Chapter 4 - Future Conditions

A 25-year planning period will be used and all forecasts on population, land use, economics, flows, and loads will be trended from the most recent available data to the year 2040.

Development

Demographic and economic projections are vital to the planning of wastewater facilities in that they permit proper sizing of both collection and treatment systems. Over estimating these projections can result in oversized facilities which are not utilizing their maximum capacities. Under estimating these projections can result in an undersized facility, which may need expensive upgrades to reach the desired degree of treatment. As a result, a need for accurate projections cannot be overstressed.

There is a potential for population and industrial growth just outside of the corporation limits of the Village. These possibilities need to be taken into consideration when designing a new wastewater system. The proposed collection and treatment systems should be sized to handle current and future growth potential.

Population Trends

The development of an area is directly related to changing population over time. In general, population growth trends create the basis for changing demand for various housing and commercial development. Population growth also has implications for demands on community facilities and infrastructure.

Determining population trends for smaller areas is more unreliable and erratic than for larger urban areas because small area growth is influenced by local political factors and social economic changes. Historically, the provision of adequate water and sewage facilities remains a major influence on future growth.

The following table shows the population of Darke County and the Village of Wayne Lakes between 1980 to 2010. The population of Wayne Lakes has fluctuated up and down over the past 30 years. But overall there has been a small increase of approximately 3 percent over this period.

Table 4-1: Population Trends

Year	Darke County Population	% Change	Wayne Lakes Population	% Change
1980	55,096	-	699	-
1990	53,619	-2.7%	705	0.9%
2000	53,309	-0.6%	684	-3.0%
2010	52,959	-0.7%	718	5.0%

To generate future population projections through the year 2040 and beyond, it is assumed that the population of Wayne Lakes will continue to increase steadily. As mentioned earlier, there are 36 homes within Fort Jefferson that are not included in the Wayne Lakes population. These homes are multiplied by the U.S. Census average of 2.8 persons per home and combined with the Wayne Lakes population. From there, we have assumed the study area will grow at a geometric gradient of approximately 5 percent for every 10 years or 1/2 percent annually. This may appear conservative based on historical trends of the community, but the development of a public sewer system may spur more development in the area. Accommodating for any lot splits adding additional housing which cannot be done currently based on the current wastewater regulations.

The following table shows the projected population for the study area and a theoretical sanitary flow based on EPA's typical 100 gallons per capita per day.

Table 4-2: Projected Population

Year	Wayne Lakes Population	Fort Jefferson Population	Combined	% Change	Sewage Flow (gpcd)	Total Theoretical Sanitary Flow (gpd)
2010	718	100	818	-	100	81,800
2020	754	105	859	5.0%	100	85,900
2030	792	110	902	5.0%	100	90,200
2040	832	115	947	5.0%	100	94,700
2050	874	120	994	5.0%	100	99,400

In addition, an allowance for future industrial development should be made. 10% will be used for the service area.

Table 4-3: Design Flow

Year	Base Residential Sanitary Flow (gpd)	Commercial and Industrial Allowance (gpd)	Total Design Flow (gpd)
Present - 2040	94,700	10,000	104,700

We recommend that the proposed wastewater treatment facility be designed for a minimum of 120,000 GPD.

Design peak flows for treatment will be based on 4.0 times the average daily flows. Therefore the peak flows will be 0.480 MGD (480,000 GPD).

Chapter 5 - Wastewater System Alternatives

The primary goal of all wastewater management systems is to remove waste products from water and to safely return the water back into the environment. Wastewater management involves:

- Collection and transport of wastewater from the source to a treatment process
- Removal of all or most of the waste products that are suspended and/or dissolved in the water
- Returning the water back to the environment
- Management of these processes to ensure that a wastewater system is fully functional

The primary public health concern in wastewater management is to substantially reduce the risk of transferring pathogens into the environment and minimize negative impacts on public health. The following sections describe different alternatives for each of these collection and treatment processes.

Collection System Alternatives

The first stage for managing wastewater is collection. Several alternatives were reviewed to provide a centralized collection system. These options are: gravity sewer system, Septic Tank Effluent Pump (STEP) sewer system, grinder pump sewer system, and a vacuum sewer system.

Gravity Sewer System

Gravity sewers are ideal for populated urban areas that create large volumes of flow. In conventional gravity collection systems the wastewater flows by gravity and except where pumping stations are required, the system is devoid of moving parts. Pump stations are added to the gravity system to overcome elevation problems within areas of rolling terrain or to avoid extremely deep installation requirements when transporting sewage over long distances. The system eliminates private septic tanks and leeching systems and replaces them with a sewer pipe that connects the building to the main sewer line. Gravity sewer systems require little maintenance in comparison to pressure systems such as the STEP or leaching type systems. The primary O,M&R costs for this type of system are generally associated with the pump stations within the system. O,M&R demands generally increase with age, but in well constructed systems, costs associated with this can be minimal. Due to larger pipe diameters, blockages within the system are rare and are generally easily removed when they do occur. With the simplicity of design and many years of application, conventional gravity sewer systems are a reliable and economical means of conveying wastewater from multiple sources to a central treatment facility. The following is a list of advantages and disadvantages for a conventional gravity sewer system.

Advantages

- Design standards and procedures well established
- Reliable operation
- Handle grit and solids
- At minimum velocity lower production of hydrogen sulfide
- Higher excess capacity for future growth

Disadvantages

- Slope requirements can require deeper excavation
- Pumping and lift stations may be required to overcome slope and elevation requirements
- Deeper manholes that require confined space entry
- Higher inflow and infiltration
- High bedrock could increase construction cost

Conventional gravity sewers are generally 8 to 15 inches in diameter and constructed of polyvinyl chloride (PVC) pipe with construction depths ranging from 7 to 20 feet. All sewers are designed and constructed to develop velocities not less than 2.0 feet per second when flowing full. Also, manholes are installed at the end of each line, at all changes in grade and/or alignment, at all intersections, and at distances not greater than 400 feet (for sewer up to 15 inches in diameter).

Upon review of the service area, we have determined that a gravity collection system would not work well for Wayne Lakes. Due to the varying topography and high groundwater table, a gravity collection system would require depths greater than 20 feet in many locations and pumping stations would be too prevalent. Therefore, a gravity sewer system is eliminated from any further consideration as a viable option.

STEP Sewer System

A Septic Tank Effluent Pump (STEP) collection system combines the traditional septic tank system with a small pump and force main or a small diameter gravity system. The STEP system collects only the effluent off of septic tanks which can be located at each customer's building or a group of customers can be on one septic tank. The STEP system then uses small effluent pumps and a network of force mains, usually 2 inch to 4 inch pipe, to collect the effluent and send it to a small package treatment plant.

This collection system conducts different stages of treatment at different locations. The solids are collected in a septic tank, where primary treatment takes place, before the sewage is discharged into a central collection system. Wastewater then flows from the pressurized collection system to a small package plant where the effluent is treated and disinfected. The following is a list of advantages and disadvantages for the STEP system.

Advantages

- Connect multiple residents to septic tank
- Infiltration reduced
- Cleanouts and valve assemblies less expensive than manholes.
- Pipe size and depth requirements reduced

Disadvantages

- Mechanical components require greater institutional involvement
- O,M&R costs higher due to number of septic tanks and pumps
- Annual preventative maintenance for septic tanks and pumps
- Life cycle replacement costs are higher
- Power outages can result in limited use for pumps
- Required solids removal as part of septic tank maintenance

Advantages of a STEP system over a conventional gravity system are smaller pipe sizes and shallower pipe depths within the collection network. Smaller pipes have lower material costs and maybe less expensive to install.

The STEP network uses all force mains and the depth of the pipes will be shallower than a conventional gravity system, thus further reducing the installation costs. On the other hand, the septic tanks and effluent pumps can drive up the initial cost of installation. The effluent pumps will need regular maintenance and repairs, and the septic tanks will require regular cleaning to remove the solids collected within them. Thus, the O,M&R cost of the system will go up as well.

A STEP system can be an effective means of collecting sewage from a small collection of homes, subdivisions, schools, and industrial parks, but it is not usually the preferred means of treatment for large communities or facilities that generate large flows. Wayne Lakes would be considered a small system.

The connection at the house will be similar to Figure 5-1. This Figure shows the typical connection for a STEP system where either the existing or new septic tank is installed on the property with an effluent pump where it is transported to the pressure main through a 1 ½ " pressure service line. Figures 5-3 and 5-4 show the layout for the STEP collection system.

A detailed construction cost analysis of this system is presented below in Table 5-1.

Table 5-1: STEP Sewer Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	1,000 GAL STEP TANK W/ PUMP	319	EA	$5,700	$1,818,300
2	2" DIA. FORCEMAIN	36,222	LF	$20	$724,440
3	3" DIA. FORCEMAIN	8,507	LF	$23	$195,661
4	4" DIA. FORCEMAIN	9,216	LF	$26	$239,616
5	6" DIA. FORCEMAIN	1,037	LF	$30	$31,110
6	AIR RELEASE VALVES	5	EA	$2,500	$12,500
7	CLEANOUTS	25	EA	$950	$23,750
8	1.25" DIA. SERVICE LATERAL & CONNECTION	319	EA	$1,000	$319,000
9	SEEDING AND MULCHING	18,327	SY	$1	$18,327
11	ASPHALT PAVEMENT REPLACEMENT	21,382	SY	$30	$641,460
12	MAINTAINING TRAFFIC	1	LS	$15,000	$15,000
13	CONSTRUCTION LAYOUT STAKING	1	LS	$ 20,000	$20,000
14	MOBILIZATION/DEMOBILIZATION	1	LS	$20,000	$20,000
15	CLEARING & GRUBBING	1	LS	$5,000	$5,000
16	TEMPORARY SOIL EROSION CONTROL	1	LS	$ 5,000	$5,000
17	PERMITTING	1	LS	$15,000	$15,000
SUBTOTAL					$4,104,164
10% CONTINGENCY					$410,416
20% NON-CONSTRUCTION					$902,916
TOTAL					**$5,417,496**

Grinder Pump Sewer System

The Grinder pump system utilizes a prefabricated pump and basin configuration. Wastewater from the house flows into the grinder pump station basin until liquid level controls turn on the pump. The grinder pump simultaneously grinds the waste into a slurry while pumping into the collection mains. Individual services are usually 1 ¼" PVC pipe with collection mains usually 2" to 6" PVC pipe.

The layout for the typical grinder system here is similar to those generated for the STEP system in this report. A low-pressure force main sewer system will follow the existing topography with the addition of isolation valves at intersections of mains, in-line cleanouts, terminal cleanouts, air release valves, and pressure monitoring stations. Main sewer lines would be constructed ranging in size from 4 inches to 6 inches in diameter. The following is a list of advantages and disadvantages for a conventional grinder pump sewer system.

Advantages

- Slope and pipe alignment not as critical as gravity sewers
- Pipe size and depth requirements reduced
- Cleanouts and valve assembles less expensive than manholes

Disadvantages

- Less- flexibility for expansion, and O,M&R concerns
- Less range of flow capacity
- Power outages can result in limited use for pumps
- Periodic maintenance

Another operating concern with low pressure systems is power outage. A typical power outage lasts less than two hours. Grinder pump basins are designed with several hours' worth of holding capacity. However, in power outage conditions individuals would need to avoid showers and other heavy water usage activities.

The Grinder Pump conventional sewer connection and collection layout would be very similar to that of the STEP system with the exception that the existing septic tank would be removed and a grinder pump would replace the effluent pump, thus eliminating the primary treatment component associated with a step system. The design for the sewer connection can be seen in Figure 5-2. The layout for the Grinder Pump collection can be found in Figures 5-3 and 5-4.

A detailed construction cost analysis of this system is presented below in Table 5-2.

