 3/31/11
Title Director, Appalachia (date)

ATTEST:

WILLIAMS MARCELLUS
GATHERING LLC

Karen Sweeney 3/31/11
Title Assistant (date)
(SEAL)



Ron Deemwell 3/31/11
Title Director, Appalachia (date)

APPROVED AS TO FORM AND LEGALITY

Laurie E. Kepler 4/15/11
Chief/Assistant Counsel (date)
Pennsylvania Fish and Boat Commission

[Signature] 4/13/11
Deputy Attorney General (date)
Office of Attorney General

**Exhibit A
Project Plan**

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

This document provides detailed information concerning the configuration and installation of the water withdrawal and water conveyance system to be installed and utilized at Donegal Lake in support of natural gas well development activities by Williams Production Appalachia LLC and Williams Marcellus Gathering LLC (hereinafter collectively referred to as “Company”) in the area surrounding the lake.

The following figures have been attached to provide a graphical depiction (i.e., site mapping and equipment details) of the text provided herein:

- Figure 1: Intake, Monitoring, and Access Plan
- Figure 2: Donegal Lake Pipeline Alignment
- Figure 3: Donegal Lake Water Access Map
- Figure 4: Pump Details
- Figure 5: Erosion and Sedimentation Control Plan

The following attachments also provide further information pertaining to the water withdrawal equipment described herein:

- Attachment A: Intake Screen Requirements
- Attachment B: Equipment Specifications
 - Pump Specifications
 - Flowmeter Specifications
 - Variable Speed Drive Specifications
 - Lake Elevation Pressure Transducer Specifications
 - Streamflow Measurement Device Specifications
- Attachment C: Biosecurity Measures

Section I - Project Area

The Project Area is comprised of the following: Access Road, Electrical Corridor, Staging Area, Water Withdrawal Area, Monitoring Areas and Pipeline Corridor.

Exact locations of these areas are described in the following text and are depicted on Figure 1, Intake, Monitoring, and Access Plan and Figure 2, Donegal Lake Pipeline Alignment, attached. Figure 3, Donegal Lake Water Access Map, provides further details pertaining to the Water Withdrawal and Staging Areas described below.

Access Road – A corridor 14 feet in width from Donegal Lake Road to the Staging Area, Water Withdrawal Area and Pipeline Corridor over the most reasonable, shortest route through the Premises for use as a thoroughfare for vehicles, equipment, materials, and personnel. No other purpose or use is permitted. A gate with dual locks shall be installed at the point where the access road exits the Commission parking lot, as shown on the attached Figure 1.

Electrical Corridor – A corridor 20 feet in width from the existing Allegheny Power utility pole #45607 to the Staging area over the most reasonable, shortest route through the Premises for use in the installation and operation of an overhead electric line to be used for the provision of electricity to the Donegal Lake withdrawal pumps.

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

Staging Area – An approximately 45 x 45 feet (not to exceed a total of 2,025 square feet) area, situated as shown on Figure 1 at the termination of the Access Road and Electrical Corridor noted above. The Staging Area maintains an approximate 185-foot setback distance from the edge of the water at normal pool (i.e., elevation of 1,460 feet above mean sea level). The use of the Staging Area is expressly limited to the placement, storage, operation, and maintenance of pumps and pump controls, pipes, generators, tanks, hoses, and materials and equipment related to Water Withdrawal activities authorized as part of the Site Plan.

The Pipeline Corridor described below shall travel through the Staging Area. In addition, a temporary building not exceeding 150 square feet shall be placed within the Staging Area for the purpose of housing the following within a secured and weather-proof location: 1) pipeline; 2) flow metering equipment; 3) electrical controls/control panel for the pumps; and 4) variable speed drives that will be used to regulate the speed at which the pump motors operate. Figure 3 depicts the location and dimensions (i.e., 12 x 12 feet) of the temporary building.

Water Withdrawal Area – The Water Withdrawal Area consists of three separate areas, as shown on Figure 1 and described as follows:

- 1) A 30-foot wide area extending from the shoreline of Donegal Lake to a distance of approximately 75 feet to the western limit of the Staging Area. This area shall be used for the placement of a manifold, pipeline, and an electrical conduit that will house pump cables. Within the portion of the lake shore where No. 3 aggregate will be placed to prevent erosion and sediment migration, the pipeline shall be anchored in place to prevent movement of the pipeline. In addition, a wooden post shall be installed immediately adjacent to the lake edge within this area to allow for the mounting of a pump motor lead junction box.
- 2) A 100 square foot area within the lake to place, anchor, operate and maintain a water intake (consisting of three [3] 15-inch diameter, 11-foot long submersible pumps, each to be placed within 24-inch diameter perforated protector pipe).
- 3) An 8-foot wide corridor within the lake to be used for the placement of three (3) 24-inch diameter pipelines, each of which will house a pump and pump discharge line.

Monitoring Areas – There shall be a total of two (2) monitoring areas associated with the project, described as follows:

1. Lake Elevation Monitoring Area: A 120 square foot area adjacent to the eastern side of the dam spillway shall be utilized for the placement, operation and maintenance of a pressure transducer that shall be used to monitor and report data on the water level within the lake (with respect to the dam spillway). The pressure transducer will be mounted on the spillway in a fixed location, and it shall be placed at a level that will ensure that it remains submerged at all times.
2. Streamflow Monitoring Area: A 120 square foot area adjacent to the eastern side of the Four Mile Run culvert used to convey the stream beneath Donegal Lake Road (Township Road 880/T-880) shall be utilized for the placement, operation and maintenance of flow metering equipment that will monitor and report flow volumes in the stream. Specifications and

EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement

installation details for the flow metering equipment that needs to be installed within the T-880 culvert will be provided to Donegal Township supervisors for their review and approval.

The remote data terminal box, which will provide automated data collection; remote data access (real-time and/or historic data); and on-site data readouts for streamflow in Four Mile Run and for the water level in Donegal Lake, will be placed and secured within the Streamflow Monitoring Area.

Data from the monitoring devices will be made available to and will be independently accessible by the Commission.

Pipeline Corridor – A corridor 15 feet in width extending from the intake location to the Staging Area and from the Staging Area to the property line of the Premises to be used for the placement, operation, maintenance, and removal of an overland water pipe to transport water from Donegal Lake to location(s) off the Premises.

The Project Area may be used 24 hours a day, seven days a week, except that during the first two weekends of trout season no construction or maintenance activity is permitted.

Section II – Site Plan

The following text provides details concerning site operations and the placement of equipment at the facility.

Pump specification, location, and installation

A total of three (3) identical submersible pumps will be installed within Donegal Lake. Pump specifications are provided in Attachment B. The pump model is an EPG Companies Inc. 95-5 SurePump that will operate at 50 horsepower and 460 volts. Each pump will have a maximum diameter of 15.25 inches (Note: Maximum pump diameter occurs at the location of the wheel mounts shown in the attached pump specification.), and will be approximately 11 feet in length. The pumps will be manufactured with an intake screen that exceeds the Commission's submerged intake screen mesh or opening size of 0.1 inches. Therefore, as described below, a sleeve will be inserted within the 24-inch diameter HDPE pipe that will be used to house each of the pumps and discharge lines. The installed intake sleeve will meet Commission's intake design requirements relative to mesh screen opening size and through-screen velocity.

Each of the submersible pumps will be placed at the base of the lake as close to the intake location shown on Figure 1 as is practicable. (Note: Latitude/longitude coordinates for where the pipe line intersects with the lake shore are as follows: latitude: 40°08'40.5712' N / longitude: -79°22'08.6694" W. The pumps will be installed within the lake at a location perpendicular to the lake shore from this intersection point.). As shown on the attached details, each pump will be installed within an approximately 200-foot length of 17 SDR 24-inch diameter high density polyethylene (HDPE) pipe (Note: The actual length of 24-inch diameter HDPE pipe installed within the lake will be field-determined based upon the distance from the lake shore at which the flat lake bottom is encountered. The 24-inch diameter HDPE protective pipe shall terminate where the lake bottom is encountered. As-built specifications for the protective pipe and pump installation will be provided to the Commission following installation). The 24-inch diameter HDPE pipe will be inserted in the lake at an angle that

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

parallels the angle of the lake bank and lake bottom. Based on historic lake bottom contour mapping obtained from the Commission, the pipe will descend into the lake at an approximately 4 to 6 degree angle.

Note: Where the 24-inch diameter protective pipe is less than 4 feet below the water surface of the lake, buoys or other markers will be placed within the lake to alert boaters and anglers.

The 24-inch diameter HDPE protector pipe described above will be perforated along the pipe terminus that is immediately adjacent to the lake bottom, as shown on the details in Figure 4 (Note: At the end of the pipe, the last 2 feet will be solid [not perforated] since the lake bottom is anticipated to be debris- and/or sediment-rich). The end of the pipe will be covered with a solid cap to prevent debris and/or sediment from entering the pipe.

Each of the pumps will be fitted with a 6-inch diameter 11 SDR HDPE discharge line. The pumps, which as shown in the specification included within Attachment B, are mounted on wheels, and can be inserted and/or removed from their respective 24-inch diameter HDPE pipelines using these mounted wheels. The 6-inch diameter discharge line will also be housed within the 24-inch diameter HDPE protective casing.

The three (3) 6-inch diameter HDPE pump discharge pipelines will converge to a 12-inch diameter manifold situated on the 12-foot wide bank stabilization area (#3 aggregate placement area as shown on Figure 3) at the eastern edge of the Water Withdrawal area. As shown in Figure 3, downgradient of the manifold, a 12-inch diameter adjustable ball valve will be installed inline within the 12-inch diameter HDPE carrier pipeline that will be used to convey water from the Water Withdrawal Area through the Staging Area and through the Commission's property. The area that includes the pipeline manifold and ball valves will be fenced and secured in order to prevent tampering.

A total of three (3) variable speed drives will be utilized to regulate the operation of each of the three (3) pump motors. Adjustments will be made depending upon the impoundment to which water withdrawn from the lake is being pumped. Specifications for the selected variable speed drive (Powerflex 400 AC) are included in Attachment B. Each unit will be sized in a manner consistent with "Frame E" described on the attached specification sheets (i.e., 23.19 inches high x 14.57 inches wide, and 10.24 inches deep).

In order to allow for the placement of these pumps within Donegal Lake, a Pennsylvania Department of Environmental Protection (PADEP) Chapter 105 general permit application for a GP-4, Intake and Outfall Structures, will be submitted for PADEP review and approval. The Company will assume all responsibility for the preparation and submittal of this application. Copies of the general permit application and of the PADEP approval letter will be provided to the Commission.

Intake device specifications

An intake sleeve will be placed and mounted within the approximately 20.5 foot-long perforated section of the 24-inch diameter HDPE protector pipe that shall meet the criteria specified in the Commission's document titled *Surface Water Intake Design Criteria to Reduce Aquatic Species Impacts* (dated June 4, 2009), included in Attachment A.

As specified in Attachment A, the through-screen velocity within the submerged intake will not exceed 0.5 feet/second, and the intake screen mesh size shall not exceed 0.1 inches. The 24-inch diameter

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

perforated pipe in which each pump shall be inserted (as described in the pump specifications below) shall deflect large debris and reduce debris clogging.

The calculated entrance velocity through the intake screen is as follows:

Initial assumptions:

- Maximum flow rate of one pump = 333.3 gallons per minute (gpm) or 0.7425 cubic feet per second (cfs)
- Select an entrance velocity equal to 0.45 feet per second (ft/s) based on the Commission's requirement that the entrance velocity must be < 0.5 ft/s.

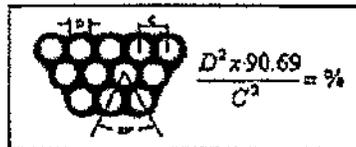
Therefore: Required open area for the intake screen = $Q/V = (0.7425 \text{ cfs}) / (0.45 \text{ ft/s}) = 1.648 \text{ ft}^2$

The intake screen will be fabricated in the stagger pattern shown in the figure below. The diameter of a singular hole will be 0.1 inch, and the distance between opening/hole centerlines will be 0.15 inch.

Pattern Layout & Open Area Calculation

Round - 60° Staggered Center
Conversion Table

- 0.1000 - Hole Diameter (D)
- 0.1500 - Center (C)
- 40.31 % - Open Area (OA)
- 51.32 - Holes per Square Inch (HPST)



Total intake screen area = required open area / % open area = $(1.648 \text{ ft}^2) / (40.31\%) = 4.088 \text{ ft}^2$

Area of one 0.1 inch diameter intake screen hole = $\pi * \text{radius}^2 (r^2)$

where $r = 0.05 \text{ inch} = 0.0042 \text{ ft}$

area = $\pi * (0.0042 \text{ ft})^2 = 0.000054 \text{ ft}^2$

Number of required intake screen openings = required open area / area of intake screen hole = $(4.088 \text{ ft}^2) / (0.000054 \text{ ft}^2) = 75,710 \text{ holes}$

Total required open area for riser pipe perforations = $75,710 \text{ holes} / 51.32 \text{ holes per square inch} = 1,476 \text{ in}^2 = 10.24 \text{ ft}^2$

Assume 12 inch x 2 inch rectangular slots will be cut into the 24 inch diameter protector pipe. The 12 inch length of each slot will be oriented parallel to the curve of the pipe. The area of one slot is 0.1667 ft^2 ; therefore, 62 slots will be required to provide the required total 10.24 ft^2 open area. Assume 2 inch spacing between individual slots. The individual slots and associated spacing will stretch 20.5 feet in length. Consequently, the intake screen length should be at least 20.5 feet long.

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

Summary:

Total number of perforations/slots in 24-inch diameter HDPE protector pipe: 62 slots
Dimensions of each slot: 12 inches long x 2 inches high
Total intake screen and perforated length: 20.5 feet (see screen dimensions in figure above)

Regular (i.e., scheduled) maintenance and inspection of the intake will not be necessary due to the redundancy that will be created by the presence of two (2) intake screens and the protective 24-inch HDPE pipe surrounding each of the pumps. If, at any time, impeded or diminished flow is noted within the system, the applicable pump assembly will be removed and inspected and cleared of debris by the Company.

Flowmeter

After passing through the pipe manifold and ball valve, flows will be conveyed to the Staging Area and through an in-line magnetic flow meter capable of measuring instantaneous flow rate (gallons per minute [gpm]) and total flow volume (gallons per day [gpd]). The collection of these measurements will ensure proper water withdrawal data collection and monitoring such that the instantaneous and daily maximum withdrawal rates described herein are not exceeded.

Specifications for the selected flowmeter, Magnetoflow® Mag Meter, are provided in Attachment B. The flow meter will be installed in-line within the 12-inch carrier pipeline where it passes through the temporary building to be installed within the Staging Area (shown on Figure 3). The flowmeter display panel will also be mounted within the temporary building.

In order to track total daily withdrawals from the lake, the Company will record total flow measurement readings at the conclusion of each day when withdrawals are occurring. In addition, instantaneous flow rates will be noted and recorded when water withdrawals are occurring in order to ensure that the Company remains in compliance with the instantaneous withdrawal limitations specified herein. Daily instantaneous and totalizer flow data will be automatically recorded by the flowmeter and downloaded by the Company for recordkeeping and DEP water reporting purposes.

Remote access to data collected by the flowmeter will be provided for via a data collection module that shall be installed on the pump control panel. A programmable logic controller will be used to 1) convert the data into a format that can be transmitted to remote users; and 2) make the data accessible remotely (via either a cellular or an internet connection).

Water withdrawal area

Shoreline disturbances due to the project will be minimal. The Company will place and maintain aggregate (No. 3) over the portion of the Water Withdrawal Area that is on the lake shoreline to a distance of 12 feet from the edge of water as shown on Figure 3. The portion of the Water Withdrawal Area that is situated on the lake shoreline will be utilized only for the placement, operation and maintenance of a pipe manifold, pump junction box, and the 12-inch HDPE carrier pipeline. Flows will be conveyed through the Water Withdrawal Area as shown on Figure 3.

In order to prevent tampering and/or damage to the pipe manifold and pump junction box described above, the Company shall install fencing around these appurtenances. The specifications of the fence

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

shall be provided to and approved by the Commission prior to installation. The fence will be installed and maintained at the Company's expense.

Staging area description and use

Within the Staging Area, a temporary/portable storage building, which will be painted an earth tone color so that it blends into the surrounding landscape, will be erected for the purpose of housing pump controls, flow metering equipment, and three (3) variable speed drives. As shown on Figure 3, the building will be less than or equal to 150 square feet. The building will be secured and will be considered the personal property of the Company. No more than five (5) gallons of fuel may be stored on the Staging Area.

Lake elevation and streamflow metering devices

Lake elevation

In order to ensure compliance with the water withdrawal parameters outlined in Section IV herein, the elevation of the water level within the lake will be monitored using a pressure transducer mounted on the lake spillway or dam breast at a fixed, known elevation (specifications for the selected pressure transducer, SDI-12 Submersible Level Transducer, Series 500 and Model 500, are included within Attachment B). The transducer shall be placed at a level such that it will remain fully submerged below the lake water surface at all times. Water level measurements will be automatically recorded every hour, and the transducer will be capable of providing data accurate to within 0.0625 inch.

The transducer shall be configured to send an alarm or notification to the Company when flow is occurring over the spillway and when the water level declines to a level that is 6 inches below the top of the spillway. These alarms will ensure that the Company maximizes opportunities to withdraw water from the lake and adheres to the water withdrawal parameters specified in Section IV.

In order to allow for remote access to the lake level data collected by the pressure transducer, the transducer cable will be routed via a below-ground conduit (no greater than an inch in diameter and buried no greater than 6 inches below the existing grade) from the spillway to the remote terminal (described below) that shall be installed within the Lake Elevation Monitoring Area. The proposed route of the cable conduit shall be presented to the Commission for approval prior to the initiation of installation activities.

Streamflow

A streamflow monitoring device shall be installed downgradient of the Donegal Lake outfall within the culvert that conveys Four Mile Run beneath Donegal Lake Road. Streamflow data that is collected will ensure that the Company adheres to the water withdrawal condition that prohibits withdrawals from the lake when streamflow is below 20 percent of the average daily stream flow.

Specifications and installation criteria for this streamflow measurement device (Starflow 6526E) are included in Attachment B. Streamflow measurements will be automatically recorded every hour. The flowmeter will be capable of providing velocity data accurate to within 2 percent, stream depth within 0.25 percent, and temperature to within 0.1°C.

In order to allow for remote access to the streamflow data collected by the flow meter, the meter will be connected to the remote data terminal described below.

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

Remote Data Terminal

Specifications for the 2011D Neon Metering Module – GSM are provided in Attachment B. As indicated, this module/data terminal will provide for automated data collection by both the pressure transducer and the streamflow meter, and will allow for remote access to real-time and/or historic data. The unit will also provide on-site access to real-time data collected by both monitoring instruments. The Neon Metering Module will utilize cell towers located proximal to the site to transmit the collected data, thereby allowing for remote data access by the Company and the Commission via multiple internet access points.

Pipeline specifications and locations

Pipeline specifications are described as follows: 11 SDR, 12-inch [outer] diameter HDPE.

Pipes will be placed in such a manner such that there is *no excavation* (provided that approval is received from the Pennsylvania Department of Environmental Protection [PADEP] to place the pipeline overland across the UNT-1 crossing) and so they do not inhibit or restrict public, wildlife and aquatic life ingress, egress, and/or regress. Since the pipelines will be installed above ground, in order to prevent freezing and rupturing, the pipelines will be evacuated via gravity drainage following withdrawal periods (particularly during periods of cold weather). Evacuated water will be discharged directly to Donegal Lake.

In order to prevent backflow or siphoning of water from the off-property water storage impoundments to Donegal Lake, the pipelines will be designed to terminate at the top of the berm and above the water level within each impoundment. Per PADEP design requirements, 2 feet of freeboard must be maintained within each of the water storage impoundments. Therefore, if the pipelines are designed to terminate at the top of the impoundment berm(s), there will be no potential for backflow from the impoundment(s) to Donegal Lake since the water level within the impoundment(s) will remain a minimum of 2 feet below the terminus of the pipeline.

The corridors are shown on the site plan diagram having GPS coordinates as follows:

- Starting location: Latitude: 40°08'40.5734" Longitude: -79°22'08.6659"

- Each turning point of the pipeline on Commission property:
 - 1. Turn 1: Latitude: 40°08'40.6587" Longitude: -79°22'06.0060"
 - 2. Turn 2: Latitude: 40°08'39.1880" Longitude: -79°22'05.3323"
 - 3. Turn 3: Latitude: 40°08'35.2377" Longitude: -79°22'03.4928"
 - 4. Turn 4: Latitude: 40°08'29.3494" Longitude: -79°22'01.4556"

- Exit from Commission property: Latitude: 40°08'31.1891" Longitude: -79°21'56.4643"

The Commission will be granted access to inspect all pipelines located on and off its property. In the event that the Commission wishes to inspect off-property pipelines, such inspections must be coordinated with the Company to ensure proper property owner notification and coordination, as applicable.

EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement

Electrical locations and specifications

There is an existing Allegheny Power-operated, West Penn System pole (Pole # 45607) within the smaller of the two parking areas situated to the northwest of the lake near the spillway, as shown on Figure 1. An application for new electrical service at this pole, for the installation of a three-phase power converter (the existing line is single-phase), and for an extension of the existing overhead power line from Pole # 45607 to the Staging Area is being coordinated by the Company. The electrical service will be utilized to provide power for the operation of the pumps, metering equipment, and temporary building.

