WASTEWATER TREATMENT PLANT FACILITY PLAN

July 2012
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Executive Summary

Purpose
The City of Piqua, Ohio (City) is planning for the necessary wastewater treatment infrastructure to eliminate sanitary sewer overflows (SSOs) and provide sufficient capacity for a 20-year growth projection. CDM Smith developed future flow projections using available documentation to quantify population growth, land use, and redevelopment opportunities within the City. Using these flows, different wastewater treatment processes were evaluated for both liquid treatment and solids processing that can meet the treatment goals for the wastewater treatment plant’s (WWTP’s) service life to eliminate SSOs and provide treatment capacity for a 20-year planning period. This document evaluates the alternatives and the recommended infrastructure to meet those goals.

Flow and Load Projections
The existing WWTP is rated for 4.5 mgd average day and 8.3 mgd peak hour capacity. Based on hydraulic limitations within the plant’s raw sewage pump station and some conveyances between unit processes, the plant can only treat a maximum flow of 7.5 mgd. The plant uses a flow equalization basin with 1 MG capacity, and some interceptor system piping, to store excessive wet weather volume and help balance peak flows. Despite these treatment and storage facilities, the constructed sanitary sewer overflow (SSO) just upstream of the plant on the West Interceptor activates on occasion and must be eliminated.

Over the 20-year planning period, the City’s sewer service area is projected to develop and lead to increased flows from the expanded customer base. The sewer service area is also anticipated to expand with continued development. The City has been approached by the Village of Covington for potential sanitary sewer service, which would have a significant impact on the design flows and loads tributary to the plant.

The rated average day capacity of the plant is recommended to increase to 6.0 MGD to meet Piqua’s future demands. The addition of the Village of Covington flow would add 1.0 MGD average day hydraulic capacity. This total projected average day rated capacity of the plant is 7.0 MGD.

Table ES-1 provides the influent wastewater characteristics for both the current plant and for the projected characteristics at the end of the 20-year planning period.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average Influent Concentration (mg/L)</th>
<th>Average Influent Loading (lbs/day)</th>
<th>Typical Influent Concentration (mg/L)</th>
<th>Projected Influent Loading (lbs/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-day Carbonaceous Biochemical Oxygen Demand (CBOD)</td>
<td>140</td>
<td>5,300</td>
<td>190</td>
<td>9,200</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>128</td>
<td>4,800</td>
<td>210</td>
<td>9,200</td>
</tr>
<tr>
<td>Ammonia (NH₃)</td>
<td>11.5</td>
<td>430</td>
<td>25</td>
<td>1,000</td>
</tr>
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</table>

The variability of flows, which are highly dependent on wet weather influences, must also be considered with the increased flows. The Sanitary Sewer System Master Plan, conducted in parallel with this Facility Plan, identified the future flow hydrographs under the 20-year planning period using
continuous model simulation with historic rainfall data. The month of April 2011 provided the worst-case conditions, with long-term precipitation.

A combination of additional flow equalization and treatment capacity were then considered to provide an overall solution to eliminate the SSO. Capital costs were then estimated for these combinations using planning-level unit costs to determine the optimum solution for the City to eliminate the SSO and provide service life for a 20-year planning period. Although calculations were provided for 6 MGD average day treatment capacity, increasing the plant’s rated capacity to 7 MGD would have an equal impact for all combinations. Results from this analysis are provided in Table ES-2 and graphically in Figure ES-1.

Table ES-2: Planning Level Costs for Combinations of Peak Wastewater Treatment and EQ Storage

<table>
<thead>
<tr>
<th>Scenario</th>
<th>WWTP Max Flow (MGD)</th>
<th>WWTP Avg Flow (MGD)</th>
<th>Max/Avg Ratio</th>
<th>Total EQ (MG)</th>
<th>Additional WWTP Cost</th>
<th>Additional EQ Cost</th>
<th>Total Cost</th>
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<tbody>
<tr>
<td>1</td>
<td>10.5</td>
<td>6</td>
<td>1.75</td>
<td>12</td>
<td>$13,500,000</td>
<td>$14,000,000</td>
<td>$27,500,000</td>
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<tr>
<td>2</td>
<td>11</td>
<td>6</td>
<td>1.83</td>
<td>9</td>
<td>$13,500,000</td>
<td>$9,500,000</td>
<td>$23,000,000</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>6</td>
<td>2.00</td>
<td>7.5</td>
<td>$13,500,000</td>
<td>$7,250,000</td>
<td>$20,750,000</td>
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<tr>
<td>4</td>
<td>13</td>
<td>6</td>
<td>2.17</td>
<td>6</td>
<td>$16,500,000</td>
<td>$5,000,000</td>
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<td>5</td>
<td>17</td>
<td>6</td>
<td>2.83</td>
<td>3</td>
<td>$28,500,000</td>
<td>$500,000</td>
<td>$29,000,000</td>
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<tr>
<td>6</td>
<td>21.5</td>
<td>6</td>
<td>3.58</td>
<td>1</td>
<td>$42,000,000</td>
<td>50</td>
<td>$42,000,000</td>
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Figure ES-1: Cost Comparison of Treatment and Equalization Volume Necessary to Eliminate SSOs
The optimum combination to eliminate the SSO is recommended to include 13 mgd peak wastewater treatment capacity and 6 MG total EQ storage. Although this combination is not the lowest combination of cost, it does fit with the original plans for the EQ basin storage facilities, and is a comparable overall construction cost, especially at this planning level estimate.

**Existing Facility Condition**

The City’s WWTP currently treats influent wastewater in accordance with its NPDES permit limits. However, many components are aging and in need of upgrade or replacement to continue reliable service. This Facility Plan evaluated the existing treatment processes throughout the plant and identified those which should be upgraded to improve reliability, redundancy, or overall efficiency. Other processes must also be upgraded to enable them to handle higher design flows and loads for the 20-year planning period.

The existing wastewater treatment facilities will continue to be used where practical. Upgrades were recommended where unit processes could be salvaged, which provides a more cost-effective solution. Where processes and equipment are near the end of their useful life, or do not meet future treatment needs, replacements will be recommended for those processes and equipment.

**Unit Process Upgrades for All Alternatives**

To continue reliable wastewater treatment, upgrade aging equipment, and meet regulatory requirements, the following unit process improvements are common for all alternatives.

- **Raw Sewage Pumping** – replace the undersized screw pumps and provide additional pumping capacity as necessary to meet the future flows
- **Headworks** – install fine screens as required to continue beneficial reuse of biosolids land application and protect downstream equipment
- **Disinfection** – replace the current gaseous chlorine disinfection and sulfur dioxide dechlorination systems with ultraviolet disinfection equipment installed into new channels in the chlorine contact tank
- **Flow Metering** – located near the plant outfall to monitor actual flow, instead of at the plant influent

**Liquid Treatment Processes**

A total of seven alternatives were initially considered for the treatment plant expansion. The following liquid process alternatives were screened for more detailed analysis in this facility plan.

- **Conventional (Upgrade and Expand Current Plant)** – supplement the existing plant treatment processes with additional similar tanks and equipment to treat the higher flows and loads
- **Extended Aeration (Parallel to Existing Upgraded Plant)** – continue to use the existing plant, but supplement the treatment processes with a parallel oxidation ditch to treat the additional flows
Executive Summary

- **Extended Aeration (New Plant)** – abandon the bulk of the existing plant, and utilize a new oxidation ditch to treat all wastewater flows
- **BioActiflo® (Parallel to Existing Upgraded Plant)** – continue to use the existing plant, but utilize a biologically enhanced high rate treatment for wet weather flows

Each of these liquid process alternatives were scored based on qualitative criteria to evaluate the non-economic components including operational requirements, reliability, flexibility, monitoring requirements, nuisance potential, and ease of expansion. **Table ES-3** summarizes the liquid treatment alternatives scoring, including unweighted total of points for each.

**Table ES-3: Non-Economic Comparison of Liquid Treatment Alternatives**

<table>
<thead>
<tr>
<th>Liquid Process Alternative</th>
<th>Operational Requirements</th>
<th>Reliability</th>
<th>Flexibility</th>
<th>Monitoring Requirements</th>
<th>Nuisance Potential</th>
<th>Ease of Expansion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Upgrade and Expand Plant</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2 – Parallel Extended Aeration Plant</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>3 – New Extended Aeration Plant</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>4 – Parallel BioActiflo</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>25</td>
</tr>
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</table>

Alternatives 3 and 4 received the highest (best) ratings for the non-economic factors. The primary reason is that they both reduce the flow to the existing plant that is at or near its useful life and utilize new technologies that are more reliable and energy efficient. Alternatives 1, 2, and 4 use the existing plant, which would require major equipment upgrades and complex underground piping and channel modifications to allow for the increased flows.

Each alternative was then evaluated for capital and annual O&M costs to implement the liquid process alternative, upgrade portions of the existing plant, and operate the system. These costs were then compared on a present worth basis, shown in **Table ES-4**, to compare costs for each process under the same 20-year planning period.

**Table ES-4: Present Worth Cost of Liquid Treatment Alternatives**

<table>
<thead>
<tr>
<th></th>
<th>1 Upgrade &amp; Expand Existing Plant</th>
<th>2 Add Parallel Oxidation Ditch</th>
<th>3 New Oxidation Ditch Plant</th>
<th>4 Parallel BioActiflo Plant</th>
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<tr>
<td>Probable Construction Cost</td>
<td>$25,000,000</td>
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<td>$30,000,000</td>
<td>$22,000,000</td>
</tr>
<tr>
<td>Annual O&amp;M Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>$300,000</td>
<td>$200,000</td>
<td>$175,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Labor &amp; Maintenance</td>
<td>$2,947,000</td>
<td>$3,500,000</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Chemicals/UV</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Total O&amp;M Costs</td>
<td>$3,257,000</td>
<td>$3,710,000</td>
<td>$3,185,000</td>
<td>$3,160,000</td>
</tr>
<tr>
<td>Present Worth O&amp;M Costs¹</td>
<td>$46,315,000</td>
<td>$52,756,000</td>
<td>$45,291,000</td>
<td>$44,935,000</td>
</tr>
<tr>
<td>Total Present Worth Cost</td>
<td>$71,315,000</td>
<td>$82,756,000</td>
<td>$75,291,000</td>
<td>$66,935,000</td>
</tr>
</tbody>
</table>

¹ Present worth cost is calculated at 3.5% interest for 20 years
The BioActiflo system alternative offers the lowest capital cost and lowest annual operating cost, which also translates to the lowest present worth cost between the four alternatives. With the most favorable non-cost parameters and the lowest capital and operating costs, the parallel BioActiflo system is the recommended liquid treatment process for the City of Piqua.

**Solids Treatment Processes**

Along with an increase in projected wastewater flows from expanded service area and development within the City’s service area, additional sludge generated from the liquids treatment processes must be managed as part of the expanded plant’s solids treatment process. Table ES-5 provides the current and future sludge production rates in dry pounds per day (dppd).

**TABLE ES-5: Sludge Production Rates**

<table>
<thead>
<tr>
<th></th>
<th>Average Influent Daily Flow (MGD)</th>
<th>Average Sludge Production Rate (dppd)</th>
<th>Maximum Month Sludge Production Rate (dppd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT</td>
<td>3.9</td>
<td>2,055</td>
<td>2,887</td>
</tr>
<tr>
<td>FUTURE</td>
<td>7.0</td>
<td>3,700</td>
<td>5,205</td>
</tr>
</tbody>
</table>

Future design flow was projected for the 20-year planning period.

The following solids treatment processes were screened for more detailed analysis in this Facility Plan. Each alternative was evaluated based on capital cost, operating cost, moisture content of dewatered biosolids, and for its potential to produce either Class B or Exceptional Quality Biosolids, shown in Table ES-6.

- **High-Rate Anaerobic Digestion** – sized to meet the future flow conditions, continue to implement energy recovery using generated methane gas
- **Temperature Phased Anaerobic Digestion (TPAD)** – anaerobic digestion of biomass to oxidize the volatile solids fraction continue to implement energy recovery using generated methane gas for sludge heating
- **Auto Thermal Aerobic Digestion (ATAD)** – aerobically digest biosolids at high temperatures to oxidize the volatile solids fraction
- **Burch-Hydro BioWave™ (Microwave)** – utilize microwave energy to dewater biosolids and deactivate microorganisms

**Table ES-6: Summary of Biosolids Processing Alternatives**

<table>
<thead>
<tr>
<th>Biosolids Processing Alternative</th>
<th>Exceptional Quality Biosolids</th>
<th>Class B Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Rate Anaerobic Digestion</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Temperature-Phased Anaerobic Digestion</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Autothermal Thermophilic Aerobic Digestion (ATAD)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Burch-Hydro BioWave™</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The ATAD system and Burch-Hydro BioWave™ microwave system offer unique benefits of biosolids volume reduction by providing significant dewatering/drying capabilities or by increased destruction
of volatile solids. This volume reduction results in the net effect of less biosolids material to process, store, and haul off-site for disposal.

One of the challenges the existing plant faces with biosolids processing is the lack of thickening before sending WAS to the digesters. By delivering 2% - 2.5% solids to the digesters instead of 5% solids, the additional water fraction leads to decreased hydraulic residence time and potential for foaming or overflow conditions. Thickening the WAS before digestion is recommended to better operate the digesters and eliminate these operational problems.

Each alternative was then evaluated for capital and annual O&M costs to implement the solids process alternative, upgrade the plant’s current digesters, and operate the system. These costs were then compared on a present worth basis, shown in Table ES-7, to compare costs for each process under a 20-year planning period. It is presumed that City staffing needs would be consistent between these alternatives, and have no net difference between them for additional labor costs.

Table ES-7 – Present Worth Cost Analysis of Sludge Digestion Alternatives

<table>
<thead>
<tr>
<th></th>
<th>High-Rate Anaerobic Digestion</th>
<th>Temperature-Phased Anaerobic Digestion</th>
<th>ATAD</th>
<th>Burch Hydro Microwave</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>$4,294,000</td>
<td>$4,543,600</td>
<td>$4,226,300</td>
<td>$4,849,000</td>
</tr>
<tr>
<td>Demolition</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$125,000</td>
<td>$180,000</td>
</tr>
<tr>
<td>Site Work</td>
<td>$25,000</td>
<td>$25,000</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Operations Building Work</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>New Dewatering/ Storage Building*</td>
<td>$600,000</td>
<td>$600,000</td>
<td>$550,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Temporary Dewatering and Landfilling</td>
<td>$110,500</td>
<td>$110,500</td>
<td>$110,500</td>
<td>$110,500</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$5,179,500</td>
<td>$5,429,500</td>
<td>$5,121,500</td>
<td>$5,849,500</td>
</tr>
<tr>
<td>Contingency @ 30%</td>
<td>$1,554,000</td>
<td>$1,629,000</td>
<td>$1,537,000</td>
<td>$1,755,000</td>
</tr>
<tr>
<td><strong>Total Construction Cost</strong></td>
<td>$6,734,000</td>
<td>$7,059,000</td>
<td>$6,659,000</td>
<td>$7,605,000</td>
</tr>
<tr>
<td><strong>Annual O&amp;M Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>$23,200</td>
<td>$23,200</td>
<td>$78,000</td>
<td>$135,000</td>
</tr>
<tr>
<td>Labor</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$74,700</td>
<td>$79,000</td>
<td>$59,500</td>
<td>$30,550</td>
</tr>
<tr>
<td>Gas</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Hauling/Land Application</td>
<td>$16,250</td>
<td>$15,990</td>
<td>$14,910</td>
<td>$13,000</td>
</tr>
<tr>
<td><strong>Total Annual O&amp;M Cost</strong></td>
<td>$114,150</td>
<td>$118,190</td>
<td>$152,400</td>
<td>$178,550</td>
</tr>
<tr>
<td><strong>Total 20-year Present Worth Cost</strong></td>
<td>$8,358,000</td>
<td>$8,741,000</td>
<td>$8,828,000</td>
<td>$10,146,000</td>
</tr>
</tbody>
</table>

*Building includes a microwave processing area for the Burch Hydro Microwave alternative.

The ATAD system is the lowest capital cost alternative, but has a higher annual operating cost that is related to the high electricity usage. However, the ATAD system provides the ability for Piqua to
produce Exceptional Quality biosolids that offer more regulatory flexibility for beneficial reuse than Class B biosolids. This system also reduces the overall volume of biosolids that must be managed and stored, which provides additional benefit. Given the nominal 20-year present worth cost difference between ATAD and TPAD, and the other benefits it offers, the ATAD solids treatment process is the recommended alternative.

Additional sludge cake storage will be required for the City to meet the new regulations, specifically to hold 120 days of volume to avoid land application during winter months when frozen soil can be present. To accommodate this storage requirement, a combined dewatering equipment building and biosolids cake storage building is recommended on the south side of the plant, on the City-owned property.

**Recommendations**

The combination of preferred liquid treatment alternative (BioActiflo) and the preferred solids treatment alternative (ATAD) were developed using separate criteria for non-cost and economic evaluations. These two processes are feasible together and will not interfere with the efficiency or performance of each other. Additional plant improvements are required to continue sufficient and reliable treatment to serve the City and its customers for a 20-year planning period. These items include new raw sewage pumping, screening, disinfection, and flow metering and are included within the respective liquid or solids process alternative costs. A summary of the costs for each alternative, including other project costs, is provided in Table ES-8.

**Table ES-8 – Recommended Alternative Cost Summary**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Liquid Treatment Alternative</td>
<td></td>
</tr>
<tr>
<td>Alt. 4 – BioActiflo Parallel to Upgraded Existing Plant</td>
<td>$22,000,000</td>
</tr>
<tr>
<td>Selected Solids Processing Alternative</td>
<td></td>
</tr>
<tr>
<td>Alt. 3 - ATAD</td>
<td>$6,659,000</td>
</tr>
<tr>
<td>Preliminary Opinion of Probable Construction Cost</td>
<td>$28,659,000</td>
</tr>
<tr>
<td>Preliminary Engineering &amp; Detailed Design</td>
<td>$2,841,000</td>
</tr>
<tr>
<td>Construction Phase Engineering Services and RPR</td>
<td>$3,500,000</td>
</tr>
<tr>
<td><strong>Total Estimated Project Cost</strong></td>
<td><strong>$35,000,000</strong></td>
</tr>
</tbody>
</table>

**Figure ES-2** provides an overall layout of the major unit process upgrades that are recommended for Piqua to implement as part of the plant expansion to handle future projected flow and eliminate the SSO.

Additional details for other improvements and specific design criteria for the new unit processes should be developed as part of a Preliminary Engineering Report to provide more insight to the specific implementation needs and costs. A schedule for implementing the plant expansion is provided in Table ES-9.
Figure ES-2

Recommended Improvements

- New 3 MG Flow Equalization Basin
- New EQ Basin Influent Pump Station
- Abandon Existing Raw Sewage Pump Station
- New Fine Screens (2) and Raw Sewage Pump Station
- ATAD Equipment and Digester Conversion
- New 1-m Gravity Belt Thickeners (2)
- New BioActiflo Treatment System
- New UV Disinfection Reactors (2)
- New Flow Meter
- Demolish Chlorination/Dechlorination Building
- New Sludge Cake Storage Building and 1-m Belt Filter Presses (2)
## Table ES-9 – Proposed Implementation Schedule

<table>
<thead>
<tr>
<th>Activity/Milestone</th>
<th>Approximate Dates</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio EPA Facility Plan Approval</td>
<td>8/2012 – 12/2012</td>
<td>5</td>
</tr>
<tr>
<td>Ohio EPA PTI Approval</td>
<td>8/2014 – 12/2014</td>
<td>5</td>
</tr>
<tr>
<td>Advertise for Bids</td>
<td>1/2015 – 2/2015</td>
<td>1</td>
</tr>
<tr>
<td>Award Construction Contract</td>
<td>3/2015</td>
<td></td>
</tr>
<tr>
<td>Begin Construction</td>
<td>4/2015</td>
<td></td>
</tr>
</tbody>
</table>
1.1 Purpose

The City of Piqua, Ohio (City) has embarked on this Wastewater Treatment Plant (WWTP) Facility Plan to identify the improvements necessary to provide sufficient treatment capacity for the next 20 years. This study identifies expansion needed to successfully treat flows and loads routed to the treatment plant and to meet current and anticipated future regulatory mandates.

Recent influent flows have approached or exceeded the plant’s rated capacity of 4.5 million gallons per day (MGD), and historic rainfall of 68 inches in 2011 led to prolonged wet weather conditions that stressed both the collection system and the treatment plant. The City has one constructed sanitary sewer overflow (SSO) that must be eliminated by January 2016 as part of the current National Pollutant Discharge Elimination System (NPDES) permit requirements. With the regulatory driver to eliminate the SSO and planning for potential growth in the sanitary sewer system, the current treatment plant's hydraulic capacity and treatment facilities will need to be increased to enable the City to continue providing reliable service to its current and future customers.

As part of this study, the City also wishes to evaluate different treatment technologies that could replace or supplement the existing liquid and solids treatment processes. These are being considered to reduce capital and operational costs, improve treatment efficiency, or better position the City to meet future environmental regulations.

In addition to the direct benefits of a periodic update to facilities planning, many funding mechanisms require a plan such as this WWTP Facility Plan be prepared and approved as a contingency of award.

1.2 Update to State 208 Plan

In the late 1970s, the State of Ohio allocated sewer system responsibility through the Section 208 Water Quality Management Plan to various municipal and governmental entities to promote efficient and comprehensive programs for controlling water pollution from point and nonpoint sources in a defined geographic area. Each of these Facility Planning Areas (FPAs) of future sewer service areas were assigned a Designated Management Agency (DMA) that has approval authority of sewer system extensions to ensure they fit within the approved plans of that DMA. The City of Piqua is the DMA for the Piqua FPA, with geographic boundary as shown in Figure 1-1.

1.2.1 Current and Future Service Areas

Although most sewer service is located within the City of Piqua's corporation limits, some unincorporated portions of Miami County are served by the City as well as the Village of Fletcher, as of 2010. Three main interceptors collect flow from the service area and convey flow to the Piqua WWTP at the southern extents of the City at 121 Bridge Street.
Figure 1-1: Facility Planning Area (MVRPC: Area Water Quality Management Plan, 2008)
To assess the future service areas over a 20-year planning period, CDM Smith evaluated data from several sources to understand the patterns of growth, likely system expansions, and industrial redevelopment within the City. These documents include:

- Miami Valley Regional Planning Commission (MVRPC) – GIS Data including population forecasts and future landuse shapefiles
- “Plan It Piqua – Redevelopment Analysis Report” dated April 2010
- “Plan It Piqua – Comprehensive Plan Update” dated 2007

The current and future sanitary sewer service areas are shown in Figure 1-2. Generally, system expansion and accompanying land use are anticipated to be commercial/industrial to the southwest; residential to the northwest; residential and commercial to the northeast; and industrial and commercial to the south. Future population projections indicate stable population within the current City corporation limits and modest growth on the periphery.

Additional sanitary sewer collection system infrastructure will be necessary to expand the system to these future customers. The City of Piqua’s Sanitary Sewer System Master Plan is being prepared concurrently with this WWTP Facility Plan and addresses the sewer system needs.

All of the contiguous planned sewer system expansions are anticipated to be within the current FPA, with some areas close to the FPA boundary in the far northeast extents and to the south of the City. These areas and any specific development plans will need to be reviewed in closer detail to ensure sewer service can be readily provided to them through the Piqua FPA.

The Village of Covington has expressed a desire to consider using the City of Piqua’s sanitary sewer and treatment system as opposed to upgrading its own sanitary sewer and treatment systems. The Village is facing wet weather management issues that led to SSOs and is considering options to either improve their systems or rely upon another FPA for service. Consideration will be given to potential service to Covington and the related impacts this would have on the Piqua system. The Village is located approximately 5.5 miles west of the City of Piqua’s sewer system extents. Flow could be collected at a central location in Covington and discharged by pump station/force main into the City’s 36-inch Hemm Road Interceptor for treatment at the Piqua WWTP.

**1.2.2 Wastewater Treatment Requirements for Areas Not Sewered**

Several areas within Piqua’s FPA are not currently sewered. These areas will continue to use home sewage treatment systems (e.g., septic tanks) to treat and dispose of their wastewater. Monitoring of these private systems will continue to be performed through the Miami County Health Department and assessed as necessary. The City does not currently accept septage for treatment and disposal, and does not plan to accept this waste in the future.
Figure 1-2: Current and Future Sanitary Sewer Service Areas
1.3 Existing Facility Condition Assessment

Faced with a WWTP expansion, the City would like to maximize its investment in existing facilities to the extent practical. This approach not only saves implementation cost and time, but also reduces the potential rate increases to the City’s rate payers. However, only facilities with remaining life suitable for continued use with higher flow rates are expected to be retained.

1.3.1 Purpose

The existing facility assessment was completed on November 10, 2011. The purpose for conducting this assessment was to determine which unit processes and components could be integrated into the planned improvements with an anticipated expansion of the plant’s capacity. The assessment included review of general structural condition, process equipment, electrical, and instrumentation components.

1.3.2 Existing Facility Assessment

CDM Smith and City staff conducted a workshop to collect additional information from the WWTP’s operators to understand existing operations and problems related to the existing facility assessment. A walkthrough of each unit process followed. The workshop discussion topics were structured similar to the process flow through the WWTP, starting with the liquid stream process and continuing on with the solids stream process. The findings from the workshop and the site visit are detailed in the following pages. Figure 1-3 presents the existing plant configuration and location of unit processes.

1.3.3 Existing Treatment Performance

The Piqua WWTP has successfully treated wastewater to meet NPDES permit requirements without violations. The figures at the end of this section show the past four years of historical conditions that the plant has experienced and its treatment efficiency.

- Influent wastewater flows demonstrates the seasonal variation and infiltration and inflow (I/I) influence. Dry weather flow ranges from approximately 2 to 3 MGD, with wet weather flows reaching up to 8 MGD (see Figure 1-12).

- Influent five-day carbonaceous biochemical oxygen demand (CBOD) typically ranges from 100 to 200 mg/L (see Figure 1-13). 100 mg/L is relatively low for a separate sanitary sewer system. Effluent CBOD generally ranges from 2 to 10 mg/L, with an average daily removal of 97.7%. Mass loading of influent CBOD is shown in Figure 1-15.

- Influent total suspended solids (TSS) typically range from 100 to 200 mg/L with an average of 130 mg/L (see Figure 1-14). Effluent TSS generally ranges from 2 to 15 mg/L, with an average daily removal of 96.5%. Mass loading of influent TSS is shown in Figure 1-15.

- Effluent nutrient concentrations for ammonia and total phosphorus demonstrate seasonal variance (see Figure 1-16).
Figure 1-3: Existing Plant Configuration
1.3.3.1 Liquid Stream Process

Flow Equalization

The flow equalization (EQ) basin was constructed in 2009 to store excess wastewater during wet weather events. The EQ basin provides wet weather flow capture for subsequent treatment, and reduces potential SSO events. Influent wastewater enters the EQ basin from the 36-inch West Interceptor over a broad-crested weir with flap gate located in the diversion chamber. The plant throttles the influent gates during wet weather events to limit the flow through the WWTP to that which can be effectively treated which raises the hydraulic grade line forcing raw sewage to the EQ basin.

Design of the EQ basin allows for 1 MG of gravity-in, gravity-out storage by accepting flow from the higher elevation West Interceptor and discharging to the lower elevation 42-inch Miami River Interceptor. Because the basin’s wall extends above the 100-year flood elevation, there is approximately 10 feet of freeboard. The EQ basin was designed to allow future pumping of the flow into the EQ basin, allowing the upper volume of the tank to be used for additional flow storage, bringing the total EQ capacity to 3 MG in the future.

The EQ basin has four submersible pumps and a jet mixing header to circulate the liquid. The header includes provision for future air addition if necessary to increase mixing intensity or add dissolved oxygen into the stored wastewater to avoid it becoming septic.

Raw Sewage Pumping

Raw sewage enters the existing plant through the raw sewage junction chamber. There are two feeds into the raw sewage junction chamber, a 42-inch pipe (Miami River Interceptor) that enters from the north and a 30-inch pipe that enters from the west (combination of the 36-inch West Interceptor and 36-inch Hemm Road Interceptor flow). The flow from these pipes is controlled by adjusting the position of the sluice gates through the electric motor actuator to a desired set-point in the junction chamber. As flows increase to the capacity of the raw sewage pump station, the sluice gates will be modulated partially closed to utilize the in-pipe storage of the Miami River Interceptor.

Once flow exits the raw sewage junction chamber, it passes through one of two 2.5-inch clear opening bar racks that are manually raked. Each bar rack is rated for a peak flow of 8.3 MGD. The raked material is placed in 55-gallon drums that are stored next to the bar racks and then subsequently hoisted from the pump station to the surface with a jib crane for disposal. After the bar racks, flow is routed to one of three raw sewage pumps.

The three raw sewage pumps (lead, lag and back-up) are enclosed screw pumps, each designed for a flow of 4.2 mgd. The number of pumps operating at a given time is determined by the flow entering the plant. Although each pump was sized identically, each pump has exhibited different capacities. The pump most capable of pumping near its design rate is Pump #2, which can reportedly pump up to 4 MGD. If Pump #2 is out of service, the actual pumping capacity is approximately 7.8 MGD.
**Condition Assessment**

The raw sewage pumping station could benefit from numerous improvements. The first recommended improvement is to increase automation at the raw sewage junction chamber. Automation of these gates to a controlled set-point would allow the plant to better utilize storage within the system, and avoid manual control. The coarse bar racks present several operational challenges to plant staff. With having to manually clean the bar racks, plant staff must monitor the racks for debris accumulation and when necessary, rake off debris and place it in a container. This can be challenging in the cold months because debris will often freeze to the racks, which blocks flow through the racks and increases the headloss. Beyond the freezing of debris to the racks, another challenge is removing the raked material from the pump station. The raked debris is deposited in 55-gallon drums next to the bar racks. To empty the drums a jib crane is used to lift the drums out of the pump station. The screenings are then placed in the screenings dumpster at the screening and grit building. This is a labor intensive and potentially hazardous activity for plant staff that could be essentially eliminated with mechanically-cleaned bar screens.

The raw sewage screw pumps are experiencing several issues due to the age of the pumps. The pumps have cracked barrels, and welding repairs have only been partially successful, and not addressed the interior sides of these cracks. These pumps have also been repaired several times in recent years to correct the rotating assembly at considerable cost. There are additional leaking issues at the top of pumps (in the operating building). Beyond the pumps’ current structural condition, none of the pumps are capable of meeting their original design capacity and certainly will not have the capacity to meet increased flow demands with an upgraded plant.

In summary, nearly all of the equipment in the raw sewage pump station is in need of improvement. The screw pumps are beyond their serviceable life and do not have the capacity to meet increased future flows. The coarse bar racks upstream of the pumps present labor intensive operations by plant staff.

In a more ideal configuration, a treatment plant would handle screenings in only one location, and currently Piqua deals with screenings at two locations (one being manual). A consolidated screenings process will be evaluated in the alternatives analysis, along with options for a new raw sewage pump station and improved screenings process capable of meeting the future flows.

**Screening and Grit/Grease Removal**

The screening and grit/grease removal process is located within a partially enclosed building. Flow from the screw pumps is passed through a single ¾-inch clear opening mechanical bar screen rated for a peak flow of 8.3 mgd. There is a bypass channel with static manually-cleaned screen for passing flow when the mechanical screen is out of service. The screenings removed by the mechanical bar screen are deposited in a washer compactor. Following screening is an aerated grit/grease tank. The tank has a traveling
bridge with a suspended grit pump to pump accumulated grit from the bottom to a de-gritting auger. A skimmer moves accumulated grease on the surface to a dumpster. The grit/grease tank has a volume of 29,330 gallons and is rated for a peak flow rate of 8.3 MGD. The dewatered screenings, grit, and grease are disposed into three 2 cubic yard roll-off dumpsters for landfill disposal on a weekly basis.

**Condition Assessment**

The building that the equipment is located in is not completely enclosed. The west side is open to allow the traveling bridge into the building. This leads to freezing within the screening and grit equipment, which leads to diminished capacity and operational efficiency. Attempts to shield the building opening from the westerly prevailing winds with plastic sheeting have been unsuccessful. Another issue related to the building itself, is leaking skylights that is evidenced by water damage on the roofing system.

The clear opening of ¾ inch on the existing mechanical screen is not compliant with the updated 503B sludge regulations. The regulations require finer screens (maximum of 5/8-inch clear) for generated biosolids to be land applied.

An intermittent issue with the grit equipment requires the traveling bridge in the aerated grit channel to be manually operated to return it. When the problem arises, it only travels one direction. At times, this equipment has periodic challenges with outdoor operations in freezing weather.

Alternatives for improvements to the screenings and grit/grease removal process and building will be evaluated during the alternatives analysis.

**Primary Settling Tanks**

Flow is distributed from a diversion chamber to three circular primary tanks. The three primary tanks are each 55-feet in diameter and have a side water depth (SWD) of 12-feet. The primaries have a combined capacity of 8.3 MGD peak flow rate at a surface overflow rate (SOR) of 1,165 gpd/sf.

Under normal flow conditions, one tank is taken off-line to maintain a sufficient sludge blanket in the other two tanks. The off-line tank is typically brought on-line during wet weather events when flows exceed 5 MGD.

**Condition Assessment**

The three primary tanks are overall in good condition. Flow can be bottlenecked under high flows at the discharge of primary tank #1 and #2 in a channel under the floor of Primary Control House A.

Operationally, primary tank #3, even though it is the newest tank, is the most difficult to operate. The plant staff report the sludge withdrawal slip tube is more difficult to use than the other tanks and they have experienced issue with sludge thickening in the sludge withdrawal line.
**Aeration Tanks**

Flow from the primary settling tanks is routed to a diversion chamber, with gates that control flow to four rectangular aeration tanks. The elevation difference between the primary settling tanks and aeration tanks is too little to allow for positive flow splitting via fixed weirs. Flow split to each aeration tank is dictated by the hydraulics of the open channels to each tank and the inlet gate at the diversion chamber.

