

PROPOSAL

COMPREHENSIVE ASSESSMENT OF ODOR EMISSIONS AND THEIR CONTROL IN THE FRANKLIN, TN WASTEWATER COLLECTION AND TREATMENT SYSTEM

Prepared for:

CITY OF FRANKLIN WATER MANAGEMENT DEPT.
124 Lumber Drive
Franklin, TN 37064

Prepared by:

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CONSULTING ENGINEERS
21 Summerfield Lane
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1. INTRODUCTION

The City of Franklin operates a wastewater treatment plant that is scheduled for an upgrade. Encroaching development around the plant has raised concerns for odor, and there have been some complaints attributed to either the wastewater treatment plant or the sewer system that collects and transmits wastewater to the plant.

The collection system includes multiple pump stations and force mains. Force mains generate more hydrogen sulfide and odor than gravity sewers because the sewage is retained in a full pipe with no opportunity for aeration. As a result, the sewage quickly becomes septic or anaerobic, favoring the generation of odorous hydrogen sulfide gas. This hydrogen sulfide gas can be released downstream of the force main discharge, or at the headworks of the plant.

The wastewater treatment plant that serves the City of Franklin uses the oxidation ditch process with no primary clarifiers. Such plants tend to have fewer odor issues than plants with primary clarifiers. However, odors can still be released from the headworks or sludge handling processes.

The following proposal is to conduct a comprehensive assessment of the wastewater collection and treatment system to provide:

1. An evaluation of the contribution of odors and hydrogen sulfide from upstream force mains and interceptors.
2. An “odor emissions inventory” of the wastewater treatment plant to provide a ranking of odor sources by their odor emission rate.
3. Odor dispersion modeling to assess the existing “odor footprint” of the treatment plant and to evaluate the effect of recommended odor control alternatives.
4. Evaluation of various odor control strategies as necessary to meet downwind objectives.
5. A report that summarizes all sampling data, presents results of dispersion modeling, and provides recommendations and cost estimate for the most cost-effective odor control strategy.

A proposed Scope of Services and Fee Estimate follow, along with a proposed Schedule and Summary of Qualifications.

2. SCOPE OF SERVICES

Task 1. Review background information and develop sampling plan

Bowker & Associates will review background information on the facilities and develop a plan to collect samples from both the wastewater collection system and treatment plant. This will include collection and field analysis of wastewater samples in the collection system, deployment of Odalogs to measure H₂S concentrations, and collection and analysis of air samples at the treatment plant to measure odor strength. The written sampling plan will be submitted to the City of Franklin for review and comment.

Task 2. Implement sampling program

The sampling plan envisioned will consist of 3 days of wastewater sampling in the collection system and 7 days of continuous H₂S measurements at multiple locations in the sewer system. We will conduct field analysis of the wastewater for sulfide, pH, oxidation-reduction potential (ORP), and temperature. A total of 8 sampling locations have been assumed for this proposal.

For the wastewater treatment plant, air samples will be collected from processes including, but not limited to:

1. Headworks
2. Screen/grit handling systems
3. Oxidation ditch surface
4. Sludge thickening exhaust
5. Sludge dewatering exhaust
6. Other sources as necessary

Air samples will be sent by overnight carrier to St. Croix Sensory in Stillwater, MN to measure the odor “concentration” in dilutions to threshold. This ASTM laboratory procedure measures the number of times the odorous sample must be diluted with odor-free air until the odor can no longer be detected. In addition, selected samples will be sent to Mayfly Laboratory in Mystic, CT to measure the concentration of reduced sulfur compounds that are responsible for the odor. This will help in determining the best technology to treat the odor, should that become necessary.

Task 3. Conduct odor dispersion modeling

Bowker & Associates will first calculate the “odor emission rate” for each process. This is simply the odor concentration multiplied by the air flow rate to estimate how many “pounds of

odor” are being released from each process. This will provide a ranking of the odor sources by how much odor they are generating.

