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Project name:
MSD Odor Control Master Plan

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Date:
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FINAL

Memo

Subject: Technical Memorandum #9 – Morris Forman Service Area – Odor Control Conceptual Design

1. Introduction

1.1 Odor Control Master Plan Background

In response to receiving a Notice of Violation (NOV) in November 2019 for failure to control nuisance odors from the Morris Forman Water Quality Center (WQTC, Plant), pumping stations and its collection system, MSD entered an agreed order with the Louisville Metro Air Pollution Control District (APCD) to develop and implement a phased District-wide Odor Control Master Plan. MSD has contracted AECOM to provide MSD with professional engineering services for the development of Phase I of the Odor Control Master Plan (Odor Control Master Plan), which is focused on the Morris Forman Service Area. MSD also contracted with a public relations firm to increase public engagement and communications during development and implementation of the phased Odor Control Master Plan.

1.2 Purpose

During previous phases of the Odor Control Master Plan, AECOM reviewed and compiled available data and documentation related to odor control and sampling within the Morris Forman Service Area. The purpose of this memorandum is to provide conceptual designs for the units proposed based on the performance of the odor control systems and technologies at the selected structures within the Morris Forman Service Area: The main objectives of this report are to:

1. Provide conceptual designs for the recommended odor control systems and technologies that are to replace or improve the selected units within the Morris Forman WQTC, Collection System, and Pump Stations in the Morris Forman Service Area.
2. Incorporate findings from TM#8A, TM#8B, and TM#8C, New Odor Control Technologies Recommendations into TM#9, Odor Control Conceptual Design.

Based on the recommendations from the current performance evaluation, action items were developed to improve the odor removal efficiency of existing odor control systems in the Morris Forman WQTC, Collection System, and Pump Stations within the Morris Forman Service Area.

1.3 Previous Documentation and Implementation Schedule

In accordance with the agreed order, MSD has submitted several documents to APCD to demonstrate ongoing odor control efforts. **Table 1** shows MSDs completed and ongoing efforts towards the APCD agreed order.

Table 1 – Master Plan Implementation Schedule

Title		Due Date	Status
TM#1	Morris Forman WQTC Background Document Review	Q1 2021	Completed
TM#2	Collection System Background Document Review	Q2 2021	Completed
TM#3	Pump Stations Background Document Review	Q2 2021	Completed
TM#4	WQTC, Pump Stations and Combined Sewer System Planned Process Modifications	Q1 2021	Completed
TM#5	Current WQTC, Pumping Stations and Combined Sewer System Odor Impact Evaluation	Q2 2021	Completed
TM#6A, TM#6B, TM#6C	Morris Forman WQTC (TM#6A), Pump Stations (TM #6C), and Collection System (TM #6B) Sampling Phase Results Analysis	Q4 2022	Completed
TM#7A, TM#7B, TM#7C	Morris Forman WQTC (TM#7A), Collection System (TM#7B), and Pump Stations (TM#7C) Current Odor Technologies Performance Evaluation	Q4 2022	Completed
TM#8A, TM#8B, TM#8C	Morris Forman WQTC (TM#8A), Collection System (TM#8B), and Pump Station (TM#8C) New Odor Control Technologies Recommendations	Q4 2022	Completed
TM#9	**Odor Control Conceptual Design**	**Q4 2022**	**Ongoing**
Odor Control Master Plan Phase I Final Report		**Q4 2022**	**Ongoing***

**- The Final Odor Control Master Plan Phase I Final Report will be comprehensive document which includes information about the Morris Forman Collection System, WQTC, and selected pump stations.*

2. Morris Forman Water Quality Treatment Center

2.1 Summary of Unit Selected

A total of five (5) locations within the Morris Forman WQTC were selected for odor control systems based on sampling results and air dispersion modelling. A description of the recommended technology for each plant location is described in the following sub-sections.

2.1.1 Sedimentation Basins/BOC System

MSD is actively coordinating with a consultant to design and construct a new system consisting of rehabilitation of the biotrickling filters and replacement of the media. As part of the odor control master plan, a second treatment stage may be considered for additional odor handling after the planned system upgrades are installed and tested for performance. A multi-media carbon unit is recommended to be installed as a polishing unit on the BOC to reduce the odor emission concentration.

2.1.2 East and West Headworks

For the East and West Headworks, it is recommended that covers are installed on the open channel portions of the flow train, and either a biofilter with synthetic media or a biotrickling filter is installed for the Headworks. Both the Biofilter and the Biotrickling media would be designed to reduce odor and H_2S levels within the Headworks including the Dumpster Building. The Biofilter would require a larger area while the Biotrickling filter is a tower installation and would typically require less of a footprint. The biotrickling filter may also need carbon polishing for further odor emission reduction which could increase the space requirements for the entire system.

2.1.3 DAFT/Main Equipment Building Exhaust

To manage the high odor levels sampled within the DAFT system and the Centrifuge Area exhaust, it is recommended that a biofilter with synthetic media or a biotrickling filter is to be installed. To achieve a centralized service and maintenance arrangement, a consideration should be on the option on having this odor control system in the same area with the Headworks odor control unit. The proposed unit would manage the high odor levels present in the DAFT unit and centrifuge area exhaust.

2.1.4 SHOC

While the SHOC had high H_2S and TRS removal efficiency, it was determined through air dispersion modeling that the SHOC had a large impact on overall odor contributions to the surrounding area. Thus, to provide further treatment, an additional multi-media carbon unit is recommended to assist in reducing odor emissions after odorous air passes through the SHOC.

2.2 Conclusions

As described above, an odor control system is proposed to be installed on the Sedimentation Basins/BOC System, East and West Headworks, DAFT Exhaust/Centrifuge Area Exhaust, and SHOC. The Sedimentation Basin/BOC system is currently being designed to rehabilitate the biotrickling filters and replace the media, but an additional multi-media carbon unit is recommended to also be installed on the BOC system. The East and West Headworks are recommended to install either a biofilter unit or a biotrickling unit that has carbon polishing for odor emission reduction. The DAFT Exhaust/Centrifuge Area Exhaust is recommended to have a biofilter with synthetic media or a biotrickling filter for odor reduction. A multi-media carbon unit is recommended for the SHOC to reduce odor emissions.

Recommendations made for each system are based on information known at the time of memorandum development. Additional investigation will need to be performed for each area to confirm feasibility of installing the recommended units. As a result, recommendations are subject to change as added information becomes available.