The approximate proposed configuration of the extended electrical line and its associated corridor/right-of-way is shown on the attached figures. Detailed specifications for the overhead line extension will be provided to the Commission when the final design has been determined by Allegheny Power, including pole spacing; pole height(s); and electrical corridor configuration, length, and location. A three-phase convertor box for will also be installed.

The Company will be responsible for applying for the electrical connection and coordinating with Allegheny Power to complete the installation of the electric line extension. The Company will be responsible for all costs associated with the application for electrical service and for all costs associated with purchasing and installing the appurtenances needed to supply electrical service for the withdrawal. Additionally, as an Allegheny Power customer, the Company will be directly billed for all of its electrical usage at Donegal Lake for the duration of the Donegal Lake water withdrawal project. The Commission will not be held responsible for any portion of the Company's electrical expenses that are incurred during this withdrawal project.

Aquatic Invasive Species (AIS) plan and adherence to bio-security protocols

Aquatic invasive species (AIS) (also referred to as aquatic nuisance species [ANS]) are aquatic animals and plants that have been introduced into waterways in which they do not live naturally. They have harmful effects on the natural resources in these ecosystems and on the human uses of these resources. In order to prevent the introduction of AIS, all equipment used on this project will be new in nature or will be disinfected in accordance with Commission-approved bio-security protocols provided in Attachment C hereto. Equipment used for this project will be dedicated to the project for its duration. As such, disinfection of the equipment is not anticipated to be necessary.

Pollution prevention controls

Minor (< 1 acre) earth disturbance activities will be completed in order to construct the 14-foot wide site access road shown on the attached figures and to erect the temporary site building depicted on Figure 3. The areas where the access road will be installed and where the temporary storage building will be placed will require some clearing/grubbing and grading work.

Specifically, as shown on Figure 5, Erosion and Sedimentation Control Plan, fill will need to be placed on the eastern side of the access road in order to reach the proposed grade, and a minor amount of excavation will need to be completed in order to reach the proposed grade on the western side of the road. In addition, a minor amount of grading will be required in order to create a level ground surface on which the temporary building can be staged.

PADEP approval will be required for a minor road crossing (via a culvert placed within the stream channel) and utility line (overhead electric) stream crossing of UNT-8, as shown on Figure 1. Approval of

EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement

these crossings will be applied for using the following PADEP Chapter 105 General Permits: GP-5, Utility Line Stream Crossing; and GP-7, Minor Road Crossing. PADEP approval will also be required for a utility line (water pipeline) stream crossing of UNT-1, as shown on Figure 2. Approval of this crossing will be applied for using the PADEP Chapter 105 General Permit GP-5, Utility Line Stream Crossing. Every effort will be made to secure PADEP approval to cross UNT-1 via overland pipe placement (in lieu of boring beneath the stream – note that boring is typically required for the installation of pipeline across small streams/tributaries that do not have a FEMA-delineated floodplain/floodway). The Commission will provide assistance to the Company and its consultant(s) to obtain PADEP for permission to cross the stream in this manner.

The general permit applications described above will include details concerning these proposed stream crossings, and copies of the applications and PADEP approval letters will be provided to the Commission. The Company will be responsible for all associated engineering costs associated with the preparation and submittal of these general permit applications.

As depicted on Figure 5, filter sock will be installed downgradient of the proposed disturbance areas (i.e., access road and portion of the Staging Area that will be graded and used to house the temporary storage building) prior to the start of construction activities. The filter sock will prevent potential sediment migration into Donegal Lake and/or the Donegal Lake 100-year FEMA floodplain that could occur prior to the establishment of vegetation on disturbed surfaces. All disturbed surfaces that are not otherwise emplaced with road aggregate or used to house the temporary building will be re-vegetated and stabilized as soon as is practicable following the completion of grading activities. Re-vegetation will be completed in accordance with the Site Restoration criteria described within Section III herein.

No earth disturbance (excavation) activities will be completed within the Electrical Corridor. This corridor will be cleared of vegetation (but not grubbed); therefore, no additional erosion and sedimentation controls will be required for this installation. Filter sock that will be installed as shown on Figure 5 downgradient of the access road and Staging Area will provide adequate erosion and sedimentation control for any sediment run-off associated with installation activities within the Electrical Corridor.

Section III – Habitat and Riparian Buffer Requirements

Habitat protection and enhancement play an important support role in fisheries management, and a focal point for protecting and enhancing aquatic habitats is riparian buffers. A riparian buffer is a zone of trees and vegetation between water and an upland area.

Existing riparian buffers will be protected and encouraged to develop naturally with a minimum of disturbance. Riparian buffers may be established by simply allowing an area to grow naturally, allowing natural succession to determine vegetative composition, or can be accelerated with plantings of native shrubs and/or trees.

Buffer Composition: A forested buffer provides the most benefits and should be promoted whenever possible. However, a native shrub and/or grass community is also acceptable if it is a more amenable land use. Native vegetation should always be selected while the use of exotics and ornamentals is prohibited.

EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement

Buffer Width: The width of the buffer area can be very subjective depending upon the use of the site. Forested buffers and areas of limited use should be a minimum of 35 feet wide, measured from the top of the bank or shoreline. On areas that have been routinely mowed for aesthetic reasons, a minimum five-foot strip of denser vegetation should be established along the top of the bank.

Buffer Maintenance: Riparian buffer areas should be allowed to grow naturally and with a minimum of disturbance. Any removal of noxious plant species and exotics should be done mechanically whenever possible. If chemicals are to be considered, they should be applied to specific target plants and they need to be approved for use near water by the Fish and Boat Commission. They also need to be used in accordance with label instructions and conform to all Federal, State and Local regulations.

Grass buffers in more manicured areas can be maintained by occasional weed eating, but should remain considerably denser and higher than the adjacent mowed lawn.

Larger woody debris found along the shoreline or elsewhere in the riparian zone should be left as habitat for aquatic and terrestrial animals, unless it is causing property damage or posing a public health or environmental safety hazard.

Site Restoration

The Company agrees to stabilize, maintain and grade the Project Area as necessary or as directed by the Commission to minimize erosion and adverse impacts on the public use of, and aquatic resources on, the Premises resulting from the Company's use of the Project Area or storm water runoff.

All raw and exposed earth impacted areas are to be seeded with a per acre mixture of 12 lbs Annual Rye Grass, 8 lbs Perennial Rye Grass, 6 lbs Virginia Wild Rye, 4 lbs White Dutch Clover, 4 lbs Switchgrass and 4 lbs Little Bluestem. Areas should be treated with lime and fertilizer if they are 50 feet or more from the edge of the lake or 30 feet from any drainage course or wetland consistent with the Pennsylvania Department of Transportation 408 Specification publication for seeding formula E. All seeded areas must be mulched with hay or straw at the time of seeding and all at risk, exposed, earth areas will be covered immediately until they can be treated and seeded. Two inches of topsoil will be used where needed or where directed by the Commission. The Commission has the right to change the components of the seed mix as needed to reflect species that may be more appropriate to the region or habitat being impacted. This obligation will survive the termination of the Agreement and will remain in place until the site has been restored and there is a 70% rooting of the seed.

Trees having a commercial or habitat value that are killed or damaged by the Company's actions will be replaced using reasonably sized replacement stock and site preparation. Trees and shrubs will be replaced in kind or from an approved list provided by the Commission as soon as reasonably possible as determined by the Commission. In the event of public complaints concerning the aesthetics or noise of operations allowed herein, the Commission may require the Company to place vegetative screening to minimize the visibility or noise of Water Withdrawal operations authorized hereunder as directed by the Commission. The vegetative screening will consist of pockets of trees and shrubs not exceeding 200 square feet spaced to minimize visibility of or noise from operations authorized hereunder. This restoration obligation will remain in place until the replacement stock is established and remains healthy for one year.

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

Approved shrub/tree list - White Pine, Pitch Pine, Virginia Pine (south of route 80) and Red Pine (north of route 80), Staghorn Sumac, Smooth Sumac, Red and Black Chokeberry, New Jersey Tea, Flowering Dogwood, Virginia Creeper, Blackberry, Blackgum, Ninebark, Choke Cherry, American Elderberry, Steeple Bush, Highbush Blueberry, Muscle Wood, Nanny Berry, Northern Arrowwood, Cockspur Hawthorn and Scrub Oak or their equivalent with prior approval. These plantings will be secured or protected from browsing herbivores.

Section IV - Water Withdrawal Parameters

The Company agrees to adhere to the more conservative or restrictive water withdrawal rates as described in this approved Project Plan or the approved DEP Water Management Plan. The following seasonal withdrawal restrictions apply under this Project Plan.

Seasonal Withdrawal Restrictions

Period of the year: March 15-May 14
 July 1-October 15

In a time of excess flow at Donegal Lake, as defined as visible and distinguishable flow of water over the spillway, and when there is a flow through the culvert under the Township Road immediately below the dam of 1.06 mgd (million gallons per day) (736 g/m [gallons per minute]), that is equal to or greater than 20 percent of the average daily flow (5.31 mgd) for Fourmile Run at the outlet of Donegal Lake, a water withdrawal rate of 1.4 mgd may be maintained and a maximum instantaneous withdrawal rate of 1,000 gpm will be permitted.

In the event the flow of water over the spillway ceases, the Company shall immediately cease withdrawing water at the aforesaid rate and abide by the hereinafter stated guidelines. The 20 percent average daily flow volumes were determined and provided by ARM Group Inc., working on behalf of the Company, and are in agreement with flow calculations provided by the Pennsylvania Department of Environmental Protection (PADEP). The Company agrees that in the event any of the flow figures are determined to be inaccurate, the aforesaid water withdrawal allowances shall be suspended until revised correct figures are ascertained by the Commission.

In a time of low flow at Donegal Lake when there is no distinguishable water flow over the spillway down to a lake elevation of six inches below the top of the spillway, hereinafter called Withdrawal Limit, the Premises can accommodate a water withdrawal rate of up to 172,800 gallons in a 24 hour calendar pumping day during the periods of time specified above. The maximum allowable instantaneous pumping rate shall be 330 gpm.

In the event the water elevation of the lake equals or falls below the Withdrawal Limit, the COMPANY shall cease all water withdrawal immediately. Under no circumstance may water be withdrawn when the lake level falls below the Withdrawal Limit.

Period of the year: October 16-March 14
 May 15-June 30

**EXHIBIT A – Project Plan
Donegal Lake Water Access Agreement**

Due to special considerations relative to herptiles during the period of time from October 16 through March 14, and due to a spawning period that occurs from May 15 through June 30, the COMPANY may only withdraw water when there is water flowing over the spillway. A water withdrawal rate of 1.4 mgd may be maintained under this condition, and a maximum instantaneous withdraw rate of 1,000 g/m will be permitted.

Water cannot be withdrawn when the lake level falls below the Withdrawal Limit, when disallowed by the PADEP-approved Water Management Plan, or during any period that the Commission is required to repair, perform maintenance or upgrade the dam. The Commission will make a reasonable effort to limit such times of dam repair, maintenance, and/or upgrading.

During the first weekend of trout season (the first Saturday and Sunday after April 11th each year), the Company shall not withdraw any water unless the Commission grants the Company written permission to withdraw water.

Recycling Requirement

The Company will recycle at least 90%, with a goal of 100%, of the flow back water attributable to drilling operations for water withdrawn from Donegal Lake in accordance with current industry tolerances, standards and best management practices. Flow back water that has been recycled beyond its useful life or is no longer needed for operations will be shipped to a licensed waste water disposal facility that is permitted by the Pennsylvania Department of Environmental Protection (DEP) and will be treated and discharged per DEP regulations and the receiving facility's permit.

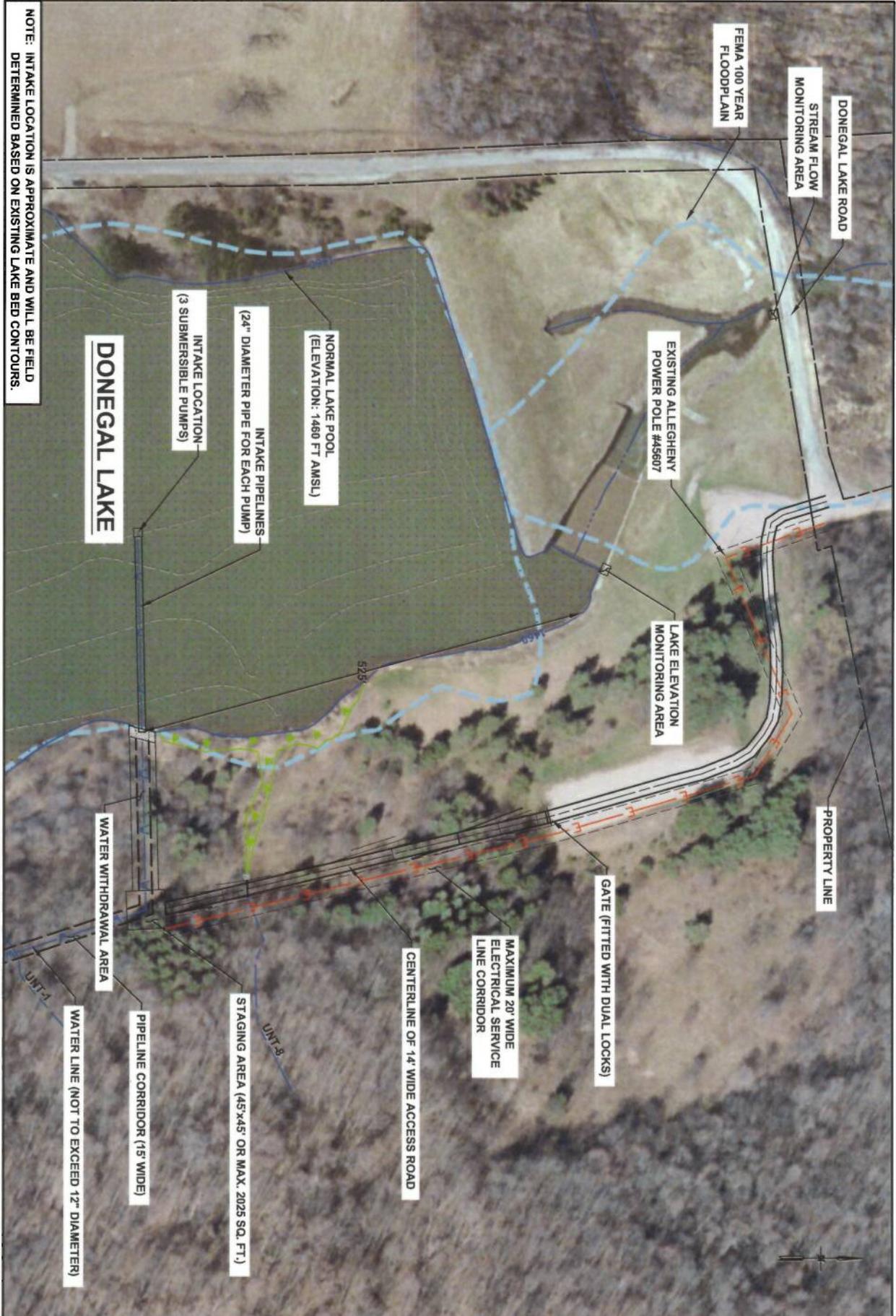
General Criteria

The Commission may grant the Company written permission to withdraw water at daily volumes that exceed the restrictions outlined above when it would be helpful to lower the level of Donegal Lake due to a biological need or when there is a need related to the Commission's maintenance, repair and operation of the dam.

The Company must utilize a flow meter, approved by DEP in conjunction with its water withdrawal operations, to document the following: amount of water withdrawn, withdrawal rates; and times and dates of water withdrawal/access. A written report of all water withdrawal activities must be provided to the Commission in accordance with DEP Water Management Plan reporting requirements. A monthly report will also be provided to the Commission to document the lake level on a daily basis.

The Company must place, operate and maintain monitoring equipment as provided for in the Water Withdrawal or Monitoring Areas of the Project Area in order to document Four Mile Run streamflow downgradient of the Donegal Lake outfall as well as lake levels on a daily basis and in real-time. Information from monitoring equipment is to be made available to the Commission upon request.

FIGURES



NOTE: INTAKE LOCATION IS APPROXIMATE AND WILL BE FIELD DETERMINED BASED ON EXISTING LAKE BED CONTOURS.

Figure 1

DONEGAL LAKE INTAKE, MONITORING, AND ACCESS PLAN

DONEGAL LAKE WITHDRAWAL
WILLIAMS PRODUCTION APPALACHIA LLC
WILLIAMS MARCKLIUS GATHERING LLC

DONEGAL TOWNSHIP
WESTMORELAND COUNTY, PENNSYLVANIA

Author	AMA/TMA	Scale	1" = 100'
Client	KAN	Date	FEBRUARY 2011
Drawn	JCK	Project	S09107-3-22

0 100 200 300

SCALE IN FEET



ARM Oil & Gas Solutions

Proven Results for the Oil & Gas Industry
2013 Sandy Drive, Suite 200 - State College, PA 16801
Ph: (814) 875-6660 Fax: (814) 875-6667

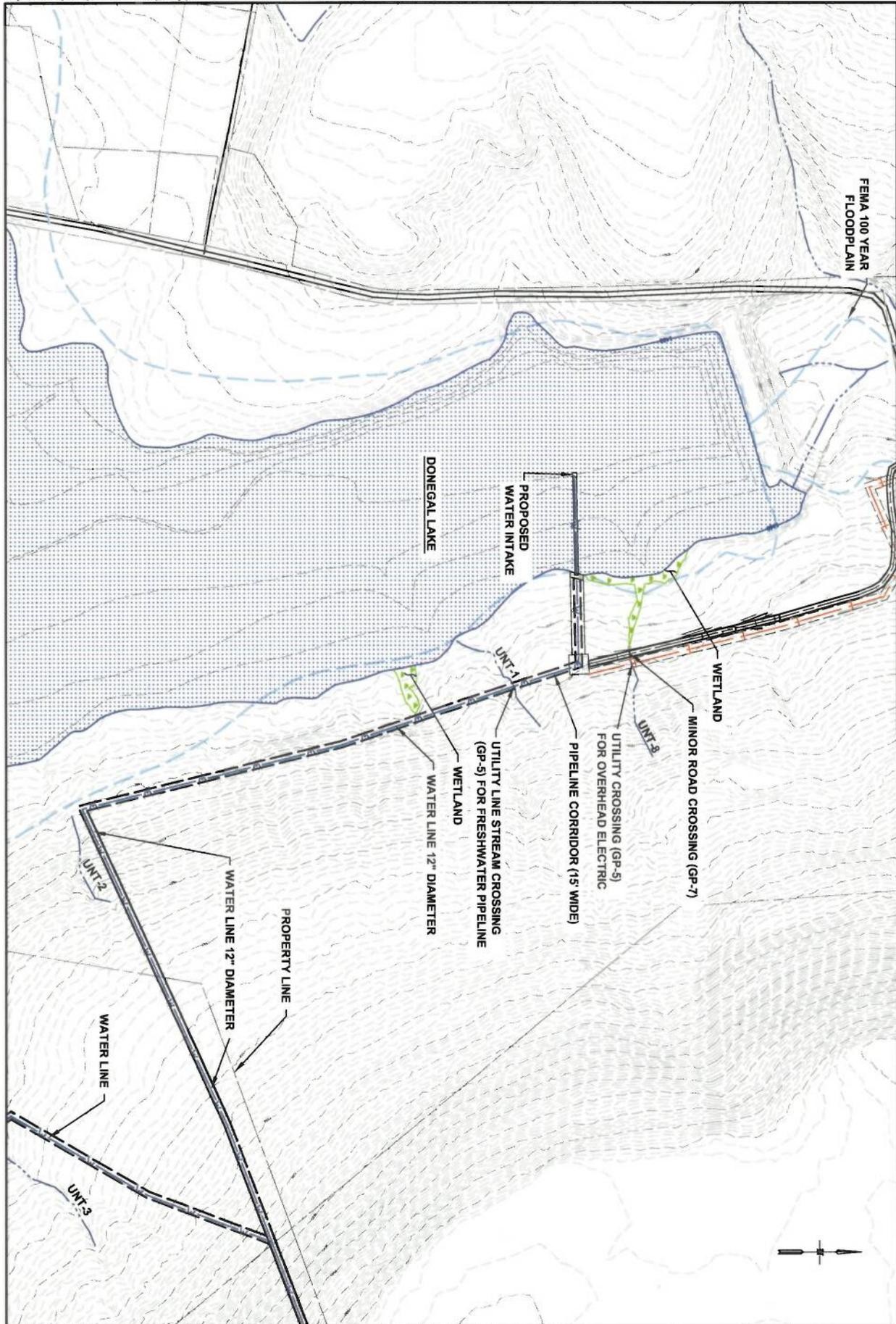


Figure 2
DONEGAL LAKE PIPELINE ALIGNMENT
 DONEGAL LAKE WITHDRAWAL
 WILLIAMS PRODUCTION APPALACHIA LLC
 WILLIAMS MARCELLUS GATHERING LLC
 DONEGAL TOWNSHIP
 WESTMORELAND COUNTY, PENNSYLVANIA