The odor emission rates are then input into the dispersion model, along with terrain data, actual weather data, building dimensions, etc. We will use the EPA-approved AERMOD dispersion model that predicts the level of odor surrounding the plant under worst-case meteorological conditions. We also use the model to estimate how often a “target” level of odor is exceeded. The dispersion model is valuable to determine the effects of implementing various odor control strategies on odor levels around the plant. Figure 1 is an example of the output of the dispersion model.

Task 4. Evaluate odor control options

We will evaluate various odor control options for those processes deemed to have the potential to generate odors that travel off-site. The selection of the proper technology is dependent on the characteristics of the air, the air flow rate, available space, required performance, and other factors. The focus will be on technologies that are well-demonstrated, reliable, and have low O&M requirements. Alternatives such as biofiltration, carbon adsorption, and bio-scrubbing are proven technologies that are frequently used to treat wastewater odors.

Addition of chemicals to the wastewater can also provide odor reduction, and will be evaluated on a case-by-case basis. While effective and easy to implement, the recurring cost of chemical addition can become prohibitive.

For the recommended odor mitigation strategy, we will prepare estimates of the capital and operating costs.

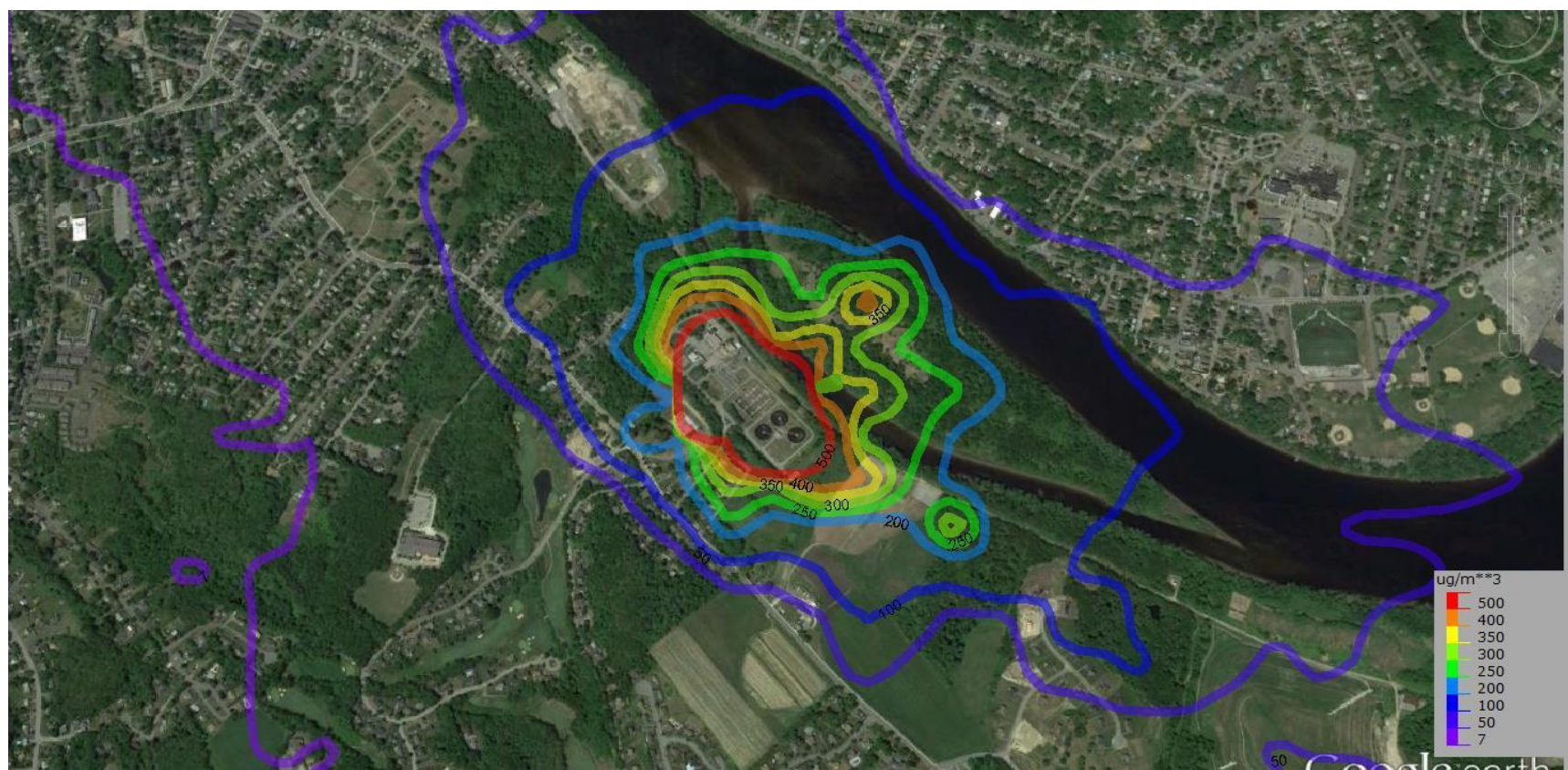
Task 5. Prepare report

Bowker & Associates will prepare a draft report for review and comment by the City of Franklin. The report will include:

1. Introduction
2. Description of facilities
3. Sampling program
4. Odor dispersion modeling
5. Evaluation of alternatives
6. Conclusions and recommendations

Upon receipt of comments, a final report will be transmitted.

FIGURE 1. EXAMPLE OF OUTPUT FROM ODOR DISPERSION MODEL SHOWING “ODOR FOOTPRINT” OF WWTP.