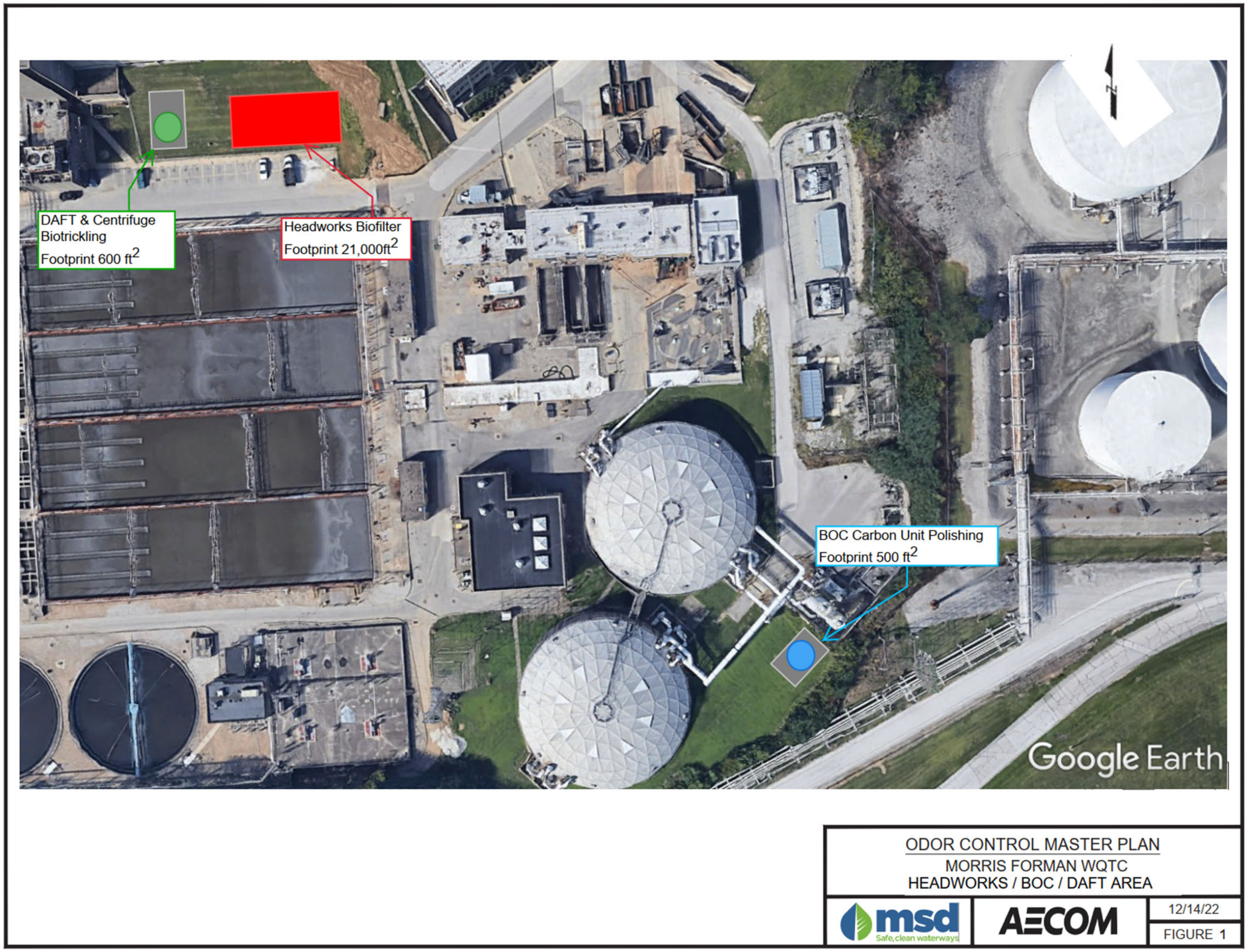

Figure 1 – Headworks / BOC / DAFT Area

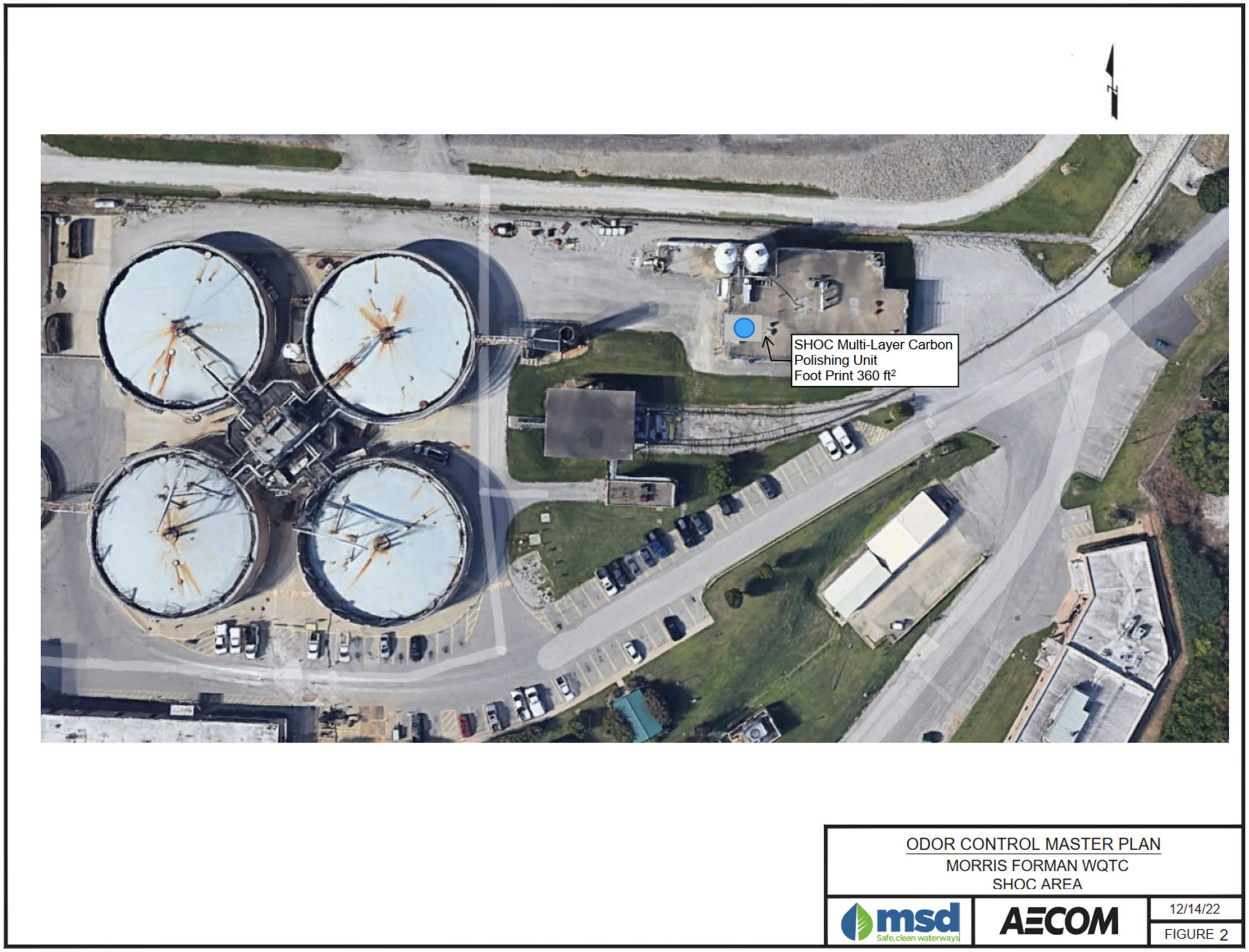

Figure 2 – SHOC Multi-Layer Carbon Polishing Area

3. Morris Forman Collection System

3.1 Summary of Collection Systems Selected

A total of 2 (two) locations within Morris Forman Collection System were selected for odor control systems based on sampling results. A description of the recommended technology/procedures for the Grand Avenue Force Main and the Western Outfall is described in the following sub-sections.

3.1.1 Grand Avenue Force Main Pilot Study

Bioxide is currently injected at five (5) locations within the Morris Forman collection system; However, H_2S levels are still high despite treatment. Based on the low performance of the Bioxide system, a pilot study is recommended to evaluate an alternative chemical that that may be more effective at reducing both odor and H_2S levels, as well as providing extended benefits for a longer length of pipe. Potential chemicals to be tested for injection could be ferrous chloride or hydrogen peroxide. This study would be performed on the Grand Avenue Force Main and if this is deemed successful, it could be incorporated full scale on the Ohio River Force Main, or other sewers within the collection system. A layout of the chemical injection station locations and the H_2S and vapor monitoring locations are provided in Figure 3

3.1.2 Western Outfall Pilot Study

The Western Outfall operates at a positive pressure, which means that all odorous air is expelled from the sewer headspace at various manhole points along the pipe. Due to this nature of the sewer system, a negative pressure unit could be installed at one or more locations along the sewer to keep the pipe running at a negative pressure. This would enable the odorous air in the sewer to be carried downstream towards the Morris Forman WQTC. The number of units running concurrently would be dependent on vendor availability and/or MSD’s budget. A conceptual layout of these pilot test locations at the two (2) selected manholes are provided in Figure 4**.**

3.2 Conclusions

As described above, odor control pilot systems are recommended to be installed on the Grand Avenue Force Main and the Western Outfall. A pilot study using a different chemical, such as ferrous chloride or hydrogen peroxide, is recommended to be conducted along the Grand Avenue Force Main for testing odor and H_2S reduction efficiency. A negative pressure pilot test is proposed for the Western Outfall sewer. Proposed site locations for the pilot tests for the Grand Avenue Force Main and the Western Outfall are provided in figures below. If the pilot studies prove to be successful, full-scale systems can be installed on these sewers, as well as the Ohio River Force Main, Ohio River Interceptor, and Southern Outfall.

Recommendations made for each system are based on information known at the time of memorandum development. Additional investigation will need to be performed for each area to confirm feasibility of installing the recommended units. As a result, recommendations are subject to change as new information becomes available.

