BASIS OF DESIGN REPORT

Girard Wastewater Treatment Facility

Peak Flow Treatment and Equalization Improvements

City of Girard, Ohio

April 12, 2017

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1.0 INTRODUCTION

The Girard Wastewater Treatment Facility (WWTF) operates under an Ohio Environmental Protection Agency (OEPA) administered National Pollution Discharge System (NPDES) Permit No. 3PD00010*ND. The current permit became effective on August 1, 2012 and contains a "Schedule of Compliance" that imposes specific requirements on the City of Girard as conditions for receiving the permit to discharge effluent to the waters of the State of Ohio. The Ohio Environmental Protection Agency (OEPA) approved **"No Feasible Alternative Analysis Report"** (NFA) was prepared as a planning document to develop the "most feasible" plan to "eliminate" plant bypasses and collection system overflows. This "Basis of Design Report" has been prepared to detail the required collection system and WWTF improvements necessary to fulfill these requirements as described in the approved, amended NFA.

When implemented the alternative plan presented in the NFA will eliminate the in-plant bypasses and reduce both the CSO events and volumes. The selected plan is ***Alternative No. 3***. This plan includes the "base improvement plan" (***Alternative No.1***) of existing plant optimization and upgrade improvements, the addition of a third set of secondary treatment process units, (one new trickling filter and one new final settling tank) to parallel the existing units and 2.4 million gallons of additional flow equalization or temporary on-site storage volume. This improvement plan will increase the "peak flow treatment capacity" of the Girard WWTF to 12.0 mgd, but will not increase the "average daily flow capacity" of 5.0 mgd (million gallons per day). The plan also addresses the enhanced treatment of potential bypass flows at the Girard WWTF and specific improvements to the combined sewer collection system to reduce the frequency and volume of the CSO events.

The Girard WWTF includes an in-plant bypass, which re-routes a portion of the wastewater flow around secondary treatment unit processes when the influent flow rate exceeds 7.2 million gallons per day (MGD). This bypass was designed into the original plant expansion in 1985 and was reviewed and approved by OEPA at that time. However, these plant overflows or bypasses are **NOT authorized** by the current permit. The City of Girard wastewater collection system is a combined sewer system. It has a single, consolidated, authorized, Combined Sewer Overflow (CSO 003), that is permitted and monitored under the terms of the current NPDES permit.

The approved, alternative NFA plan for implementation is ***Alternative No.3***. The details of this plan are included in the body of the report. ***Figure 1*** located at the end of this report, presents the general plan for the improvements. Figures 2A through 2C show the wet and solid stream flow schematics. The design data for the plan is presented in the design data table in ***Appendix A.*** Functional Control Descriptions of the treatment process under normal and high flow conditions is provided in ***Appendix B***. BioWin modeling results are included in ***Appendix C***.

2.0 EXISTING & FUTURE FLOWS

Table 2.1 presents the existing and estimated future average daily and peak flows for the Girard WWTF. Data for 2009 through 2012 is included along with the current design capacity. The present 5.0 mgd capacity is allocated between Trumbull County and the City of Girard with Trumbull County's dedicated capacity being 1.75 mgd per a 2000 agreement with the City. The remaining 3.25 mgd of capacity is allocated to the City of Girard.

TABLE 2.1
City of Girard WWTF Existing & Future Flows

Year	Average Daily Flow		Total Average Daily Flow
	Girard Annual Average (mgd)	Trumbull County Annual Average (mgd)	
2009	1.22	1.34	2.56
2010	1.26	1.28	2.54
2011[(1)]	1.84	1.47	3.31
2012	1.52	1.16	2.68
Total Design Capacity	3.25	1.75	5.00
Projected 2033 Flow	3.00	1.70	4.70
2012 Reserve ADF Cap	1.73	0.59	2.32

[(1)] 2011 was the wettest Year on Record at 62.3 inches of rain or 26.0 over avg.

3.0 COLLECTION SYSTEM IMPROVEMENTS

3.1.1 Description of Existing System.

The City of Girard sewer system is a combined sewer system and consists of approximately 215,000 lineal feet of predominantly vitrified clay pipe main line sewers or reinforced concrete pipe for the larger trunk sewers. There are approximately 800 manholes and 4,300 connections. The system also contains an estimated 290,000 lineal feet of service laterals. Recent renovations have replaced the clay pipe with PVC when and where repairs or sewer replacements are needed. The age of the sewer system varies from the early 1900's through the present.

As a combined system there were 17 combined system overflows (CSO's) or sanitary overflows in 1987 per the 1987 SSES and the Draft 2002 Long Term Control Plan. Through the action of the city over the last 15 years, all of the CSOs were eliminated except two and these two were consolidated into a single CSO (CSO 003) in 2004. CSO 003 is monitored via radio telemetry at the WWTF and outlet flows are screened, metered, and sampled. This CSO is located near the Girard WWTF on the consolidation of existing Trunk Sewers A&B that serve the downtown area of Girard and the two system pump stations. Constructed in 2004 as part of a major storm-sanitary sewer separation project, CSO 003 is the only active CSO in the City. It discharges overflow when activated to the Little Squaw Creek at the entrance of the 1,600-foot long culvert to the Mahoning River.

CSO 003 deserves special consideration for the important role it plays in the Girard Collection System and at the WWTF. The one remaining CSO is located in close proximity to the WWTF. It is approximately 600 feet upstream of the plant on one of the main 24-inch trunk sewers. The overflow weir is located at an elevation where the surcharge flow level at CSO 003, when an overflow event begins, is influenced by the water level in the WWTF influent wet well. This feature can be used to control the frequency and volume of both current and future CSO discharges. This fact is even more important because CSO 003 is the only active CSO in the system. The necessary permanent flow monitoring to evaluate this influence has been in place for several years.

The collection system has two pump stations that were constructed in the 1960's and renovated in 1987, when the original WWTF (1960) was expanded and upgraded to secondary treatment. These stations are the "Syro Pump Station" and the "Broadway Pump Station". These stations are monitored via an existing radio telemetry system and the WWTF Supervisory Control and Data Acquisition (SCADA) system. There is no permanent flow metering at the stations.

The Syro Station is located off North State Street just north of Squaw Creek and provides service for Mini-areas D & E. Syro Pump Station is a three pump wet pit/dry pit type station with a firm pumping capacity of 1,400 gpm through a 14-inch ductile iron force main. The Broadway Pump Station is located at the west end of Broadway Avenue adjacent to the Mahoning River and provides service to Mini-areas C, D & E. Broadway PS operates as a relief pump station for the 18-inch Mini-area A trunk sewer (1947) and pumps flow to the newer (1960) Mini-area B 24-inch trunk sewer.

Based on the plant flow monitoring and performance evaluations given in the approved NFA Report, it is anticipated that it will be cost-effective to "transport and treat" more flow from the system. This strategy will reduce CSO volumes by controlling the hydraulic grade of the sewer system at CSO 003. This can be accomplished by a nominal increase in the peak influent pumping rate combined with adequate storage and treatment at the WWTF.

3.1.2 Collection System Improvements

Listed below are collection system specific improvements and actions that are to be completed as part of these improvements.

Pump Station and Collection System Related Improvement Items include:

1. Provide permanent flow metering at the Syro and Broadway Pump Stations.
2. Provide improved pumping efficiency Syro pump station by replacing the existing triplex pumping system with new duplex chopper pumps.
3. Replace the existing triplex pumping system at the Broadway Pump Station with larger capacity duplex pumps and modify the influent flume so that the station runs at least once per day to improve reliability.
4. Both stations will require replacement of components of the existing electrical systems.
5. Provide an automatic force main "drain back option" for odor control at the Broadway Pump Station.
6. Reset the weir at CSO 003 to a higher elevation to reduce the frequency of small CSO events during intense short duration rainfalls. (This shall be coordinated with the final plant improvements and the new system hydraulic profile.)
7. The development of a service area wide GPS based mapping system to facility ongoing SSES activities.

4.0 WASTEWATER TREATMENT FACILITY IMPROVEMENTS

4.1 Description of Existing Facility

The existing Girard WWTF has an average daily design flow capacity of 5.0 million gallons per day (mgd) with a complete treatment daily/hourly capacity of 7.2 mgd. The plant was originally constructed in 1960 as a primary treatment facility with anaerobic digestion and sludge dewatering. The secondary treatment was added in a major upgrade to the facility in 1985 to 1987. The most recent modification occurred in 2000 with the addition of mechanical screening and grinder equipment and flow splitting improvements. The detailed design data for the existing WWTF and the design data for the upgrades and improvements are presented in ***Appendix A*** The design influent loadings and NPDES Permit effluent limits shown in Tables 4.1 and 4.2 below are based on an average daily flow of 5.0 mgd. Note that there is currently no Ammonia limit and the plant is not designed to nitrify.

TABLE 4.1
City of Girard WWTF Design Influent Loadings

Parameter	Average Daily Concentration (mg/L)	Average Daily Loading (lb/day)
$CBOD_5$	130	5,421
TSS	140	5,838
Ammonia-N	16.5	688

TABLE 4.2
City of Girard WWTF Permitted Effluent Loadings

Parameter	30-Day Average Concentration (mg/L)	30-Day Average Loading (lb/day)
$CBOD_5$	25	1,042.5
TSS	30	1,251.0
Ammonia-N	--	--
E. Coli	126/100 mL	--
Dissolved Oxygen	5.0	5.0

The plant liquid stream processes include:

1. Raw Wastewater Pumping

2. Preliminary Treatment
3. Pre-aeration & Primary Settling
4. Trickling Filters with Plastic Media
5. Final Settling
6. Flow Equalization (Retention)
7. Disinfection (Gas Chlorination and Sulfur Dioxide Gas De-Chlorination)

Sludge is processed by two-stage, anaerobic digestion followed by sludge dewatering using a 2-meter belt filter press and ultimate disposal in a landfill.

4.2 Existing Unit Process Evaluations, Renovations and Additions

The results of the liquid-stream unit process evaluation and improvements for the Girard WWTP are presented below. The solids-stream unit process designs were also modified as part of the Ohio EPA NFA review process. These additional liquid and solids-stream process changes and addition have been developed in response to the OEPA comments. The aspects of the additional and accepted improvements were described in the approved NFA Addendum. The modifications are needed to accommodate the required high rate, Chemically Enhanced Primary Treatment (CEPT) operation at peak flows. This will maximize the removal of suspended solids prior to secondary treatment and prior to the equalization of primary effluent flows exceeding 12 mgd.

This portion of the "Basis of Design Report" summarizes the individual unit process systems at the plant in terms of original and final performance, capacity and final design. The approved improvements, included in the NFA Report, will optimize the performance and/or capacity of each process area with the following main goals in mind:

- Reduction in the number of CSO events and volumes;
- Reduction or elimination of the in-plant secondary treatment bypasses;
- Increase in capacity of the secondary treatment process; and
- Enhanced treatment of bypassed flows.

This final "Basis of Design Report" evolved from the "Preliminary Basis of Design Report" document and the detailed design process and development of the final construction plans and specifications. The final design work, as described below and summarized in the "Detailed Design Data" (***Appendix A***), includes the renovation of the existing unit process tanks and equipment combined with the new design elements necessary to increase the peak treatment capacity at the WWTF. This "Basis of Design Report" presents the individual unit process evaluations, capacity upgrades and improvements required to implement the approved alternative plan of ***NFA Alternative No. 1: "Base Upgrade Plan"*** plus ***Alternative No. 3: "Additional Secondary Peak Flow Treatment Capacity & Additional Flow Equalization."***

Alternative No.3 is the "base plan" of ***Alternative No.1*** plus the expansion of the existing secondary treatment process AND additional equalization basin volume to supplement the existing Retention Tank volume of 1.1 million gallons (mg) to eliminate the bypassing of secondary treatment. One new trickling filter and one new final settling tanks will be constructed along with the necessary interconnecting piping additions and modifications to provide for the peak flow treatment of 12.0 mgd. This daily peak rate increases the peak flow rate through secondary by 50%, but it is not sufficient to handle the peak day, design storm volume of 16.3 mg, therefore additional flow equalization basin capacity will be constructed to handle the very largest of storms.

4.2.1 Raw Wastewater Pumping

Description. The existing influent pump station, located in the Control Building, houses two 1,800-gallon-per-minute (gpm) capacity and three 3,600 gpm capacity pumps. When the largest pump is out of service, the WWTP has a pumping capacity of 15 million gallons per day (mgd). If all pumps are available and the wet well is surcharged the station has hit peaks of 20 mgd for short periods. This surcharge reduces the static head on the pumps and more flow can be pumped for a short time. The wet well surcharging may cause the CSO 003 to become active, because the CSO is very near to and on the same hydraulic profile as the influent wet well. The existing pumps are in fair to poor condition and are high maintenance items.

The pumps were flooded and rebuilt in 2003 and the main bearings and volutes are at the end of their useful life due to 30-years of wear from grit and other normal wastewater solids. The amount of maintenance required to keep all pumps on-line is increasing with each passing year. There is a manually cleaned, 1-3/8 inch opening, bar screen prior to the wet well. This screen allows a large percentage of rags and debris to pass through to the preliminary and primary treatment units. When this screen is blinded with rags and debris the influent trunk sewers surcharge, that may lead to a CSO event as described above.

Performance Evaluation. The excessive amount of debris and rags entering the wet well may prohibit optimum pumping and treatment efficiency. In all other regards, the pumping station has been operating adequately. There is also some concern over the rated peak pumping capacity of the raw wastewater pumps. The large 5 mgd, suction lift, high-flow, backup pump is unable to provide the necessary pumping capacity and will be replaced as part of the improvements.

Capacity Evaluation. The rated capacity for the existing WWTF influent pumping station, including the 1-3/8 inch bar screen, is 15 mgd. The peak pumping capacity and reliability of the individual raw wastewater pumps are questionable for continued use.

Improvements. A new mechanically cleaned, coarse bar screen with a 1-inch openings, will be installed to replace the existing manually cleaned bar screen. This will help eliminate the large rag and heavy debris problems in the wet well and insure that surcharging of the influent sewers on non-rainfall days does not occur. The overflow weir at the CSO Station will be raised 18 inches, to reduce the possibility of a blocked screen causing an overflow at CSO 003.

An increase in design pumping capacity will necessitate the replacement of these critical pumps with new larger capacity pumps, valves and piping. The Raw Wastewater Pumps and related valves and piping be replaced with new screw centrifugal pumps, valves and piping. The existing standby suction lift pump will be replaced with two submersible pumps, which will be installed in the wet well.

4.2.2 Preliminary Treatment

Description. The preliminary treatment area contains the influent magnetic flow meter, one mechanical screen-grinder combination, one detritus tank (grit removal), and one primary influent Parshall flume flow meter. It also has an automatic bypass that carries all flow above a predetermined amount to the Primary Effluent Pump Station wet well. This system was last upgraded in 2000.

Performance Evaluation. The preliminary treatment system is currently not performing up to the limits of the original design intent. The influent magnetic flow meter has been maintained and performs well it is the most reliable meter in the plant. The mechanical screen-grinder is out of service due to mechanical equipment failure. In addition, this screen does not have the hydraulic capacity to treat flows above 15 mgd. It is often bypassed hydraulically during high flows and offline much of the time, due to mechanical issues.

The grit system has adequate hydraulic capacity to pass up to 24 mgd. However, it is only capable of removing larger grit particles from the flow. A complete rebuild or replacement of this outdated technology with a newer design is necessary to restore this unit process operation to meet current design standards. The related grit washing facilities do not perform up to expectations and necessitates a high level of maintenance. This washing equipment was replaced approximately 16 years ago and will be replaced as part of the grit system renovations.

The primary tank bypass weir has performed adequately in diverting peak flows around primary treatment. As a set or fixed weir, it has been observed that significantly more flow (exceeding the original 7.2 mgd peak design capacity) is sent to the primary settling tanks during high flow events. As much as 12 to 14 mgd has been sent through the primary tanks, which overload the tanks causing solids wash out. These solids are then transported to the Primary Effluent Pump Station wet well and on to the trickling filters or the secondary bypass.