Table 5-2: Grinder Pump Sewer Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	SIMPLEX GRINDER PUMP UNITS	319	EA	$6,000	$1,914,000
2	2" DIA. FORCEMAIN	36,222	LF	$20	$724,440
3	3" DIA. FORCEMAIN	8,507	LF	$23	$195,661
4	4" DIA. FORCEMAIN	9,216	LF	$26	$239,616
5	6" DIA. FORCEMAN	1,037	LF	$30	$31,110
6	AIR RELEASE VALVES	6	EA	$2,500	$15,000
7	CLEANOUTS	12	EA	$950	$11,400
8	1.25" DIA. SERVICE LATERAL & CONNECTION	319	EA	$1,000	$319,000
9	SEEDING AND MULCHING	18,327	SY	$1	$18,327
10	ASPHALT PAVEMENT REPLACEMENT	21,382	SY	$30	$641,460
11	MAINTAINING TRAFFIC	1	LS	$15,000	$15,000
12	CONSTRUCTION LAYOUT STAKING	1	LS	$20,000	$20,000
13	MOBILIZATION/DEMOBILIZATION	1	LS	$20,000	$20,000
14	CLEARING & GRUBBING	1	LS	$5,000	$5,000
15	TEMPORARY SOIL EROSION CONTROL	1	LS	$5,000	$5,000
16	PERMITTING	1	LS	$15,000	$15,000
SUBTOTAL					$4,190,014
10% CONTINGENCY					$419,001
20% NON-CONSTRUCTION					$921,803
TOTAL					**$5,530,818**

Vacuum Sewer System

Vacuum sewer systems are a mechanized system of wastewater transport where, unlike gravity flow, differential air pressure is used to move the wastewater. It requires a central source of power to run vacuum pumps which maintain a vacuum on the collection system. The system requires a normally closed vacuum/gravity interface valve at each entry point to seal the lines so that vacuum is maintained. These valves, located in a pit, open when a predetermined amount of wastewater accumulates in the collecting sump. The resulting differential pressure between atmosphere and vacuum becomes the driving force that propels the wastewater towards the vacuum station. A vacuum system is similar to a rural water distribution system in that it is a dendriform shape. The following is a list of advantages and disadvantages of a vacuum sewer system.

Advantages

- Installed following the existing topography
- Pipe size and depth requirements reduced

Disadvantages

- Less- flexibility for expansion and O,M&R concerns
- A broken main line can cause substantial operating problems
- Few vacuum sewer systems are in use

The layout for the typical Vacuum Sewer system here, again, is similar to those generated for the Gravity collection system in this report. A Vacuum Sewer system will follow the existing topography with the addition of vacuum valves, auxiliary vents, valve pits/sump pits, vacuum stations, and lift stations. Main sewer lines would be constructed ranging in size from 4 inches to 6 inches in diameter.

The connection at the house will be similar to Figure 5-5. This Figure shows the typical connection for a Vacuum system where the existing septic tank is abandoned and wastewater from the home flows by gravity to a valve pit, which is then transported to the main via 3 inch vacuum service line. A potential layout of the vacuum collection system can be found in Figures 5-6 and 5-7.

A detailed construction cost analysis of this system is presented below in Table 5-3.

Table 5-3: Vacuum Sewer System Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	6.0' - 2PC HYBRID VALVE PIT	319	EA	$4,700	$1,499,300
2	AIR TERMINALS	319	EA	$230	$73,370
3	TRAILER MOUNTED VACUUM PUMP	1	EA	$40,000	$40,000
4	PACVAC 165M-10	1	LS	$350,000	$350,000
5	6" VACUUM MAIN, COMPLETE	1,037	LF	$32	$33,184
6	4" VACUUM MAIN, COMPLETE	9,216	LF	$28	$258,048
7	3" VACUUM MAIN, COMPLETE	44,729	LF	$25	$1,118,225
8	6" ISOLATION VALVE, COMPLETE	8	EA	$1,500	$12,000
9	4" ISOLATION VALVE, COMPLETE	14	EA	$1,200	$16,800
10	VAC STA - SITE WORK	1	LS	$30,000	$30,000
11	VAC STA - BUILDING/FOUNDATION	1	LS	$10,000	$10,000
12	VAC STA - TANK INSTALLATION	1	LS	$25,000	$25,000
13	VAC STA - MECHANICAL/ELECTRICAL (BLDG TO TANK)	1	LS	$30,000	$30,000
14	VAC STA - VALVE VAULT(S)	1	LS	$5,000	$5,000
15	VAC STA - ODOR CONTROL	1	LS	$20,000	$20,000
16	VAC STA - GENERATOR	1	LS	$35,000	$35,000
17	MOBILIZATION/DEMOBILIZATION	1	LS	$20,000	$20,000
18	CLEARING AND GRUBBING	1	LS	$5,000	$5,000
19	TEMPORARY SOIL CONTROL	1	LS	$5,000	$5,000
20	MAINTAINING TRAFFIC	1	LS	$15,000	$15,000
21	CONSTRUCTION LAYOUT STAKING	1	LS	$20,000	$20,000
22	SEEDING AND MULCHING	18,327	SY	$1	$18,327
23	ASPHALT PAVEMENT REMOVAL & REPLACEMENT, COMPLETE	21,382	SY	$30	$641,460
24	PERMITTING	1	LS	$15,000	$15,000
SUBTOTAL					$4,295,714
10% CONTINGENCY					$429,571
20% NON-CONSTRUCTION					$945,057
TOTAL					**$5,670,342**

Treatment System Alternatives

Treatment of the wastewater is the second stage in managing wastewater. Four scenarios were reviewed for the Village of Wayne Lakes. Three scenarios include the construction of a new treatment facility in Wayne Lakes. These treatment options include an Extended Aeration plant, a Lagoon system, and a Packed Bed Media system. One additional scenario includes transporting wastewater to the Village of Greenville's existing treatment facility and contracting with Greenville for treatment operations.

Given that the proposed wastewater treatment facilities are new, there are currently no specific effluent parameters for the Village of Wayne Lakes. Without having specific effluent limitation parameters, effluent will need to comply with the EPA's Best Available Demonstrated Control Technology for new sources discharging sanitary wastewater which is identified as follows:

Table 5-4: Design Effluent

Parameter	30 Day Limit	Daily or 7 Day Limit	Max/Min Limit
CBOD5	10 mg/l	15 mg/l	n/a
Total Suspended Solids	12 mg/l	18 mg/l	n/a
Ammonia (summer)	1.0 mg/l	1.5 mg/l	n/a
Ammonia (winter)	3.0 mg/l	4.5 mg/l	n/a
Dissolved Oxygen	n/a	n/a	6.0 mg/l (min.)
Total Residual Chlorine	n/a	n/a	0.038 mg/l (max.)
E. Coli	126 / 100 ml	235 / 100 ml	n/a

In addition, a final decision upon the amount of residual treated wastewater constituents requires a formal study of the receiving water, in this case Mud Creek.

For the purpose of this study, it will be assumed that any new wastewater treatment facility will consist of primary, secondary and tertiary treatment. In the three scenarios evaluated, the extent of each component i.e. primary, secondary and tertiary treatment will be described briefly and used to evaluate the alternatives. Figure 5-8 shows a possible location for a new treatment plant. This location is near the discharge point, Mud Creek, and it also has an access location, Weaver-Fort Jefferson Road. The collection system would also not need to cross Mud Creek, as opposed to other various treatment plant locations.

New Mechanical Treatment Plant – Extended Aeration

The first alternative for a new wastewater treatment plant utilizes Extended Aeration. Extended Aeration is a modified form of the activated sludge treatment process and is ideal for smaller flows. For purpose of this study, it will be assumed that the proposed treatment facility would consist of mechanical screening and grit removal as primary treatment. Secondary treatment would be the extended aeration process and clarification. This would be followed by tertiary filtration, Ultra Violet (UV) disinfection, post aeration and sludge treatment for land application.

Treatment of the wastewater will begin with the removal of large pieces of debris and any materials carried through the collection system using a bar screen followed by a mechanical fine screen. The bar screen will need to be manually cleaned by an operator. Mechanical fine screens typically have an automated self cleaning system. The screenings will be collected and disposed of appropriately.

Following the screening process the wastewater will then proceed to secondary treatment which in this alternative is the extended aeration process. The proposed Biolac System is an activated sludge biological treatment system that is suitable for many municipal wastewater applications. It is an extended aeration system with internal final clarification. The system utilizes low-loaded activated sludge technology, single basin operation, simple basin construction, and high-efficiency aeration chains with suspended fine –bubble diffusers. These features make the system very effective and cost efficient. The treatment process is presented in the diagram in Figure 5-9.

The system also offers a longer activated sludge age than most treatment systems. This provides excellent BOD removal, complete nitrification, and nutrient removal in warm and cold climates. The process incorporates a wave-oxidation process, which simplifies biological nutrient removal. Air distribution can be adjusted to vary the dissolved oxygen content and promotes alkalinity recovery. It also promotes nitrification, denitrification, and biological phosphorous removal.

Clarification is the next step in the treatment process and this occurs in a chamber that is integral to the extended aeration basin. The clarified wastewater then proceeds to the rapid sand filters where the tertiary filtration occurs. The rapid sand filters will be utilized as a polishing step to improve the quality of the wastewater prior to discharge.

After tertiary filtration, the wastewater is then disinfected as it proceeds through the UV disinfection unit. This is the followed by post aeration to meet the dissolved oxygen requirements. The treated effluent is then discharged to the receiving stream i.e. Mud Creek.

Sludge that is collected at the bottom of the clarifier flows to a sludge holding tank. From the sludge holding tank, some of the sludge can be pumped and returned to be mixed with the influent. This can be either upstream of the screening process or combined with the influent to the aeration basin. Any remaining sludge in the sludge holding tank can be held for extended periods of time without aeration. Air can be easily introduced into the sludge if required via the diffused air piping in the sludge holding tank. No further digestion is required and the large quantity of biomass can treat fluctuating loads with minimal operational changes. It also minimizes excess sludge and makes the process very stable. Excess sludge can be pumped to sludge drying beds for dewatering and further processing prior to land application.

A building will also be provided for the blowers, electrical equipment, process controls and other appurtenances necessary for the operation of the plant. A sludge building will also be considered for sludge processing equipment as required.

Advantages

- Modular – ready for installation
- Routinely maintains good effluent quality
- Highest capacity to accept increased wastewater flows
- Relatively odorless and noiseless operation
- Less indicative to site selection

Disadvantages

- Increased power consumption
- Increased O,M&R
- More frequent sludge handling

Under this scenario, the Village of Wayne Lakes would construct, own, operate, and maintain a wastewater treatment plant, which would be designed to handle wastewater flows of 120,000 GPD. The location of the wastewater treatment plant would be northwest of the Village of Wayne Lakes along the northern end of Mud Creek.

Listed below in Table 5-5 is a construction cost estimate for an extended aeration plant.

Table 5-5: Extended Aeration Treatment System Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	BARS/SCREEN UNIT	1	LS	$80,000	$80,000
2	BIOLAC SYSTEM	1	LS	$500,000	$500,000
3	SAND FILTER	2	LS	$40,000	$80,000
4	SLUDGE DRYING BED	2	LS	$40,000	$80,000
5	SLUDGE DRYING BED BUILDING	1	LS	$50,000	$50,000
6	UV DISINFECTION UNIT	1	LS	$80,000	$80,000
7	POST AERATION TANK/FLOW METERS	1	LS	$50,000	$50,000
8	OFFICE/BLOWERS BUILDING	1	LS	$150,000	$150,000
9	YARD PIPING	1	LS	$120,000	$120,000
10	SITE WORK	1	LS	$60,000	$60,000
11	ELECTRICAL AND CONTROL	1	LS	$70,000	$ 70,000
12	6" SANITARY FORCE MAIN, COMPLETE	1,500	LF	$24	$36,000
13	LAND ACQUISITION	2	AC	$10,000	$20,000
SUBTOTAL					$1,376,000
10% CONTINGENCY					$137,600
20% NON-CONSTRUCTION					$302,720
TOTAL					**$1,816,320**

New Wastewater Treatment Plant - Facultative Lagoon System

The second alternative for the new wastewater treatment plant for the Village of Wayne Lakes considered in this study is a facultative lagoon system. The primary treatment for wastewater in this case is also screening. This will help to minimize floatables that could potentially accumulate in the lagoon.