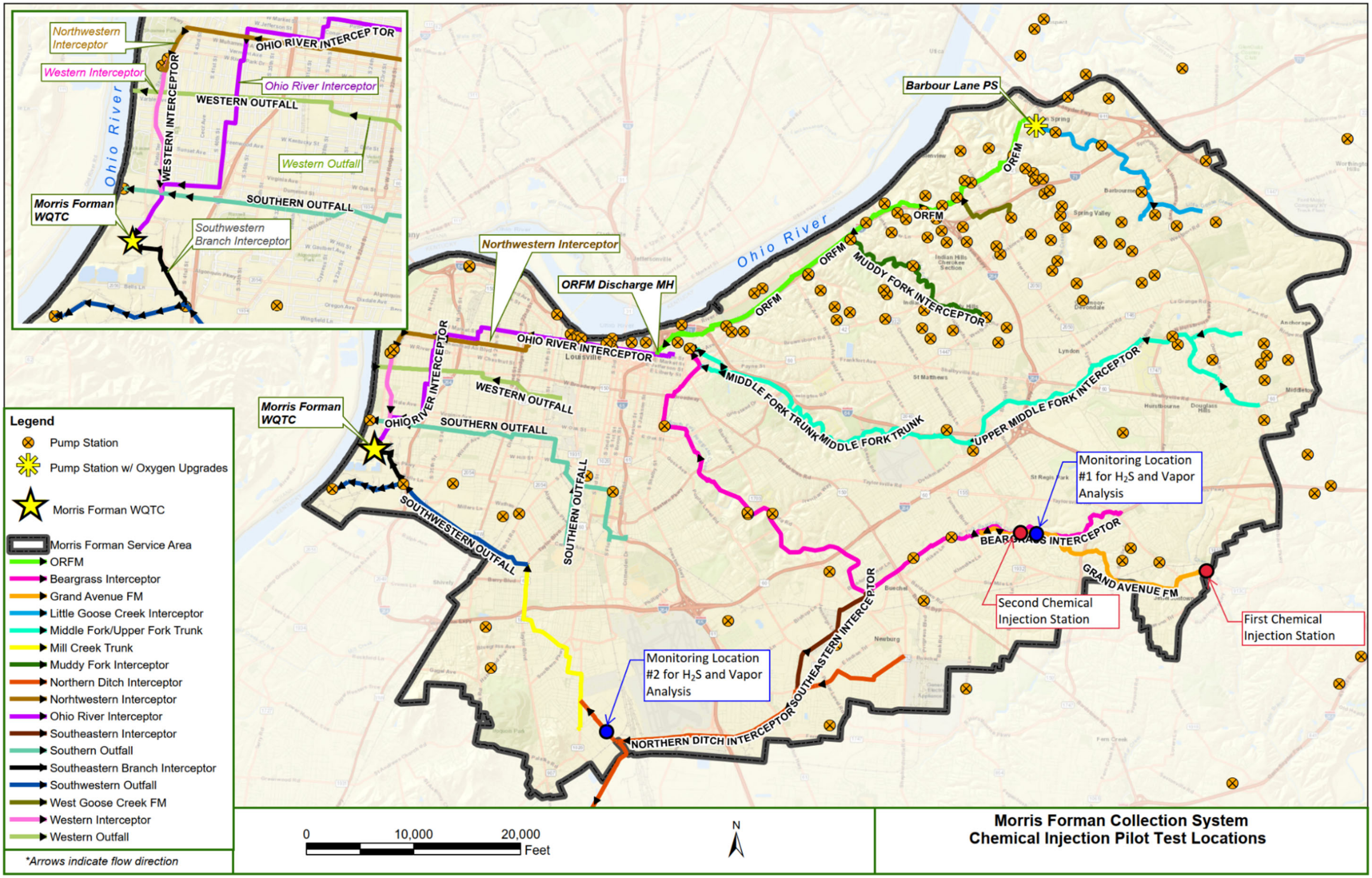

Figure 3 – Chemical Injection Pilot Test Locations

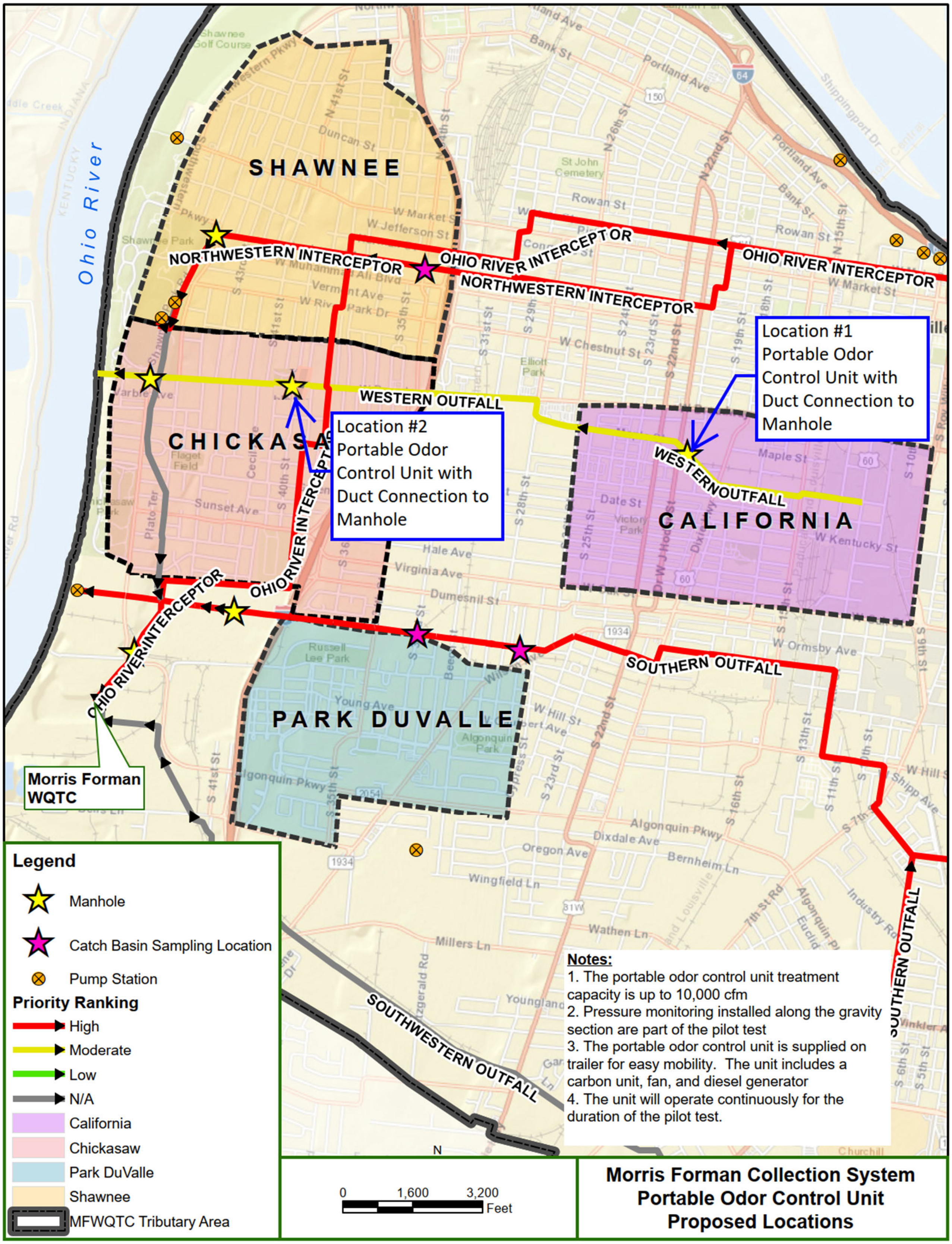

Figure 4 – Portable Odor Control Unit Proposed Locations

4. Morris Forman Pump Stations

4.1 Summary of Pump Stations Selected

A total of five (5) pump stations within the Morris Forman Service Area were selected for odor control systems based on sampling results and air dispersion modelling. A description of the recommended technology for each pump station is described in the following sub-sections.

4.1.1 Pump Station #4

At Pump Station #4, there were two (2) odor control systems recommended for odor and H_2S level improvements. It is recommended that either a hydroxyl generator or a photoionization (UV) unit could be installed at this facility. There is no existing odor control system installed at this location.

Two (2) hydroxyl generators, with air intake capabilities of 1,000 CFM, would be installed along the wall of the facility, each handling the exhaust of a portion of the wet wells. Exhaust from wet wells would be treated through 4" diameter pipes connected to the hydroxyl generators. The hydroxyl enclosure dimensions are 7.5' x 24'. Two additional small diameter goose neck vents would be installed within the wet wells, along with a new air supply and exhaust system for the overall pump station. Figure 5 shows the schematic conceptual design of the hydroxyl generator for Pump Station #4.

The photoionization unit would be installed along the northeast wall of the facility and have a capacity of 10,000 CFM, an intake pipe, and a chamber with the dimensions 18' x 10'. A supply air plenum would be installed within the existing pump station to facilitate air distribution, in addition to an exhaust plenum for supplying air to the new photoionization unit. Figure 6 shows the schematic conceptual design of the photoionization unit for Pump Station #4.

Both of these schematic conceptual designs are not final and may be modified to account for site-specific conditions.

4.1.2 Pump Station #6

At Pump Station #6, there were two (2) odor control systems recommended for odor and H_2S level improvements. Either a hydroxyl generator or a multi-layer carbon unit are recommended for installation at this facility. There is no existing odor control system installed at this location.