Capacity Evaluation. Influent magnetic flow meter will be upgraded in size to handle flows up to the new peak hourly flow rate of 22 mgd. The existing 18-inch meter does not have enough capacity to handle the higher flow rate. Influent flow up to 22 mgd can be hydraulically passed through the preliminary treatment process tankage and flumes with the exceptions of the screen-grinder. This unit is of an older design and does not do a good job of keeping smaller rags and debris out of the primary tanks and the raw sludge that goes to the digesters. This makes for major operational problems at the Anaerobic Digesters.

The existing Primary Influent Parshall flume and flow meter can be modified and renovated to accurately measure flows in the range of 12 to 15 mgd. This meter can be used in combination with an automatic weir gate to control the amount of flow into primary treatment. The addition of a CEPT system, using ferric or ferrous chloride, will improve solids capture at peak flows and assist in maximizing primary tank performance.

The second part of the enhanced primary treatment process at the Girard WWTF involves modifications to the sludge removal system and eliminating the discharge of secondary sludge and digester supernatant from the primary influent flow under high flow conditions. The renovated primary settling tank performance will be optimized during high flows through chemically enhanced primary treatment (CEPT). The primary settling tank renovations are further described below.

Improvements. The existing influent magnetic flow meter will be replaced with one 24-inches in diameter, to handle the higher anticipated influent flows of up to 22 mgd (new peak hourly rate). A new punch plate-type, fine screen with 1/4-inch (6 mm) openings, will be installed. The hydraulic capacity of the screen will be 22 mgd. This unit will remove rags, debris, solids and even some grit prior to primary settling. The new fine screen will be equipped with a screenings washing and compacting system. All new equipment will be enclosed in a new heated structure that will also house a new grit classifier and solid waste dumpster.

The existing detritor grit chamber and grit classifying equipment will be replaced a vortex-type, grit removal system, with two new grit transfer pumps and a new grit washing/classifying equipment. The new grit system will be designed effectively remove grit at the peak hourly design flow rate of 22 mgd.

The new fine screening and improved grit removal technology will be very important to limit the amount of debris that will be transported to the equalization basins and stored under peak flow conditions.

4.2.3 Pre-aeration and Primary Settling

Description. The Girard WWTF has four pre-aeration tanks that precede four primary settling tanks. Both processes have been designed for an average daily flow of 5.0 mgd and a peak daily flow rate of 7.2 MGD. The flow to the primary treatment system was limited in this way by the original design with the bypassed flow going to disinfection. This flow pattern was modified in 2000 to send the primary bypass flow to the primary effluent pump station wet well. The blended overflow volumes from the level controlled wet well were then allowed to bypass secondary treatment as previously described.

The pre-aeration tanks were originally designed as part of a lime reactor, chemical treatment process in the 1960 WWTF design. Effluent from the lime reactor clarifiers was discharged to the Little Squaw Creek after disinfection. These pre-aeration tanks increase the dissolved oxygen concentration in the raw sewage prior to primary settling. Air is supplied by three centrifugal blowers located in the grit washing and loadout building.

Sludge is withdrawn from the primary tanks and pumped directly to the Anaerobic Digesters based on the timer operation of air operated control valves and sludge pumps, which have been continual maintenance and control problems in recent years. The collector equipment in the primary settling tanks is relatively new within the last 8 years, but the three centrifugal blowers for the pre-aeration tanks are in fair to poor condition.

Performance Evaluation. The side water depth (SWD) of the Primary Tanks is 8.6 feet. The "Ten State Standards" (10SS) recommends a minimum side water depth of 10 feet. However, no reconstruction of the tanks is necessary to comply with this standard, because the overall performance of the tanks has been good under the current loading rates. Only if the total flow is allowed to exceed 8.0 mgd does the performance suffer. These tanks also receive the waste secondary sludge from the Final Clarifiers. It was found that the average removal efficiencies through the Primary Tanks for carbonaceous biochemical oxygen demand (CBOD) and total suspended solids (TSS) was 30% and 47% respectively. While both of these values fall in the normal range for Primary Settling performance efficiencies, the efficiency can be increased if the weirs are properly adjusted and the scum and sludge removal equipment is replaced.

Capacity Evaluation. There were no hydraulic limitations found during hydraulic and process modeling calculations in the primary treatment area. As noted above, the weirs in the Primary Clarifiers are not level, causing an uneven flow distribution along the effluent lauders. The removal efficiencies, as verified by sampling, indicates acceptable performance at current design flow rates.

Ten State Standards indicates that primary tanks receiving waste activated sludge should not exceed a surface overflow rate of 1,200 gpd/ft^2. Technically, the sludge received by the Primary Tanks is called secondary sludge (sludge from Clarifiers that follow attached growth reactors or Trickling Filters) and therefore it is not waste activated sludge. Currently, at the peak design flow rate of 7.2 mgd, the surface overflow rate is 1,440 gpd/ft^2 and at 8.0 mgd, it is 1,600 gpd/ft^2. These values are in agreement with the limits established by 10SS for Primary Settling Tanks that *do not* receive waste activated sludge. The design maximum surface overflow rate for the Primary Settling Tanks is 2,000 gpd/ft^2.

The maximum weir overflow rate stipulated by 10SS is 30,000 gpd/ft. At 7.2 mgd, the weir overflow rate is 11,000 gpd/ft. Therefore, a weir overflow rate of 18,300 gpd/ft at 12.0 mgd will be well below the allowable maximum value. The current weir configuration will support an enhanced, peak flow primary treatment design.

The hydraulic detention time for these tanks, at 7.2 mgd, is 1.1 hours. Standard best design practice recommends 1.5 to 2.5 hours to promote optimum efficiency. The detention time at 12.0 mgd will be 0.6 hour. This will be an acceptable new peak design capacity because automated flow control will be added to the primary influent flume. Settling during peak flows will be augmented through the addition of the CEPT process. The CEPT process was approved as part of the improvements in the NFA Addendum.

Improvements. The existing primary treatment complex will be renovated into a high rate, modified conventional, primary treatment facility with chemically enhanced settling and improved influent flow control. The peak primary treatment capacity will be increased to 12.0 mgd. A Primary Bypass weir will be set at an elevation so that all flow over 12.0 mgd (the Primary Treatment peak capacity) will be directed to the Primary Effluent Pump Station (PEPS) wet well where it will be pumped to the Trickling Filters or the 1.1 mg Retention Tank (and to Equalization lagoons if needed). Two of the Pre-Aeration Tanks will be converted into aerated/mixed Sludge Storage/Blending Tanks to facilitate the revisions to the solids handling and process improvements. The remaining two Pre-Aeration Tanks will provide aeration of the plant influent under normal operating conditions and will act as coagulation zones during CEPT operation (i.e. high flow conditions). The preliminary design evaluated and accepted the option of "centralizing solids handling" in the area of the Control Building, where the Belt Filter Press and existing digested sludge feed well are located.

The two re-purposed Pre-Aeration Tanks will be renovated to accept and store waste solids as required by the approved NFA addendum solids handling improvements. Raw primary sludge, secondary sludge from the Final Tanks, and Digester supernatant will be discharged to one of the two renovated tanks. These tanks shall serve as sludge equalization and holding tanks. These renovated tanks will be provided with mechanical, air-sparge, hyperboloid mixers. The three existing centrifugal pre-aeration blowers will be removed and replaced with two new positive displacement blowers to provide aeration for pre-aeration in the renovated Pre-Aeration Tanks and mixing in the Sludge Storage/Blending Tanks.

All weirs in the Primary Tanks will be leveled, new primary effluent launders and sludge removal equipment replaced. The skimming system will also be replaced along with a new screw conveyor for positive scum transport to the scum well. The primary sludge wasting valves and pumps shall also be replaced with a new sludge pumping system, which will discharge to the new Sludge Storage/Blending Tanks or directly to the Anaerobic Digesters. Each Primary Tank will be served by a dedicated pump to remove sludge based on an operator-adjustable timer. The sludge pumps will be plumbed so they can serve two Primary Tanks in the event of a pump failure.

The primary settling process will be supplemented with a new chemical feed system (coagulant: Polyaluminum chloride (PAX); flocculant: anionic polymer) for utilizing CEPT for solids removal at peak flows. PAX is recommended since it does not affect alkalinity or negatively affect the UV disinfection like other coagulants, namely Ferric or Ferrous Chloride do. Coagulant will be fed at the influent end of the Pre-Aeration Tanks, the mixing action provide by the new hyperbolic mixers will promote rapid contact and floc formation. The flocculant (anionic polymer) will be injected in the influent channel to the Primary Settling Tanks. Anticipated feed rates are as follows:

Polyaluminum Chloride:	20-30 mg/L
Polymer:	1-3 mg/L

A 2,500-gallon bulk storage tank will be provided for coagulant storage providing approximately 5 days of storage at PDF. Polymer will be stored in a 300-gallon tote, providing approximately 6 days of storage at PDF.

Flow to the Primary Settling Tanks will be monitored and controlled to optimize the treatment capabilities, especially under peak flow conditions. The existing 24-inch parshall flume and an automated control weir gate will be utilized to control and allow flows up to 12.0 mgd into the renovated "high rate" Primary Tanks. The surface overflow rates will be 2,000 gpm/ft^2 at 10 mgd and 2,400 gpm/ft^2 at 12 mgd. The potential for solids washout will be reduced through optimization of the primary treatment process through:

- Removal of the secondary waste sludge and digester supernatant from the primary influent during high flows;
- Application of CEPT;
- Replacement and leveling of the effluent weirs and launders; and
- Replacing the sludge removal system.

The peak daily flow of 12.0 mgd will match the peak design flow of the renovated secondary treatment process.

4.2.4 Trickling Filters

Description. The Girard WWTF has two Trickling Filters that use modular PVC cross flow-type media. The WWTF recirculates trickling filter effluent back to the towers to maintain a wetting rate of the media of 1.0 gpm/sq. ft. During the Trickling Filter process evaluation, it was discovered that both of the rotary distributor seals were leaking around the pivot/bearing connection, causing an excessive amount of flow to escape at the center of the tower. Without an even distribution to the media, treatment is less than optimal. Due to ineffective screening, the arms of the distributor become clogged with rags and other debris, prohibiting even flow distribution over the media surface. Orifices are spaced on the distributor arms by the manufacturer in such a way that they equalize flow across the filter. The exterior shell of the towers is also showing signs of deterioration along the seams of the concrete walls. This is also an indication that the media may be partially blocked at an intermediate depth causing uneven flow and ponding within the media. This leads to flooding against the exterior walls. The top courses of the media are in poor condition, which again can lead to uneven flow distribution through the filters, especially at high flows.

The Primary Effluent Pump Station (PEPS) houses two 1,735 gpm and two 3,470 gpm pumps, which direct primary effluent to both the Trickling Filters and the Retention Basin. With the largest pump out of service, the pump station has the capacity to provide a total flow rate of approximately 9.6 mgd, which is split between the Trickling Filters and the Retention Basin. The system is designed to operate the secondary process at rate not to exceed 7.2 mgd. In order to accomplish this design flow rate, the recirculation valve closes and the Retention Basin valve opens to fill the existing 1.1 mg flow equalization tank. The Retention Basin is currently operated as an off-line storage tank. The secondary bypass, which is sent to the Retention Basin, allows primary effluent to be stored in the tank for future treatment when the flow to the plant has subsided. Once the Retention Basin is full, flow to the tank is terminated. The portion of flow over the secondary treatment capacity of 7.2 mgd will then flow through a gravity overflow line, connected to the primary effluent wet well, directly to the Chlorine Contact Tank and discharged to the receiving stream. When this occurs, it is noted in the plant's monthly reporting documents as WWTF Bypass Station 602.

Performance Evaluation. There was a concern that the rated capacity of the primary effluent pumps was not achievable. In 2010 a concerted maintenance effort was undertaken to put the pumps back into the best condition possible. **Secondary bypassing will occur if these pumps are not capable of pumping the rated design capacity.** Any increase of flow to the secondary treatment process will require a major upgrade to these pumps. They are of the same vintage as the existing raw wastewater pumps.

The tabulated influent (primary effluent) and effluent concentrations of the Trickling Filters indicated an average removal rate of 48% of total CBOD and an average removal rate of 72% of soluble CBOD, under normal conditions. This information is confirmed by the fact that the normal flow is nitrified (ammonia removed) about 40%-45% of the time. This is accepted as a normal to above average range of performance. However, the Trickling Filters are never loaded more than 7.2 MGD under the current operating plan. A reduction in performance may occur at higher flow rates if the necessary improved screening is not accomplished and rags continue to plug the distributor orifices. The process modeling focused on the Trickling Filters and Final Tank operations both now and at higher loading rates (See ***Appendix C***, BioWin Modeling Results).

Capacity Evaluation. A pumping capacity study was conducted over several months and has been continued as a normal operational procedure. The study found that 7.5 mgd could consistently be pumped through the Trickling Filters without causing a degradation in effluent quality. Increased solids "sloughing" from the media was noted at times. The computer modeling indicated that the hydraulic capacity of the filters can be safely raised to 4.0 mgd per filter and that this rate can be sustained over long periods.

There are no discrepancies between the current design and the requirements for Trickling Filters set forth by the 10SS. Therefore, the filters should be able to be operated at the higher hydraulic loading level for sustained time intervals. The recirculation of tower effluent would not be required or allowed during these times. The addition of a third identical Trickling Filter will increase the peak capacity of the secondary treatment process. This design element, along with the new Final Settling Tank, are key items included to provide peak flow treatment.

If a flow rate of 7.2 mgd is being routed to the Trickling Filters, the remaining pumping capacity of 2.4 mgd can be used to pump flow to the Retention Basin. Flow above this 9.6 mgd rate is normally bypassed by gravity to the Chlorine Contact Tank for disinfection and discharge. The maximum value of this secondary bypass flow is 5.4 mgd, assuming the retention basin is not full or overflowing and the raw wastewater pumps are pumping at the maximum rate of 15.0 mgd. This is insufficient to treat or store a peak hourly flow rate of 22 mgd. The flow split needed to accomplish the peak flow treatment will be 12 mg pumped to secondary (Trickling Filters) and 10 mg pumped to Equalization (1.1 mg existing capacity).

Improvements. The Trickling Filters are the main treatment elements of the Girard WWTF. Therefore, it is of critical importance that they perform effectively and meet the NPDES permit limits under all flow conditions. This is not possible with the existing hydraulically limited distribution equipment and questionable media. Both of the existing rotary distributors and the filter media be replaced in order to provide for the uprating of the filters to 4.0 mgd each, for a total of 8.0 mgd. The addition of one new Trickling Filter, in the space provided by the original design, will increase the total peak secondary treatment capacity to 12.0 mgd. The computer modeling of the filter performance at 12.0 mgd flow for CBOD, both soluble and total, removals indicated the predicted future performance of the Trickling Filters would be satisfactory to meet the current CBOD limits. The increased hydraulic loading rate will be 1.5 gpm/ft^2. Each of the Trickling Filters will have new rotary distributors and stacked media installed.

Controls. Normally, flow to the Trickling Filters will be operator-adjustable using VFD controllers connected to each Primary Effluent Pump and a magnetic flow meter on the Trickling Filter feed line. Typically, the feed rate to the Trickling Filters will be approximately 1.0 gpm/ft^2. At low flows, this will require recycling of previously treated water from the Trickling Filter effluent line to maintain the required minimum wetting rate. During high flow conditions, a wet well level transmitter signal will be used to control the speed of the lead pump to maintain the operator-adjustable, wet well level set point. As the wet well continues to rise, the SCADA system will energize additional pumps as needed. Similar to the influent pumps, when additional pumps are called, all pumps will ramp down to low speed and ramp up synchronously until full speed is achieved. Lead pump designation will be alternated automatically, based on time, to equalize run-times among the pumps. Back-up float switches will be supplied to provide control in the event of a level sensor failure.