3. FEE ESTIMATE

Table 1 provides a breakdown of estimated fee for the tasks described above. The total cost of \$40,740 includes all labor, travel, and analytical expenses.

4. SCHEDULE

The major factor driving the schedule of this project is the need to conduct the sampling during peak, warm-weather conditions. Typically these conditions occur during the months of July through September. Assuming a July sampling schedule, it is anticipated that a draft report would be submitted by September 30. The project could start at any time, say March 1, 2018.

5. SUMMARY OF QUALIFICATIONS

Bowker & Associates has specialized in the control of odors from waste handling systems for 25 years, and has completed over 200 projects at wastewater pump stations, treatment plants, collection systems, and landfills. Robert Bowker is a professional engineer with over 40 years of experience in the wastewater industry, and has co-authored several EPA and WEF manuals on the subject of odors and corrosion in wastewater systems. Mr. Bowker's resume is attached. Our full Statement of Qualifications and Experience is available upon request.

TABLE 1

FEE ESTIMATE

FRANKLIN, TN ODOR STUDY

Bowker & Associates, Inc.

January, 2018

<u>Task</u>		<u>Estimated fee, \$</u>
<u>1. Review background information and develop sampling plan</u>		
<i>Labor:</i>		
R. Bowker:	12 hrs @ \$175/hr	\$ 2,100
Clerical:	2 hrs @ \$50/hr	<u>100</u>
	Subtotal Task 1	\$ 2,200
<u>2. Implement sampling plan for collection system and treatment plant</u>		
<i>Labor:</i>		
R. Bowker:	56 hrs @ \$175/hr	\$ 9,800
Clerical:	4 hrs @ \$50/hr	200
<i>Travel:</i>		
Airfare:		600
Rental car:	7 days @ \$80/day	560
Hotels:	7 nights @ \$150/night	850
Meals:	7 days @ \$50/day	350
<i>Analytical:</i>		
Odalogs:	8 units @ \$160/wk	1,280
Odor panel:	12 samples @ \$350 each	4,200
Reduced sulfurs:	4 samples @ \$250 each	1,000
Supplies:		500
Shipping:		<u>600</u>
	Subtotal Task 2	\$19,940