Each aeration tank is configured with a forward/return pass and tapered air addition through six cells. The aeration tanks are 25-feet wide and each pass is 76-feet long and 15-feet deep. The total volume under aeration is 1,645,820 gallons. The aeration is provided by fine bubble diffusers. All the diffusers were recently retrofitted with SSI diffusers. The air is provided to the diffusers by three centrifugal blowers (designed for two in service and one stand-by) each rated for 2,850 SCFM. Only one blower is required to operate under current flow and loading conditions. Two of the blowers are driven by electric motors and one by a digester gas-powered engine. The engine has a complete heat recovery package (exhaust and jacket cooling water) to assist in heating the primary digester.

**Condition Assessment**

The air supply from the blowers is more than adequate, and serves all plant air needs including aeration, aerated grit/grease tank, supernatant oxidation, and post-aeration processes. The plant actually wastes air through over-aeration (D.O. in excess of 2 mg/l in the aeration tanks). The blower runs in a throttled, or “choked”, position to reduce the amount of air supplied to better meet the overall process needs. The plant runs one blower that is throttled back, and has never needed to operate a second blower.

The plant sees occasional elevated ammonia concentrations, although it has not exceeded NPDES permit limits. The plant does not have permanent dissolved oxygen meters for process control, which could be used to control blower operation and stabilize ammonia removal.

Currently, the blowers are oversized and approaching the end of their useful lives given their age and overall efficiency. Blower capacity and type of aeration will be evaluated during the alternatives analysis.

**Secondary Settling Tanks**

Flow from the aeration tanks is routed to a diversion chamber, with gates to control flow to four circular secondary settling tanks. Three of the tanks are 55-feet diameter by 12-feet deep and the fourth is 55-feet by 10-feet deep. The total peak flow capacity of the secondary tanks is 8.3 MGD based on a SOR of 873 gpd/sf. The elevation difference between the aeration tanks and secondary settling tanks is too little to allow for positive flow splitting via fixed weirs. Flow split to each secondary settling tank is dictated by the hydraulics of the piping to each tank and the inlet gate at the diversion chamber.
**Condition Assessment**

Several of the gates in the diversion chamber are inoperable and could be contributing to some of the flow split problems at the secondary settling tanks. The inoperable gates also make access for any repairs nearly impossible without temporary bulkheads or bypass pumping.

Secondary settling tank #3 has an outdated hydraulic sludge draw-off system and only 10-feet SWD. The other tanks are deeper at 12-feet SWD, which operates better to control the sludge blanket and prevent solids from escaping over the weirs.

The alternatives analysis will evaluate options to improve the flow split into the secondary clarifiers and evaluate improvements to enable the plant staff to maintain the process equipment and improve performance. These improvements include; upgrading influent flow dispersion with energy dissipating influent baffling, Stamford baffling to further prevent flow velocity short circuits along the bottom of the tanks, and weir and scum baffle brush cleaning systems to prevent build-up of long stringy algae that can plug the flushing water system or blind the UV system. These improvements are especially important for tank #3 which is only 10 feet deep.

**Disinfection**

Flow from the secondary settling tanks is routed to the disinfection process. Effluent is disinfected with chlorine gas solution, and then dechlorinated with sulfur dioxide. The effluent is dosed on a fixed rate that is manually adjusted based on influent plant flow. The dose rate is manually adjusted during prolonged high or low flows. The single chlorine contact basin has a volume of 87,490 gallons giving a maximum treatment capacity of 8.3 mgd at the minimum requirement of 15 minutes of detention time.

**Condition Assessment**

The plant has had no issues meeting their current permit limit of 1000 CFU of fecal coliform/100 mL. There were concerns with the current disinfection system being able to meet the new permit limit of 126 CFU of E. coli/100mL. Currently the plant is able to meet the new E. coli limit, although elevated concentrations are observed immediately following wet weather events.

There is no reliable method for flow pacing the chlorine feed, because of a non-functioning effluent flow meter. Regardless of the disinfection system recommended during the alternatives analysis, a new effluent flow meter will be needed. The plant has been certifying monitoring reports to Ohio EPA based on influent flow, which is not truly representative of effluent flows considering all the internal process recycle and treating stormwater drainage. The plant should implement effluent metering for permit compliance purposes and to be able to pace disinfection.

One-ton containers of chlorine gas are used for disinfection at the plant. These containers pose a significant safety hazard to operating staff and to the general public. There is a bike path adjacent to the chlorine building. Additionally, with a single basin, there is no redundancy to allow for periodic cleaning or maintenance of the basin without bypassing the entire disinfection process. Recent upgrades were completed to the chlorination and de-chlorination feed systems because of the new E.-coli based disinfection requirements which all Ohio plants are finding very difficult to meet without increasing the chemical feed by as much as 50%. Plants utilizing a UV disinfection system are having no problems meeting the new requirements. This fact along with safety, lower operation and maintenance costs, and ease of operation have resulted in the recommendation by CDM Smith and the City’s desire to convert to a UV system.
One of the most popular non-chemical disinfection technologies is ultraviolet (UV) disinfection. More plants are transitioning their gaseous chlorine systems to UV to reduce the safety hazards involved with handling dangerous chemicals. A key design parameter of determining UV's applicability at a plant is UV transmittance. CDM Smith has requested that the City collect and record UV transmittance (UVT) data at 254 nm wavelength, so that this alternative disinfection technology can be properly evaluated during the alternatives analysis.

### Post-Aeration and Outfall Discharge

Treated effluent passes through an aeration basin to increase dissolved oxygen after which it is routed through the plant's outfall pipe to the Great Miami River. Effluent can also be pumped into the Post Aeration Basin prior to flowing to the river during high river levels, when the gravity outfall is surcharged. There are three vertical mixed flow pumps, each with a rated capacity of 4.2 mgd (total firm capacity of 8.3 MGD). The pumps are tested monthly but are rarely used (once every 5 to 10 years).

**Condition Assessment**

The plant gets excellent dissolved oxygen (DO) transfer by this post-aeration process. The plant staff desire better and safer access to the effluent pipe to facilitate sample collection. The current method used for sample collection is grab samples. Options to improve sampling will be evaluated during the alternatives analysis.

### 1.3.3.2 Solids Stream Process

#### Anaerobic Digestion

The plant operates a primary and a secondary digester. The primary digester has a fixed cover with a roof-mounted gas mixing system and the secondary cover is a floating gas-holder cover. Each digester is 50-feet in diameter with a side water depth (SWD) of 22-feet. The anaerobic digesters are fed by the primary sludge pumps, which pump sludge from the primary settling basins and un-thickened WAS is also pumped to the primary digester at a constant 10 gpm. The digesters have experienced overloading due the limits on disposal of the sludge. The new Ohio sludge regulations have restricted land application in winter months which has in turn increased the need for sludge storage at the plant. When the sludge storage tanks fill the only option for the operators is to decrease wasting activated sludge and increasing the mixed liquor suspended solids and sludge age. When this old sludge is introduced into the anaerobic digesters, foaming starts. All solids alternatives will consider expansion and upgrade with thickening WAS, dewatering digested sludge, and land application for disposal of the sludge.

**Condition Assessment**

There are several issues with the digesters. The secondary digester gas-holder cover has developed holes in the side skirt and cannot function efficiently in retaining the methane gas. Occasionally, foam will escape from vents in top of the primary digester. It is thought that the secondary treatment process may contribute to this problem as a result of nocardia formation or from introducing un-thickened WAS into the digester. Thickening the WAS would reduce the hydraulic loading on the digester, provide increased detention time, and minimize the foam formation within the digesters.
The primary digester bubble gun mixing system was not mixing properly due to the bubble generator not functioning correctly in two of the three mixers. This poor mixing recently resulted in decreased gas production and contributed to the primary digester discharge pipe becoming plugged with solids. The decreased gas production also resulted in operational problems with the heat exchanger due to an insufficient supply of methane. The plant staff supplemented the heat produced by the heat exchanger by tapping into the hot water heating system at the plant. The cause of the poor mixing was identified as a malfunctioning float valve that was preventing the bubble guns from getting a sufficient flow of gas. The repair to the malfunctioning float valve appears to have remedied the mixing issues, restored gas production, and improved heating of the primary digester.

All the gas safety equipment is approaching the end of its service life and is recommended for replacement. The plant has four gas meters and all of them were rebuilt in 2010 and work properly.

The options for improving the digesters will be thoroughly evaluated during the alternatives analysis. It is apparent that several modifications need to be made to the digesters to increase capacity, efficiency, and safety.

**Biosolids Dewatering**

The City currently contracts with Burch Hydro to provide and operate a belt filter press, truck dewatered solids to off-site storage stockpiles, and manage disposal to farm fields. The City provides the building, electricity, water, and access for Burch Hydro to conduct their contract operations.

**Condition Assessment**

Sludge is dewatered twice a week, running at 100 to 200 gpm to draw down the sludge storage tank underflow. The supernatant oxidation system becomes overloaded when the belt press is operated and filtrate is sent to the supernatant oxidation tank along with digester supernatant. During sludge dewatering, digester supernatant is not drawn.

Waste Activated Sludge (WAS) was previously thickened with a solid bowl-type centrifuge. The centrifuge was removed as a result of required costly repairs. Consideration should be given to implementing another WAS thickening operation to reduce the water content being pumped to the digesters.

**Supernatant Oxidation**

The digester supernatant is the main source of influent to this process. The tank also receives filtrate from the belt filter press when it is in operation. The plant pumps a small amount of primary effluent into the basin to feed the biomass in the tank.

**Condition Assessment**

There is no dedicated blower to provide oxygen transfer to the supernatant oxidation process. This process uses a sidestream from the plant’s main blowers that supply air to all needs.
Flow coming into this process enters as a slug discharge and is not attenuated as a stable flow pattern. The plant has observed process issues when the belt filter press is in operation because of the additional filtrate flow being routed to the supernatant oxidation process. A holding tank or other means to provide a steady flow regime to this process would likely increase the effectiveness of this unit process and reduce the variability in detention time.

**SCADA/Automation**

The plant operates three shifts, but is considering additional automation to allow the City to eliminate one or two shifts. The plant staff is interested in evaluating options for increasing automation at the plant through the SCADA system. The plant uses RSView 32 for its graphical package and Operator 10 for trending, reporting, and data analysis.

*Condition Assessment*

Most of the plant SCADA is configured for monitoring purposes and not automatic control of processes. An operator is required to manually start/stop most processes, although several pumps have automatic start/stop logic and a logic loop controls the RAS flow.

The pH and temperature probes (GLI – Hach product) in the influent channel have experienced corrosion issues due to the harsh environmental conditions. The City would prefer to collect influent samples after the fine screens and not ahead of them as is currently done.

The plant currently has several valves and gates that must be actuated locally. There are several valves and gates that are not operable regardless due to service beyond their useful life. Replacing inoperable valves and gates should be included in the plant upgrade, and consideration for motorized actuators that can be monitored and operated remotely through the SCADA/HMI interface.

**Pumps**

All of the pumps at the treatment plant are nearing the end of their service life and will need to be evaluated further as alternative treatment options are investigated. Additionally, these pumps will be evaluated for their ability to meet a higher flow condition that is anticipated, if they are deemed salvageable.

It was noted during the workshop that the plant staff was comfortable with submersible pumps for potential use for a new raw sewage pump station.

*Condition Assessment*

The supernatant oxidation return pump discharges upstream of the mechanical screen and has experienced plugging issues. The plant staff resolved this issue by placing a stand pipe on the discharge, with discharge holes in the upper reaches of the stand pipe to prevent plugging. Any changes to this return flow configuration will take into consideration the possibility of plugging.

The two digested sludge pumps baseplates are severely corroded. The pumps have been in operation for over 20-years and should be replaced.
The automatic strainer on the flushing water system (non-potable water) leaks. Additionally, the original galvanized steel pipe has several leaks throughout the plant, including some yard hydrants. This system will be evaluated for potential replacement.

The return activated sludge pumps have been recently rebuilt. Valve actuators on the suction side of the pumps are broken and should be repaired/rebuilt. The pumps are throttled by valves on the discharge line to meet a desired flow, but could be automated with variable speed drives to do so. The plant has never operated two pumps at the same time and typically only one pump is operated at 55% capacity.

Plant staff thought a level sensor to monitor the sludge blanket in the basins would be beneficial over their current manual methods used to detect sludge depths.

Security
The plant is currently staffed 24 hours a day, which provides a level of security. However, as more automation is added to the plant, the possibility exists that the plant may not need to be staffed 24 hours a day. Several items will be evaluated to determine what, if any, improvements may be necessary to the plant for security purposes.

Condition Assessment
The plant is located along a public bike path, which was constructed in 2009. Although most of this traffic is pedestrian and bike traffic occurs during daylight hours when the plant is staffed, there is concern about having a more public and noticeable operation that could impact security measures.

Options for including additional fencing and lock/access policy will be evaluated. Security closed circuit television (CCTV) cameras will also be considered to provide surveillance at potential access points.

Miscellaneous
In addition to above equipment concerns and issues, the following miscellaneous items were mentioned for consideration during the Facility Plan development.

Condition Assessment
Concrete floors in the Operations Building are wearing and have exposed reinforcing steel in some areas. This floor should be repaired.

In the Blower Building, plastic covers are used to minimize water damaging the MCC due to a leaking roof on the building. The roof should be repaired or replaced to prevent the potential water damage to the electric gear and reduce the safety hazard. Removal of the blowers for repairs is a difficult process. Modifications to improve access to the blowers will be evaluated.

The old MCC in the Blower Building needs to be replaced. The insulation on the original wiring is cracking and crumbling off of the wire, making it a safety issue.

Primary tank #3 is not able to be sampled from the auto sampler. Options should be evaluated to locate a sampling device.
The City would like to remove the underground fuel oil tank by the digesters. Using fuel oil as an energy source is expensive, and the City would like to explore other cost-effective heating options. Natural gas supply from Vectren, the local gas utility, would be preferred if the plant cannot generate enough methane gas from the digestion to sustain its operations. There is currently no natural gas available at the plant site. Vectren would have to construct a new gas line to the plant.

**Conclusion**

The plant has numerous pieces of equipment that are approaching or are beyond their useful life. In order for future flows to the plant to be treated reliably and efficiently, these pieces of equipment will need to be replaced or updated. The extent of improvements necessary for other unit processes will be dependent on the identified design flows and selected treatment processes.
A summary of unit processes and equipment that is expected to be replaced or significantly updated for use in an improved treatment plant is included in Table 1-1.

Table 1-1: Condition Assessment Summary of Major Improvement Needs

<table>
<thead>
<tr>
<th>Unit Process</th>
<th>Component</th>
<th>Improve Condition or Operations</th>
<th>Need to Meet Permit/Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Treatment</td>
<td>Raw Sewage Pumping</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Preliminary Treatment</td>
<td>Main Drain Pumping</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Preliminary Treatment</td>
<td>Coarse Bar Rack</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Preliminary Treatment</td>
<td>Screening</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Preliminary Treatment</td>
<td>Grease and Grit</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Aeration</td>
<td>Blowers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Secondary Clarification</td>
<td>Secondary Tanks Influent Junction Chamber</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Secondary Clarification</td>
<td>Secondary Tank #3 sludge withdrawal</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Digestion</td>
<td>Digesters</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Digestion</td>
<td>Waste Gas Flare</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Disinfection</td>
<td>Chlorination</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Outfall</td>
<td>Effluent Flow Meter</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Structural Conditions</td>
<td>Operations Building Concrete Floor</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Structural Conditions</td>
<td>Operations Building Roof</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Structural Conditions</td>
<td>Screenings Building Roof</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 1-12: Historical Plant Influent Flow
Figure 1-13: Historical Plant Influent and Effluent CBOD Concentrations
Figure 1-14: Historical Plant Influent and Effluent TSS Concentrations
Figure 1-15: Historical Plant Influent and Effluent TSS Loadings
Figure 1-16: Historical Plant Ammonia and Phosphorus Effluent Concentrations
2
Future Treatment Capacity Needs

2.1 Forecasts of Population Growth

The City of Piqua (City) has had a steady population base of just over 20,000 people for the past several decades. Previous studies incorporated into the water distribution system and water treatment plant master plans identified nominal population growth within the City for the next 20 years. In addition, the City currently serves portions of unincorporated areas within Miami County that will likely expand within the 20-year planning period.

2.2 Forecasts of Other Capacity Demands

Like many communities, the City is planning for non-residential development and redevelopment of former industrial properties. These developments generally carry a higher water usage demands and potential for industrial wastewater with higher organic or nutrient loadings. The specific timeframe of these new and redeveloped properties is unclear; however, for the purpose of this Facility Plan, it is anticipated to occur within the 20-year planning period.

The Sanitary Sewer System Master Plan identified these properties and potential service area expansion, and quantified the associated additional wastewater flows that must be treated at the plant. Using a ratio of projected water demands from the water treatment planning effort, water consumption is anticipated to increase 33% in the next 20-years to meet a similar service area as the sanitary sewer system service area. Using a similar ratio to quantify necessary average day rated capacity, the expanded treatment plant must be able to treat 6.0 MGD on an average day, maximum month basis.

To eliminate SSOs, additional treatment capacity is necessary and will drive the need for potentially increasing the maximum day plant capacity. However, additional flow EQ volume can mitigate SSOs by storing wet weather flows and allowing the plant to treat the influent wastewater over a longer period of time. A combination of additional treatment capacity and additional EQ volume is expected to provide the optimum capital and lifecycle cost to the City.

As part of the Sanitary Sewer System Master Plan, CDM Smith performed continuous simulation modeling of Piqua’s sanitary sewer system over a 50-year period of record rainfall data. This evaluation found that the month of April 2011 with its frequent and extensive rainfall presented the worst case scenario for planning purposes in terms of influent flow and volume to manage at the plant. This same month of rainfall data was then simulated in the model environment under the 20-year (2030) future conditions to quantify the combinations of treatment capacity and EQ storage that would eliminate the SSO. The resulting curve of treatment/EQ combinations is presented in Figure 2-1.
It is apparent that adding additional EQ capacity would not fully eliminate SSOs. Adding treatment capacity with the current 1 MG of EQ storage is feasible, but would require nearly triple the current maximum capacity with 21 MGD of treatment capacity necessary. An evaluation of additional treatment capacity and EQ storage was made to find the optimum combination of peak treatment capacity and storage.

To evaluate the costs of the treatment and EQ expansion options, CDM Smith used the following planning level estimates.

- Capital cost of additional treatment from 4.5 MGD to 6 MGD average day = $9/gpd
- Capital cost of additional treatment beyond 12 MGD max day = $3/gpd
- Capital cost to expand EQ storage from 1 MG to 3 MG with influent pump station = $500,000
- Capital cost to expand EQ storage beyond 3 MG = $1,500,000/MG

CDM Smith then evaluated different combinations of treatment/EQ needs for the 20-year planning period using these unit cost factors. Table 2-1 shows the various combinations of peak wastewater treatment rates and EQ storage volumes and planning level costs. Figure 2-2 presents the cost curve of these combinations.
Table 2-1: Planning Level Costs for Combinations of Peak Wastewater Treatment and EQ Storage

<table>
<thead>
<tr>
<th>Scenario</th>
<th>WWTP Max Flow (MGD)</th>
<th>WWTP Avg Flow (MGD)</th>
<th>Max/Avg Ratio</th>
<th>Total EQ (MG)</th>
<th>Additional WWTP Cost</th>
<th>Additional EQ Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.5</td>
<td>6</td>
<td>1.75</td>
<td>12</td>
<td>$13,500,000</td>
<td>$14,000,000</td>
<td>$27,500,000</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>6</td>
<td>1.83</td>
<td>9</td>
<td>$13,500,000</td>
<td>$9,500,000</td>
<td>$23,000,000</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>6</td>
<td>2.00</td>
<td>7.5</td>
<td>$13,500,000</td>
<td>$7,250,000</td>
<td>$20,750,000</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>6</td>
<td>2.17</td>
<td>6</td>
<td>$16,500,000</td>
<td>$5,000,000</td>
<td>$21,500,000</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>6</td>
<td>2.83</td>
<td>3</td>
<td>$28,500,000</td>
<td>$500,000</td>
<td>$29,000,000</td>
</tr>
<tr>
<td>6</td>
<td>21.5</td>
<td>6</td>
<td>3.58</td>
<td>1</td>
<td>$42,000,000</td>
<td>$0</td>
<td>$42,000,000</td>
</tr>
</tbody>
</table>

The resulting cost curve indicates that a combination of treatment expansion and additional flow equalization provides the lowest capital costs to eliminate the SSO. At a capital cost of approximately $21M - $22M, either the 12 MGD treatment/7.5 MG EQ or 13 MGD treatment/6 MG EQ combinations offer the most cost-effective solution.

The previous EQ basin project was planned so that a pump station and second basin of the same size, 3 MG, could be constructed to provide 6 MG total capacity. If a second basin of 4.5 MG capacity was constructed, a total of 7.5 MG would be available; however, this may require additional property acquisition to construct the larger basin. By comparing these two scenarios based on planning level
costs, providing slightly more treatment capacity while maintaining the original concept of EQ storage volume is perceived to be more beneficial and implementable than additional incremental EQ storage volume. For these reasons, the combination of 13 MGD of peak treatment capacity and 6 MG of EQ volume is recommended.

As mentioned in Section 1, the Village of Covington has expressed interest about conveying their wastewater to Piqua’s WWTP. Therefore, these future flows should also be included in the projected future flows for Piqua. Based on Covington’s rated flow in their NPDES operating permit, it was assumed an additional 1.0 mgd of average dry weather flow (ADF) would be conveyed to Piqua. This additional flow would affect all the treatment/storage options mentioned above equally, so this additional flow is added to the treatment flows mentioned above.

Therefore, the recommended treatment and storage capacities for the WWTP expansion are the following:

- Average Design Flow = 7.0 MGD average day, max month
- Peak Design Flow = 13 MGD max day, max month
- Design EQ Storage = 6 MG total storage

2.3 Effluent Limitations

The City maintains a NPDES permit, Appendix A, for wastewater discharge from the plant. This permit contains effluent limitations from both concentration and mass loading perspectives for various water quality parameters. This requires associated sampling, monitoring and reporting system to verify treatment performance.

2.3.1 Receiving Stream

Treated effluent from the wastewater treatment plant is discharged to the Great Miami River. The stream is a major river that is classified as Exceptional Warmwater Habitat by Ohio EPA (OAC 3745-1-21). The river has recreational activity, including direct human contact.

The plant outfall operates by gravity under most conditions. During periods of high river water elevation, three vertical mixed flow pumps above the plant’s outfall can be used to convey the treated effluent to discharge to the river. An auxiliary outfall located upstream of the low-head dam has been recently abandoned and discharge to this outfall is no longer allowable in the NPDES permit.

2.3.2 NPDES Permit Requirements

Ohio EPA issued the current NPDES permit to the City with an effective date of August 1, 2011; it expires on January 31, 2016. Treatment performance standards and comparison to the previous permit is presented in Table 2-2. Specific language is included such that the constructed SSO must be eliminated by January 31, 2016.
Table 2-2: NPDES Permit Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment Performance Requirements</th>
<th>Change from Previous NPDES Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSO</td>
<td>None Permitted</td>
<td>No change</td>
</tr>
<tr>
<td>cBOD Weekly/Monthly</td>
<td>Winter: 40/23 mg/L</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Summer: 23/15 mg/L</td>
<td></td>
</tr>
<tr>
<td>TSS Weekly/Monthly</td>
<td>Winter: 45/30 mg/L</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>Summer: 30/20 mg/L</td>
<td></td>
</tr>
<tr>
<td>Nitrogen, Ammonia Weekly/Monthly</td>
<td>Fall/Spring: 13.5/9.0 mg/L</td>
<td>Summer slightly more stringent</td>
</tr>
<tr>
<td></td>
<td>Dec – Feb: 22.5/15.0 mg/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Summer: 4.4/2.9 mg/L</td>
<td></td>
</tr>
<tr>
<td>E.Coli, Weekly/Monthly</td>
<td>Summer: 284/126 CFU/100mL</td>
<td>2,000/1,000 (Fecal Coliform)</td>
</tr>
<tr>
<td>Chlorine Residual Maximum</td>
<td>Summer: 0.035 mg/L</td>
<td>No change</td>
</tr>
<tr>
<td>Oil and Grease Maximum</td>
<td>Year-round: 10 mg/L</td>
<td>No change</td>
</tr>
</tbody>
</table>

2.4 Future Influent and Effluent Criteria

2.4.1 Future Influent Loads

The existing influent waste loading concentrations for CBOD, TSS, and ammonia to the WWTP have been dilute, based on industry standards. Table 2-3 presents a comparison of the existing influent loadings to the plant from 2008 through 2011 against medium strength wastewater values (referenced from Metcalf & Eddy – Wastewater Engineering).

Table 2-3: Influent Loading Comparison

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Existing Loading Concentrations, mg/L</th>
<th>Typical Loading Concentrations, mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOD</td>
<td>140</td>
<td>190</td>
</tr>
<tr>
<td>TSS</td>
<td>128</td>
<td>210</td>
</tr>
<tr>
<td>NH\textsubscript{3}</td>
<td>11.5</td>
<td>25</td>
</tr>
</tbody>
</table>

The future influent loadings to the plant has been calculated using the existing, dilute, concentration for the current average design flow of the plant (4.5 MGD). The 2.5 MGD (1.5 MGD from Piqua, 1.0 MGD for Covington) increase in average daily flow was assumed to be loaded at typical loading concentrations. It was assumed the increase in average daily flow would be the result of industry, which would have a higher strength concentration than the existing loading. The calculation of the daily loading can be seen in Appendix B. The average daily loads are:

- Design influent CBOD$_5$ = 9,200 lb/day
- Design Influent TSS = 9,200 lb/day
- Design Influent NH$_3$ = 1,000 lb/day

2.4.2 Future Effluent Criteria

With the planned expansion, additional effluent flow will be discharged to the Great Miami River. The treatment plant has been assigned a Waste Load Allocation (WLA) from Ohio EPA for pollutant
discharge to the Great Miami River. Higher flows at the same pollutant concentrations will lead to higher mass loadings. These future mass loadings must be compared to the plant’s WLA to determine if improved treatment performance is required. An anti-degradation addendum will likely be required as part of a new NPDES permit negotiation for the higher flow requested. As an alternate to the Anti-degradation addendum, it is possible for the City to maintain the same mass loading at the higher flows by providing treatment to achieve greater removals. Based on proposed design flows of 7 MGD instead of 4.5 MGD, each parameter would need to be reduced such that the mass discharged remains the same. The limits would be as shown in Table 2-4 for future conditions.

Table 2-4: Allowable Effluent Discharge Concentrations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration (mg/L)</th>
<th>Monitoring Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOD</td>
<td>14</td>
<td>Winter</td>
</tr>
<tr>
<td>CBOD</td>
<td>9</td>
<td>Summer</td>
</tr>
<tr>
<td>TSS</td>
<td>19</td>
<td>Winter</td>
</tr>
<tr>
<td>TSS</td>
<td>12</td>
<td>Summer</td>
</tr>
<tr>
<td>NH₃</td>
<td>5</td>
<td>Fall/Spring</td>
</tr>
<tr>
<td>NH₃</td>
<td>9</td>
<td>Dec.-Feb.</td>
</tr>
<tr>
<td>NH₃</td>
<td>1</td>
<td>Summer</td>
</tr>
</tbody>
</table>

Additional process modeling will be required during the design phase of the selected alternative to quantify the anticipated effluent concentrations under a range of flow conditions. This detailed process evaluation is outside the current facility planning scope. If additional treatment efficiency is necessary to reduce pollutant concentrations, an improved treatment process, such as tertiary treatment, may be required.

Nutrient removal may be required in future NPDES permits. Space will be identified to achieve these potential future goals of total nitrogen and total phosphorus removal. Options include biological nutrient removal and chemical precipitation. Each liquid process alternative will address the potential of incorporating a process change to meet future nutrient removal requirements.
Section 3
Development of Liquid Stream Alternatives

3.1 General
The discussion on treatment alternatives for the WWTP is divided into two processes, liquids and solids. There were seven liquids treatment alternatives discussed during the workshop, which were evaluated on several criteria. These criteria were assigned weighting percentages totaling 100%, and each treatment alternative was assigned a point value score on a 0-5 basis with higher numbers being more preferred. The multiplication of these criteria and weighting factors results in a weighted sum for each alternative, which is provided in Table 3-1.

Table 3-1 Liquids Treatment Alternatives Ranking

<table>
<thead>
<tr>
<th>Treatment Alternatives</th>
<th>Capital Cost</th>
<th>O&amp;M Costs</th>
<th>Maintenance of Plant Operations (MOPO)</th>
<th>Treatment Efficiency</th>
<th>Ease of Operation</th>
<th>Weighted Sum (1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30%</td>
<td>20%</td>
<td>15%</td>
<td>20%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>1 – Conventional</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>3.20</td>
</tr>
<tr>
<td>2a – Extended Aeration (Parallel)</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3.00</td>
</tr>
<tr>
<td>2b – Extended Aeration (New Plant)</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3.20</td>
</tr>
<tr>
<td>3 – MBR</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2.55</td>
</tr>
<tr>
<td>4 – IFAS</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2.95</td>
</tr>
<tr>
<td>5 – SBR</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2.75</td>
</tr>
<tr>
<td>6 – BioActiflo®</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3.35</td>
</tr>
</tbody>
</table>

The four highest scored alternatives from the workshop developed a shortlist of liquids process alternatives. The shortlisted alternatives for the liquid process alternatives were the following:

1. Conventional (Upgrade and Expand Existing Plant)
2. Extended Aeration (Parallel to Existing Upgraded Plant)
3. Extended Aeration (New Plant)
4. BioActiflo® (Parallel to Existing Upgraded Plant)

These alternatives will be evaluated in Section 4 of this Facility Plan.

Common to each alternative will be improvements to raw sewage pumping, headworks (screening and grit/grease removal), and disinfection. These three unit processes will be evaluated separately from the four shortlisted liquids treatment alternatives listed above.
3.2 Headworks

New headworks facilities will be evaluated for each liquid stream alternative and will include influent pumping and preliminary treatment (mechanical screening, grit and grease removal).

3.2.1 Raw Sewage Pumping

The raw sewage screw pumps will be replaced with new submersible pumps that will be capable of delivering the new plant design flows. New raw sewage pumping will be common to all treatment alternatives. Two options were considered to improve raw sewage pumping:

- Construct new pump station/wet well in a separate structure.
- Retro-fit the existing pump station area in-place with new pumps and wet well modifications.

3.2.2 Preliminary Treatment

Preliminary treatment consists of automatic mechanical screening using screens with openings of ¼-inch and grit and grease removal. Screenings, grit and grease will be collected, classified, washed and compacted prior to disposal to containers that will be collected by a waste collection company for disposal at a landfill.

3.2.2.1 Screenings

The existing mechanical bar screen should be replaced with new fine screens that meet OAC 3745-40 sludge regulations (clear opening of <5/8-inch) prior to any land application, which must be operational by July 1, 2015. Fine screens that were evaluated are:

- Multi-rake design
- Perforated plate
- Climber/stepper

3.2.2.2 Grit (and Grease)

The higher design flows will require additional grit removal and management facilities. Options that were evaluated included:

- Aerated grit system
- Vortex separation
- Eutek Systems – HEADCELL™ (not discussed in workshop – see additional information in Section 4)

Grease removal currently takes place concurrently with grit removal via the Schreiber grit and grease removal system.
3.3 Primary Treatment

As discussed below, four liquid treatment alternatives were considered for expansion/upgrading. Primary clarification would be required for two of these, Alternative 1: Upgrade and Expand the Existing Plant and Alternative 2: Upgrade the Existing Plant and Construct Parallel Oxidation Ditch.

Alternative 1 would require one additional primary clarifier, improvements to the raw sewage pump station and headworks, and changes in the Primary Control House. The new primary clarifier would be 55-feet diameter with 12-feet sidewater depth to be consistent with the existing primary clarifiers. Alternative 2 does not require new primary clarifiers be added; however continued use of the primary clarifiers may require repair and upgrading to meet identified deficiencies.

3.4 Biological Treatment Options

The current biological process is a conventional activated sludge system that is highly dependent on staff being able to waste sludge when needed to keep the aeration tank mixed liquor suspended solids (MLSS) in the range of 1500 mg/l. Operational flexibility is limited by a number of factors including: on-site sludge storage volume, marginal sludge digestion capacity, and small window of time for land application based on the new Ohio Sludge Rules. Problems in the solids handling system can require operating staff to waste less solids, which in turn increases the MLSS in the aeration tanks and negatively impacts treatment and settling of the solids in the secondary clarifiers. This ultimately results in a higher effluent solids discharge. All of the liquid biological treatment options depend on the solids handling system having major upgrades and expansion. All of the biological treatment alternatives have included re-installing thickening equipment to help increase the solids treatment and storage capacity requirements.

The current plant has a supernatant oxidation process to treat recycled flows including the filtrate from the belt filter press and supernatant from the digesters. This tank was innovative for its time and was very effective in pretreating nutrients, mostly ammonia; however, with the new more stringent nutrient limits this tank may need to be expanded or new tanks will need to be modeled to account for the impact of the nutrient loads that are recycled from systems’ side-streams.

3.4.1 Alternative 1 – Upgrade and Expand Existing Plant

This alternative would provide an expansion of the existing treatment plant processes as required to meet the design flows and loadings. Significant work would be required to increase hydraulic flow capacity by improving flow splitting between unit processes at higher flow rates. Additional property would be required to locate new tankage to the east.

Biological treatment would be the same configuration as the current system utilizing primary settling: conventional activated sludge aeration with diffused air, and secondary settling with return activated sludge and waste activated sludge pumping.

Significant costs would be required to upgrade the existing facilities to ensure their continued use for another 20 years. Some of the major upgrade items to be addressed include: hydraulics for primary clarifiers, aeration tanks and secondary clarifier flow splitting; the main drain pump station; aeration blowers; non-potable water system; conversion to UV disinfection, and improved effluent metering and sampling.
Advantages – Much of the plant’s concrete structures, electrical power, and HVAC systems are still in good condition to continue in service for the new plant, which could produce a potential cost savings. In addition, operation of the plant will not change, thus minimizing operations and maintenance training.