When flows exceed the Trickling Filter's hydraulic loading (12.0 mgd), a motorized valve will be modulated to provide no more than 12.0 mgd to the Trickling Filters and another valve will open on the discharge line to direct the excess flow to the Retention Tank/EQ Basins. A second magnetic flow meter will meter the flow to the Retention Tank/EQ Basins.

4.2.5 Final Settling

Description. The Girard WWTF has two existing circular Final Settling Tanks (Clarifiers) that were designed with the intent of building a future third unit. The piping from the influent chamber also was designed with this concept in mind. The clarifiers are 75-feet in diameter with a side water depth of 10 feet. The tanks are equipped with conventional scraper-type sludge collection mechanisms, fiberglass weirs and launders, and surface skimmers.

Performance Evaluation. The performance data indicates that the clarifiers are doing an acceptable job of removing the sloughed biomass from the Trickling Filters at nearly all flows. These units work in tandem with the Trickling Filters to convert soluble CBOD to solids and then separate the solids from the liquid stream to produce the final effluent. There have been specific times in the 31-month data period of record that high levels of suspended solids have been discharged. The reasons for this may this may have been a short-term, high sludge blanket in the Final Tanks caused by failure to remove solids efficiently, the failure of the drive mechanism due to heavy solids loadings and/or high hydraulic loadings.

The current hydraulic loading on the final is 825 gpd/sq.ft. This hydraulic loading is less than the allowable peak rate of 1,200 gpd/sq.ft. It is anticipated that the performance of these tanks can be enhanced by improving the ability to more efficiently remove settled sludge from the tanks and provide better sludge pumping control. The existing sludge is withdrawn via a telescoping valve connected to a wet well, from where it is pumped back to the head of the Primary Tanks for co-settling with the raw wastewater solids and then to anaerobic digestion. Although this process works well, the performance could be optimized improved sludge removal equipment and control.

Capacity Evaluation. The WWTF has experienced overflows at the Final Clarifier influent chamber at flows approaching 7.0 mgd. However, hydraulic calculations made as part of the NFA study indicated that the tanks should not have any problem handling flows up to 8.0 mgd or more. One major factor in the hydraulic capacity of the Final Clarifiers is the different lengths of feed piping between the distribution chamber and the tanks. A differential in piping length necessitates a difference in headloss, and therefore, flow between the two tanks may not be evenly distributed. This may not be significant at low flows, but could definitely be a major problem under peak flow conditions. It is a conclusion of this evaluation that the rated capacity of each Final Clarifier can and should be set at 4.0 mgd. The Flow Distribution Chamber can be modified to provide for better flow splitting and prohibit the possibility of an overflow at this location.

Even though the computations for surface overflow and weir overflow rates at 8.3 mgd do not exceed the limits set forth by 10SS, the recommendation for the existing Final Clarifiers is to establish a new peak daily flow rate of 8.0 mgd. This is complementary with the optimized peak flow capacity of the existing Trickling Filters at 8.0 mgd. These conditions were modeled as part of the computer modeling.

Improvements. The existing Final Tank mechanisms are conventional sludge scrapers installed in 10-feet SWD tanks. The tank sludge collection mechanisms be upgraded to spiral arm collectors to direct the sludge to the tank sludge hopper. This will give the operator better direct control of the sludge blanket depth and improve solids removal performance at all hydraulic loading rates. The current conventional drive mechanisms will be upgraded to include precision gear drives for extended life and reduced maintenance. A third 75-foot diameter Final Settling Tank, to match the renovated tank configuration, will be added. This addition will increase the peak flow secondary treatment capacity to 12.0 mgd. The design of the renovated and expanded secondary process will improve the sustainable peak daily performance to provide enhanced suspended solids removal. All three of the Final Tanks will be upgraded to include energy dissipating inlets (EDI's) and density current baffles (Stamford baffles) to optimize performance, particularly under peak flow conditions. The effluent weirs will be raised slightly to match the new hydraulic profile created by the new Ultra Violet disinfection system (described below).

The rapid removal equipment in the Final Tanks will complement the Trickling Filter improvements. New telescoping valves will allow the operator to set them at a level to remove sludge continuously. The sludge removal rate will be controlled by maintaining a constant sludge level in the Secondary Sludge Well. A new level transmitter in the Sludge Well will control the pump motor speed using variable frequency drive (VFD) controlled Secondary Sludge Pumps through the upgraded supervisory control and data acquisition (SCADA) system.

4.2.6 Retention Basin Renovations

Description. The existing Retention Basin at the WWTF is a precast, wire-wrapped, post-tensioned concrete design and holds 1.1 mg when full. The basin is served by one 500 cubic feet per minute (cfm) blower, a diffused air system and three submersible, mechanical, mixers. A drain/effluent line directs flow back to the PEPS wet well for treatment (or to the head of the plant), when capacity and flows allow. An 8-inch overflow line is used to direct the tank overflow to a manhole on the main sewer that re-cycles the overflow to the Raw Wastewater Pump Station wet well. There were no structural issues or needs observed for the Retention Basin.

Performance Evaluation. The Retention Basin has worked well in the role of off-line storage for the plant. The basin works as designed to receive and hold up to 1.1 mg of primary effluent or Primary Tank bypass flow. The basin maintains the wastewater in a mixed and aerated state until it is returned to the PEPS wet well for complete secondary treatment. The relatively large volume of 1.1 mg, compared to the plant average daily design flow of 5.0 mgd, can be more useful to the plant as part of an optimized flow scheme. There does exist a high potential for odors from basin at the end of a drain down cycle. Odors typically are associated with the solids left in the tank after it is drained. The current wash-down system and tank access will be updated through the installation of water cannon (monitors) to reduce the potential for odor generation.

Capacity Evaluation. With a 1.1 mg capacity, the off-line Retention Basin is able to retain or hold flow for the WWTF during a storm event. Assuming that the Retention Basin is empty at the time of the storm event, the WWTF could pump to the basin at a rate of 1.1 mg and reach capacity in 24 hours. If the flow rate into the plant exceeds 7.2 mgd it would be possible for the Primary Effluent Pump Station to pump a maximum rate of 2.4 mgd to the basin. At this rate, the basin would reach its capacity in 11 hours, again assuming the basin is empty. Therefore, the total equalized, peak daily flow would be 8.3 mg. If the basin is full, from previous storm events, the peak daily flow to secondary would remain at 7.2 mgd and any flow in excess of 7.2 mgd would be bypassed to disinfection and discharge.

It is possible to increase the effectiveness of the basin in capturing and treating peak flows by allowing the basin to serve as a large settling tank after it has become full during any single storm event or combination of storm events. The primary effluent that is pumped to the Retention Basin during high flows will have relatively high concentrations of suspended solids and dissolved oxygen, but a relatively low concentration of soluble CBOD. By automatically shutting off the air supply and mixing equipment two hours before the tank would normally overflow, additional solids can be captured for treatment once the tank is drained.

The existing basin can be modified to be a flow-through settling tank once it is completely full. This modification can be achieved by adding overflow weirs, launders and scum baffles to the existing retention basin, along with a new larger overflow pipe to direct the flow to either more storage or to disinfection/discharge. The addition of a chemical coagulant to the existing Equalization (Retention) Basin influent flow will further assist in the capture of suspended solids. This process optimization modification would enhance the removal of both suspended solids and insoluable CBOD during bypass events where the existing 1.1 mg capacity is exceeded. The existing limited volume would not eliminate the current secondary bypass events or even the total volume. Therefore, additional equalization storage volume will be required.

Improvements. The existing Retention Basin will be an integral part of the plant improvements that include flow storage/equalization. Renovations to the existing basin include the internal weirs, launders and overflow piping to route flow in excess of the treatment and current storage capacity to two new storage basins as described below. The renovated Retention Tank will provide a means to capture a majority of the mass of suspended solids during storm events. These improvements shall also include a chemical storage and feed system (see CEPT system discussion above) to facilitate the removal of solids suspended in the flow entering the renovated Retention Basin.

The existing submersible mixers shall be replaced with one new mixer and supplemental diffused air. To retain solids, the mixing and aeration system will be shut-down approximately 1-hour prior to the tank being completely full. This will maximize the solids capture in this first phase of the equalization process. The existing 500 cfm air supply blower will be replaced in kind. The existing control system shall be modified to accomplish the new fill rates, settling and flow management.

4.2.7 New Flow Equalization Basins

Additional flow equalization (EQ) volume is required as determined by the detailed flow analysis of the design storm events completed during the development of the NFA Report. The appropriate sizing of the new storage volume required is a critical element of the design of the improvements. The purpose of this section of the Basis of Design Report is to present the rational supporting the calculations used to determine the volume of additional wastewater storage needed to reduce the occurrences of combined sewer overflows (at CSO 003) and secondary treatment bypasses at the Girard WWTF.

Additional Storage Volume Determination & Basin Design. The City of Girard has one CSO station, CSO 003. It is located along South State Street approximately 600 feet upstream of the raw wastewater influent wet well at the WWTF. CSO 003 is located very close to the WWTF physically and hydraulically. CSO’s occur during heavy storm events when the inflow to the wet well exceeds raw influent pumping capacity. When pumping capacity is exceeded, the level in the wet well can rise high enough to cause the influent sewers to surcharge and overtop the internal bypass weir located at the CSO station. The limiting factor on the ability of the Girard WWTF to minimize CSO events is therefore the raw wastewater pumping capacity. Since all influent must be pumped to the WWTF, the pumping capacity also establishes the peak rate of flow through the plant that must either be treated or stored for future treatment, when the rain event is over.

During the 31-month period over which the NFA plant flow and rainfall database was developed, the City of Girard experienced two well-documented storm events, which resulted in annual maximum peak flow conditions at the WWTF. The wastewater flow rates and volumes from these two events were used to determine the required peak influent and peak primary effluent pumping rates and the total volume of flow that needed to be either stored or treated over the duration of each rain event. The events were as follows:

- October 2012 design storm of 4-day duration and a recurrence frequency of 5-years; and
- July 2013 design storm of 24-hour duration and a recurrence frequency of 50-years.

Flow Response Evaluation to Storm Events. Daily WWTF performance data was compiled to evaluate the influent flow response during extreme rainfall events. The flow data recorded consisted of plant influent, secondary bypass and CSO discharge rates and volumes. These data were compared to rainfall amounts for the period between January 2011 and July 2013. This complete data file is presented in the final amended and approved NFA Report.

The event days with the greatest rainfall, plant bypasses and CSO's were chosen as the design storms. These design storms are summarized in ***Table 4-1***. (Note: Storm Event No. 2 is the critical design storm.) For both storms, the rainfall and high flows lasted for multiple days, as noted, and the design 24-hour-50-year storm, with 4.25 inches of rain in 24 hours, occurred from 3:00 am on July 10, 2013 to 2:00 am on July 11, 2013.

Table 4-1
Storm Event Rainfall Summary

Storm Event	Date	Rainfall Depth	Duration	Storm Frequency
Storm No. 1 (Hurricane Sandy)	10/27/2012-10/31/2012	4.08 Inches	4 days	5 Year
Storm No. 2	7/8/2013-7/11/2013	4.25 Inches	24 hrs	50 Year

CSO and secondary bypass events occurred during both of these design storms. The pumping rates and flow volumes during these two events exceeded all other CSO events and secondary bypass events in the 31-day database.

Hourly data was gathered for these events to determine the peak hourly flow rate and required equalization volume to prohibit a CSO event or a secondary bypass from occurring. A summary of the peak flow rates generated by both storms are shown in the ***Table 4-2***.

Table 4-2
Storm Event Peak Flow Rate Summary

Storm Event	Peak Plant Flow Rate, mgd	Peak CSO Flow Rate, mgd	Total Peak Flow, mgd
Storm No. 1 (Hurricane Sandy)	16.29	2.172	18.5
Storm No. 2	16.23	4.956	***21.2***

As Shown in **Table 4-2**, Storm No. 2 produced a larger total ***peak flow rate of 21.2 mgd***, which exceeds the maximum pumping capacity of the raw influent pumps as well as the primary effluent pumps and therefore allowed a CSO event and a plant bypass to occur because the total flow was over 10.0 mgd. Equalization volume calculations for both storm events were done to determine the storage volume necessary to prevent a CSO and secondary bypass occurrence. The data is summarized in ***Table 4-3***. Calculations were based on having two different secondary treatment capacities in anticipation of two different peak secondary treatment capacities: 1) 8.0 mgd optimized existing peak flow capacity; and 2) 12.0 mgd of total expanded secondary peak flow capacity. The ability to treat an additional 4.0 mgd of peak flow is the selected basis of design for the Girard WWTF.

Table 4- 3
Design Analysis Summary
Equalization Basin Volume Requirements by Storm Event

Description	8.0 mgd Peak Flow Treatment Option		12.0 mgd Peak Flow Treatment Option	
	Storm Event No. 1	Storm Event No. 2	Storm Event No. 1	Storm Event No. 2
Total Volume of EQ Needed, mg	6.0	7.3	1.4	3.5
Existing Volume of Retention Basin, mg	1.1	1.1	1.1	1.1
Additional Volume of EQ Needed, mg	**4.9**	***6.2***	**0.3**	***2.4***

As shown in ***Table 4-3***, Storm No. 2 shall be used as the basis of design for improvements produced since it resulted in the greatest storage volume requirement for both treatment options. The equalization volumes are calculated by multiplying the duration of the storm by the flow rate in excess of treatment capacity.

There shall be two new EQ Basins as shown in ***Figures 1 and 3*** of the preliminary site plans. The basins shall be lined and be equipped will fill and drain lines and aeration equipment for mixing and positive dissolved oxygen control.

Summary. **The improvements described above, will increase the firm pumping capacity to 22.0 mgd for both the Raw Wastewater Pumping Station and the Primary Effluent**

Pumping Station. Once the flow reaches treatment capacity of 12.0 mgd, the excess flows, which have received preliminary and primary treatment, will be pumped to the renovated 1.1 mg Retention Basin. One hour before the basin is full, the aeration/mixing will be terminated to allow solids to settle. Primary effluent will continue to be pumped to the Retention Basins and will force, by displacement, the clarified primary effluent over a new overflow weir, and directed to the two new Equalization Basins. The new EQ basins will be filled in series. The Retention Tank and EQ Basins will be cleaned using water cannon and Non-Potable Water (NPW).

4.2.8 Disinfection

Description. The existing Girard WWTF uses chlorine gas for disinfection and sulfur dioxide gas for de-chlorination. A chlorine solution is mechanically mixed into the flow (secondary effluent or combined secondary effluent and secondary bypass flow) at the beginning of a concrete serpentine channel Contact Tank. A solution of sulfur dioxide is added to the disinfected flow to achieve de-chlorination (removal of excess residual chlorine) of the final effluent before metering and discharge to the Little Squaw Creek.

Performance Evaluation. The plant has recently converted from a fecal coliform standard to an E. coli standard for monitoring disinfection effectiveness. There were some issues related to consistently meeting the new limits during the transition period when both standards were in effect. The plant installed a new drive motor on the mixer where chlorine, secondary effluent and secondary bypass flows blend and it has helped maintain compliance. The total detention time at peak flows is a concern and will be addressed as part of the peak flow improvements. The process has generally allowed the plant to meet the limits imposed by the NPDES permit.

Capacity Evaluation. The only criteria set by 10SS, which is a concern, is the contact time within the Chlorine Contact Chamber. According to the standard, there must be a minimum detention of 15 minutes at the peak flow rate. At a flow rate of 9.6 mgd the contact time is just under 15 minutes, at 13.4 minutes. At the current maximum flow rate of 15.0 mgd, the detention time is only 8.34 minutes. This detention time is well below the 15-minute requirement and adding additional volume to the Chlorine Contact Chamber would require major work. It is calculated that at the new peak flow rate of 22.0 mgd the existing contact tank provides 5.2 minutes of detention time. Based on this data, the volume of the contact tank would need to be tripled to meet the detention time requirement. The chemical feed systems would also need to be renovated to feed high rates of both chlorine and sulfur dioxide.