3. Odor dispersion modeling

Labor:

R. Bowker:	32 hrs @ \$175/hr	\$5,600
Clerical:	4 hrs @ \$50/hr	200

Weather & terrain data		<u>1,000</u>
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Subtotal Task 3	\$ 6,800
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4. Evaluate odor control options

Labor:

R. Bowker:	24 hrs @ \$175/hr	<u>\$ 4,200</u>
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Subtotal Task 4	\$ 4,200
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5. Prepare draft & final reports

Labor:

R. Bowker:	40 hrs @ \$175/hr	\$ 7,000
Clerical:	12 hrs @ \$50/hr	<u>600</u>

Subtotal Task 1	\$ 7,600
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TOTAL	\$40,740
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RESUME OF ROBERT BOWKER

ROBERT P. G. BOWKER, P.E.
President

TECHNICAL EXPERTISE

- Odor and corrosion control technology
- Odor emissions inventories
- Sewer corrosion assessments
- Corrosion protection systems
- Sewer rehabilitation
- Innovative technology

YEARS OF EXPERIENCE: 35

EDUCATION:

B.S. Civil Engineering, University of New Hampshire, 1973
M.S. Environmental Engineering, Cornell University, 1976

PROFESSIONAL REGISTRATION:

P.E. Sanitary Engineering - Maine, New Hampshire, Ohio

ORGANIZATIONS:

- Water Environment Federation
 - New England Water Environment Association
- Maine Wastewater Control Association
- Air and Waste Management Association
 - WEF Air Quality and Odor Control Committee

PROFESSIONAL PROFILE

Robert P.G. Bowker has over 35 years' experience in the planning, design, and operation of wastewater facilities. His career includes nine years with the U.S. Environmental Protection Agency Office of Research and Development and over 25 years as a consulting engineer. Since 1985, Mr. Bowker has specialized in the control of odors and corrosion in wastewater collection and treatment systems, solid waste processing and landfill operations, and industrial processes and waste management facilities. Mr. Bowker is considered an international expert in odor and corrosion control in waste handling systems.

HIGHLIGHTS

- Preparing, as principal author, the EPA Design Manual on Odor and Corrosion Control in Sanitary Sewers and Treatment Plants and the EPA Report to Congress on Sulfide Corrosion in Wastewater Collection and Treatment Systems.
- Contributing author of EPA Handbook on Sewer System Infrastructure Analysis and Rehabilitation.
- Conducting odor emission surveys and evaluating odor control alternatives for wastewater treatment facilities from 0.5 to 300 mgd in over 50 cities throughout the U.S., Canada, and abroad.
- Directing or participating in comprehensive sulfide monitoring and corrosion control projects in St. Petersburg, FL, Tempe, AZ, Framingham, MA, Syracuse, NY, Edmonton, Alberta, Collier County, FL, Henrico County, VA, and Woodbridge, NJ.
- Designing and providing design assistance for odor control systems in Keene, NH, Hartford, CT, Cromwell, CT, Portland, ME, Concord, NH, Fitchburg, MA, Lexington, KY, Singapore, Perth, Australia, Toronto, ON, and elsewhere.
- Contributing author of 1995 WEF MOP 22 "Odor Control in Wastewater Treatment Plants," 2001 IWA "Odours in Wastewater Treatment," and 2003 WEF "Control of Odors and Emissions from Wastewater Treatment Plants."
- Serving as independent peer reviewer for major odor/corrosion control projects in Los Angeles, CA, Washington, DC, Oakland, CA, Toronto, ON, and Santa Cruz, CA.

REPRESENTATIVE PROJECTS

Township of Woodbridge, NJ Biological Odor Control. Bowker & Associates worked with a local firm to evaluate odor emissions and their control at a large wastewater pumping station. An innovative odor containment and treatment system was conceived and designed. A biological scrubber eliminated odor complaints, and the new odor containment system greatly improved working conditions.