Disadvantages – Retrofitting existing facilities always has hidden construction costs due to the need to keep the existing facilities operational while the construction work is completed. Existing facilities may not meet new codes and will need to be upgraded. Most of the plant is over 55 years old with the most recent expansion over 25 years old, which is beyond the useful life of most mechanical equipment. Current and anticipated future discharge requirements are more stringent than the existing plant design may be capable of and therefore computer modeling of the biological system and process modifications would be required to refine the capabilities to meet future needs. This could be performed during preliminary and final design and is not considered necessary at the current planning level. Another consideration is the existing site is compact and any work involving yard piping, electrical power, or communication will have many interferences.

3.4.2 Alternative 2 – Extended Aeration Parallel to Upgraded Existing Plant

This alternative features an oxidation ditch operating as an extended aeration process with long hydraulic retention times (approximately 24 hours) and solid retention times (20 – 30 days) which is a stable and reliable treatment process. The modern oxidation ditch was chosen due to its proven record of achieving biological nutrient removal (BNR) of ammonia, total nitrogen, and phosphorus using various process configurations with anaerobic, anoxic, and oxic (aerated) zones/compartments.

This new parallel plant would be designed and constructed so that the new process units would handle only the required incremental capacity that cannot be reliably processed by the existing plant and retain only the existing facilities considered in acceptable condition to use with the new plant. This would result in a plant capacity of 3.5 MGD (ADF) and 6.0 MGD peak through the existing facilities and a new parallel oxidation ditch of 3.5 MGD (ADF) and 7.0 MGD capacity. The new unit process would be located east of the existing plant in property that would have to be acquired from the quarry. Solids from this process would be returned to the existing plant facilities to be processed with solids from the existing plant.

Advantages – The project could be constructed in phases so that the new parallel plant is constructed first and can then be put online to treat the current flow and the existing taken off line for upgrading. The parallel plant could be sized so the existing plant flows would be 3.5 MGD average daily flow and 6.0 MGD peak hour flow. This would relieve the hydraulic flow splitting problems that the existing plant experiences when flows exceed 7.0 MGD.

Disadvantages – The soils for the new site were not tested and may require special foundations and/or fill. There would be two distinct plants to operate and monitor. Each plant would have its own unique biological populations, solids retention time, return activated sludge (RAS), and waste activated sludge (WAS). The solids handling will be also be affected by the two different types of biosolids generated from the two plants. Oxidation ditches do not use primary clarification and therefore there will be no primary sludge from half the plant, changing the characteristics of the sludge feed to the sludge process. This may change the type of sludge processing required prior to digestion. WAS is also harder to dewater and will typically result in a lower sludge percent solids cake for disposal.
3.4.3 Alternative 3 – New Extended Aeration Plant

This alternative considers constructing a new 7.0 MGD ADF/13 MGD PHF plant that could treat all the flow and partially abandon the existing plant. Only the components for sludge processing, storage, and recycle treatment would be used as well as existing buildings associated with storage and sludge thickening.

Historically, oxidation ditches are operator friendly and have the lowest operation and maintenance costs of all other systems in the less than 20 MGD flow range. They can be automatically operated using SCADA with dissolved oxygen probes or oxidation-reduction potential probes.

The new plant would be located adjacent (east) of the existing plant and would require two new secondary clarifiers along with new RAS/WAS pumps and controls.

The new plant would be computer monitored and controlled with a new SCADA system so that 24/7 operation would not be required. All information could be web accessible and fully alarmed.

- **Advantages** – The plant would be constructed on a “green” site with minimal interferences with current operation and shorter construction period. Contractor bids are much more competitive with a green site. Existing tankage could be used for flow equalization, supernatant oxidation, sludge thickener feed storage, digesters or digested sludge storage.

- **Disadvantages** – The soils for the new site were not tested and may require special foundations and/or fill. Assuming the existing administration building would be used for any new plant alternative, it would be somewhat removed from the new plant site.

3.4.4 Alternative 4 – Biological High Rate Clarification (BioActiflo®) Parallel to Upgraded Existing Plant

Peak wet weather events occur less than 20 times per year typically and last for short periods of time. Expanding the treatment plant capacity by adding primary clarification, aeration, and secondary clarification would be costly, both in capital and operational costs. High-rate clarification (HRC) was developed primarily for treatment of combined sewer overflows to remove 60 percent of biochemical oxygen demand (CBOD) and greater than 90 percent of the total suspended solids (TSS); however, because of its inability to remove soluble CBOD, it has not been used for wet weather flows from separate sanitary sewer systems. Currently Kruger – the manufacturer of the HRC - is pilot testing a new biologically enhanced high-rate clarification (BEHRC) system that can provide soluble BOD removal at the higher rates. The pilot test is being performed under USEPA criteria and, if successful, will allow these very cost-effective systems to be used for treatment of peak wet weather sanitary flows.

This process introduces RAS in a contact tank for biological treatment prior to a sand-ballasted flocculation process for enhanced TSS removal, necessary to meet secondary treatment standards.

It also allows for high hydraulic loadings, most commonly used in wet weather events to treat excess flows. This alternative would be constructed as a parallel train to the existing plant and used during wet weather flow periods.

- **Advantages** – Very small footprint for treatment unit, capital costs that may be as little as one-third the cost of alternative biological systems, fast start-up (typically 30 minutes or less), low energy costs with minimal operational costs during normal flow conditions. This process has
also been used in installations where the process flow can be altered during dry weather to provide final effluent chemical treatment for total phosphorus removal to exceptionally low levels.

- **Disadvantages** – The Ohio EPA has recently approved this relatively new technology for use at a plant that has a separate sanitary sewer system. Ohio EPA would most likely require pilot testing for use at Piqua’s plant. If this alternative is selected, it would require upgrades to the existing plant.

### 3.5 Disinfection

The plant’s existing disinfection process uses gaseous chlorine for disinfection and sulfur dioxide for dechlorination of the plant effluent. The current disinfection process consistently has met permit requirements for fecal coliform (1,000 CFU/100 mL monthly and 2,000 CFU/100 mL weekly). However, the Ohio EPA has reissued more stringent disinfection requirements by switching the indicating organism from fecal coliform to *Escherichia coli (E. coli)* and establishing the permit limit at 284 CFU/100 mL and 126 CFU/100 mL. As required by the Schedule of Compliance in the current NPDES permit, the City evaluated its current disinfection process and determined it is able to meet the more stringent disinfection requirements using current methods at a slightly higher chlorine feed rate.

In a workshop, disinfection alternatives were presented to the City for meeting the *E. coli* limits and included the following:

- Chlorination with sodium hypochlorite (bulk or on-site generation) followed by dechlorination with sodium bisulfite
- Ozone
- Ultraviolet (UV) light

The City’s preferred disinfection alternative was UV disinfection for many safety and operational reasons (i.e., constructible within existing contact basin and eliminate handling of dangerous chemicals). Improved disinfection using UV will be common to all liquid and solids treatment processes and conceptual layouts will be further discussed later in this report.
Section 4

Evaluation of Liquid Stream Alternatives

4.1 Basis of Evaluation

Each of the alternatives defined in Section 3 were evaluated based on monetary and non-monetary factors. The monetary evaluation compares capital costs, operation and maintenance and replacement (OM&R) costs for each alternative. OM&R costs include electrical power, labor, chemicals, supplies, and equipment maintenance and replacement. Non-monetary costs include land requirements, operational requirements, reliability, flexibility, monitoring requirements, nuisance potential, and ease of expansion.

The liquid stream treatment alternatives that were evaluated are:

- **Alternative 1** – Upgrade and expand existing plant
- **Alternative 2** – Extended aeration parallel to upgraded existing plant
- **Alternative 3** – New extended aeration plant
- **Alternative 4** – BioActiflo parallel to upgraded existing plant

4.2 Raw Sewage Pumping

Wastewater collected in Piqua is conveyed to the Piqua WWTP by a system of gravity sewers, pump stations and force mains for treatment. Pumps at the beginning of the treatment process are required to provide the necessary head to convey flow through the treatment plant for treatment before it is discharged to the Great Miami River. The entire WWTP, including the raw sewage pump station, is in need of upgrading and expansion to eliminate the SSO. Elimination of the SSO will be accomplished through a combination of improvements in the sanitary sewer system and at the plant. The improvements at the plant will consist of increased treatment capacity and additional storage to equalize the peak wet weather flows.

The sewer system conveys wastewater to the wet well of the raw sewage pump station at the WWTP. Raw sewage is then pumped to the downstream screening process where the remainder of the flow proceeds through the other processes by gravity.

Increasing capacity of the raw sewage pump station and subsequent processes is critical as the existing facilities have insufficient capacity to convey and treat flows occurring during wet weather. Increasing capacity of the raw sewage pump station is a key component for eliminating the SSO.

Adding a fourth screw pump to the existing structure was not considered because of space limitations in the existing pump station and hydraulic restrictions in the downstream raw sewage channel. Three alternatives for expanding capacity of the raw sewage pump station to handle peak flow rates of 13 MGD were identified in Workshop 2. The first alternative consisted replacing the existing screw pumps with newer, higher output screw pumps to meet the future flow requirements. The second alternative consisted of replacement of the existing pumps with submersible pumps in the existing
wet well. The third alternative involves abandoning the existing pump station and building a new facility with a firm capacity to meet the projected peak wet-weather flow requirements.

Early in the study, Alternative 1 was deemed infeasible because of spatial limitations that prevent larger size screw pumps to be installed. Therefore, only Alternatives 2 and 3 were considered as viable options for upgrading the raw sewage pump station.

### 4.2.1 Existing Pump Station

The existing pump station was placed into operation in 1988. Three screw pumps were installed with a flow capacity of 4.2 MGD each. However, plant staff reported during Workshop 1 that the maximum pumping rate is only 7.9 MGD. Each pump has a dedicated wet well connected to the influent channel system.

Flow passes through manually cleaned bar rack with 2½-inch openings before entering the pump wet wells. The water depth in the wet wells is maintained between 1.5 to 2.8 feet above the base slab of the wet well. This operating range is well suited for the existing low-speed screw pumps, but may present challenges to retrofit other pump types that require more water depth or net positive suction head (NPSH) to operate.

The existing pump station provides a firm capacity with the largest unit out of service of approximately 5,500 gpm or 7.9 MGD. If all three influent pumps are operated at the same time, the total design capacity is 8,300 gpm or 12 MGD. Table 4-1 provides a summary of the existing raw sewage flow.

<table>
<thead>
<tr>
<th>Flow Parameter</th>
<th>Raw Sewage Flow (MGD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Flow</td>
<td>2.0</td>
</tr>
<tr>
<td>Average Day Flow</td>
<td>3.9</td>
</tr>
<tr>
<td>Peak Day Flow</td>
<td>7.5</td>
</tr>
</tbody>
</table>

### 4.2.2 Projected Flows

Future capacity requirements have been established based on the ultimate goal of eliminating the SSO. Currently, SSOs occur during wet weather events and are the result of infiltration and inflow into the sanitary sewer system. Sanitary sewer system improvements are being evaluated concurrently with this Facility Plan in the Sanitary Sewer System Master Plan, as discussed earlier in this report. The selected approach includes increased capacity of portions of the sewer system, increasing the capacity of the WWTP, and providing additional EQ storage at the WWTP. The projected flows and storage requirements are presented in Table 4-2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Day Flow (MGD)</td>
<td>7.0</td>
</tr>
<tr>
<td>Peak Hour Flow (MGD)</td>
<td>13.0</td>
</tr>
<tr>
<td>Storage (MG)</td>
<td>6.0</td>
</tr>
</tbody>
</table>
4.2.3 Pumping Configurations

To determine the recommended design, it is necessary to evaluate various pumping configurations for the selected alternatives. These configurations were determined based on the required capacity, existing facility site, existing equipment layouts, capacities and the hydraulic analysis, and limitations of the existing system. The development of the proposed configurations included considerations for both dry-weather and wet-weather system operation. Two pump station configurations were identified for further evaluation:

**Retro-Fit Existing Pump Station**

This option consists of replacing the existing screw pumps with submersible pumps, with a firm capacity of 13 MGD. Under this configuration, a single type and size of variable speed pumps would handle both dry- and wet-weather flows. Each pump would have an independent discharge connected to a header pipe routed to the new screenings facility. There is insufficient vertical and horizontal clearance within the existing pump station for a mechanical screen upstream of the pumps, so the pumps would be protected by a channel grinder. A manually raked bar rack, would be used in a bypass channel in the event the channel grinder is out of service.

This alternative makes use of the existing station’s structure and electrical equipment to the fullest extent possible. However, modifications to deepen the wet wells by removing the reinforced concrete structure would be required to provide adequate submergence on the submersible pumps. Alternatively, the flow level could be allowed to increase within the wet well to provide the necessary submergence without concrete removal. However, this would impact the collection system piping capacity by eliminating free discharge and creating sediment buildup problems in the Miami River Interceptor.

Components of a retro-fitted pump station include the following:

- A channel grinder with a manual bar screen bypass
- Deepened wet well with level indication and isolation gates
- Submersible non-clog pumping equipment with variable speed drives
- Station piping, pump control valves and isolation valves
- Ancillary building systems, including mechanical, electrical and plumbing systems

**New Pump Station**

This option consists of a new pump station to replace the existing pump station with a firm capacity of 13 MGD. The new pump station would be located to the northeast of the existing raw sewage pump station across the access road and adjacent to the access drive to the EQ basin. Influent sewers would be re-routed to new junction chambers and wet well. Under this configuration, four submersible pumps would handle both dry- and wet-weather flows. The pumps would be arranged in a split wet well, with each wet well having two pumps. The pumps would consist of a 3.5 MGD and 6 MGD pump capacity, with one of each on each side of the wet well. The 3.5 MGD capacity pumps would have VFDs while the 6 MGD pumps would be constant speed for high flow events. This configuration would reliably cover the entire range of influent flows the plant could experience from 2.0 MGD up to 13 MGD with one 6 MGD pump out of service.
Components of the new replacement station are as follows:

- Two mechanical screens, each rated for the 13 MGD peak flow
- Electrically-actuated influent channel gates for level control at both low and high flows
- Partitioned, rectangular wet well with level indication and isolation gates
- Submersible non-clog pumping equipment with variable speed drives on 3.5 MGD pumps
- Station piping, pump control valves, and isolation valves
- Ancillary building systems, including mechanical, electrical, and plumbing systems

### 4.2.4 Construction Costs

#### 4.2.4.1 Retro-Fit Pump Station

The estimated total construction cost for the retro-fitted pump station is $1,700,000. The key components of this cost estimate are the equipment and demolition and reconstruction of the existing wet well. The existing wet well is too shallow to install submersible pumps, requiring the wet well to be deepened. This was a considerable cost as the foundation consists of four feet of reinforced concrete. Due to the required depth of the deepened wet well, there was a considerable cost associated with this reconstruction including the cost for bypass pumping and dewatering costs to maintain plant operations.

#### 4.2.4.2 New Pump Station

The estimated total construction cost for the new pump station is $1,900,000. The key components of this cost estimate are the equipment and the concrete to construct a new wet well. The new wet well is a deep structure as it has an estimated wet well invert of 818.0 and a top of wall elevation of 858.0. The need for such a deep structure was driven by hydraulics and the need to protect the electrical and mechanical equipment to above the 100-year flood elevation.

### 4.2.5 Operation and Maintenance Costs

Estimated O&M costs for the retro-fitted and new pump stations are based on charts developed in the Water Environment Federation, Manual of Practice (MOP) No. 7 titled *Wastewater Collection Systems Management*. The MOP gives approximate percentages for maintenance materials and annual salary and benefits based on overall capital costs. However, these charts are based on a network of several pump stations. Therefore, interpretation was necessary to develop average annual O&M costs for a single pump station. The interpreted value was estimated to be 2 percent of the capital cost.

By making this assumption, the annual O&M costs developed for these alternatives were similar to the representative O&M costs developed in the WEF MOP No. 7. Additional labor hours were included for the retro-fitted pump station alternative for maintenance of the wet well. The new pump station was assumed to be of the trench style, which has less maintenance than a traditional rectangular wet well, similar to the retro-fitted alternative.
The power consumption costs were based on the actual operating horsepower for average daily flows using $0.06 per kW-hr. Annual electrical costs were computed as follows:

- **Retro-fitted Pump Station**: assume one pump operates continuously throughout the year and two other pumps operate approximately 15 percent of the year to convey wet-weather flows.

- **New Pump Station**: assume one 3.5mgd pump operates continuously throughout the year; one 6 mgd pump operates 50 percent of the year. The two remaining pumps operate 15 percent of the year to convey wet weather flows.

**Table 4-3** shows the annual O&M cost difference between the retro-fitted and new pump station is approximately $6,000. This small difference is within 10% of the annual cost and deemed to be similar for planning level purposes.

### Table 4-3: Raw Sewage Pump Station O&M Costs

<table>
<thead>
<tr>
<th></th>
<th>Retro-fit Pump Station</th>
<th>New Pump Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>$26,000</td>
<td>$19,000</td>
</tr>
<tr>
<td>Power</td>
<td>$54,000</td>
<td>$54,000</td>
</tr>
<tr>
<td>Parts/Materials</td>
<td>$6,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Total Annual O&amp;M Cost</td>
<td>$86,000</td>
<td>$80,000</td>
</tr>
</tbody>
</table>

### 4.3 Screening

Screening improvements are required to replace the existing mechanical bar screen with a screening system that will comply with the Ohio EPA, Ohio Administrative Code (OAC) 3745-40. This new regulation requires "prior to the beneficial use of biosolids, influent wastewater and septage, or sewage sludge at a treatment works must be treated by a process such as physical screening or another method to significantly remove manufactured inerts." The OAC states this may be accomplished by either of the following:

i. Screening influent wastewater and influent septage through a bar screen with a maximum aperture of five-eighths inch (1.59 centimeters) designed to screen the average daily design flow

ii. Screening all biosolids through a bar screen with a maximum aperture of five-eighths inch (1.59 centimeters) prior to beneficial use

Screening improvements are also desired to consolidate the screening operations, if feasibly possible. The existing plant has coarse bar racks upstream of the raw sewage pumps that must be manually cleaned. The pumped influent then is mechanically screened prior to grit and grease removal system. Consolidation of screening facilities would allow plant staff more time to focus on more critical tasks.
This sub-section compares and evaluates screening technologies previously outlined in Workshop 2 – Treatment Alternatives. Information on manufacturers is provided for the discussed technologies. The screens were evaluated to comply with the OAC requirement; however, emphasis will also be placed on:

- Screenings loads for normal and peak load operations
- Headloss
- Screening configuration
- Screening discharge

These items will be described in the following sub-sections.

**4.3.1 Screen Technology and Design Criteria**

This sub-section evaluates and compares the screen types and technologies listed from Workshop 2, as well as issues to consider during screen selection. These screen types were:

- Multi-Rake
- Perforated Plate
- Climber Screen

All these screen types are capable of meeting the OAC requirements, but the Climber screen was not evaluated during this process as the multi-rake and climber screens are similar in function, with the exception that the multi-rake has a greater screenings capacity. The multi-rake and perforated plate screens were evaluated with ¼-inch openings, which meet OAC requirements. These screens are described below.

**4.3.1.1 Multi-Rake Bar Screens**

Multi-rake screens are the most commonly used screen in the U.S. There are several providers of the multi-rake screens such as:

- Headworks Mahr® screen
- RakeMax by Huber Technologies
- Chain & Rake Monster by JWC Environmental

Multiple rake screen manufacturers offer screens down to 3 mm openings. However, equipment representatives and staff from some WWTPs with ¼-inch inch and smaller screens have indicated that grit and rocks can get lodged between bars, causing screen blinding and wear on the bars and rakes as the rake moves up the screen. Since these are bar screens, these screens have a lower screenings capture ratio, as compared to perforated plate screens, due to removal in one-dimension only. However, the screens are more rugged and more appropriate for raw sewage at treatment plants or combined sewers. These screens have lower headloss compared to other types of screens.

Multiple rake screens are equipped with upper and lower sprockets or guides that carry the drive chain. Multiple rakes are attached to a chain to permit quick cleaning of the bars and to reduce the
amount of screen blinding. This design allows these units to have very low headroom requirements with only the motor, frame, and doctor blade mechanism located above the screen discharge point. This design does have a submerged lower sprocket and bearing, but technology innovations have greatly increased the durability of the submerged components. For example, the lower sprocket and bearing are a self-lubricating design and grease lines are not required.

4.3.1.2 Perforated Plate Screens

The perforated plate screen, sometimes called continuous element, is a fine screen with a continuous band of perforated plate that rotates through the flow stream. The screen serves the dual purposes of removing debris from the flow stream and conveying it out of the channel and up to the operating floor for discharge. The debris is then usually removed from the screen by a water spray, sometimes in conjunction with a counter-rotating brush. There are two styles of continuous element screens; continuous perforated plate screens and continuous bar screens. The continuous bar screens rely on plastic media and hooks that tend to break and lead to increased maintenance. Therefore, this type of continuous element screen was not considered further.

Five perforated plate panel continuous element screens on the market in the U.S. are the Aqua Guard PF® manufactured by Parkson, the Filterscreen® manufactured by FSM, the Perforator marketed by Headworks, the Escamax® manufactured by Huber, and the Aqua-Screen 2® manufactured by Andritz.

Installation for both styles of units includes completely enclosing the screen section above the channel wall for odor reduction and safety. Common to both units, the wastewater flows through the screen and suspended particles are captured on its surface. Panels on the screens are fabricated in a step type design to carry debris from the channel. Captured screenings are discharged to a totally enclosed chute where a counter-rotating drive brush with an integral spray bar removes solids remaining on the screen. The unit is mounted on an angle between 60 and 75 degrees to aid in material removal. This angle allows a greater screen face and a greater screenings removal at peak flows due to reduced velocity through the perforations. The perforated plates are typically attached to a drive roller-chain.

The main advantage to the continuous element perforated screens is a high screenings capture ratio. The perforations prevent thin objects from wedging into the screen, and the step design aids in lifting large debris out of the flow. The screen footprint is generally considered medium size due to the recommended angle of inclination. Another advantage to these units is that there are typically no submerged bearings.

A disadvantage of the continuous element screens is high headloss because of the low percentage of open area and flow having to pass through the screen twice. Headloss through these types of screens can further be aggravated if a mat forms along the face of the screen. This problem can be countered by increasing the rotational speed of the screen. Whether or not the speed can be increased to the point that prevents mat formation during peak screen loading is a critical evaluation factor for this type of screen.

Maintenance issues noted with the continuous element screens include plugging of openings with hair and other stringy material unable to be removed by the cleaning brush or spray water. This is referred to as “stapling”. This problem is a key consideration for O&M differences between perforated plate and multi-rake screens. Another potential problem is the brush or spray water not fully removing the screened material. When this happens, material removed on the upstream side of the unit is carried
over and deposited in the downstream flow, partially reducing the capture of the screen. The brush itself is also commonly found to be a messy and a high maintenance item.

### 4.3.2 Screenings Production

Design guidelines for the amount of screenings to be anticipated from separate and combined sewer systems are published by the Water Environment Federation in its Manual of Practice No. 8 (MOP 8). Average volumes range from 0.5 cubic feet/million gallons (ft³/MG) for coarse screens (nominal 2½-inch openings) to approximately 14.0 ft³/MG for fine screens (nominal ¼-inch openings) for bar style configuration. Peak hourly volumes can range from 2 to 20 times these values. Typically, the peak volumes are produced during wet weather periods with the increased screenings volumes predominantly consisting of coarser material gathered from the storm water influences or washed out sediment from the sewer system.

In general, as the opening between bars decreases from 1-inch, the quantity of screenings removed increases rapidly. It was reported the plant currently generates approximately 1.5-cy of screenings per week. This screenings generation aligns with the values reported in MOP8 for a ¾-inch screen. Around 1/4-inch spacing, the average quantity of screenings removed is approximately 14 ft³/MG. During design a more thorough analysis is needed to quantify the increased generation of screenings and the best way to handle them. It is important to note that these estimates are for vertical bar screens. Perforated screens will remove more screenings from the flow because they have smaller open flow area.

### 4.3.3 Hydraulics

Ten State Standards state that when two or more mechanically cleaned screens are used “the design shall provide for taking any unit out of service without sacrificing the capability to handle the design peak instantaneous flows.” For that reason, the screens were sized for the PHF of 13 MGD, without a diversion channel. Multiple screens of 6.5 MGD and an overflow channel were considered, but the higher capacity screens were incrementally more expensive and the increased cost would be offset by not providing an overflow channel.

The hydraulics constraints are typically a key design parameter for fine screens. The improvements to the raw sewage pump station will slightly reduce this impact, provided the headloss is not so great that it significantly changes the pumping requirements by requiring a significantly deeper wet well. As mentioned previously, the headloss through a perforated plate screen is significantly greater than that of a multi-rake screen as shown in Table 4-4.

**Table 4-4: Hydraulic Performance of Screens**

<table>
<thead>
<tr>
<th>Screen Type</th>
<th>Headloss w/o Blinding</th>
<th>Headloss w/30% Blinding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Rake</td>
<td>1.3-in</td>
<td>7.2-in</td>
</tr>
<tr>
<td>Perforated Plate</td>
<td>~12-in</td>
<td>19-in</td>
</tr>
</tbody>
</table>
4.3.4 Screen Location and Alternatives

In addition to meeting the requirements of the OAC, the City also desires to consolidate the screening process for a single point of removal. To accomplish this, the mechanical screens would need to be placed upstream of the raw sewage pumps. This would require screens to be installed in a 33-ft deep channel. If the screens were installed after the pumps, pumps would convey unscreened raw sewage that could cause them to clog or prematurely fail, but the screens could be placed in a much shallower 6-foot deep channel at grade level. A coarse bar screen would be required ahead of the influent pumps, if mechanical screens are not constructed ahead of the pumps, to protect against potentially large items or debris that could damage them. An alternative to the manual bar screen would be an in channel grinder. The location of the mechanical screens results in four screening alternatives:

- Multi-Rake Screens upstream of new pump station
- Perforated Plate Screens upstream of new pump station
- Multi-Rake Screens downstream of raw sewage pumps
- Perforated Plate Screens downstream of raw sewage pumps

The layout of the raw sewage pumps and screens are shown in Figure 4-1.
4.3.5 Capital Cost of Screening Alternatives

Given the design criteria, planning level costs were requested from screen manufacturers for perforated plate and multi-rake screens in a 6-ft deep channel and a 33-ft deep channel. Each screen was sized to handle the PHF of 13 MGD. There was little variation from the perforated plate and multi-rake screens layouts, so the conceptual layouts were assumed to be identical for the different screen technologies.

4.3.5.1 Multi-Rake Screens Upstream of New Pump Station

The estimated total construction cost to construct multi-rake screens upstream of the new pump station alternative is $3,100,000. The key cost components of this alternative consisted of the equipment and concrete to construct the channels.

4.3.5.2 Perforated Plate Screens Upstream of New Pump Station

The estimated total construction cost to construct perforated plate screens upstream of the new pump station alternative is $3,800,000. The key cost components of this alternative are identical to the deep multi-rake screen alternative, except the screen equipment was $300,000 more expensive than multi-rake screens.

4.3.5.3 Multi-Rake Screens Downstream of New Pump Station

The estimated total construction cost to construct multi-rake screens downstream of the new pump station alternative is $1,300,000. The key cost components of this alternative consisted of the equipment and concrete to construct the channels. The significant reduction in channel depth has a significant cost savings by reducing the equipment cost and the concrete needed to construct the channels.

4.3.5.4 Perforated Plate Screens Downstream of New Pump Station

The estimated total construction cost to construct perforated plate screens downstream of the new pump station alternative is $1,800,000. Similar to the deep screening option, the key cost components are identical, with the exception that the perforated plate screen equipment is $170,000 more expensive than multi-rake screens.

4.3.6 Operation and Maintenance Cost of Screening Alternatives

The O&M cost for screening operations is rarely done for conceptual comparisons due to the difficulty in predicting screenings production and the variability in screenings related to wet weather events. As a result, O&M comparison is done qualitatively.

As discussed earlier, the perforated plate screens are more capable at removing screening material from wastewater. This is due to the clear opening being the same size in all orientations. This will result in a significant increase in the screenings in comparison to a multi-rake design. The increased screenings production has as direct result on the O&M cost. The more screenings collected results in additional cleaning and dewatering. However, debris passing through a multi-rake design may require increased maintenance in a downstream process. The WWTP has not had any issues with screening debris downstream or in the digesters with the existing ¾-inch mechanical screen. If a new biosolids process is selected, such as ATAD, the higher screen capture may prove to be more beneficial to that process by eliminating or minimizing plugging of mixing nozzles.
4.4 Grit and Grease Removal

4.4.1 General
Grit removal is an important part of the wastewater treatment process to protect downstream equipment and biological processes. The removal of grit reduces unnecessary abrasion and wear of mechanical equipment, such as primary clarifier sludge pumps, digester recirculation pumps, and sludge dewatering equipment, particularly centrifuges. Additionally, grit removal prevents grit deposition in other unit processes, such as primary clarifiers, aeration basins, or digesters, which can cause operational issues to the aforementioned processes.

Quantification of grit loading through a study is the preferred method to ensure proper sizing of the grit dewatering/cleaning processes and conveyors. However, without the benefit of such a study, grit loadings of 2-5 cubic feet per million gallons are typically used. Typically, grit loading numbers vary widely, and will be highly dependent on the type and age of the collection system and degree of grit washing provided. A very efficient system with excellent grit washing can actually result in a fairly low grit quantity due to the complete lack of organic material.

In addition to the quantity of the grit, the grit density is also a critical design criterion. The density is determined by settling velocity and applying Stoke’s law. The settling velocity should be determined in a large diameter cylinder to avoid errors due to wall effects. Grease coating of grit particles and the dispersion effect of detergent (or what Eutek refers to as the “froth effect”), are likely reasons why traditional grit removal systems have generally not performed according to expectations. The density measurement will provide an evaluation of the severity of the froth effect. This data is used to refine methods for sizing the primary grit removal process. If a large percentage of low density grit is found, the grit system sizing should be more conservative, and methods of lowering the density of the grit such as vigorous aeration, or returning waste activated sludge to the grit chamber, should be considered.

4.4.2 Existing System
The existing grit removal system is a Schreiber Grit and Grease removal system. This system is a unique system designed to remove both grit and grease in a common structure. The system consists of a trapezoidal-shaped concrete channel that has two separate zones. Combined, these zones separate and collect both grit from the bottom and grease for removal from the quiescent zone. One zone is designed to settle grit particles for removal and the other collects grease for removal. Grit removal is accomplished by a rotating spiral flow pattern which scour and washes organics from the grit. The grit is then deposited in a trough at the bottom of the channel. A grit pump mounted to a traveling bridge pumps the collected grit to an elevated trough sloped at one end of the structure to transfer the grit slurry to a grit classifier for further washing and dewatering.

Floating grease and scum are transported to one end of the channel by a grease skimmer blade and basket. The grease is directed to screw conveyor. As the screw conveyor rotates, lifting the grease for disposal in a collection container, the water content is reduced, thus reducing the overall volume of material being transferred for disposal.

The existing grit and grease removal system was sized to treat a PHF of 8.3 MGD, with a hydraulic detention time of 5.2 minutes. The existing system does not have sufficient capacity to handle the future peak flow of 13.0 MGD. Therefore, this sub-section will evaluate various alternatives for providing grit removal at the plant for the higher design flows.
4.4.3 Initial Screening Process

During a workshop with the City, numerous technologies for removing grit were discussed. These technologies consisted of aerated grit chambers and vortex grit basins. An additional technology not discussed during the workshop was a plate settler, such as Eutek's HeadCell unit. There is considerable controversy as to the preferred method of grit removal. There is a roughly equal split the preference for aerated or vortex basins. Aerated basins are still largely preferred in Europe, whereas vortex basins have gained a broader acceptance in the US. European plants tend to be smaller and the aerated basins are more affordable, whereas in the larger US plants, considerable cost savings can be realized by using vortex basins. Plate settlers used for grit removal represent a very small portion of grit removal application, so currently, less is known about this technology. However, it appears to be a promising technology. To meet future demands for grit removal, the following grit removal alternatives were evaluated:

- Additional aerated grit chamber and upgrades to the existing aerated grit system
- Replacement of aerated grit chamber with vortex grit basin
- Replacement of aerated grit chamber with grit plate settler

It was assumed that grit removal would be accomplished by a singular technology, i.e. the existing additional aerated grit chamber (AGC) would be expanded with an additional AGC or the existing AGC would be replaced with a new technology (vortex or plate settler).

4.4.4 Technology Overview and Design Criteria

4.4.4.1 Aerated Grit Chamber

The additional AGC would be located adjacent to the existing system. This location will allow common dumpsters to be used for both the grit and grease. It was reported that cold weather has caused operational issues for the grit removal equipment. As a result, the headworks building should be reconfigured, so that the equipment is no longer exposed to the elements. It is anticipated that the existing steel structure will be demolished, salvaged, and rebuilt with a new structure that is tolerant of the corrosive environment associated with wastewater treatment headworks. It is likely the building will be CMU block with concrete roof. Ventilation will be in accordance with applicable laws, regulations, and guidelines. Heating will be provided in the winter to keep the building at a temperate (about 50° F) level.
Table 4-5 Design Criteria for Aerated Grit Chamber

<table>
<thead>
<tr>
<th>GRIT SEPARATION FACILITY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grit Facility Traveling Bridge</strong></td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>Constant Speed</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Grit Blowers</strong></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>2</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>15</td>
</tr>
<tr>
<td><strong>Grit Screw Classifier</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Screw conveyor w/classifier &amp; washer</td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
</tr>
<tr>
<td>Classifier Size, in</td>
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</tr>
<tr>
<td>Motor Size, hp</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Grease Screw Conveyor</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>shafted</td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
</tr>
<tr>
<td>Motor Size, hp</td>
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</tr>
<tr>
<td><strong>Grit Pump</strong></td>
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</tr>
<tr>
<td>Number</td>
<td>1</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>2.4</td>
</tr>
<tr>
<td>Headloss</td>
<td>&lt;6&quot;</td>
</tr>
</tbody>
</table>

1. Air could be supplied from the aeration system blowers as is the current practice.

4.4.4.2 Vortex Grit System

Vortex grit basins first began to be commonly used in the 1980’s. Vortex grit basins are subcategorized into two types; forced vortex or free vortex. Free vortex grit basins use centrifugal force to throw the grit particles against the side walls of the grit basin, and the particles travel down and out the bottom of the tank. Forced vortex grit removal basins use a much slower circular flow pattern to create a quiescent zone at the center of the basin where the grit migrates to and is then removed. Forced vortex basins use stirring paddles to control the velocity in the chamber and lift out any organics that also might migrate to the quiescent zone. A forced vortex basin is used as the basis of consideration for this alternative.