A lagoon is a passive method of providing treatment by retaining wastewater for many months allowing microbes to break down the waste. In this process, sludge will be produced as a by-product which settles to the bottom until dredged.
Lagoons are used for residential, small commercial and small community applications that have suitable, available land. Lagoons provide treatment at a slow rate. Large volume and slow treatment are tradeoffs for little to no external energy requirements. Lagoons provide treatment through physical and biological processes.

Two types of lagoon systems commonly used for small communities include flow-through and controlled discharge lagoons which is dependent upon the stream size and characteristics for discharge. Flow-through systems require larger streams to minimize impact to the water quality. In this case, large streams are not immediately available, thus a controlled discharge lagoon would be considered.

In cold climates, lagoons which treat strong wastewater may require aerated lagoon systems. In an aerated lagoon, oxygen is supplied by means of surface aerators or diffused air units. The turbulence in a basin created by aeration keeps solids in suspension and aids in microbial growth to break down components in the wastewater. In this case, since wastewater is primarily residential, aeration will not be considered a necessary design addition.

Lagoon type systems are one of the most commonly used type system for small communities. The advantages of this type of system are the low O,M&R cost and minimum maintenance requirements. However, this type of system requires a large area for construction and treatment parameters of the effluent can't be controlled by operational means, which might require construction of additional treatment units.

Ten States Standards requires construction of three lagoons as a minimum and retaining the average daily flow for 180 days using an average depth of 4 feet in the ponds because of sludge accumulation. With an average daily flow of 120,000 GPD, a surface area of 16.6 acres would be needed to meet the storage requirements. In order to construct dikes to contain the water surface, an additional 80% of the water surface land size is needed. Thus site requirements would approach 30 acres (1.8 x 16.6 = 29.88 acres).

Advantages

- Easy to operate
- Requires little energy
- Smaller quantity of removed material

Disadvantages

- Difficult to control or predict ammonia levels
- Require large areas of land
- Burrowing animals

Listed below in Table 5-6 is a construction cost estimate for a lagoon treatment system.

Table 5-6: Lagoon Treatment System Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	EXCAVATION & EMBANKMENT	1	LS	$ 600,000	$600,000
2	PROCESS PIPING	1	LS	$55,000	$55,000
3	CONTROLS	1	LS	$80,000	$80,000
4	INFLUENT CHAMBERS	1	LS	$60,000	$60,000
5	OUTFALL STRUCTURE	1	LS	$100,000	$100,000
6	SITE WORK	1	LS	$90,000	$90,000
7	GROUNDWATER CONTROL	1	LS	$70,000	$70,000
8	LAND ACQUISITION	40	AC	$10,000	$400,000
9	6" SANITARY FORCE MAIN, COMPLETE	1,500	LF	$24	$36,000
SUBTOTAL					$1,491,000
10% CONTINGENCY					$149,100
20% NON-CONSTRUCTION					$328,020
TOTAL					**$1,968,120**

New Wastewater Treatment Plant -Packed Bed Media

Packed bed media filters are a secondary treatment option and designed to follow primary treatment, as achieved in the STEP collection system. If a different collection system is utilized then some other primary treatment process will have to be provided. Some of the media options for the packed bed media filter are sand/gravel, peat, foam, and textile (AdvanTex). The textile filter operates in the recirculating mode, similar to a recirculating sand or gravel filter and is the proposed media for this alternative.

Wastewater first enters an anoxic tank and then is applied over the top of the filter in small, uniform doses several times per hour. This process provides maximum holding time for the water within the fabric. Effluent is then collected at the bottom of the filter and returns to the Recirculation /Dilution (R/D) tank. The effluent is typically recirculated four times before being discharged. A diagram of the packed bed media process can be found in Figure 5-10.

Periodic maintenance by a trained service provider is critical to maintaining high quality effluent from the filter. If the biomat builds on top of the textile configuration, it will need to be periodically removed. The land size requirement for a packed bed media filter is smaller than most treatment systems. The land size requirement for this project would approximately be 1/2 for the plant and 2 acres for the building, parking, and future expansions.

Disinfection in this alternative will be achieved using UV disinfection and the treated effluent can be discharged.

A building will be provided for the electrical components, process controls and appurtenances as required.

Advantages

- Limited operator involvement
- Low power costs
- Able to handle seasonal or increasing flows
- Easy to expand

Disadvantages

- Needs Primary Treatment First
- Occurrence of clogging
- Media requires cleaning

Listed below in Table 5-7 is a construction cost estimate for a packed bed media treatment system.

Table 5-7: Packed Bed Media Treatment System Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	42 ft AX-MAX	12	EA	$75,000	$900,000
2	21 ft AX-MAX	1	EA	$48,000	$48,000
3	14 ft PUMP BASIN	2	EA	$30.000	$60.000
4	RNE PUMP	1	EA	$600	$600
5	DUPLEX PUMPING PACKAGE	18	EA	$2,000	$36.000
6	35 ft AX-MAX	5	EA	$65,000	$325,000
7	PRE-ANOXIC TANK	1	EA	$100,000	$100,000
8	DISCHARGE PUMPING PACKAGE	1	LS	$2,000	$2,000
9	ALKALINITY WATER FEED PUMP	1	EA	$600	$600
10	ALKALINITY FEED SYSTEM	1	LS	$12,000	$12,000
11	INSTRUMENTATION/ FLOW METER	1	EA	$10,000	$10,000
12	FLOW EQUALIZATION TANK PUMPING EQUP.	1	LS	$5,000	$5,000
13	DISINFECTION (UV)	1	EA	$50,000	$50,000
14	CONTROLS BUILDING	1	EA	$70,000	$70,000
15	TELEMETRY CONTROL PANEL	12	EA	$8,000	$96,000
16	LAND ACQUISION	2	AC	$10,000	$20,000
17	6" SANITARY FORCE MAIN, COMPLETE	1,500	LF	$24	$36,000
SUBTOTAL					$1,771,200
10% CONTINGENCY					$177,120
20% NON-CONSTRUCTION					$389,664
TOTAL					**$2,337,984**

Regionalize with Adjacent Community - Transport Wastewater to Greenville

Another treatment option is to have a pump station transport the wastewater through a force main from Wayne Lakes to the Village of Greenville's WWTP. The proposed force main would travel north along state route 121. The Village of Greenville's WWTP is approximately 7.3 miles away located on the east side of the City. Figure: 5-11 illustrates the path of the force main from Wayne Lakes to Greenville. The design capacity for the Greenville WWTP is 3.5 MGD and the average daily flow is 2.2 MGD.

Listed below in Table 5-8 is a construction cost estimate for transporting wastewater to Greenville.

Table 5-8: Transport to Greenville Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	6" SANITARY FORCE MAIN, COMPLETE	38,544	LF	$24	$925,056
2	AIR RELEASE MANHOLE AND VALVE	2	EA	$6,000	$12,000
3	PAVEMENT REMOVAL & REPLACEMENT	6,424	SY	$30	$192,720
4	SEEDING & MULCHING, COMPLETE	29,977	SY	$1	$29,977
5	MAINTENANCE & PROTECTION OF TRAFFIC	1	LS	$10,000	$10,000
SUBTOTAL					$1,169,753
10% CONTINGENCY					$116,975
20% NON-CONSTRUCTION					$257,346
TOTAL					**$1,544,074**

Regionalize with Adjacent Community – Transport Wastewater to Palestine/Hollansurg

The Villages of Palestine / Hollansburg, and the unincorporated community of Glen Karn are currently in the design stage for a regional combined lagoon treatment facility on the west side of Hollansburg. There are a total of approximately 225 customers within these communities with a design flow of 70,000 GPD.

Contact was made with the Village's consultant regarding the possibility of joining into the regional sewer district and the general perception received was that they would not be interested in expanding the design of the facility. For that reason, and the fact that the distance is great between Wayne Lakes and Hollansburg (over 46,000 feet – close to 9 miles), this option is given very little credit as being viable. Figure 5-12 shows a path for a force main from Wayne Lakes to the Palestine/Hollansburg proposed WWTP site.

Listed below in Table 5-9 is a construction cost estimate for transporting wastewater to the Palestine/Hollansburg facility.

Table 5-9: Transport to Palestine/Hollansburg Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	6" SANITARY FORCE MAIN, COMPLETE	46,400	LF	$24	$1,113,600
2	AIR RELEASE MANHOLE AND VALVE	6	EA	$6,000	$36,000
3	PAVEMENT REMOVAL & REPLACEMENT	7,700	SY	$30	$231,000
4	SEEDING & MULCHING, COMPLETE	36,000	SY	$1	$36,000
5	MAINTENANCE & PROTECTION OF TRAFFIC	1	LS	$15,000	$15,000
SUBTOTAL					$1,431,600
10% CONTINGENCY					$143,160
20% NON-CONSTRUCTION					$286,320
TOTAL					**$1,861,080**

Regionalize with Adjacent Community – Transport Wastewater to New Madison

The Village of New Madison owns and maintains its own wastewater collection and treatment system to service the Village. It has a design capacity of 130,000 GPD with limited excess capacity (approximately 60,000 GPD as noted in 2011). Wayne Lakes has a design flow of 110,000 GPD. As such, the treatment facility would need to be expanded in order to provide service to Wayne Lakes.

In 2009, the Villages of Palestine and Hollansburg approached New Madison about the possibility of transporting wastewater to New Madison for treatment. New Madison did not want to relinquish any capacity or increase capacity through treatment plant expansion. They wanted to reserve any remaining capacity for customers within the Village of New Madison.

For this reason, and again the great distance between Wayne Lakes and New Madison (37,000 feet – 7 miles), this option is also given little credit as being viable. A path for the force main transporting the wastewater from Wayne Lakes to New Madison is shown in Figure 5-13.

Listed below in Table 5-10 is a construction cost estimate for transporting wastewater to the Village of New Madison.