Two (2) hydroxyl generators, with air intake capabilities of 1,000 CFM, would be installed along the east wall of the facility. Hydroxyl radicals would be dispersed through small diameter pipes to treat the exhaust from each of the wet wells. The hydroxyl enclosure dimensions are 7.5' x 24'. Figure 7 shows the schematic conceptual design of the hydroxyl generator for Pump Station #6.

The multi-layer carbon unit would be installed along the east wall of the facility and have a treatment capacity of 9,500 CFM, an intake duct, and a new air intake system for supplying wet well exhaust to the new multi-layer carbon unit. Figure 8 shows the schematic conceptual design of the multi-layer carbon unit for the pump station.

Both of these schematic conceptual designs are not final and may be modified to account for site-specific conditions.

4.1.3 Pump Station #8

At Pump Station #8, there were two (2) odor control systems recommended for odor and H_2S level improvements. Installation of either a hydroxyl advanced oxidation unit (Vapex) or a photoionization unit are recommended at this facility. There is no existing odor control system installed at this location.

The hydroxyl advanced oxidation unit would consist of 2 separate Vapex units along the east wall of the pump room. Each Vapex unit would have a small diameter pipe with a spray head for dispersing Hydroxyl radicals to treat wet well exhaust. Two (2) air supply plenums would additionally be installed on the north and south walls of the pump room to facilitate air dispersion. Figure 9 shows the schematic conceptual design of a Vapex unit for Pump Station #8.

The photoionization unit would be installed along the south wall of the facility and have a 6,000 CFM capacity, an intake duct collecting air from the pump room, and a chamber with the dimensions 16' x 9'. Two (2) air supply plenums would be installed on the north and south walls of the pump room to facilitate air distribution. Figure 10 shows the schematic conceptual design of a photoionization unit for Pump Station #8.

Both of these schematic conceptual designs are not final and may be modified to account for site-specific conditions.

4.1.4 Pump Station #2

At Pump Station #2, two (2) odor control systems are recommended for odor and H_2S level improvements. It is recommended that either a biotrickling unit or a photoionization unit are installed at this facility. The proposed units would replace the existing dual bed carbon adsorber odor control system currently installed at this location.

The biotrickling unit would be installed along the southeast wall of the facility and would have a treatment capacity of 9,000 CFM. It would be 11' 6" x 27' in size, have an air intake duct, and a new air supply system to ventilate wet well exhaust to the biotrickling unit. Figure 11 shows the schematic conceptual design of implementing a photoionization unit to the pump station.

The photoionization unit would be installed along the southeast wall of the facility and have a 9,000 CFM capacity, an air intake duct collecting air from the pump room, and a chamber with the dimensions 15' x 9'. An additional air intake vent would be installed to supply air to the photoionization unit. Figure 12 shows the schematic conceptual design of a photoionization unit for the pump station.

Both of these schematic conceptual designs are not final and may be modified to account for site-specific conditions.

4.1.5 Pump Station #3

At Pump Station #3, two (2) odor control systems are recommended for odor and H_2S level improvements. It is recommended that either a new multimedia carbon unit or a biotrickling unit are installed at this facility. The proposed units would replace the existing dual bed carbon adsorber odor control system currently installed at this location.

The multi-layer carbon unit would be installed along the southeast wall of the facility and have a treatment capacity of 9,000 CFM, an intake duct, and a new air intake system for supplying wet well exhaust to the new multi-layer carbon unit. Figure 13 shows the schematic conceptual design of implementing the multi-layer carbon unit to the pump station.

The biotrickling unit would be installed along the southeast wall of the facility and would have a treatment capacity of 9,000 CFM. It would be 11' 6" x 27' in size, have an air intake duct, and a new air supply system to ventilate wet well exhaust to the biotrickling unit. Figure 14 shows the schematic conceptual design of implementing a photoionization unit to the pump station.

Both of these schematic conceptual designs are not final and may be modified to account for site-specific conditions.

4.2 Conclusions

As described above, each pump station has two (2) recommended odor control technologies that can provide odor and/or H_2S reduction. The recommended technologies at each location are listed in Table 2:

Table 2 – Morris Forman Pump Station Odor Control Technology Recommendations

Pump Station	Odor Control System Recommendations	
Pump Station #4	Two (2) Hydroxyl Generators	Photoionization Unit
Pump Station #6	Two (2) Hydroxyl Generators	Multi-Layer Carbon Unit
Pump Station #8	Hydroxyl Advanced Oxidation Unit	Photoionization Unit
Pump Station #2	Biotrickling Unit	Photoionization Unit
Pump Station #3	Multi-Layer Carbon Unit	Biotrickling Unit

Each recommended odor control system was given a correlated figure that provides the conceptual design and installation location at the pump station.

Recommendations made for each system are based on information known at the time of memorandum development. Additional investigation will need to be performed for each area to confirm feasibility of installing the recommended units. As a result, recommendations are subject to change as new information becomes available.