A vortex grit removal system would consist of one basin and a bypass channel, in accordance with the Ten State Standards Section 63.3. An enclosure would be constructed over the grit pump and motor, which is mounted in the center of the grit basin. The grit would be pumped to the grit washer/classifier in the new grit handling building, adjacent to the new screening facility. This location would allow for consolidation of screening and grit handling into building.
### Table 4-6 Design Criteria for Vortex Grit Basin

<table>
<thead>
<tr>
<th>GRIT SEPARATION FACILITY</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Grit Facility Common Mixer</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Vertical Shaft</td>
</tr>
<tr>
<td>Motor</td>
<td>Constant Speed</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Grit Vortex Unit</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Vortex</td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
</tr>
<tr>
<td>Capacity (each), MGD</td>
<td>16</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Grit Screw Classifier</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Screw conveyor w/classifier &amp; washer</td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
</tr>
<tr>
<td>Capacity, gpm</td>
<td>250</td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>3</td>
</tr>
<tr>
<td>Headloss</td>
<td>&lt;4”</td>
</tr>
</tbody>
</table>

#### 4.4.4.3 Plate Settler System

The plate settling unit used for this evaluation was the Eutek HeadCell®. This system is an all hydraulic grit concentrator, which uses vortex flow and a stacked plate (or tray) design to efficiently capture and settle fine grit via large surface area and short settling distances. The unit is typically installed into the process flow, downstream of screening. The unit requires no external power source, has no internal moving parts, is self-cleaning, and has a compact modular construction. Wide turndown ratios can be accommodated in this system. An illustration of a typical unit has been provided in Figure 4-2 to assist the City is evaluating this option.
At Piqua, the HeadCell unit would consist of one unit. The unit would have seven settling plates 12-feet in diameter. With a loading rate of 11.4 gpm/ft², the unit would be capable of removing 95% of all grit (specific gravity of 2.65) ≥ 106 microns at peak flow conditions. Additionally, the unit would be capable of removing 95% of all grit (specific gravity of 2.65) ≥ 5 microns at average flow conditions. The grit is collected at the bottom of the unit. The grit slurry is then removed by a pump and discharged to the grit washer/classifier. The washed grit is removed and deposited in a dumpster for disposal. The water from the washing process is put back in the wastewater for removal of organics.
### 4.4.5 Construction Cost

#### 4.4.5.1 Aerated Grit Chamber

The estimated total construction cost to construct an additional aerated grit chamber is $1,200,000. The key cost components of this alternative consisted of the equipment, concrete, and building to house the grit handling facility. This alternative has an identical construction cost as the plate settling unit, but removes grease in addition to grit. The AGC is the only process discussed in this Facility Plan that is capable of removing both grit and grease. The concentration of grease in the influent should be considered when making a decision on the preferred grit removal alternative. Adding a second AGC in parallel with the existing unit may create some piping and hydraulic problems for several of the biological process alternatives because of existing hydraulic limitations of the downstream channels.

#### 4.4.5.2 Vortex Grit Removal

The estimated total construction cost to construct a vortex grit removal system is $870,000. This is the lowest cost alternative to remove grit. This system also has the lowest headloss, which would help minimize pumping costs to convey flows through this process. This alternative is not capable of removing grease. The importance of grease removal must be considered when making a decision on the preferred grit removal alternative.

#### 4.4.5.3 Plate Settler System

The estimated total construction cost to construct a plate settler grit removal system is $1,200,000. This alternative is tied for the highest cost alternative. However, based on manufacturers' data, this process has the best grit removal performance. This high removal efficiency comes at a “cost” of the highest headloss, which is approximately triple, the headloss of a vortex unit.

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### Table 4-7 Design Criteria for Plate Settler

<table>
<thead>
<tr>
<th>GRIT SEPARATION FACILITY</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grit Facility Common Mixer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Vertical Shaft</td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>Constant Speed</td>
<td></td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><strong>Grit Vortex Unit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Vortex</td>
<td></td>
</tr>
<tr>
<td>Number</td>
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<td></td>
</tr>
<tr>
<td>Capacity (each), MGD</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Grit Screw Classifier</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Screw conveyor w/classifier &amp; washer</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Capacity, gpm</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Motor Size, hp</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Headloss</td>
<td>&lt;12&quot;</td>
<td></td>
</tr>
</tbody>
</table>
4.4.6 Operation and Maintenance Cost of Grit Removal Alternatives

The O&M cost for grit removal operation is difficult to predict. This is due to the highly variable grit concentrations seen during typical average dry weather flows compared to peak flow events. During the peak flow a massive surge, or plug, of grit is introduced to the plant. Typically, without site specific data for grit concentrations, O&M costs were not developed during this stage of the planning process.

4.5 Biological Processes

A goal of the project was to provide a stable treatment process that will handle the highly variable flow/loading conditions, while protecting the Great Miami River. The following alternative biological processes were chosen for evaluation based on low capital cost, simple operation and low maintenance, high shock load resistance and overall capacity, and compatibility with future biological nitrogen and phosphorus removal.

4.5.1 Alternate No. 1 – Upgrade and Expand Existing Process

**Figure 4-3** shows the existing process flow schematic for the Piqua WWTP. This alternative would expand all those units necessary to meet the Ten States Standards for Wastewater Treatment Plants at the proposed Average Daily Flow (ADF) and the Peak Hourly Flow (PHF). The major units which would need to be expanded are: one new primary clarifier; aeration system including new basins, blowers and aeration piping; and new secondary clarifier(s). A conceptual layout for Alternative 1 is provided in **Figure 4-4** to assist in evaluation of this alternative.

The advantages of this system are that the plant staff is already familiar with the process and how to operate it. Most of the existing concrete tanks are structurally sound and would save capital costs and time associated with constructing new ones.

The disadvantages are old technology that is sensitive to temperature, high-strength industrial waste, variable influent quality, and will require extensive upgrades in mechanical equipment and yard piping to accommodate increased hydraulic flows. All mechanical units are past their useful life and should be replaced to ensure continued treatment for more than 20 years. Operation and maintenance costs would be higher than other alternatives. The plant has a difficult time operationally with digester foaming and removing solids from the system. The plant operates best at a MLSS level close to 1,500 mg/L, which requires the plant to waste solids more frequently, which is not always possible operationally due to the way that the biosolids are processed and the lack of sludge storage at the plant. Currently the solids treatment train has a major impact on the liquid process train meeting the nutrient discharge limits. Even with the advanced recycle treatment system, the plant must schedule dewatering of sludge and decanting of digesters so that the nitrogen and phosphorus levels recycled to the influent are manageable. Any plant upgrade will need to address future nutrient removal needs by either providing more retention time for anaerobic and anoxic zones for enhanced biological conversion/removal of the nutrients, or by use of chemicals.
Section 4 • Evaluation of Liquid Stream Alternatives

Figure 4-3
Existing Flow Schematic
Wastewater Treatment Plant Facility Plan Update
City of Piqua, Ohio
Section 4 • Evaluation of Liquid Stream Alternatives

WWTP Alternative 1:
Upgrade and Expand Existing Processes
Figure 4-4
Upgrading the existing system and increasing the flow capacity would require numerous and difficult modifications to the plant, especially considering that the plant must be kept on-line to continuously treat the wastewater. Flow splitting is uneven due to minimal available head between processes and the use of gates and valves for flow balancing, which are not very effective for balancing continually fluctuating flows. To optimize the plant, extensive new yard piping or channels would be required. Currently the flow is conveyed between unit processes using concrete channels, however, these are integral with the tops of underground tunnels that run between the major structures making it difficult to reconstruct while keeping the plant on-line.

Intermediate pumping between the primary clarifiers and the aeration tanks would be necessary to overcome the additional headloss and to allow for switching the activated sludge to step aeration or contact stabilization for more efficient use of available tankage. Intermediate pumping would also be required between the aeration tanks and the secondary settling tanks to have a way to positively balance the flow to each of the existing and new secondary settling tanks.

4.5.2 Alternate No. 2 – Extended Aeration Parallel to Upgraded Existing Plant

For this Facility Plan, the extended aeration process considered the use of an oxidation ditch. Oxidation ditches were developed in the 1950s and came in prominence in the 1970s as an inexpensive and reliable method of treating wastewater. Often referred to as a closed loop reactor process, the oxidation ditch is a modified form of the extended aeration complete mix process. There are several manufacturers of the aeration/mixing equipment and all are capable of configurations capable of achieving biological nutrient removal for nitrification and denitrification for total nitrogen removal as well as enhanced biological phosphorus removal. All manufacturers have real time process monitoring and controls to continuously adjust operation and reduce energy costs.

Key to each manufacturer’s design is their aerators (surface brushes or submerged rotors) and the tank configuration. The Ovivo Carousel-type ditch was used for layout and budget estimating and would be designed for full BNR in the future with computerized automatic controls. A conceptual layout for Alternative 2 is provided in Figure 4-5 to assist in evaluation of this alternative. Following preliminary treatment, the flow would be divided into two treatment systems, the existing conventional activated sludge plant and the new parallel oxidation ditch. Each treatment train would treat 3.5 MD average daily flow and 6.5 MGD peak hourly flow. Two new secondary clarifiers would be installed with the oxidation ditch along with a new return activated sludge (RAS) and waste activated sludge (WAS) system. Extended aeration systems do not require primary treatment. After secondary clarification the two train flows would join and proceed to the UV disinfection system.

The disadvantage of this alternative is that oxidation ditches have a large foot print which requires a significant amount of property. The existing plant site does not have adequate room to add the new parallel plant and the City would have to purchase property from the quarry to the east. Advantages are the oxidation ditch is easy to operate, produces a reliable high quality effluent, and has a low energy requirement.
Section 4 • Evaluation of Liquid Stream Alternatives

WWTP Alternative 2:
New Oxidation Ditch with Existing Plant
Figure 4-5
4.5.3 Alternate No. 3 – New Extended Aeration Plant

This alternative considers constructing an all new extended aeration plant, using the oxidation ditch configuration, on the adjacent land east of the existing plant. The new plant would be designed to treat the entire 7 MGD average daily flow and 13 MGD peak hourly flow. Once constructed, the existing plant tankage could be utilized for sludge storage or additional flow equalization. Other structures including the laboratory and administration building could remain as well for similar purposes.

The Ovivo Carousel type ditch was used for layout and budget estimating. As discussed in Alternate 2, the oxidation ditch would be designed for full BNR in the future with computerized automatic controls. A conceptual layout for Alternative 3 is provided in Figure 4-6 to assist in evaluation of this alternative.
4.5.4 Alternate No. 4 – Biological High Rate Clarification (BioActiflo®) Parallel to Upgraded Existing Plant

The goal of the Piqua Sanitary Sewer System Master Plan and this WWTP Facility Plan is to develop a systematic approach to addressing the SSO elimination and meet current and future wastewater treatment needs. Recently, more municipalities which have combined sewer overflows (CSOs) have been using high-rate clarification (HRC), however, despite being able to remove 60 percent of CBOD and greater than 90 percent of TSS, the HRC has not been applied, or acceptable, on separate sanitary sewer systems due to its inability to remove soluble CBOD. Therefore, HRC effluent must be blended with secondary treated wastewater to meet discharge limits; which has been determined by some USEPA regions to be acceptable on sanitary sewer systems and not acceptable by others. Recent research by CDM Smith has demonstrated that the biologically enhanced high rate clarification (BEHRC), a process that adds RAS to the HRC system to achieve soluble CBOD absorption, can meet secondary treatment requirements. Studies have shown that through soluble CBOD uptake followed by HRC, BEHRC can provide secondary treatment of wet-weather flows achieving greater than 85 percent total CBOD removal and greater than 90 percent TSS removal.

The advantages of this new technology are a much smaller footprint of treatment units and lower capital costs. A conceptual layout for Alternative 4 is provided in Figure 4-7 to assist in evaluation of this alternative.

This alternative involves upgrading the existing plant, which will retain the rated capacity of 4.5 MGD average daily flow and up to 7 MGD peak hourly flow. Any flow above 7 MGD will be diverted to the BEHRC unit. Average daily flows in excess of the current 4.5 MGD flows will be directed to the BEHRC system. Figure 4-8 presents a process flow schematic to depict the basic functions of the BEHRC concept.
Figure 4-8
BIOACTIFLO Alternative 4
Wastewater Treatment Plant Facility Plan Update
City of Piqua, Ohio
4.6 UV Disinfection

As discussed in Section 3, the existing disinfection process is able to meet the more stringent disinfection requirements outlined in the WWTP’s operating permit. However, with the increased plant capacity to handle future flows, the City wanted to evaluate different disinfection treatment alternatives to meet the more stringent standards, while providing a safer work environment for its staff and the community. The selected alternative was UV disinfection.

The use of UV for disinfecting treated wastewater is widespread in the United States, and is popular in wastewater treatment because of its effectiveness, ease of use, and no chemicals to handle. There are reportedly over 3,500 UV wastewater disinfection systems currently operating in North America, treating flows of up to 300 MGD (CDM Smith Disinfection Report for NYC WPCP). As alluded to, UV disinfection eliminates the operational and environmental hazards associated with the use of chlorine compounds (and sulfite compounds when dechlorination is required), and does not produce harmful disinfection by-products.

4.6.1 Effectiveness of UV

UV is a physical process, relying on the transfer of electromagnetic energy to a microbe’s DNA. When absorbed in sufficient quantity (the “dose”), the energy damages the DNA strands by causing specific thymine monomers to combine, which in turn prevents the cell from replicating. This inability to reproduce is the lethal effect of UV. DNA absorbs UV light in the spectral region between 200 and 300 nm, with maximum absorption, and germicidal impact, between 240 and 280 nm. The optimal germicidal wavelength for UV disinfection is 254 nm.

4.6.2 UV Configurations

There are several manufacturers of UV systems. These are commercially available in “low-pressure” and “medium-pressure” lamp configurations, driven by electronic ballasts. Medium-pressure lamps are polychromatic and exhibit a continuous spectral UV output between 200 and 400 nm, and have several significant output lines between 240 and 290 nm. With the higher mercury pressures, the lamps are driven at substantially higher input power levels (greater than 1 kW, and as high as 20 kW per lamp) and temperatures (600 to 800 degrees C). They are not as efficient as the monochromatic low-pressure lamps, with conversion of about 7 to 9 percent of their input power to 254 nm output, and 10 to 15 percent total output in the germicidal region. Overall, the medium pressure lamps require about 4 to 5 times the power than the low pressure lamps to deliver an equivalent germicidal energy. However, because of their much higher absolute output levels, fewer lamps are needed, often resulting in a smaller footprint for the UV system.

Low-pressure design, lamp output is optimized via mercury vapor pressure and electric current control, and is effectively monochromatic about the resonance line for mercury, or 253.7 nm, which is very near the optimum germicidal wavelengths for UV disinfection. These low-pressure lamps are highly efficient, converting nearly half of their input energy to light, with 85 percent of this light at 254 nm. The original low pressure systems absolute outputs were relatively low, with typical UV ratings of 30 to 50 Watts per lamp at 254 nm, for 80 to 110 W input lamps. These systems were known as low pressure low output technology (LPLO). Advances in these low-pressure lamps, using mercury amalgams and driving the lamps at a higher input power (300 to 500 W) have resulted in higher UV outputs (100 to 150 W), while retaining their highly efficient energy conversion characteristic, known
as low pressure high output technology (LPHO). The higher input power levels of medium pressure systems would be less cost effective than a LPHO system. Therefore, an LPHO system was used for this evaluation.

The lamps of a LPHO system are sheathed in quartz sleeves (highly transmissible in the UV region), and submerged in the flowing wastewater. The lamp/quartz assemblies are typically arranged in modules, with several modules comprising a bank of lamps. The banks of lamps are typically placed in open channels, either horizontally or vertically oriented, with level control devices that maintain water levels above the submergence level of the lamps.

Pressure units, using closed-vessel reactors, are also used for wastewater, although far less frequently than the open-channel designs. Many LPHO systems employ automatic cleaning systems which are integral to the lamp banks, to remove fouling and maintain the transparency of the quartz surfaces. Depending on the manufacturer of the LPHO system, periodically dipping of the UV modules in a weak acidic solution is required in addition to the automatic cleaning system.

4.6.3 Design Considerations

There are several factors that affect the design of a UV system for wastewater disinfection. These factors will affect the required design dose, defined as the product of the intensity of UV energy (the rate at which it is being delivered) and the time to which the organism is exposed to this intensity. Ideally, these factors can be applied such that all of the wastewater receives the same dose as it passes through the UV unit. But the practical application of UV is not ideal; there is a variable intensity field within the unit and a distribution of exposure times, resulting in a dose distribution. Effective design optimizes this dose distribution and avoids any semblance of hydraulic short-circuiting through the UV unit.

Exposure time is dependent on the hydraulic characteristics of the unit, reflecting the spacing of the quartz/lamp assemblies, inlet and outlet conditions, and hydraulic loading rates. Intensity is affected by the output energy of the lamps, the transmissivity of the quartz sleeves, and the transmittance of the wastewater itself. The loss of energy due to the aging of lamps and degradation of the quartz sleeve transparency must be accommodated in the design and sizing of the UV units.

Generally, the lamp output will decrease to between 50 and 80% of the nominal output at its end life (typically warranted at 12,000 hours for low pressure lamps and 5,000 hours for medium pressure lamps). Quartz fouling will typically account for a 20 to 30 percent decrease in transparency through the life of the quartz sleeve, assuming that the quartz sleeves are routinely cleaned of materials adhering to the surface. The transmittance of treated wastewater effluents generally ranges between 50 and 75 percent and preliminary results indicate that Piqua’s WWTP effluent is on the high end of that range. The dose requirement is a key parameter. Typically, a dose of 30,000 to 40,000 µWatts-sec per square centimeter (µW-s/cm²) is specified for treated wastewater disinfection.

The dose requirement is determined by directly testing the response of the targeted organisms to UV dose. This is accomplished via specific laboratory test protocol using a collimated beam apparatus which allows the intensity and time of exposure to be measured precisely, unlike the inability to do so with a flow-through UV unit. This testing will be done with the assistance of UV manufacturers during the preliminary phases of design.
The key parameters that comprise the design basis for a UV system include:

- UV transmittance
- Inlet bacterial densities
- Suspended solids
- Particle densities and size distribution
- Flow rates
- Fouling factors, e.g. hardness and iron concentrations
- Hydraulics

Knowledge of these parameters is essential to meet the anticipated disinfection goal of 126 CFU/100 mL of *E. coli* and will be further defined during design, particularly the hydraulics. Although these parameters will require through evaluation during design, the design criteria used to evaluate UV as a disinfection technology at Piqua is presented in Table 4-8.

### Table 4-8 – UV Design Criteria

<table>
<thead>
<tr>
<th>Process Criteria</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td>MGD</td>
<td>7</td>
</tr>
<tr>
<td>PDF</td>
<td>MGD</td>
<td>13</td>
</tr>
<tr>
<td>UV design dose</td>
<td>µWs/cm²</td>
<td>30,000</td>
</tr>
<tr>
<td>UV system type</td>
<td></td>
<td>LPHO</td>
</tr>
<tr>
<td>UV channels</td>
<td>No.</td>
<td>2</td>
</tr>
<tr>
<td>UV transmittance (minimum)</td>
<td>%</td>
<td>70</td>
</tr>
<tr>
<td>Headloss per channel</td>
<td>inches</td>
<td>&lt;12</td>
</tr>
</tbody>
</table>

#### 4.6.4 UV at Piqua

At Piqua, a UV disinfection system would be located inside the existing chlorine contact basin. Therefore, there would be no change to the current process flow at the WWTP as shown in Figure 4-9.

![Figure 4-9 – UV Process Flow Schematic](image)

The UV system would consist of two UV channels. Each channel would be able to treat up to 6.5 MGD of flow (for a total capacity of 13 MGD with both channels). A two channel configuration allows for increased energy efficiency and ease of operations and maintenance. Keeping the lamps of the UV system submerged is also essential to ensure efficient and proper operation of the UV system. Submergence of the lamps would be provided by effluent weirs located at the end of each UV channel.
A potential layout of a UV system is shown in Figure 4-10. Note that a design approach is shown that would allow both UV channels to be constructed within one run of the existing chlorine contact basin, allowing the other to be used for flow through.

With UV as the primary plant disinfectant, supplemental chlorine addition would still be necessary to meet the needs of the non-potable water (NPW) system and to continue to control filamentous bacteria through the RAS chlorination system. The chlorine dosage is infrequent and minimal for these purposes, but must still be included in the capital cost estimate. Although, system design requirements and basis of analysis will require more consideration and coordination with the City staff to come to a sustainable long-term basis for design. As such, this component of the analysis will be evaluated further during preliminary design.

### 4.6.5 UV Cost

A planning level cost estimate to construct a UV system within the existing chlorine contact chamber was estimated to be $1,200,000. A vertical system was used for this planning level cost estimate. However, during design, a thorough evaluation between vertical and horizontal UV systems should be conducted to find the best possible configuration for Piqua. Construction costs for the UV include maintenance of plant operations to keep the plant in compliance while during the change from a chlorination/de-chlorination system to a UV system is completed.
### Table 4-9 – UV Operation and Maintenance Cost Estimate

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>O&amp;M Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual electricity costs for UV</td>
<td>$3,200</td>
</tr>
<tr>
<td>Annual costs for lamp replacement</td>
<td>$4,700</td>
</tr>
<tr>
<td>Annual costs for ballast replacement</td>
<td>$1,000</td>
</tr>
<tr>
<td>Annual maintenance costs</td>
<td>$9,800</td>
</tr>
<tr>
<td>Present Value of Annual Costs</td>
<td>$210,000</td>
</tr>
</tbody>
</table>

## 4.7 Summary of Liquid Stream Process Evaluation

### 4.7.1 Construction Costs

This section presents budgetary cost estimates for each of the four alternatives. The estimates involve a significant amount of judgment at this stage of planning and should be considered only approximate but relative to each other in accuracy. Generally, planning level estimates are considered to have an accuracy of +/- 30 percent. More refined estimates will be developed at each subsequent design phase of the project.

Construction costs were developed using supplier quotations and historic cost data and published data. The costs are based on 2012 costs with no inflation. A comparison of the alternative capital costs are:

- Alternative 1 - $25,000,000
- Alternative 2 - $30,000,000
- Alternative 3 - $30,000,000
- Alternative 4 - $22,000,000

### 4.7.2 Operation and Maintenance Costs

Alternative 4 would appear to be the most cost effective system since the BioActiflo will only be used on a periodic basis, which is estimated to be 20 to 30 days per year. However there are no historical data to show the true costs for operation of the BioActiflo system. CDM Smith contacted the City of Port Clinton, Ohio regarding their Actiflo system. They recommended that the cost of a full time operator be used to account for upkeep of the tanks, sand storage and polymer handling. There is also an impact on sludge handling since there is a loss of sand from the liquid system to the sludge processing system.

Alternatives 2 and 3 utilize the oxidation ditch process which is an energy efficient process when using a BNR control system with D.O. monitors and VFD drives on the mixers; however it cannot save enough to overcome the large capital cost difference of Alternatives 1 and 4.

### 4.7.3 Non-Economic Evaluation

Each alternative was evaluated on non-economic basis considering:

- **Operational Requirements**: Operational complexity, operator attention, and daily adjustments required.
- **Reliability**: History of the system to continuously meet discharge requirements during changes in weather, influent flow conditions, and wastewater characteristics.

- **Flexibility**: Ease of operation to adapt to changing process conditions.

- **Monitoring Requirements**: Standard operating procedures and documentation requirements of the operations staff.

- **Nuisance Potential**: The potential for odor generation, noise and freeze potential.

- **Ease of Expansion**: Expandability, including use of modular construction so that the facility can be expanded as future demand increases.

The non-economic comparison of alternatives is presented in Table 4-10. Numerical ratings from 1 to 5 were assigned to each factor. A rating of 1 is poor and a rating of 5 is excellent.

### Table 4-10: Non-Economic Comparison of Liquid Treatment Alternatives

<table>
<thead>
<tr>
<th>Liquid Process Alternative</th>
<th>Operational Requirements</th>
<th>Reliability</th>
<th>Flexibility</th>
<th>Monitoring Requirements</th>
<th>Nuisance Potential</th>
<th>Ease of Expansion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Upgrade and Expand Plant</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2 – Parallel Extended Aeration Plant</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>3 – New Extended Aeration Plant</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>4 – Parallel BioActiflo</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Alternatives 3 and 4 received the highest (best) ratings for the non-economic factors. The primary reason is that they both reduce the flow to the existing plant that is at or near its useful life and utilize new technologies that are more reliable and energy efficient. Alternatives 1, 2, and 4 use the existing plant, which would require major equipment upgrades and complex underground piping and channel modifications to allow for the increased flows.

Alternative 3 received the highest rating for operational requirements because it produces the best effluent (cleanest wastewater discharge) of the options and is easily controlled by state of the art computer programs which adjust treatment schemes based on inputs from the influent flow meter, dissolved oxygen and oxygen reduction probes which provide a continuous stream of data to the oxidation ditch control program.

Alternative 4 is the highest rated for non-economic factors and has the lowest estimated construction cost. The BioActiflo system utilizes new technology combined with a treatment process that is reliable, easy to operate, flexible for making adjustments to fluctuating flows and pollution loading, and can be operated totally automatically or manually. BioActiflo is a energy efficient alternative, and would only be operated during wet weather events that exceed the existing plant capacity, which is likely 30 days per year. The main advantages of this alternative are that it does not require additional property to be acquired (unique of all alternatives), does not require extensive upgrade of the existing plant facilities, and requires only limited new underground piping between unit processes. Because of these benefits, the construction costs will be significantly lower and will have the least interference on maintenance and operation of the plant during the construction period.
4.7.4 Present Worth Analysis

The cost analysis of the alternatives includes the development of total present worth costs based on construction and annual operation and maintenance (O&M) costs. The cost figures developed not only facilitate the direct comparison between alternatives but also indicate the magnitude of the cost for implementing each Alternative.

The cost estimates are based on the planning level design of each alternative to determine the equipment, land area, process building, structure requirements, electrical utility, maintenance, and staffing requirements. Construction and annual O&M costs of similar facilities constructed were considered in the cost analysis as well as information provided by manufacturers of the various processes and past budgets for operation of the Piqua plant.

The construction and O&M costs are compared using a 20-year life and an interest rate of 3.5 percent. The present worth cost includes both construction and O&M costs over the next 20 years. The analysis assumes that the facilities are constructed at one time and the constant O&M costs start at the same time and continue over the 20-year period. This procedure converts these costs over the project life into an equivalent cost that represents the current investment that would be required to satisfy all of the identified project costs for the planning period.

The cost analysis of the alternatives is based on the following specific parameters:

- Project design period (useful life of the facilities) = 20 years
- Interest rate = 3.5 percent
- Present worth factor = 14.23 (O&M cost x 14.23)
- Labor cost = $35.00 per hour (includes fringe benefits)
- Electricity cost = $0.06 per Kw-hr
- Gas cost = $7.35 per mmBTU
- Maintenance cost = historical budgets of the Piqua WWTP

Engineering design, construction management, and legal are not included in the costs, but presumed to be similar between the alternatives. The O&M cost estimates are based on the average daily flows and peak hourly flows anticipated during the 20-year design period. Administration and laboratory costs are included in the annual O&M cost estimates.

Contractor insurance, bonds, general conditions and overhead and profit were assumed to be 15% of the total construction cost including contingency.

A construction cost contingency of 30% is added to the construction cost of each alternative. A 30% contingency is appropriate at a planning level to allow for unforeseen and undefined cost items. It is important to note that the cost estimates are preliminary planning level costs based on information available at the time of the estimates and are considered to be "order of magnitude". The actual cost of the recommended alternative will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other factors. As a result, the final costs will most likely vary from the estimates presented herein.
Table 4-11 provides a summary of the present worth cost analysis for the four alternatives.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probable Construction Cost</td>
<td>$25,000,000</td>
<td>$30,000,000</td>
<td>$30,000,000</td>
<td>$22,000,000</td>
</tr>
<tr>
<td>Annual O&amp;M Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>$300,000</td>
<td>$200,000</td>
<td>$175,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Labor &amp; Maintenance</td>
<td>$2,947,000</td>
<td>$3,500,000</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Chemicals/UV</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Total O&amp;M Costs</td>
<td>$3,257,000</td>
<td>$3,710,000</td>
<td>$3,185,000</td>
<td>$3,160,000</td>
</tr>
<tr>
<td>Present Worth O&amp;M Costs</td>
<td>$46,315,000</td>
<td>$52,756,000</td>
<td>$45,291,000</td>
<td>$44,935,000</td>
</tr>
<tr>
<td>Total Present Worth Cost¹</td>
<td>$71,315,000</td>
<td>$82,756,000</td>
<td>$75,291,000</td>
<td>$66,935,000</td>
</tr>
</tbody>
</table>

¹ Present worth cost is calculated at 3.5% interest for 20 years

4.8 Conclusions and Recommendations

Four liquid stream alternatives were developed and compared in terms of; facility requirements, regulatory requirements including current and impending future discharge limits, construction, annual O&M, and present worth/life cycle costs. Advantages and disadvantages of each alternative related to cost and non-cost parameters were identified. This information developed and analyzed assisted in arriving at the recommended liquid stream process for the Piqua WWTP.

The Biological High Rate Clarification (BHRC) alternative has the lowest construction cost, lowest present worth cost and was the highest rated alternative for non-economic factors. The alternative proposes to utilize all the existing treatment plant facilities with needed upgrades and provides innovative technology to treat high wet weather flows and eliminate all sanitary sewer overflows.

The major advantages of this system are the small footprint of the system, can be operated on an as-needed basis with quick start-up, ability to produce a high quality effluent, and ability to serve as tertiary treatment if required in the future. Because of this the system does not waste energy running when not needed during low flows and has high hydraulic surface loading rates, the system offers low construction cost, O&M costs and overall life cycle cost.
Section 5
Development of Solids Stream Alternatives

5.1 General
The Piqua Wastewater Treatment Plant (WWTP) is a conventional activated sludge plant rated for 4.5 MGD. The liquid treatment scheme at the WWTP consists of screening, grease and grit removal, primary settling, activated sludge aeration, secondary settling, chlorination, dechlorination, and post aeration. Plant effluent is discharged to the Great Miami River. The solids treatment scheme involves separate primary and waste activated sludge pumping, anaerobic digestion, sludge dewatering, and land application.

A key to a reliable wastewater treatment plant operation is the effective management of the wastewater solids generated at the plant. Wastewater solids are removed from the wastewater stream by physical unit processes and produced by biological processes during sewage treatment. These solids include screenings, grit, scum, and sludge. The Federal Part 503 Standards for the use and disposal of sewage sludge define sewage sludge as a solid, semi-solid, or liquid residue generated during treatment of sewage in a treatment plant. Sewage sludge includes scum or solids removed in primary, secondary, or advanced wastewater treatment processes but does not include grit and screenings. Organic residuals from primary and secondary treatment constitute most of the sludge. Piqua employs three circular primary tanks and four circular secondary settling tanks to remove sewage sludge from the liquid wastewater stream.

At a certain point in the solids processing scheme the sludge is referred to as biosolids. Biosolids are primarily organic solids produced by WWTP stabilization processes that can be beneficially reused or recycled. The term biosolids is used only after the beneficial use criteria have been achieved through a sludge stabilization process. The United States Environmental Protection Agency (USEPA) and the State of Ohio Environmental Protection Agency (OEPA) are very supportive of the beneficial use of biosolids in their sewage sludge regulations and emphasize the beneficial nature of this valuable, recyclable resource.

The current biosolids management plan at Piqua consists of anaerobic digestion and land application of the biosolids. Sludge treatment/stabilization processes convert sewage sludge to a stable end product by reducing pathogen (disease-causing organism) levels in the sludge and offensive odors. Anaerobic digestion of wastewater sludge is approved by the OEPA and USEPA as a Process to Significantly Reduce Pathogens (PSRP) and a Process to Further Reduce Pathogens (PFRP). PSRP and PFRP are the criteria for alternate levels of pathogen reduction (i.e., Class B and Exceptional Quality (EQ) biosolids, respectively) as required by the federal and state regulations prior to land application and/or distribution and marketing. Anaerobic digestion also meets vector (e.g., insects, birds, rodents, etc.) attraction reduction (VAR) requirements set by the USEPA and OEPA. The Piqua anaerobic digestion process is a PSRP producing Class B biosolids and meeting the vector attraction reduction requirements. The digested biosolids are stored in a tank prior to dewatering via a belt filter press. A private contractor (Burch Hydro) transports and land applies the biosolids on nearby farmlands.

The Piqua plant currently utilizes a two-stage, primary-secondary, mesophilic anaerobic digestion system. Primary sludge and unthickened waste activated sludge (WAS) is sent first to the Primary
Digester that is used to provide active mixing, heating, and digestion. Next, the sludge is transferred to the Secondary Digester that serves as a solid-liquid separator; it provides settling and separation of the sludge solids from the excess water (supernatant). The methane gas which is produced during the digestion process is used to run the gas engine driven aeration blower or burned to heat the digesting sludge. The concentrated digested sludge is removed from the Secondary Digester and pumped to either the Sludge Truck Loading Station or the Digested Sludge Storage Tank. The supernatant, which is drawn from the top portion of the Secondary Digester, flows by gravity to either the plant main drain for additional treatment or to the Supernatant Pump Station from which it is pumped to the Supernatant Oxidation Tank for additional treatment.