Improvements. The detention time limitation at flows above 8.3 mgd rate are one of the current limiting factors on the peak capacity of the plant. The disinfection process be converted to ultra-violet (UV) light disinfection with a peak capacity of 22.0 mgd. Redundant units will be installed to ensure disinfection in the event of a failure of one of the UV systems. This technology will improve the reliability and safety of the entire disinfection system. The disinfection improvements in the post treatment area will also include a new 42-inch diameter effluent magnetic flow meter to measure and record the plant effluent discharge.

4.2.9 Solids Handling Improvements

Description. The existing Girard WWTF produces raw primary sludge and waste secondary sludge from the trickling filters. Currently, secondary sludge is returned to the head of the primary tanks where it is mixed with the preliminary treatment effluent and settled in in the primary tanks as a component of the raw primary sludge. The combined sludge is pumped to the primary anaerobic digester for digestion, then to the secondary digester for stabilization and holding then to dewatering (via Belt Filter Press) and transported to an approved landfill for disposal.

Evaluation. The co-mingling of primary and secondary sludge above the average design flow rate (5.0 mgd) is no longer applicable for several reasons. In order to convert the primary settling process to an enhanced high rate process, the solids load on the primary tanks will need to be reduced. Therefore, the waste secondary sludge and the anaerobic digester supernatant will be handled by different methods under high flow conditions.

Improvements. The current practice of pumping the raw primary sludge directly to the anaerobic digesters will be modified. Primary and secondary sludge will be mixed, blended, and stored in one of two new Sludge Storage/Blending Tanks. As discussed above, these tanks will be two of the re-purposed Pre-Aeration Tanks. The sludge will be thickened, by gravity settling in a batch-type process using telescoping valves for decanting the supernatant, prior to being pumped to the Anaerobic Digesters. Two new sludge transfer pumps will be installed for this purpose. Redundant pumps will be provided for all functions and alternative flow piping plans will be provided for tank draining and maintenance.

The thickened sludge will be transferred to the Primary Anaerobic Digester for digestion. Digested sludge will be pumped to the Secondary Anaerobic Digester for storage. Digester mixing will be improved through the installation of a pump-driven mixing system, with redundant pumps. The digested sludge will be pumped from the Digested Sludge Well or directly from the Secondary Anaerobic Digester to the Belt Filter Press for dewatering and final disposal. This flow pattern and new mixing and transfer pumps will improve overall sludge disposal efficiency and allow for the coordinated operation of thickening and dewatering. The ability to mix both digester tanks will be included to optimize both the digestion and dewatering processes.

Please refer to Appendix A for the detailed design criteria for the modified sludge handling facilities.

4.2.10 Pump Station Improvements

Description. The City operates two pump stations in the collection system tributary to the WWTF. The stations, Syro and Broadway, have equipment that is original to the construction of the facilities and are in need of renovation to meet current flow, code and performance criteria.

Performance Evaluation. Syro pump station is a triplex station that has a firm pumping capacity of 2.0 mgd, with the largest pump out of service. The pumps are designed to pump 700 gpm each. No flow metering is currently installed. An evaluation of the station found the station's comminutor channel and manual screen to be ineffective. The comminutor is non-functional and the bar screen can become blinded quickly causing unscreened sewage to enter the wet well.

The Broadway station is also a triplex station. However, two pumps are designed to pump 1,150 gpm while the third has capacity of 2,300 gpm. The firm pumping capacity, with the largest pump out of services is 3.0 mgd. There is no flow meter in the station.

Capacity Evaluation. Based on current or anticipated planning-term flow within the service area, there is no need to increase the firm pumping capacity of either station.

However, the Broadway pump station, as currently designed, receives excess diurnal or wet weather flow from the trunk sewer, which passes by the station, and pumps it to the WWTF. Under normal "dry" conditions, the station may pump only once a day. This results in the contents of the wet well becoming septic and prone to hydrogen sulfide production. When the pumps are eventually activated, the septic sewage discharged from the station creates serious odors from the collection system and has corrosive properties. The influent line to the station will be modified to ensure the station receives adequate flow to initiate a pumping sequence, at a minimum, twice per day. This will aid in keeping the sewage fresh and reduce corrosive hydrogen sulfide production and the resulting odors emanating from the pump station wet well and downstream sewers.

Improvements. Improvements to the Syro pump station will include removing the comminutor and enlarging the manually cleaned bar screen. When the bar screen becomes blinded, flow will overtop a weir wall and flow into the by-pass channel and then to the wet well.
The triplex pump design will be changed to a duplex pump system. Each new chopper-type pump will have a firm pumping capacity of 2.0 mgd, or 1,400 gpm. A magnetic flow meter will be installed in the new pump discharge header to measure the pump station flow.

At the Broadway pump station, in addition to the influent piping changes, the improvements will include replacing the triplex pump system with a duplex pump design. The new pumps will have a firm pumping capacity of 3.0 mgd or 2,300 gpm. A new magnetic flow meter will be installed in the discharge header.

FIGURES

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HORIZONTAL AND VERTICAL CONTROL				
CONTROL POINT	DESCRIPTION	ELEV.	NORTHING	EASTING
–	–	–	–	–
BENCHMARK				
BM #1	CHISELED SQ. TOP WALL	868.10		
BM #2	ARROW TOP OF FIRE HYDRANT	866.80		
BM #3	'X' CUT TOP OF EAST FOUNDATION BOLT	869.13		

BUILDING AND STRUCTURE LOCATIONS			
DESCRIPTION	CORNER	NORTHING	EASTING
HEADWORKS BLDG.	NW	9857.1	9999.1
	NE	9856.6	10031.1
PRIMARY EFFLUENT PUMP BLDG.	SW	9808.0	10213.4
	SE	9807.7	10233.1
NEW TRICKLING FILTER	CENTER	9838.0	10289.5
NEW CLARIFIER	CENTER	9945.1	10384.9

SOIL BORING LOCATIONS		
BORING	NORTHING	EASTING
SB-1	9810.9	10241.4
SB-2	9846.8	10302.1
SB-3	9911.7	10401.2
SB-4	10002.8	10382.1
SB-5	10267.2	10493.2
SB-6	10271.6	10653.9
SB-7	10336.0	10658.8
SB-8	10507.5	10451.4
SB-9	10515.2	10347.2
SB-10	9852.6	10022.6
SB-11	9982.5	10450.5
SB-12	10102.1	10385.4
SB-13	10433.8	10321.1

LEGEND
- EXISTING ASPHALT
- EXISTING CONCRETE
- EXISTING SIDEWALK
- NEW ACCESS DRIVE

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REVISIONS		

BURGESS & NIPLE
50 SOUTH MAIN STREET, SUITE 600
AKRON, OHIO 44308

CITY OF GIRARD, OHIO
WASTEWATER TREATMENT PLANT
PEAK FLOW TREATMENT AND
EQUALIZATION IMPROVEMENTS

FIGURE 1
GENERAL SITE PLAN

SCALE: 1" = 50'
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	REVISIONS	

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CITY OF GIRARD, OHIO
WASTEWATER TREATMENT PLANT
PEAK FLOW TREATMENT AND
EQUALIZATION IMPROVEMENTS

FIGURE 2A
PLANT WASTEWATER FLOW SCHEMATIC

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WASTEWATER TREATMENT PLANT
PEAK FLOW TREATMENT AND
EQUALIZATION IMPROVEMENTS

FIGURE 2B
PLANT WASTEWATER FLOW SCHEMATIC

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CITY OF GIRARD, OHIO
WASTEWATER TREATMENT PLANT
PEAK FLOW TREATMENT AND
EQUALIZATION IMPROVEMENTS

CITY OF GIRARD, OHIO
WASTEWATER TREATMENT PLANT
PEAK FLOW TREATMENT AND
EQUALIZATION IMPROVEMENTS

FIGURE 2C
PLANT BIOSOLIDS FLOW SCHEMATIC

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APPENDIX A

Appendix A

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	Peak Design Flows (PDF /PHF)	Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities	
	Plant Design Flows:				
	Averge Daily Flow, MGD	5.0	5.0	**5.0**	The Average Daily Flow will remain at 5.0 MGD
	Peak Daily Flow, MGD		15.0	**22.0**	
	Peak Hourly Flow, MGD		15.0	**22.0**	
	Peak Daily Flow, MGD to Secondary		7.2	**12.0**	
	Peak Hourly Flow, MGD to Equalization		7.8	**10.0**	
	Equalization Storage Volume, MG Total		1.1	**3.5**	
1.	**Coarse Bar Screen:**				
	Existing Coarse Screen			**--**	Existing Bar Rack Capacity is 24.0 MGD
	One Unit, Manually Cleaned				
	1-3/8-inch Spacing @ 60 Degree Angle				
	Remove and Replace with New Coarse Screen			**1-Inch**	New Mechanically Cleaned Coarse Screen in Wet Well. Screenings discharged to dumpster at ground level.
	Type			**Mechanically Cleaned Raked Bar Screen, No Bottom Sprocket**	22.0 MGD capacity
	Existing Channel Fine Screen after raw pumping				Not Functional.

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	**Peak Design Flows (PDF /PHF)**	**Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities**	
	New Fine Screen (after Raw Pumps)			**1**	1 Manual bypass screen
	Type			**Mechanically Cleaned Perforated Punch Plate**	22.0 MGD capacity, 1/4-inch Punch Plate-Type housed in a heated building
	Channel Width				
	New Screenings Washer/Compactor			**1**	Screened solids disposed of in dumpster and then to landfill
2.	**Raw WW Pumping**				
	Design Flow, MGD	5.0	15.0	**22.0**	With largest pump out of service
	2 @ 1,800gpm (2.5 MGD each)			**Replace**	TDH = 32.0 ft w/ 30 hp VFD
	2 @ 3,600gpm (5.0 MGD each)			**Replace**	TDH = 32.0 w/ 50 hp VFD
	1 @ 3, 600gpm (5.0 MGD)			**Replace**	TDH =32.0 ft Constant Speed Suction Lift Trash Pumps
	New Pumps:				
	4 - 3,100 gpm @ 33' TDH ea. **Dry Pit Horizontal Screw Centrifugal** **2 - 3,100 gpm @ 23' TDH ea.** **Submersible Pumps**			**6 -New = 22.0 MGD w/ largest out of service**	Replace Existing 5 Pumps with 6 New Pumps: 4 Dry Pit, End Suction, Horizontal, Screw Centrifugal and 2 Submersible Pumps. 4 Dry Pit Screw Centrifugal Pumps will be VFD controlled and 2 Submersible Pumps will be Constant Speed. New headers and piping new Mag meters (24 inch & 16 inch). Peak pumping capacity will be met with largest unit out of service.
3.	**Grit Chamber**				
	Design Flow, MGD	5.0	15.0	**22.0**	
	Existing:				
	One Square Unit, Detritus				
	22'W x 22'L x 2.6' SWD				
	Detention Time, min	2.7	0.9	**24**	The recommended maximum horizontal velocity is 0.8 to 1.3 ft/sec (Medcalf & Eddy)
	Horizontal Velocity, fps	0.2	0.3	**0.96**	Check on Final Review

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	Peak Design Flows (PDF /PHF)	Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities	
	New:				Replace Detritus Grit Collector, Drive and Bridge with New Mechanical Vortex Type System
	One Mechanical Vortex Grit Chamber with Bypass Channel				
	18 foot Diameter				
	Design Flow, MGD	5.0	15	**5.0/22.0**	
	Grit pumps, GPM			**250**	
	Number of Units	2		**2**	Screw centrifugal
	Grit Washer-Classifer	1.0	1	**1**	Dispose of grit in dumpster and then to landfill. Consider bagger attachment to avoid splattering
4.	**Preaeration Tanks/Sludge Holding Tanks**				
	Primary Design Flow, MGD	5.0	7.2	**12.0**	Primary Tanks: Peak Flow limited to 12.0 by Inlet flow control with Chemical Treatment. Add new flow control gate at primary tank influent flume and parshall flume meter
	Preaeration Tanks, 2 Units @ 150 SCFM each				Two existing tanks will serve as pre-aeration and coagulation chambers during CEPT operations
	20' W x 22' L x 11.4' SWD				
	Volume, Total Gallons	---	---	**75,000**	37,500 gallons each with mixer and aeration supply
	Sludge Tanks, 2 Units				Convert two existing pre-aeration tanks to sludge holding tanks. Used for sludge blending (primary/secondary) prior to digestion
	20' W x 22' L x 11.4' SWD				
	Volume, Total Gallons	---	---	**75,000**	37,500 gallons each with mixing only
	New Low Horsepower Mixers (2, 1/tank)				Top mounted hyperboloid type
	2 New Rotary Lobe Compressors			**600 SCFM Each**	New Pre-aeration Compressors (Blowers)
					New diffusers and drop pipes & control valves
					New mixers in 2 sludge tank

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	**Peak Design Flows (PDF /PHF)**	**Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities**	
5.	**Primary Treatment**				
	Design Flow, MGD	5.0	7.2	**12.0**	10SS, 71.2 - Effective flow splitting devices added in 2000
	Four Units				Peak Flow limited to 12.0 by Inlet flow control to pumping and Equalization with Chemical Treatment
	2@20' W x 60' L x 8.6' SWD				10SS, 72.1 - Min. Recommended SWD is 10 ft. (Do Not Revise)
	2@20' W x 65' L x 8.6' SWD				10SS, 72.3 - Elimination of floating material at Inlet
	Rectangular, Chain & Flight				
	Detention Time, hr	1.5	1.1	**0.6**	
	Surface Overflow, gpd/ft^2	1,042	1,440	**2,400**	10SS, 72.21 - Max. Peak Overflow Rate is 1,500 gpd/sf to 2,000 gpd/sf CEPT operations allow increased SOR's to 3,000-4,000 gpd/sf
	Total Weir Length, 656 ft				
	Weir Overflow Rate, gpd/ft	7,621	11,000	**18,300**	10SS, 72.41 - Overflow weirs shall be adjustable Maximum peak rate is 30,000 gpd/ft
	Replace Weirs, Launders, and Scum Removal System				Adjust Weirs to be level & replace scum removal systems
	Replace Sludge Collection Equipment and Pumps				Provide for better control of Primary Sludge and Scum withdrawal and removal to the Anaerobic Digesters
6.	**Primary Effluent Pumping**				
	Design Flow @ 46' TDH, MGD	5.0	7.2		Existing firm pumping capacity is 10.0 MGD w/ largest pump out of service
	2@1,735gpm				
	2@3,470gpm				
	Variable Frequency Drive				

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	Peak Design Flows (PDF /PHF)	Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities	
	New Pumps:	5.0		**22.0**	New Pumps shall have 22.0 MGD firm pumping capacity w/ largest pump out of service
	4 @ 5,100 gpm (7.33 MGD)			**4 -New = 22.0 MGD w/ largest out of service**	Replace 4 Existing Pumps with 4 New Pumps: Dry Pit Vertical Screw Centrifugal Type, with VFD's. New headers and piping new mag meters (24 inch) on each side of the station. North side to Equalization/Retention with flow control valve and South side to Trickling Filters
7.	**Trickling Filters**				
	Design Flow, MGD	5.0	5.0	**5.0**	
	Peak Flow, MGD	5.0	7.2	**12.0**	Increase Flow to Secondary Treatment
	Number Of Units	2	2	**3**	New and Replaced media
	Modular PVC media, Cross Flow and Vertical			**Remove & Replace**	Chamber and arms (10SS, 91.212)
	48' Diameter, 18' Media Depth				Add one additional unit
	Media Volume, ft^3 Total	79,600	79,600	**97,700**	0.5:1 - 4:1 (recirculation verses design)
	Media Specific Surface Area	30 ft^2/ft^3	30 ft^2/ft^3	**30 ft^2/ft^3**	Standard Design
	Organic Loading, lbs $BOD_5/1000ft^3$	40	40	**33**	10SS, 91.43 - For Ventilation no more than
	Hydraulic Loading, gpm/ft^2	1.0	1.0	**1.5**	
	Existing Dist. Arms Rated @ 3.6 MGD ea.			**Remove & Replace**	
	New Dist. Arms Rated @ 4.0 MGD ea.			**3**	
8.	**Final Clarifiers**				
	Design Flow, MGD	5.0	---	**5.0**	
	Peak Flow, MGD	---	7.2	**12.0**	
	Number Of Units	2	2	**3**	Replace Sludge Collector with Spiral Arm Type
	75' Diameter, 10' SWD				New unit to match existing tank dimensions/design
	Detention Time, hr	3.2	2.2	**2.0**	
	Surface Area, Total Ft^2	8,800	8,800	**13,200**	
	Surface Overflow, gpd/ft^2	566	815	**910**	10SS, 72.232 - Max. peak overflow rate is 1,200 gpd/ft^2
	Weir Overflow Rate, gpd/ft	10,600	15,254	**16,930**	