Table 5-10: Transport to New Madison Cost Analysis

ITEM	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL
1	6" SANITARY FORCE MAIN, COMPLETE	37,000	LF	$24	$888,000
2	AIR RELEASE MANHOLE AND VALVE	6	EA	$6,000	$36,000
3	PAVEMENT REMOVAL & REPLACEMENT	6,200	SY	$30	$186,000
4	SEEDING & MULCHING, COMPLETE	28,000	SY	$1	$28,000
5	MAINTENANCE & PROTECTION OF TRAFFIC	1	LS	$15,000	$15,000
SUBTOTAL					$1,153,000
10% CONTINGENCY					$115,300
20% NON-CONSTRUCTION					$188,166
TOTAL					**$1,498,900**

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VILLAGE OF WAYNE LAKES

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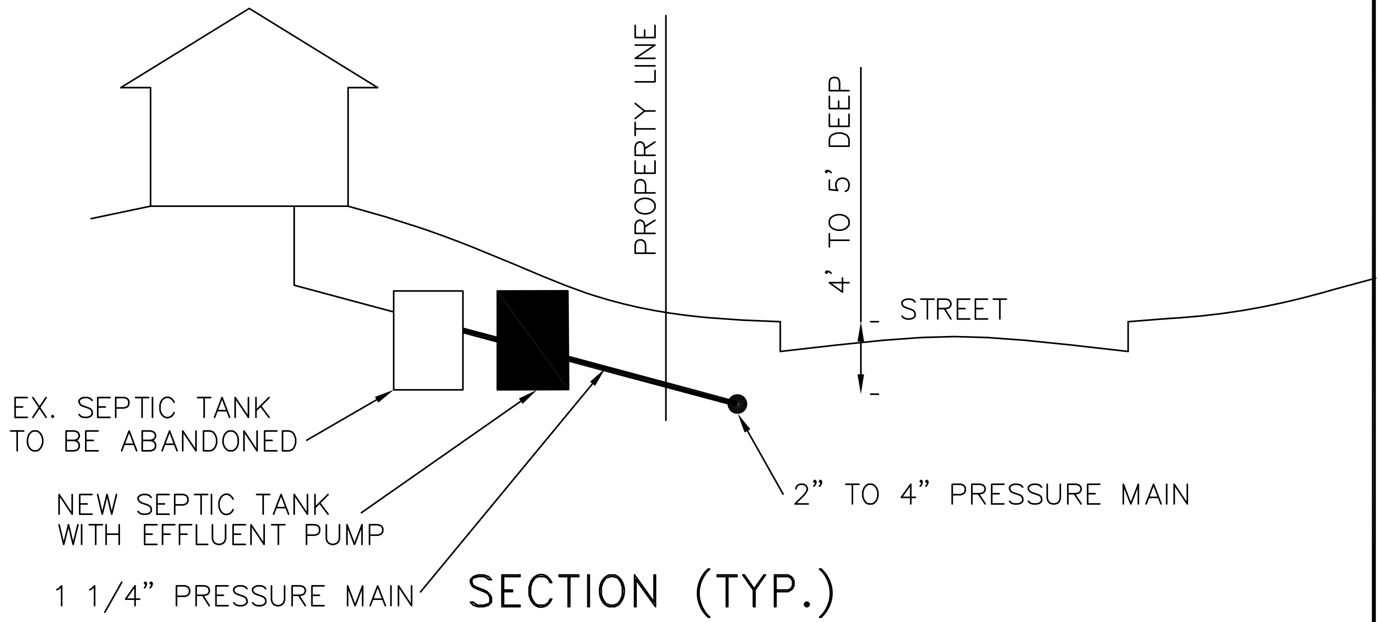
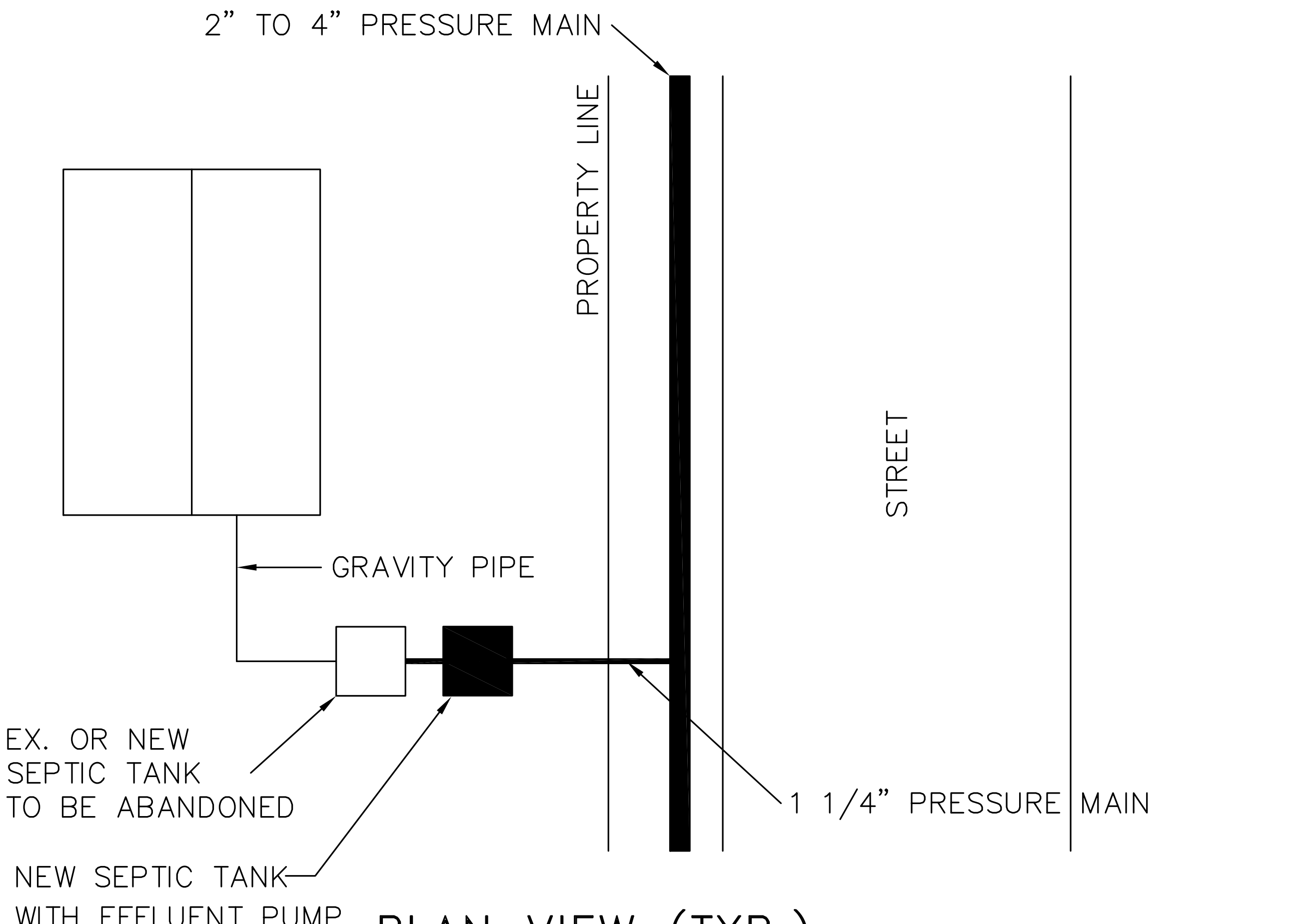
SEPTIC TANK EFFLUENT PUMP
(STEP) SYSTEM
FIGURE 5-1



SECTION (TYP.)



PLAN VIEW (TYP.)

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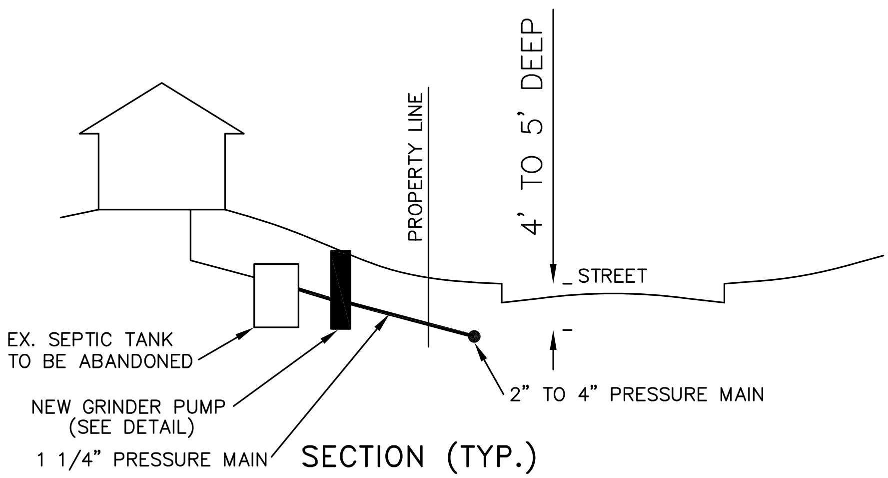
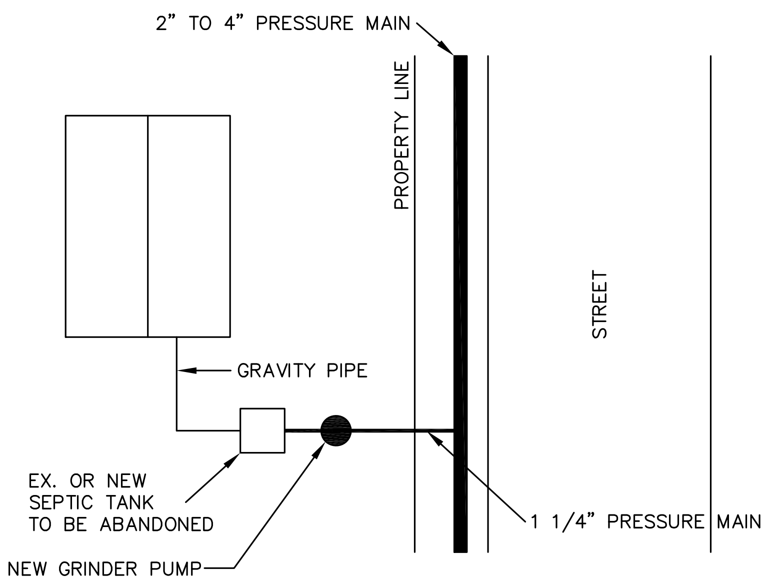
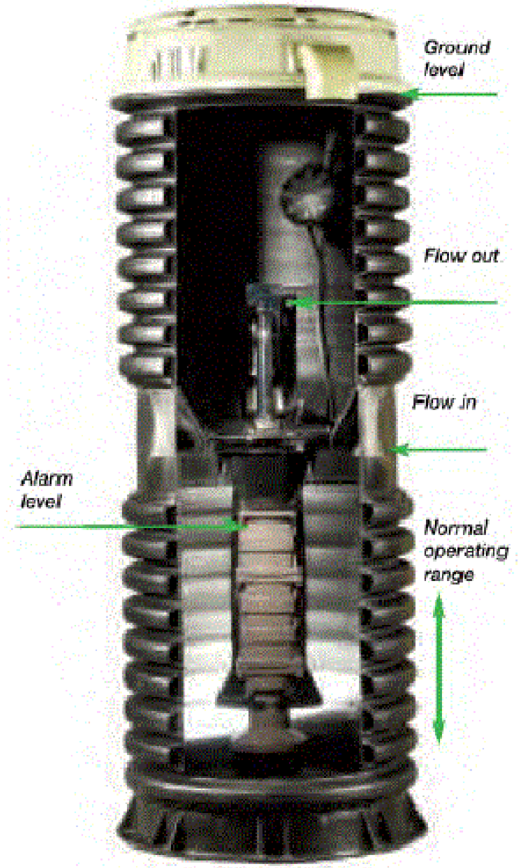
CONVENTIONAL GRINDER SEWER CONNECTION
FIGURE 5-2



SECTION (TYP.)



PLAN VIEW (TYP.)