The two-tank system is comprised of the following major components:

- A 50-foot diameter Primary Digester with sidewater depth (SWD) of 20 feet, a fixed cover, an external heating system, and a gas mixing system.
- A 50-foot diameter Secondary Digester with SWD of 20 feet and a gas holding, floating cover held up by the pressure of the sludge gas produced mainly from the Primary Digester. There are no heating or mixing systems for the Secondary Digester.

The Primary Digester heating system consists of process hot water piping, sludge circulation piping, digester sludge recirculation pumps, a process water pump, an engine jacket water pump, a sludge heater, a sludge heat exchanger, a process heat exchanger, and an excess heat exchanger.

The mixing system in the Primary Digester consists of three 18-inch diameter by 17-feet long mixing guns that are symmetrically positioned on top of the digester cover. Each mixing gun assembly includes a mixing tube and a gas distributor which generates intermittent gas piston-like bubbles at a controlled frequency to produce a continuous sludge flow through the gun stack. Two liquid ring-type mixing compressors are used to provide the compressed gas flow of 60 SCFM required for the operation of the mixing guns, which provide a scouring velocity along the bottom of the digester to prevent the deposition of heavy solids and organic materials.

The anaerobic system uses two sludge recirculation pumps, which withdraw sludge from the Primary Digester and pump it though the sludge heating system then back into the Primary Digester to maintain a constant temperature or could be used to circulate supernatant to the Secondary Digester. Digested sludge pumps are used to pump digested sludge from the Digested Sludge Draw-off Well to either the Sludge Truck Loading Station or to the Digested Sludge Storage Tank.

The two-stage digester gas handling system consists of meters, filters, a waste gas burner, and piping. The digester gas produced in the Primary Digester can either be burned in the sludge heater for the digester heating system or used to run the gas engine driven aeration blower. Any unused gas can be burned in the waste gas burner.

**5.1.1 EQ Biosolids versus Class B Biosolids – Regulatory Outlook**

Since the most recent revisions to the sewage sludge regulations in the State (effective July 1, 2011) make them stricter, the City of Piqua is concerned with the long-term viability of their Class B sludge digestion system. Ohio WWTPs must meet the sewage sludge regulations in the Part 503 (including all amendments) as well as the Ohio’s sewage sludge regulations enforced by the OEPA. As a delegate, OEPA has the exclusive authority to revise the current sludge disposal regulations as long as the Federal regulations are met. That is, OEPA can make the sludge regulations more stringent. In fact,
Ohio’s sewage sludge regulations are considered to be stricter than other states in the country. Over the years, OEPA has made revisions to the regulations mainly with the permitting and management of Class B biosolids. The most recent changes now regulate the management practices of bulk EQ biosolids and impose stricter land application requirements, such as the prohibition of surface application of Class B biosolids and bulk EQ biosolids from December 15 to March 31. Only injection or incorporation within 24 hours could lift the ban. This requirement reinforces the need for 120-day sludge storage at plants and causes WWTPs that do not have adequate sludge storage to look at other means to dispose of their sludge. The regulations now include precipitation restrictions for Class B and bulk EQ biosolids. For example, beneficial reuse is not permitted when the forecast predicts a 50% chance that a ½ inch of rain will occur within 24 hours of beneficial use application. Another recent change to the regulations involves screening at the head of the plant. By July 1, 2015, any treatment plant who plans on practicing beneficial reuse of biosolids must include fine screening (5/8” max aperture or finer) in the liquid treatment train to remove manufactured inerts from influent sewage, septage, or sewage sludge. Moreover, there is always the recurring threat to ban land application of Class B biosolids, but the likelihood of it being enforced within the next twenty years is highly doubtful. Replacing Class B systems with EQ systems would require additional treatment and have a significant impact on the capital and operational costs associated with biosolids management.

According to OEPA records for the Year 2009, only 30 treatment plants in Ohio land apply or distribute and market EQ biosolids, while 336 Ohio plants land apply Class B biosolids. Furthermore, 47% of the biosolids produced in 2009 was either land applied or distributed and marketed, with the remaining 53% disposed of via landfillsing and incineration. Any changes in the current regulations to require the production of EQ biosolids would affect many communities including Piqua. OEPA has indicated that a requirement to produce EQ biosolids is not likely in the foreseeable future. However, it is prudent as part of a comprehensive WWTP plan to examine alternatives to produce EQ biosolids in the event the regulatory climate changes.

### 5.1.2 Piqua Biosolids Management Plan

Although the Class B anaerobic digestion system at the Piqua plant has generated a very useful product for nearby farmers for several years, the City is concerned with the long-term viability of the current process. Due to age and inadequate performance, replacement of existing equipment is warranted. For instance, the bubble gun mixers are inefficient, the gas holder cover is defective, and gas collection and safety system needs to be upgraded. In addition, the OEPA’s most recent ban on surface application during the winter months necessitates additional long-term biosolids storage. The City realizes that upgrades to their current Class B biosolids management system is required. They have also expressed interest in a system that could produce Exceptional Quality biosolids. With Exceptional Quality biosolids sludge application rates would be safe no matter how much biosolids were applied to the land, whereas Class B biosolids have additional restrictions. The goal of this part of the overall Facility Plan is to develop a long-term biosolids management program that is environmentally sound, cost-effective, and more importantly meets the needs of the community and is publicly accepted.
5.2 Biosolids Management Options and Initial Screening Process

Numerous technologies can be applied to sludge removed from wastewater for volume reduction, treatment, and stabilization. Common sludge treatment/stabilization technologies include anaerobic digestion, aerobic digestion, autothermal thermophilic aerobic digestion (ATAD), composting, and lime stabilization. Sludge treatment/stabilization processes convert sewage sludge to a stable end product (biosolids). Such processes are the key to an effective, reliable WWTP operation. These treatment processes are used so that various disposal or utilization methods can be undertaken. Essentially, the selection of a stabilization method depends on the utilization/disposal procedure to be used. Biosolids disposal methods include landfilling and incineration. Common biosolids utilization practices include land application to agricultural and non-agricultural lands and distribution and marketing.

In an effort to streamline the comprehensive study process and to involve City staff directly in the decision-making process, CDM Smith conducted an all-day workshop that along with the liquid side of the plant assessed the existing wastewater solids processing facilities at the Piqua WWTP, and several sludge stabilization and biosolids management alternatives considered as viable options for the City were identified, evaluated, and screened.

In order to develop a Biosolids Management Plan (BMP) for the City of Piqua the integration of several combinations of treatment/stabilization technologies and disposal/utilization methods with the overall treatment process at the Piqua plant were reviewed and screened. The following BMP alternatives were considered:

- Aerobic Digestion/Land Application
- Mesophilic Anaerobic Digestion/Land Application
- Thermophilic Anaerobic Digestion/Land Application
- Autothermal Thermophilic Aerobic Digestion (ATAD)/Land Application and/or Distribution and Marketing
- Exceptional Quality and Class B Alkaline Stabilization/Land Application and/or Distribution and Marketing
- Composting/Distribution and Marketing
- Thermal Drying/Distribution and Marketing
- Burch-Hydro microwave process (BioWave™ Process)/Land Application and/or Distribution and Marketing

Lime stabilization, composting, and thermal drying were quickly eliminated. The digestion and microwave options remained. After further discussion, anaerobic digestion, ATAD, and the BioWave™ Process were selected to be further evaluated based on the cost and non-cost parameters. More specifically, the following sludge stabilization/biosolids utilization alternatives were shortlisted for final evaluation:
Section 5 • Development of Solids Stream Alternatives

- High-Rate Anaerobic Digestion/Land Application
- Temperature-Phased Anaerobic Digestion (TPAD)/Land Application and/or Distribution and Marketing
- ATAD/Land Application and Distribution and Marketing
- Burch-Hydro BioWave™ Process/Land Application and/or Distribution and Marketing

The purpose of Section 5 of this report is to develop the remaining alternatives considered for installation at the Piqua WWTP.

5.3 Evaluation Criteria

Each alternative is presented through a process description and evaluation of the process. Evaluation criteria are applied to the development and comparison of the alternatives. Facility requirements and regulatory requirements are considered in the screening process. Construction, annual operation and maintenance (O&M) and present worth costs, and other non-cost parameters are established and analyzed in Section 6 of this report.

Facility Requirements

All alternatives are evaluated along with auxiliary equipment or operations that would be required to make a fair comparison of the alternatives. The role of each existing unit treatment process and operational practice in conjunction with the potential new processes in achieving the overall sludge stabilization and process objectives are assessed. In some cases, existing treatment processes are replaced or upgraded, and in other cases existing processes are abandoned.

The sizing requirements for the BMP options were established. The facilities were sized and designed for a useful life of 20 years as dictated by the OEPA. CDM Smith reviewed the treatment plant monthly operating reports (MORs) (2008 through 2011). The MORs were collected, compiled, and analyzed to identify current plant flows, sludge production quantities, sludge characteristics, and sludge peaking factors. Current plant flow and sludge production values provided the basis for estimating future flow and sludge production rates. The average influent wastewater flow at the Piqua plant for the examined period was 3.90 MGD. The average sludge production rate for the period was 2,055 dry pounds per day (dppd). A future design flow of 7.0 mgd was projected for the 20-year planning period.

The new sludge stabilization facilities must be sized to handle both the estimated future average sludge production rate and a future maximum quantity – the maximum month sludge production rate. Based on peaking factors obtained from the existing treatment plant data and other facilities similar to the Piqua plant, future sludge loads were projected and are summarized in Table 5-1.

<table>
<thead>
<tr>
<th></th>
<th>Average Influent Daily Flow (MGD)</th>
<th>Average Sludge Production Rate (dppd)</th>
<th>Maximum Month Sludge Production Rate (dppd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT</td>
<td>3.9</td>
<td>2,055</td>
<td>2,887</td>
</tr>
<tr>
<td>FUTURE</td>
<td>7.0</td>
<td>3,700</td>
<td>5,205</td>
</tr>
</tbody>
</table>

Future design flow was projected for the 20-year planning period.
The following assumptions were made in sizing the facilities:

- Feed sludge percent solids = 5.0%
- Blended sludge volatile solids = 74%
- Volatile solids reduction = anaerobic digestion (50%); TPAD (55%); and ATAD (60%)
- Digested sludge percent solids = 2.0%
- Dewatered digested biosolids percent solids = High-Rate – 20%; TPAD – 20%; and ATAD – 25%
- Dewatered/dried biosolids percent solids = 70%

In summary, the facility requirements presented in this section for each of the digestion and drying alternatives are determined based on a projected future average digested biosolids production rate of 3,700 dppd. Moreover, each option is sized to handle an estimated maximum month digested biosolids production rate of 5,205 dppd. Furthermore, the various treatment processes are sized according to the USEPA and OEPA sludge regulatory requirements for pathogen reduction (for an Exceptional Quality or Class B end product) and vector attraction reduction. Design criteria described in the 10-State Standards, or other widely accepted design parameters, the validity of which have been proven historically, are also used to size the facilities. Variations in these assumptions may be experienced with different liquid process alternates; however, these planning level assumptions are considered appropriate for developing comparison. Applicability of each biosolids process to the liquid process alternates will be addressed as appropriate.

5.4 Biosolids Management Alternatives

5.4.1 Alternative No. 1 – High-Rate Anaerobic Digestion

Process Description

Anaerobic digestion is the most widely used method of sludge stabilization in the wastewater industry. Moreover, it is the most common stabilization process in Ohio. Anaerobic digestion has been used in virtually all sizes of wastewater treatment plants. The Piqua WWTP currently employs a primary-secondary anaerobic digestion system.

The anaerobic digestion system considered for this alternative is a high-rate digestion system. A high-rate system is characterized by each tank/reactor having auxiliary heating and mixing, and a controlled, elevated temperature to increase the rate of volatile solids destruction. High-rate digesters are operated in mesophilic temperature ranges (approximately 95 to 110°F) and thermophilic temperature ranges (approximately 131 to 140°F). The amount of volatile solids destroyed is a function of both temperature and solids retention time (SRT). Digester sizing in this study is based on a 15-day SRT to achieve a reduction of the volatile solids content by 50%.

Facility Requirements

The existing anaerobic digestion system as shown in Figure 5-1 consists of two 50-foot diameter tanks each with a 20-foot sidewater depth. The Operations Building is situated adjacent to the two tanks. Associated pumps, piping, heat exchangers, boilers, gas mix system, and other auxiliary equipment are located in the Operations Building. In order to convert the existing process into a high-rate anaerobic digestion system, several changes will need to be made.
Figure 5-1: High-Rate Anaerobic Digestion Layout
Demolition work for this option would involve removing the fixed and floating covers on the primary and secondary digesters, respectively; the Atara bubble gun mixing system in the primary tank; and the gas collection and safety equipment. The two tanks would be converted to high-rate digesters with mixing and heating in each tank. Site work would be minimal for this option.

Assuming a feed solids concentration of 5 percent, both existing digesters are required to provide a SRT of 15 days. Both digesters would be heated and mixed to mesophilic conditions. New external draft tube mechanical mixers (two per tank), two combination heater and heat exchangers, two recirculation pumps, two transfer pumps, piping, and valves would need to be installed, along with gas collection, handling, and safety equipment. The digesters would be equipped with membrane-type gas holders to accommodate gas storage. Digester gas would be utilized to heat the incoming sludge. Note that various mixing systems were investigated including draft tube mixers, jet mixers, and vertical liner motion mixers. It is assumed that existing sludge feed piping and valves to the existing belt filter press (BFPs) would be reused. The Operations Building would house all of the digestion equipment. Two gravity belt thickeners (GBTs) would be needed to thicken the sludge to 5% prior to entering the digesters. These GBTs would be housed in the existing Secondary Control Building. A new Dewatering/Biosolids Storage Building would also need to be constructed. The new building would house two BFPs and associated processing equipment and controls, and a biosolids storage area capable of 120-days storage. The building would be a 4,750-square foot pre-engineered type structure with concrete floors and push walls. The size of this building varies with each alternative. The building would be constructed just south of the Digested Sludge Storage Tank. See Figure 5-2 for a location plan. Note that the location for this building is the same for all four BMP alternatives being evaluated.

Along with the GBTs, GBT feed pumps, transfer pumps, digested sludge feed pumps (to pump digested sludge to the dewatering facilities), piping (in-tank and out-of-tank), and valves would need to be installed.
Regulatory Requirements

Anaerobic digestion is a PSRP. Under the 40 CFR Part 503 standards, sewage sludge meeting the requirements of a PSRP is considered Class B with respect to pathogens. According to the regulations, anaerobic digestion can be classified as a PSRP if the SRT under anaerobic conditions (sewage sludge treated in the absence of air) is at least 15 days at 35⁰C to 55⁰C (95⁰F to 131⁰F). Anaerobic digestion achieves the vector attraction reduction requirements by reducing the volatile solids in the sludge by at least 38%. Class B anaerobic digested biosolids can be land applied as long as the pollutant limits and vector attraction requirements are achieved. These criteria are easily met by a properly designed and operated digestion system.

See Figure 5-3 for the process flow schematic of the High-Rate Anaerobic Digestion alternative.

5.4.2 Alternative No. 2 – Temperature-Phased Anaerobic Digestion (TPAD)

Process Description

TPAD is a two-phase digestion process with the first phase operating in the thermophilic temperature range (131 to 140 °F) and second phase in mesophilic temperature range (95 to 110 °F). Sludge can meet one of the Exceptional Quality biosolids pathogen reduction criteria when it is heated to 131 °F and held at that temperature for at least one day. After having met the Exceptional Quality biosolids pathogen reduction criteria, sludge can then be digested in the mesophilic phase to further destruct volatile solids to meet the VAR criteria. The existing Primary Digester would be converted into the thermophilic tank, and the existing Secondary Digester would be converted into the mesophilic tank.

The TPAD process is designed to take advantage of the thermophilic digestion rates, which are estimated to be four times faster than mesophilic digestion. The thermophilic digester would provide about 2 to 5 days of SRT. This tank would also need to operate in a fill-hold-draw batch mode to make sure that the digester content is held at the specified temperature for at least 24 hours to meet EPA’s
Exceptional Quality biosolids pathogen reduction criteria. Testing would be conducted to verify that all sludge particles in the thermophilic phase have maintained a temperature of 131 °F or higher for at least 24 hours. The mesophilic digester would provide 10 days of SRT.

Digester sizing in this study is based on the SRTs stated and a reduction in the volatile solids content by 55%. A major challenge in modifying a conventional mesophilic process to a thermophilic, sequential-batch system is meeting the heating loads that are about twice that of mesophilic digestion at the same feed rate. Heat exchanger selection is a critical step in this design.

**Facility Requirements**

Since the plant has two existing anaerobic digesters, each tank can achieve the recommended SRT; no new tanks are needed. *Figure 5-4* presents a layout of this alternative.

![Figure 5-4: Temperature-Phased Anaerobic Digestion (TPAD) Layout](image)

To accommodate a TPAD system several existing systems would need to be removed or replaced. Similar to the high-rate anaerobic digestion system option, demolition work for this option would also
involve removing both digester covers, removing the bubble gun mixing system and associated equipment, removing the recirculation pumps, and the heat exchanger system. Major new equipment would include gas-holder covers for both digesters, a mixing system for each digester, two heater/heat exchangers (one each for mesophilic conditions and thermophilic conditions), recirculation pumps, and transfer pumps. Two gravity belt thickeners (GBTs) would be needed to thicken the sludge to 5% prior to entering the thermophilic digester. These GBTs would be housed in the existing Secondary Control Building. A new Dewatering/Biosolids Storage Building would also need to be constructed. The new building would house two BFPs and associated processing equipment and controls, and a biosolids storage area capable of 120-days storage. The building would be a 4,750-square foot pre-engineered type structure with concrete floors and push walls. The building would be constructed just south of the Digested Sludge Storage Tank. See Figure 5-2 for a location plan.

Along with the GBTs, GBT feed pumps, transfer pumps, digested sludge feed pumps (to pump digested sludge to the dewatering facilities), piping (in-tank and out-of-tank), and valves would need to be installed.

**Regulatory Requirements**

TPAD can be a PSRP or PFRP. Under the 40 CFR Part 503 standards, sewage sludge meeting the requirements of a PSRP is considered Class B with respect to pathogens. According to the regulations, TPAD can be classified as a PSRP if the SRT under anaerobic conditions (sewage sludge treated in the absence of air) is at least 10 days at 55°C to 60°C (131°F to 140°F). TPAD achieves the vector attraction reduction requirements by reducing the volatile solids in the sludge by at least 38%. Class B anaerobic digested biosolids can be land applied as long as the pollutant limits and vector attraction requirements are achieved. These criteria are easily met by a properly designed and operated digestion system. TPAD can achieve PFRP status (Exceptional Quality biosolids) under the time-temperature regime of the Part 503 standards with respect to pathogens. That is, sewage sludge must be operated at thermophilic temperatures in a sequential batch mode manner such that every particle is subjected to time and temperature conditions. The time and temperature requirement is 24 hours at 55°C, with additional time needed at lower temperatures and less time at higher temperatures. Pathogen destruction (pasteurization) must precede or be accomplished concurrently with vector attraction reduction. TPAD achieves the vector attraction reduction requirements by reducing the volatile solids in the sludge by at least 38%. These criteria can be met by a properly designed and operated TPAD system. Exceptional Quality biosolids can be utilized via land application and distribution and marketing.

See Figure 5-5 for the process flow schematic of the TPAD alternative.
5.4.3 Alternative No. 3 – Autothermal Thermophilic Aerobic Digestion (ATAD)

Process Description

The Autothermal Thermophilic Aerobic Digestion (ATAD) process is an aerobic digestion technology that operates at thermophilic temperatures by utilizing the heat produced by the process. Autothermal conditions result from an adequately thickened sludge feed, a suitably insulated reactor, good mixing, and an efficient aeration device that keeps the latent heat loss to an acceptable level. Heat generated by the sludge decomposition is sufficient to warm the incoming sludge without an external heat source.

ATAD is a refinement of the conventional aerobic digestion process that achieves thermophilic operating temperatures without supplemental heat (autothermal) beyond that supplied by mixing energy. In this process the feed sewage sludge is pre-thickened and an efficient aerator is used. Because of the severe odor problems associated with the off-gases expelled from the 1st generation ATAD systems, a 2nd generation ATAD process by Thermal Process Systems (patented ThermAer™ ATAD system) was considered. Compared to the 1st generation ATAD units, the 2nd generation ATAD units provide less complex reactor schemes, higher SRT levels, and improved high-efficiency aeration and mixing systems. Moreover, the biofiltration system included with the process has proven to be very efficient in treating odors. ATAD reactor sizing in this study is based on a 10 to 12-day SRT in the reactors to achieve a reduction of the volatile solids content by 60% and an SRT of a minimum of 5 days in the storage tank.

Facility Requirements

As with the anaerobic digestion options, demolition work for this option would involve removing the bubble gun mixing system, primary fixed cover, secondary gas holder cover, associated pumps, heat exchanger system, boiler, and gas equipment in the tanks and Operations Building. The primary tank would be converted to an ATAD Thermaer reactor, and the existing secondary tank would become the
Storage/Nitrification/Denitrification (SNDR) tank. The Thermaer reactor tank would have a concrete cover and be insulated. The SNDR tank would have an aluminum dome cover. Site work for this option would include a biofiltration odor control unit approximately 50 ft x 25 ft x 10 ft. From previous ATAD facilities in Ohio, the installation of fine screens at the headworks is necessary.

The existing anaerobic digesters would be retrofitted into a 2nd generation ATAD facility. Assuming a feed solids concentration of 5 percent, one reactor (Thermaer™ reactor) and one storage tank (SNDR tank) are needed to provide the required SRTs. One reactor tank would be required to provide a detention time of 10-12 days for the design solids loading. One jet-motive pump aeration system (ThermAer™ liquid and air jet header and nozzle systems) and one hydraulic foam control system would be installed in the reactor. The jet manifold is comprised of integrally fabricated air and liquid headers equipped with jet nozzles. The jet manifold has a dedicated 75-horsepower, variable speed, dry pit, end suction, centrifugal pump for the liquid recirculation component and two 40-horsepower, variable speed, positive displacement blowers to provide the airflow component. One blower would serve as a spare for the reactor and SNDR. The jet aeration system will be equipped with a pneumatic flushout system and foam control jet motive pump.

Downstream of the reactor, sludge storage for a period of 5 days is required to allow the biosolids to cool to a mesophilic temperature. This cooling step is critical for efficient dewatering of the biosolids downstream. A heat exchanger also aids in the cooling process. The Secondary Digester would be converted into a storage tank equipped with a jet-motive pump aeration system. An aluminum cover would replace the existing floating as-holder cover.

A two-stage odor control system consisting of a humidification system and biofilter would be used to control odorous emissions from the reactors and storage tank. A biofilter is an odor control technology that uses a biologically active, media bed to adsorb and absorb contaminants from the air stream passing upward through the bed and retain them for subsequent microbial degradation and oxidation. The microorganisms that reside in the media feed on the odorous compounds releasing non-odoriferous air to the atmosphere. A biofilter fan would draw air from the tanks via collection piping and discharge the odoriferous air up through the biofilter media bed.

The first stage of the odor control system is the humidification/scrubber unit. This humidification/scrubber unit removes a large amount of ammonia from the influent foul air stream, controls the temperature of the air assuring that it is conducive to biological activity, and raises the humidity of the foul air for further treatment by the biofilter downstream, the second stage of the odor control system. The biofilter would be a 50-foot by 25-foot aboveground unit consisting of a concrete tank, a plastic aeration plenum, and biofilter media (placed within the tank walls approximately 10-feet high) supported by the plenum below.

In addition, this alternative includes two GBTs housed in the existing Secondary Control Building to increase the solids feed to 5% enroute to the reactor. Higher solids feed result in greater reduction of the volatile solids. Along with the GBTs, GBT feed pumps, transfer pumps, digested sludge feed pumps (to pump digested sludge to the dewatering facilities), piping (in-tank and out-of-tank), and valves would need to be installed.

The Operations Building would house all of the ATAD equipment, pumps, piping, valves, and instrumentation and controls. A new Dewatering/Biosolids Storage Building would also need to be constructed. The new building would house two BFPs and associated processing equipment and controls, and a biosolids storage area capable of 120-days storage. The building would be a 4,250-
square foot pre-engineered type structure with concrete floors and push walls. The building would be constructed just south of the Digested Sludge Storage Tank. See Figure 5-2 for a location plan.

A layout of this alternative is presented in Figure 5-6.

**Regulatory Requirements**

ATAD is a PFRP. Under the Part 503 standards, sewage sludge meeting the requirements of a PFRP is considered Exceptional Quality with respect to pathogens. According to the regulations, ATAD can be classified as a PFRP if the SRT under aerobic conditions (sewage sludge agitated with air or oxygen) is 10 consecutive days at 55°C to 60°C (131°F to 140°F). ATAD achieves the vector attraction reduction requirements by reducing the volatile solids in the sludge by at least 38%. These criteria are easily met by a properly designed and operated ATAD system. Exceptional Quality biosolids can be utilized via land application and distribution and marketing.
See Figure 5-7 for the process flow schematic of the ATAD alternative.

5.4.4 Alternative No. 4 – Burch-Hydro BioWave™ Process

Process Description

The objective of the microwave system is to remove water from the biosolids, producing biosolids with relatively high percent solids, which in turn reduces the weight and volume of the biosolids. The drying process is flexible and can produce marketable products that meet Class B or Exceptional Quality standards. The reduction in volume and weight also reduces transportation costs; however, in Piqua’s case there would not be a significant cost reduction since they have eligible farm land in close proximity to the plant.

The ideal percent solids produced via the microwave process is about 60 to 70%. At existing facilities this is accomplished by drying to 50% using the microwave dryer and then the biosolids will lose another 10% while in the storage pile before disposal. The 60% solids is desired because it kills all pathogens (they do not regenerate) and reduces ammonia odors (which helps with public acceptance). Since the drying only removes water, the product retains the beneficial nutrients, and it is very close to what farmers are used to handling with their spreaders so they have a high acceptance of the product. The BioWave™ uses electromagnetic waves or microwaves to thermally heat the biosolids and then with supplemental gas and fans, drive off the moisture as safe steam to an odor control system. The unit has four major components: the control center, the transmitters, the waveguides, and the applicator oven. Two of the components, the transmitters and the control center, should be in a climate controlled room. The waveguides and applicator oven should be in a building, but climate control is not required. However, for the comfort of the operators some temperature control is advised.
The control center is a programmable logic controller that can monitor and control various functions such as belt speed, burner temperature, magnetron power, and air flow. The panel includes a touch screen which can also monitor and control belt filter press controls.

There would be four transmitters, each housing one magnetron. Each magnetron converts 0-100 KW of electrical energy into microwaves. The microwaves are then transmitted through special ducts called waveguides to the applicator oven, which is an open stainless steel shell approximately 2-meters wide and 50-feet long with a belt running through it. The belt can be run continuously because each end of the applicator oven is equipped with choke pins which trap the microwaves from escaping to the outside. The belt speed and the microwave power are both adjustable so that you can increase or decrease the percent solids of the product by either slowing or speeding up the belt, or increasing or decreasing the power to the magnetrons.

The system has been tested for municipal sludge treatment and no air pollution permits are required. The microwave dryer’s major advantage is that it will reduce the volume and weight of Piqua’s biosolids by 60 to 70%.

**Facility Requirements**

The existing Secondary Control Building houses a one-meter belt filter press along with a polymer feed system with a polymer feed pump and a Seepex progressive cavity sludge feed pump. The solids handling is contracted to Burch Hydro. Burch Hydro dewatering, hauls, and land applies the digested cake. They currently run the belt filter press on average 2-3 days per week and 8 hours per day. They process 17 dry tons per month. A major advantage of the microwave system is that it can be set to match the output of the belt filter press, and one person can operate both the press and the microwave. However, to do this the two systems need to be next to each other. The existing Secondary Control Building cannot accommodate adding the microwave dryer into the building. Additional electrical power will need to be run to the new microwave building to supply the large demand of the microwave. In addition, upgrades to the existing digestion system would still have to be carried out with this alternative. A combination of high-rate digestion upgrades and a microwave drying process makes up Alternative No. 4.

Unlike the other options, sludge thickening facilities are not required, since the actual stabilization step is the microwave. However, digested sludge feed pumps (to pump digested sludge to the dewatering facilities), piping (in-tank and out-of-tank), and valves would still need to be installed.

A new Dewatering/Microwave Drying/Biosolids Storage Building would also need to be constructed. The new building would house two BFPs and associated processing equipment and controls, a 400-kW microwave system, and a biosolids storage area capable of 120-days storage. The building would be a 4,250-square foot pre-engineered type structure with concrete floors and push walls. The building would be constructed just south of the Digested Sludge Storage Tank. See Figure 5-2 for a location plan.
Regulatory Requirements

The BioWave™ Process is an approved US EPA Exceptional Quality process and listed by the Agency as an emerging technology. Of the six pathogen reduction alternatives the BioWave qualifies as an Exceptional Quality process through Alternative 1, Regime B of the 503 regulations – Thermally Treated Biosolids, which means it dries the biosolids to 8% or more and raises the temperature of the biosolids to 50°C for more than 15 seconds. It can meet either Option 7 or Option 8 of the vector attraction reduction alternatives, depending on the level of treatment the biosolids have undergone before entering the system. Option 7 requires drying to 75% when the biosolids are digested and Option 8 requires drying to 90% solids for undigested sludge. Since the plant will continue to practice digestion, the microwave system would be sized to produce EQ biosolids with a solids content of 70%.

See Figure 5-8 for the process flow schematic of the Microwave Drying alternative.

5.5 Sludge Thickening

Sludge thickening is required to reduce volumetric loading on the digestion process, produce a relatively solids-free supernatant, and increase the efficiency of subsequent solids-processing steps. The primary and WAS sludge blend will need to be thickened from 3% to 5% prior to entering the digesters. Doing so will increase volatile solids destruction which improves operation and reduces the costs for storage.

Three common sludge thickening methods are gravity thickening, gravity belt thickening, or centrifugal thickening. For this study, CDM Smith assumed the use of gravity belt thickeners.
A gravity belt thickener (GBT) is a belt filter press with a modified upper gravity drainage zone that allows water to drain through the moving, fabric-mesh belt while coagulating and flocculating solids. GBTs typically capture 95% solids and can thicken up to 6% solids. Because of the efficient space requirement, lower power use, and moderate capital costs, GBTs are a popular technology. It is assumed two 1-meter gravity belt thickeners would be installed to thicken the primary sludge and WAS prior to entering the digesters.

### 5.6 Biosolids Dewatering

A dewatering system will be needed after digestion to further remove water from solids to reduce the volume and produce a biosolids cake material suitable for land application. The dewatering process will produce a liquid stream, which can be recycled to the supernatant oxidation process. Typical dewatering systems include belt filter presses, centrifuges, and rotary presses. For this study, CDM Smith assumed the use of belt filter presses.

Gravity drainage and compression aids the filter belt in separating water from solids. With low energy consumption per volume of solids dewatered, the BFP can produce a cake containing 15 to 20% solids when dewatering anaerobically digested material and has solids capture rate range of 85 to 95%. It is assumed two 1-meter belt filter presses would be installed to dewater the digested sludge prior to land application or further microwave drying.

### 5.7 Summary

Table 5-2 provides a summary of each biosolids processing alternative evaluated.

<table>
<thead>
<tr>
<th>Biosolids Processing Alternative</th>
<th>Exceptional Quality Biosolids</th>
<th>Class B Biosolids</th>
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<tr>
<td>High-Rate Anaerobic Digestion</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Temperature-Phased Anaerobic Digestion</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Autothermal Thermophilic Aerobic Digestion (ATAD)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Burch-Hydro BioWave™</td>
<td>Yes</td>
<td>Yes</td>
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</tbody>
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Section 6
Evaluation of Solids Stream Alternatives

6.1 Basis of Evaluation

The cost analysis of the alternatives includes the development of total present worth costs based on construction and annual operation and maintenance (O&M) costs. The cost figures developed not only facilitate the direct comparison between alternatives but also indicate the magnitude of the cost for implementing each biosolids management plan (BMP).

The cost estimates are based on the preliminary design of each alternative to determine the equipment, land area, process building, storage, odor control, utility, maintenance, and staffing requirements. Construction and annual O&M costs of similar facilities constructed were considered in the cost analysis as well as information provided by manufacturers of the various processes.

The construction and O&M costs are compared using a 20-year life and an interest rate of 3.5 percent. The present worth cost includes both construction and O&M costs for the next 20 years. The analysis assumes that the facilities are constructed at one time and the constant O&M costs start at the same time and continue over the 20-year period. This procedure converts these costs over the project life into an equivalent cost that represents the current investment that would be required to satisfy all of the identified project costs for the planning period.

The cost analysis of the alternatives is based on the following specific parameters:

- Project design period (useful life of the facilities) = 20 years
- Interest rate = 3.5 percent
- Present worth factor = 14.23 (O&M cost $x$ 14.23)
- Labor cost = $35.00 per hour (includes fringe benefits)
- Electricity cost = $0.06 per Kw-hr
- Maintenance cost = 2.0% $x$ equipment cost

Engineering design, construction management, and legal are not included in the costs, but presumed to be similar between the alternatives. The O&M cost estimates are based on the average daily solids production of 1.85 dry tons per day anticipated during the 20-year design period. Administration and laboratory costs are not included in the annual O&M cost estimates.

A contingency of 30% is added to the construction cost of each alternative. A contingency is appropriate at a planning level to allow for unforeseen and undefined cost items. It is important to note that the cost estimates are preliminary planning-level costs based on information available at the time of the estimates and are considered to be "order of magnitude". The actual cost of the recommended alternative will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other factors. As a result, the final costs will most likely vary from the estimates presented herein.
6.2 Construction Costs
See Table 6-1 for a cost breakdown of each alternative. Differences in construction costs for each of the alternatives are described below.

6.2.1 Alternative No. 1 – High-Rate Anaerobic Digestion
The construction cost for the High-Rate Anaerobic Digestion option is estimated at $6,734,000. Major equipment included in this cost consists of two gravity belt thickeners (GBT), two belt filter presses (BFP), two gas-holding membrane covers, two mixers, two heat exchangers (to maintain mesophilic temperatures), and biosolids storage.