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	**Peak Design Flows (PDF /PHF)**	**Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities**	
9.	**Retention Basin**				
	Reinforced Concrete Round Tank				
	1.1 MG				
	90' Diameter, 24.2' SWD				10SS, 65.52 - DO > 1.0 mg/l
	Existing 500 SCFM Blower				Replace existing blower with new 500 SCFM unit
	Existing 3 Submerged Turbine Mixers				Replace existing 3 mixers w/ 1 new unit
	Overflow Weir & Launders	--	--	**NEW**	Fiberglass weir, launder and scum baffle
	Fill Rate, MGD		0 - 2.4	**0-12 mgd rate**	
	Volume to Basin, MG Maximum per Day	--	1.1	**1.1**	Secondary & Primary bypass flow will fill basin then overflow to 2 new Equalization Basins
	Overflow Volume to Additional Equalization Volume, MG			**2.4**	Added Equalization storage volume to minimize Secondary bypasses & CSOs
	Equalization Lagoons				
	Two Lagoons and Volumes			**1 MG and 1.4 MG**	Concrete lined lagoons with dual-use influent and drain piping.
	Two Floating Mixers, One per Lagoon				
	Total Equalization Volume, MG			**3.5**	
10.	**Disinfection System : Chlorination/UV**			**New UV System**	Existing system is undersized Chlorination /Dechlorination (Gas Cl_2 & SO_2)
	Design Flow, MGD	5.0		**5.0**	10SS, 102.2 - Dosage @ 10mg/L
	Peak Hourly Flow, MGD		7.2	**22.0**	Through new UV disinfection units
	Peak Daily Flow, MGD		14.0	**22.0**	Existing System is undersized Chlorination /Dechlorination (Gas Cl2 & SO2)
	1 @ 3.5' W x 356' L x 9.5' SWD				
	Detention Time, min	25.0	8.3	**N/A**	10SS, 102.44 - Min. contact time of 15 minutes at Peak Flow
	Serpentine Channel			**Convert to UV Channel**	Replace Cl_2 & SO_2 Systems with UV Disinfection System

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	Peak Design Flows (PDF /PHF)	Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities	
11	**Anaerobic Digesters**				
	Heat Exchanger				Walker HX375 - existing to be refurbished
	Boiler				Existing - Recent Replacement - Natural Gas Fuel only.
	Gas Mixing System				Existing to be removed
	Gal Piping			**New Piping and Valves**	To be replaced along with Safety Equipment and new Gas Flare
	Recirculation Pumps				
	One Vortex Wemco and One HG Chopper				
	New Pumps:				
	Recirculation Pumps	2	EA	**150 gpm each**	Screw centrifugal
	New Digester Pump mixing system				
	Digester Mixing Pumps	2	EA	**1200 gpm each**	Vaughan or Evoqua (system with any chopper pump)
12	**Syro Lift Station**				Existing pumps are horizontal non-clog pumps by Fairbanks Morse.
	Design Flow 1,400 gpm @ xx' TDH	2.0	2.0		Existing firm pumping capacity is 2.0 MGD w/ largest pump out of service
	3 Pumps @ 700 gpm each				
	New Pumps:	2.0		**2.0**	New Pump system shall have 2 MGD firm pumping capacity w/ largest pump out of service
	2 @ 1,400 gpm (2 MGD) each			**2 -New = 2.0 MGD w/ largest out of service**	Replace 3 existing pumps with 2 new pumps. Install new mag meter on discharge line.
13	**Broadway Lift Station**				Existing pumps are vertical non-clog pumps by Fairbanks Morse.
	Design Flow 2,300 gpm @ 40' TDH	3.0	3.0		Existing firm pumping capacity is 3.0 MGD w/ largest pump out of service
	2 Pumps @ 1,150 gpm @ 34' TDH				
	1 Pump @ 2,300 gpm @ 34' TDH				
	New Pumps:	3.0		**3.0**	New Pump system shall have 3 MGD firm pumping capacity w/ largest pump out of service
	2 @ 2,300 gpm (3 MGD) each			**2 -New = 3.0 MGD w/ largest out of service**	Replace 3 existing pumps with 2 new pumps. Install new mag meter on discharge line.

Girard WWTF Basis of Design
Peak Flow Treatment & Equalization Improvements

DETAILED DESIGN DATA

		Existing Conditions		Proposed Improvements	REMARKS
		ADF	Peak Design Flows (PDF /PHF)	Additional Flow Equalization, Increased Secondary Treatment Capacity and Optimized Facilities	

LEGEND
ADF - Average Daily Flow
EQ - Equalized
GPM - Gallons per Minute
PDF - Peak Daily Flow
MG - Million Gallons
MGD - Million Gallons per Day
SWD - Side Water Depth
WAS - Waste Activated Sludge
10SS - Ten State Standards

APPENDIX B

APPENDIX B
FUNCTIONAL CONTROL DESCRIPTIONS

RAW WATER PUMPING:

Control. The new coarse bar screen will be controlled by level transmitters located ahead of and behind the screen element. When the level ahead of the screen reaches a factory-selected set point, the screen-cleaning device will be energized and complete a cleaning cycle to remove debris from the screen face. A back-up float switch will be provided to start a cleaning cycle and sound an alarm in the event of a failure of the ultrasonic level sensor.

Screenings will be deposited into a dewatering screw conveyor. The compacted screenings will be transported to a dumpster for landfill disposal. The screen and dewatering compactor will be interconnected so that if one of the units shuts down, for any reason, the other unit will be de-energized also.

The new pumps will be controlled to maintain an operator-selectable level in the wet well. The pumping rate will be monitored and adjusted via SCADA through Variable Frequency Drives (VFD) for each of the six influent pumps (four normal duty and two storm duty). As the wet well level increases, the lead pump will speed up to maintain the target level. If the level continues to increase, the lag pump(s) will be energized. The lead pump will be slowed down and all energized pumps will speed up simultaneously until the level limit is attained. If the level continues to rise, the high water alarm will be activated and the lead storm-flow pump (located in the wet well) will be started. The two storm pumps will have a separate force main, which will direct flow to the preliminary treatment building for screening and grit removal. Magnetic flow meters will be installed in both the normal duty force main and the storm pump force main to meter influent wastewater flow. Lead pump designation will be alternated automatically, based on time, to equalize run-times among the pumps. Back-up float switches will be supplied to provide control in the event of a level sensor failure.

The screen and pumps status will be monitored through SCADA. Equipment stop and start functions will be limited to operator input from the local control panels, for safety reasons.

APPENDIX B

FUNCTIONAL CONTROL DESCRIPTIONS

PRELIMINARY TREATMENT:

Controls. The Fine Screen will be controlled by a pair of level transmitters located in the influent channel ahead of and behind the screen element. When the water level ahead of the screen reaches a factory-selected, set point, the screen-cleaning device will be energized and complete a cleaning cycle to remove debris from the screen face. A back-up float switch will be provided to start a cleaning cycle and sound an alarm in the event of a failure of the ultrasonic level sensor.

Screenings will be deposited into a dewatering screw conveyor and compactor. The compacted screenings will be transported to a dumpster for landfill disposal. The screen and dewatering compactor will be interconnected so that if one of the units shuts down, for any reason, the other unit will be de-energized also.

The Vortex Grit Removal System will be controlled by the vendor supplied control panel. Grit will be removed by the vortex action induced by a submerged mixer in the unit. The lead Grit Pump will be automatically called to start based on an operator selectable timer in the control panel. Two pumps will be installed to provide redundancy and will be automatically alternated to extend the service life of the pumps. Grit slurry will be pumped to a new Grit Classifier where the grit will be washed, dewatered and deposited into a dumpster for landfill disposal. The Vortex Grit Removal System, Grit Pumps and Grit Classifier will be interconnected to stop all components in the event any one of these units should be stopped.

The run status of the screening and grit equipment will be monitored by the SCADA system. For safety, on-off control will be limited to operator selection from the vendor-supplied control panel(s) for each piece of equipment or the local shut-off provided.

PRE-AERATION AND PRIMARY SETTLING:

Controls. Pre-aeration of the sewage, prior to primary settling, will be provided by two, positive displacement, blowers. The blowers will be controlled by a vendor-supplied control panel and will be constant speed. Dissolved air concentrations in Pre-Aeration will be monitored using a portable Dissolved Oxygen (DO) meter and adjusted using manually operated butterfly valves.

APPENDIX B

FUNCTIONAL CONTROL DESCRIPTIONS

Mixers in the Pre-Aeration Tanks and Sludge Holding/Blending Tanks will be able to be started or stopped manually or through SCADA. The mixers will have a single speed motor and will typically run continuously.

Primary Settling Tanks will provide sludge collection and scum removal from the influent wastewater. The Sludge and Scum Collectors will be controlled manually from the control panel and run continuously. Sludge removal rates from each Primary Settling Tank will be operator adjustable through SCADA and VFDs connected to each Sludge Pump motor. Typically, the pumps will run continuously to remove sludge from each Primary Tank. Sludge will be transported to the Sludge Holding/Blending Tanks or it can be pumped directly to the Anaerobic Digester if desired. Sludge will be fed to the Anaerobic Digester either continuously or in a batch mode, as determined by the operator.

During high flow conditions (≥12.0 mgd) the SCADA or the operator will initiate the CEPT process. Adjustments to the coagulant and flocculant feed rates will be done from the Chemical Feed Pump control panel or through SCADA. Flow pacing will be accomplished by using the flow rate to the Primary Tanks, measured at the influent Parshall flume, and adjusting the coagulant and flocculant pumps accordingly. Chemical Feed and Polymer Blending start and stop functions will be provided through the SCADA system.

TRICKLING FILTERS:

Controls. Normally, flow to the Trickling Filters will be operator-adjustable using VFD controllers connected to each Primary Effluent Pump and a magnetic flow meter on the Trickling Filter feed line. Typically, the feed rate to the Trickling Filters will be approximately 1.0 gpm/ft^2. At low flows, this will require recycling of previously treated water from the Trickling Filter effluent line to maintain the required minimum wetting rate. A wet well level transmitter signal will be used to control the speed of the lead pump to maintain the operator-adjustable, wet well level set point. As the wet well continues to rise, the SCADA system will energize additional pumps as needed. Similar to the influent pumps, when additional pumps are called, all pumps will ramp down to low speed and ramp up synchronously until full speed is achieved. Lead pump designation will be alternated automatically, based on time, to equalize run-times among the pumps. Back-up float switches will be supplied to provide control in the event of a level sensor failure.

When flows exceed the Trickling Filter's peak hydraulic loading (12.0 mgd), two motorized valves will be controlled through SCADA and modulated to provide no more than 12.0 mgd to the Trickling Filters. All flow above the 12.0 mgd will be pumped to the Retention Tank/EQ Basins. A second magnetic flow meter will meter the flow to the Retention Tank/EQ Basins.

FINAL SETTLING:

Controls. The Final Settling Tanks Sludge and Scum Collectors shall run continuously and will be started or stopped manually from the local control panel. Sludge and scum will be collected and directed to the Sludge/Scum Well located in the PEPS Building. Sludge will be wasted continuously, the rate being controlled by telescopic valves. Two Sludge Pumps (one lead and one stand-by) will direct the final sludge and scum to the Primary Settling Tanks for co-settling with the influent waste. However, during high flow conditions (>12.0 mgd), the final sludge and scum will be discharged to the Sludge Holding/Blending Tanks to avoid overloading the Primary Settling Tanks. This change will be accomplished automatically using a motorized valve and flow meter signal. If the Sludge Holding Tanks are full, an alarm will be activated and an interconnect between the tank level will shut down the final Sludge Pumps until flows recede or the Sludge Holding/Blending Tanks are emptied. Under this condition, the Final Settling Tank Sludge Collector will be stopped and the sludge valve must be closed to the Final Sludge/Scum Well until the Sludge Holding/Blending Tanks are emptied or flow recede to normal levels.

The final sludge pumping rate is fixed by the two existing constant speed pumps. The sludge pumping will be controlled by a level transmitter (with back-up float switches) in the Sludge/Scum Well. Level signal will start or stop the lead pump. Pumps are be alternated automatically to equalize run times. Pump status will be monitored by SCADA.

FLOW RETENTION/EQUALIZATION:

Controls. As discussed above, flow to the Retention Tank/EQ Basins will be provided by the PEPS pumps when plant flow exceeds the Trickling Filter hydraulic loading rate of 12.0 mgd. The existing Retention Tank will be filled first. A level transmitter in the tank will start a mixer and the blower when the water level reaches an operator-adjustable set point. The mixing/aeration will continue during filling and storage.

When the Retention Tank is filled to its 1.5 mg capacity, any additional water entering the tank will overflow a fixed overflow weir and into the EQ Basin fill/drain line. The water will enter another flow distribution structure, between the two new EQ Basins, where it will fill the EQ Basins in series. The southern EQ Basin will fill first and as the flow rises in the basin and the distribution structure, it will be forced over a fixed weir wall in the structure and begin filling the northern EQ Basin. Ultrasonic level transmitters, located in the distribution structure, will provide a level signal to monitor the level in each Basin. An overflow pipe will be installed in the northern basin to direct flow in excess of the 3.5 mg of storage back to the 24-inch trunk line and returned to the plant headworks for treatment.

Prior to draining the Retention Tank and EQ Basins, the operator will stop the mixing/aeration to allow solids to settle. The Tank and Basin contents will be returned to the treatment plant by opening a motorized valve on the drain line connected to the PEPS wet well for secondary treatment. A flow meter on the drain line will enable the operator to monitor and adjust the flow rate of the Tank and Basin contents back to the PEPS wet well.

DISINFECTION:

Controls. The UV system will be controlled by the new 42-inch effluent flow meter signal. The UV control panel will receive flow data from the meter and energize the appropriate number of UV modules (bulbs) as necessary to disinfect the effluent flow. The UV system will be on continuously during the disinfection season, May through October. SCADA will monitor the UV on/off status and bulb intensity.

Disinfected water will be utilized for the NPW system. Two vertical, centrifugal water pumps (one lead and one stand-by) will be installed to provide the necessary service pressure. The NPW will be used for tank cleaning, Belt Filter Press wash water and other maintenance purposes. Self-cleaning strainers will be provided to filter the NPW used for "process" purposes. NPW for tank cleaning will not be strained. The pumps will be controlled by a NPW system pressure signal, which will adjust the pump speed through VFDs to maintain an operator-adjustable pressure set point in the NPW distribution system. Lead pump designation will be alternated automatically based on run time to equalize pump use.

SOLIDS HANDLING:

Controls. The primary digester receives the raw, blended sludge from the Primary Sludge Pump Building. Mixing of the digester contents is necessary to provide complete digestion and stabilization of the sludge. Mixing will be provided by a chopper-type pump mixing system. One lead pump and one stand-by pump will be provided. The pumps will discharge the sludge through mixing nozzles, located at the bottom of the digesters to provide full mixing of both the primary and secondary digesters. The mixing can be programmed, on the mixing pump control panel, to operate on a continuous or timed basis. The primary digester will typically be mixed continuously, whereas the secondary digester will be mixed periodically to maintain a homogenous mixture specifically while pumping digested sludge to the BFP for dewatering the sludge prior to landfill disposal. The mixing pumps will be alternated automatically based on time to equalize the "lead pump" use.