GRINDER DETAIL

GRAPHIC SCALE

0 250 500

(IN FEET)

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SHEET TITLE:

STEP/GRINDER SEWER LAYOUT - NORTH

FIGURE 5-3

GRAPHIC SCALE

0 250 500

(IN FEET)

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SHEET TITLE:

STEP/GRINDER SEWER LAYOUT - SOUTH

FIGURE 5-4

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VILLAGE OF WAYNE LAKES

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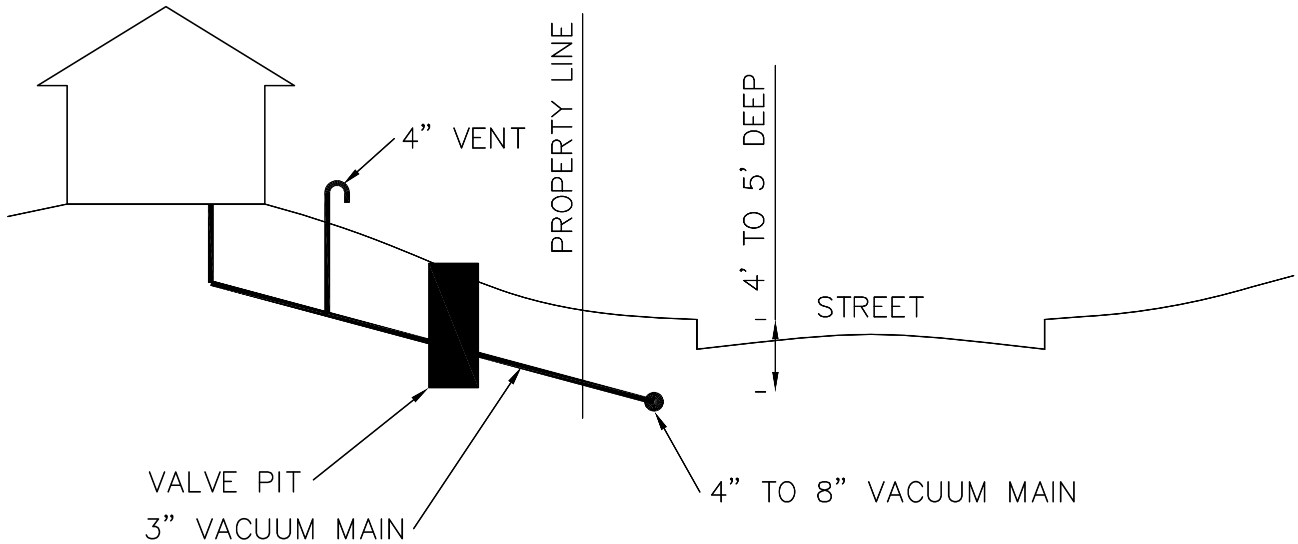
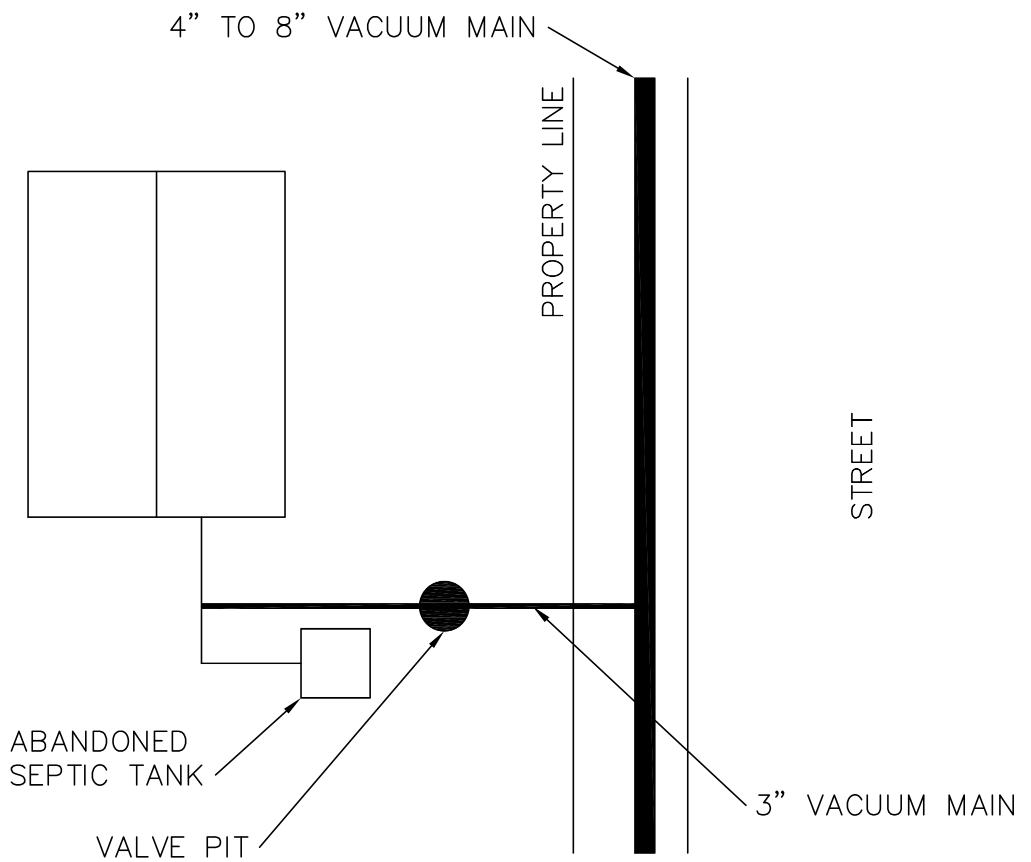
VACUUM SEWER SYSTEM
FIGURE 5-5



SECTION (TYP.)



PLAN VIEW (TYP.)

GRAPHIC SCALE

0 250 500

(IN FEET)

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SHEET TITLE:

VACUUM SEWER LAYOUT - NORTH

FIGURE 5-6

GRAPHIC SCALE

0 250 500

(IN FEET)

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SHEET TITLE:

VACUUM SEWER
LAYOUT-SOUTH

FIGURE 5-7

GRAPHIC SCALE

0 500 1000

(IN FEET)

1 inch = 1000 ft.

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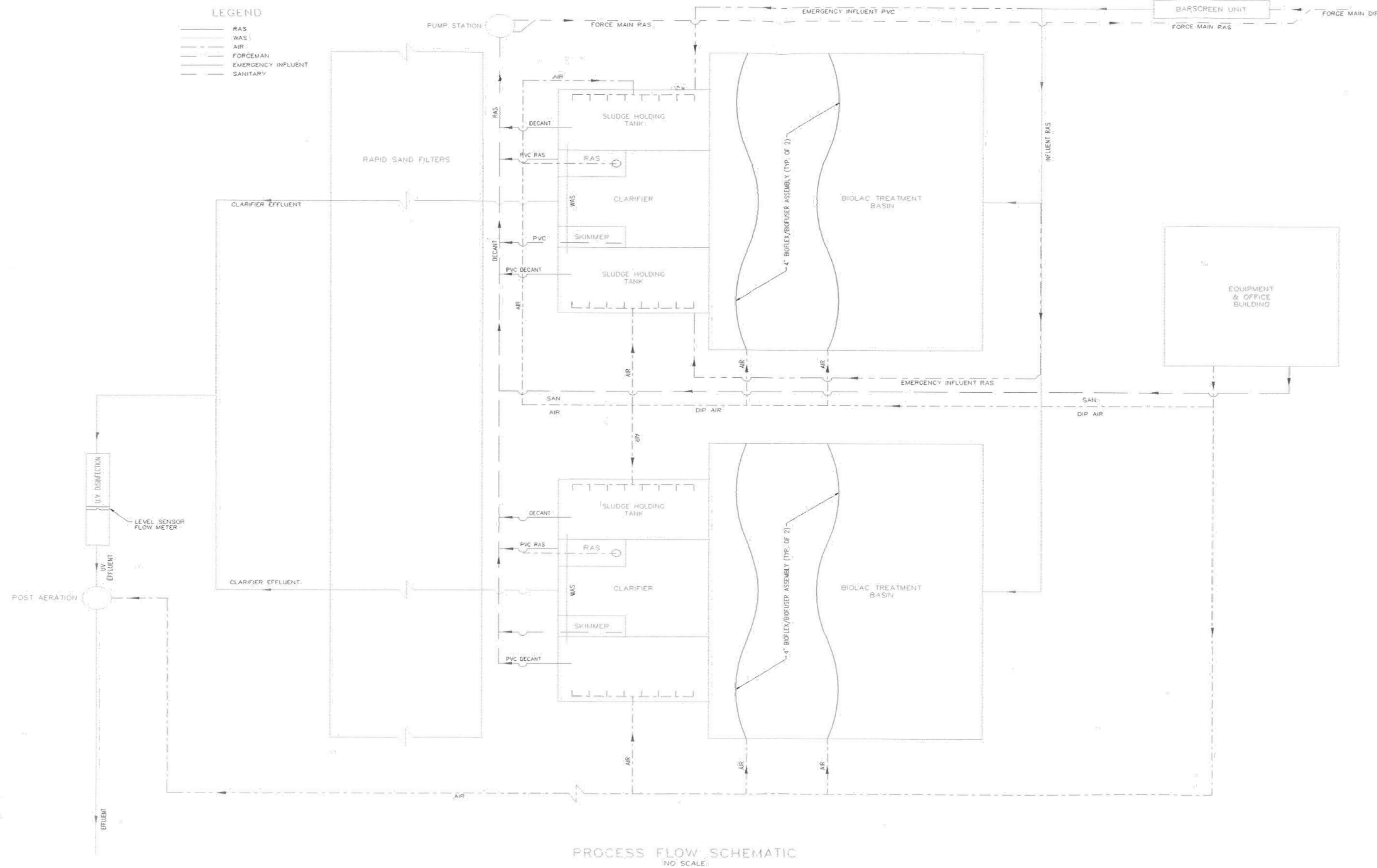
SHEET TITLE:

PROPOSED WWTP LOCATION

FIGURE 5-8



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SHEET TITLE:

EXTENDED AERATION TREATMENT PROCESS

FIGURE 5-9

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VILLAGE OF WAYNE LAKES

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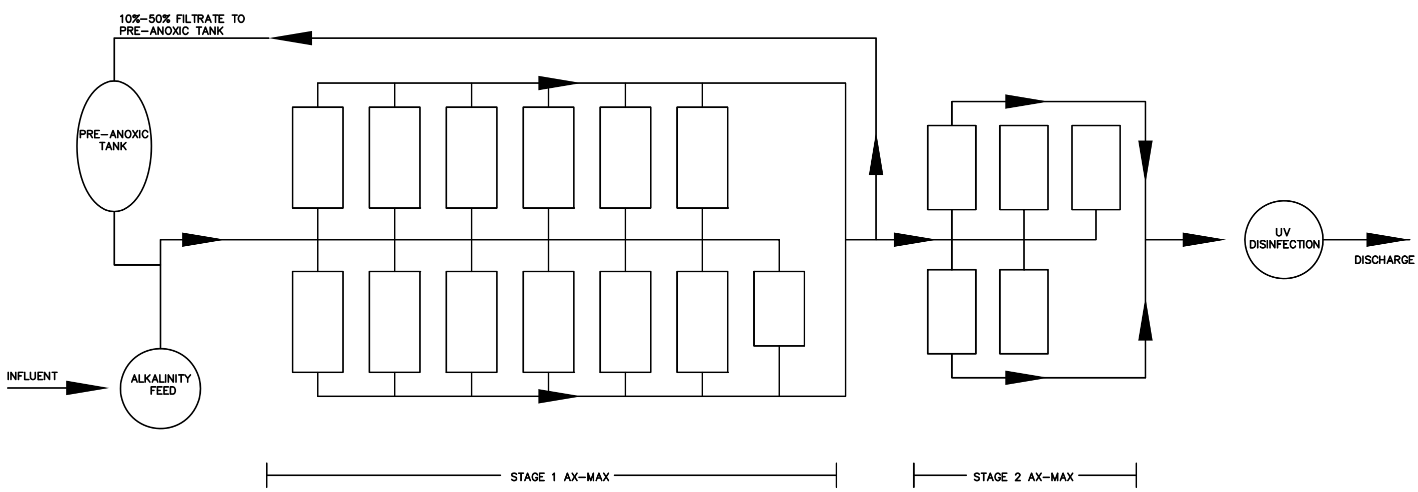
PACKED BED MEDIA TREATMENT SYSTEM
LAYOUT
FIGURE 5-10



GRAPHIC SCALE

0 1250 2500

(IN FEET)