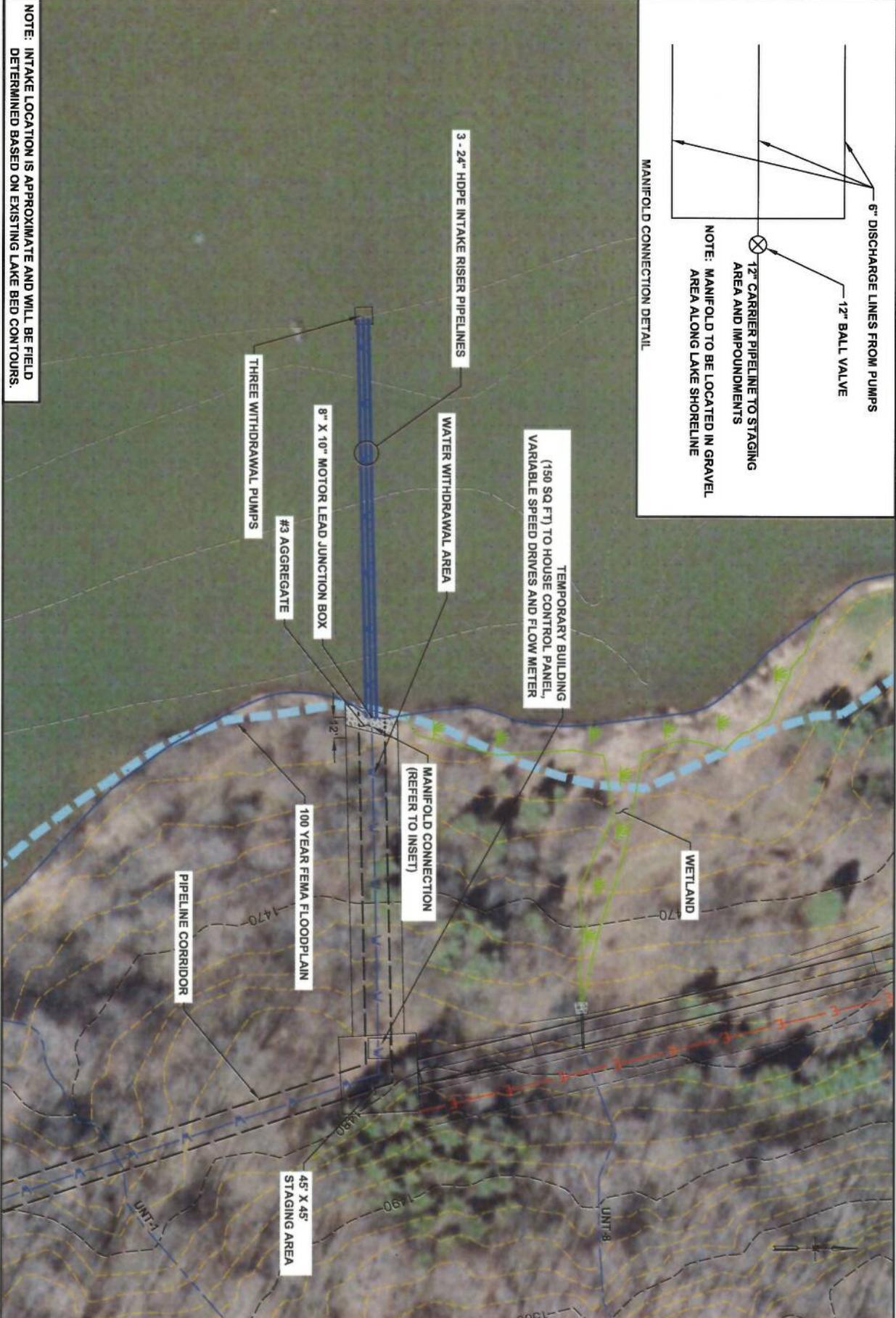
Author	AMA/TMA	Scale	1" = 200'
Checked	KAN	Date	FEBRUARY 2011
Drawn	JCK	Project	509107-3-22

0 200 400 600
 SCALE IN FEET



ARM Oil & Gas Solutions
 Proven Results for the Oil & Gas Industry
 2013 Steady Drive, Suite 200 - State College, PA 16803
 Ph: (814) 872-2460 Fax: (814) 872-0467

NOTE: INTAKE LOCATION IS APPROXIMATE AND WILL BE FIELD DETERMINED BASED ON EXISTING LAKE BED CONTOURS.



MANIFOLD CONNECTION DETAIL

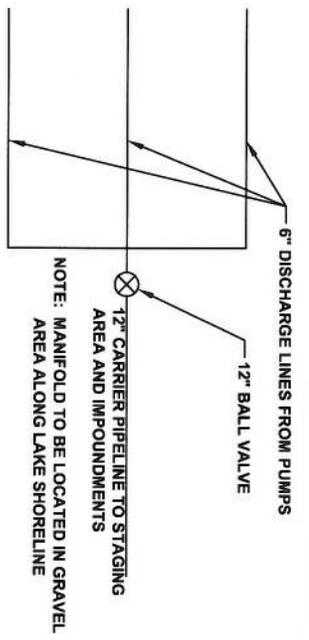


Figure 3

DONEGAL LAKE WATER ACCESS MAP

DONEGAL LAKE WITHDRAWAL
WILLIAMS PRODUCTION APPALACHIA LLC
WILLIAMS MARCELLUS GATHERING LLC

DONEGAL TOWNSHIP
WESTMORELAND COUNTY, PENNSYLVANIA

Author	AMA/TMA	Scale	1" = 50'
Checked	KAN	Date	FEBRUARY 2011
Drawn	JCK	Project No.	S09107-3-22

0 50 100 150

SCALE IN FEET

ARM Oil & Gas Solutions

Proven Results for the Oil & Gas Industry
2013 Steady Drive, Suite 200 - State College, PA 16801
Ph: (814) 372-9458 Fax: (814) 372-9467

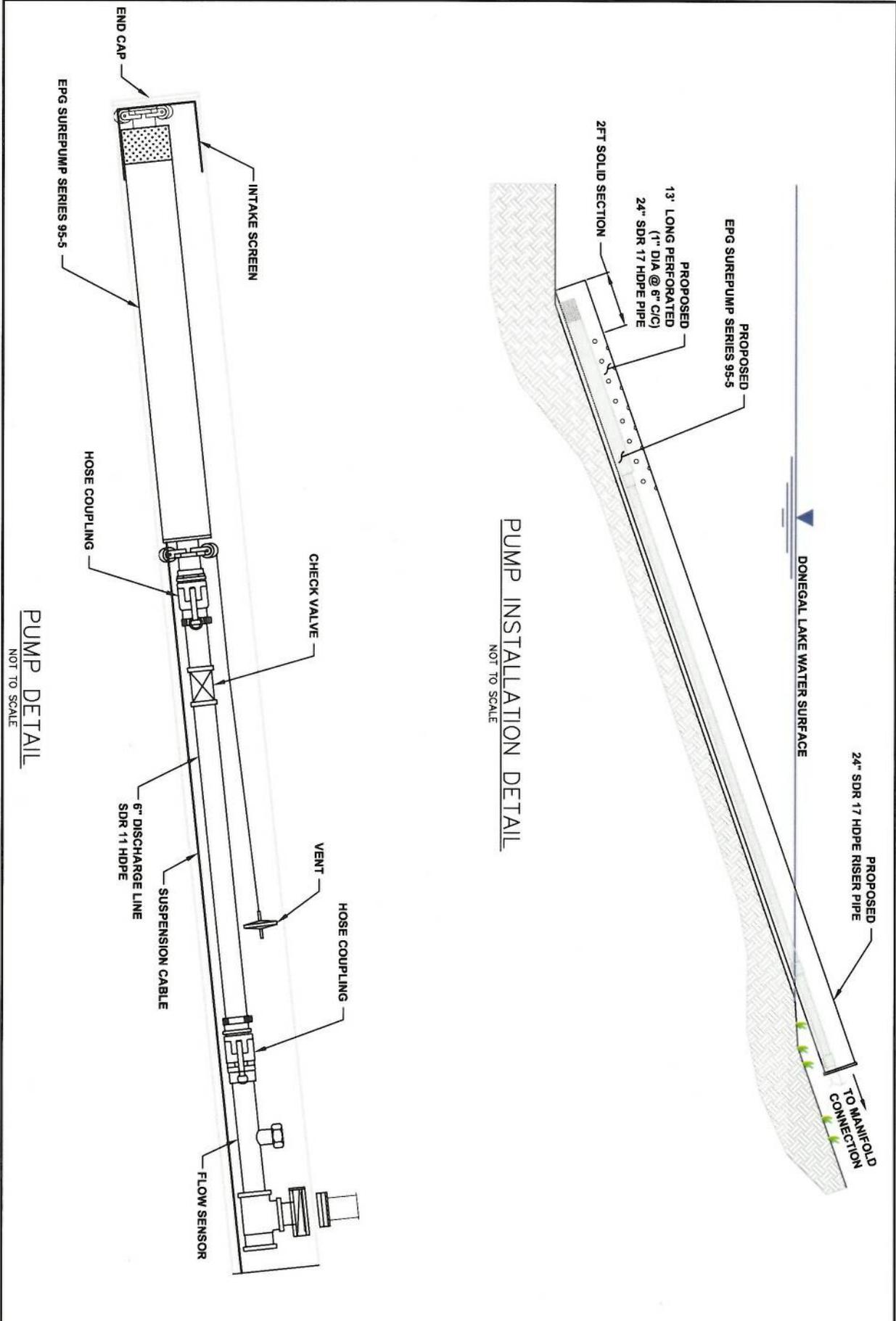
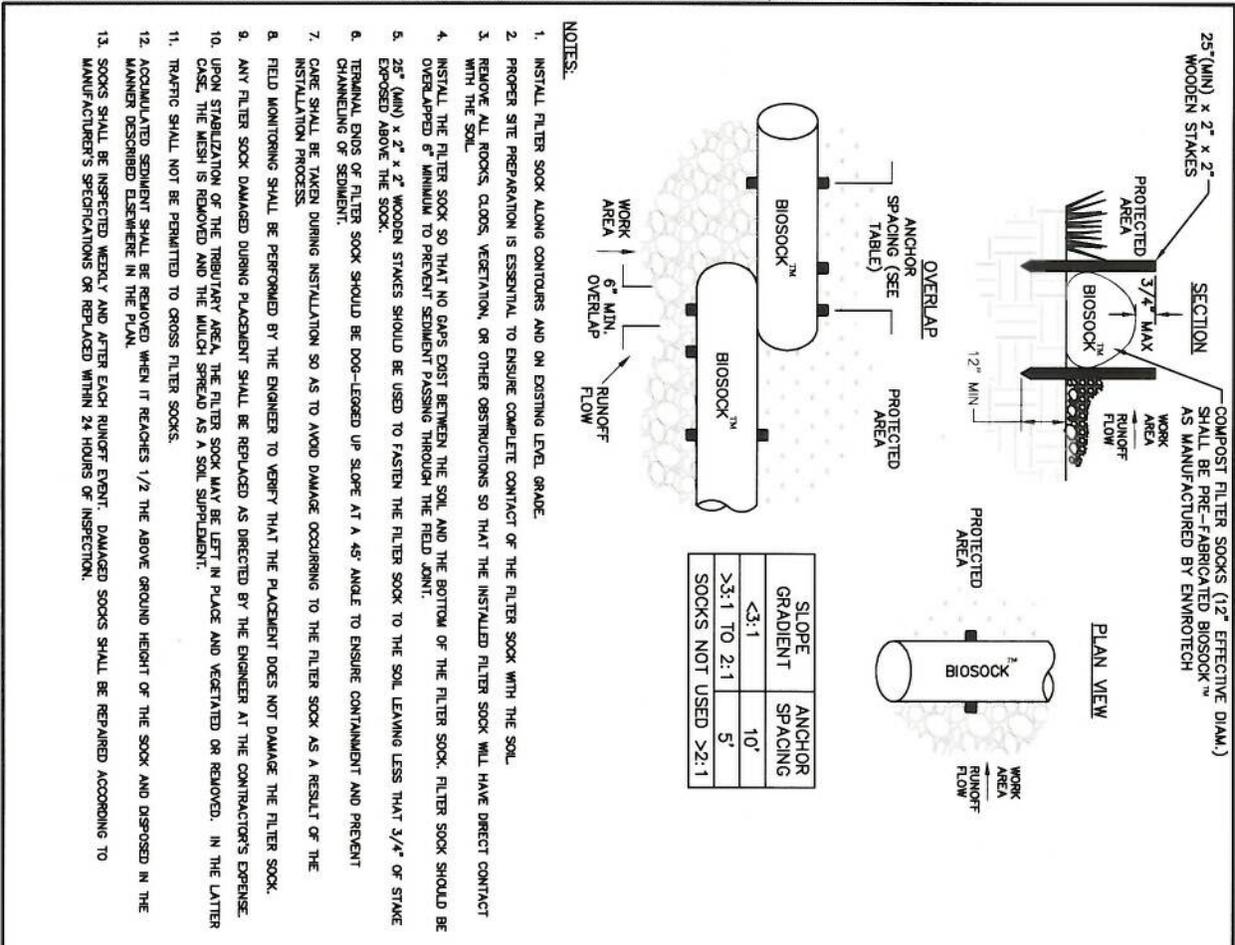
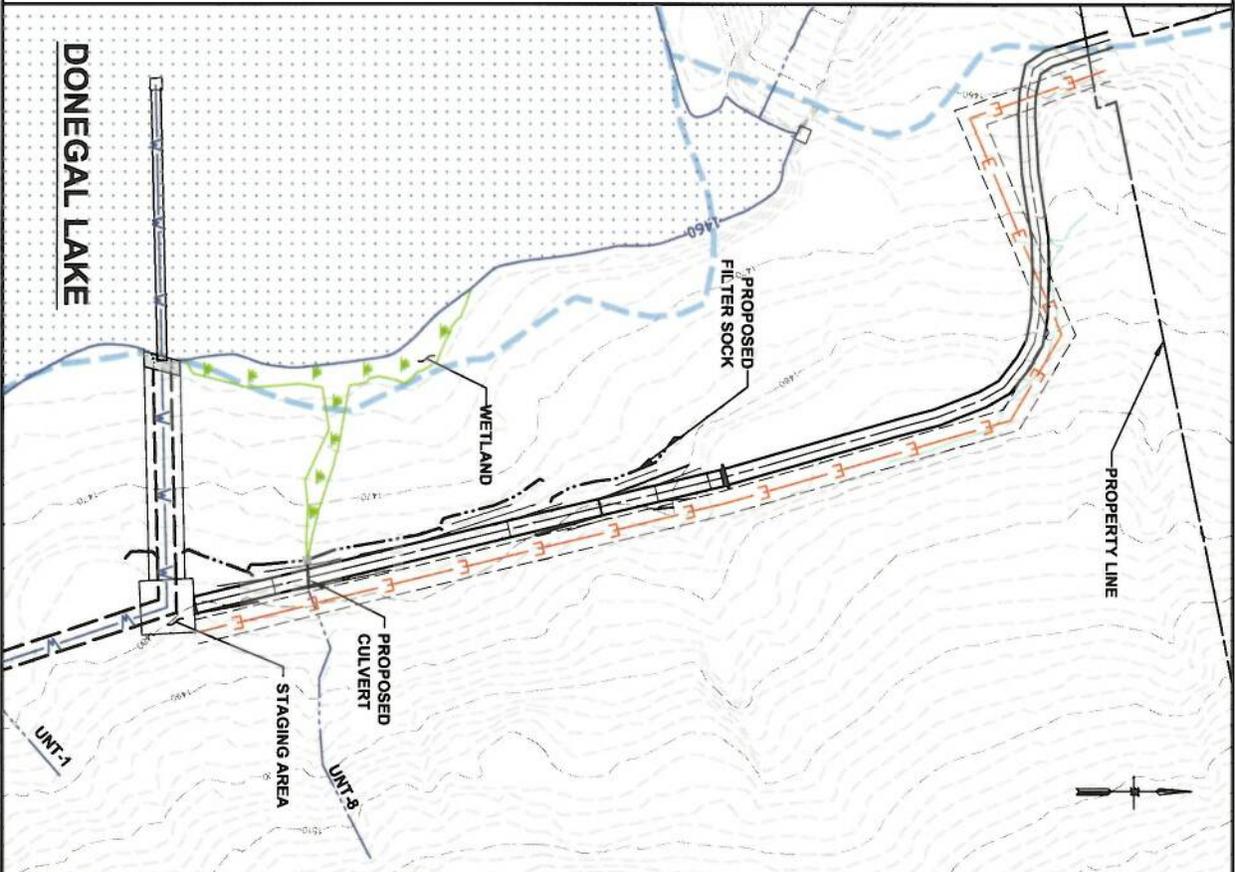


Figure 4 DONEGAL LAKE WITHDRAWAL WILLIAMS PRODUCTION APPALACHIA LLC WILLIAMS MARCELLUS GATHERING LLC	PUMP DETAILS	Design: AMA/TMA	Scale: AS NOTED
		Drawn: KAN	Date: FEBRUARY 2011
Donegal Township Westmoreland County, Pennsylvania		Review: BAA	Project no: S00107-3-22

ARM Oil & Gas Solutions
 Proven Results for the Oil & Gas Industry
 2015 Steady Drive, Suite 206 • State College, PA 16801
 Fax: (814) 272-0452 Fax: (814) 272-0407



- NOTES:**
1. INSTALL FILTER SOCK ALONG CONTOURS AND ON EXISTING LEVEL GRADE.
 2. PROPER SITE PREPARATION IS ESSENTIAL TO ENSURE COMPLETE CONTACT OF THE FILTER SOCK WITH THE SOIL.
 3. REMOVE ALL ROCKS, CLODS, VEGETATION, OR OTHER OBSTRUCTIONS SO THAT THE INSTALLED FILTER SOCK WILL HAVE DIRECT CONTACT WITH THE SOIL.
 4. INSTALL THE FILTER SOCK SO THAT NO GAPS EXIST BETWEEN THE SOIL AND THE BOTTOM OF THE FILTER SOCK. FILTER SOCK SHOULD BE OVERLAPPED 6" MINIMUM TO PREVENT SEDIMENT PASSING THROUGH THE FIELD JOINT.
 5. 25" (MIN) x 2" x 2" WOODEN STAKES SHOULD BE USED TO FASTEN THE FILTER SOCK TO THE SOIL LEAVING LESS THAN 3/4" OF STAKE EXPOSED ABOVE THE SOCK.
 6. TERMINAL ENDS OF FILTER SOCK SHOULD BE DOG-LEGGED UP SLOPE AT A 45° ANGLE TO ENSURE CONTAMINANT AND PREVENT CHANNELING OF SEDIMENT.
 7. CARE SHALL BE TAKEN DURING INSTALLATION SO AS TO AVOID DAMAGE OCCURRING TO THE FILTER SOCK AS A RESULT OF THE INSTALLATION PROCESS.
 8. FIELD MONITORING SHALL BE PERFORMED BY THE ENGINEER TO VERIFY THAT THE PLACEMENT DOES NOT DAMAGE THE FILTER SOCK.
 9. ANY FILTER SOCK DAMAGED DURING PLACEMENT SHALL BE REPLACED AS DIRECTED BY THE ENGINEER AT THE CONTRACTOR'S EXPENSE.
 10. UPON STABILIZATION OF THE TRIBUTARY AREA, THE FILTER SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH IS REMOVED AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.
 11. TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.
 12. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/2 THE ABOVE GROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.
 13. SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.



<p>Figure 5</p> <p>EROSION AND SEDIMENT CONTROL PLAN</p> <p>DONEGAL LAKE WETDRAWAL WILLIAMS PRODUCTION APPALACHIA LLC WILLIAMS MARCELLUS GATHERING LLC</p>	<p>DONEGAL TOWNSHIP WESTMORELAND COUNTY, PENNSYLVANIA</p>	<p>WMP</p>	<p>1" = 100'</p>
		<p>KAN</p>	<p>FEBRUARY 2011</p>
		<p>JCK</p>	<p>S09107-3-22</p>
		<p>0 100 200 300</p> <p>SCALE IN FEET</p>	
		<p>ARM Oil & Gas Solutions</p> <p>Proven Results for the Oil & Gas Industry 2013 Seelye Drive, Suite 205 • State College, PA 16803 Ph: (814) 872-6400 Fax: (814) 872-6407</p>	

ATTACHMENT A

INTAKE SCREEN REQUIREMENTS



**Pennsylvania Fish and Boat Commission Recommendations
Surface Water Intake Design Criteria to Reduce Aquatic Species Impacts**

6/4/09

I. Intake design specifications to minimize impingement and entrainment

- A. Minimizing impingement of aquatic organisms
 - 1. Through-screen velocity in a submerged or floating intake should be no more than 0.5 feet/second to minimize impingement of aquatic organisms.
 - 2. Through screen velocities of greater than 0.5 feet/second will be considered on a case-by-case basis when a detailed justification for a higher through-screen velocity is submitted and deemed appropriate.
- B. Minimizing entrainment of aquatic organisms
 - 1. Floating intake screen mesh size or opening size shall be no greater than 3/16 inches.
 - 2. Submerged intake screen mesh size or opening size shall be no greater than 0.1 inches.
 - 3. Mesh sizes or opening sizes greater than those listed above will be considered on a case-by-case basis when a detailed justification for an increased mesh-size or opening size is submitted and deemed appropriate.