Heating of the sludge is provided by two recirculation pumps (one lead and one stand-by) that pump the sludge through a heat exchanger. Recirculation pumps will run continuously. The operator will alternate the "lead pump" manually, based on time, to equalize run time between the two pumps. A thermometer, located in the primary digester, will provide a digital signal through SCADA so the operator can monitor the digested sludge temperature. SCADA will monitor sludge mixing and recirculation pumps for on/off status. No automatic start/stop functions will be provided for safety purposes.

PUMP STATIONS:

Control. The Syro Pump Station will be controlled by a level transmitter in the wet well. The lead pump will be programmed to speed up or slow down the pump to maintain the operator-adjustable, wet well level, set point. If flow into the pump station continues to fill the wet well, the high water alarm will be activated and the lag pump will be started. Both pumps will start at low speed and ramp up to full speed together. "Lead" pump designation will be alternated automatically to equalize run-times between the pumps. A magnetic flow meter will provide a reading of flow out of the pump station. Back-up float switches will be supplied to provide control in the event of a level sensor failure.

As noted above, the Broadway pump station influent line will be modified to enable the pump station to operate at least twice per day. These pumps will be designed as constant speed pumps with an automatic alternator to equalize run time between the lead and lag pump. The lead pump will be called when the level transmitter in the wet well senses water at the operator-selected, "lead pump on" level set point. If flow exceeds the pumping rate of the lead pump, the high water alarm will be activated and the lag pump will be started. Both pumps will operate until the "pump off" level is achieved. A magnetic flow meter will record flows from the Broadway Pump Station. Back-up float switches will be supplied to provide control in the event of a level sensor failure.

A new SCADA system will be installed in both pump stations to monitor pump status and provide alarms to the operations staff in the event of a malfunction.

APPENDIX C

Appendix C

Girard WWTP NFA General Plan

Biowin™ Modeling Summaries

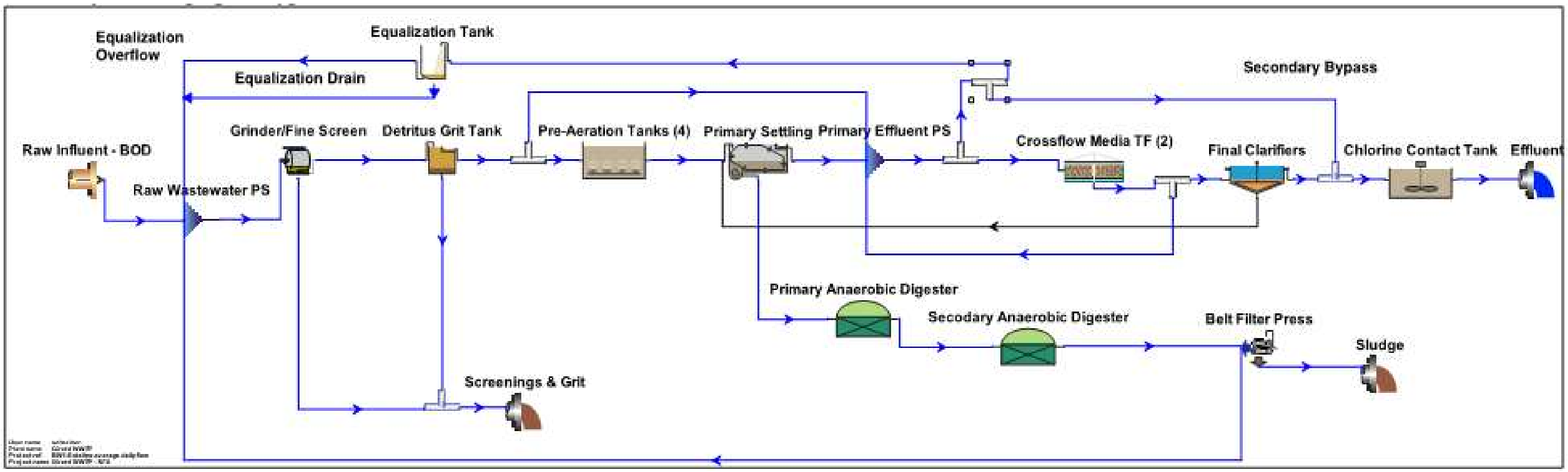
Appendix __
Biowin™ Modeling Summaries

Sheet Index

APPENDIX __
CITY OF GIRARD WWTP - NO FEASIBLE ALTERNATIVE
GENERAL PLAN
Biowin™ MODELING SUMMARIES

Biowin™ PROCESS FLOW SCHEMATIC - CASES 1 THROUGH 7 - CALIBRATION AND DESIGN FLOW SIMULATIONS

CELLS LIST TRICKLING FILTER LOADING AT LBS BOD/1000 CI



CASE 1: First Calibration Run. 3.04 mgd (ADF - 2011 thru June, 2013), 2 Trickling Filters, 2 Final Settling Tanks, 22C,

Elements	Total Carbonaceous BOD [mg/L]	Actual data (2011 to June 2013)	Filtered Carbonaceous BOD [mg/L]	Actual data (2011 to June 2013)	Total suspended solids [mgTSS/L]	Actual data (2011 to June 2013)	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Actual data (2011 to June 2013)	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	115	115	38.8		138.32		110	-----	16.5	11.4	25	25	0	3	6	7.3	10
Raw Wastewater Pump Station	115.51		38.82		139.06		110.74	-----	17.18		25.71	25.71	0	3.62	6.64	7.27	10.03
Grinder/Fine Screen	111.7		38.82		124.25		97.33	-----	17.18		25.03	25.03	0	3.62	6.35	7.28	10.03
Detritus Grit Tank	111.7		38.82		106.95		97.33	-----	17.18		25.03	25.03	0	3.62	6.35	7.27	10.03
Primary Bypass	111.7		38.82		106.95		97.33	-----	17.18		25.03	25.03	0	3.62	6.35	7.27	10.03
Pre-Aeration Tanks (2)	111.38		38.38		107.17		97.51	-----	17.06		24.93	24.92	0.01	3.62	6.35	7.4	10.02
PST	75.01	63.7	37.78	18.1	55.55		50.57	-----	16.87		23.03	22.92	0.11	3.61	5	7.39	10
Primary Effluent PS	75.01		37.78		55.55		50.57	23.77	16.87		23.03	22.92	0.11	3.61	5	7.39	10
Crossflow Plastic Media TF	50.19	21.9	7.29	8.3	66.16		60.3	5890.04	7.27		17.72	12.3	5.42	3.42	5	7.04	8.96
Recirc Splitter	50.19		7.29		66.16		60.3	-----	7.27		17.72	12.3	5.42	3.42	5	7.04	8.96
Final Clarifiers	16.04		7.29		13.49		12.3	-----	7.27		15.09	9.68	5.42	3.42	3.74	7.04	8.96
Mixer-cct	16.05		7.29		13.5		12.31	-----	7.27		15.09	9.68	5.42	3.42	3.74	7.04	8.96
Chlorine Contact Tank	15.98		7.22		13.52		12.32	-----	7.22		15.09	9.64	5.46	3.42	3.74	7.08	8.95
Effluent	15.98	14.3	7.22		13.52		12.32	-----	7.22	2.6	15.09	9.64	5.46	3.42	3.74	7.08	8.95

APPENDIX __
CITY OF GIRARD WWTP - NO FEASIBLE ALTERNATIVE
GENERAL PLAN
Biowin™ MODELING SUMMARIES

CASE 2: Second Calibration Run. 3.04 mgd (ADF - 2011 thru June, 2013), 2 Trickling Filters, 2 Final Settling Tanks, 22C, adjusted influent TKN down

Elements	Total Carbonaceous BOD [mg/L]	Actual data (2011 to June 2013)	Filtered Carbonaceous BOD [mg/L]	Actual data (2011 to June 2013)	Total suspended solids [mgTSS/L]	Actual data (2011 to June 2013)	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Actual data (2011 to June 2013)	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	115	115	38.8		138.32		110	-----	13.2	11.4	20	20	0	3	6	7.3	10
Raw Wastewater Pump Station	115.51		38.82		139.06		110.74	-----	13.65		20.48	20.48	0	3.62	6.64	7.27	10.01
Grinder/Fine Screen	111.7		38.82		124.25		97.33	-----	13.65		19.84	19.84	0	3.62	6.35	7.28	10.01
Detritus Grit Tank	111.7		38.82		106.95		97.33	-----	13.65		19.84	19.84	0	3.62	6.35	7.27	10.01
Primary Bypass	111.7		38.82		106.95		97.33	-----	13.65		19.84	19.84	0	3.62	6.35	7.27	10.01
Pre-Aeration Tanks (2)	111.39		38.39		107.16		97.51	-----	13.55		19.77	19.76	0.01	3.62	6.35	7.4	10
PST	74.97	63.7	37.79	18.1	55.49	49.2	50.52	-----	13.36		18.28	18.18	0.1	3.61	5	7.39	9.98
Primary Effluent PS	74.97		37.79		55.49		50.52	23.76	13.36		18.28	18.18	0.1	3.61	5	7.39	9.98
Crossflow Plastic Media TF	49.99	21.9	7.27	8.3	65.98	51.7	60.13	5834.08	3.88		13.3	8.33	4.97	3.42	5	7.04	8.98
Recirc Splitter	49.99		7.27		65.98		60.13	-----	3.88		13.3	8.33	4.97	3.42	5	7.04	8.98
Final Clarifiers	15.98		7.27		13.46		12.26	-----	3.88		10.92	5.95	4.97	3.42	3.74	7.04	8.98
Mixer-cct	15.99		7.27		13.47		12.27	-----	3.88		10.92	5.95	4.97	3.42	3.74	7.04	8.98
Chlorine Contact Tank	15.92		7.2		13.49		12.28	-----	3.84		10.92	5.91	5	3.42	3.74	7.08	8.98
Effluent	15.92	14.3	7.2		13.49	20	12.28	-----	3.84	2.6	10.92	5.91	5	3.42	3.74	7.08	8.98

CASE 3: 5 MGD, 2 Trickling Filters, 2 Final Settling Tanks, Average Loading, 22C

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	115	38.8	138.32	110	-----	13.2	20	20	0	3	6	7.3	10
Raw Wastewater Pump Station	115.73	38.81	139.43	111.04	-----	13.57	20.41	20.41	0	3.56	6.59	7.27	10.01
Grinder/Fine Screen	111.89	38.81	124.56	97.59	-----	13.57	19.77	19.77	0	3.56	6.3	7.29	10.01
Detritus Grit Tank	111.89	38.81	107.23	97.59	-----	13.57	19.77	19.77	0	3.56	6.3	7.27	10.01
Primary Bypass	111.89	38.81	107.23	97.59	-----	13.57	19.77	19.77	0	3.56	6.3	7.27	10.01
Pre-Aeration Tanks (2)	111.71	38.56	107.35	97.69	-----	13.5	19.72	19.72	0	3.55	6.3	7.39	10
PST	75.76	38.24	55.63	50.69	-----	13.46	18.25	18.23	0.02	3.55	4.95	7.39	10
Primary Effluent PS	75.76	38.24	55.63	50.69	39.49	13.46	18.25	18.23	0.02	3.55	4.95	7.39	10
Crossflow Plastic Media TF	55.03	11.73	65.54	59.9	6110.75	9.55	15.11	13.91	1.2	3.36	4.95	7.16	9.66
Recirc Splitter	55.03	11.73	65.54	59.9	-----	9.55	15.11	13.91	1.2	3.36	4.95	7.16	9.66
Final Clarifiers	20.49	11.73	13.27	12.12	-----	9.55	12.91	11.72	1.2	3.36	3.68	7.16	9.66
Mixer-cct	20.5	11.73	13.28	12.13	-----	9.55	12.91	11.72	1.19	3.36	3.68	7.16	9.66
Chlorine Contact Tank	20.46	11.68	13.3	12.15	-----	9.53	12.91	11.71	1.2	3.36	3.68	7.18	9.66
Effluent	20.46	11.68	13.3	12.15	-----	9.53	12.91	11.71	1.2	3.36	3.68	7.18	9.66

CASE 4: 5 MGD, 2 Trickling Filters, 2 Final Settling Tanks, Average Loading, 10C

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	115	38.8	138.32	110	-----	13.2	20	20	0	3	6	7.3	10
Raw Wastewater Pump Station	116.06	39.12	139.44	111.05	-----	13.45	20.29	20.29	0	3.61	6.64	7.28	10
Grinder/Fine Screen	112.22	39.12	124.58	97.6	-----	13.45	19.65	19.65	0	3.61	6.35	7.19	10
Detritus Grit Tank	112.22	39.12	107.24	97.6	-----	13.45	19.65	19.65	0	3.61	6.35	7.28	10
Primary Bypass	112.22	39.12	107.24	97.6	-----	13.45	19.65	19.65	0	3.61	6.35	7.28	10
Pre-Aeration Tanks (2)	112.1	38.95	107.33	97.67	-----	13.42	19.64	19.63	0	3.61	6.35	7.35	10
PST	76.15	38.67	55.57	50.51	-----	13.41	18.16	18.16	0.01	3.6	5.05	7.35	9.99
Primary Effluent PS	76.15	38.67	55.57	50.51	39.69	13.41	18.16	18.16	0.01	3.6	5.05	7.35	9.99
Crossflow Plastic Media TF	58.39	15.24	65.36	59.28	6485.68	12.33	17.25	16.78	0.47	3.29	5.05	7.2	9.91
Recirc Splitter	58.39	15.24	65.36	59.28	-----	12.33	17.25	16.78	0.47	3.29	5.05	7.2	9.91
Final Clarifiers	23.98	15.24	13.23	12	-----	12.33	15.15	14.68	0.47	3.29	3.64	7.2	9.91
Mixer-cct	23.98	15.25	13.24	12.01	-----	12.33	15.15	14.68	0.47	3.29	3.64	7.2	9.91
Chlorine Contact Tank	23.95	15.2	13.26	12.02	-----	12.33	15.15	14.68	0.47	3.28	3.64	7.22	9.91
Effluent	23.95	15.2	13.26	12.02	-----	12.33	15.15	14.68	0.47	3.28	3.64	7.22	9.91

CASE 5: 8 MGD, 2 Trickling Filters, 2 Final Settling Tanks, Peak Loading, 22C

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	107	29.88	167.3	110	-----	11.55	17.5	17.5	0	3	6	7.3	10
Raw Wastewater Pump Station	107	29.88	167.29	109.99	-----	11.55	17.5	17.5	0	3	6	7.29	10
Grinder/Fine Screen	103.15	29.88	151.5	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.31	10
Detritus Grit Tank	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Primary Bypass	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Pre-Aeration Tanks (2)	103.05	29.73	116.37	97.12	-----	11.51	16.89	16.88	0	3	5.72	7.38	10
PST	66.38	29.61	58.81	49.17	-----	11.5	15.6	15.6	0.01	3	4.41	7.38	10
Primary Effluent PS	66.38	29.61	58.81	49.17	55.36	11.5	15.6	15.6	0.01	3	4.41	7.38	10
Crossflow Plastic Media TF	52.46	12.48	65.03	54.59	6072.69	9.62	14.11	13.46	0.65	2.76	4.41	7.23	9.84
Recirc Splitter	52.46	12.48	65.03	54.59	-----	9.62	14.11	13.46	0.65	2.76	4.41	7.23	9.84
Final Clarifiers	20.54	12.48	13.1	11	-----	9.62	12.32	11.67	0.65	2.76	3.09	7.23	9.84
Mixer-cct	20.55	12.49	13.12	11.01	-----	9.62	12.32	11.67	0.65	2.76	3.09	7.23	9.84
Chlorine Contact Tank	20.52	12.46	13.13	11.02	-----	9.62	12.32	11.66	0.65	2.76	3.09	7.24	9.83
Effluent	20.52	12.46	13.13	11.02	-----	9.62	12.32	11.66	0.65	2.76	3.09	7.24	9.83