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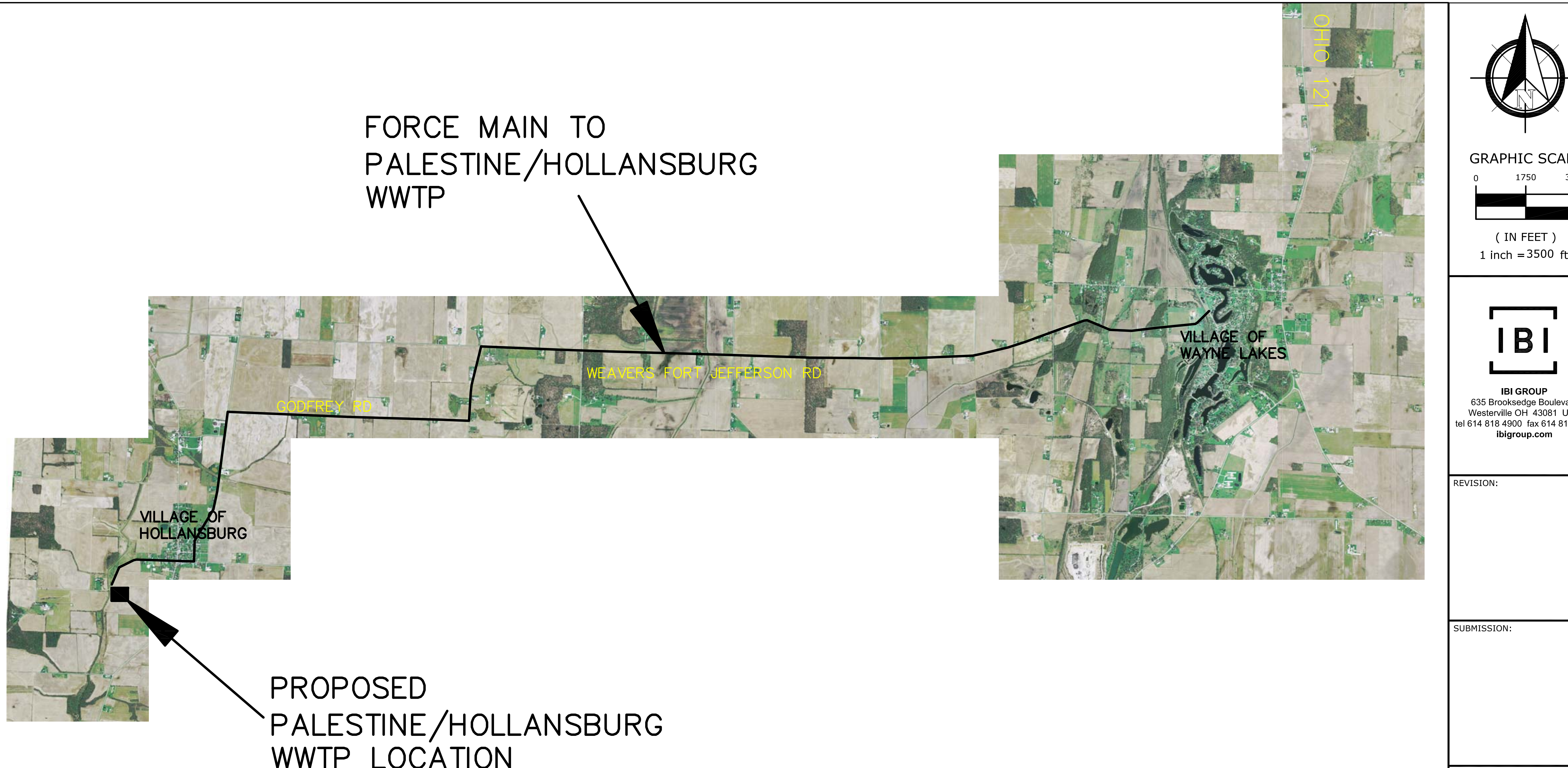
SHEET TITLE:

FORCE MAIN TO
GREENVILLE

FIGURE 5-11



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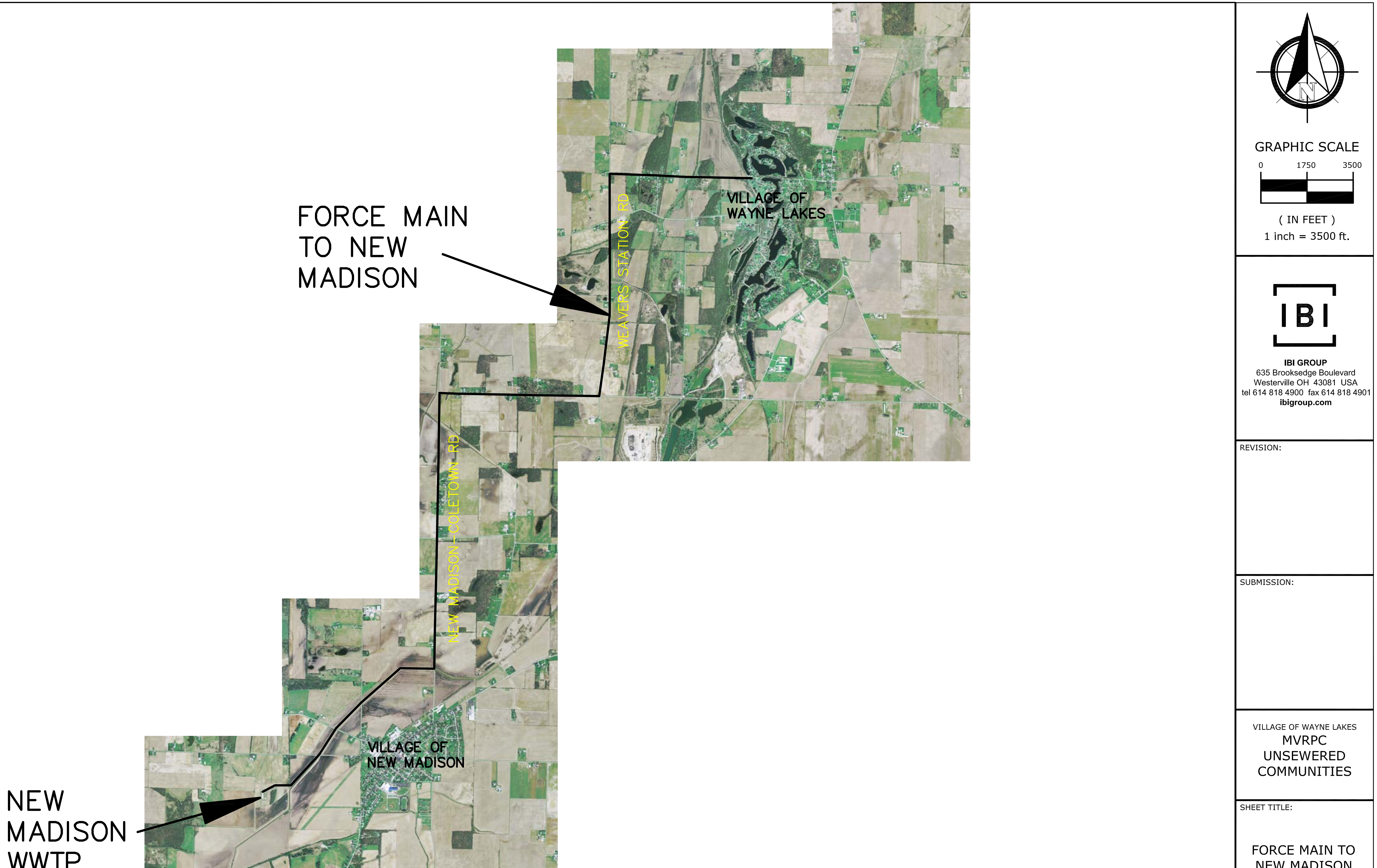
SHEET TITLE:

FORCE MAIN TO
PALESTINE/
HOLLANSBURG

FIGURE 5-12



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SUBMISSION:

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COMMUNITIES

SHEET TITLE:

FORCE MAIN TO
NEW MADISON

FIGURE 5-13

Chapter 6 – Other Cost

The alternatives presented in this study are evaluated economically by comparing their present worth. The present worth of an alternative is the amount of money invested at 6 percent, which would provide the funds needed for all expenses during the life of the project (including O,M&R). This provides a method of comparing the real costs of each system in its entirety, as opposed to the comparison of construction costs only. The procedures used in developing present worth are as follows:

Contingency

Contingency costs are capital costs incurred to purchase and install each component of a collection and treatment alternative. These costs are estimates for a future construction date and include a 10 percent design contingency. Contingency costs typically cover the following:

- Sewers, force mains, and pump stations
- Fittings and valves
- Earthwork
- Pavement replacement
- Grading and seeding
- Boring and jacking under railroads, highways, and streams
- Granular backfill Bid margin
- Design
- Appurtenances

Contingency cost estimates for the various alternatives are included in the individual estimates.

Non - Construction Costs

Non-construction costs are calculated at 20 percent of the sum of the construction cost and contingency cost. They include the following:

- Engineering, legal, and administrative cost
- Easements
- Interest during construction
- Initial operation
- Construction inspection and administration
- Financing/Funding Administration

Operation, Maintenance, and Repair

O,M&R costs are those costs associated with the daily or periodic inspection/ upkeep of the proposed collection system. They include, but are not limited to, the following:

- Salary – Labor costs are based on the number of operating personnel required including benefits.
- Pump Stations - O,M&R costs including inspections, repairs to impellers and bearings, etc.
- Collection System – Maintenance costs are historically calculated at a unit cost per mile of collection pipe. Unit costs vary according to type of system.
- Electrical – Electrical costs associated with pump stations, effluent pumps, and vacuum stations.
- Office & Overhead – Costs associated with the monthly billing operations such as paper, stamps, computers, and personnel.

The O,M&R costs associated with the STEP, vacuum, and grinder collection systems are as follows:

Table 6-1: Collection System O,M&R Costs

Septic Tank Effluent Pump Collection System

ITEM	DESCRIPTION	COST
1	PRIMARY TANK PUMP OUT (319 tanks based on 7 year frequency @ $300 per tank)	$14,000
2	PRO-ACTIVE PREVENTITIVE MAINTENANCE (pump and controls inspection annually)	$5,000
3	REACTIVE MAINTENANCE (repairs to pump components)	$3,000
4	EQUIPMENT REPAIR AND REPLACEMENT (pump replacement frequency 10 years)	$7,000
TOTAL		**$29,000**

Grinder Pump Collection System

ITEM	DESCRIPTION	COST
1	PRO-ACTIVE PREVENTITIVE MAINTENANCE (pump and controls inspection annually)	$5,000
2	REACTIVE MAINTENANCE (repairs to pump components)	$10,000
3	EQUIPMENT REPAIR AND REPLACEMENT (pump replacement frequency 8 years)	$16,000
TOTAL		**$31,000**

Vacuum Collection System

ITEM	DESCRIPTION	COST
1	VACUUM STATION POWER	$14,000
2	PRO-ACTIVE PREVENTITIVE MAINTENANCE	$6,000
3	REACTIVE MAINTENANCE	$3,000
4	EQUIPMENT REPAIR AND REPLACEMENT	$13,000
TOTAL		**36,000**

The O,M&R costs associated with the treatment systems are as follows:

Table 6-2: Treatment Systems O,M&R Costs

Extended Aeration Treatment

ITEM	DESCRIPTION	COST
1	LABOR & ADMINISTRATION	$30,000
2	CHEMICALS	$3,000
3	POWER	$5,000
4	LABORATORY	$4,000
5	SLUDGE HANDLING	$6,000
6	EQUIPMENT REPAIR AND REPLACEMENT	$12,000
TOTAL		**$60,000**

Lagoon Treatment System

ITEM	DESCRIPTION	COST
1	LABOR & ADMINISTRATION	$20,000
2	CHEMICALS	$2,500
3	POWER	$4,000
4	LABORATORY	$4,000
5	EQUIPMENT REPAIR AND REPLACEMENT	$5,000
TOTAL		**$35,500**

Packed Bed Media Treatment System

ITEM	DESCRIPTION	COST
1	LABOR & ADMINISTRATION	$20,000
2	CHEMICALS	$2,000
3	POWER	$3,000
4	LABORATORY	$2,000
5	EQUIPMENT REPAIR AND REPLACEMENT	$6,000
TOTAL		**$33,000**

Transport to Greenville

ITEM	DESCRIPTION	COST
1	FORCEMAIN MAINTENANCE	$1,000
2	ODOR CONTROL	$1,000
3	GREENVILLE TREATMENT CHARGES (based on $3.04/750 gal – 110,000 GPD)	$162,800
TOTAL		**$164,800**

Transport to Palestine/Hollansburg

ITEM	DESCRIPTION	COST
1	FORCEMAIN MAINTENANCE	$2,000
2	ODOR CONTROL	$2,000
3	TREATMENT CHARGES (unknown – assume $5.00/1,000 gal – 110,000 GPD)	$200,750
TOTAL		**$204,750**

Transport to New Madison

ITEM	DESCRIPTION	COST
1	FORCEMAIN MAINTENANCE	$2,000
2	ODOR CONTROL	$2,000
3	TREATMENT CHARGES (unknown – assume $5.00/1,000 gal – 110,000 GPD)	$200,750
TOTAL		**$204,750**

Summary

The previously identified sewer system alternatives have been analyzed for feasibility based on existing and future projected demands, regulatory considerations, estimated costs and with regional service options based on user rate analysis. The following section will identify the recommended alternative based on the factors listed above.