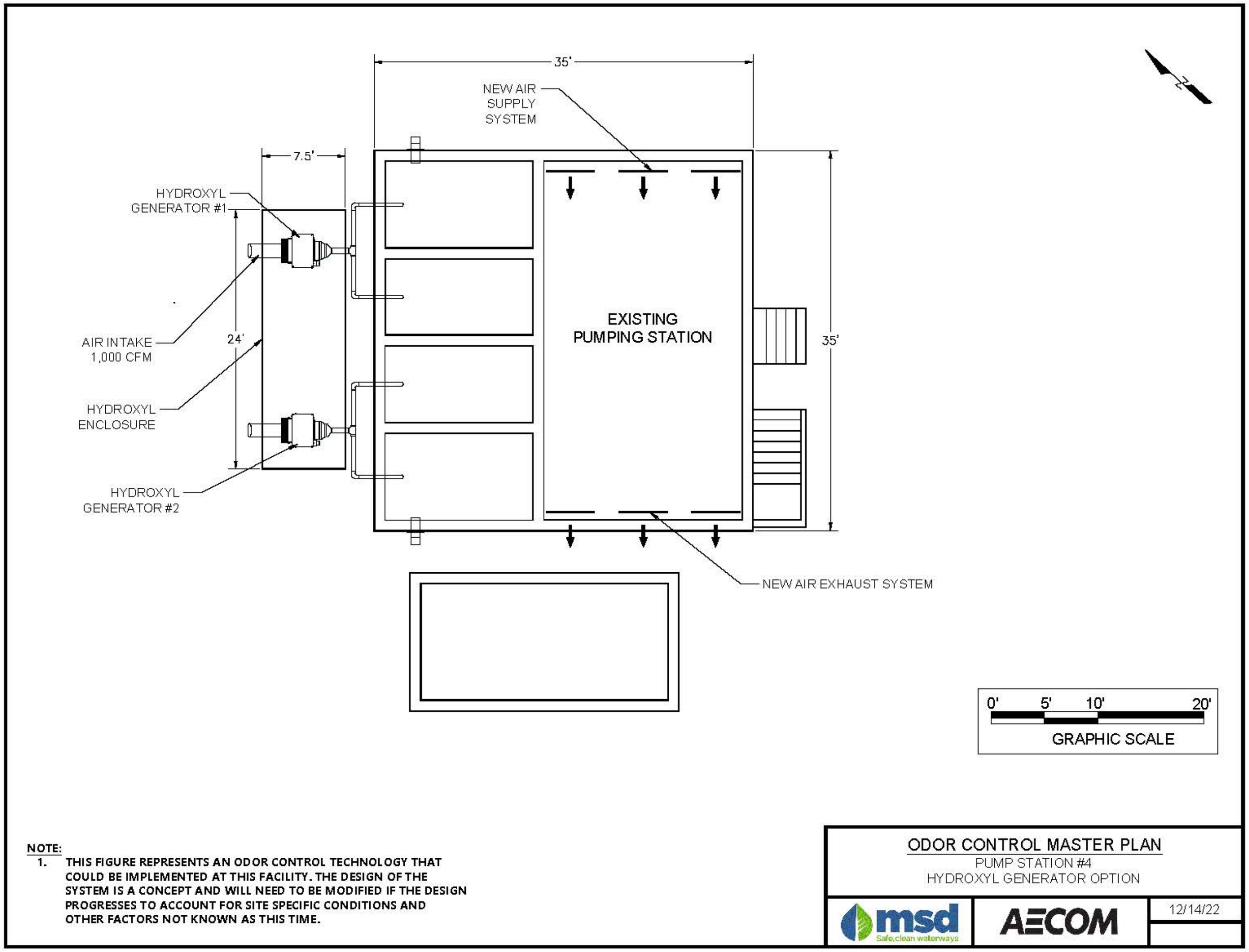

Figure 5 –Pump Station #4 Hydroxyl Generator Option

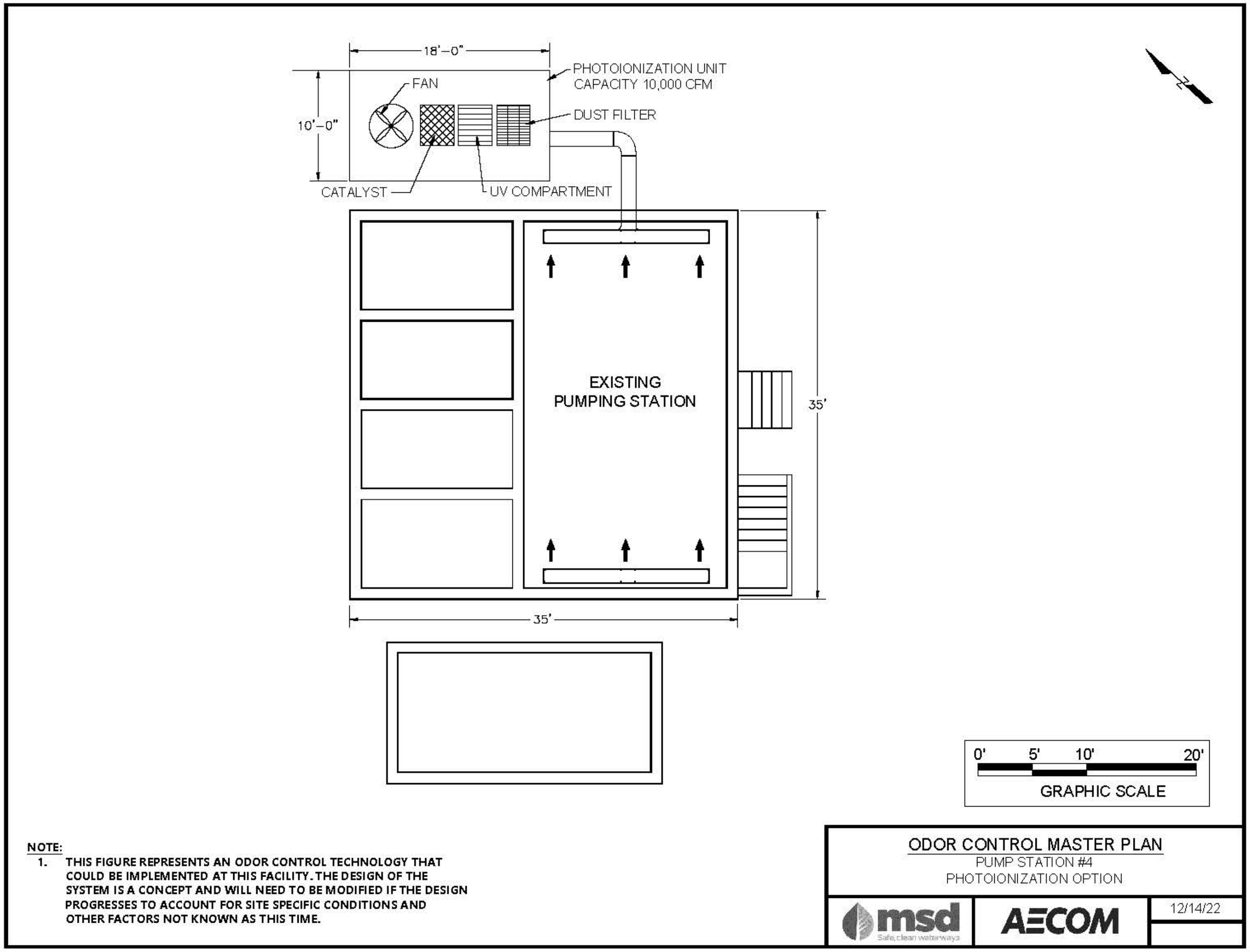

Figure 6 –Pump Station #4 Photoionization Option

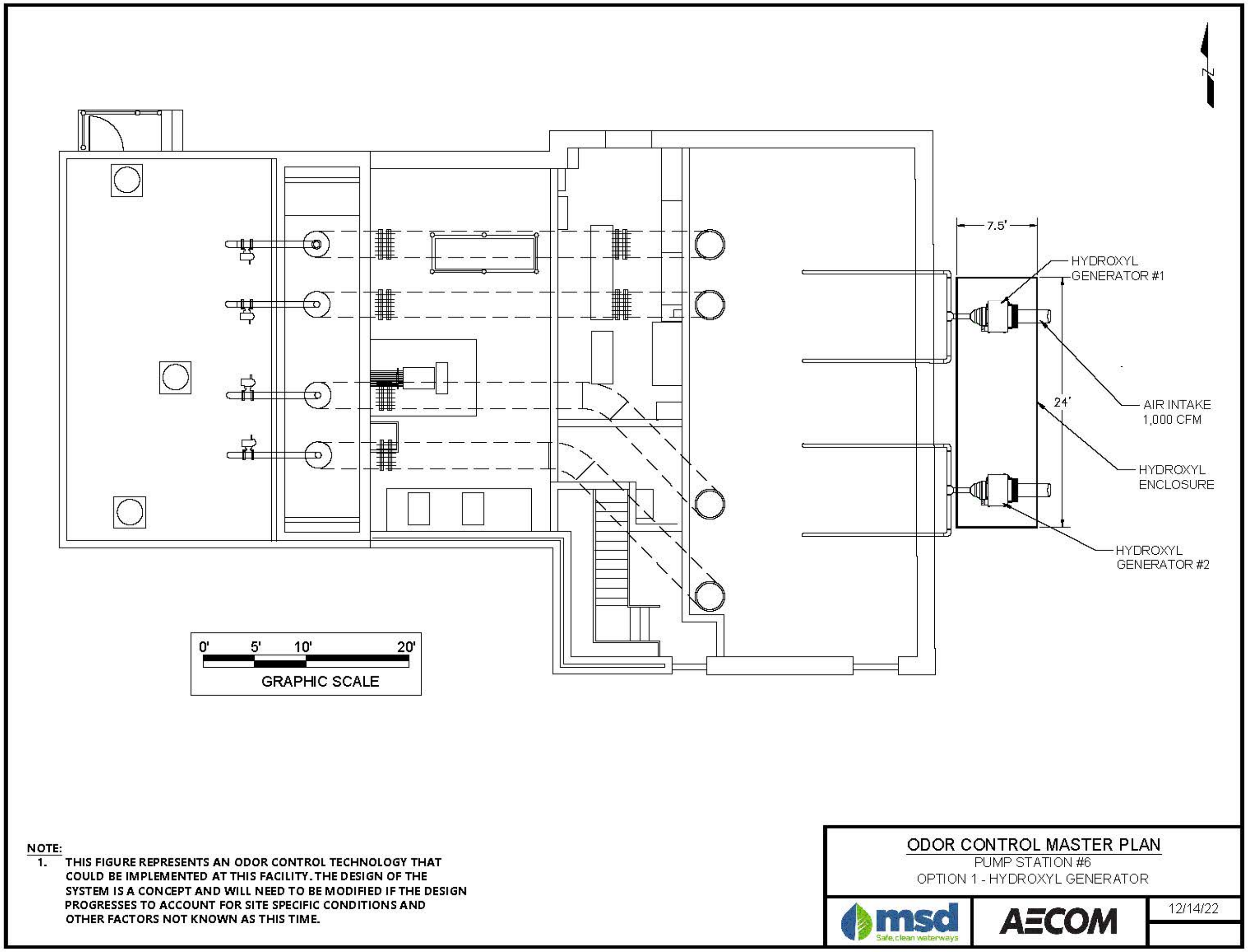