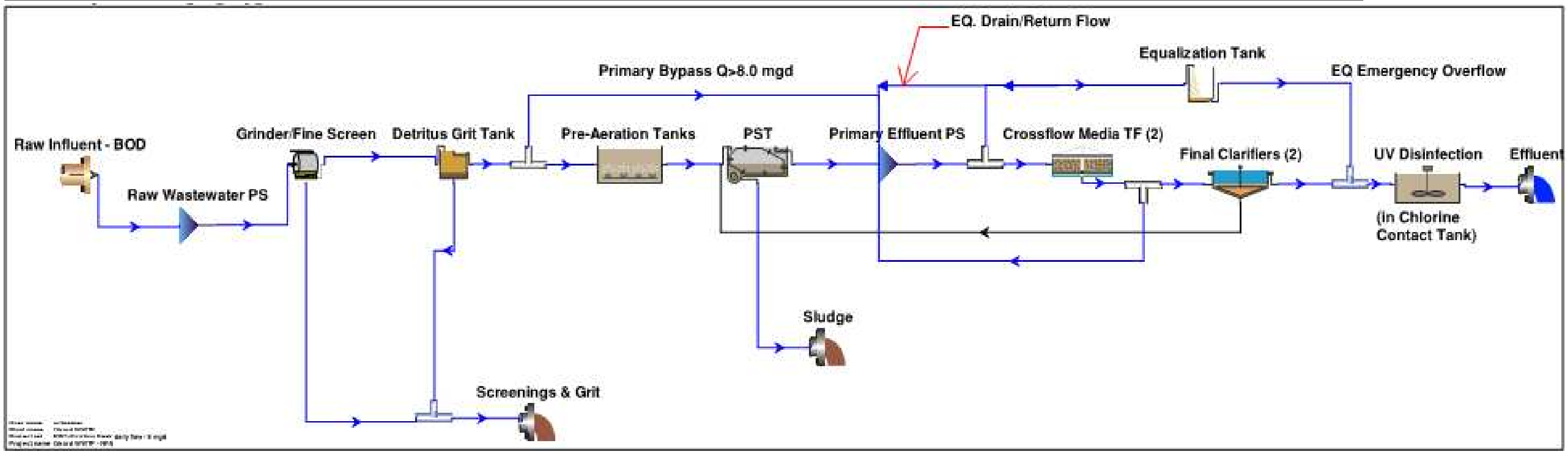
CASE 6: 8 MGD, 22 Trickling Filters, 2 Final Settling Tanks, Peak Loading, 10C

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	107	29.88	167.3	110	-----	11.55	17.5	17.5	0	3	6	7.3	10
Raw Wastewater Pump Station	107	29.88	167.29	109.99	-----	11.55	17.5	17.5	0	3	6	7.29	10
Grinder/Fine Screen	103.15	29.88	151.5	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.21	10
Detritus Grit Tank	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Primary Bypass	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Pre-Aeration Tanks (2)	103.08	29.78	116.35	97.11	-----	11.53	16.9	16.9	0	3	5.72	7.35	10
PST	66.29	29.67	58.53	48.89	-----	11.53	15.59	15.59	0	3	4.42	7.35	10
Primary Effluent PS	66.29	29.67	58.53	48.89	55.29	11.53	15.59	15.59	0	3	4.42	7.35	10
Crossflow Plastic Media TF	54.89	15.43	64.05	53.6	6388.09	11.02	15.14	14.9	0.24	2.74	4.42	7.25	9.96
Recirc Splitter	54.89	15.43	64.05	53.6	-----	11.02	15.14	14.9	0.24	2.74	4.42	7.25	9.96
Final Clarifiers	23.38	15.43	12.91	10.8	-----	11.02	13.47	13.23	0.24	2.74	3.08	7.25	9.96
Mixer-cct	23.39	15.44	12.92	10.81	-----	11.02	13.47	13.23	0.24	2.74	3.08	7.25	9.96
Chlorine Contact Tank	23.38	15.42	12.93	10.82	-----	11.02	13.47	13.23	0.24	2.74	3.08	7.26	9.96
Effluent	23.38	15.42	12.93	10.82	-----	11.02	13.47	13.23	0.24	2.74	3.08	7.26	9.96

CASE 7: 8 MGD, 2 Trickling Filters, 2 Final Settling Tanks, Average Loading, 22C (simulates higher extended plant flows after first flush loading)

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	72	24.18	87.2	69	-----	8.25	12.5	12.5	0	1.88	3.75	7.3	10
Raw Wastewater Pump Station	72	24.18	87.19	69	-----	8.25	12.5	12.5	0	1.87	3.75	7.29	10
Grinder/Fine Screen	69.61	24.18	77.91	60.63	-----	8.25	12.1	12.1	0	1.87	3.57	7.31	10
Detritus Grit Tank	69.61	24.18	66.8	60.63	-----	8.25	12.1	12.1	0	1.87	3.57	7.29	10
Primary Bypass	69.61	24.18	66.8	60.63	-----	8.25	12.1	12.1	0	1.87	3.57	7.29	10
Pre-Aeration Tanks (2)	69.55	24.1	66.84	60.66	-----	8.22	12.08	12.08	0	1.87	3.57	7.39	10
PST	47.19	23.99	34.48	31.32	-----	8.2	11.19	11.18	0.01	1.87	2.74	7.38	10
2ndary Bypass to EQ	47.19	23.99	34.48	31.32	39.36	8.2	11.19	11.18	0.01	1.87	2.74	7.38	10
Crossflow Plastic Media TF	35.46	9.23	39.87	36.29	4849.31	5.07	9.41	8.02	1.39	1.76	2.74	7.2	9.69
Recirc Splitter	35.46	9.23	39.87	36.29	-----	5.07	9.41	8.02	1.39	1.76	2.74	7.2	9.69
Final Clarifiers	14.52	9.23	8.03	7.31	-----	5.07	8.09	6.7	1.39	1.76	1.96	7.2	9.69
Mixer-cct	14.52	9.23	8.04	7.32	-----	5.07	8.09	6.7	1.39	1.76	1.96	7.2	9.69
Chlorine Contact Tank	14.51	9.22	8.05	7.32	-----	5.06	8.09	6.69	1.39	1.76	1.96	7.21	9.69
Effluent	14.51	9.22	8.05	7.32	-----	5.06	8.09	6.69	1.39	1.76	1.96	7.21	9.69

Biowin™ PROCESS FLOW SCHEMATIC - CASES 8 THROUGH 11 - EXISTING PLANT OPERATING UNDER PEAK FLOW AND LOADING (ALTERNATES 1 & 2)



CASE 8: 12 MGD IN EXISTING PLANT WITH 2 TRICKLING FILTERS and 2 FINAL SETTLING TANKS OPERATING UNDER PEAK LOADING. 22C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.3	10
Raw Wastewater Pump Station	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.29	10
Grinder/Fine Screen	12	69.41	20.12	101.59	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.31	10
Detritus Grit Tank	12	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Primary Bypass	8.01	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Pre-Aeration Tanks (2)	8.01	69.35	20.03	78.16	65.33	-----	7.89	11.58	11.58	0	2	3.81	7.38	10
PST	8.04	47.13	19.95	43.46	36.38	-----	7.87	10.78	10.77	0.01	2	3.01	7.38	10
Primary Effluent PS	8.01	54.52	20.01	54.96	45.97	45.47	7.89	11.06	11.05	0.01	2	3.28	7.35	10
Crossflow Media TF (2)	8.01	44.46	8.73	57.98	48.66	5224.12	4.81	9.39	7.91	1.48	1.92	3.28	7.19	9.68
Recirc Splitter	8.01	44.46	8.73	57.98	48.66	-----	4.81	9.39	7.91	1.48	1.92	3.28	7.19	9.68
Final Clarifiers (2)	7.95	15.93	8.73	11.68	9.81	-----	4.81	7.93	6.44	1.48	1.92	2.19	7.19	9.68
Mixer-cct	7.95	15.93	8.73	11.68	9.81	-----	4.81	7.93	6.44	1.48	1.92	2.19	7.19	9.68
UV in Chlorine Contact Tank	7.95	15.92	8.71	11.69	9.81	-----	4.8	7.93	6.44	1.49	1.92	2.19	7.21	9.68
Effluent	7.95	15.92	8.71	11.69	9.81	-----	4.8	7.93	6.44	1.49	1.92	2.19	7.21	9.68
2ndary Bypass to EQ	4.01	54.52	20.01	54.96	45.97	-----	7.89	11.06	11.05	0.01	2	3.28	7.35	9.68
Effluent	11.96	28.86	12.50	26.20	21.93	-----	5.84	8.98	7.99	0.99	1.95	2.56	7.26	9.68

CASE 9: 16 MGD, 2 TRICKLING FILTERS, 2 FINAL SETTLING TANKS, PEAK LOADING. 22C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.3	10
Raw Wastewater Pump Station	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.29	10
Grinder/Fine Screen	16	52.08	15.5	76.2	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.31	10
Detritus Grit Tank	16	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Primary Bypass	8.01	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Pre-Aeration Tanks (2)	8.01	52.03	15.44	58.32	48.52	-----	5.92	8.69	8.69	0	1.5	2.86	7.39	10
PST	8.04	36.31	15.37	33.73	28.08	-----	5.89	8.13	8.11	0.02	1.5	2.29	7.38	10
Primary Effluent PS	8.01	44.17	15.43	45.98	38.27	36.88	5.92	8.41	8.4	0.01	1.5	2.57	7.34	10
Crossflow Media TF (2)	8.01	35.97	6.7	47.95	39.96	4430.32	2.41	6.96	4.99	1.97	1.45	2.57	7.18	9.62
Recirc Splitter	8.01	35.97	6.7	47.95	39.96	-----	2.41	6.96	4.99	1.97	1.45	2.57	7.18	9.62
Final Clarifiers (2)	7.95	12.6	6.7	9.66	8.05	-----	2.41	5.75	3.78	1.97	1.45	1.67	7.18	9.62
Mixer-cct	7.95	12.6	6.7	9.66	8.05	-----	2.41	5.75	3.78	1.97	1.45	1.67	7.18	9.62
UV in Chlorine Contact Tank	7.95	12.59	6.69	9.66	8.05	-----	2.41	5.75	3.78	1.97	1.45	1.67	7.19	9.62
Effluent	7.95	12.59	6.69	9.66	8.05	-----	2.41	5.75	3.78	1.97	1.45	1.67	7.19	9.62
2ndary Bypass to EQ	8.01	44.17	15.43	45.98	38.27	-----	5.92	8.41	8.4	0.01	1.5	2.57	7.34	10
Effluent	15.96	28.44	11.08	27.89	23.22	-----	4.17	7.09	6.10	0.99	1.48	2.12	7.27	9.81
Total Effluent Load	15.96	3,130	1,293	2,958	2,463									

CASE 10: 16 MGD, 2 TRICKLING FILTERS, 2 FINAL SETTLING TANKS, PEAK LOADING. 22C

Note: Case peaks the flow to the trickling filters and final settling to match 10-States maximum overflow rate for the clarifiers.

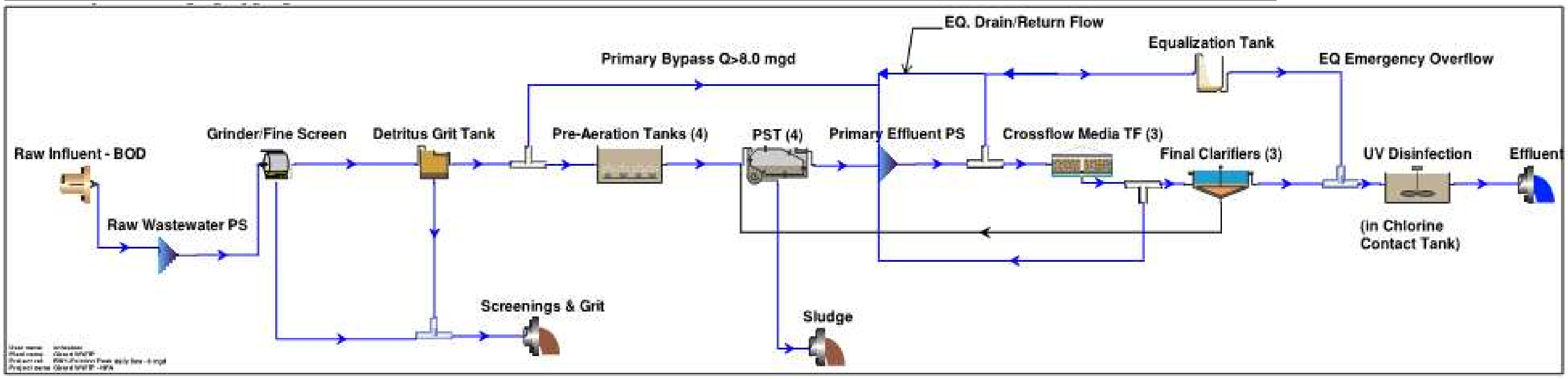
Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.3	10
Raw Wastewater Pump Station	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.29	10
Grinder/Fine Screen	16	52.08	15.5	76.2	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.31	10
Detritus Grit Tank	16	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Primary Bypass	8.01	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Pre-Aeration Tanks (2)	8.01	52.03	15.44	58.32	48.52	-----	5.92	8.69	8.69	0	1.5	2.86	7.39	10
PST	8.04	39.47	15.38	38.76	32.29	-----	5.9	8.27	8.25	0.01	1.5	2.41	7.38	10
Primary Effluent PS	10.5	45.76	15.44	48.5	40.37	33.39	5.92	8.48	8.48	0.01	1.5	2.63	7.34	10
Crossflow Media TF (2)	10.5	38.93	8	50.31	41.96	4642.72	3.48	7.34	6.09	1.24	1.45	2.63	7.21	9.74
Recirc Splitter	10.5	38.93	8	50.31	41.96	-----	3.48	7.34	6.09	1.24	1.45	2.63	7.21	9.74
Final Clarifiers (2)	10.44	14.22	8	10.12	8.44	-----	3.48	6.12	4.87	1.24	1.45	1.69	7.21	9.74
Mixer-cct	10.44	14.22	8	10.12	8.44	-----	3.48	6.12	4.87	1.24	1.45	1.69	7.21	9.74
UV in Chlorine Contact Tank	10.44	14.22	8	10.12	8.44	-----	3.48	6.12	4.87	1.25	1.45	1.69	7.23	9.74
Effluent	10.44	14.22	8	10.12	8.44	-----	3.48	6.12	4.87	1.25	1.45	1.69	7.23	9.74
2ndary Bypass to EQ	5.52	45.76	15.44	48.5	40.37	-----	5.92	8.48	8.48	0.01	1.5	2.63	7.34	10
Effluent	15.96	25.13	10.57	23.39	19.48	-----	4.32	6.94	6.12	0.82	1.47	2.02	7.27	9.83
Total Effluent Load		3,345	1,407	3,114	2,593									

APPENDIX __
CITY OF GIRARD WWTP - NO FEASIBLE ALTERNATIVE
GENERAL PLAN
Biowin™ MODELING SUMMARIES

CASE 11: 24 MGD, 2 TRICKLING FILTERS, 2 FINAL SETTLING TANKS, PEAK LOADING. 22C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	24	36	10.06	56.1	37	-----	3.3	5	5	0	1	2	7.3	10
Raw Wastewater Pump Station	24	36	10.06	56.1	37	-----	3.3	5	5	0	1	2	7.29	10
Grinder/Fine Screen	24	34.7	10.06	50.79	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.31	10
Detritus Grit Tank	24	34.7	10.06	39.06	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.29	10
Primary Bypass	8.01	34.7	10.06	39.06	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.29	10
Pre-Aeration Tanks (2)	8.01	34.68	10.03	39.07	32.66	-----	3.29	4.8	4.8	0	1	1.91	7.39	10
PST	8.04	24.34	9.99	23.16	19.31	-----	3.27	4.52	4.5	0.01	1	1.54	7.39	10
Primary Effluent PS	8.01	31.24	10.04	33.74	28.19	26.09	3.29	4.71	4.71	0	1	1.78	7.32	10
Crossflow Media TF (2)	8.01	25.02	4.43	34.14	28.36	3260.81	0.69	4.26	2.49	1.77	0.99	1.78	7.2	9.69
Recirc Splitter	8.01	25.02	4.43	34.14	28.36	-----	0.69	4.26	2.49	1.77	0.99	1.78	7.2	9.69
Final Clarifiers (2)	7.95	8.58	4.43	6.88	5.72	-----	0.69	3.49	1.72	1.77	0.99	1.15	7.2	9.69
Mixer-cct	7.95	8.58	4.43	6.88	5.72	-----	0.69	3.49	1.72	1.77	0.99	1.15	7.2	9.69
UV in Chlorine Contact Tank	7.95	8.57	4.43	6.88	5.71	-----	0.69	3.49	1.72	1.77	0.99	1.15	7.21	9.69
Secondary EffluentEffluent	7.95	8.57	4.43	6.88	5.71	-----	0.69	3.49	1.72	1.77	0.99	1.15	7.21	9.69
2ndary Bypass to EQ	16.01	31.24	10.04	33.74	28.19	-----	3.29	4.71	4.71	0	1	1.78	7.32	9.69
Effluent	23.96	23.72	8.18	24.83	20.73	-----	2.43	4.31	3.72	0.59	1.00	1.57	7.28	9.69