Oakland and Macomb Counties Odor and Corrosion Control. Bowker & Associates was a key player in the assessment of corrosion and odors in a large deep-tunnel collection system serving suburban Detroit. A variety of recommendations were developed to mitigate odor releases and control corrosion in the tunnel system, including upstream chemical addition, improved ventilation with odor treatment, and protection of the concrete with an inert lining system.

Humber WWTP Odor Control Improvements. Bowker & Associates participated in the Value Engineering Program for the proposed Humber WWTP odor control improvements in Toronto. New recommendations developed by the VE Team resulted in significant projected savings in both capital and O&M costs. Bowker & Associates was subsequently part of the design team for the improvements, which consisted largely of containment of the odors followed by treatment in organic media biofilters.

City of Los Angeles Independent Odor Control Review. Bowker & Associates, Inc. was selected by the City of Los Angeles, the State of California, and U.S. EPA to provide an independent review of the City of LA Sewer Odor Control Program as required by a Court settlement regarding sewer odor emissions. The program included extraction and treatment of sewer air with 2-stage odor control systems at seven locations.

Collier County, FL Odor/Corrosion Control Project. Bowker & Associates worked with a major national engineering firm to assess and control odors and corrosion in a large, complex wastewater collection system in Collier County, Florida. Recommendations included turbulence reduction, biological treatment of odorous air, and rehabilitation of corroded pump stations.

Lexington, KY Town Branch WWTP Odor Control Project. Bowker & Associates assisted a local engineering firm in the evaluation and design of innovative odor control improvements that included odor treatment by activated sludge diffusion and oxygen ionization.

Washington, DC Odor Control Peer Review. Bowker & Associates was selected to provide expert peer review for a comprehensive assessment of odor

emissions and their control for the 350 mgd Blue Plains WWTP in Washington, DC.

Salem, MA and New Bedford, MA Odor Control Optimization Studies. Bowker & Associates conducted odor control optimization studies and fugitive odor emissions surveys at two 30 mgd wastewater treatment plants in eastern Massachusetts.

Onondaga County Odor/Corrosion Control Projects. Bowker & Associates conducted comprehensive odor and corrosion assessment and control projects for the 80 mgd Syracuse Metro WWTP as well as the Baldwinsville and Oak Orchard WWTPs operated by the County of Onondaga.

City of Edmonton Odor/Corrosion Control Projects. Bowker & Associates has worked with a large Canadian engineering firm on multiple projects involving odors and corrosion in the sewer system, treatment plant, and off-site sludge treatment/storage facility serving the City of Edmonton, Alberta.

Henrico County, VA Odor and Corrosion Control Assessment. Bowker & Associates worked with a national engineering firm to conduct a comprehensive assessment of odors and corrosion in a large wastewater collection system. Recommendations included an innovative iron-peroxide chemical addition process, a cost-saving biological scrubber system, and rehabilitation of corroded sewer lines.

City of Mamaroneck, NY Odor and Noise Control at a Solid Waste Transfer Station. Bowker & Associates worked with Webster Environmental Associates to quantify the odor and noise emissions from the waste transfer station, and assess their impact via dispersion modeling. Recommendations included use of high-velocity dispersion fans, collection and treatment of odorous air, and multiple noise control systems.

PARTIAL LIST OF PUBLICATIONS

Bowker, R.P.G., P.H. Albert, A. Dalmazzi, J. Pratt, D. Bowen, "Control of Odor Emissions from a CSO Storage Tunnel in Providence, RI", in Proceedings of WEF Odor Specialty Conference, Louisville, KY, 2012.

Bowker, R.P.G., D.J. Skibicki, J.T. Kotowski, "Innovative Odor Containment and Treatment at a Large Wastewater Pumping Station," in Proceedings of WEF Odor Specialty Conference, Charlotte, NC, 2010.