Figure 7 – Pump Station #6 Hydroxyl Generator Option

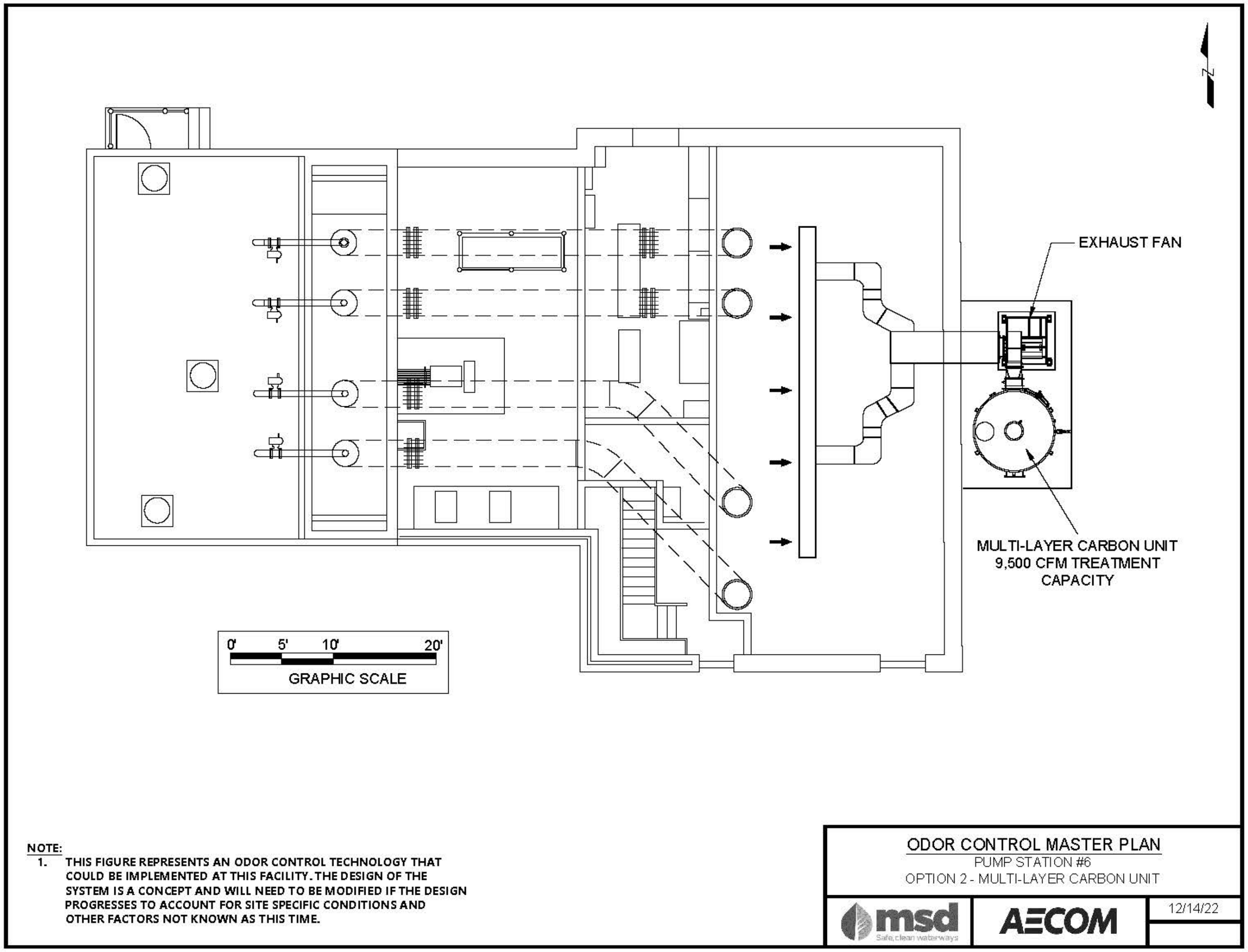

Figure 8 – Pump Station #6 Multi-Layer Carbon Unit Option

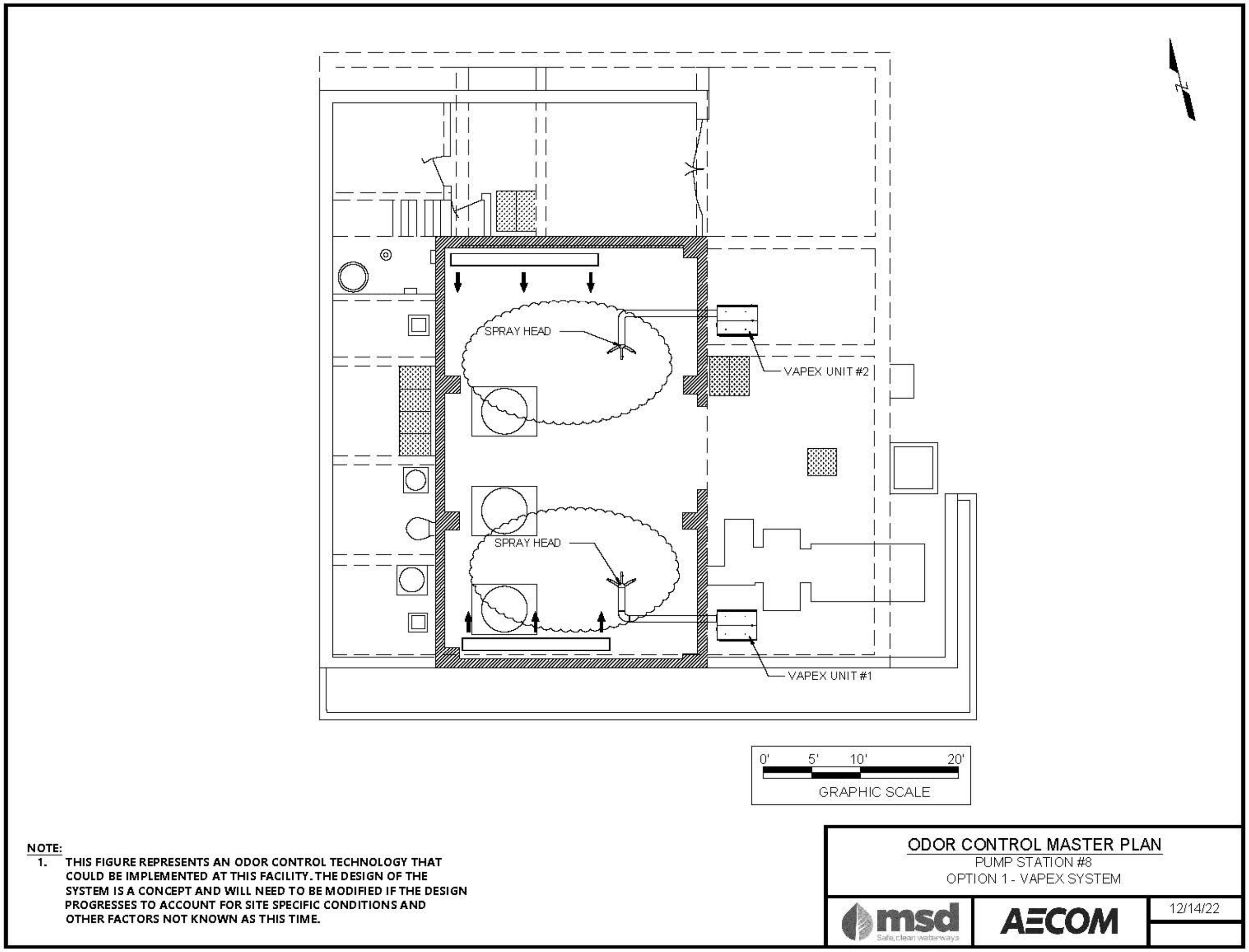

Figure 9 – Pump Station #8 Vapex System Option