6.2.2 Alternative No. 2 – Temperature-Phased Anaerobic Digestion
The construction cost for the TPAD option is estimated at $7,059,000. This cost is the highest of the three digestion alternatives. Major equipment included in this cost consists of two GBTs, two BFPs, two gas-holding membrane covers, two mixers, two heat exchangers, and biosolids storage. This digestion option requires one 1,900,000 BTU/Hr heat exchanger for the thermophilic tank and one 750,000 BTU/Hr heat exchanger for the mesophilic tank. A major difference in cost is due to the higher capacity heat exchanger that is needed to meet the increased heat demand.

6.2.3 Alternative No. 3 – Autothermal Thermophilic Aerobic Digestion (ATAD)
The construction cost for the ATAD option is estimated at $6,659,000. This cost is slightly lower than the other two digestion options since the ATAD system will require no gas-holding covers and less biosolid storage space. The ATAD system includes the following equipment: two GBTs, two BFPs, a concrete cover for the reactor, an aluminum cover for the SNDR tank (storage), jet mixing systems, transfer pumps, foam control systems, biofilter odor control unit, and biosolids storage.

6.2.4 Alternative No. 4 – Burch-Hydro BioWave™ Process
The construction cost for the BioWave™ option is estimated at $7,605,000. This is the highest construction cost of the four options evaluated mainly due to the fact that improvements to the digesters (switching to high-rate) must still be accomplished. Major equipment included in this cost consists of two BFPs, two gas-holding membrane covers, two mixers, two heat exchangers, a 400-KW microwave system, and biosolids storage. The new dewatering/storage building not only will house the BFPs and biosolids storage but also includes an area for the microwave system.

6.2.5 Maintenance of Plant Operations (MOPO)
Maintenance of plant operations (MOPO) was considered in the evaluation of the four biosolids management alternatives. Since all four options require upgrades to the existing anaerobic digesters, the digestion operation at the Piqua plant must be taken off-line in order to construct each alternative. In order to minimize negative impacts to the existing plant operations during construction, a contract for temporary dewatering, hauling, and landfiling must be retained. Primary and waste activated sludge would need to be dewatered via the existing belt filter press or a mobile unit. The sludge cake would then need to be hauled and landfilled at a facility that accepts raw sludge. The cost for this temporary operation is included in Table 6-1 for each alternative being evaluated. It was assumed that the temporary operation would need to be on-line for a 12-month period.
6.3 Operation and Maintenance Costs

See Table 6-1 for a cost breakdown of each alternative. Assumptions and operating conditions for each of the alternatives are described below.

6.3.1 Alternative No. 1 – High-Rate Anaerobic Digestion

The total annual O&M cost is estimated at $114,150. The total present worth cost equates to $8,358,000.

It is expected that the digestion system would be operated 8 hours a day, five days a week, 52 weeks per year with no additional operator or maintenance person at the plant. Annual operation and maintenance costs include the cost for electricity and maintenance (e.g., lubricants and replacement parts). It is assumed that the digester gas will fuel the heaters. The O&M costs include costs for hauling and applying the digested biosolids at a land application site.

6.3.2 Alternative No. 2 – Temperature-Phased Anaerobic Digestion

The total annual O&M cost is estimated at $118,190. The total present worth cost equates to $8,741,000.

It is expected that the digestion system would be operated 8 hours a day, five days a week, 52 weeks per year with no additional operator or maintenance person at the plant. Annual operation and maintenance costs include the cost for electricity and maintenance (e.g., lubricants and replacement parts). It is assumed that the digester gas will fuel the heaters. The O&M costs include costs for hauling and applying the digested biosolids at a land application site.

6.3.3 Alternative No. 3 – Autothermal Thermophilic Aerobic Digestion (ATAD)

The total annual O&M cost is estimated at $152,400. The total present worth cost equates to $8,828,000.

It is expected that the ATAD system would be operated 8 hours a day, five days a week, 52 weeks per year with no additional operator or maintenance person at the plant. Annual operation and maintenance costs include the cost for electricity and maintenance (e.g., lubricants and replacement parts). The O&M costs include costs for hauling and applying the digested biosolids at a land application site. The ATAD option has a higher energy cost than the two anaerobic digestion options.

6.3.4 Alternative No. 4 – Burch-Hydro BioWave™ Process

The total annual O&M cost is estimated at $178,550. The total present worth cost equates to $10,146,000.

It is assumed that the BioWave™ system would be operated two ways: (1) 8 hours a day, five days a week, 52 weeks per year with no additional operator or maintenance person at the plant or (2) 10 hours a day, 4 days a week, 52 weeks per year with no additional operator or maintenance person at the plant. Annual operation and maintenance costs include the cost for electricity and maintenance (e.g., lubricants and replacement parts). The O&M costs include costs for hauling and applying the digested biosolids at a land application site. The microwave process has the highest energy cost of the options evaluated. On the other hand, its greater volume reduction results in a cost savings with regard to land application.

6.4 Non-Economic Evaluation

Many non-cost parameters and constraints affect either positively or negatively the ranking of the alternatives under evaluation. These criteria refer to such issues as ease of implementing the
alternatives, operability, and space impacts. These issues may not have a cost associated but may impact the operation of the facility. In order for the alternatives to be acceptable for implementation, these parameters must be satisfied, and their negative impacts must be minimized. The non-cost parameters considered in this evaluation of each alternative are public acceptance/potential for odor, long-term viability/ regulatory requirements, constructability and space constraints, ease of use/maintainability, flexibility/ adaptability, reliability/performance, safety impacts, and final product end use.

6.4.1 Alternative No. 1 – High-Rate Anaerobic Digestion

The advantages and disadvantages of the High-Rate Anaerobic Digestion alternative include the following:

**Advantages/Disadvantages**

**Advantages:**

- Lowest present worth cost of the options evaluated. Low net energy requirements.
- Ability to use existing Operations Building for digester heating and mixing equipment.
- The process produces a recoverable energy by-product, methane gas, which can be burned to provide energy for sustaining the process. Surplus methane can be used for other purposes within the treatment plant including heating, fuel for an engine-driven aeration blower, or generation of electricity. Net operational cost can be low if methane gas is used.
- Reduces the total sludge mass requiring disposal. Typically 25-45% of the raw sludge solids and 40-50% of the volatile solids are destroyed during the digestion process.
- Reduces the odor potential and opportunity for rodents and insects to be attracted to the resulting sludge product.
- Inactivates pathogens during its lengthy processing time.
- Tanks and Operations Building are already existing; therefore, relatively limited concrete construction work is needed.
- Proven technology with proven system equipment - most widely used stabilization process in the wastewater industry. Process reliability is high.
- Existing tanks can handle future plant capacity if WAS is thickened prior to introducing to digesters.
- No adverse environmental impacts are anticipated.
- Plant staff is familiar with the operation and maintenance of an anaerobic digestion system since it is currently used at the plant – no real learning curve.
- Biosolids suitable for agricultural use containing nutrients and organic matter that can improve the fertility and texture of soils.
Disadvantages:
- Produces a strong recycle stream (supernatant) that can have a high oxygen demand and concentrations of nitrogen and suspended solids. These streams can impact the overall plant treatment process.
- Can generate nuisance odors resulting from anaerobic nature of the process.
- The production of methane gas raises safety issues concerning flammability of the gas. High capital cost for gas handling and safety equipment.
- Requires a significant amount of mechanical equipment. The complexity of the equipment requires a qualified operating staff. Requires skilled operators for process control. Digester cleaning is difficult (scum and grit).
- Process is susceptible to upsets because methane formers (principle microorganisms involved in the decomposition process) are sensitive to small changes in their environment. Anaerobic bacteria are slow-growing and typically recover slowly from any upset.
- May continue to experience foaming.

6.4.2 Alternative No. 2 – Temperature-Phased Anaerobic Digestion (TPAD)

The advantages and disadvantages of the TPAD alternative include the following:

Advantages/Disadvantages

Advantages:
- Second most cost-effective option evaluated.
- Increased volatile solids destruction (50-55%). Reduced biosolids volume to the land apply.
- Increased biogas production.
- Shortened solids residence time.
- Biosolids suitable for agricultural use containing nutrients and organic matter that can improve the fertility and texture of soils. Potential to meet the EQ biosolids requirement.
- Proven and reliable technology with several plants in the United States with TPAD configuration.
- Plant staff knows how to operate and maintain anaerobic digestion systems. The thermophilic step adds a minor learning curve.
- Tanks and Operations Building are already existing; therefore, relatively limited concrete construction work is needed.

Disadvantages:
- Higher operating temperature results in increased heat demand. Heating loads are substantially higher than mesophilic digestion. Heat recovery or purchase of natural gas to supplement digester gas may be required.
High capacity heat-exchanger equipment is not readily available.

Odors can result from thermophilic stage.

EQ biosolids are not assured.

Thermophilic digestion is more costly to implement and operate than mesophilic digestion.

Increase ammonia loading in the cake filtrate as a result of greater volatile solids destruction.

Increased polymer demand for dewatering.

Added equipment and operational requirements.

The production of methane gas raises safety issues concerning flammability of the gas. High capital cost for gas handling and safety equipment.

Requires a significant amount of mechanical equipment. The complexity of the equipment requires a qualified operating staff. Requires skilled operators for process control. Digester cleaning is difficult (scum and grit).

### 6.4.3 Alternative No. 3 – Autothermal Thermophilic Aerobic Digestion (ATAD)

The advantages and disadvantages of the ATAD alternative include the following:

**Advantages/Disadvantages**

**Advantages:**

- Lowest construction cost of the options evaluated.
- Third most cost-effective option evaluated.
- Achieves good volatile solids destruction (55 to 60%). Reduces total sludge mass requiring disposal.
- ATAD is a PFRP – an EQ biosolids digestion process. Biosolids are suitable for land application and/or distribution and marketing. Product can serve as a soil amendment enriching the soil with essential nutrients and organic matter. Product can also be blended with other organic materials such as yard waste compost.
- Reduced hydraulic retention time compared with conventional aerobic digestion.
- The existing digester tanks can handle future plant buildout capacity.
- No adverse environmental impacts are anticipated.
- Safety impacts are minimal.
- ATAD is a proven and reliable technology with several full-scale systems operational in the United States, including four in Ohio.
- Tanks and Operations Building are already existing; therefore, relatively limited concrete construction work is needed.
Disadvantages:

- Significantly higher energy consumption and cost than the other anaerobic digestion alternatives evaluated.
- Can generate nuisance odors.
- Although not as complex as anaerobic digestion equipment, the equipment requires a qualified operating staff. Requires skilled operators for process control. Learning curve is required.
- May experience foaming.
- Cooling step (SNDR) is required for efficient dewatering.
- Thickening to 5% solids is required.

6.4.4 Alternative No. 4 – Burch-Hydro BioWave™ Process

The advantages and disadvantages of the Burch-Hydro BioWave™ alternative include the following:

Advantages/Disadvantages

Advantages:

- Flexible drying process and can produce marketable products that can meet either EQ or Class B biosolids standards. End product can be blended with other organic materials.
- Large reduction in volume and weight.
- One operator can operate the belt filter press and microwave with two systems typically located next to each other.
- 80% energy efficient.
- Dried product has no odor.
- Can be stored for over a year with no regrowth in pathogens or odor generation.
- Does not require a GBT prior to digestion system.
- Tanks and Operations Building are already existing; therefore, relatively limited concrete construction work is needed.

Disadvantages:

- Highest construction, O&M, and present worth costs of the options evaluated.
- Complexity of microwave equipment requires a qualified operator. A significant learning curve is required.
- Recordkeeping and tracking is time consuming.
- Can take 40-50 minutes before product is ready (plus start-up and clean-up time)
- Large electrical power demand. May require additional electric power service to the plant.
- Digestion system upgrades are still necessary.
6.5 Summary of Evaluation

TABLE 6-1 – Present Worth Cost Analysis of Biosolids Management Plan Alternatives

<table>
<thead>
<tr>
<th></th>
<th>High-Rate Anaerobic Digestion</th>
<th>TPAD</th>
<th>ATAD</th>
<th>Burch-Hydro BioWave™</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>$4,294,000</td>
<td>$4,543,600</td>
<td>$4,226,300</td>
<td>$4,849,000</td>
</tr>
<tr>
<td>Demolition</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$125,000</td>
<td>$180,000</td>
</tr>
<tr>
<td>Site Work</td>
<td>$25,000</td>
<td>$25,000</td>
<td>$60,000</td>
<td>$60,000</td>
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<tr>
<td>Operations Building Work</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>New Dewatering/ Storage Building*</td>
<td>$600,000</td>
<td>$600,000</td>
<td>$550,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Temporary Dewatering and Landfilling</td>
<td>$110,500</td>
<td>$110,500</td>
<td>$110,500</td>
<td>$110,500</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$5,179,500</td>
<td>$5,429,500</td>
<td>$5,121,500</td>
<td>$5,849,500</td>
</tr>
<tr>
<td>Contingency @ 30%</td>
<td>$1,554,000</td>
<td>$1,629,000</td>
<td>$1,537,000</td>
<td>$1,755,000</td>
</tr>
<tr>
<td><strong>Total Construction Cost</strong></td>
<td>$6,734,000</td>
<td>$7,059,000</td>
<td>$6,659,000</td>
<td>$7,605,000</td>
</tr>
<tr>
<td><strong>Annual O&amp;M Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>$23,200</td>
<td>$23,200</td>
<td>$78,000</td>
<td>$135,000</td>
</tr>
<tr>
<td>Labor</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$74,700</td>
<td>$79,000</td>
<td>$59,500</td>
<td>$30,550</td>
</tr>
<tr>
<td>Gas</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Hauling/Land Application</td>
<td>$16,250</td>
<td>$15,990</td>
<td>$14,910</td>
<td>$13,000</td>
</tr>
<tr>
<td><strong>Total Annual O&amp;M Cost</strong></td>
<td>$114,150</td>
<td>$118,190</td>
<td>$152,400</td>
<td>$178,550</td>
</tr>
<tr>
<td><strong>Total Present Worth Cost</strong></td>
<td>$8,358,000</td>
<td>$8,741,000</td>
<td>$8,828,000</td>
<td>$10,146,000</td>
</tr>
</tbody>
</table>

*Building includes a microwave processing area for the Burch-Hydro Biowave™ alternative.

6.6 Conclusions and Recommendation

Four biosolids management alternatives – three digestion and one microwave dryer – have been developed. Each alternative was developed and compared in terms of facility requirements, regulatory requirements, construction, annual O&M, and present worth/life-cycle costs. In addition, advantages and disadvantages of each option related to cost and non-cost parameters were identified. This information developed and analyzed assisted in arriving at the recommended Biosolids Management Plan for the Piqua WWTP.

The ATAD alternative has the lowest construction cost of the four options evaluated, and the High-Rate Anaerobic Digestion alternative has the lowest present worth cost. The TPAD option has the second lowest present worth cost with ATAD not far behind. The BioWave™ process has the highest construction and present worth costs.

The High-Rate Anaerobic Digestion alternative upgrades the existing digesters so that they will run at mesophilic and thermophilic temperatures. Although Class B biosolids (mesophilic) are still the end result, increased volatile solids destruction and volume reduction are benefits of high-rating the digesters. Anaerobic digestion is the current sludge stabilization process at the Piqua plant so the learning curve for this option would be minimal. The benefits of the TPAD option, in which part of the digestion train operates under thermophilic conditions, are increased volatile solids destruction, increased biogas production, shortened solids residence time, and the potential to generate EQ
biosolids. However, there is an increased heat demand as a result of the higher temperature; increased ammonia loading in the dewatering sidestream as a result of greater volatile solids destruction; increased polymer demand for dewatering; and added equipment and operational requirements. The thermophilic temperatures can result in an EQ biosolids product, but the batch processing mode is required and not easily achieved. The BioWave™ process is an emerging drying technology with three successful facilities in Ohio (Urbana, Zanesville, and Fredericktown). The microwave dryer generates a granular, EQ, marketable product with a 70% dry solids content. The heat-dried material can be used as a fertilizer, fertilizer supplement, or soil conditioner. The heat-dried product is easily handled, conveyed and stored. Although a marketing study would need to be conducted to verify potential end-users, this product could be blended with the end product produced at the City's yard waste composting facility. However, the drawback of this process is high energy cost and the fact that digestion upgrades must be included which significantly drives up its cost and leads to its elimination.

ATAD is a proven process that has been used for years with numerous plants throughout the US including four successful operations in Ohio (Middletown, Delphos, Bowling Green, and Portsmouth). The ATAD option would not only provide the biological stabilization benefits of digestion at a similar cost but also offer the added benefit of producing EQ biosolids. The product could also be blended with the end product produced at the City's yard waste composting facility. The ATAD system does not have the inherent digester gas handling and safety issues as with the high-rate and TPAD anaerobic digestion alternatives. Although it will require a learning curve to operate and maintain the system, the equipment is not as complex as anaerobic digestion equipment. Converting the existing digestion system to an ATAD system is straightforward. The construction cost is lower than the other anaerobic digestion alternatives, and more importantly this system is an EQ process. Based on the advantages and disadvantages presented and evaluated, the recommended Biosolids Management Plan to be implemented at the Piqua WWTP is the ATAD system with utilization of the end product via a land application and distribution and marketing program.
Section 7
Summary and Recommendations

7.1 Summary
Additional storage and treatment capacity is needed at the Piqua WWTP to eliminate the SSO and provide capacity for future system growth and development within the current and future sewer service area. Several treatment technologies are available that can meet these hydraulic demands of 7.0 MGD average day flow and 13 MGD peak day flow with a total of 6 MG flow equalization storage. Additional improvements are also necessary for the existing plant to maintain its treatment performance, reduce unnecessary manual operations, and meet regulatory demands.

Through the evaluation process, the BioActiflo biologically enhanced high-rate treatment option provides the most cost-effective treatment technology for the liquid process. For the solids treatment portion of the plant, the Autothermal Thermophilic Aerobic Digestion (ATAD) process provides the City with the lowest capital cost alternative and the ability to produce an Exceptional Quality biosolids product for beneficial reuse.

The overall recommended treatment components for the liquid process and solids process, as well as the existing plant upgrades are indicated on Figure 7-1.

7.2 Financing Options
Piqua has multiple options to finance the capital cost necessary to implement the plant expansion. A loan will be required to fund the planning, design and construction efforts. Available funding sources include multiple State of Ohio programs and municipal revenue bonds that are described below. Different options carry different requirements for approvals as well as payment terms and interest rates.

- **Water Pollution Control Loan Fund (WPCLF)** is administered through Ohio EPA Department of Environmental and Financial Assistance (DEFA). Funds are available through this agency for planning, design, and construction phases of the project. Discussions with Ohio EPA/DEFA staff indicate that their funding is aimed at addressing existing problems instead of funding growth. Standard loan rates through WPCLF are currently at 2.63% both for 20 years for construction and for 5 years for planning and design; which can be rolled into the construction loan. There is a loan application fee of 0.35% of the project amount. A discount of up to 0.2% on the interest rate is available for conversion from Class B Biosolids to Exceptional Quality Biosolids processes. The value of savings on the loan amount is limited to the cost of the facilities needed to accomplish the sludge processing enhancement. It is necessary for Ohio EPA/DEFA to review the facilities planning and complete an environmental review similar to the one prepared for the EQ basin project. The environmental review will require the issuance of a Finding of No Significant Impact (FONSI) prior to the award of the design loan.
Figure 7-1
Recommended Improvements

- New 3 MG Flow Equalization Basin
- New EQ Basin Influent Pump Station
- Abandon Existing Raw Sewage Pump Station
- New Fine Screens (2) and Raw Sewage Pump Station
- ATAD Equipment and Digester Conversion
- New 1-m Gravity Belt Thickeners (2)
- New UV Disinfection Reactors (2)
- New Flow Meter
- Demolish Chlorination/Dechlorination Building
- New Sludge Cake Storage Building and 1-m Belt Filter Presses (2)
- New BioActiflo Treatment System
Ohio Water Development Authority (OWDA) provides a variety of funding for planning, design, and construction of wastewater facilities under their Freshwater Program without regard for whether the project is funding growth or is addressing existing problems. Rates are currently 3.86% for communities the size of Piqua (over 5,000 population) for both design and construction loans; with a potential discount of 0.5% for communities with prior borrowing experience with OWDA (which Piqua has) for construction projects up to $25 million in any one calendar year. No discounts are available for construction projects over $25 million. There is a loan application fee of 0.35% of the project amount. Unlike with WPCLF funding, this source of funds has the advantage of ready availability and funding payment terms of up to 30 years are available. Like with WPCLF, this funding source is also without the issuance and coverage costs of conventional revenue bonding.

OWDA is considering a program change that would affect short-term loans for planning and design, which could be rolled into a future construction loan. These rates for short term design loans may be lower than current WPCLF rates and could provide an alternative source of funding for the design phase. The OWDA board will also be considering changing from the Bond Buyer GO 20 Bond Index as the basis of calculating rates that could lower basic rates for the Freshwater Program. How these potential program changes would affect funding for Piqua was estimated by OWDA as follows.

- 1.98% for 5 years for a short-term design loan
- 2.71% for 20 years (blended rate) for a $30 million loan
- 3.02% for 30 years (blended rate) for a $30 million loan

While it is not certain that these modifications will be approved by the Board, it is likely that these changes will be accepted. Currently OWDA and Ohio EPA management staff are reviewing these changes (which may also be reflected in changes to the WPCLF rates) and expect that a determination on whether fundamental changes to the rates will be accomplished by October of 2012. Such changes should be monitored on a continuing basis and considered as part of the City’s final project funding planning, especially if schedule becomes a significant concern for the City. With OWDA, it is possible to secure funding within a month.

Ohio Department of Development has funds available to assist communities and encourage industrial and commercial development based on formulas linked to the number of new jobs created. These programs are generally aimed at specific large-scale employment opportunities, but may be available for limited funding of infrastructure for smaller projects. To qualify for these funds, it is essential to have specific economic development plans with demonstrable economic impact. At this time, this is not a viable source for the current improvements, but should be considered for future industrial developments to be located in Piqua.

Community Development Block Grant (CDBG) funds are generally limited and are available for low and moderate income areas. The funds are usually restricted to addressing existing problems. Seeking these funds would be most appropriate for wastewater collection system improvements specifically directed at economically disadvantaged portions of the community.

Ohio Public Works Commission (OPWC) provides a grant/loan program in which interest rates and mix of grant and loan percentages will vary. Project awards are competitive with other projects in Ohio, and an award would require significant effort to secure. Competition is
likely from other projects needing financial support in a multi-county district. A request for participation on a single project element may be advantageous, i.e. implementation of a part of the off-site piping work (siphon improvements) could be submitted for consideration.

- **Conventional bonding** involves variable rates depending on market conditions and community bond rating and possibly requiring bond insurance. Current interest rates for AA rated, 20 year maturity municipal (general obligation) bonds found on internet listings are approximately 0.5 to 4.0% and revenue bonds would typically be higher. More detailed information on current bond market funding as it relates to Piqua should be obtained from the City’s financial advisor. Note that use of general obligation bonds may adversely affect the City’s ability to borrow for other necessary projects, as the total general obligation indebtedness is limited.

### Table 7-1: Most Viable State Funding Loan Programs

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Availability</th>
<th>Loan Admin. Fee</th>
<th>Current Interest Rates</th>
<th>Loan Period</th>
<th>Interest Rate Discounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPCLF</td>
<td>Planning Design</td>
<td>0.35 % of Total</td>
<td>2.63 %</td>
<td>5 years</td>
<td>• 0.2 % for upgrade to Exceptional Quality Biosolids production</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>0.35 % of Total</td>
<td>2.63 %</td>
<td>20 years</td>
<td></td>
</tr>
<tr>
<td>OWDA</td>
<td>Planning Design</td>
<td>0.35 % of Total</td>
<td>3.86 %</td>
<td>5 years</td>
<td>• 0.5 % for prior Ohio EPA customers</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>0.35 % of Total</td>
<td>3.86 %</td>
<td>Up to 30 years</td>
<td>• 0.5 % for Ohio EPA Findings and Orders or documented health risk</td>
</tr>
</tbody>
</table>

*1. Interest rates are subject to change on a monthly basis, and are anticipated to be significantly changed for OWDA funding mechanisms.*

### 7.3 Recommendations

Ohio EPA will require pilot testing of the BioActiflo system. This testing will provide the necessary technical data to design the system, including hydraulic retention times, treatment performance, and better insight to the operations of the treatment technology.

Additional ultraviolet transmittance (UVT) data should be collected on the current plant’s effluent to support the UV disinfection system design. Initial testing for average and high flows during two events in December 2011 provides some insight that the plant produces effluent quality with high enough UVT to facilitate this new disinfection system. However, more data should be collected to support design and system sizing needs and provide more confidence in the equipment selection to continue to meet the NPDES disinfection requirements.

The City has several financing options that can be considered for the design and construction of the recommended improvements. Discussions should continue with OWDA to determine if the program changes to enable more favorable short-term rates for the design services, which would also enable a faster project start because they do not require an environmental review like Ohio EPA/DEFA, which can require approximately 6 months. Dividing the project into separate phases and loans can stagger
the construction costs in different years to fall below the $25 million threshold to achieve optimal interest rate discounts through OWDA.

The recommended alternative cost summary for construction costs and overall project cost is provided in Table 7-2.

**TABLE 7-2: Recommended Alternative Cost Summary**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected Liquid Treatment Alternative Alt. 4 – BioActiflo Parallel to Upgraded Existing Plant</td>
<td>$22,000,000</td>
</tr>
<tr>
<td>Selected Solids Processing Alternative Alt. 3 - ATAD</td>
<td>$6,659,000</td>
</tr>
<tr>
<td>Preliminary Opinion of Probable Construction Cost</td>
<td>$28,659,000</td>
</tr>
<tr>
<td>Preliminary Engineering &amp; Detailed Design</td>
<td>$2,841,000</td>
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<tr>
<td>Construction Phase Engineering Services and RPR</td>
<td>$3,500,000</td>
</tr>
<tr>
<td><strong>Total Estimated Project Cost</strong></td>
<td><strong>$35,000,000</strong></td>
</tr>
</tbody>
</table>

### 7.4 Schedule

Implementing the recommended improvements should follow a normal progression of design and construction, and include necessary times for regulatory review and plan approvals. The anticipated schedule of activities and milestones are presented in Table 7-3.

**TABLE 7-3: Project Implementation Schedule**

<table>
<thead>
<tr>
<th>Activity/Milestone</th>
<th>Approximate Dates</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio EPA Facility Plan Approval</td>
<td>8/2012 – 12/2012</td>
<td>5</td>
</tr>
<tr>
<td>Ohio EPA PTI Approval</td>
<td>8/2014 – 12/2014</td>
<td>5</td>
</tr>
<tr>
<td>Advertise for Bids</td>
<td>1/2015 – 2/2015</td>
<td>1</td>
</tr>
<tr>
<td>Award Construction Contract</td>
<td>3/2015</td>
<td></td>
</tr>
<tr>
<td>Begin Construction</td>
<td>4/2015</td>
<td></td>
</tr>
</tbody>
</table>

The City’s NPDES permit expires on January 31, 2016, which is also the milestone for eliminating the SSO. This anticipated schedule would not meet that deadline to account for the work and timing necessary to complete the construction activities. The City has limited options to advance the schedule given the required regulatory review periods and anticipated durations for preliminary design, detailed design, and construction.
Application No. OH0027049

Issue Date: June 24, 2011

Effective Date: August 1, 2011

Expiration Date: January 31, 2016

Ohio Environmental Protection Agency
Authorization to Discharge Under the
National Pollutant Discharge Elimination System

In compliance with the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq., hereinafter referred to as the "Act"), and the Ohio Water Pollution Control Act (Ohio Revised Code Section 6111),

City of Piqua

is authorized by the Ohio Environmental Protection Agency, hereinafter referred to as "Ohio EPA," to discharge from the City of Piqua wastewater treatment works located at 121 Bridge Street, Piqua, Ohio, Miami County and discharging to the Great Miami River in accordance with the conditions specified in Parts I, II, and III of this permit.

This permit is conditioned upon payment of applicable fees as required by Section 3745.11 of the Ohio Revised Code.

This permit and the authorization to discharge shall expire at midnight on the expiration date shown above. In order to receive authorization to discharge beyond the above date of expiration, the permittee shall submit such information and forms as are required by the Ohio EPA no later than 180 days prior to the above date of expiration.

_________________
Scott J. Nally
Director

Total Pages: 45
Part I, A. - INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of the permit and lasting until 12 months from the effective date of the permit, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from the following outfall: 1PD00008001. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

Table - Final Outfall - 001 - Interim

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Parameter</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Concentration Specified Units</td>
<td>Loading* kg/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum Minimum Weekly Monthly Daily Weekly Monthly</td>
<td></td>
</tr>
<tr>
<td>00010 - Water Temperature - C</td>
<td>- -</td>
<td>- - - - -</td>
<td>1/Day</td>
</tr>
<tr>
<td>00300 - Dissolved Oxygen - mg/l</td>
<td>- 5.0</td>
<td>- - -</td>
<td>1/Day</td>
</tr>
<tr>
<td>00530 - Total Suspended Solids - mg/l</td>
<td>- -</td>
<td>30 20</td>
<td>3/Week</td>
</tr>
<tr>
<td>00530 - Total Suspended Solids - mg/l</td>
<td>- -</td>
<td>45 30</td>
<td>3/Week</td>
</tr>
<tr>
<td>00552 - Oil and Grease, Hexane Extr Method - mg/l</td>
<td>10</td>
<td>- - -</td>
<td>1/Month</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- -</td>
<td>22.5 15</td>
<td>3/Week</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- -</td>
<td>4.8 3.2</td>
<td>3/Week</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- -</td>
<td>13.5 9.0</td>
<td>3/Week</td>
</tr>
<tr>
<td>00625 - Nitrogen Kjeldahl, Total - mg/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Month</td>
</tr>
<tr>
<td>00630 - Nitrite Plus Nitrate, Total - mg/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Month</td>
</tr>
<tr>
<td>00665 - Phosphorus, Total (P) - mg/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Week</td>
</tr>
<tr>
<td>00719 - Cyanide, Free - mg/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01009 - Barium, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01074 - Nickel, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01079 - Silver, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01094 - Zinc, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01113 - Cadmium, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>01114 - Lead, Total Recoverable - ug/l</td>
<td>- -</td>
<td>- -</td>
<td>1/Quarter</td>
</tr>
<tr>
<td>Parameter</td>
<td>Concentration Specified Units</td>
<td>Loading* kg/day</td>
<td>Measuring Frequency</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------</td>
<td>----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>Maximum Minimum Weekly Monthly Daily Weekly Monthly</td>
<td>1/Quarter 24hr Composite</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>Loading* kg/day</td>
<td>Measuring Frequency</td>
<td>Sampling Type</td>
</tr>
<tr>
<td>01118 - Chromium, Total Recoverable - ug/l</td>
<td>- - - - - - - -</td>
<td>1/Quarter 24hr Composite</td>
<td>Quarterly</td>
</tr>
<tr>
<td>01119 - Copper, Total Recoverable - ug/l</td>
<td>- - - - - - - -</td>
<td>1/Quarter 24hr Composite</td>
<td>Quarterly</td>
</tr>
<tr>
<td>01220 - Chromium, Dissolved Hexavalent - ug/l</td>
<td>- - - - - - - -</td>
<td>1/Quarter 24hr Composite</td>
<td>Quarterly</td>
</tr>
<tr>
<td>31616 - Fecal Coliform - #/100 ml</td>
<td>- - 2000 1000 - - - -</td>
<td>3/Week Grab</td>
<td>Summer</td>
</tr>
<tr>
<td>31648 - E. coli - #/100 ml</td>
<td>- - - - - - - -</td>
<td>3/Week Grab</td>
<td>Summer</td>
</tr>
<tr>
<td>50050 - Flow Rate - MGD</td>
<td>- - - - - - - -</td>
<td>1/Day Continuous</td>
<td>All</td>
</tr>
<tr>
<td>50060 - Chlorine, Total Residual - mg/l</td>
<td>0.035 - - - - - -</td>
<td>1/Day Multiple Grab</td>
<td>Summer</td>
</tr>
<tr>
<td>50092 - Mercury, Total (Low Level) - ng/l</td>
<td>- - - - - - - -</td>
<td>1/Month Grab</td>
<td>All</td>
</tr>
<tr>
<td>61425 - Acute Toxicity, Ceriodaphnia dubia - TUA</td>
<td>- - - - - - - -</td>
<td>1/Year 24hr Composite</td>
<td>September</td>
</tr>
<tr>
<td>61426 - Chronic Toxicity, Ceriodaphnia dubia - TCc</td>
<td>- - - - - - - -</td>
<td>1/Year 24hr Composite</td>
<td>September</td>
</tr>
<tr>
<td>61427 - Acute Toxicity, Pimephales promelas - TUA</td>
<td>- - - - - - - -</td>
<td>1/Year 24hr Composite</td>
<td>September</td>
</tr>
<tr>
<td>61428 - Chronic Toxicity, Pimephales promelas - TUC</td>
<td>- - - - - - - -</td>
<td>1/Year 24hr Composite</td>
<td>September</td>
</tr>
<tr>
<td>61941 - pH, Maximum - S.U.</td>
<td>9.0 - - - - - -</td>
<td>1/Day Multiple Grab</td>
<td>All</td>
</tr>
<tr>
<td>61942 - pH, Minimum - S.U.</td>
<td>- 6.5 - - - - - -</td>
<td>1/Day Multiple Grab</td>
<td>All</td>
</tr>
<tr>
<td>70300 - Residue, Total Filterable - mg/l</td>
<td>- - - - - - - -</td>
<td>1/Quarter 24hr Composite</td>
<td>Quarterly</td>
</tr>
<tr>
<td>80082 - CBOD 5 day - mg/l</td>
<td>- - 23 15 - 392 256</td>
<td>3/Week 24hr Composite</td>
<td>Summer</td>
</tr>
<tr>
<td>80082 - CBOD 5 day - mg/l</td>
<td>- - 40 23 - 682 392</td>
<td>3/Week 24hr Composite</td>
<td>Winter</td>
</tr>
</tbody>
</table>

Notes for station 1PD00008001:

- Effluent loadings based on average design flow of 4.5 MGD.
- Total residual chlorine - See Part II, Item J.
- Nickel, silver, zinc, cadmium, lead, total chromium, and copper - See Part II, Item M.
- Dissolved hexavalent chromium - See Part II, Item N.
- Mercury - See Part II, Items N and U.