The estimated costs for each collection and treatment alternative have been developed and are presented in the Tables below. These tables include the total project cost, estimated annual O,M&R costs, and present worth.

A 20-year present value analysis was used to compare alternatives against each other. Present value, also known as present worth or present discounted value, is the value on a given date (i.e. the present) for a future payment or series of future payments, discounted to reflect the time value of money. Present value calculations are widely used in engineering economics to provide a means to compare costs at different times on a meaningful “like to like” basis.

Criteria and factors used in the present value analysis include the following:

Design Life	20 years
Replacement Period	10 years
Discount Rate	6 percent
O,M&R Present Worth Factor	11.4699

The following pages show each possible collection and treatment option for Wayne Lakes.

The set of tables below show all of the options for the Village of Wayne Lakes.
The first option in a table is the collection system alternative, and the treatment alternative is listed directly below. The project cost of each of these is listed in the project cost column. The operation, maintenance, and repair for each option is listed in the O,M&R column. The present worth for each of the options is calculated by multiplying the O,M&R cost by the present worth factor (11.4699) and adding the project cost. The bold number in the table represents the total project present worth cost for that collection and treatment combination. The lowest present worth cost is highlighted in yellow.

STEP Sewer System

	Project Cost	O,M&R	Present Worth
STEP Sewer	$5,417,496	$29,000	$5,750,123
Packed Bed Media	$2,337,984	$33,000	$2,716,491
Total	$7,755,480	$62,000	**$8,466,614**

Grinder Pump Sewer System

	Project Cost	O,M&R	Present Worth
Grinder Sewer	$5,530,818	$ 31,000	$5,886,385
Extended Aeration	$1,816,320	$60,000	$2,504,514
Total	$7,347,138	$91,000	**$8,390,899**

	Project Cost	O,M&R	Present Worth
Grinder Sewer	$5,530,818	$ 31,000	$5,886,385
Lagoon	$1,968,120	$35,500	$2,375,301
Total	$7,498,938	$66,500	**$8,261,686**

	Project Cost	O,M&R	Present Worth
Grinder Sewer	$ 5,530,818	$31,000	$5,886,385
Pump to Greenville	$ 1,544,074	$164,800	$3,434,314
Total	$ 7,074,892	$195,800	**$9,320,698**

	Project Cost	O,M&R	Present Worth
Grinder Sewer	$5,530,818	$31,000	$5,886,385
Pump to Palestine/Hollansburg	$1,861,080	$204,750	$4,209,542
Total	$7,391,898	$235,750	**$10,095,927**

	Project Cost	O,M&R	Present Worth
Grinder Sewer	$5,530,818	$31,000	$5,886,385
Pump to New Madison	$1,498,900	$204,750	$3,847,362
Total	$7,029,718	$235,750	**$9,733,747**

Vacuum Sewer System

	Project Cost	O,M&R	Present Worth
Vacuum Sewer	$5,670,342	$36,000	$6,083,258
Extended Aeration	$1,816,320	$60,000	$2,504,514
Total	$7,486,662	$96,000	**$8,587,772**

	Project Cost	O,M&R	Present Worth
Vacuum Sewer	$5,670,342	$36,000	$6,083,258
Lagoon	$ 1,968,120	$35,500	$2,375,301
Total	$ 7,638,462	$71,500	**$8,458,560**

	Project Cost	O,M&R	Present Worth
Vacuum Sewer	$ 5,670,342	$36,000	$6,083,258
Pump to Greenville	$ 1,544,074	$164,800	$3,434,314
Total	$ 7,214,416	$200,800	**$9,517,572**

	Project Cost	O,M&R	Present Worth
Vacuum Sewer	$5,670,342	$36,000	$6,083,258
Pump to Palestine/Hollansburg	$1,861,080	$204,750	$4,209,542
Total	$7,531,422	$240,750	**$10,292,800**

	Project Cost	O,M&R	Present Worth
Vacuum Sewer	$5,670,342	$36,000	$6,083,258
Pump to New Madison	$1,498,900	$204,750	$3,847,362
Total	$7,169,242	$240,750	**$9,930,620**

As mentioned earlier the best way to look at the price of the wastewater system is to look at the present worth. The Grinder Pump collection system and the treatment option for a new Lagoon system has the lowest present worth. However, there may not be an adequate amount of land to account for the size of the lagoon treatment system necessary. Assume, the next lowest present worth is the Grinder Pump collection system and a new Mechanical Treatment Plant – Extended Aeration system.

Conclusions

The previously identified wastewater collection and treatment system alternatives have been analyzed to determine the best collection system and treatment system scenario for the Village of Wayne Lakes. Each of these scenarios took the project cost, O,M&R cost, and the environmental conditions into consideration to provide the Village of Wayne Lakes a viable option for a future wastewater system.

Recommendations

Based on the cost analysis and environmental conditions, the best scenario for the Village of Wayne Lakes is to have a grinder pump sewer collection system with a new mechanical treatment plant – extended aeration system.

The grinder pump sewer system allows for the depth of the pipes to be shallower. The alignment for the slopes of the pipes is also not as critical as a gravity collection system.

The new mechanical treatment plant (extended aeration) can increase the amount of inflow easily and maintain good effluent quality. This plant also allows for relatively no odor or noise.

Chapter 8 – Funding

There are several Federal and State funding sources available to help assist in covering the cost of this project. Below are several sources which Wayne Lakes may consider with the project. These include both grants and low-interest loans.

Each year, qualified communities are bypassed in the apportioning of public funds, not for lack of need or eligibility, but simply because of failure to meet deadlines and provide necessary documentation. With the assistance of a qualified funding consultant, communities can be assisted in the time-consuming and laborious task of applying for grants and loans.

Federal Funding

Community Development Block Grants (Grant Program)

Approximately $20.4 million is average annually split up among Ohio Counties. Counties typically fund 3 to 4 projects up to $50,000. Financing is available in the form of supplemental grants. To be eligible for this grant, the project benefit area must include at least 51% Low to Moderate Income (LMI) households. The Village of Wayne Lakes 2014 Low Moderate Income is currently listed as 42.0%. A new income survey would need to be conducted to revise or confirm the current census data. Applications are due to the County in the Spring of each year.

Rural Development (Grant/Loan Program)

Grants are available on an open cycle competitive bases with a funding amounts varying depending on the affordability threshold of the community. Applicants must be under Ohio EPA Findings & Orders and have a Median Household Income (MHI) in the range of $38,651-$49,694. The Village of Wayne Lakes has an MHI of $41,136 (according to the 2014 American Community Survey), and would be considered eligible for the grant funds combined with a low interest loan of 2.75% for up to 40 years.

State Funding

Ohio Public Works Commission (Grant/Loan Program)

Financing is available in the form of grants and loans with varying interest rates. Grants may pay up to 50% of water or sewer project costs for new projects and up to 90% for repair or replacement projects. Loans may fund up to 100% of total project costs, each district will recommend an interest rate from 0% to 3% interest. The Loan Assistance is a grant that pays for the interest on a public or private loan during the construction period plus one year. Once project is complete a payment schedule is provided requiring payments every January and July, there is no prepayment penalty.

Ohio Water Development Authority (Loan)

Financing is available in the form of a loan program to plan, design and construct projects. The loan interest rate is current market rate. Discount rates are offered to previous borrowers and disadvantaged communities. The Village of Wayne Lakes has a Median Household Income of $41,136 (according to the 2014 American Community Survey), and would be considered a disadvantaged community. The loan has a term of 5 to 30 years. To date, all eligible applicants have been funded.

Residential Public Infrastructure (Grant) = COBG

Grants are available on a competitive basis up to $480,000, at a $1 to $1 (other funds) ratio for projects benefiting at least 51% LMI households. Applications are due 2nd Quarter of each year. The Village of Wayne Lakes 2014 Low Moderate Income is 42.0% (according to the 2014 Low-Moderate-Income Summary Data for Ohio Counties and Places) . A new income survey would need to be conducted to revise or confirm the current census data.

Unsewered Area Assistance Program (Grant) - OWDA

Grants are available for construction of a publicly owned sewer system for unsewered areas that have failing on-lot sanitary systems. The project area must have a Median household Income below the state MHI ($48,071), per the American Community Survey. The Village of Wayne Lakes MHI is $41,136 and has over 200 customers as such, they could possibly qualify for $250,000 in grant funding under this program.

Water Pollution Control Loan Fund (Loan) – Ohio EPA

Financing is available through a revolving fund designed to operate in perpetuity to provide low interest rate loan and other forms of assistance for water resource protection and improvement projects. Interest rates are determined by project areas Median household Income. The Village of Wayne Lakes' MHI is $41,136 and would qualify for an interest rate of 0% for 20 years. Applications may be submitted requesting a 30 year loan and cannot exceed the project useful life.

In order to fund this project, the following two funding plans are presented for consideration: one includes a customer capacity fee and the other without a capacity fee.