Biowin™ PROCESS FLOW SCHEMATIC - CASES 12 THROUGH 15 - NEW PLANT OPERATING UNDER PEAK FLOW AND LOADING (ALTERNATE 3)



CASE 12: 8 MGD IN EXISTING PLANT FLOW TO 3 TRICKLING FILTERS and 3 FINAL SETTLING TANKS OPERATING UNDER PEAK LOADING. 22C

Elements	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	107	29.88	167.3	110	-----	11.55	17.5	17.5	0	3	6	7.3	10
Raw Wastewater Pump Station	107	29.88	167.29	109.99	-----	11.55	17.5	17.5	0	3	6	7.29	10
Grinder/Fine Screen	103.15	29.88	151.5	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.21	10
Detritus Grit Tank	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Primary Bypass	103.15	29.88	116.31	97.07	-----	11.55	16.91	16.91	0	3	5.72	7.29	10
Pre-Aeration Tanks (4)	103.08	29.78	116.35	97.11	-----	11.53	16.9	16.9	0	3	5.72	7.35	10
PST	66.39	29.64	58.87	49.21	-----	11.52	15.63	15.62	0.01	3	4.41	7.35	10
Primary Effluent PS	66.39	29.64	58.87	49.21	36.91	11.52	15.63	15.62	0.01	3	4.42	7.35	10
Crossflow Media TF (3)	51.6	11.71	65.25	54.74	9296.58	9.97	14.83	13.87	0.96	2.74	4.42	7.2	9.84
Recirc Splitter	51.6	11.71	65.25	54.74	-----	9.97	14.83	13.87	0.96	2.74	4.42	7.2	9.84
Final Clarifiers (3)	19.75	11.71	13.15	11.03	-----	9.97	13.03	12.07	0.96	2.74	3.08	7.2	9.84
Mixer-cct	19.75	11.71	13.15	11.03	-----	9.97	13.03	12.07	0.96	2.74	3.08	7.2	9.84
UV in Chlorine Contact Tank	19.73	11.69	13.16	11.04	-----	9.97	13.03	12.06	0.96	2.74	3.08	7.21	9.84
Effluent	19.73	11.69	13.16	11.04	-----	9.97	13.03	12.06	0.96	2.74	3.08	7.21	9.84

CASE 13: 12 MGD, 3 Trickling Filters, 3 Final Settling Tanks, Peak Loading, 10C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.3	10
Raw Wastewater Pump Station	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.29	10
Grinder/Fine Screen	12	69.41	20.12	101.59	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.21	10
Detritus Grit Tank	12	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Primary Bypass	8.01	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Pre-Aeration Tanks (2)	8.01	69.36	20.06	78.15	65.32	-----	7.91	11.59	11.59	0	2	3.81	7.35	10
PST	8.05	53.93	19.97	54.32	45.50	-----	7.89	11.11	11.1	0.01	2	3.27	7.35	10
Primary Effluent PS	12.04	59.06	20.02	62.2	52.05	49.42	7.9	11.27	11.26	0.01	2	3.45	7.33	10
Crossflow Plastic Media TF	12.04	50.93	10.8	64.78	54.37	8488.25	6.41	10.63	9.75	0.88	1.93	3.45	7.22	9.84
Recirc Splitter	12.04	50.93	10.8	64.78	54.37	-----	6.41	10.63	9.75	0.88	1.93	3.45	7.22	9.84
Final Clarifiers	11.96	18.87	10.8	13.04	10.95	-----	6.41	9.07	8.19	0.88	1.93	2.23	7.22	9.84
Mixer-cct	11.96	18.87	10.8	13.04	10.95	-----	6.41	9.07	8.19	0.88	1.93	2.23	7.22	9.84
UV	11.96	18.87	10.79	13.05	10.95	-----	6.41	9.07	8.19	0.88	1.93	2.23	7.23	9.84
Effluent	11.96	18.87	10.79	13.05	10.95	-----	6.41	9.07	8.19	0.88	1.93	2.23	7.23	9.84

CASE 14: 12 MGD, 3 TRICKLING FILTERS, 3 FINAL SETTLING TANKS, PEAK LOADING. 22C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.3	10
Raw Wastewater Pump Station	12	72	20.12	112.2	74	-----	7.92	12	12	0	2	4	7.29	10
Grinder/Fine Screen	12	69.41	20.12	101.59	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.31	10
Detritus Grit Tank	12	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Primary Bypass	8.01	69.41	20.12	78.13	65.3	-----	7.92	11.6	11.6	0	2	3.81	7.29	10
Pre-Aeration Tanks (2)	8.01	69.35	20.03	78.16	65.33	-----	7.89	11.58	11.58	0	2	3.81	7.38	10
PST	8.05	53.91	19.92	54.51	45.65	-----	7.86	11.13	11.11	0.02	2	3.27	7.38	9.99
Primary Effluent PS	12.04	59.04	19.99	62.33	52.16	49.40	7.88	11.28	11.27	0.01	2	3.45	7.35	10
Crossflow Plastic Media TF	12.04	49.1	8.9	65.23	54.74	8182.39	4.86	9.6	8.17	1.42	1.92	3.45	7.19	9.69
Recirc Splitter	12.04	49.1	8.9	65.23	54.74	-----	4.86	9.6	8.17	1.42	1.92	3.45	7.19	9.69
Final Clarifiers	11.96	17	8.9	13.13	11.02	-----	4.86	7.96	6.53	1.42	1.92	2.23	7.19	9.69
Mixer-cct	11.96	17	8.9	13.13	11.02	-----	4.86	7.96	6.53	1.42	1.92	2.23	7.19	9.69
UV	11.96	16.99	8.89	13.14	11.02	-----	4.85	7.96	6.53	1.43	1.92	2.23	7.2	9.69
Effluent	11.96	16.99	8.89	13.14	11.02	-----	4.85	7.96	6.53	1.43	1.92	2.23	7.2	9.69

CASE 15: 16 MGD, 3 TRICKLING FILTERS, 3 FINAL SETTLING TANKS, PEAK LOADING. 10C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.3	10
Raw Wastewater Pump Station	16	54	15.5	84.15	55	-----	5.94	9	9	0	1.5	3	7.29	10
Grinder/Fine Screen	16	52.08	15.5	76.2	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.21	10
Detritus Grit Tank	16	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Primary Bypass	8.01	52.08	15.5	58.29	48.51	-----	5.94	8.7	8.7	0	1.5	2.86	7.29	10
Pre-Aeration Tanks (4)	8.01	52.05	15.46	58.31	48.52	-----	5.93	8.7	8.7	0	1.5	2.86	7.35	10
PST (4)	8.05	41.42	15.38	41.93	34.94	-----	5.91	8.37	8.35	0.01	1.5	2.48	7.35	10
Primary Effluent PS	16.04	46.73	15.44	50.08	41.69	39.01	5.93	8.53	8.53	0.01	1.5	2.67	7.32	10
Crossflow Media TF (3)	12.01	40.07	8.21	51.84	43.24	7025.07	3.89	7.93	6.6	1.33	1.45	2.67	7.21	9.77
Recirc Splitter	12.01	40.07	8.21	51.84	43.24	-----	3.89	7.93	6.6	1.33	1.45	2.67	7.21	9.77
Final Clarifiers	11.93	14.63	8.21	10.44	8.71	-----	3.89	6.68	5.36	1.33	1.45	1.7	7.21	9.77
Mixer-cct	11.93	14.63	8.21	10.44	8.71	-----	3.89	6.68	5.36	1.33	1.45	1.7	7.21	9.77
UV in Chlorine Contact Tank	11.93	14.62	8.21	10.44	8.71	-----	3.89	6.68	5.35	1.33	1.45	1.7	7.21	9.77
Secondary Effluent	11.93	14.62	8.21	10.44	8.71	-----	3.89	6.68	5.35	1.33	1.45	1.7	7.21	9.77
2ndary Bypass to EQ	4.03	46.73	15.44	50.08	41.69	-----	5.93	8.53	8.53	0.01	1.5	2.67	7.32	9.77
Effluent	15.96	22.73	10.04	20.45	17.04	-----	4.41	7.15	6.15	1.00	1.46	1.94	7.24	9.77

CASE 16: 24 MGD, 3 TRICKLING FILTERS, 3 FINAL SETTLING TANKS, PEAK LOADING. 10C

Elements	Flow [mgd]	Total Carbonaceous BOD [mg/L]	Filtered Carbonaceous BOD [mg/L]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Biofilm TSS mass [lb]	Ammonia N [mgN/L]	Total N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrite + Nitrate [mgN/L]	Soluble PO4-P [mgP/L]	Total P [mgP/L]	pH []	Alkalinity [mmol/L]
Raw Influent - BOD	24	36	10.06	56.1	37	-----	3.3	5	5	0	1	2	7.3	10
Raw Wastewater Pump Station	24	36	10.06	56.1	37	-----	3.3	5	5	0	1	2	7.29	10
Grinder/Fine Screen	24	34.7	10.06	50.79	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.21	10
Detritus Grit Tank	24	34.7	10.06	39.06	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.29	10
Primary Bypass	8.01	34.7	10.06	39.06	32.65	-----	3.3	4.81	4.81	0	1	1.91	7.29	10
Pre-Aeration Tanks (4)	8.01	34.69	10.04	39.07	32.65	-----	3.29	4.81	4.81	0	1	1.91	7.35	10
PST (4)	8.05	27.81	9.99	28.71	23.96	-----	3.28	4.66	4.64	0.01	1	1.67	7.35	10
Primary Effluent PS	24.04	32.39	10.04	35.59	29.74	27.04	3.29	4.76	4.75	0	1	1.83	7.31	10
Crossflow Media TF (3)	12.01	27.46	5.32	36.2	30.17	5183.42	1.36	4.51	3.14	1.37	0.98	1.83	7.21	9.77
Recirc Splitter	12.01	27.46	5.32	36.2	30.17	-----	1.36	4.51	3.14	1.37	0.98	1.83	7.21	9.77
Final Clarifiers	11.93	9.78	5.32	7.29	6.08	-----	1.36	3.74	2.37	1.37	0.98	1.15	7.21	9.77
Mixer-cct	11.93	9.78	5.32	7.29	6.08	-----	1.36	3.74	2.37	1.37	0.98	1.15	7.21	9.77
UV in Chlorine Contact Tank	11.93	9.78	5.32	7.29	6.08	-----	1.36	3.74	2.36	1.37	0.98	1.15	7.22	9.77
Secondary Effluent	11.93	9.78	5.32	7.29	6.08	-----	1.36	3.74	2.36	1.37	0.98	1.15	7.22	9.77
2ndary Bypass to EQ	12.03	32.39	10.04	35.59	29.74	-----	3.29	4.76	4.75	0	1	1.83	7.31	9.77
Effluent	23.96	21.13	7.69	21.50	17.96	-----	2.33	4.25	3.56	0.68	0.99	1.49	7.27	9.77

BIOWIN MODELING PARAMETERS

Parameter	Averages, Exist. Jan. 2011 to June, 2013	projected to ADDF	ADDF loading, lb/day	standard deviation of data set, mg/L	Peaking Factor based on one standard deviation	**Peak Day (based on existing data)**	**Peak Day loading, lb/day**	MOP 8 peaking Factors (Table 3.5, CSO)	Peak Day (based on MOP 8)	PDF at average loading
Flow, mgd	3.04	5		1.61	1.53	**8**		1.62	8	8
CBOD, mg/L	115.3	116.0	4837.2	54.6	1.47	**106.9**	**7,130**	1.61	116.7	72.5
TSS, mg/L	137.5	138.0	5754.6	128.4	1.93	**166.8**	**11,128**	1.88	162.2	86.25
Ammonia, mg/L	11.4	12.0	500.4	5.5	1.48	**11.1**	**741**	1.39	10.4	7.5
TKN, mg/L	20.0	20.0	834.0	9.6	1.40	**17.5**	**1,168**	1.4	17.5	12.5

Modeling Temperatures:
Summer 22 C
Winter 10 C

Notes:
One standard deviation of the data set accounts for approximately 84% (std. dev. = 68% + 1/2 of balance 32%) of all data points in the s
Peak day loading will be used for peak modeling runs {8 mgd(2 ex. TF's) and 12 mgd(3 TF's) and higher peak flows}
Average day loading/concentrations are used in average day runs and calibration.

Below is calculated Raw Influent Parameters for different flows using the actual average values where available.

Raw Influent - BOD - Peak Daily Flow (and loading)						**Raw Influent - BOD - ADDF**				
Parameters	Conc. (mg/L) @ 8 mgd	Conc. (mg/L) @ 12 mgd	Conc. (mg/L) @ 16 mgd	Conc. (mg/L) @ 24 mgd	Mass rate (lb/d)	Parameters	Conc. (mg/L)	Mass rate (lb/d)	Notes	PDF at average loading
Volatile SS	110	73	55	37	7,344	Volatile SS	110	4589.97		68.79
TSS	167.3	112	84	56	11,169	TSS	138.32	5771.51		86.50
Particulate COD	175.4	117	88	59	11,710	Particulate CC	175.36	7317.31		109.67
Filtered COD	53.52	36	27	18	3,573	Filtered COD	66.79	2787.13		41.77
Total COD	228.91	153	115	76	15,283	Total COD	242.16	10104.44		151.45
Soluble PO4-P	3	2.0	1.5	1.0	200	Soluble PO4-I	3	125.18		1.88
Total P	6	4.0	3.0	2.0	401	Total P	6	250.36		3.75
Filtered TKN	14.01	9.3	7.0	4.7	936	Filtered TKN	16.07	670.67		10.05
Particulate TKN	3.49	2.3	1.7	1.2	233	Particulate TK	3.93	163.87		2.46
TKN	17.5	12	9	6	1,168	TKN	20	834.54		12.51
Filtered CBOD	29.88	20	15	10	1,995	Filtered CBOI	38.8	1618.82		24.26
Total CBOD	107	71	54	36	7,144	Total CBOD	115	4798.61		71.92
Nitrite + Nitrate	0	-	-	-	-	Nitrite + Nitrat	0	0		-
Total N	17.5	12	9	6	1,168	Total N	20	834.54		12.51
Total inorganic N	11.55	8	6	4	771	Total inorgani	13.2	550.8		8.26
Alkalinity, mmol/L and kmol/d	10				303	Alkalinity	10	189.27	mmol/L and kmol/d	
pH	7.3					pH	7.3			
Volatile fatty acids	5.49				367	Volatile fatty a	5.81	242.51		
ISS precipitate	0				-	ISS precipitate	0	0		
ISS cellular	0.3				20	ISS cellular	0.32	13.18		
ISS Total	57.3	38	29	19	3,825	ISS Total	28.32	1181.54		
Ammonia N	11.55	8	6	4	771	Ammonia N	13.2	550.8		
Nitrate N	0	-	-	-	-	Nitrate N	0	0		
Flow	8	12	16	24 mgd		Flow	5 mgd			