- Free cyanide - See Part II, Items N and T.

- Dissolved oxygen and pH (minimum) - Report critical low value.

- pH (maximum) - Report critical maximum value.

- Whole effluent toxicity - See Part II, Item W.
### Table - Final Outfall - 001 - Final

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Concentration Specified Units</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>00101 - Water Temperature - °C</td>
<td>- - - - - -</td>
<td>1/Day</td>
<td>Maximum Indicating Thermometer</td>
</tr>
<tr>
<td>00300 - Dissolved Oxygen - mg/l</td>
<td>- 5.0 - - - -</td>
<td>1/Day</td>
<td>Multiple Grab</td>
</tr>
<tr>
<td>00530 - Total Suspended Solids - mg/l</td>
<td>- - 45 30 - 768 512</td>
<td>3/Week</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00530 - Total Suspended Solids - mg/l</td>
<td>- - 30 20 - 512 341</td>
<td>3/Week</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00552 - Oil and Grease, Hexane Extr Method - mg/l</td>
<td>10 - - - - - -</td>
<td>1/Month</td>
<td>Grab</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- - 13.5 9.0 - 230 153</td>
<td>3/Week</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- - 4.4 2.9 - 74.9 49.4</td>
<td>3/Week</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00625 - Nitrogen Kjeldahl, Total - mg/l</td>
<td>- - - - - -</td>
<td>1/Month</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00630 - Nitrite Plus Nitrate, Total - mg/l</td>
<td>- - - - - -</td>
<td>1/Month</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00665 - Phosphorus, Total (P) - mg/l</td>
<td>- - - - - -</td>
<td>1/Week</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>00719 - Cyanide, Free - mg/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>Grab</td>
</tr>
<tr>
<td>01099 - Barium, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>01074 - Nickel, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>01079 - Silver, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>01094 - Zinc, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>01113 - Cadmium, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>01114 - Lead, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter</td>
<td>24hr Composite</td>
</tr>
<tr>
<td>Effluent Characteristic</td>
<td>Concentration Specified Units</td>
<td>Discharge Limitations</td>
<td>Monitoring Requirements</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>01118 - Chromium, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter 24hr Composite Quarterly</td>
<td></td>
</tr>
<tr>
<td>01119 - Copper, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>1/Month 24hr Composite All</td>
<td></td>
</tr>
<tr>
<td>01220 - Chromium, Dissolved Hexavalent - ug/l</td>
<td>- - - - - -</td>
<td>1/Quarter Grab Quarterly</td>
<td></td>
</tr>
<tr>
<td>31648 - E. coli -#/100 ml</td>
<td>- - 284 126</td>
<td>3/Week Grab Summer</td>
<td></td>
</tr>
<tr>
<td>50050 - Flow Rate - MGD</td>
<td>- - - - - -</td>
<td>1/Day Continuous All</td>
<td></td>
</tr>
<tr>
<td>50060 - Chlorine, Total Residual - mg/l</td>
<td>0.035 - - - -</td>
<td>1/Day Multiple Grab Summer</td>
<td></td>
</tr>
<tr>
<td>50092 - Mercury, Total (Low Level) - ng/l</td>
<td>- - - - - -</td>
<td>1/Month Grab All</td>
<td></td>
</tr>
<tr>
<td>61425 - Acute Toxicity, Ceriodaphnia dubia - TUA</td>
<td>- - - - - -</td>
<td>1/Year 24hr Composite September</td>
<td></td>
</tr>
<tr>
<td>61426 - Chronic Toxicity, Ceriodaphnia dubia - TUC</td>
<td>- - - - - -</td>
<td>1/Year 24hr Composite September</td>
<td></td>
</tr>
<tr>
<td>61427 - Acute Toxicity, Pimephales promelas - TUA</td>
<td>- - - - - -</td>
<td>1/Year 24hr Composite September</td>
<td></td>
</tr>
<tr>
<td>61428 - Chronic Toxicity, Pimephales promelas - TUC</td>
<td>- - - - - -</td>
<td>1/Year 24hr Composite September</td>
<td></td>
</tr>
<tr>
<td>61941 - pH, Maximum - S.U.</td>
<td>9.0 - - - -</td>
<td>1/Day Multiple Grab All</td>
<td></td>
</tr>
<tr>
<td>61942 - pH, Minimum - S.U.</td>
<td>- 6.5 - - - -</td>
<td>1/Day Multiple Grab All</td>
<td></td>
</tr>
<tr>
<td>70300 - Residue, Total Filterable - mg/l</td>
<td>- - - - - -</td>
<td>1/Quarter 24hr Composite Quarterly</td>
<td></td>
</tr>
<tr>
<td>80082 - CBOD 5 day - mg/l</td>
<td>- - 40 23 - 682 392</td>
<td>3/Week 24hr Composite Winter</td>
<td></td>
</tr>
<tr>
<td>80082 - CBOD 5 day - mg/l</td>
<td>- - 23 15 - 392 256</td>
<td>3/Week 24hr Composite Summer</td>
<td></td>
</tr>
</tbody>
</table>

Notes for station 1PD00008001:

* Effluent loadings based on average design flow of 4.5 MGD.
- Total residual chlorine - See Part II, Item J.
- Nickel, silver, zinc, cadmium, lead, total chromium, and copper - See Part II, Item M.
- Dissolved hexavalent chromium - See Part II, Item N.
- Mercury - See Part II, Items N and U.

- Free cyanide - See Part II, Items N and T.

- Dissolved oxygen and pH (minimum) - Report critical low value.

- pH (maximum) - Report critical maximum value.

- Whole effluent toxicity - See Part II, Item W.
Part I, B. - DOWNSTREAM-NEARFIELD MONITORING REQUIREMENTS

6. Downstream-Nearfield Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor the receiving stream, downstream of the point of discharge, at Station Number 1PD00008901, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sampling.

Table - Downstream-Nearfield Monitoring - Final

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Concentration Specified Units</td>
<td>Measuring Frequency</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>00010 - Water Temperature - C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00300 - Dissolved Oxygen - mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00400 - pH - S.U.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00630 - Nitrate Plus Nitrate, Total - mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00665 - Phosphorus, Total (P) - mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00900 - Hardness, Total (CaCO3) - mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>01119 - Copper, Total Recoverable - ug/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31648 - E. coli - #/100 ml</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

NOTES for Station Number 1PD00008901:
- Nitrite plus nitrate, phosphorus and copper - See Part II, Item M.
Part I, B. - SSO MONITORING EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. SSO Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor at Station Number 1PD00008300, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sampling.

Table - SSO Monitoring - 300 - Final

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter</td>
<td>Concentration Specified Units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum Minimum Weekly Monthly Daily Weekly Monthly</td>
</tr>
<tr>
<td>74062 - Overflow Occurrence - No./Month</td>
<td>- - - - - - -</td>
<td>1/Month Total All</td>
</tr>
</tbody>
</table>

NOTES for Station Number 1PD00008300:

- A sanitary sewer overflow is an overflow, spill, release, or diversion of wastewater from a sanitary sewer system. These overflows shall be monitored when they discharge. Only sanitary sewer overflows that enter waters of the state, either directly or through a storm sewer or other conveyance, must be reported under this monitoring station.

- For the purpose of counting occurrences, each location on the sanitary sewer system where there is an overflow, spill, release, or diversion of wastewater on a given day that enters waters of the state is counted as one occurrence. For example, if on a given day overflows occur from a manhole at one location and from a damaged pipe at another location and they both enter waters of the state, record two occurrences for that day. If overflows from both locations continue on the following day, record two occurrences for the following day. At the end of the month, total the daily occurrences and report this number in the first column of the first day of the month on the 4500 form. If there are no overflows during the entire month, report "zero" (0).

- All sanitary sewer overflows are prohibited.

- See Part II, Items D and E.
### Part I, B. - SLUDGE MONITORING REQUIREMENTS

2. Sludge Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor the treatment works' final sludge at Station Number 1PD00008581, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sludge sampling.

**Table - Sludge Monitoring - 581 - Final**

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Concentration Specified Units</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>00611 - Ammonia (NH3) In Sludge - mg/kg</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>00627 - Nitrogen Kjeldahl, Total In Sludge - mg/kg</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>00668 - Phosphorus, Total In Sludge - mg/kg</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>00938 - Potassium In Sludge - mg/kg</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01003 - Arsenic, Total In Sludge - mg/kg</td>
<td>75 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01028 - Cadmium, Total In Sludge - mg/kg</td>
<td>85 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01043 - Copper, Total In Sludge - mg/kg</td>
<td>4300 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01052 - Lead, Total In Sludge - mg/kg</td>
<td>840 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01068 - Nickel, Total In Sludge - mg/kg</td>
<td>420 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01093 - Zinc, Total In Sludge - mg/kg</td>
<td>7500 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>01148 - Selenium, Total In Sludge - mg/kg</td>
<td>100 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>51129 - Sludge Fee Weight - dry tons</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Total Semi-annual</td>
</tr>
<tr>
<td>70316 - Sludge Weight - Dry Tons</td>
<td>- - - - -</td>
<td>- - - - -</td>
<td>2/Year Total Semi-annual</td>
</tr>
<tr>
<td>71921 - Mercury, Total In Sludge - mg/kg</td>
<td>57 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
<tr>
<td>78465 - Molybdenum In Sludge - mg/kg</td>
<td>75 - - - -</td>
<td>- - - - -</td>
<td>2/Year Composite Semi-annual</td>
</tr>
</tbody>
</table>

**NOTES for Station Number 1PD00008581:**

- Monitoring is required when sewage sludge is removed from the permittee’s facility for application to the land. The monitoring data shall be reported on the June and December Discharge Monitoring Report (DMR). The monitoring data can be collected at any time during the reporting period.
- Metal pollutant analysis must be completed during each reporting period, whether sewage sludge is removed from the facility or not, or the number of composite samples collected and reported shall be increased prior to the next land application event to account for the reporting period(s) in which land application did not occur, unless all previously accumulated sewage sludge has been removed and disposed of via a landfill, through incineration or by transfer to another treatment works.

- If no sewage sludge is removed from the facility during the reporting period, enter the results for the metal analysis in eDMR or on the 4500 report and enter "0" for sludge weight and sludge fee weight.

- If no sewage sludge is removed from the facility during the reporting period and no metal analysis is completed during the reporting period, the permittee shall report under station 581 in the following manner: select the "No Discharge" check box on the data entry form. PIN the eDMR.

- If metal analysis has not been completed previously during each reporting period: when sewage sludge is removed from the facility all metal analysis results shall be reported on the applicable DMR by entering the separate results on different days within the DMR. For example, if no sewage sludge has been removed from the facility for a full calendar year, and quarterly monitoring is required by the permit, then five (four from the previous year and one for the current monitoring period) separate composite samples of the sewage sludge are required to be collected and analyzed for metals prior to removal from the facility. The first sample result may be entered on the first day of the DMR, the second result on the second day of the DMR, and so on. A note may then be added to indicate the actual day(s) when the samples were collected.

- It is recommended that composite samples of the sewage sludge be collected and analyzed close enough to the time of land application to be reflective of the sludge’s current quality, but not so close that the results of the analysis are not available prior to land applying the sludge.

- The permittee shall maintain the appropriate records on site to verify that the requirements of Pathogen Reduction and Vector Attraction Reduction have been met.

- Units of mg/kg are on a dry weight basis.

- Sludge weight is a calculated total for the year. To convert from gallons of liquid sewage sludge to dry tons of sewage sludge: dry tons = gallons x 8.34 (lbs/gallon) x 0.0005 (tons/lb) x decimal fraction total solids.

- Sludge fee weight means sludge weight, in dry U.S. tons, excluding any admixtures such as liming material or bulking agents.

- See Part II, Items P, Q, R, and S.
3. Sludge Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor the treatment works' final sludge at Station Number 1PD00008586, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sludge sampling.

Table - Sludge Monitoring - 586 - Final

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration Specified Units</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>51129 - Sludge Fee Weight - dry tons</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

NOTES for Station Number 1PD00008586-

- Monitoring is required when sewage sludge is removed from the permittee’s facility for disposal in a mixed solid waste landfill. The total Sludge Fee Weight of sewage sludge disposed of in a mixed solid waste landfill for the entire year shall be reported on the December Discharge Monitoring Report (DMR).

- If no sewage sludge is removed from the Permittee’s facility for disposal in a mixed solid waste landfill during the year select the "No Discharge" check box on the data entry form. PIN the eDMR.

- Sludge fee weight means sludge weight, in dry U.S. tons, excluding any admixtures such as liming material or bulking agents.

- See Part II, Items P, R, and S.
**Part I, B. - INFLUENT MONITORING REQUIREMENTS**

4. Influent Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor the treatment works' influent wastewater at Station Number 1PD00008601, and report to the Ohio EPA in accordance with the following table. Samples of influent used for determination of net values or percent removal must be taken the same day as those samples of effluent used for that determination. See Part II, OTHER REQUIREMENTS, for location of influent sampling.

Table - Influent Monitoring - 601 - Final

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effluent Characteristic</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Concentration Specified Units</td>
<td>Loading* kg/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum Minimum Weekly Monthly Daily Weekly Monthly</td>
<td>All-------</td>
</tr>
<tr>
<td>00400 - pH - S.U.</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>00530 - Total Suspended Solids - mg/l</td>
</tr>
<tr>
<td>00719 - Cyanide, Free - mg/l</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>01079 - Nickel, Total Recoverable - ug/l</td>
</tr>
<tr>
<td>01074 - Nickel, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>01094 - Zinc, Total Recoverable - ug/l</td>
</tr>
<tr>
<td>01113 - Cadmium, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>01114 - Lead, Total Recoverable - ug/l</td>
</tr>
<tr>
<td>01118 - Chromium, Total Recoverable - ug/l</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>01119 - Copper, Total Recoverable - ug/l</td>
</tr>
<tr>
<td>01220 - Chromium, Dissolved Hexavalent - ug/l</td>
<td>- - - - - -</td>
<td>- - - - - -</td>
<td>80082 - CBOD 5 day - mg/l</td>
</tr>
</tbody>
</table>

NOTES for Station Number 1PD00008601:
- Nickel, silver, zinc, cadmium, lead, total chromium and copper - See Part II, Item N.
- Dissolved hexavalent chromium - See Part II, Item O.
- Free cyanide - See Part II, Item O and T.
- Mercury - See Part II, Items O and U.
Part I, B. - UPSTREAM MONITORING REQUIREMENTS

5. Upstream Monitoring. During the period beginning on the effective date of the permit and lasting until the expiration date of the permit, the permittee shall monitor the receiving stream, upstream of the point of discharge at Station Number 1PD00008801, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sampling.

Table - Upstream Monitoring - 801 - Final

<table>
<thead>
<tr>
<th>Effluent Characteristic</th>
<th>Discharge Limitations</th>
<th>Monitoring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentration Specified Units</td>
<td>Loading* kg/day</td>
</tr>
<tr>
<td></td>
<td>Maximum Minimum Weekly Monthly Daily Weekly Monthly</td>
<td></td>
</tr>
<tr>
<td>00010 - Water Temperature - °C</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>00300 - Dissolved Oxygen - mg/l</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>00400 - pH - S.U.</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>00610 - Nitrogen, Ammonia (NH3) - mg/l</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>00630 - Nitrite Plus Nitrate, Total - mg/l</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>00665 - Phosphorus, Total (P) - mg/l</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>31648 - E. coli - #/100 ml</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>61432 - 48-Hr. Acute Toxicity Ceriodaphnia dubia - % Affected</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>61435 - 96-Hr. Acute Toxicity Pimephales promela - % Affected</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>61438 - 7-Day Chronic Toxicity Ceriodaphnia dubia - % Affected</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
<tr>
<td>61441 - 7-Day Chronic Toxicity Pimephales promelas - % Affected</td>
<td>- - - - -</td>
<td>- - - - -</td>
</tr>
</tbody>
</table>

NOTES for Station Number 1PD00008801:
- Whole effluent toxicity - See Part II, Item W.
Part I, C - Schedule of Compliance

1. E. coli and Summer Ammonia Limits Schedule

The permittee shall achieve compliance with the final effluent limits for Escherichia coli and ammonia-nitrogen during the months of June - September as soon as possible, but not later than the dates developed in accordance with the following schedule:

a. The permittee shall evaluate the ability of its existing treatment facilities to meet the final effluent limits for E. coli and ammonia-N (June - September) at outfall 1PD00008001.

b. Not later than 6 months from the effective date of this permit, the permittee shall submit to the Ohio EPA Southwest District Office a brief status report on the ability of its existing treatment facilities to meet the final effluent limits for E. coli and ammonia-N (June - September) or on plant improvements necessary to meet the final effluent limits. (Event Code 95999)

c. If the permittee determines that its existing treatment facilities are not capable of meeting the final effluent limits for E. coli and ammonia-N (June - September), not later than 6 months from the effective date of this permit, the permittee shall submit an approvable Permit To Install, if necessary, for plant improvements necessary to meet the final effluent limits.

d. Not later than 9 months from the effective date of this permit, the permittee shall commence construction, if necessary, for plant improvements to meet the final effluent limits for e. coli and ammonia-N (June - September).

e. Not later than 12 months from the effective date of this permit, the permittee shall achieve the final effluent limits for E. coli and ammonia-N (June - September) at outfall 1PD0008001. (Event code 05699)

f. The permittee shall notify the Ohio EPA Southwest District Office in writing within 7-days of achieving compliance with the final effluent limits for E. coli and ammonia-N (June - September).

2. Municipal Sanitary Sewer Overflow (SSO) Schedule

Sanitary sewer overflows on the permittee's collection system are not authorized by this permit, including the provisions in this schedule of compliance.

The permittee shall complete the actions described below as soon as possible, but not later than the dates included in the following schedule:
a. The permittee shall evaluate the impacts that construction of the equalization basin and other improvements have had on the West Interceptor Sewer SSO located just upstream of the wastewater plant. From February through October 2011 the City shall complete flow monitoring, update its interceptor model, recalibrate the interceptor model and evaluate alternatives to eliminate the SSO.

b. The permittee shall expand its interceptor-only model to include its major trunk sewers. From February through August 2011, the City shall complete the necessary flow monitoring, update its interceptor model and complete model calibration.

c. Not later than June 30 2012, the permittee shall submit two copies of a collection system master plan to the Ohio EPA Southwest District Office. The master plan shall include a prioritized list of projects that the City must complete to eliminate the West Interceptor Sewer sanitary sewer overflow. (Event Code 01299)

d. Not later than December 31, 2012, the permittee shall submit an approvable Permit-to-Install application(s) and detailed plans, if necessary, for the projects to eliminate the SSO.

e. Not later than August 31, 2013, the permittee shall begin construction, if necessary, of projects to eliminate the SSO.

f. Not later than January 31, 2016, the permittee shall complete all work identified as necessary to eliminate the West Interceptor Sewer SSO. (Event Code 04599)

g. The permittee shall notify the Ohio EPA Southwest District Office within 7 days of completing all work identified as necessary to eliminate the sanitary sewer overflow.

h. Beginning on June 1, 2013 and annually thereafter, the permittee shall submit to the Ohio EPA Southwest District Office a written status report on all work completed during the previous 12 months to eliminate the West Interceptor Sewer SSO. (Event Code 03599)

3. Municipal Pretreatment Schedule

a. The permittee shall evaluate the adequacy of local industrial user limitations to attain compliance with final table limits. A technical justification for revising local industrial user limitations to attain compliance with final table limits, along with a pretreatment program modification request, or technical justification for retaining existing local industrial user limitations shall be submit to Ohio EPA, Central Office Pretreatment Unit, in duplicate, as soon as possible, but no later than 6 months after the effective date of this permit. (Event Code 52599)
Technical justification is required for arsenic, cadmium, total chromium, dissolved hexavalent chromium, copper, free cyanide, lead, molybdenum, nickel, selenium, silver and zinc unless screening of wastewater and sludge indicate these pollutants are not present in significant amounts. Furthermore, technical justification is required for any other pollutants where a local limit may be necessary to protect against pass through and interference.

a. To demonstrate technical justification for new local industrial user limits or justification for retaining existing limits, the following information must be submitted to Ohio EPA:

i. Treatment plant flow, domestic/background concentrations, and industrial flows to which local limits will be applied.

ii. Treatment plant removal efficiencies.

iii. A comparison of maximum allowable headworks loadings based on all applicable criteria. Criteria may include sludge disposal, NPDES permit limits, waste load allocation values, and interference with biological processes such as activated sludge, sludge digestion, nitrification, etc.

iv. If revised industrial user discharge limits are proposed, the method of allocating available pollutant loads to industrial users.

v. Supporting data, assumptions, and methodologies used in establishing the information in item a.i through iv above.

b. If revisions to local industrial user limitations including best management practices are determined to be necessary, no later than 2 months after the date of Ohio EPA's approval, the permittee shall incorporate revised local industrial user limitations in all industrial user control documents.

c. The permittee shall evaluate the adequacy of local industrial user limitations for mercury. A technical justification for revising local industrial user limitations, along with a pretreatment program modification request, or technical justification for retaining existing local industrial user limitations shall be submitted to Ohio EPA, Central Office Pretreatment Unit, in duplicate, as soon as possible, but no later than 6 months from the effective date of this permit. (Event Code 52599)
To demonstrate technical justification for new local industrial user limits or justification for retaining existing limits, the following information must be submitted to Ohio EPA:

i. Treatment plant flow, domestic/background concentrations, and industrial flows to which local limits will be applied. When representative sampling of the collection system and industrial pollutant contributors conducted using EPA Method 245.1 or 245.2 shows mercury concentrations that are below detection, EPA Method 1631 or 245.7 shall be used to quantify domestic/background and industrial pollutant contributions of mercury.

ii. Treatment plant removal efficiencies. When representative sampling of the influent and effluent conducted using EPA Method 245.1 or 245.2 shows mercury concentrations that are below detection, EPA Method 1631 or 245.7 shall be used to quantify influent and effluent mercury concentrations.

iii. A comparison of maximum allowable headworks loadings based on all applicable criteria. Criteria may include sludge disposal, NPDES permit limits, waste load allocation values, and interference with biological processes such as activated sludge, sludge digestion, nitrification, etc.

iv. If industrial user discharge limits are proposed, the method of allocating available pollutant loads to industrial users. When appropriate, industrial user discharge limits may include narrative local limits requiring industrial users to develop and implement best management practices for mercury. These narrative local limits may be used either alone or as a supplement to a numeric limit.

v. Supporting data, assumptions, and methodologies used in establishing the information in Item c.i. through iv above.

d. If revisions to local industrial user limitations for mercury are required, no later than 2 months after the date of Ohio EPA’s approval, the permittee shall incorporate revised local industrial user limitations in all industrial user control documents.
Part II, Other Requirements

A. Operator Certification Requirements

1. Classification

a. In accordance with Ohio Administrative Code 3745-7-04, the sewage treatment facility at this facility shall be classified as a Class III facility.

b. All sewerage (collection) systems that are tributary to this treatment works are Class II sewerage systems in accordance with paragraph (B)(1)(a) of rule 3745-7-04 of the Ohio Administrative Code.

2. Operator of Record

a. The permittee shall designate one or more operator of record to oversee the technical operation of the treatment works and sewerage (collection) system in accordance with paragraph (A)(2) of rule 3745-7-02 of the Ohio Administrative Code.

b. Each operator of record shall have a valid certification of a class equal to or greater than the classification of the treatment works as defined in Part II, Item A.1 of this NPDES permit.

c. Within three days of a change in an operator of record, the permittee shall notify the Director of the Ohio EPA of any such change on a form acceptable to Ohio EPA. The appropriate form can be found at the following website:


d. Within 60 days of the effective date of this permit, the permittee shall notify the Director of Ohio EPA of the operators of record on a form acceptable to Ohio EPA.

e. The operator of record for a class II, III, or IV treatment works or class II sewerage system may be replaced by a backup operator with a certificate one classification lower than the treatment works or sewerage system for a period of up to thirty consecutive days. The use of this provision does not require notification to the agency.

f. Upon proper justification, such as military leave or long term illness, the director may authorize the replacement of the operator of record for a class II, III, or IV treatment works or class II sewerage system by a backup operator with a certificate one classification lower than the facility for a period of greater than thirty consecutive days. Such requests shall be made in writing to the appropriate district office.
3. Minimum Staffing Requirements

a. The permittee shall ensure that the treatment works operator of record is physically present at the facility in accordance with the minimum staffing requirements per paragraph (C)(1) of rule 3745-7-04 of the Ohio Administrative Code or the requirements from an approved 3745-7-04(C) minimum staffing hour reduction plan.

b. Sewerage (collection) system Operators of Record are not required to meet minimum staffing requirements in paragraph (C)(1) of rule 3745-7-04 of the Ohio Administrative Code.

c. If Ohio EPA approves a reduction in minimum staffing requirements based upon a facility operating plan, any change in the criteria under which the operating plan was approved (such as enforcement status, history of noncompliance, or provisions included in the plan) will require that the treatment works immediately return to the minimum staffing requirements included in paragraph (C)(1) of rule 3745-7-04 of the Ohio Administrative Code.

B. Description of the location of the required sampling stations are as follows:

<table>
<thead>
<tr>
<th>Sampling Station</th>
<th>Description of Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1PD00008001</td>
<td>Final effluent prior to discharge to the Great Miami River</td>
</tr>
<tr>
<td></td>
<td>(Lat: 40 N 07' 49&quot;; Long: 84 W 14' 06&quot;)</td>
</tr>
<tr>
<td>1PD00008581</td>
<td>Sludge disposal by land application at agronomic rates</td>
</tr>
<tr>
<td>1PD00008586</td>
<td>Sludge disposal by hauling to mixed solid waste landfill</td>
</tr>
<tr>
<td>1PD00008300</td>
<td>System-wide sanitary sewer overflow occurrences</td>
</tr>
<tr>
<td>1PD00008601</td>
<td>Plant influent</td>
</tr>
<tr>
<td>1PD00008801</td>
<td>Upstream of wastewater plant at the Main Street bridge in the Great Miami River</td>
</tr>
<tr>
<td>1PD00008901</td>
<td>Downstream of wastewater plant at the Farrington Road bridge in the Great Miami River</td>
</tr>
</tbody>
</table>

C. All parameters, except flow, need not be monitored on days when the plant is not normally staffed (Saturdays, Sundays, and Holidays). On those days, report "AN" on the monthly report form.

D. Sanitary Sewer Overflow (SSO) Reporting Requirements

A sanitary sewer overflow is an overflow, spill, release, or diversion of wastewater from a sanitary sewer system. SSOs do not include wet weather discharges from combined sewer overflows specifically listed in Part II of this NPDES permit (if any). All SSOs are prohibited.
1. Reporting for SSOs That Imminently and Substantially Endanger Human Health

a) Immediate Notification

You must notify Ohio EPA (1-800-282-9378) and the appropriate Board of Health (i.e., city or county) within 24 hours of learning of any SSO from your sewers or from your maintenance contract areas that may imminently and substantially endanger human health. The telephone report must identify the location, estimated volume and receiving water, if any, of the overflow. An SSO that may imminently and substantially endanger human health includes dry weather overflows, major line breaks, overflow events that result in fish kills or other significant harm, overflows that expose the general public to contact with raw sewage, and overflow events that occur in sensitive waters and high exposure areas such as protection areas for public drinking water intakes and waters where primary contact recreation occurs.

b) Follow-Up Written Report

Within 5 days of the time you become aware of any SSO that may imminently and substantially endanger human health, you must provide the appropriate Ohio EPA district office a written report that includes:

(i) the estimated date and time when the overflow began and stopped or will be stopped (if known);
(ii) the location of the SSO including an identification number or designation if one exists;
(iii) the receiving water (if there is one);
(iv) an estimate of the volume of the SSO (if known);
(v) a description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe);
(vi) the cause or suspected cause of the overflow;
(vii) steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps; and
(viii) steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps.

An acceptable 5-day follow-up written report can be filled-in or downloaded from the Ohio EPA Division of Surface Water Permits Program Technical Assistance Web page at http://www.epa.ohio.gov/dsw/permits/technical_assistance.aspx.
2. Reporting for All SSOs, Including Those That Imminently and Substantially Endanger Human Health

a) Monthly Operating Reports

Sanitary sewer overflows that enter waters of the state, either directly or through a storm sewer or other conveyance, shall be reported on your monthly operating reports. You must report the system-wide number of occurrences for SSOs that enter waters of the state in accordance with the requirements for station number 300. A monitoring table for this station is included in Part I, B of this NPDES permit. For the purpose of counting occurrences, each location on the sanitary sewer system where there is an overflow, spill, release, or diversion of wastewater on a given day is counted as one occurrence. For example, if on a given day overflows occur from a manhole at one location and from a damaged pipe at another location and they both enter waters of the state, you should record two occurrences for that day. If overflows from both locations continue on the following day, you should record two occurrences for the following day. At the end of the month, total the daily occurrences from all locations on your system and report this number using reporting code 74062 (Overflow Occurrence, No./Month) on the 4500 form for station number 300.

b) Annual Report

You must prepare an annual report of all SSOs in your collection system, including those that do not enter waters of the state. The annual report must be in an acceptable format (see below) and must include:

(i) A table that lists an identification number, a location description, and the receiving water (if any) for each existing SSO. If an SSO previously included in the list has been eliminated, this shall be noted. Assign each SSO location a unique identification by numbering them consecutively, beginning with 301.

(ii) A table that lists the date that an overflow occurred, the unique ID of the overflow, the name of affected receiving waters (if any), and the estimated volume of the overflow (in millions of gallons). The annual report may summarize information regarding overflows of less than approximately 1,000 gallons.

(iii) A table that summarizes the occurrence of water in basements (WIBs) by total number and by sewershed. The report shall include a narrative analysis of WIB patterns by location, frequency and cause. Only WIBs caused by a problem in the publicly-owned collection system must be included.
Not later than March 31 of each year, you must submit one copy of the annual report for the previous calendar year to the appropriate Ohio EPA district office and one copy to: Ohio EPA; Division of Surface Water; NPDES Permit Unit; P.O. Box 1049; Columbus, OH 43216-1049. You also must provide adequate notice to the public of the availability of the report.

Systems serving fewer than 10,000 people are not required to prepare an annual report if all monthly operating reports for the preceding calendar year show no discharge from overflows.

An acceptable annual SSO report can be filled-in or downloaded from the Ohio EPA Division of Surface Water Permits Program Technical Assistance Web page at http://www.epa.ohio.gov/dsw/permits/technical_assistance.aspx.

E. The permittee shall maintain in good working order and operate as efficiently as possible the "treatment works" and "sewerage system" as defined in ORC 6111.01 to achieve compliance with the terms and conditions of this permit and to prevent discharges to the waters of the state, surface of the ground, basements, homes, buildings, etc.

F. Composite samples shall be comprised of a series of grab samples collected over a 24-hour period and proportionate in volume to the sewage flow rate at the time of sampling. Such samples shall be collected at such times and locations, and in such a fashion, as to be representative of the facility's overall performance.

G. Grab samples shall be collected at such times and locations, and in such fashion, as to be representative of the facility's performance.

H. Multiple grab samples shall be comprised of at least three grab samples collected at intervals of at least three hours during the period that the plant is staffed on each day for sampling. Samples shall be collected at such times and locations, and in such fashion, as to be representative of the facility's overall performance. The critical value shall be reported.

I. The treatment works must obtain at least 85 percent removal of carbonaceous biochemical oxygen demand (five-day) and suspended solids (see Part III, Item 1).
J. The parameters below have had effluent limitations established that are below the Ohio EPA Quantification Level (OEPA QL) for the approved analytical procedure promulgated at 40 CFR 136. OEPA QLs may be expressed as Practical Quantification Levels (PQL) or Minimum Levels (ML).

Compliance with an effluent limit that is below the OEPA QL is determined in accordance with ORC Section 6111.13 and OAC Rule 3745-33-07(C). For maximum effluent limits, any value reported below the OEPA QL shall be considered in compliance with the effluent limit. For average effluent limits, compliance shall be determined by taking the arithmetic mean of values reported for a specified averaging period, using zero (0) for any value reported at a concentration less than the OEPA QL, and comparing that mean to the appropriate average effluent limit. An arithmetic mean that is less than or equal to the average effluent limit shall be considered in compliance with that limit.

The permittee must utilize the lowest available detection method currently approved under 40 CFR Part 136 for monitoring these parameters.

REPORTING:

All analytical results, even those below the OEPA QL (listed below), shall be reported. Analytical results are to be reported as follows:

1. Results above the QL: Report the analytical result for the parameter of concern.

2. Results above the MDL, but below the QL: Report the analytical result, even though it is below the QL.

3. Results below the MDL: Analytical results below the method detection limit shall be reported as "below detection" using the reporting code "AA".

The following table of quantification levels will be used to determine compliance with NPDES permit limits:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PQL</th>
<th>ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine, tot. res.</td>
<td>0.050 mg/l</td>
<td>--</td>
</tr>
</tbody>
</table>

This permit may be modified, or, alternatively, revoked and reissued, to include more stringent effluent limits or conditions if information generated as a result of the conditions of this permit indicate the presence of these pollutants in the discharge at levels above the water quality based effluent limit (WQBEL).
K. POTWs that accept hazardous wastes by truck, rail, or dedicated pipeline are considered to be hazardous waste treatment, storage, and disposal facilities (TSDFs) and are subject to regulation under the Resource Conservation and Recovery Act (RCRA). Under the "permit-by-rule" regulation found at 40 CFR 270.60(c), a POTW must:

1) comply with all conditions of its NPDES permit,
2) obtain a RCRA ID number and comply with certain manifest and reporting requirements under RCRA,
3) satisfy corrective action requirements, and
4) meet all federal, state, and local pretreatment requirements.