II. Debris management

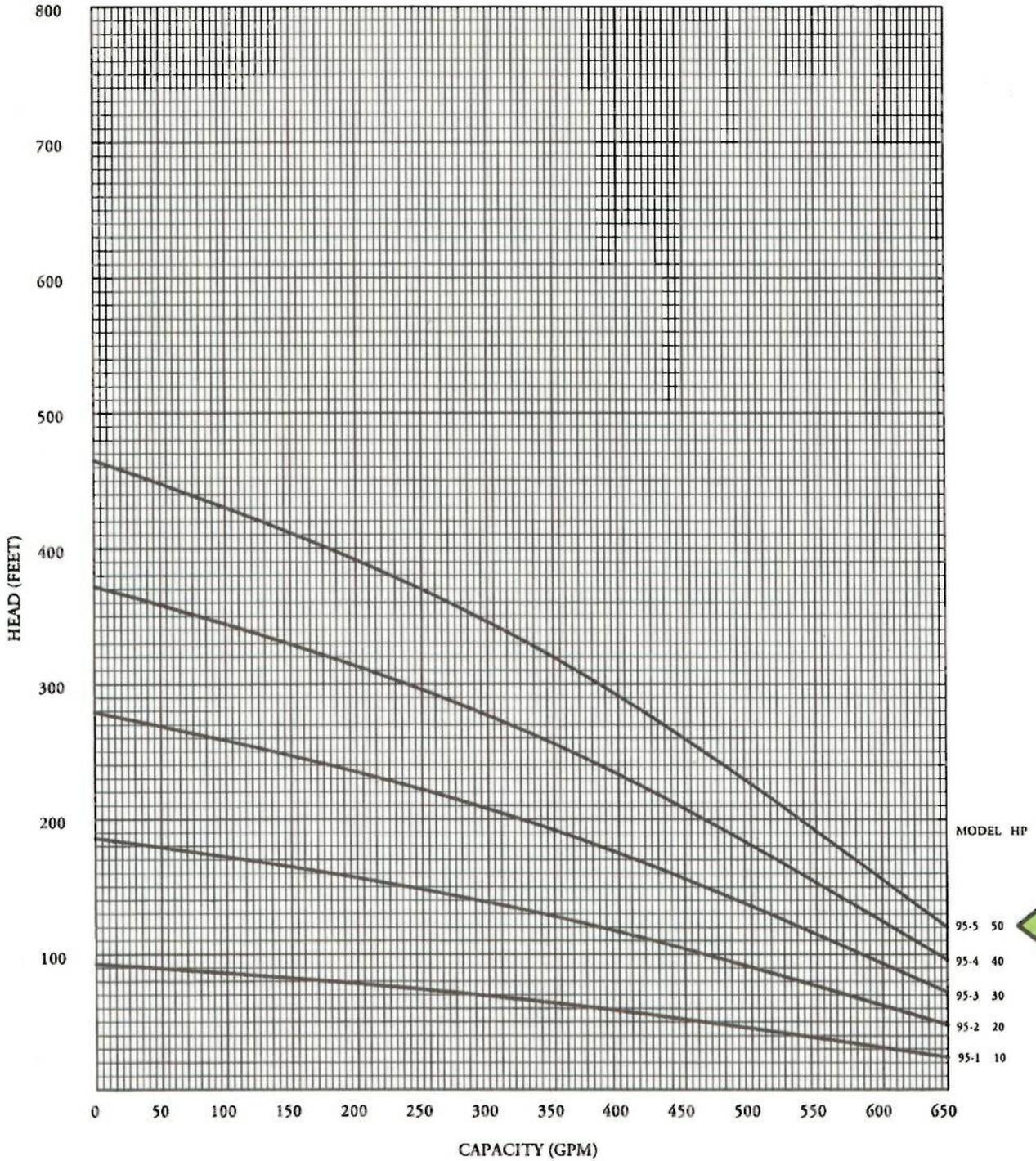
- A. An outer barrier, guard or trash rack is recommended to be placed around the intake to deflect large debris and reduce debris clogging.
- B. Maintenance and inspection of the intake, including debris cleaning, should be performed at intervals frequent enough to allow the design conditions to be met at all times.
- C. A maintenance plan that includes frequency of inspection and debris cleaning should be submitted for approval along with the submittal of intake design specifications.

ATTACHMENT B

EQUIPMENT SPECIFICATIONS

PUMP SPECIFICATIONS

SERIES 95 SurePump™
 Flow Range 95-680 GPM
 60 Hz



DATA SUBJECT TO CHANGE WITHOUT NOTICE

SERIES 95 SUMP DRAINER SELECTION GUIDE

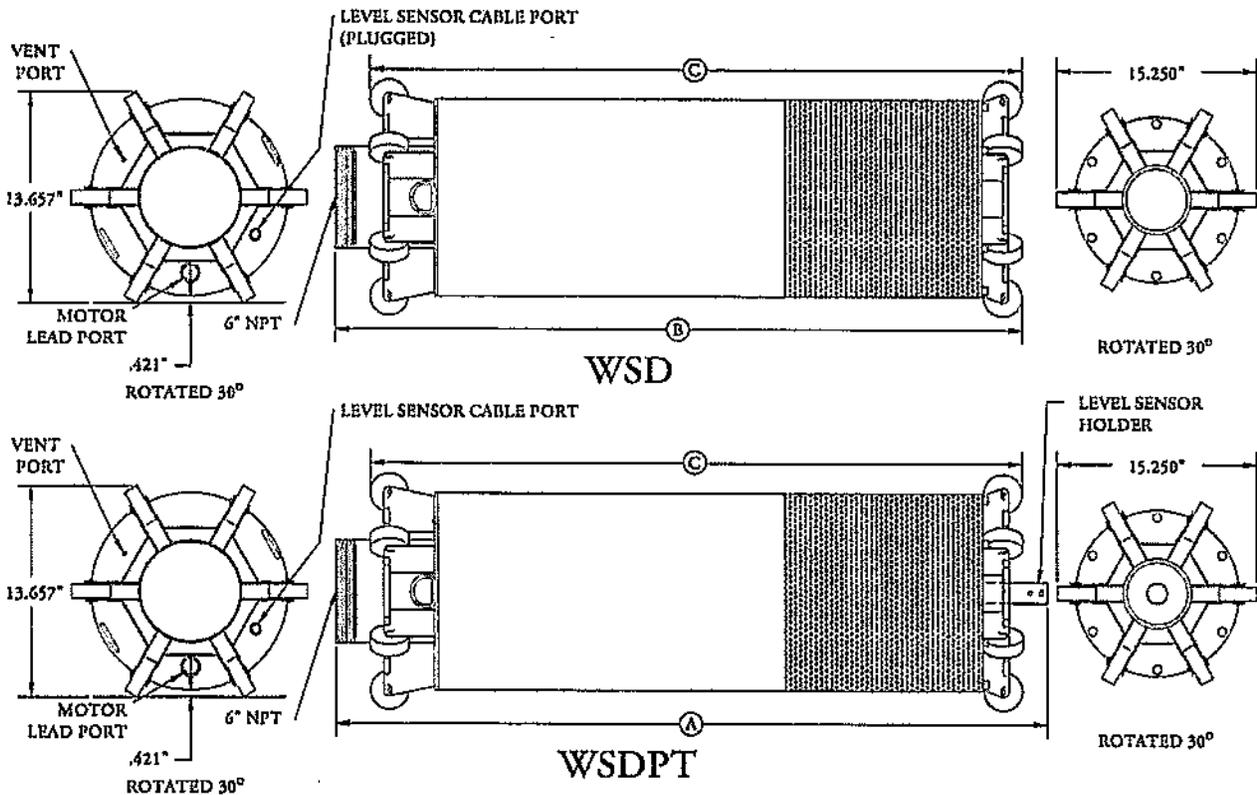
To select the appropriate sump drainer:

1. Select SINGLE or THREE PHASE, motor HORSEPOWER, and system supply VOLTAGE.
2. Determine the DISTANCE from the power supply to the pump.
3. Use the sump drainer size from the SUMP DRAINER column to find its respective dimensions on the following pages. MOTOR LEAD column shows minimum motor power cable size.

SINGLE PHASE MOTORS				
HORSEPOWER	VOLTAGE	DISTANCE FROM SERVICE ENTRANCE TO PUMP IN FEET	SUMP DRAINER	MOTOR LEAD
10.0	230	0 TO 125'	SIZE 12	8 GA
10.0	230	125' TO 225'	SIZE 12	6 GA

THREE PHASE MOTORS				
HORSEPOWER	VOLTAGE	DISTANCE FROM SERVICE ENTRANCE TO PUMP IN FEET	SUMP DRAINER	MOTOR LEAD
10.0	200	0 TO 120'	SIZE 12	10 GA
10.0	200	120' TO 205'	SIZE 12	8 GA
10.0	200	205' TO 330'	SIZE 12	6 GA
10.0	230	0 TO 150'	SIZE 12	10 GA
10.0	230	150' TO 280'	SIZE 12	8 GA
10.0	230	280' TO 440'	SIZE 12	6 GA
10.0	460	0 TO 450'	SIZE 12	12 GA
10.0	460	450' TO 710'	SIZE 12	10 GA
10.0	460	710' TO 1125'	SIZE 12	8 GA
10.0	460	1125' TO 1765'	SIZE 12	6 GA
20.0	200	0 TO 150'	SIZE 12	6 GA
20.0	230	0 TO 130'	SIZE 12	8 GA
20.0	230	130' TO 200'	SIZE 12	6 GA
20.0	460	0 TO 370'	SIZE 12	10 GA
20.0	460	370' TO 585'	SIZE 12	8 GA
20.0	460	585' TO 930'	SIZE 12	6 GA
30.0	460	0 TO 215'	SIZE 12	10 GA
30.0	460	215' TO 385'	SIZE 12	8 GA
30.0	460	385' TO 610'	SIZE 12	6 GA
40.0	460	0 TO 255'	SIZE 12	8 GA
40.0	460	255' TO 400'	SIZE 12	6 GA
50.0	460	0 TO 330'	SIZE 12	6 GA

SERIES 95 SIZE 12 WHEELED SUMP DRAINER



MODEL	HP	PHASE	A	B	C	*APPROX SHIPPING WEIGHT	
						WSD	WSDPT
95-1	10.00	1	87.12	86.17	83.03	429.05	434.05
95-1	10.00	3	81.92	80.97	78.73	390.84	395.84
95-2	20.00	3	92.22	91.27	89.03	453.03	458.03
95-3	30.00	3	102.42	101.47	99.23	512.98	517.98
95-4	40.00	3	112.62	111.67	109.43	580.92	585.92
95-5	50.00	3	133.02	132.07	129.83	736.82	741.82

NOTE: ALL DIMENSIONS ARE IN INCHES.

*SHIPPING WEIGHT INCLUDES
 WSD: CRATE, 50' OF 10-4 MOTOR LEAD, 50' OF 1/4" SS CABLE.
 WSDPT: CRATE, 50' OF 10-4 MOTOR LEAD, 50' OF 1/4" SS CABLE,
 LEVEL SENSOR AND CABLE.

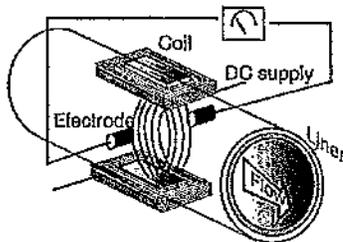
FLOWMETER SPECIFICATIONS

GENERAL

Badger's Magnetoflow line is the result of 35 years of research and field use in electromagnetic flow meters. Based on Faraday's law of induction, these meters can measure almost any liquid, slurry or paste that has a minimum of electrical conductivity. Designed, developed and manufactured under the strictest quality standards, the Magnetoflow meter ranks among the best in the market. Its sophisticated, processor based signal conversion represents the state of the art in the industry with accuracies of 0.25% or better. The wide selection of liner and electrode materials insures maximum compatibility and minimum maintenance over a long operating period.

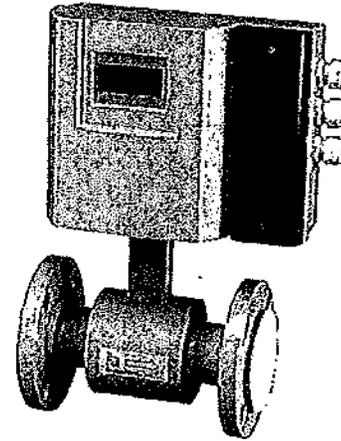
OPERATION

The flow meter is basically a stainless steel tube lined with a nonconductive material. Outside the tube two DC powered electromagnetic coils are positioned diametrically opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. When the coils are energized, a magnetic field is created across the whole diameter of the pipe. When a conductive fluid flows through this magnetic field, a voltage is induced across the electrodes. This voltage is directly proportional to the average flow velocity of the fluid and is picked up by the two electrodes. This induced voltage is then amplified and processed digitally by the converter to produce a very accurate analog or digital signal. The signal can then be used to indicate flow rate, totalization or to communicate to remote sensors and controllers. The main advantages of this technology are that with no parts in the flow stream, there is no pressure loss, the accuracy is not affected by temperature, pressure, viscosity, density or flow profile and with no moving parts there is practically no maintenance required.



APPLICATION

Because of its inherent advantages over other more conventional technologies, this meter can be used in the majority of industrial flow applications. Whether the fluid is water or something highly corrosive, very viscous, contains a moderate amount of solids or requires special handling, this meter will be able to accurately measure it. Today Magnetoflow meters are successfully being used in most industries including food and beverage, pharmaceutical, water and wastewater, and chemical.



Magnetoflow® Flanged

FEATURES

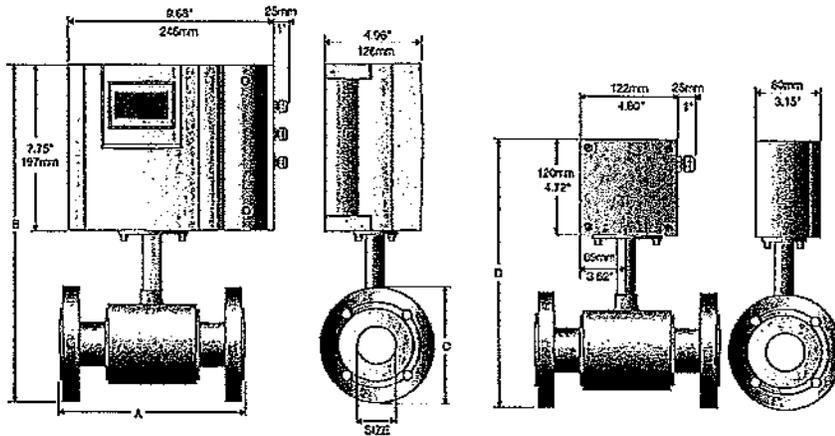
- 0.25% accuracy independent of fluid viscosity, density and temperature
- Unaffected by most solids contained in fluids
- Pulsed DC magnetic field for zero point stability
- No pressure loss for low operational costs
- Long life corrosion resistant liners
- Calibrated in state of the art facilities
- Integral and remote signal converter availability
- Optional grounding rings or grounding electrode
- Measurement largely independent of flow profile
- NSF listed

Electrodes

The two measuring electrodes, when looking from the end of the meter into the inside bore, are positioned at 3 o'clock and 9 o'clock. Badger Meter's Magnetoflow Mag meters have an "Empty Pipe Detection" feature. This is accomplished by the use of a third electrode that is positioned between 12 o'clock and 1 o'clock in the meter. At any time this electrode is not covered by fluid, (for a minimum of a five second duration), the meter will display an Empty Pipe Detection condition, send out an error message if desired, and stop measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

As an option to the use of a set of grounding rings, to assure proper grounding in a given installation a grounding electrode (4th electrode) can be installed in the meter when initially fabricated. The position of this electrode is about 6 o'clock.





Meter with Primo[®] Amplifier

Meter with junction box for remote Primo[®] Amplifier

Size	A		B		C		D		Est. Weight with Primo		Flow Range				
	inch	mm	inch	mm	inch	mm	inch	mm	Lbs	Kg	Min LPM	Max LPM	Min GPM	Max GPM	
1/4	6	6.7	170	14.0	358	3.5	89	11.4	288	12	5.5	0.063	20	0.02	5
5/16	8	6.7	170	14.0	358	3.5	89	11.4	288	12	5.5	0.114	34	0.03	9
3/8	10	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.177	53	0.05	14
1/2	15	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.416	125	0.11	33
3/4	20	6.7	170	14.2	361	3.9	99	11.5	293	15	6.5	0.75	225	0.2	59
1	25	8.9	225	14.4	366	4.3	108	11.7	298	20	9.0	1.20	350	0.3	83
1 1/4	32	8.9	225	15.2	386	4.6	117	12.6	318	22	10.0	2.00	575	0.5	152
1 1/2	40	8.9	225	15.4	390	5.0	127	12.7	322	23	10.5	3.00	900	0.8	239
2	50	8.9	225	15.9	403	6.0	152	13.2	335	28	12.5	4.70	1400	1	373
2 1/2	65	11.0	280	17.1	434	7.0	178	14.4	366	54	24.5	8	2400	2	631
3	80	11.0	280	17.3	440	7.5	191	14.7	372	58	26.5	12	3600	3	956
4	100	11.0	280	18.4	466	9.0	229	15.7	398	58	26.5	19	5600	5	1493
5	125	15.8	400	19.6	498	10.0	254	16.9	430	60	27.0	30	8800	8	2334
6	150	15.8	400	20.6	524	11.0	279	17.9	456	62	28.0	40	12700	11	3381
8	200	15.8	400	22.5	572	13.5	343	20.4	518	88	40.0	75	22800	20	5975
10	250	19.7	500	26.8	681	16.0	406	24.1	613	180	82.0	120	36300	30	9336
12	300	19.7	500	28.9	734	19.0	483	26.2	666	209	95.0	170	50800	45	13444
14	350	19.7	500	30.8	782	21.0	533	28.2	716	260	118	230	69200	60	18299
16	400	23.6	590	33.7	856	23.5	597	31.0	789	308	140	300	90400	80	23901
18	450	23.6	590	35.0	890	25.0	635	32.4	822	402	182	380	114000	100	30250
20	500	23.6	590	38.2	969	27.5	699	35.5	901	495	225	470	140000	125	37346
22	550	23.6	590	39.6	1005	29.5	749	36.9	937	525	238	570	170000	150	45188
24	600	23.6	590	42.2	1071	32.0	813	39.5	1003	554	252	680	200000	180	53778
28	700	23.6	590	48.2	1173	36.5	927	44.0	1118	850	295	920	275000	240	73100
30	750	31.5	800	48.3	1228	39.0	984	45.7	1161	764	320	1060	316000	280	84000
32	800	31.5	800	52.2	1325	41.4	1015	49.5	1257	770	350	1200	361000	320	95600
36	900	31.5	800	55.3	1405	45.0	1168	54.1	1374	850	386	1500	457000	400	121000
40	1000	31.5	800	60.0	1525	50.2	1280	57.4	1457	924	420	1900	565000	500	149300
42	1050	36.0	914	65.0	1675	53.0	1346	63.4	1610	1100	500	2100	620000	550	164600
46	1200	39.4	1000	69.9	1775	59.4	1455	67.2	1707	1210	560	2700	814000	720	216100
54	1400	39.4	1000	78.5	1956	68.4	1675	75.9	1927	1364	620	3700	1100000	980	292700

SPECIFICATIONS - Detector

Flow Range: 0.1 - 39.4 fps (0.03-12 m/s)
 Sizes: 1/4" to 54" (16 to 1400 mm)
 Min. Conductivity: ≥ 5 micromhos/cm
 Accuracy:
 ± 0.25% accuracy of rate from 1-39.4 fps.
 ± 0.5% accuracy of rate from 0.1-1.0 fps.
 Electrode Materials: Standard: Alloy C
 Optional: 316 Stainless Steel, Gold/Platinum
 Plated, Tantalum, Platinum/Rhodium
 Liner Material: PFA up to 3/8", PTFE 1/2" thru
 24", Soft and Hard Rubber from 1" to 54",
 Halar[®] from 14" to 40"
 NSF Listed: Models with Hard Rubber Liner 4"
 size and up; PTFE Liner - All sizes.

Only products bearing the NSF Mark are Certified.

Fluid Temperature:

With Remote Converter:
 PFA, PTFE & Halar 311°F, (165°C)
 Rubber 178°F, (80°C)
 With Meter Mounted Converter:
 PFA, PTFE & Halar 212°F, (100°C)
 Rubber 178°F, (80°C)
 Pressure Limits:
 150 psi (10Bar) optional 300psi (20Bar)
 Coil Power: Pulsed DC
 Ambient Temperature: -4°F to 140°F, (-20°C to 60°C)
 Pipe Spool Material: 316 Stainless Steel
 Meter Housing Material: Carbon Steel welded

Flanges: Carbon Steel - Standard (ANSI B16.5 Class

150 RF) 316 Stainless Steel - Optional
 Meter Enclosure Classification: Nema 4
 Optional: Submersible Nema 6P (Remote Amplifier
 Required)
 Junction Box Enclosure Protection:
 (For Remote Converter Option) Powder coated die-
 cast aluminum, Nema 4
 Cable Entries: 1/2" NPT Cord Grip
 Optional Stainless Steel Grounding Rings:
 Meter Size Thickness (of one ring)
 up thru 10" .135"
 12" to 20" .187"

Magnetoflow[®] and Primo[®] are registered trademarks of Badger Meter, Inc.
 Halar[®] is a registered trademark of Ausimont U.S.A., Inc.

Please see our website at
www.badgermeter.com
 for specific contacts.