Bowker, R.P.G., et al, "Collection System Ventilation Research Report," Water Environment Research Foundation, Alexandria, VA, 2009.

Bowker, R.P.G., S. Sibold, A. Rupprecht, and J. Reish, "Magnesium Hydroxide Controls Sulfide Corrosion in Rural Pennsylvania Sewer System," in Proceedings of WEF Odor and Air Emissions Specialty Conference, Phoenix, AZ, April 2008

Bowker, R.P.G., D.A. Apgar, J. Witherspoon et al, "Minimization of Odors and Corrosion in Collection Systems," Water Environment Research Foundation, Alexandria, VA 2007.

Bowker, R.P.G., Michael A. McGinley, and James Schubert, "Analysis of Ambient Odor Data from an Industrial Area with Multiple Odor Sources," in Proceedings of WEF/A&WMA Odors and Air Emissions Specialty Conference, Bellevue, WA, April, 2004.

Bowker, R.P.G. and Robert Trueblood, "Control of ATAD Odors at the Eagle River Water and Sanitation District," in Proceedings of WEF Conference on Control of Odors and VOC Emissions, Albuquerque, NM, April, 2002.

Bowker, R.P.G. (contributing author), "Odours in Wastewater Treatment. Measurement, Modeling and Control," International Water Association, London, 2001.

Bowker, R.P.G. and B. Blades, "Optimization of Packed Bed Scrubbers to Control Odors from Solids Handling Processes," in Proceedings of WEF Specialty Conference on Odors and VOC Emissions, Cincinnati, OH, April, 2000.

Bowker, R.P.G. (contributing author), "Odor and VOC Control Handbook," McGraw-Hill, New York, 1998.

Bowker, R.P.G., "Biological Odor Control by Diffusion into Activated Sludge Basins," in Proceedings of WEF Conference on Control of Odors and VOC Emissions, Houston, TX, April, 1997.

Bowker, R.P.G. (contributing author), Manual of Practice No. 22, "Odor Control at Wastewater Treatment Facilities," Water Environment Federation, Alexandria, VA, 1995.

Bowker, R.P.G., A.A. King, and G.W. Holcomb, "U-Tube Oxygen Dissolver Controls Odors," Water Environment & Technology, 7(1):20-21, January, 1995.

Bowker, R.P.G., "Containment of Odors at Wastewater Treatment Facilities," Journal of the New England Water Environment Association, 28(2):211-220, November, 1994.

Bowker, R.P.G., "Guide to Septage Treatment and Disposal," EPA/625/R-94/002, U.S. EPA Office of Research and Development, Washington, DC, September, 1994.

Bowker, R.P.G., C.M. McGinley, N.A. Webster, "Estimating Odor Emission Rates from Wastewater Treatment Facilities," in Proceedings of WEF Conference on Odor and Volatile Organic Compound Emission Control for Municipal and Industrial Treatment Facilities, Jacksonville, FL, April, 1994.

Bowker, R.P.G., G.A. Audibert, H.J. Shah, and N.A. Webster, "Detection, Control, and Correction of Hydrogen Sulfide Corrosion in Existing Wastewater Systems," EPA 832-R-92-001, U.S. EPA Office of Water, Washington, DC, 1992.

Smith, J.M., R.P.G. Bowker, and H.J. Shah, "Handbook: Sewer System Infrastructure Analysis and Rehabilitation," EPA/625/6-91/030, U.S. EPA Office of Research and Development, Cincinnati, OH, October, 1991.

Bowker, R.P.G., J.M. Smith, and H.J. Shah, "Hydrogen Sulfide Corrosion in Wastewater Collection and Treatment Systems - Report to Congress," EPA 430/09-91-009, U.S. EPA Office of Water, Washington, DC, September, 1991

Bowker, R.P.G., Stensel, H.D., "U.S. EPA Design Manual for Phosphorus Removal," EPA/625/1-87/001, Cincinnati, Ohio, September, 1987.

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