L. Final permit limitations based on preliminary or approved waste load allocations are subject to change based on modifications to or finalization of the allocation or report or changes to Water Quality Standards. Monitoring requirements and/or special conditions of this permit are subject to change based on regulatory or policy changes.

M. Sampling for these parameters at station 1PD00008001, 1PD00008601, and 1PD00008901 shall occur the same day.

N. Sampling at station 1PD00008601 for these parameters shall occur one detention time (the time it takes for a volume of water to travel through the treatment plant) after sampling at station 1PD00008001 for the same parameters on the same day.

O. Sampling at station 1PD00008001 for these parameters shall occur one detention time (the time it takes for a volume of water to travel through the treatment plant) prior to sampling at station 1PD00008601 for the same parameters on the same day.

P. All disposal, use, storage, or treatment of sewage sludge by the Permittee shall comply with Chapter 6111. of the Ohio Revised Code, Chapter 3745-40 of the Ohio Administrative Code and any future revisions thereof, any further requirements specified in this NPDES permit, and any other actions of the Director that pertain to the disposal, use, storage, or treatment of sewage sludge by the Permittee.

Q. Sewage sludge composite samples shall consist of a minimum of six grab samples collected at such times and locations, and in such fashion, as to be representative of the facility's sewage sludge.

R. No later than January 31 of each calendar year the Permittee shall submit two (2) copies of a report summarizing the sewage sludge disposal, use, storage, or treatment activities of the Permittee during the previous calendar year. One copy of the report shall be sent to the Ohio EPA, Division of Surface Water, P.O. Box 1049, Columbus, Ohio 43216-1049, and one copy of the report shall be sent to the Ohio EPA Southwest District Office. The report shall be submitted on Ohio EPA Form 4229.
S. Each day when sewage sludge is removed from the wastewater treatment plant for use or disposal, a representative sample of sewage sludge shall be collected and analyzed for percent total solids. This value of percent total solids shall be used to calculate the total Sewage Sludge Weight (Discharge Monitoring Report code 70316) and/or total Sewage Sludge Fee Weight (Discharge Monitoring Report code 51129) removed from the treatment plant on that day. The results of the daily monitoring, and the weight calculations, shall be maintained on site for a minimum of five years. The test methodology used shall be from the latest edition, Part 2540 G of Standard Methods for the Examination of Water and Wastewater American Public Health Association, American Water Works Association, and Water Environment Federation. To convert from gallons of liquid sewage sludge to dry tons of sewage sludge: 
\[
\text{dry tons} = \text{gallons} \times 8.34 \text{ (lbs/gallon)} \times 0.0005 \text{ (tons/lb)} \times \text{decimal fraction total solids}.
\]

T. It is understood by Ohio EPA that at the time permit 1PD00008 becomes effective, an analytical method is not approved under 40 CFR 136 to comply with the free cyanide monitoring requirements included in the permit. The permittee shall utilize method 4500-CN I in the 18th, 19th, or 20th edition of Standard Methods.

U. The permittee shall use either EPA Method 1631 or EPA Method 245.7 promulgated under 40 CFR 136 to comply with the influent and effluent mercury monitoring requirements of this permit.

V. Not later than 4 months from the effective date of this permit, the permittee shall post a permanent marker on the stream bank at each outfall that is regulated under this NPDES permit and discharges to the Great Miami River. This includes final outfalls, bypasses, and combined sewer overflows. The marker shall consist at a minimum of the name of the establishment to which the permit was issued, the Ohio EPA permit number, and the outfall number and a contact telephone number. The information shall be printed in letters not less than two inches in height. The marker shall be a minimum of 2 feet by 2 feet and shall be a minimum of 3 feet above ground level. The sign shall be not be obstructed such that persons in boats or persons swimming on the river or someone fishing or walking along the shore cannot read the sign. Vegetation shall be periodically removed to keep the sign visible. If the outfall is normally submerged the sign shall indicate that. If the outfall is a combined sewer outfall, the sign shall indicate that untreated human sewage may be discharged from the outfall during wet weather and that harmful bacteria may be present in the water.

W. Biomonitoring Program Requirements

General Requirements

All toxicity testing conducted as required by this permit shall be done in accordance with "Reporting and Testing Guidance for Biomonitoring Required by the Ohio Environmental Protection Agency" (hereinafter, the "biomonitoring guidance"), Ohio EPA, July 1998 (or current revision). The Standard Operating Procedures (SOP) or verification of SOP submittal, as described in Section 1.B. of the biomonitoring guidance shall be submitted no later than three months after the effective date of this permit. If the laboratory performing the testing has modified its protocols, a new SOP is required.
Testing Requirements

1. Chronic Bioassays

The permittee shall conduct annual chronic toxicity tests using Ceriodaphnia dubia and fathead minnows (Pimephales promelas) on effluent samples from outfall 1PD00008801. These tests shall be conducted as specified in Section 3 of the biomonitoring guidance.

2. Acute Bioassays

Acute endpoints, as described in Section 2.H. of the biomonitoring guidance, shall be derived from the chronic test.

3. Testing of Ambient Water

In conjunction with the chronic toxicity tests, upstream control water shall be collected at a point outside the zone of effluent and receiving water interaction at station 1PD00008801. Testing of ambient waters shall be done in accordance with Section 3 of the biomonitoring guidance.

4. Data Review

a. Reporting

Following completion of each annual bioassay requirement, the permittee shall report results of the tests in accordance with Sections 3.H.1., and 3.H.2.a. of the biomonitoring guidance, including reporting the results on the monthly DMR and submitting a copy of the complete test report to Ohio EPA, Division of Surface Water, NPDES Permit Unit, P.O. Box 1049, Columbus, OH, 43216-1049.

Based on Ohio EPA's evaluation of the results, this permit may be modified to require additional biomonitoring, require a toxicity reduction evaluation, and/or contain whole effluent toxicity limits.

b. Definitions

TUa = Acute Toxicity Units = 100/LC50

TUc = Chronic Toxicity Units = 100/IC25

This equation for chronic toxicity units applies outside the mixing zone for warmwater, modified warmwater, exceptional warmwater, coldwater, and seasonal salmonid use designations except when the following equation is more restrictive (Ceriodaphnia dubia only):

TUc = Chronic Toxic Units = 100/square root of (NOEC x LOEC)

X. Pretreatment Program Requirements
The permittee's pretreatment program initially approved on February 8, 1985 and all subsequent modifications approved before the effective date of this permit, shall be an enforceable term and condition of this permit.

To ensure that the approved program is implemented in accordance with 40 CFR 403, Chapter 3745-3 of Ohio Administrative Code and Chapter 6111 of the Ohio Revised Code, the permittee shall comply with the following conditions:

1. Legal Authority

The permittee shall adopt and maintain legal authority which enables it to fully implement and enforce all aspects of its approved pretreatment program including the identification and characterization of industrial sources, issuance of control documents, compliance monitoring and reporting, and enforcement.

The permittee shall establish agreements with all contributing jurisdictions, as necessary, to enable the permittee to fulfill its requirements with respect to industrial users discharging to its system.

2. Industrial User Inventory

The permittee shall identify all industrial users subject to pretreatment standards and requirements and characterize the nature and volume of pollutants in their wastewater. Dischargers determined to be Significant Industrial Users according to OAC 3745-3-01(FF) must be notified of applicable pretreatment standards and requirements within 30 days of making such a determination. This inventory shall be updated at a frequency to ensure proper identification and characterization of industrial users.

3. Slug Load Control Plans for Significant Industrial Users

The permittee shall evaluate the need for a plan, device or structure to control a potential slug discharge at least once during the term of each significant industrial user’s control mechanism. Existing significant industrial users shall be evaluated within one year of the effective date of this permit if the users have never been evaluated. New industrial users identified as significant industrial users shall be evaluated within one year of being identified as a significant industrial user.
4. Local Limits

The permittee shall develop and enforce technically based local limits to prevent the introduction of pollutants into the POTW which will interfere with the operation of the POTW, pass through the treatment works, be incompatible with the treatment works, or limit wastewater or sludge use options.

The permittee shall use the following waste load allocation values when evaluating local limits for the following pollutants for which a final effluent limit has not been established:

- Arsenic 59 ug/l
- Cadmium 13 ug/l
- Chromium, hexavalent 25 ug/l
- Chromium, total 482 ug/l
- Copper 53 ug/l
- Free Cyanide 0.042 mg/l
- Lead 59 ug/l
- Mercury 12 ng/l
- Molybdenum 45950 ug/l
- Nickel 296 ug/l
- Selenium 11 ug/l
- Silver 3.0 ug/l
- Zinc 610 ug/l

For the purpose of periodically reevaluating local limits, the permittee shall implement and maintain a sampling program to characterize pollutant contribution to the POTW from industrial and residential sources and to determine pollutant removal efficiencies through the POTW. The permittee shall continue to review and develop local limits as necessary.

5. Control Mechanisms

The permittee shall issue control mechanisms to all industries determined to be Significant Industrial Users as define in OAC 3745-3-01(FF). Control mechanisms must meet at least the minimum requirements of OAC-3745-3-03(C)(1)(c).
6. Industrial Compliance Monitoring

The permittee shall sample and inspect industrial users in accordance with the approved program or approved modifications, including inspection and sampling of all significant industrial users at least annually. Sample collection, preservation and analysis must be performed in accordance with procedures in 40 CFR 136 and with sufficient care to produce evidence admissible in judicial enforcement proceedings.

The permittee shall also require, receive, and review self-monitoring and other industrial user reports when necessary to determine compliance with pretreatment standards and requirements. If the permittee performs sampling and analysis in lieu of an industrial user’s self-monitoring, the permittee shall perform repeat sampling and analysis within 30 days of becoming aware of a permit violation, unless the permittee notifies the user of the violation and requires the user to perform the repeat analysis and reporting.

7. POTW Priority Pollutant Monitoring

The permittee shall annually monitor priority pollutants, as defined by U.S. EPA, in the POTW's influent, effluent and sludge. Sample collection, preservation, and analysis shall be performed using U.S. EPA approved methods.

a. A sample of the influent and the effluent shall be collected when industrial discharges are occurring at normal to maximum levels. Sampling of the influent shall be done prior to any recycle streams and sampling of the effluent shall be after disinfection. Both samples shall be collected on the same day or, alternately, the effluent sample may be collected following the influent sample by approximately the retention time of the POTW.

Sampling of sludge shall be representative of sludge removed to final disposal. A minimum of one grab sample shall be taken during actual sludge removal and disposal unless the POTW uses more than one disposal option. If multiple disposal options are used, the POTW shall collect a composite of grab samples from all disposal practices which are proportional to the annual flows to each type of disposal.

b. A reasonable attempt shall be made to identify and quantify additional constituents (excluding priority pollutants and unsubstituted aliphatic compounds) at each sample location. Identification of additional peaks more than ten times higher than the adjacent background noise on the total ion plots (reconstructed gas chromatograms) shall be attempted through the use of U.S. EPA/NIH computerized library of mass spectra, with visual confirmation by an experienced analyst. Quantification may be based on an order of magnitude estimate compared with an internal standard.

The results of these samples must be submitted on Ohio EPA Form 4221 with the permittee's annual pretreatment report. Samples may be collected at any time during the 12 months preceding the due date of the annual report and may be used to fulfill other NPDES monitoring requirements where applicable.
8. Enforcement

The permittee shall investigate all instances of noncompliance with pretreatment standards and requirements and take timely, appropriate, and effective enforcement action to resolve the noncompliance in accordance with the permittee's approved enforcement response plan.

On or prior to April 15th of each year, the permittee shall publish, in the largest daily newspaper within the permittee's service area, a list of industrial users which, during the previous period of April 1st through March 31st, have been in Significant Noncompliance [OAC 3745-3-03(C)(2)(h)] with applicable pretreatment standards or requirements.

9. Reporting

All reports required under this section shall be submitted to the following address in duplicate:

Ohio Environmental Protection Agency
Division of Surface Water
Pretreatment Unit
P.O. Box 1049
Columbus, OH 43216-1049

a. Quarterly Industrial User Violation Report

On or prior to the 15th day of each February, May, August, and November, the permittee shall report the industrial users that are in violation of applicable pretreatment standards during the previous corresponding periods of November through January, February through April, May through July and August through October.

The report shall be prepared in accordance with guidance provided by Ohio EPA and shall include a description of all industrial user violations and corrective actions taken to resolve the violations.

b. Annual Pretreatment Report

On or prior to April 15th of each year, the permittee shall submit an annual report on the effectiveness of the pretreatment program for the previous twelve-month period of April 1st through March 31st.

The report shall be prepared in accordance with guidance provided by Ohio EPA and include, but not be limited to: a discussion of program effectiveness; and industrial user inventory; a description of the permittee's monitoring program; a description of any pass through or interference incidents; a copy of the annual publication of industries in Significant Noncompliance; and, priority pollutant monitoring results.
10. Record Keeping

All records of pretreatment activities including, but not limited to, industrial inventory data, monitoring results, enforcement actions, and reports submitted by industrial users must be maintained for a minimum of three (3) years. This period of retention shall be extended during the course of any unresolved litigation. Records must be made available to Ohio EPA and U.S. EPA upon request.

11. Program Modifications

Any proposed modifications of the approved pretreatment program must be submitted to Ohio EPA for review, on forms available from Ohio EPA and consistent with guidance provided by Ohio EPA. If the modification is deemed to be substantial, prior approval must be obtained before implementation; otherwise, the modification is considered to be effective 45 days after the date of application. Substantial program modifications include, among other things, changes to the POTW's legal authority, industrial user control mechanisms, local limits, confidentiality procedures, or monitoring frequencies.
PART III - GENERAL CONDITIONS

1. DEFINITIONS

"Daily discharge" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

"Average weekly" discharge limitation means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week. Each of the following 7-day periods is defined as a calendar week: Week 1 is Days 1 - 7 of the month; Week 2 is Days 8 - 14; Week 3 is Days 15 - 21; and Week 4 is Days 22 - 28. If the "daily discharge" on days 29, 30 or 31 exceeds the "average weekly" discharge limitation, Ohio EPA may elect to evaluate the last 7 days of the month as Week 4 instead of Days 22 - 28. Compliance with fecal coliform bacteria or E coli bacteria limitations shall be determined using the geometric mean.

"Average monthly" discharge limitation means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month. Compliance with fecal coliform bacteria or E coli bacteria limitations shall be determined using the geometric mean.

"85 percent removal" means the arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 15 percent of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period.

"Absolute Limitations" Compliance with limitations having descriptions of "shall not be less than," "nor greater than," "shall not exceed," "minimum," or "maximum" shall be determined from any single value for effluent samples and/or measurements collected.

"Net concentration" shall mean the difference between the concentration of a given substance in a sample taken of the discharge and the concentration of the same substances in a sample taken at the intake which supplies water to the given process. For the purpose of this definition, samples that are taken to determine the net concentration shall always be 24-hour composite samples made up of at least six increments taken at regular intervals throughout the plant day.
"Net Load" shall mean the difference between the load of a given substance as calculated from a sample taken of the discharge and the load of the same substance in a sample taken at the intake which supplies water to given process. For purposes of this definition, samples that are taken to determine the net loading shall always be 24-hour composite samples made up of at least six increments taken at regular intervals throughout the plant day.

"MDG" means million gallons per day.

"mg/l" means milligrams per liter.

"ug/l" means micrograms per liter.

"ng/l" means nanograms per liter.

"S.U." means standard pH unit.

"kg/day" means kilograms per day.

"Reporting Code" is a five digit number used by the Ohio EPA in processing reported data. The reporting code does not imply the type of analysis used nor the sampling techniques employed.

"Quarterly (1/Quarter) sampling frequency" means the sampling shall be done in the months of March, June, August, and December, unless specifically identified otherwise in the Effluent Limitations and Monitoring Requirements table.

"Yearly (1/Year) sampling frequency" means the sampling shall be done in the month of September, unless specifically identified otherwise in the effluent limitations and monitoring requirements table.

"Semi-annual (2/Year) sampling frequency" means the sampling shall be done during the months of June and December, unless specifically identified otherwise.

"Winter" shall be considered to be the period from November 1 through April 30.

"Bypass" means the intentional diversion of waste streams from any portion of the treatment facility.

"Summer" shall be considered to be the period from May 1 through October 31.

"Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
"Sewage sludge" means a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works as defined in section 6111.01 of the Revised Code. "Sewage sludge" includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes. "Sewage sludge" does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator, grit and screenings generated during preliminary treatment of domestic sewage in a treatment works, animal manure, residue generated during treatment of animal manure, or domestic septage.

"Sewage sludge weight" means the weight of sewage sludge, in dry U.S. tons, including admixtures such as liming materials or bulking agents. Monitoring frequencies for sewage sludge parameters are based on the reported sludge weight generated in a calendar year (use the most recent calendar year data when the NPDES permit is up for renewal).

"Sewage sludge fee weight" means the weight of sewage sludge, in dry U.S. tons, excluding admixtures such as liming materials or bulking agents. Annual sewage sludge fees, as per section 3745.11(Y) of the Ohio Revised Code, are based on the reported sludge fee weight for the most recent calendar year.

2. GENERAL EFFLUENT LIMITATIONS

The effluent shall, at all times, be free of substances:

A. In amounts that will settle to form putrescent, or otherwise objectionable, sludge deposits; or that will adversely affect aquatic life or water fowl;

B. Of an oily, greasy, or surface-active nature, and of other floating debris, in amounts that will form noticeable accumulations of scum, foam or sheen;

C. In amounts that will alter the natural color or odor of the receiving water to such degree as to create a nuisance;

D. In amounts that either singly or in combination with other substances are toxic to human, animal, or aquatic life;

E. In amounts that are conducive to the growth of aquatic weeds or algae to the extent that such growths become inimical to more desirable forms of aquatic life, or create conditions that are unsightly, or constitute a nuisance in any other fashion;

F. In amounts that will impair designated instream or downstream water uses.

3. FACILITY OPERATION AND QUALITY CONTROL

All wastewater treatment works shall be operated in a manner consistent with the following:

A. At all times, the permittee shall maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee necessary to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with conditions of the permit.

B. The permittee shall effectively monitor the operation and efficiency of treatment and control facilities and the quantity and quality of the treated discharge.

C. Maintenance of wastewater treatment works that results in degradation of effluent quality shall be scheduled during non-critical water quality periods and shall be carried out in a manner approved by Ohio EPA as specified in the Paragraph in the PART III entitled, "UNAUTHORIZED DISCHARGES".
4. REPORTING

A. Monitoring data required by this permit shall be submitted on Ohio EPA 4500 Discharge Monitoring Report (DMR) forms using the electronic DMR (e-DMR) internet application. e-DMR allows permitted facilities to enter, sign, and submit DMRs on the internet. e-DMR information is found on the following web page:

http://www.epa.ohio.gov/dsw/edmr/eDMR.aspx

Alternatively, if you are unable to use e-DMR due to a demonstrated hardship, monitoring data may be submitted on paper DMR forms provided by Ohio EPA. Monitoring data shall be typed on the forms. Please contact Ohio EPA, Division of Surface Water at (614) 644-2050 if you wish to receive paper DMR forms.

B. DMRs shall be signed by a facility's Responsible Official or a Delegated Responsible Official (i.e. a person delegated by the Responsible Official). The Responsible Official of a facility is defined as:

1. For corporations - a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or the manager of one or more manufacturing, production or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

2. For partnerships - a general partner;

3. For a sole proprietorship - the proprietor; or,

4. For a municipality, state or other public facility - a principal executive officer, a ranking elected official or other duly authorized employee.

For e-DMR, the person signing and submitting the DMR will need to obtain an eBusiness Center account and Personal Identification Number (PIN). Additionally, Delegated Responsible Officials must be delegated by the Responsible Official, either on-line using the eBusiness Center's delegation function, or on a paper delegation form provided by Ohio EPA. For more information on the PIN and delegation processes, please view the following web page:

http://www.epa.ohio.gov/dsw/edmr/eDMRpin.aspx

C. DMRs submitted using e-DMR shall be submitted to Ohio EPA by the 20th day of the month following the month-of-interest. DMRs submitted on paper must include the original signed DMR form and shall be mailed to Ohio EPA at the following address so that they are received no later than the 15th day of the month following the month-of-interest:

Ohio Environmental Protection Agency
Lazarus Government Center
Division of Surface Water - PCU
P.O. Box 1049
Columbus, Ohio 43216-1049
D. Regardless of the submission method, a paper copy of the submitted Ohio EPA 4500 DMR shall be maintained onsite for records retention purposes (see Section 7. RECORDS RETENTION). For e-DMR users, view and print the DMR from the Submission Report Information page after each original or revised DMR is submitted. For submittals on paper, make a copy of the completed paper form after it is signed by a Responsible Official or a Delegated Responsible Official.

E. If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified in Section 5. SAMPLING AND ANALYTICAL METHODS, the results of such monitoring shall be included in the calculation and reporting of the values required in the reports specified above.

F. Analyses of pollutants not required by this permit, except as noted in the preceding paragraph, shall not be reported to the Ohio EPA, but records shall be retained as specified in Section 7. RECORDS RETENTION.

5. SAMPLING AND ANALYTICAL METHOD

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored flow. Test procedures for the analysis of pollutants shall conform to regulation 40 CFR 136, "Test Procedures For The Analysis of Pollutants" unless other test procedures have been specified in this permit. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to insure accuracy of measurements.

6. RECORDING OF RESULTS

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

A. The exact place and date of sampling; (time of sampling not required on EPA 4500)
B. The person(s) who performed the sampling or measurements;
C. The date the analyses were performed on those samples;
D. The person(s) who performed the analyses;
E. The analytical techniques or methods used; and
F. The results of all analyses and measurements.
7. RECORDS RETENTION

The permittee shall retain all of the following records for the wastewater treatment works for a minimum of three years except those records that pertain to sewage sludge disposal, use, storage, or treatment, which shall be kept for a minimum of five years, including:

A. All sampling and analytical records (including internal sampling data not reported);
B. All original recordings for any continuous monitoring instrumentation;
C. All instrumentation, calibration and maintenance records;
D. All plant operation and maintenance records;
E. All reports required by this permit; and
F. Records of all data used to complete the application for this permit for a period of at least three years, or five years for sewage sludge, from the date of the sample, measurement, report, or application.

These periods will be extended during the course of any unresolved litigation, or when requested by the Regional Administrator or the Ohio EPA. The three year period, or five year period for sewage sludge, for retention of records shall start from the date of sample, measurement, report, or application.

8. AVAILABILITY OF REPORTS

Except for data determined by the Ohio EPA to be entitled to confidential status, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the appropriate district offices of the Ohio EPA. Both the Clean Water Act and Section 6111.05 Ohio Revised Code state that effluent data and receiving water quality data shall not be considered confidential.

9. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking, and reissuing, or terminating the permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. RIGHT OF ENTRY

The permittee shall allow the Director or an authorized representative upon presentation of credentials and other documents as may be required by law to:

A. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit.
B. Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit.
C. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit.
D. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.
11. UNAUTHORIZED DISCHARGES

A. Bypass Not Exceeding Limitations - The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 11.B and 11.C.

B. Notice

1. Anticipated Bypass - If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

2. Unanticipated Bypass - The permittee shall submit notice of an unanticipated bypass as required in paragraph 12.B (24 hour notice).

C. Prohibition of Bypass

1. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

c. The permittee submitted notices as required under paragraph 11.B.

2. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph 11.C.1.

12. NONCOMPLIANCE NOTIFICATION

A. Exceedance of a Daily Maximum Discharge Limit

1. The permittee shall report noncompliance that is the result of any violation of a daily maximum discharge limit for any of the pollutants listed by the Director in the permit by e-mail or telephone within twenty-four (24) hours of discovery.

The permittee may report to the appropriate Ohio EPA district office e-mail account as follows (this method is preferred):

Southeast District Office: sedo24hourpdes@epa.state.oh.us
Southwest District Office: swdo24hourpdes@epa.state.oh.us
Northwest District Office: nwdo24hourpdes@epa.state.oh.us
Northeast District Office: nedo24hourpdes@epa.state.oh.us
Central District Office: cedo24hourpdes@epa.state.oh.us
Central Office: co24hourpdes@epa.state.oh.us

The permittee shall attach a noncompliance report to the e-mail. A noncompliance report form is available on the following web site:

http://www.epa.ohio.gov/dsw/permits/permits.aspx
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Or, the permittee may report to the appropriate Ohio EPA district office by telephone toll-free between 8:00 AM and 5:00 PM as follows:

Southeast District Office: (800) 686-7330
Southwest District Office: (800) 686-8930
Northwest District Office: (800) 686-6930
Northeast District Office: (800) 686-6330
Central District Office: (800) 686-2330
Central Office: (614) 644-2001

The permittee shall include the following information in the telephone noncompliance report:

a. The name of the permittee, and a contact name and telephone number;
b. The limit(s) that has been exceeded;
c. The extent of the exceedance(s);
d. The cause of the exceedance(s);
e. The period of the exceedance(s) including exact dates and times;
f. If uncorrected, the anticipated time the exceedance(s) is expected to continue; and,
g. Steps taken to reduce, eliminate or prevent occurrence of the exceedance(s).

B. Other Permit Violations

1. The permittee shall report noncompliance that is the result of any unanticipated bypass resulting in an exceedance of any effluent limit in the permit or any upset resulting in an exceedance of any effluent limit in the permit by e-mail or telephone within twenty-four (24) hours of discovery.

The permittee may report to the appropriate Ohio EPA district office e-mail account as follows (this method is preferred):

Southeast District Office: sedo24hournpdes@epa.state.oh.us
Southwest District Office: swdo24hournpdes@epa.state.oh.us
Northwest District Office: nwdo24hournpdes@epa.state.oh.us
Northeast District Office: nedo24hournpdes@epa.state.oh.us
Central District Office: cdo24hournpdes@epa.state.oh.us
Central Office: co24hournpdes@epa.state.oh.us

The permittee shall attach a noncompliance report to the e-mail. A noncompliance report form is available on the following web site:

http://www.epa.ohio.gov/dsw/permits/permits.aspx

Or, the permittee may report to the appropriate Ohio EPA district office by telephone toll-free between 8:00 AM and 5:00 PM as follows:

Southeast District Office: (800) 686-7330
Southwest District Office: (800) 686-8930
Northwest District Office: (800) 686-6930
Northeast District Office: (800) 686-6330
Central District Office: (800) 686-2330
Central Office: (614) 644-2001
The permittee shall include the following information in the telephone noncompliance report:

a. The name of the permittee, and a contact name and telephone number;

b. The time(s) at which the discharge occurred, and was discovered;

c. The approximate amount and the characteristics of the discharge;

d. The stream(s) affected by the discharge;

e. The circumstances which created the discharge;

f. The name and telephone number of the person(s) who have knowledge of these circumstances;

g. What remedial steps are being taken; and,

h. The name and telephone number of the person(s) responsible for such remedial steps.

2. The permittee shall report noncompliance that is the result of any spill or discharge which may endanger human health or the environment within thirty (30) minutes of discovery by calling the 24-Hour Emergency Hotline toll-free at (800) 282-9378. The permittee shall also report the spill or discharge by e-mail or telephone within twenty-four (24) hours of discovery in accordance with B.1 above.

C. When the telephone option is used for the noncompliance reports required by A and B, the permittee shall submit to the appropriate Ohio EPA district office a confirmation letter and a completed noncompliance report within five (5) days of the discovery of the noncompliance. This follow up report is not necessary for the e-mail option which already includes a completed noncompliance report.

D. If the permittee is unable to meet any date for achieving an event, as specified in a schedule of compliance in their permit, the permittee shall submit a written report to the appropriate Ohio EPA district office within fourteen (14) days of becoming aware of such a situation. The report shall include the following:

1. The compliance event which has been or will be violated;

2. The cause of the violation;

3. The remedial action being taken;

4. The probable date by which compliance will occur; and,

5. The probability of complying with subsequent and final events as scheduled.

E. The permittee shall report all other instances of permit noncompliance not reported under paragraphs A or B of this section on their monthly DMR submission. The DMR shall contain comments that include the information listed in paragraphs A or B as appropriate.

F. If the permittee becomes aware that it failed to submit an application, or submitted incorrect information in an application or in any report to the director, it shall promptly submit such facts or information.

13. RESERVED

14. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.
15. AUTHORIZED DISCHARGES

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than, or at a level in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit. Such violations may result in the imposition of civil and/or criminal penalties as provided for in Section 309 of the Act and Ohio Revised Code Sections 6111.09 and 6111.99.

16. DISCHARGE CHANGES

The following changes must be reported to the appropriate Ohio EPA district office as soon as practicable:

A. For all treatment works, any significant change in character of the discharge which the permittee knows or has reason to believe has occurred or will occur which would constitute cause for modification or revocation and reissuance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. Notification of permit changes or anticipated noncompliance does not stay any permit condition.

B. For publicly owned treatment works:

1. Any proposed plant modification, addition, and/or expansion that will change the capacity or efficiency of the plant;

2. The addition of any new significant industrial discharge; and

3. Changes in the quantity or quality of the wastes from existing tributary industrial discharges which will result in significant new or increased discharges of pollutants.

C. For non-publicly owned treatment works, any proposed facility expansions, production increases, or process modifications, which will result in new, different, or increased discharges of pollutants.

Following this notice, modifications to the permit may be made to reflect any necessary changes in permit conditions, including any necessary effluent limitations for any pollutants not identified and limited herein. A determination will also be made as to whether a National Environmental Policy Act (NEPA) review will be required. Sections 6111.44 and 6111.45, Ohio Revised Code, require that plans for treatment works or improvements to such works be approved by the Director of the Ohio EPA prior to initiation of construction.

D. In addition to the reporting requirements under 40 CFR 122.41(l) and per 40 CFR 122.42(a), all existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe:

1. That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis of any toxic pollutant which is not limited in the permit. If that discharge will exceed the highest of the "notification levels" specified in 40 CFR Sections 122.42(a)(1)(i) through 122.42(a)(1)(iv).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the "notification levels" specified in 122.42(a)(2)(i) through 122.42(a)(2)(iv).

17. TOXIC POLLUTANTS

The permittee shall comply with effluent standards or prohibitions established under Section 307 (a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement. Following establishment of such standards or prohibitions, the Director shall modify this permit and so notify the permittee.
18. PERMIT MODIFICATION OR REVOCATION

A. After notice and opportunity for a hearing, this permit may be modified or revoked, by the Ohio EPA, in whole or in part during its term for cause including, but not limited to, the following:

1. Violation of any terms or conditions of this permit;

2. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

3. Change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

B. Pursuant to rule 3745-33-04, Ohio Administrative Code, the permittee may at any time apply to the Ohio EPA for modification of any part of this permit. The filing of a request by the permittee for a permit modification or revocation does not stay any permit condition. The application for modification should be received by the appropriate Ohio EPA district office at least ninety days before the date on which it is desired that the modification become effective. The application shall be made only on forms approved by the Ohio EPA.

19. TRANSFER OF OWNERSHIP OR CONTROL

This permit may be transferred or assigned and a new owner or successor can be authorized to discharge from this facility, provided the following requirements are met:

A. The permittee shall notify the succeeding owner or successor of the existence of this permit by a letter, a copy of which shall be forwarded to the appropriate Ohio EPA district office. The copy of that letter will serve as the permittee’s notice to the Director of the proposed transfer. The copy of that letter shall be received by the appropriate Ohio EPA district office sixty (60) days prior to the proposed date of transfer;

B. A written agreement containing a specific date for transfer of permit responsibility and coverage between the current and new permittee (including acknowledgement that the existing permittee is liable for violations up to that date, and that the new permittee is liable for violations from that date on) shall be submitted to the appropriate Ohio EPA district office within sixty days after receipt by the district office of the copy of the letter from the permittee to the succeeding owner;

At anytime during the sixty (60) day period between notification of the proposed transfer and the effective date of the transfer, the Director may prevent the transfer if he concludes that such transfer will jeopardize compliance with the terms and conditions of the permit. If the Director does not prevent transfer, he will modify the permit to reflect the new owner.

20. OIL AND HAZARDOUS SUBSTANCE LIABILITY

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act.

21. SOLIDS DISPOSAL

Collected grit and screenings, and other solids other than sewage sludge, shall be disposed of in such a manner as to prevent entry of those wastes into waters of the state, and in accordance with all applicable laws and rules.

22. CONSTRUCTION AFFECTING NAVIGABLE WATERS

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.
23. CIVIL AND CRIMINAL LIABILITY

Except as exempted in the permit conditions on UNAUTHORIZED DISCHARGES or UPSETS, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

24. STATE LAWS AND REGULATIONS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Clean Water Act.

25. PROPERTY RIGHTS

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

26. UPSET

The provisions of 40 CFR Section 122.41(n), relating to "Upset," are specifically incorporated herein by reference in their entirety. For definition of "upset," see Part III, Paragraph 1, DEFINITIONS.

27. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

28. SIGNATORY REQUIREMENTS

All applications submitted to the Director shall be signed and certified in accordance with the requirements of 40 CFR 122.22.

All reports submitted to the Director shall be signed and certified in accordance with the requirements of 40 CFR Section 122.22.

29. OTHER INFORMATION

A. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

B. ORC 6111.99 provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $25,000 per violation.

C. ORC 6111.99 states that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $25,000 per violation.

D. ORC 6111.99 provides that any person who violates Sections 6111.04, 6111.042, 6111.05, or division (A) of Section 6111.07 of the Revised Code shall be fined not more than $25,000 or imprisoned not more than one year, or both.
30. NEED TO HALT OR REDUCE ACTIVITY

40 CFR 122.41(c) states that it shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with conditions of this permit.

31. APPLICABLE FEDERAL RULES

All references to 40 CFR in this permit mean the version of 40 CFR which is effective as of the effective date of this permit.

32. AVAILABILITY OF PUBLIC SEWERS

Not withstanding the issuance or non-issuance of an NPDES permit to a semi-public disposal system, whenever the sewage system of a publicly owned treatment works becomes available and accessible, the permittee operating any semi-public disposal system shall abandon the semi-public disposal system and connect it into the publicly owned treatment works.