Copyright © Badger Meter, Inc. 2006. All rights reserved.



BadgerMeter, Inc.

P.O. Box 245036, Milwaukee, WI 53224-9536
 Telephone: (414) 355-0400 / (877) 243-1010
 Fax: (414) 355-7499 / (866) 613-9305
www.badgermeter.com

©

Due to continuous research, product improvements and enhancements,
 Badger Meter reserves the right to change product or system specifications
 without notice, except to the extent an outstanding contractual obligation exists.

VARIABLE SPEED DRIVE SPECIFICATIONS

LISTEN.
THINK.
SOLVE.

PRODUCT PROFILE

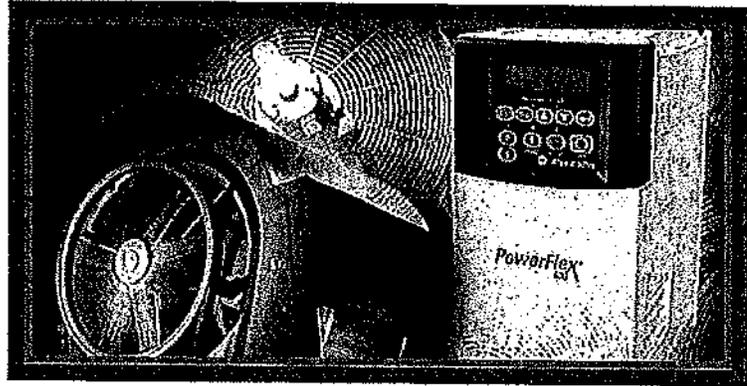
POWERFLEX® 400 AC DRIVE

AC DRIVE OPTIMIZED FOR COMMERCIAL FAN AND PUMP APPLICATIONS

Providing users with easy installation in mechanical fan and pump systems, the Allen-Bradley PowerFlex® 400 AC drive offers a wide range of built-in features allowing for seamless building system integration. Available in power ratings of 2.2-250 kW (3.0-350 Hp) @ 380 – 480V AC and 2.2-37 kW (3.0-50 Hp) @ 200 – 240V AC, the PowerFlex 400 AC Drive is designed to meet global OEM, contractor and end-user demands for flexibility, space savings and ease-of-use. The PowerFlex 400 AC drive is a cost-effective solution for speed control in variable torque fan and pump applications.

Features

- Integral PID Controller allows a process variable to be maintained by automatically adjusting the output frequency
- Three programmable Skip Frequencies and Bands prevent the drive from running continuously at resonant speeds which could cause mechanical breakdowns
- Selectable Fan/Pump Curves provide reduced voltage patterns for centrifugal fan and pump loads
- Sleep Function allows the drive to be cycled off when the system demand drops below a preset level and to be restarted automatically when the demand increases
- For applications that require unattended operation, the Start At PowerUp Function provides the ability to resume running once power is restored after a power outage
- Connection to fire and life safety systems via Freeze/Fire and Purge inputs
- Auxiliary Motor Control allows staging of additional line-started motors to meet system demand
- Damper Input can be used to disable the drive output until desired damper position is obtained, even with a valid run command



PowerFlex 400 AC Drive

Operator Keypad

- Integral keypad features 2 line, 16 character LCD display
- 5 LED indicators provide system configuration and fault status
- Configurable Hand/Off/Auto function buttons

Communications

- RS485 communications integral to base drive
- Embedded Modbus RTU, Metasys N2 and P1-Plant Floor Network protocols are parameter selectable and require no additional hardware or software
- Supports Drive Serial Interface (DSI) communication modules and accessories including DeviceNet™, EtherNet/IP™, ControlNet™, PROFIBUS™ DP, BACnet™, LonWorks™ and Bluetooth™ communications adapters
- DriveExplorer™ and DriveTools™ SP software can be used to easily program, monitor and control the drives

Premier Integration with PowerFlex Drives

For simplified AC drive start-up and reduced development time using the Allen-Bradley Logix control platform, we've integrated PowerFlex® AC drive configuration with RSLogix™ 5000 software. This single-software approach simplifies parameter and tag programming while still allowing stand-alone drive software tool use on the factory floor.

Packaging

- Installation flexibility is enhanced by the UL plenum rating allowing for direct mounting in an air handling system
- Disconnect and contactor bypass packages in NEMA 1, 12, 3R and 4 designs simplify installation and startup by combining operator interface, control, communications and power options in preconfigured assemblies
- Contactor bypass packages supplied with 3 - contactors allowing drive test functionality and drive isolation when in bypass mode
- Meets seismic requirements of the 2003 International Building Code as specified by AC156

SPECIFICATIONS

Standards	<ul style="list-style-type: none"> • UL and cUL (CSA) Listed • UL Plenum Rating • C-Tick 	<ul style="list-style-type: none"> • CE Marked • EMC EN61800-3 (with external filter) • Low Voltage EN60704-1/EN50178 			
Input Specification	3-Phase Voltage: 200-240 / 380-480V \pm 10% Frequency: 48-63 Hz Logic Control Ride Through: \geq 0.5 seconds, 2 seconds typical				
Output Specification	Voltage: Adjustable from 0V to rated motor voltage Frequency Range: 0 to 320 Hz Overload Current: 110% for 60 seconds and 150% for 3 seconds				
Electrical	Voltage Tolerance: 200-240V \pm 10% / 380-480V \pm 10% Frequency Tolerance: 48-63 Hz Input Phases: Three-phase input provides full rating. Single-phase operation provides 35% rated current. Displacement Power Factor: 0.93 across entire speed range Efficiency: 97.5% at rated Amps, nominal line voltage Maximum Short Circuit Rating: 100,000 Amps Symmetrical (Frame C Drives) / 200,000 Amps Symmetrical (Frame D-H Drives) Actual Short Circuit Rating: Determined by IEC Rating of installed fuse/circuit breaker Transistor Type: Isolated Gate Bipolar (IGBT) Internal DC Bus Choke: 200-240V AC Input: 11-37 kW (15-50 Hp) Panel Mount Drives 380-480V AC Input: 11-110 kW (15-150 Hp) Panel Mount Drives				
Enclosure and Ambient Operating Temperature	<ul style="list-style-type: none"> • Frame C IP20 / NEMA/UL Type Open: IP30 / NEMA/UL Type 1 (with conversion kit): NEMA 12 and NEMA 3R/4 • Frame D, E, F IP30 / NEMA/UL Type 1 (with conversion kit): NEMA 12 and NEMA 3R/4 • Frame G, H IP30 / NEMA/UL Type 1 (with conversion kit): 	<ul style="list-style-type: none"> -10 to 50°C (14 to 122°F) -10 to 45°C (14 to 113°F) -10 to 40°C (14 to 104°F) -10 to 45°C (14 to 113°F) -10 to 40°C (14 to 104°F) -10 to 45°C (14 to 113°F) 			
Control	<ul style="list-style-type: none"> • 7 Digital Inputs (24V sink/source) <ul style="list-style-type: none"> - 3 Semi-Programmable - 4 Programmable • 2 Programmable Form C Relay Outputs 	<ul style="list-style-type: none"> • 2 Analog Inputs <ul style="list-style-type: none"> - 1 Isolated (-10 to 10V or 4 to 20mA) - 1 Non-Isolated (0 to 10V or 4 to 20mA) • 2 Analog Outputs (0 to 10V or 4 to 20mA) <ul style="list-style-type: none"> • 1 Optocoupler Output 			
Options (Accessories)	<ul style="list-style-type: none"> • Communication: LonWorks®, DeviceNet®, EtherNet/IP®, PROFIBUS®, ControlNet®, BACnet®, Bluetooth® • EMC Line Filters • Line and Load Reactors 	<ul style="list-style-type: none"> • 6-output relay card (Frame D, E, F, G and H) • DSI Cables • IP30 Conversion/Conduit Kit (Frame C) 			
 Ratings	Input Voltage Class	Output Voltage Class	kW (Hp)	Cont. Output Current (Amps)	Frame
	200-240V, 3Ø	0-230V, 3Ø	2.2-7.5 (3-10)	12-33	C
	200-240V, 3Ø	0-230V, 3Ø	11-22 (15-30)	49-90	D
	200-240V, 3Ø	0-230V, 3Ø	30-37 (40-50)	120-145	E
	380-480V, 3Ø	0-460V, 3Ø	2.2-15 (3.0-20)	6-30	C
	380-480V, 3Ø	0-460V, 3Ø	18.5-30 (25-40)	38-60	D
	380-480V, 3Ø	0-460V, 3Ø	37-75 (50-100)	72-142	E
	380-480V, 3Ø	0-460V, 3Ø	90-110 (125-150)	170-208	F
	380-480V, 3Ø	0-460V, 3Ø	132-160 (200-350)	260-310	G
	380-480V, 3Ø	0-460V, 3Ø	200-250 (300-350)	370-460	H
Dimensions mm (in)	C Frame: 260 (10.2) H x 130 (5.1) W x 180 (7.1) D D Frame: 384 (15.12) H x 250 (9.84) W x 205.4 (8.08) D E Frame: 589 (23.19) H x 370 (14.57) W x 260 (10.24) D F Frame: 850 (33.46) H x 425 (16.73) W x 260 (10.24) D G Frame: 892 (35.1) H x 425 (16.7) W x 264 (10.4) D H Frame: 1364 (53.7) H x 529 (20.8) W x 359 (14.1) D				

PowerFlex, RSLogix, DriveExplorer and DriveTools SP are registered trademarks of Rockwell Automation. Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

**STREAMFLOW MEASUREMENT DEVICE
SPECIFICATIONS**

Starflow 6526E



Applications

- Velocity, depth, computed flow and temperature
- New velocity filter for more accurate readings
- Integrated micrologger
- Compatible with Starlog
- SDI-12 communications
- LCD option available

This ultrasonic Doppler instrument is a compact, easy-to-use system for measuring the velocity and depth of water in rivers and streams, open drainage channels, and large pipes.

It is suitable for use in a wide range of water qualities ranging from sewage and wastewater to clean streams, potable water, and even sea water. The instrument measures forward and reverse flow conditions and may be programmed to compute flow rate and total flow in pipes and open channels.

The newest model, the 6526E, includes a new velocity algorithm. The ultrasonic transducer assembly is profiled to

reduce flow disturbance and signal electronics. It is designed to be placed at (or near) the bottom of the water channel for upstream measurement. A single cable connects the instrument to a 12V DC power source.

Water velocity is measured by the ultrasonic Doppler principle which relies on suspended particles or small air bubbles in the water to reflect the ultrasonic detector signal. The instrument will not operate in very clean, degassed water. Water depth is gauged by a hydrostatic pressure sensor, referenced to atmospheric pressure through the vented power and signal cable.

Specifications

Velocity:	Range:	21 mm/s to 4500 mm/s bi-directional
	Accuracy:	2% of measured velocity
	Resolution:	1 mm/s
Depth:		0 to 5 m in two ranges
Resolution:	Range	0 m to 2.5 m
	Range	0 m to 5.0 m
	Accuracy	Typical $\pm 0.25\%$
Temperature:	Temperature:	-17 °C to 60 °C
	Resolution:	0.1 °C
Flow:	Computation:	Flow rate, totalised flow
	Channel type:	Pipe, open channel, natural stream,
Integrated micrologger:	Storage memory:	100 kB, CMOS RAM
	Log interval:	Programmable, five seconds to one week
	SDI-12:	1200 bps instrument channel
	Communication:	RS-232, 300-38400 bps
	Control:	CMOS output trigger (water sampler)
General:	Cable:	15 metre, 9 way vented, <<SQL>> compatible
	Power source:	External battery 12V DC
	Power usage:	11.5 to 15V DC, 50µA standby, 200mA active, 90mA communications
	Operating Temp:	0 °C to 60 °C water temperature
	Material:	PVC body, stainless steel mounting plate
	Dimensions:	290 mm x 70 mm x 30 mm (LxWxH)
	Weight:	1 kg (2 kg with 15 m cable)

6526E

- Velocity, depth, computed flow & temperature
- Integrated micrologger
- Compatible with Starlog
- SDI-12 support
- LCD option available
- Cost effective



geo scientific ltd.
watershed monitoring instrumentation

Unit 247 - 2628 Granville St. Vancouver, BC V6H 4B4
Tel 604-731-4944 Fax 604-731-9445 Geoscientific.com

SPECIFICATIONS

Mechanical:
 Size: 290mmL x 70mmW x 25mmH
 Weight: 850g (2K with 15m cable)
 Material: PVC body, Stainless steel mounting
 Cable: 15metres, 9 core vented cable, <SQL> compatible

Integrated MicroLogger:
 Storage Memory: 120KB, CMOS RAM
 Log Interval: Programmable 5 seconds to 1 week
 Communication: RS-232, 300-38400 baud
 SDI-12: 1200bps, instrument channel
 Control: CMOS output trigger (water sampler)
 Flow Computations: Flow Rate, Totalized Flow
 Temperature: 0 °C to 60 °C water temperature
 Compatibility: STARLOG compatible

Power:
 Battery: External 12VDC
 Solar Panels (optional): 7W or 12W panels
 Power Usage: 11.5V to 15VDC
 50uA standby, 200mA active
 90mA in communications

Velocity:
 Range: 21mm/s to >600mm/s bi-directional
 Inm/s
 Resolution: 2% of measured velocity
 Signal Pkts: 30° above horizontal

Depth:
 Range: 0 to 2m (Model 6521-21)
 0 to 5m (Model 6521-51)
 Resolution: 2mm
 Accuracy: ±0.25% of calibrated range

Temperature:
 Type: Vented hydrostatic pressure sensor
 Range: -17°C to +60°C
 Resolution: 0.1° C

Flow:
 Computations: Flow rate, Totalized flow
 Channel Type: Pipe, Open Channel, Natural Stream

STARFLOW ACCESSORIES

Digital Display Option: Model 6526 LCD
 Model 6701S/LCD
Cables & Connectors: Vented Cables SQL
 Model 6603V/10m
 Model 6603V/20m
Weatherproof Enclosures: Model 6701A
 Expanding Band Kit: Model 6705
 Mounting Brackets: Model 6524M
 Solar Panel Assembly: Model 6904
 Batteries: 12V Sealed Lead Acid
 Model 6707B
Data Communications: Low Powered Modem
 Cellular Data System: Model 6802LP
 Starflow Termination Strip: Model 6103K

NEW DIGITAL DISPLAY OPTION

STARFLOW SQL
 (Starflow Quick Link) System
 Starflow (SQL) includes the basic system, a SQL to PC computer lead, weatherproof enclosure & simplified connectors



STARFLOW
 Basic System

Measures:

- Velocity (+ or -)
- Temperature
- Depth

Calculates:

- Flow Rate
- Total Discharge

Records:

- Via Internal 120K Data Logger

Communications:

- RS232
- SDI-12

Compact Rugged

Low Cost

Options:

- DIGITAL Display
- Telemetry



geo scientific Ltd.
 watershed monitoring instrumentation

Unit 247 - 2628 Granville St. Vancouver, BC V6H 4H4
 Tel 604-731-4944 Fax 604-731-9445 Geoscientific.com

STARFLOW



Versatile Ultrasonic Flow Monitor

• STARFLOW is a unique combination of water velocity, depth and temperature sensors integrated with a fully programmable Data Logger in a single compact package. When the Starflow system is combined with the 6526 LCD display the result is a complete flow monitoring system at an economical price. The new DISPLAY option will allow easy on-site access to the information provided by Starflow without requiring a computer or disturbing the Starflow's normal operation.

• STARFLOW is able to perform in a wide range of environments by using digital signal processing techniques. It is used to record flows in partly filled pipes, open channels, small streams, rivers and operates in a wide range of water qualities from fresh streams to primary sewage channels. A rain gauge and sampler can be connected to make a complete storm water monitoring system.

• STARFLOW is particularly useful at sites where no stable stage / velocity relationship exists and where flows are affected by variable tailwater conditions, culvert entry blockages, pipe surcharging and unstable flow conditions. Starflow is also a bi-directional instrument capable of measuring forward & reverse flow and may be programmed to compute Flow Rate & Total Flow in pipes and open channels.

• STARFLOW is designed to be placed on (or near) the bottom of the stream / pipe / culvert and measures velocity and depth of the water flowing over it. It can also be side mounted for larger channels. A single cable connects the instrument to a 12V DC power source.

• STARFLOW provides an RS232 port allowing programming and data retrieval to be done either by direct connection to a computer or remotely via a modem. An output is available for sampler activation. The device also includes an SDI-12 interface and may be configured as either a SDI-12 Sensor or SDI-12 Recorder.



**LAKE ELEVATION PRESSURE TRANSDUCER
SPECIFICATIONS**

FEATURES

- Custom Level Ranges up to 230 ft (70 m) H₂O
- Unsurpassed Accuracy of $\pm 0.05\%$ Total Error Band
- SDI-12 Communication Interface
- Welded 316 SS or Titanium Construction
- On-board Surge Protection
- Optional Lifetime Lightning Protection
- Custom Cable Lengths



APPLICATIONS

- Well Monitoring
- Down Hole
- Level Monitoring
- Ground Water Monitoring
- Surface Water Monitoring
- Oceanographic Research
- Dewatering
- Reservoirs
- Tank Level

The Series 500 submersible hydrostatic level transducer represents the leading edge of level sensing technology available today. Incorporating a highly stable media-isolated sensor, the Series 500 features SDI-12 serial-digital interface. SDI-12 is a standard for interfacing data recorders with microprocessor-based sensors, especially in the environmental monitoring field. The transducer meets the demanding requirements of the USGS Office of Surface Water (OSW) accuracy specification for stage monitoring. The Series 500 is intended for applications with requirements that include battery-powered operation with minimal current drain, low system cost, and use of a single recorder with multiple sensors "daisy-chained" on one cable. It will accommodate cable lengths between sensors and recorder up to 200 feet.

Able to operate from unregulated 12VDC power, each unit contains a microprocessor and EEPROM, which in addition to supporting the SDI-12 interface, are used to implement sophisticated compensation algorithms. This technique, combined with superior media-isolated sensing technology and proven packaging, results in a price/performance combination unmatched by any previous technique. The attached electrical cable is custom manufactured to Pressure Systems' specifications and includes Kevlar® members to prevent errors due to cable elongation, and a unique water block feature that self-seals in the event of accidental cuts to the cable. Each transducer is shipped with our latest SuperDry™ Vent Filter that prevents moisture from entering the vent tube for at least one year without maintenance, even in the most humid environments.

The Series 500 is CE compliant to EN 61000-6-4:2001 and EN 61000-6-2:2001 and have an IP 68 and NEMA 6P housing protection rating. All KPSI Transducer calibrations are traceable to the National Institute of Standards and Technology (NIST).



geo scientific ltd.
watershed monitoring instrumentation

Unit 247 - 2628 Granville St. Vancouver, BC V6H 4B4
Tel 604-731-4944 Fax 604-731-9445 Geoscientific.com

Series 500

Specifications

Specifications subject to change without notice.

Parameter	500	501	Units	Comments
LEVEL RANGES				
Full Scale Level Ranges ¹	10 thru 230 (3 thru 70)	10 thru 50 (3 thru 15)	ft H ₂ O (m H ₂ O)	for vented gage reference
Proof Pressure	1.5		x FS	
Burst Pressure	2.0		x FS	
STATIC PERFORMANCE				
Measurement Accuracy				
Level	±0.05 ±0.10	N/A	%FS TEB %FS TEB	level ranges > 10 ft (3m) H ₂ O level ranges = 10 ft (3m) H ₂ O
	N/A	±0.01 ±0.10	ft H ₂ O % reading	reading ≤ 10 ft (3m) H ₂ O reading > 10 ft (3m) H ₂ O
Temperature	±0.5		°C	
Excitation	±0.5		VDC	8 to 28 volts
MEASUREMENT RESOLUTION				
Level	±0.0001		% FS	
Temperature	±0.001		°C	
Excitation	±0.1		VDC	
ENVIRONMENTAL				
Wetted Materials	316 SS or Titanium; Delrin®; polyurethane or Viton®			Delrin® and Viton® are registered trademarks of DuPont.
Compensated Temp Range	0 to 50		°C	
Operating Temp Range	-20 to 60		°C	when using polyurethane cable
	0 to 50		°C	when using ETFE cable ³
Protection Rating	IP 68, NEMA 6P			
ELECTRICAL				
Excitation	6-28		VDC	
Input Current	8		mA	average current during data acquisition
	11		mA	peak current during data acquisition for addressed sensor (~40mS duration)
	0.5		mA	quiescent
Interface	SDI-12 RS-485			version 1.3 SDI-12 protocol

Notes:

- Intermediate level ranges are available.
- Total Error Band (TEB) includes the combined errors due to nonlinearity, hysteresis, nonrepeatability, and thermal effects over the compensated temperature range per ISA S51.1.
- 20°C to 50°C for level ranges ≤ 100 ft (70m) H₂O when using ETFE cable.

Specifications subject to change without notice.