Table 8-1: Funding Summary
(With Capacity Fee)

			Option #1 Using OWDA Loan	Option #2 Using Ohio EPA Loan	Option #3 Using RD Grant/Loan
CUSTOMERS/EDUs			319	319	319
PROJECT COST- Collection System			$5,530,818	$5,530,818	$5,530,818
PROJECT COST- Treatment System			$1,816,320	$1,816,320	$1,816,320
TOTAL PROJECT COST			$7,347,138	$7,347,138	$7,347,138
ANNUAL O,M&R			$91,000	$91,000	$91,000
FINANCING					
CDBG Formula Grant			$50,000	$50,000	$50,000
Residential Public Infrastructure Grant			$480,000	$480,000	$480,000
OPWC Grant			$400,000	$400,000	$400,000
Unsewered Area Assistance Program			$250,000	$250,000	$250,000
Local Funds - Capacity Fee $3,000/Customer			$957,000	$957,000	$957,000
Rural Development Grant (up to 35% of Project Cost)			$ -	$ -	$2,571,498
OPWC Loan	30	0.00%	$800,000	$800,000	$800,000
OWDA Loan	30	2.00%	$4,410,138	$ -	$ -
OEPA WPCLF Loan	30	0.00%	$ -	$4,410,138	$ -
Rural Development Loan	40	2.75%	$ -	$ -	$1,838,640
Total Financing			$7,347,138	$7,347,138	$7,347,138
ANNUAL DEBT					
Annual OPWC Payment			$26,667	$26,667	$26,667
Annual OWDA Payment			$196,912	$ -	$ -
Annual OEPA WPCLF Payment			$ -	$147,005	$ -
Annual Rural Development Payment			$ -	$ -	$ 76,361
ANNUAL DEBT PAYMENT			$223,579	$173,671	$103,028
DEBT PAYMENT PER MONTH PER EDU			$58.41	$45.37	$ 26.91
O,M&R PAYMENT PER MONTH PER EDU			$23.77	$ 23.77	$23.77
TOTAL PAYMENT PER MONTH PER EDU			**$82.18**	**$ 69.14**	**$50.69**

Table 8-2: Funding Summary
(Without Capacity Fee)

			Option #1 Using OWDA Loan	Option #2 Using Ohio EPA Loan	Option #3 Using RD Grant/Loan
CUSTOMERS/EDUs			319	319	319
PROJECT COST- Collection System			$5,530,818	$5,530,818	$5,530,818
PROJECT COST- Treatment System			$1,816,320	$1,816,320	$1,816,320
TOTAL PROJECT COST			$7,347,138	$7,347,138	$7,347,138
ANNUAL O,M&R			$91,000	$91,000	$91,000
FINANCING					
CDBG Formula Grant			$50,000	$50,000	$50,000
Residential Public Infrastructure Grant			$480,000	$480,000	$480,000
OPWC Grant			$400,000	$400,000	$400,000
Unsewered Area Assistance Program			$250,000	$250,000	$250,000
Local Funds - Capacity Fee $3,000/Customer					
Rural Development Grant (up to 35% of Project Cost)			$-	$-	$2,571,498
OPWC Loan	30	0.00%	$800,000	$800,000	$800,000
OWDA Loan	30	2.00%	$5,367,138	$-	$-
OEPA WPCLF Loan	30	0.00%	$-	$5,367,138	$-
Rural Development Loan	40	2.75%	$-	$-	$2,795,640
Total Financing			$7,347,138	$7,347,138	$7,347,138
ANNUAL DEBT					
Annual OPWC Payment			$26,667	$26,667	$26,667
Annual OWDA Payment			$239,642	$-	$-
Annual OEPA WPCLF Payment			$-	$178,905	$-
Annual Rural Development Payment			$-	$-	$116,107
ANNUAL DEBT PAYMENT			$266,309	$205,571	$142,774
DEBT PAYMENT PER MONTH PER EDU			$69.57	$53.70	$37.30
O,M&R PAYMENT PER MONTH PER EDU			$23.77	$23.77	$23.77
TOTAL PAYMENT PER MONTH PER EDU			**$93.34**	**$77.47**	**$61.07**

Three potential scenarios are presented above based on the recommended grinder collection system and extended aeration treatment facility. The upper portion is constant between all three options showing the total number of customers, construction cost, and annual O,M&R costs.

Under the Financing and Annual Debt sections, we show the maximum available grants and loans through CDBG and OPWC assuming eligibility thresholds are met as described on the previous pages. Table 8-1 includes an assumed $3,000 Capacity Fee per customer. This capacity fee can be adjusted as the Village sees fit or eliminated altogether with the understanding that monthly rates will adjust accordingly.

Option #1 and Option #2 are very similar with the only difference being the remaining loan balance after all grants are maximized being from different sources. Option #1 shows OWDA loan at a 2-percent rate where Option #2 shows a 0-percent rate through Ohio EPA funding. These rate differences affect the annual debt payment shared between each customer as shown on the Debt Payment per Month per EDU line.

Option #3 is the most optimistic scenario utilizing a Rural Development grant/loan combination. It is time consuming and requires a commitment from the community in order to secure, but can also significantly lower the average monthly cost per customer.

In most communities, sewer rates are based on metered water consumption to each customer. Since Wayne Lakes currently does not operate a public water system, water meters can be installed on each private well or a flat rate billing system established. Each of these scenarios above reflect a flat rate that each customer would need to be charged in order to operate and maintain the system based 319 total customers.

Chapter 9 – Arrangement for Implementation

Institutional Responsibilities

The Village of Wayne Lakes has the necessary statutory authority for implementing this system and has the necessary legal, financial, institutional, and managerial resources available to ensure construction and O,M&R of the proposed collection system. The proposed collection system involves the Village of Wayne Lakes, MVRPC, Neave Township, and potentially the Village of Greenville. Various Ordinances and Resolutions of Agreement will have to be passed by the governmental bodies to implement the Wayne Lakes and surrounding areas collection and treatment system.

Implementation Steps

The Village of Wayne Lakes would be the primary stakeholder in this project. Neave Township would also be involved with this project in that the sewer system will be constructed within their jurisdiction. They will have varying degrees of direct managerial and supervisory responsibilities for the proposed Wayne Lakes collection and treatment facility. The owner will be assisted by the Engineer in the preparation of detailed plans, construction, and O,M&R of the proposed facility.

The Village plans to finance the project through grants, loans, and user charges. The user charges will be programmed to provide adequate monies to meet bond retirement obligations and operate and maintain the proposed facility, without placing undue burden on local citizens.

The following steps should be completed in order to implement facilities plan recommendations:

1. Completion of the final “facilities plan” and submission for approval by local, regional, and state agencies.
2. Preparation of detailed plans and specifications for the proposed improvements.
3. Submission of the detailed plans and specifications for the proposed system, along with preparation of a financing agreement for State approval.
4. Preparation of all funding applications such as Ohio EPA, OPWC, CDBG, etc.
5. Execution of financial agreements, concurrent with grant/loan approval.
6. Advertisement for bids, bid evaluation, and award of contracts.
7. Construction of proposed system.
8. Preparation of operation and maintenance manual.
9. Employment of additional operation, maintenance, repair, and administrative personnel.
10. Initiation of operation of the improved facilities.

The following implementation schedule is feasible and represents the shortest time to project implementation:

Planning:	
Submit completed feasibility plan	June, 2015
Design:	
Authorization to start engineering design	October, 2015
Submit for OWDA planning loan	November, 2015
Completion of detailed plans	August, 2016
Obtain district and Ohio EPA approval	October, 2016
Finalize funding applications	April, 2017
Construction:	
Advertisement for bids	June, 2017
Receive bids	August, 2017
Award contracts	September, 2017
Complete construction	August, 2018
Final inspection	October, 2018

Operation, Maintenance, and Monitoring

The Village of Wayne Lakes wastewater treatment plant will need to be staffed with adequately trained and certified operation and maintenance personnel including a Class I or Class II wastewater treatment plant operator. An operation and maintenance manual for the improved facilities will be prepared by the Engineer and used for the preparation of daily operation and maintenance schedules. This manual will also describe the operation and maintenance requirements of newly constructed sewers and pump stations.

Chapter 10 – Summary of Environmental Considerations

Future Environment without Project

The future environment of the unsewered areas with a "no action" policy would allow for the continuation of present conditions to go unabated. This would allow improperly treated wastewater from individual residences to drain into the surrounding natural waterways causing local water pollution problems. Taking no action to solve existing wastewater management problems within the study area would result in the continued malfunctioning of individual soil absorption systems and the surface ponding and discharge of improperly treated septic tank effluent. High fecal coliform levels in roadside ditches preclude compliance with Ohio's Water Quality Standards and present potential health risks to area residents. Because this alternative does not meet the "effectiveness" criteria established by Ohio's Water Quality Standards, it was eliminated from further environmental evaluation.

Environmental Evaluation of Alternatives and Selected Plan

The environmental impacts of each alternative include primary and secondary impacts. The primary impacts are those directly related to the construction and operation of the facility. The secondary impacts are induced changes in the patterns of land use, population growth or the resultant effects upon the environment caused by these changes. Both adverse and beneficial impacts must be considered. Items included in this evaluation are the following:

- Air, land, and water quality
- Public Health
- Environmental aesthetics
- Historical and cultural area
- Noise and odors

Air, Land, and Water Quality

Each of the alternatives involving construction will have an initial detrimental or negative impact on air quality near the construction site.

An increase in total suspended particulates in the form of dust, carbon monoxide, and photochemical oxidents is anticipated during the construction period. The increase is a result of diesel and gasoline powered internal combustion engines. The alternatives involving large construction sites will impose a negative initial impact on air quality. The "no action" alternative will have the least negative impact on air quality except for occasional odors.

The overall secondary or induced impact will be beneficial as odors will be reduced. A gravity collection system or vacuum collection system will have the least impact associated with odors where STEP systems or grinder systems may have odor impacts.

Each of the alternatives involving construction will have an initial negative primary impact on the land at the construction site. During and immediately after construction, the land will appear scarred and lacking suitable cover. Erosion will probably occur, creating unsightly washes, puddles and small gullies. The alternatives involving larger construction sites will experience greater negative impact. The secondary impacts will have essentially no impact, beneficial or adverse, on land or development.

Each of the alternatives involving construction will have an initial adverse impact on water quality near the construction site. Erosion will result in an increase in suspended solids and turbidity in area streams. The secondary impact on water quality will be beneficial for all alternatives with the exception of the "no action" alternative. It will result in a considerably lower organic, nutrient and ammonia loadings to the receiving streams.

Public Health

All of the alternatives, with respect to the "no action" alternative, will result in a beneficial primary and secondary effect on public health.

Environmental Aesthetics

The impact of the various alternatives on environmental aesthetics are closely related to the impacts on land and water quality. The immediate primary impact during construction is adverse. The smallest construction site represents the least adverse effect on environmental aesthetics. The 'no action" alternative will result in no construction impacts.

Historical and Cultural

Each of the alternatives including the "no action" alternative will have no impact on any of the historical/archaeological or cultural elements within the planning area.

Noise and Odors

Each of the alternatives, except for the "no action" alternative will result in noise and odors inherent to construction activities. These adverse impacts will vary depending upon the extent of the construction activity and the proximity to existing residences. The secondary impacts will be virtually non-existent.

Selected Plan Environmental Impacts

The recommended plan for the study area is the construction of a grinder pump sewer collection system with a new mechanical treatment plant with extended aeration. Grinder pump systems have the advantage of the pipes being able to follow the topography of the land and staying relatively closer to the surface than a gravity sewer. This will keep the depth of excavation down during installation. The construction activities will include removal of vegetative cover, noise, dust and occasional odors. A slight degree of water quality degradation may take place after rainstorms as a result of erosion and siltation. The secondary impacts of the proposed action will be beneficial.

Mitigation Measures

Adverse impacts expected from the proposed action will primarily occur during the construction phase. The beneficial long-term impacts must outweigh the short-term adverse impacts for the project to be viable. To insure that the project does not harm the environment, mitigative measures must be taken to lessen the adverse effects of the proposed plan.

Erosion/Dust Control

The soil surface will be exposed only for the minimum amount of time to facilitate construction. Sewers, force mains and appurtenances will be aligned along existing right-of-way and easements to minimize the destruction of vegetative cover. Reseeding and mulching will follow construction as soon as possible. Topsoil removed during construction will be stockpiled for reuse at the site. Terracing, erosion control structures and contouring will be incorporated in the design. Dust control measures will include periodic sprinkling of exposed earth surfaces.

Archaeological/Historical Preservation

The proposed action will not have any impact on known historical or archaeological sites within the planning area. Therefore, no mitigative measures will be required. The Ohio Historic Preservation Office will be notified immediately upon discovery of unknown artifacts uncovered during construction.

Vegetation

As previously mentioned, the construction sites have been selected to minimize disturbance of vegetative cover. Exposed areas will be seeded upon settling and final grading. Fertilizing and watering will be included in routine site maintenance.

Noise Control Practices

Construction equipment will be required to have exhaust mufflers as required by safety standards. Construction activities in close proximity to residential areas will be limited to daytime working hours.

Odor Control Practices

With proper O,M&R, including routine cleaning and sewer maintenance, no objectionable odors should be produced.