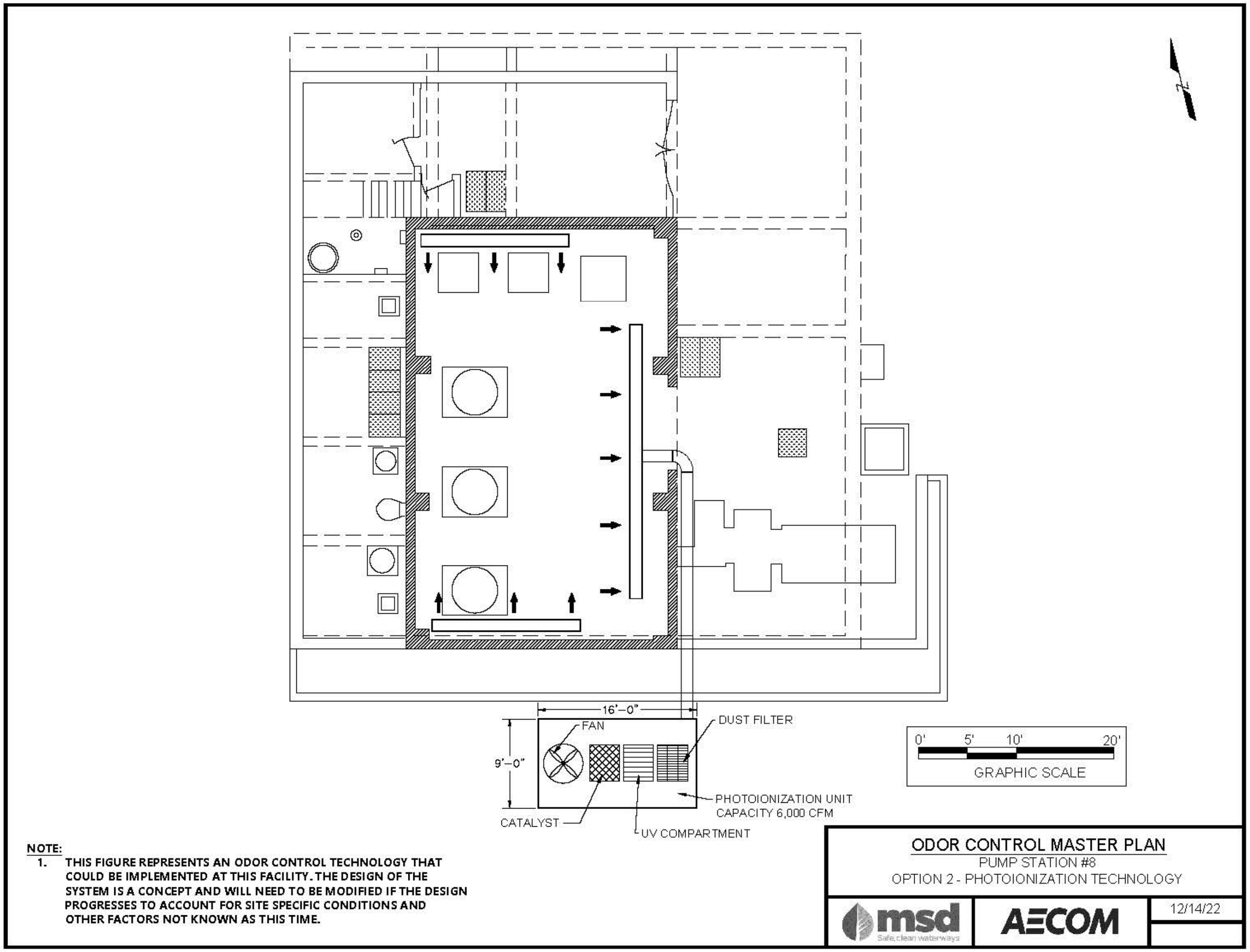

Figure 10 – Pump Station #8 Photoionization Option

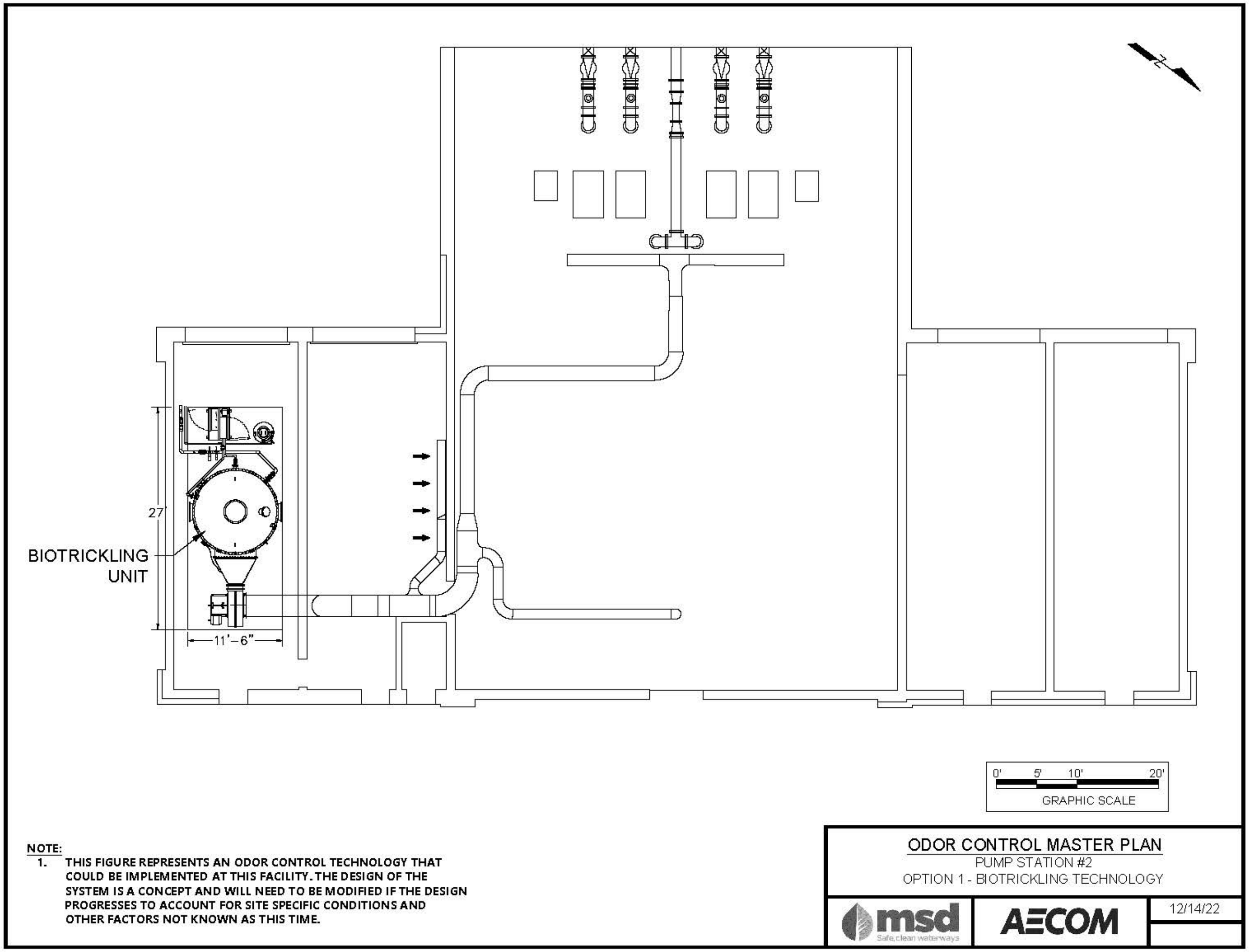

Figure 11 – Pump Station #2 Biotrickling Option

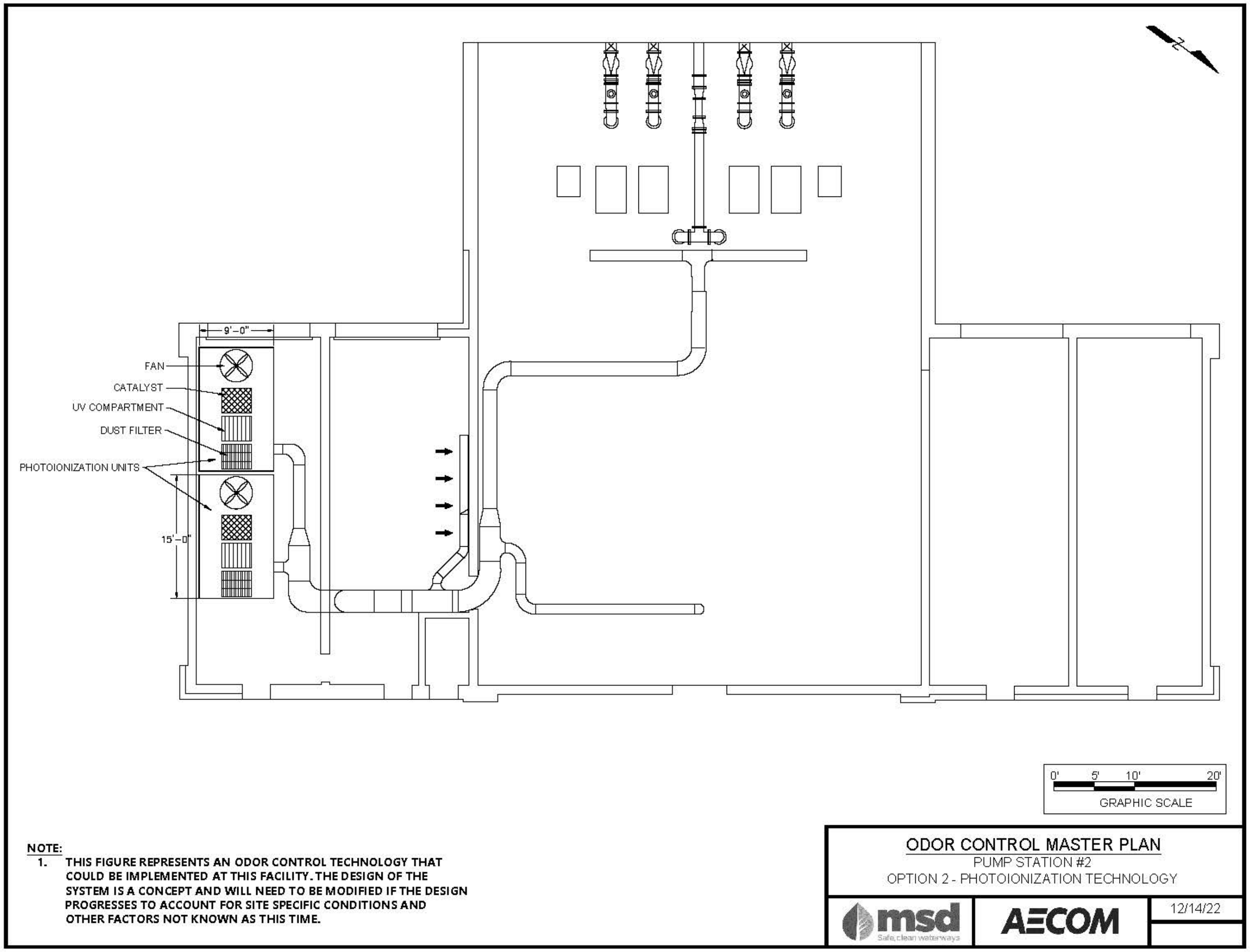