Parameter	500	Units	Comments
PHYSICAL			
Approximate Weight	0.75 (340) 0.05 (79)	lbs (g) lbs/ft (g/m)	transducer cable
Cable Jacket Material	Polyurethane (std) ETFE ⁴ (opt)		Tefzel®, Teflon® and Kevlar® are registered trademarks of DuPont.
Pull Strength	200 (90)	lbs (kg)	
Number of Conductors	4		
Conductor Size	22	AWG	
Cable Seal	Molded Polyurethane Viton® Gland		for polyurethane cable for ETFE cable
LIGHTNING PROTECTION (OPTIONAL)⁵			
Life Expectancy	> 1000 operations		
Peak Clamping Voltage	36 volts		
Response Time	< 10 nsecs		

Notes:

4 ETFE is a fluoropolymer (Teflon® derivative) material, Tefzel® or equivalent

5 The power supply needs to be limited to 150 mA to avoid lock up of the gas tube after a suppression event.

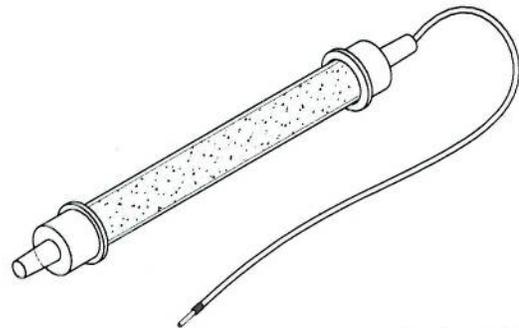
Uniquely-Designed Submersible Cable

The attached cable can incorporate either polyurethane or ETFE jacket material. The ETFE (Tefzel® or equivalent) cable jacket provides superior chemical resistance and durability over polyurethane. While more expensive and less flexible than polyurethane, ETFE cable can reduce overall maintenance costs when used in applications involving caustic media, high abrasion, or potential cross-contamination. ETFE is a fluoropolymer recommended over Teflon® for such applications due to its superior tensile strength and flexibility while rivaling Teflon's chemical resistance.

Both cable types incorporate Kevlar® strength members to prevent errors due to cable elongation, and a unique liner to prevent water intrusion in the event the cable jacket suffers minor cuts. Cable length is determined from the cable end of the transducer and any length of 5 feet or more may be ordered. Polyurethane cable is attached using a polyurethane molded seal while ETFE cable is attached using a compressed Viton® gland seal.

Moisture Protection

Our submersible transducers are equipped with custom, vented cable. The vent provides an atmospheric reference for the sensor, which is necessary for ensuring the highest possible accuracy when making a level measurement. It must be noted that if left unprotected, it provides a pathway for water vapor to enter the level transducer. This vapor will condense into water and could create an offset in the transducer output, or cause permanent damage. For these reasons, a Series 810 desiccant-filled vent filter is provided free of charge with each Series 500 we ship. Our latest SuperDry™ Vent Filter prevents moisture from entering the vent tube for at least one year without maintenance. Replacement filters are available from the factory.



**Series 810
SuperDry™ Long Life Vent Filter**

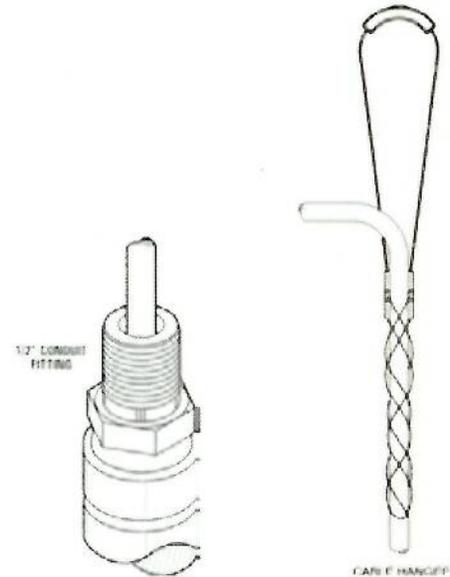
Installation Tips

The Series 500 family of submersible transducers may be suspended directly in the media or in a perforated 1" PVC instrumentation still well. Alternatively, the transducer may be attached to a rigid conduit using a ½" NPT male conduit fitting.

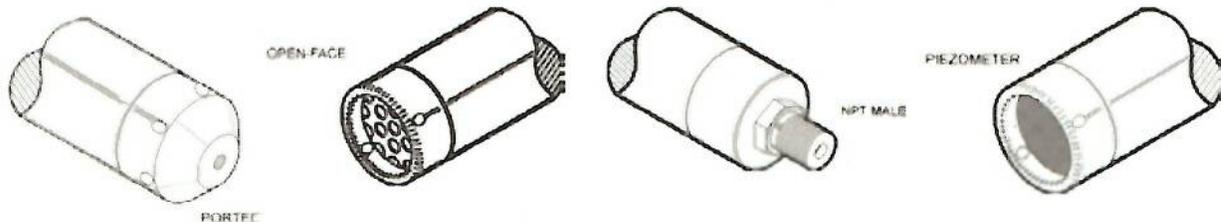
When suspending by the cable, users often utilize our cable hanger (PN# 12-90-0931). This device slides onto the cable from the bare-wire end and is easily positioned anywhere on the cable by pushing the ends together. Once positioned, the cable hanger contracts to provide a snug grip.

Nose Cap

Several different user-installable nose caps are available for the Series 700, 710, 720, 730, and 735 submersible level transducers. The ported nose cap with #8-32UNC-2B threaded hole is best used where weights are required and for those installations where users may encounter sharp, protruding objects. **Caution must be exercised when inserting a screw into the nose cap as the maximum insertion length should not exceed 0.175"**. The standard submersible open-face nose cap which allows maximum contact with the liquid media is ideal for wastewater and "greasy" applications where clogging of the sensor is a concern. The ¼" male NPT pressure nose cap is not only useful for calibration purposes but also allows the device to be used as a submersible or above ground pressure transducer. The piezometer nose cap allows the unit to be buried in the ground without damage to the sensor diaphragm.



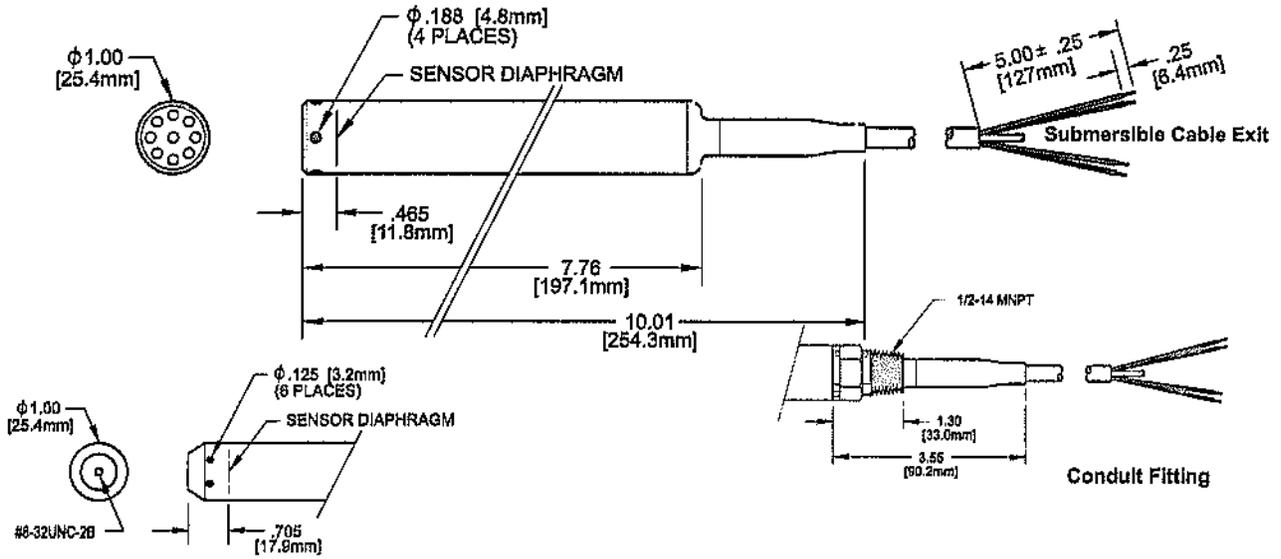
The standard submersible open-face nose cap which allows maximum contact with the liquid media is ideal for wastewater and "greasy" applications where clogging of the sensor is a concern. The ¼" male NPT pressure nose cap is not only useful for calibration purposes but also allows the device to be used as a submersible or above ground pressure transducer. The piezometer nose cap allows the unit to be buried in the ground without damage to the sensor diaphragm.

**Optional Lifetime Lightning/Surge Protection**

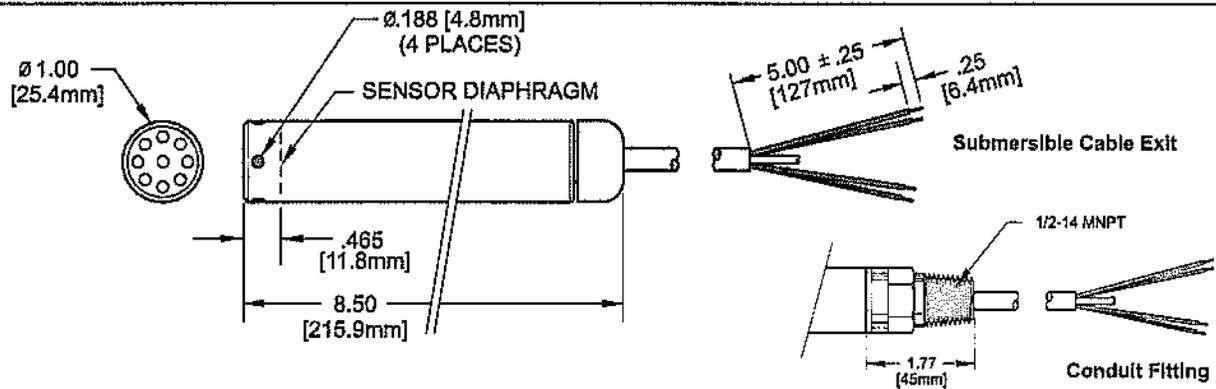
Lightning/surge protection is offered as an option for our Series 500 submersible level transducers. This is achieved through the use of 2 protectors. One is located in the 1 inch OD 316 SS housing of the transducer while the other is located at the surface and grounded via DIN-rail or ground wire. Whether lightning protection is employed or not, the cable shield is left exposed so that the shield can be attached to an earth ground. This option is in addition to the standard onboard surge protection with a 2 year warranty. This option increases the length of the housing by 4.30". The power supply needs to be limited to 150 mA to avoid lock up of the gas tube after a suppression event. **A unit ordered with this option is warranted for the life of the instrument against damage due to voltage surge, when this 2-part option is properly installed. Lightning protection is not available for the Series 500 using RS-485 communication.**

Series 500

Technical Data



Molded Cable Seal Configuration for Polyurethane Cable



Gland Cable Seal Configuration for ETFE cable

ELECTRICAL TERMINATION		
22AWG CONDUCTORS IN A SHIELDED CABLE WITH VENT TUBE		
SDI-12	RED	+ SUPPLY
	BLACK	- SUPPLY
	WHITE	SIGNAL
RS-485	RED	+ SUPPLY
	BLACK	- SUPPLY
	WHITE	RS485-A
	GREEN	RS485-B
ALL	DRAIN WIRE	SHIELD



**REMOTE TERMINAL WITH CELLULAR
TRANSCIEVER (FOR DATA COLLECTION AND
REMOTE ACCESS) SPECIFICATIONS**

2011D Neon Metering Module - GSM

- Internet enabled
- Compact case with simplified external wiring
- Up to 5 years battery life depending on reporting schedule
- Built in logger with optional 8Mb on-board non-volatile flash memory archive
- Almost unlimited data storage
- Expandable via the Starlogger interface
- SDI-12 interface for connection to a wide range of low-power instruments
- On-board digital and analogue interfaces for direct connection to sensors / instruments



The 2011D NMM GSM is a small self-contained unit in a compact case which connects to sensors in the field, collects readings from those sensors, and transmits the collected data to a central server via a cellular telephone network.

The Neon central server system is provided on a Neon Data Service basis and on a Neon Client System basis and provides a central computer system to monitor and receive data from many NMM units in the field.

The 2011D NMM GSM terminal is designed to automate collection of remote data from environmental monitoring, industrial measurements, and utility metering via GSM/GPRS cellular networks from any location within the cellular network coverage area.

Fully bi-directional communications are possible via the Neon server. Data can be collected directly and the 2011D NMM GSM can be programmed from any internet connection.

The 2011D NMM GSM supports integrated logging or automated collection of data from an external datalogger.

It's built-in modem supports packet data, and SMS communications. It has long battery life and low operating costs through use of advanced microcontroller technology.

Supports GSM 850/ 900/ 1800/ 1900Mhz.

Physical specifications

Material:	Polycarbonate
Size:	85 mm x 165 mm x 56 mm (HxWxD)
Weight:	350 grams (including battery pack)
Operating temperature:	-20 °C to 60 °C. Not affected by humidity
Antennae:	Internal stub, optional external whip antenna

Electrical specifications

Battery:	3.6V 13Ah lithium (non-rechargeable)
Battery life:	5 years (based on daily schedule).
External power:	6V to 24V DC input available if required
Instrument power:	5V unregulated supply (5mA max) plus 2.5V ref (5mA max)
I/O:	4 x analog inputs – 12 bit resolution 1 x counter input – 16 bit/3kHz, 3–5V DC signal (included) 3 x counter inputs 8 bit/300Hz, 3–5V DC signal (option) 1 x open collector output, 250mA maximum 1 x HSIO (16 x 16 bit bi-directional, synchronous data) channel
SDI-12:	SDI-12V1.3 recorder (1200 baud smart instrument channel)
Modbus:	Optional RS485 RTU Protocol, 19200 baud max, Functions 01,02,03,04,05/15,06/16

Integrated logger specifications

Storage memory:	30kB/15,000 readings – non-volatile flash memory
Optional storage memory:	8MB/4,000,000 readings – non-volatile flash memory
Time clock:	Crystal regulated, +/- 10 seconds/month – automatically network synchronised
Scan rates:	Programmable from 1 second to 5 minutes
Log intervals:	Programmable from 1 second to 24 hours



geo scientific ltd.
 watershed monitoring instrumentation
 Unit 247 - 2628 Granville St. Vancouver, BC V6H 4B4
 Tel 604-731-4944 Fax 604-731-9445 Geoscientific.com



22 3 2010 0400



neon
Neon Metering Module
CDMA / GSM / WCDMA / HSPA
GPRS
NET Status

Panasonic
Vented Recycled Lead-Acid Battery
Model No. LC-RD1217P
12V (12.8V)
Constant Voltage Charge
Voltage Regulation
Float Voltage: 13.8V-14.0V (28°C)
Initial Current: less than 0.0A3
Standby Rate: 12.8V-13.0V (28°C)
RECYCLE
Pb
CAUTION
Do not short-circuit or use high resistance
Do not pierce the battery terminals
Do not overcharge
Do not touch terminals or case if contact
is made with electrolyte. Avoid
Panasonic Electric Components (USA) Inc., Orangeburg, NY
Made in China

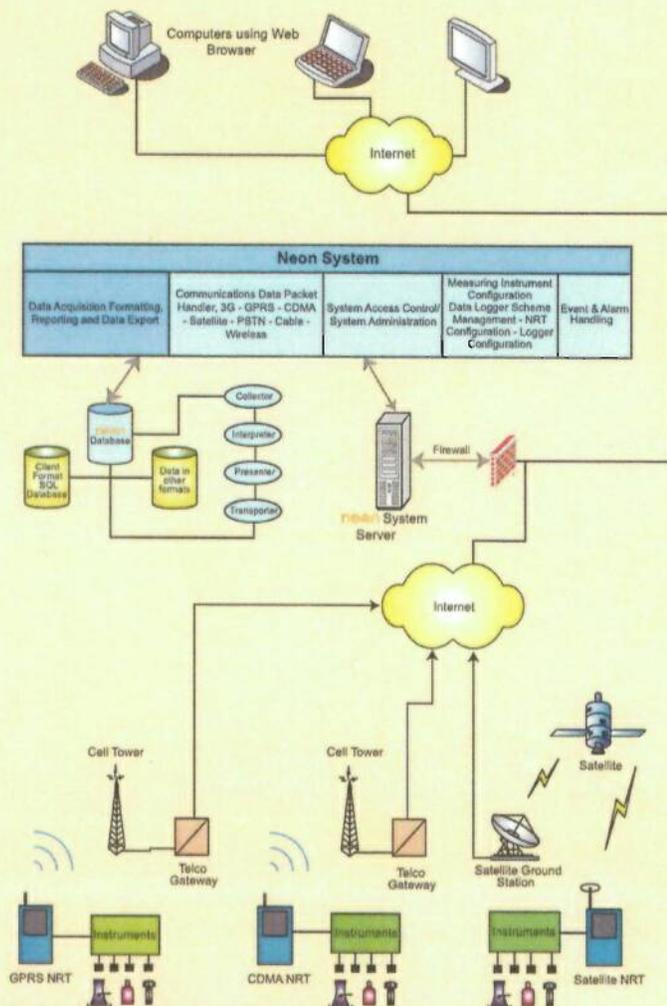


Neon Server Applications Software for environmental monitoring & automated meter reading

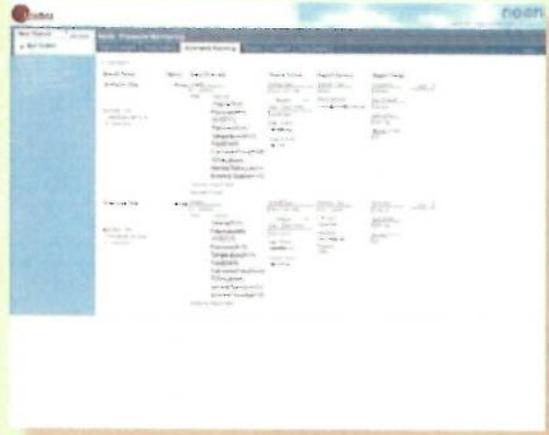
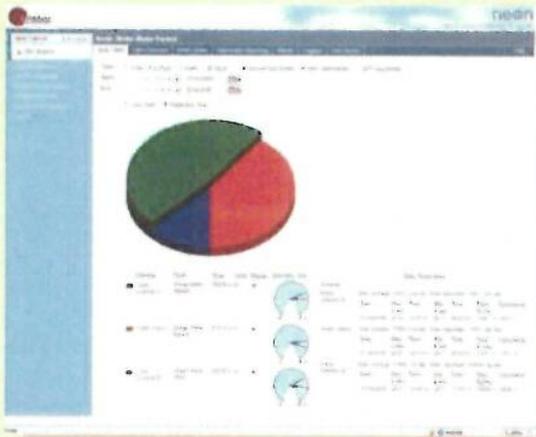
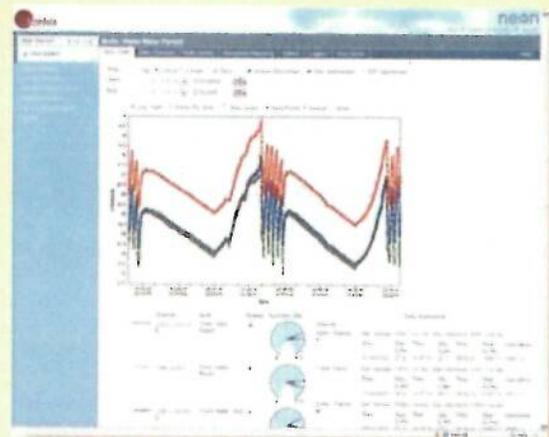
The Neon Server Applications software uses leading technologies to provide access to remote instruments in the fields via standard internet access methods and protocols.

The Neon Server Applications software provides remote data collection and logger-scheme updating for Neon Remote Terminals (NRTs) and any connected loggers (e.g., Starlogger, Prologger, Starflow Instrument, Precision Water Level Instrument) from any internet access point in the world. The system has been specifically designed for environmental data collection and automated meter reading. Low cost and very low power consumption with a high level of on-line access, diagnosis, and reconfiguration have been key design targets.

Neon System



Neon screen display examples



The Neon Software can display the data in a tabular form, or export the data to an excel spreadsheet. It can also be graphed on the screen. There are several ways of selecting the data period to view, to export, or to graph.

Server Platform Software Details

Microsoft Windows 2003 Standard or Small Business Server, supplied with appropriate license, recovery CD and manuals

Neon Server Application Software

This software is used to provide communicate between the server and on site loggers. Main functions include:

1. Retrieving data from the loggers and storing the data on the server
2. Managing logger configuration
3. Uploading new programs and logger schemes to the loggers
4. Displaying retrieved data in real time
5. Sending automated data reports to external systems

User Interface

The application software has a web-site user interface that can be accessed from anywhere on the Internet.

Logger Capacity

The application software is able to handle at least 500 loggers, assuming that the communication parameters have been appropriately configured.

User Capacity

The application software is able to handle 500 configured users. The concurrent usage is dependent on server hardware and internet bandwidth capability.

Logger configuration

All configuration and operating parameters of the loggers can be remotely managed via the application software. Users do not have to visit loggers on location to change their operating parameters.

Logger Network Configuration

The application software can group loggers and display data according to an unlimited number of geographic areas and locations.

Data Display

Retrieved logger data can be viewed in real time, via the following methods:

1. Charting
2. Data Table
3. Excel Export

Network Map Display

Geographic areas, locations and loggers can be assigned a Latitude and Longitude and then displayed on a geographic map.

Logger Network Status

The application software can display the status of each location in the network and indicate if the logger is inactive, operating normally or has an alarm condition. This status is also displayed on the Network Map.

Alarm Configuration and Notification

Logger alarms conditions can be configured via the software application and can notify users of active alarms via the following methods:

1. Web site on screen display
2. Email
3. SMS

Automated Data Export

Automated data reports can be configured to export logger data from the Neon server to an external database.

User Security

The application software can handle any number of security access profiles, which can be configured according to access requirements. These access profiles can control which geographic area, location or logger a user can access

System administrators can create users and assign the appropriate security access profile to them.



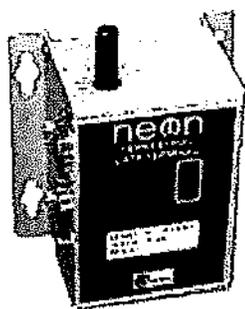
Site Map
Contact Us
Technical References

PRODUCTS

- Dataloggers
 - ▶ Remote Access
 - ▶ Universal
 - ▶ Dedicated
 - Water Quality
 - Water Level
- Datalogger Sensors
- Water Quality Meters
- Flow & Current Meters
- Sampling Instruments
- Ground Water Instruments
- GPS

Neon Remote Terminal (NRT) with Cellular or Satellite Transceiver

The Neon Remote Terminal (NRT) combines a data logger with either a duplex cellular or satellite transceiver. The NRT is designed to automate collection of remote data from environmental monitoring, industrial measurement, and utility metering sites. It connects to sensors in the field, collects readings from the sensors, and transmits the collected data to a central server. Fully bidirectional communication is possible via the Neon server - data can be collected directly, and the NRT programmed, from any internet connection on the globe.



Neon Terrestrial Remote Terminal
(NRT Terrestrial GSM/GPRS/CDMA)



Neon Satellite Remote Terminal
(NRT Satellite)

The NRT-Cellular (Terrestrial) utilizes the popular GSM/GPRS cellular network which is very cost effective in both hardware and transmission fees. The NRT-Satellite utilizes the international Globalstar LEO Satellite network and is suited for remote monitoring sites outside of cellular coverage.

The NRT built-in modem supports packet data, switchboard circuit data, and SMS communications. Long battery life and low operating costs are made possible through use of advanced microcontroller technology and an efficient protocol that takes advantage of GSM/GPRS and Globalstar packet data transfer capability. With 15000 data point storage capacity and built-in analog, digital and SDI-12 channels no additional data logger is required for simple monitoring applications. For expanded monitoring applications, the Neon can be connected to the Unidata Starlog Series of Data Loggers and any SDI-12 compatible instrument such as the Eureka Multi-Parameter Water Quality Sonde.

Neon Client/Server Application Software System

A web based client system server software is available for users who are operating large monitoring networks and want the remote data sent directly to their server. For smaller applications, the secure Unidata Neon host server can be utilized for a monthly fee. Either way you have full multi-level administration and end user control to load, verify, and unload your NRT directly from any internet access point. You can access the data in tabular or graphical form, as well as receive alerts and alarms via email, SMS messages, or voice calls.

The system has been specifically designed for environmental data collection and automated meter reading. Low cost and very low power consumption have been key design targets.

Neon Data Service Key Features

- Low overhead cost
- Scaleable architecture
- Internet data access
- Bi-directional communications
- Alert and alarm generation
- Platform independent software
- Time synchronization from master Neon clock
- Guaranteed data delivery service

Summary of the Neon Data Service Provider Features

- Load, verify, and unload your field instruments and data loggers directly from your office desk anywhere in the world using software that runs on any computer
- Access your data using any web browser in tabular or graphical form
- View your data directly using the client Graphical User Interface
- Collect and share your data with colleagues through the Neon databank
- Convert your data to standard formats such as CSV or Excel for use in statistical or data analysis packages
- Receive alerts and alarms via email, SMS messages, or voice calls
- Prevent data loss through scheduled updates from the field
- Connect industry standard instruments and data loggers directly to the Terrestrial GSM/GPRS and Satellite NRT
- Achieve unparalleled equipment life with our low power NRTs that provide up to 2½ years unattended operation even without a solar panel or other power source

Copyright © 2001 Geo Scientific Inc., All Rights Reserved
[Home](#) | [Contact Us](#)



Site Map
 Contact Us
 Technical References

PRODUCTS

- **Dataloggers**
 - ▶ Remote Access
 - ▶ Universal
 - ▶ Dedicated
 - Water Quality
 - Water Level
- Datalogger Sensors
- Water Quality Meters
- Flow & Current Meters
- Sampling Instruments
- Ground Water Instruments
- GPS

Remote Access Data Loggers

Data Logger Configured with Satellite or Cellphone Transceiver and User Configurable Channels

Neon Terrestrial Remote Terminal (NRT Terrestrial GSM/GPRS/CDMA)

Material:	Anodised aluminium
Size:	130 mm H x 100 mm W x 50 mm D
Weight:	850 grams (including battery pack)
Operating temperature:	-20 to 60 °C. Not affected by humidity.
Antennae:	External conical dielectric resonator 103 mm D x 63 mm H, 1 m cable
Battery:	3.6V 13Ah lithium (non-rechargeable)
Battery Life:	Up to 2 years (based on daily schedule) 600µA operating current
Power:	- Continuous 3.6V nom (20mA max) plus 2.5V ref (5mA max) - 10.5 to 16VDC external input available if required
I/O:	2 x analog inputs – 12 bit resolution 1 x counter input – 16 bit 500Hz or 3–5V DC signal 1 x control output 1 x HSIO (16 x 16 bit bidirectional, synchronous data) channel
SDI-12:	SDI-12 V1.3 recorder (1200 baud smart instrument channel)
IrDA:	V1.0 9.6kbps (Eco Power mode) for PALM PDA connection
Storage memory:	15,000 readings – non-volatile flash memory
Time clock:	Crystal regulated, +/- 10 seconds/month – automatically network synchronised
Scan rates:	Programmable from 1 second to 6 hours
Log intervals:	Programmable from 1 second to 1 week
Storage memory:	15,000 readings – non-volatile flash memory
Operating modes:	- Scheduled (Continuously to weekly – daily is default) - Integrated – fully programmable STARLOG compatible micrologger - FTU – Field Test Unit via RS232 & IrDA for field support

Copyright © 2001 Geo Scientific Inc., All Rights Reserved
 Home | Contact Us

ATTACHMENT C

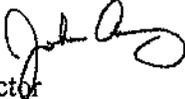
BIOSECURITY MEASURES

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH & BOAT COMMISSION

ADMINISTRATIVE POLICY

SUBJECT: Biosecurity Measures for Commission Operations, Facilities, and Equipment

NUMBER: 2009-001

AUTHORIZED BY: John A. Arway 
Executive Director

EFFECTIVE DATE: March 16, 2011

REPLACES: Reissued without change, replacing 2009-001 – Biosecurity Measures for Commission Operations, Facilities, and Equipment, dated June 22, 2009

In recent years, introduction of various aquatic invasive species (AIS) into the waters of the Commonwealth, and areas hydrologically connected to Pennsylvania, have been well-documented. AIS include both microscopic and macroscopic organisms, with highly varied distributions. Some macroscopic AIS, such as zebra mussels (*Dreissena polymorpha*), Didymo (*Didymosphenia geminata*), and northern snakehead (*Channa argus*), are already found in Pennsylvania, whereas other species (e.g., bighead carp, *Hypophthalmichthys nobilis*, and silver carp, *H. molitrix*) are in the Ohio River and are expected to eventually reach waters of the Commonwealth. The microscopic AIS, Viral Hemorrhagic Septicemia IVb (VHS) virus, has been identified in the Great Lakes Basin and its occurrence may have widespread implications for wild and hatchery fishes and the aquaculture industry. These organisms pose potentially significant ecological and economic threats to Pennsylvania. For fish production, AIS can pose a serious health issue for reared fish as well as having substantial economic implications for the Commission. In fragile ecosystems, AIS may compete with, or prey upon, native flora and fauna.

To reduce the threat presented by AIS, the Commission has developed the attached protocols for its field operations, fish production, and disease monitoring procedures. These procedures will be implemented to reduce the inadvertent transmission of AIS, especially as a result of activities that require staff to regularly enter or move equipment and materials between water bodies. Commission staff will, to the extent practical, follow the most current protocols for disinfecting equipment and other items moved between waters of the Commonwealth.

This policy remains in effect until revised or rescinded by the Executive Director.

Pennsylvania Fish and Boat Commission Biosecurity Protocols:
*Procedures to minimize the transfer of aquatic invasive species
into or between waters of the Commonwealth*

Table of Contents	
Topic	Page
Introduction	2
Surveys and Sampling Guidance	2
Exposure and Handling of Diseased Specimens	4
Equipment Disinfection Protocols	4
Boat and Trailer	4
Boat Motors	6
Commonly Used Equipment	7
PFBC State Fish Hatchery (SFH) Protocols	8
Hatchery Water Sources	8
Stocking Procedures	10
Trucks and Other Equipment	10
Fish, Fish Gametes, and Fertilized Fish Egg Transfers	11
Awareness	11
Summary	11
Appendix 1	13
Species-Specific Disinfectants and Procedures for Their Use	13
Disinfecting Solutions and Agents	14
Appendix 2	16
General Safety Precautions for Disinfectant Use	16
AIS Biosecurity Protocols Check List	17

1. Introduction

In recent years, potential environmental problems associated with the introduction of various aquatic invasive species (AIS) have become well-known. The effects of some of these organisms are well-documented. Zebra mussels (*Dreissena polymorpha*) are already present in waters where Pennsylvania Fish and Boat Commission (PFBC) staff operate boats. Didymo (*Didymosphenia geminata*) was recently discovered in the upper portion of the Delaware River and in the Gunpowder River in northern Maryland. Additionally, Viral Hemorrhagic Septicemia IVb (VHS) virus has been identified in the Great Lakes Basin and the efforts to control its spread have had widespread implications for the aquaculture industry. The effects of other, lesser-known AIS are only beginning to be understood. As an example, chytrid fungus (*Batrachochytrium dendrobatidis*), of African origin, is a globally decimating amphibian species and would be a serious threat to Pennsylvania species if it becomes established. Overall, AIS pose threats to the ecological health and the economic benefits of the waters of the Commonwealth, to the state's natural biodiversity, to the operation of PFBC facilities, and to the agency's ability to fulfill its mission. The PFBC has enhanced its fish production and disease monitoring procedures to address this problem. However, additional procedures are needed to further minimize the possible inadvertent spread of AIS through routine PFBC activities which require staff to regularly move boats, sampling equipment, and other items between water bodies. This document establishes procedures to be implemented by PFBC field staff to help prevent the spread of aquatic invasive species and/or other potentially harmful aquatic organisms. The following procedures must be followed when fieldwork necessitates the movement of boats and equipment between waterways or across watershed basins. To the extent practical, all susceptible equipment moved between watersheds must be properly cleaned and disinfected. Particular attention must be given to situations where AIS are known or suspected to occur. These guidelines were developed, in part, from biosecurity protocols currently being used in Wisconsin and New York. Additional information used in the development of this document was obtained from <http://www.biosecurity.govt.nz/> and http://www.nwhc.usgs.gov/publications/amphibian_research_procedures/specimen_collection.jsp.

2. Surveys and Sampling Guidance

- A. It is assumed that all waterways and all locations within a given watershed are vulnerable to AIS infestation. Therefore, to minimize and avoid transport of AIS as a result of Commission activities, only properly treated equipment shall be used during activities conducted in waters of the Commonwealth. It will be the responsibility of all PFBC field staff to stay current with any announced changes to this Biosecurity Protocol.
- B. For the purposes of this document, hatchery waters are considered waters of the Commonwealth. Hatchery protocols are discussed later in this document. All vehicles and boats entering the hatchery areas must be thoroughly disinfected following the appropriately prescribed protocols described throughout this document. Protocols for each hatchery may need to be developed to address circumstances unique to each facility. Personnel must follow hatchery-specific biosecurity procedures when conducting sampling or marking hatchery fish.

PFBC Biosecurity Protocols

- C. For the purposes of this document, wetlands, vernal pools, and similar amphibian and/or reptile habitats are considered waters of the Commonwealth. It is critical that biosecurity protocols, particularly those pertaining to the spread of disease pathogens, be followed when equipment is exposed to or transported between these waters. The below disinfection procedures, particularly those involving the use of chlorine bleach, are effective against the pathogens of concern.
- D. As part of the routine scheduling of any PFBC activity that will occur on waters of the Commonwealth or waters located in neighboring states or countries, every reasonable effort will be made to determine if AIS occur in those waters. This will allow precautionary measures to be taken to prevent translocation of AIS into non-infected waters or transmission from infected waters. Depending on the type of work being done, it may be possible and desirable to work with other agencies or partners to use equipment located on-site to collect samples. This would potentially limit the amount of equipment required for disinfection.
- E. The Commission shall provide extra equipment to ensure that disinfected or dry equipment is available. If having duplicate gear items is not practical, then all susceptible equipment must be properly treated prior to use. In situations when activities are scheduled to occur in succession on both infected and non-infected waters, then non-infected waters must be worked prior to working infected waters. **Do not work infected waters first!**
- F. If a high percentage of work activities are done in waters with AIS, staff shall dedicate certain equipment for use only in those waters.
- G. For activities conducted in waters of the Commonwealth where the status of AIS is unknown, work shall start at the upper-most reach and then proceed in a downstream or down lake direction, if feasible. This will ensure that non-motile organisms are not transported on boots or other equipment to uninfected up-stream or up-lake locations.
- H. If a water of the Commonwealth is known to contain AIS, but the extent of infestation is not clear, then efforts shall be made to replace or disinfect equipment before beginning subsequent activities.
- I. In waters of the Commonwealth where occurrences of AIS are known to be system-wide, work order and preventative measures are less important. It must not be assumed, however, that all waterways within a watershed are infected. When in doubt, disinfection procedures shall be followed when moving between waterways.
- J. If a new occurrence of an AIS is suspected, the following steps shall be taken:
 - 1. Document the location of the suspected AIS. (Collect GPS coordinates if possible.)
 - 2. If possible, secure a specimen for positive identification by qualified personnel. (Fisheries Management staff shall have specimen collection kits available on all surveys.)

PFBC Biosecurity Protocols

3. If specimen collection is not possible, secure a high-quality digital image or color photograph.
4. Notify appropriate PFBC staff: Communications Chief, Bureau Director-Fisheries, Chief of Fish Production, Chief-Fisheries Management, Bureau Director-Boating and Access. No information should be released to the public until a positive identification of specimens is verified.

3. Exposure and Handling of Diseased Specimens

A. Causal assessment of external abnormalities or death in amphibians, reptiles, or fish

First, note whether there are sick, deformed, or dead animals of more than one vertebrate class and phyla (e.g., dead birds, frogs, fish, snails, insects) present in the immediate area; if so, there is a much greater chance the problem was caused by a toxicant (poison). In this case, field personnel should exercise caution to prevent self-contamination. If, however, only one taxon (type of animal) has been affected, it is more likely that the illness, deformities, or deaths are due to an infectious disease.

B. Disease precautions and procedures

Any amphibians, reptiles, or fish (dead or alive) that appear to be “sick” or deformed should be considered contagious specimens. Only handle suspected animals while wearing “rubber” gloves. Dispose of the gloves after handling the animal and do not use them to handle other reptiles, amphibians, or fish at the site. Retained specimens are to be secured in appropriate containers such as tightly capped bottles or doubled zip bags, immediately labeled (date, place, etc.), and the exterior of the container is to be disinfected. Specimen kits appropriate for collecting potentially contagious specimens will be made available to all field units. Affected living animals and any carcasses should never be released or discarded at other sites and should not be taken into laboratory settings with other amphibians, fish, or reptiles. Follow the disinfection guidelines below for any exposed equipment. Contact the Natural Diversity Section (814-359-5237) for further instructions for disposal or transport (for testing, identification, etc.) of the diseased specimen(s).

4. Equipment Disinfection Protocols

These protocols are to be used to reduce the risk of spreading AIS during all Pennsylvania Fish and Boat Commission activities.

A. Boat and Trailer

1. Upon arrival and prior to launching, and upon removal from the water and prior to departure from a boat launch site, the following procedures will be conducted:
 - a) Inspect and remove all visible aquatic plants, animals, mud, and other organic material from the boat, trailer, and equipment at the work location. Aquatic plants, animals, mud, and other organic material found on equipment prior to launching that remained from a previous

PFBC Biosecurity Protocols

location shall be collected and placed into an approved container for transport back to regional offices for proper disposal.

- b) Drain the bilges of the boat by removing the drain plug. Bilge pumps are not capable of removing all water from those areas. Wet wells, live wells, and any other compartments that could hold water must be drained of water at the field site, when appropriate. If the boat and trailer will not be in contact with other waters of the Commonwealth, the bilge area may be drained upon return to the boat storage facility provided that facility is sufficiently isolated from local waters and hatchery operations as to prevent their contamination.
 - c) Disinfect trailers equipped with carpeted bunks after the boat is launched, when the boat is not being returned to the trailer, *and* the trailer is being removed from the launch site. The trailer may be decontaminated at the storage facility if there is no potential for contaminating other waters. Disinfect the trailer according to one of the approved methods described in Appendix 1.
2. Upon return to the storage facility and prior to launching into another water of the Commonwealth:
- a) Inspect and remove any remaining aquatic plants, animals, mud, and other organic material from the boat, trailer, and equipment at the work location and dispose of properly.
 - b) Recheck the bilges, wet wells, live wells, and any other compartments for any remaining water. Spray these areas.
 - i. If bilge water is drained at the storage facility, the water shall be collected, disinfected, and disposed of properly to avoid causing environmental damage or contamination.
 - ii. Pumps must be operated to take in the disinfectant and make sure that the solution comes in contact with all parts of the pump and hose.
 - c) After draining all water from boat compartments, all compartments that held water shall be washed with a high temperature (200°F) pressure washer or with an approved disinfectant and allowed to remain wet for the appropriate contact time, as described in Appendix 1. Compartments shall be left open to completely dry prior to next use.
 - d) All boats and trailers used in field activities will be cleaned using a high temperature pressure washer or through application of disinfectant solution working from fore to aft and gunnels to keel in a thorough manner.
 - i. Particular attention must be paid to the cooling water intakes on the lower unit of the motor.
 - ii. Particular attention must be paid to the carpeted trailer bunks since they can hold water for extended periods of time.

PFBC Biosecurity Protocols

- iii. Lower the motor to drain all water from the lower unit and disinfect motor according to the procedures described below.
- e) After application of disinfectant solution, the boat, trailer, bilges, live well, and pumps must be rinsed with clean water after the appropriate contact time. *Every effort shall be made to keep the disinfectant and rinse water out of surface waters and to properly dispose of the solutions.*

B. Boat Motors

1. Upon return to storage facility, and prior to launching into another water of the Commonwealth, boat motors shall be treated in the following manner:
 - a) Outboards
 - i. Clean all exterior parts of the motor with one of the approved methods described in Appendix 1.
 - ii. Immerse the lower unit in a bucket of disinfectant and run the motor to ensure contact with all internal parts allowing for appropriate contact time as described in Appendix 1.
 - iii. Attach a short (6-foot) piece of garden hose to lower unit muff. A pail of the disinfectant can be set in the back of the boat and gravity fed to the lower unit to run the disinfectant through the motor. The hose will need to be primed to start the gravity flow because the lower unit does not create enough suction to prime the hose.
 - iv. Allow the disinfectant to remain in the motor for the appropriate contact time.
 - v. A non-corrosive disinfectant such as *Virkon Aquatic* is recommended for use to protect the impeller. PLEASE NOTE: *Virkon Aquatic*[®] is labeled for use only as a bactericide and viricide! Do not depend on its use against other AIS such as invertebrates (e.g., zebra mussel), plants, vertebrate species, etc. See Appendix 1 for other disinfection methods!
 - b) Jet Drives
 - i. Clean all exterior parts of the motor with one of the approved methods described in Appendix 1.
 - ii. Spray any open and accessible portions of the water intake and nozzle portions of the motor. A non-corrosive disinfectant such as *Virkon Aquatic* is recommended. PLEASE NOTE: *Virkon Aquatic*[®] is labeled for use only as a bactericide and viricide! Do not depend on its use against other AIS such as invertebrates (e.g., zebra mussel), plants, vertebrate species, etc. See Appendix 1 for other disinfection methods!
2. After application of disinfectant solution, the motor must be rinsed with clean water after the appropriate contact time. *Every effort shall be made to keep the disinfectant and rinse water out of surface waters and to properly dispose of the solution.*

PFBC Biosecurity Protocols

C. Commonly Used Equipment

1. After use, and prior to using equipment in another water of the Commonwealth, the equipment must be treated using the following procedures. Careful record keeping and equipment labeling will be necessary to ensure that equipment has been treated for sufficient time with the proper disinfection procedures and to ensure that dedicated equipment will only be used in its assigned waterways.
 - a) Large Equipment (e.g., stocking trucks, dredges) – Organic debris must be removed prior to disinfection. Power washing is not required, but large equipment could be sprayed with a garden hose to remove debris. Equipment may be steam cleaned, washed, and dried thoroughly for five days or treated with a disinfectant. When appropriate, immerse equipment in disinfectant for the required contact period as described in Appendix 1.
 - i. After application of disinfectant solution, the equipment must be rinsed with clean water after the appropriate contact time. *Every effort shall be made to keep the disinfectant and rinse water out of surface waters and to properly dispose of the solution.*
 - b) Small Equipment (e.g., buckets, water sampling equipment, electrofishing equipment) – Remove all organic material from gear and follow one of the options described below.
 - i. Spray with disinfectant and maintain a wet surface for the appropriate contact time described in Appendix 1.
 - ii. Fill a tub with disinfectant and place all equipment in the tub for the appropriate contact time as described in Appendix 1.
 - iii. Use a completely new set of equipment for each water body sampled throughout the work day or work week. Disinfect all equipment at the end of the activity using option one or two.
 - o Dissolved oxygen probes and other sensitive electronic equipment can be damaged by disinfectants and must only be rinsed with clean water. Do not store dissolved oxygen probes or other water chemistry gear in water from the work site. Use distilled or tap water for probes and empty all lake containers and samplers used during chemical or vertical profile assessments at the survey location.
 - c) Personal Protective Equipment (e.g., rain gear, gloves, boots, waders, and PFDs) – Remove all organic material from gear and follow one of the options described below.
 - i. Scrub personal protective equipment with an approved disinfectant. After scrubbing, the equipment must be kept wet with the disinfectant for the appropriate contact time as described in Appendix 1.
 - ii. Personal equipment may be steam cleaned or dried thoroughly for five days after cleaning with soap and water.
 - iii. After application of disinfectant solution, the equipment must be rinsed with clean water after the appropriate contact time. *Every effort shall be made to keep the disinfectant and rinse water out of surface waters and to properly dispose of the solution.*

5. PFBC State Fish Hatchery (SFH) Protocols

Recent outbreaks of Viral Hemorrhagic Septicemia (VHS) in the Great Lakes drainage have drawn attention to the need for biosecurity improvements to prevent or minimize the possible introduction of VHS and other pathogens and aquatic invasive species into our fish production facilities. The needs and abilities of individual production facilities to adopt biosecurity measures will vary and a “one size fits all” approach is not practical, but both short- and long-term efforts must be directed at improvement. In general, each hatchery must be evaluated and, within each hatchery, zones of high and low disease risk must be identified. Each identified zone should have its own equipment and specific zone isolation and disinfection procedure. The following are areas for consideration when developing individual hatchery biosecurity plans.