Figure 12 – Pump Station #2 Photoionization Option

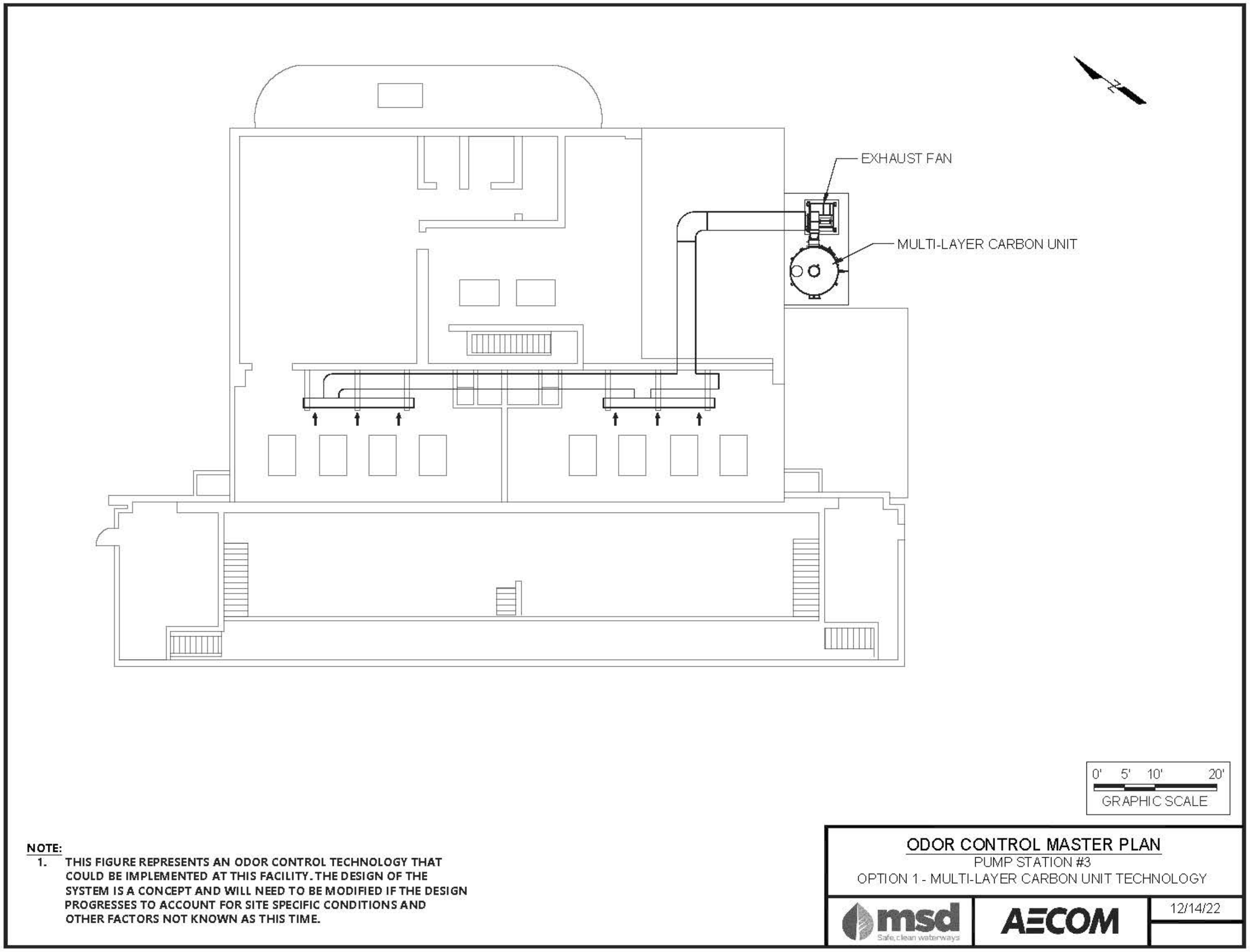

Figure 13 – Pump Station #3 Multi-Layer Carbon Unit

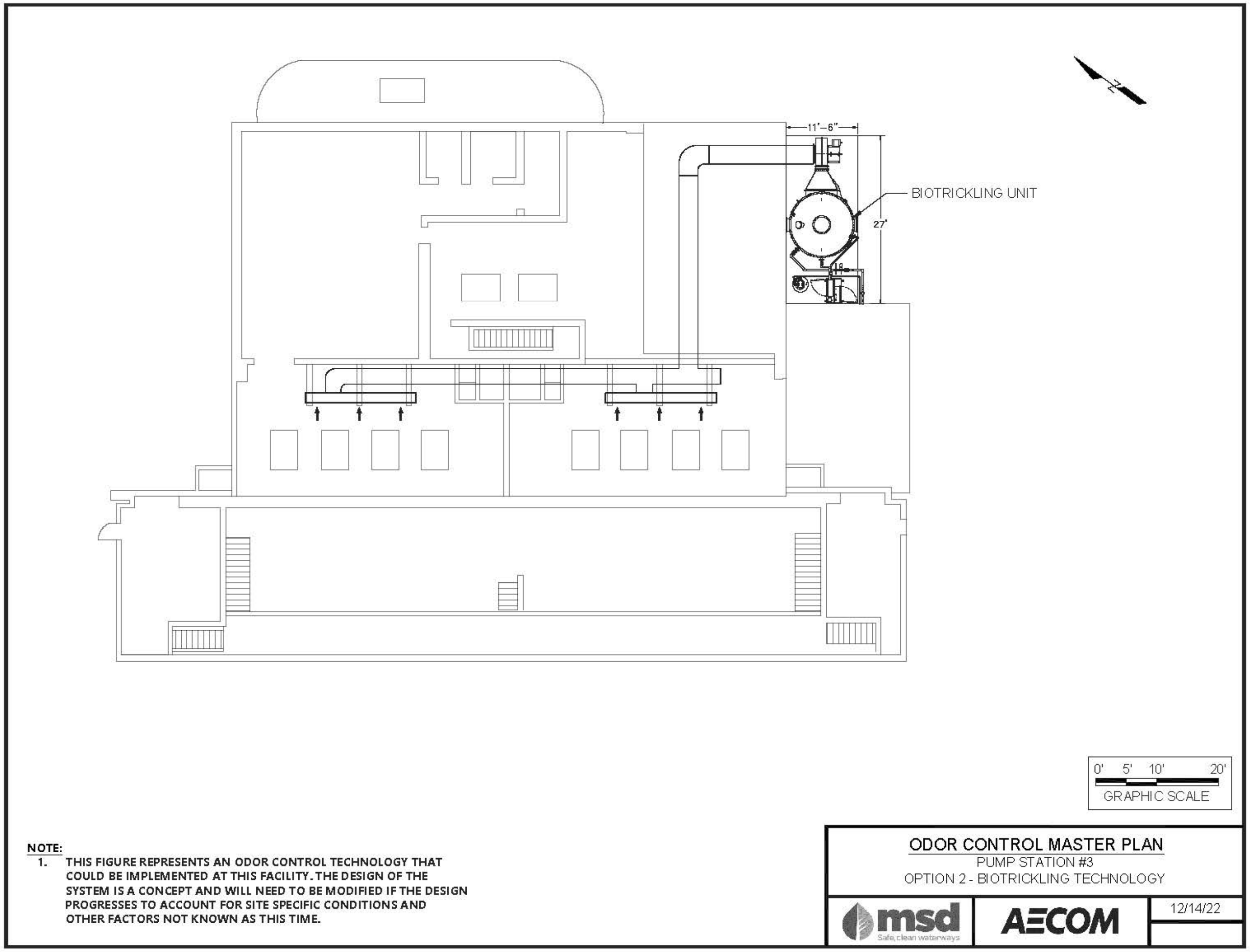

Figure 14 – Pump Station #3 Biotrickling Unit