A. Hatchery Water Sources

Optimally, water sources should be PFBC-owned, fenced, and free of fish. Water sources need to be as secure as possible within the parameters of each hatchery. Minimally, springs and wells must be fenced and secured where feasible.

1. Hatch Houses

- a) Hatch house influent water – Most facilities have equipment for UV treatment and pre-filtration of hatch house influent water. In some cases, it is limited to egg incubators only. As funding becomes available, these systems should be upgraded to include all hatch house production water. These systems must be properly maintained, including the cleaning of quartz sleeves and the replacement of UV bulbs at manufacturer recommended periods. Where feasible, upgrading to ozone treatment should be considered.
- b) Egg disinfection – It is important that all production trout eggs be properly disinfected. The modified California method has been tried at many of our trout stations without any significant additional egg mortality. This procedure triples the standard surface disinfection contact time and, at least theoretically, allows iodophor to enter the egg during the hardening process. This procedure must be made a Standard Operating Procedure (SOP) at all trout hatcheries. All eyed eggs should be processed through a mechanical picker to remove dead eggs and then surface disinfected with iodophor before further incubation. Eggs shipped to other SFHs must be disinfected by the receiving facility before being placed into incubation units. Warm/cool water eggs must also be disinfected per instructions from Production Managers based on the results of ongoing egg disinfection studies.
- c) Hatch house equipment – Hatch house equipment (nets, brushes, buckets, basins, etc.) must be dedicated for hatch house use only (color-coded) and this equipment must be stored away from the equipment used in outside rearing units. Equipment disinfection containers that are sufficient in depth to submerge nets, brushes, etc., must be present in all hatch houses. These containers must be properly maintained with disinfectant to ensure complete

PFBC Biosecurity Protocols

disinfection. Nets, brushes, and other equipment must be allowed a sufficient contact time for complete disinfection. Rearing units should be surface disinfected between lots of fish. Suitable disinfectants may include *Virkon Aquatic* or *Iodophor* solutions, depending on use.

- d) Spawning – During spawning activities, brood fish should not be brought into hatch house areas where eggs or juvenile fish are cultured. Disinfectant footbaths must be used when transporting eggs into hatch house/egg incubation areas. If fish must be spawned in proximity to hatch house eggs/fish due to hatchery limitations, a specific spawning area with proper disinfection and isolation must be set up to minimize contamination. Only disinfected materials (e.g., eggs, equipment) are allowed to leave this area and enter other areas of the hatch house. The spawning area must be thoroughly disinfected at the end of each day.
- e) Cleaning activities – All rearing units should be cleaned daily. All nets, brushes, and other equipment, especially mortality collection nets, must be disinfected between each tank or rearing unit. As indicated above, sufficient contact time must be permitted for disinfection of the equipment. All mortalities should be removed from rearing units daily, and they must be disposed of properly. Mortalities must not be disposed of in tank drains or in open drain aqueducts.
- f) Access to hatch house buildings – Access to hatch house buildings should be restricted to essential staff only. All equipment brought into hatch house buildings must be surface disinfected. All staff must use disinfectant footbaths and wash their hands with disinfectant soap before entering a hatch house building. Hatch houses with garage doors or multiple-use should have a barrier (e.g., simple hanging chain) around tanks to force foot traffic through foot bath areas. These areas may be off-limits to visitors and tour groups.

2. Outside Rearing Units

- a) Influent water disinfection – Systems to disinfect influent water for outside rearing units are currently not available in PFBC hatcheries. As funding becomes available, case-by-case consideration should be given to installing such systems.
- b) Cleaning activities – Solids collection sections of rearing units must be cleaned regularly according to best management practices. Mortalities should be removed daily from the entire rearing unit, not just at the effluent rack or screen. Unless untreated, recirculated water is used, rearing units should be cleaned and mortalities should be removed in a downstream progression by row, not across rows. Exceptions may be made for limited water flow conditions that would harm the fish by cleaning as stated above. Dedicated sets of nets, brushes, and other equipment must be provided for the raceway area.
- c) Predator control – Where available, bird netting and other predator controls must be maintained and operated properly to prevent the entry of predators into rearing units.

PFBC Biosecurity Protocols

- d) Brood fish – Brood fish should be held in rearing units that are isolated from production fish. If this is not possible, brood fish should be held at the heads of raceway rows or in rows dedicated to brood fish only and physically separated from adjacent rearing unit rows. Brood fish should not be held in recirculated water.
- e) Aqueducts and piping – At least annually, efforts must be made to eliminate escapee fish from pipes and aqueducts. These fish serve as reservoirs for fish pathogens. Escapee fish in downstream piping and polishing ponds should never be moved into upstream rearing units. Open aqueducts should be cleaned at least annually to remove aquatic vegetation and accumulated debris.
- f) Cool/warm water areas – Dedicated, color-coded equipment (nets, brushes, etc.) must be maintained for use in outdoor cool/warm water rearing areas. Combination hatcheries (cold-ww/cw) must have separate equipment for both outdoor rearing areas. All potential means of cross contamination between cool/warm water culture areas and coldwater culture areas must be avoided.
- g) Hand feeding – Employees engaged in hand feeding must ensure that scoops or other utensils are used to distribute the feed. In instances where utensils are not used, hands should be covered by gloves that are dedicated for use at a specific feeding site or rearing unit.

B. Stocking Procedures

Necessary precautions need to be taken to minimize contaminating stocking equipment (nets, buckets, hoses, etc.) during stocking operations. Waterways Conservation Officers shall inform volunteers to keep buckets out of the receiving waters and dump buckets of fish rather than dip them into waters. Stocking buckets shall be labeled “Dump It Don’t Dip It” using commercially available stencils and permanent ink or paint. If volunteers contaminate a bucket, they should be given another bucket if available. Contaminated buckets and equipment must not come into contact with uncontaminated hatchery water within the transport tanks. Any contaminated equipment shall be disinfected by drivers before going to another water body for stocking. A spray bottle pre-mixed with disinfectant will be acceptable for most applications. Disinfected buckets shall be rinsed with transport tank water prior to adding more fish to the bucket. In situations where the transport tank water is tempered by stream or lake water to reduce fish stress and buffer temperature changes, bucket disinfection should be done and rinse water taken from tank compartments that were not tempered before going to another water body. When tempering is necessary, all tempered tank water will be discharged from the stocking truck before moving on to the next water body or returning to the hatchery. Additional disinfection measures should be taken when returning to the hatchery as outlined elsewhere in these protocols.

C. Trucks and Other Equipment

All vehicles and their equipment, including stocking trucks, boats, boat trailers, sludge trucks, construction and maintenance equipment, and other vehicles that contact water bodies outside

PFBC Biosecurity Protocols

of a specific fish production site must be disinfected prior to entering the fish production portion of a hatchery. If stocking trucks and associated equipment (e.g., nets, buckets, hoses) come into contact with receiving waters, equipment must be disinfected before moving to the next water body for stocking purposes. All containers and other equipment used to transport fish, fish gametes, or fertilized eggs to or from other facilities, or used by other facilities must be disinfected and all associated transport water must be disinfected prior to discharge at a production facility. Where feasible, this must include vehicle wheel dips at facility entry points and at locations where vehicles pass between identified disease risk zones within a hatchery. Vehicle and equipment disinfections at the hatcheries must be conducted at designated areas and must include external surfaces, empty internal tank surfaces, and equipment carried on the transportation units, such as nets, buckets, etc.

It is a common practice for employees from one facility to assist at another facility in order to complete certain tasks, such as cleaning a polishing lagoon or fin clipping. In these types of situations, special consideration must be given to disinfecting personal equipment and apparel, such as boots, outer weather gear, gloves, etc., that are exposed to fish or transport/receiving waters. This equipment must be disinfected before entering the water or handling fish. There must be several pairs of spare waders, aprons, and gloves on site for use by visiting workers. Occasionally, construction crews may need to have contact with water sources or production water in the performance of their duties. Their tools and personal equipment must be disinfected following the same protocols as hatchery staff. Felt-soled waders must not be used in hatchery waters.

Trucks or equipment that have been in contact with waters known to contain certain AIS such as zebra mussels and Didymo will undergo additional disinfection methods known to kill those species.

Care must be taken to avoid the discharge of potentially harmful, un-neutralized disinfectants.

D. Fish, Fish Gametes, and Fertilized Fish Egg Transfers

All transfers of fish gametes, fertilized eggs, and fish from within the PFBC fish production system and from other production sources must be approved in advance by the Fish Health Unit and the Fish Production Division Managers and Director.

6. Awareness

Training, oversight, and signage will be needed to maximize opportunities for success.

7. Summary

A biosecurity program can only be effective if it is a priority for administrators, hatchery managers and their staff, field biologists, regional outreach and education staff, water safety instructors, construction and maintenance operators, etc. Reduced flexibility will occur in moving fish from one facility to another to meet short-term production needs. Increased

PFBC Biosecurity Protocols

awareness and vigilance will be needed to ensure that oversights or mishaps do not occur that could quickly undo years of biosecurity precautions. Staff from all PFBC divisions will be required to observe the biosecurity restrictions and measures defined in the individual hatchery management plans.

Appendix 1

A. Species-Specific Disinfectants and Procedures for Their Use

Note that many of these methods will be effective against multiple species – but when in doubt, always research which method is best for the particular species and equipment that is to be disinfected. Disinfection procedures for invertebrates are still being developed and evaluated. Thus, try to ensure successful disinfection – use the highest concentration disinfecting agent for the longest duration that won't adversely affect your gear. Always be aware of disposal procedures for disinfectant solutions in order to avoid accidentally polluting waterways!

Zebra/Quagga Mussel – *Dreissena spp.* (and most other invertebrates)

- Wash using a high temperature steam pressure washer at temperatures >200° F or 100° C for 3 – 10 minutes depending on organism lifestage, density, etc. (e.g., thick clusters of adults will take longer to kill than a few scattered larvae)
- Wash in water at a minimum temperature of 120° F (49° C) (e.g., undiluted hot tap water) for at least 20 minutes (note: water must be maintained at 120° F (49° C) or above throughout process)
- Use of chlorine-based disinfection procedures (see below) (precautions necessary)
- Equipment drying procedures (see below) – Note that it can take up to 21 days to kill adult zebra mussels by drying but most will die within one week (must be tested to confirm death)
- Phenol base cleaners (e.g., Lysol) – immersion in full strength for at least 2 minutes
- Ethanol (50%) – immerse for at least 2 minutes or use repeated flooding rinses of ethanol
- Salt solution (saturated salt solution diluted to 5%; e.g., 50 ml saturated salt solution in 950 ml water) – immersion for at least 30 minutes (exact exposure time depends on mussel life stage, density of mussels, etc.)
- Freezing solid for 1 – 24 hours depending on organism lifestage, density, etc.

Whirling Disease

- Wash using a high temperature steam pressure washer at temperatures >104° F or 40° C.

Didymo – *Didymosphenia geminata*

(** minimum of 1 minute exposure to any one (1) of the following):

- Hot water: 140°F
- Dishwashing detergent: 5% solution (~1 cup detergent to 1 gallon of water) (“environmentally friendly” detergents are not considered effective)
- Salt solution: 5% solution (saturated salt solution diluted to 5%; e.g., 50 ml saturated salt solution in 950 ml water)
- Air: *Didymosphenia geminata* can survive for months in moist conditions. If complete drying isn't possible, restrict use of gear to a single waterway.

PFBC Biosecurity Protocols

Boats and Other Equipment – “Check, Clean, Dry”

- Check: Look for and remove visible algae and plant material from boots, gear, or anything that has made contact with the water or sediments.
- Clean: Soak, scrub, and/or expose all equipment in one of the solutions described above for a minimum of 1 minute. Absorbent items like felt-soled waders require 30-40 minutes of soaking.
- Air Dry: Items must be dried “to touch,” and then allowed to dry for an additional 48 hours when possible.
 - *Didymosphenia geminata*. Dry: Items must be dried “to touch,” and then allowed to dry for an additional 48 hours when possible. Can survive for months in moist conditions. If complete drying isn’t possible, restrict use of gear to a single waterway.
 - Check trailers, trailer “bunks” with absorbent carpet, engines, paddles/oars, bilge areas, ropes, anchors, etc.

B. Disinfecting Solutions and Agents

Virkon: 0.5% (1:200) solution of Virkon Aquatic[®] sprayed on at an application rate of 300 ml per square meter. Virkon is available from Western Chemical. Contact number is 1-800-283-5292. PLEASE NOTE: Virkon Aquatic[®] is labeled for use only as a bactericide and viricide! Do not depend on its use against other AIS such as invertebrates (e.g. zebra mussel), plants, vertebrate species, etc. See above in Appendix 1 for other disinfection methods!

Chlorine: (NOTE: Chlorine, especially at high concentrations, is highly corrosive and causes degradation of plastics and rubber. Chlorine solutions must be neutralized with sodium thiosulfate prior to flushing.)

- 50% (1:1) household bleach (5.25% liquid sodium hypochlorite) dip, wipe, or spray; or
- 10% (1:9) household bleach (5.25% liquid sodium hypochlorite) immersion for 10 minutes; or
- 200 ppm [150 ml of household bleach (5.25% liquid sodium hypochlorite)/10 gal water or 35 g of granular 70% HTH[®] (pool chlorine)/26 gal water dip or spray (not for use on nets); or
- 20 ppm [15 ml of household bleach (5.25% liquid sodium hypochlorite)/10 gal water or 3.5 g of granular 70% HTH[®]/26 gal water complete immersion for 30 minutes.
- Household bleach (5.25% chlorine) can be purchased with VISA through the PFBC’s cleaning supply contract (Grainger).
- HTH is granular chlorine (70% calcium hypochlorite) and can be purchased from a pool supply company.
- Sodium thiosulfate should be available at a pool supply company or from a chemical supply company.

PFBC Biosecurity Protocols

Quaternary Ammonium Compounds (follow manufacturer instructions)

- Roccal-D™; or
- BrightWater™; or
- Parvosol™; or
- Formula 409®, 1:2 dilution for soaking or full strength as a spray for 10 minutes.

Heated Water

- 200°F (93°C) poured on gear
- 140°F (60°C) complete immersion for 15 minutes (requires a consistent heat source)
- 113°F (45°C) complete immersion for 60 minutes (requires a consistent heat source)

Salt Solution

- Always start with a saturated salt solution and dilute with water to the desired concentration (e.g., 5% salt solution; saturated salt solution diluted to 5%; 50 ml saturated salt solution in 950 ml water)

Sunlight

- Complete drying in direct sunlight for a minimum of 4-6 hours. Because of the necessarily limited times involved, this method is only recommended for non-absorbent materials.

Freezing

- Items must be frozen for a sufficient duration to kill all AIS life stages – preferably 24 hours or longer.

Air Drying

- Items must be dried long enough to completely dehydrate the organism of concern (many AIS can survive for months in barely damp conditions!). When in doubt, always dry to touch and then continue drying for at least an additional 48 hours. More absorbent materials will take more time to dry thoroughly.

Rubbing Alcohol (Ethanol)

- For wiping down small equipment.

Appendix 2

General Safety Precautions for Disinfectant Use

- When handling or spraying chlorine bleach solution, wear protective equipment (mask, gloves, goggles, rain gear, etc.) and use in a well-ventilated area (follow precautions on MSDS). Stay upwind when spraying. Chlorine will break down in sunlight and when in contact with organic material.
- Chlorine is corrosive to metal and rubber and is toxic to fish at the recommended concentrations. So, rinse well after disinfection or neutralize with sodium thiosulfate. For neutralizing chlorine, spray sodium thiosulfate at 800 ppm solution (3 grams per gallon of water) on all chlorine treated surfaces after the disinfection period is over. Rinse with water from the next waterbody to remove any remaining sodium spray.
- Virkon Aquatic – This is a disinfectant in the peroxygen (hydrogen peroxide) family. It is a powder. It is 99.9% biodegradable and breaks down to water and oxygen and is not corrosive at the working dilution. Wear a dust mask and eye protection if mixing powder. Wear rain gear and gloves if spraying. Stay upwind from the spray.

PFBC Biosecurity Protocols

AIS Biosecurity Protocols Check List (08/08/08)		
Equipment	Activity	Checked
AT WORK SITE		
INSPECT	Inspect and remove all visible aquatic plants, animals, mud, and other organic material from the boat, trailer, and equipment.	
DRAIN	Drain bilges or water holding containers.	
DISINFECT	Disinfect equipment.	
AT STORAGE FACILITY		
INSPECT	Inspect and remove all visible aquatic plants, animals, mud, and other organic material from the boat, trailer, or other equipment.	
DRAIN	Drain the bilges or other water holding equipment.	
DISPOSE	Collect disinfected and disposed of bilge water.	
DISINFECT	Operate pumps to take in the disinfectant and make sure that the solution comes in contact with all parts of the pump and hose.	
	Wash water holding compartments with a high temperature pressure washer or with an approved disinfectant.	
	Clean equipment used in field activities using a high temperature pressure washer or through application of disinfectant solution.	
Boat Motors		
INSPECT	Immerse the lower unit in a bucket of disinfectant and run the motor.	
DISINFECT	Allow the disinfectant to remain in the motor for the appropriate contact time.	
Large Equipment		
INSPECT	Inspect and remove all vegetation and other organic debris prior to disinfection.	
DISINFECT	Power washing is not required, but large equipment could be sprayed with a garden hose to remove debris.	
RINSE	After application of disinfectant solution, the equipment must be rinsed with clean water.	
Small Equipment & Personal Equipment		
INSPECT	Inspect and remove all organic material from gear.	
DISINFECT	Spray with disinfectant; maintain a wet surface for the appropriate contact time described in Appendix 1.	
RINSE	After application of disinfectant solution, the equipment must be rinsed with clean water.	

Exhibit B
Insurance Requirements

During any term of this Agreement, the COMPANY shall maintain or cause to be maintained the following minimum insurance coverage with insurance companies rated "B+" or better by A.M. Best rating service (or equivalent if not rated by A.M. Best). Company's liability limits can be satisfied by any combination of primary and excess liability policy:

<u>Coverages</u>	<u>Limits of Liability</u>	
Workers' Compensation Insurance Employers' Liability Insurance	Statutory Per Occurrence	\$1,000,000
Commercial General Liability Insurance, including contractual and products/completed operations	Per Occurrence General Aggregate	\$1,000,000 \$2,000,000
Automobile Liability Insurance, including non-owned and hired vehicle coverage	For bodily injury and property damage Per Occurrence	\$1,000,000
Excess Umbrella	Per Occurrence	\$2,000,000

Prior to exercising any of its privileges under the Agreement, the COMPANY shall furnish the COMMISSION certificates of insurance to the effect that such insurance has been procured and is in force. Prior to the expiration of any of the insurance policies required herein, the COMPANY shall furnish the COMMISSION certificates of insurance, in accordance with the terms hereof, evidencing the renewal of such insurance for a period equal to at least one year from the date of expiration of the then current insurance policies.

The insurance policies required herein shall be endorsed with, and the certificates of insurance shall contain, the following language:

"To the extent of liability assumed under this Agreement:

1. The Commonwealth of Pennsylvania, Pennsylvania Fish and Boat Commission, its officials and employees are named as an Endorsed Additional Insured for third party bodily injury and property damage claims with respect to the commercial general, excess umbrella, and automobile liability policies set forth herein.
2. A waiver of the underwriter's rights of subrogation applies in favor of the Pennsylvania Fish and Boat Commission as its interest may appear with respect to all policies described herein."

Prior to cancellation or a material change in a policy, the COMPANY shall notify the COMMISSION.