VILLAGE OF FREEBURG

FREEBURG MUNICIPAL CENTER
14 SOUTHGATE CENTER, FREEBURG, IL 62243
PHONE: (618) 539-5545 • FAX: (618) 539-5590
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January 8, 2018

NOTICE

MEETING OF THE PUBLIC WORKS COMMITTEE
Trash/Water/Sewer
(Blaies/Meehling/Pruett/Trout)

A Public Works Committee Meeting of the Village of Freeburg will be held at the Municipal Center, Executive Board Room, on **Wednesday, January 10, 2018, at 5:45 p.m.**

PUBLIC WORKS COMMITTEE MEETING AGENDA

I. Items to be Reviewed
- A. Old Business
  1. Approval of December 13, 2017 Minutes
  2. New Sewer Plant
  3. Sewer Issues/Sewer Fuel Odors
  4. FSH Minutes
  5. Sewer Main – Jack's Car Wash
  6. W. Apple St./Schiermeier Road/Old Freeburg Road Water Lines
  7. Private Sewer at Potter/West Street
  8. East and West Tower Work
- B. New Business
- C. General Concerns
- D. Public Participation
- E. Adjourn

At said Committee Meeting, the Village Board of Trustees may vote on whether or not to hold an Executive Session to discuss potential litigation, [5 ILCS, 120/2 - (c)(11)] ; the selection of a person to fill a public office [5 ILCS, 120/2 – (c) (3)] personnel [5 ILCS, 120/2 – (c) (1)]; or real estate transactions [5 ILCS, 120/2 – (c) (5)].

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PUBLIC WORKS COMMITTEE MEETING
Trash/Water/Sewer
(Blaies/Meehling/Pruett/Trout)
Wednesday, December 13, 2017 at 5:45 p.m.

The Public Works Committee Meeting was called to order at 5:45 p.m. on Wednesday, December 13, 2017, by Chairman Mike Blaies. Members present were Chairman Mike Blaies, Trustee Lisa Meehling, Trustee Dean Pruett, Trustee Matt Trout, Mayor Seth Speiser, Village Clerk Jerry Menard, Trustee Denise Albers, Trustee Ray Matchett, Public Works Director John Tolan, Village Administrator Tony Funderburg and Office Manager Julie Polson. Guest present: Janet Baechle

A. OLD BUSINESS:

1. Approval of November 15, 2017 minutes: *Trustee Lisa Meehling motioned to approve the November 15, 2017 minutes and Trustee Dean Pruett seconded the motion.* All voting yea, the motion carried.

2. New Sewer Plant: Village Administrator Tony Funderburg stated we are going to review the facility plan sometime next week, then it will be sent to EPA. After the facility plan is back, then we can go out for a RFP.

3. Sewer issues/Sewer Fuel Odors: John stated they went around about 10 days ago, and there are no odors. We haven't had any rain lately and the groundwater is non-existent. He commented we will see what happens in March. He reported there was a clog at the high school in the old line that runs through the alley. They were able to clear it.

4. FSH Minutes: Quiet.

5. Sewer Main – Jacks Car Wash: John said he and Tony have discussed this, and we will get it done by the end of this budget.

6. W. Apple St./Schiermeier Road/Old Freeburg Road Water Lines: John advised the West Apple water line is in the ground, backfilled and ready to be flushed and chlorinated. Tony stated we have quite a bit of money in the budget for water lines, and he would like to bid out Schiermeier Road, and also accept the engineering for Old Freeburg Road in order to get that done in this year's budget. There will be significant savings if we do the Old Freeburg Road line. John said after that project, he would like to move into town and replace water mains. Tony confirmed we have $120,000 in the budget to do Schiermeier Roadd.

   Trustee Matt Trout motioned to recommend to the full Board to send the Schiermeier Road water line out to bid and Trustee Deaen Pruett seconded the motion. All voting yea, the motion carried.

7. Private Sewer at Potter/West Street: John advised he needs to pothole it and locate the sewers.

8. East and West Tower Work: John is waiting on the report from Suez when they inspected the east tower .

We have completed the hydrant flushing for the year and will submit it to the fire department. John also said we have had 7 breaks in 4 weeks, mostly services and believes it is due to the dry weather. Jesse completed the lead sampling for the grade school and also collected St. Joe's this week. John met with SLM and Curry last week to review the operation, chlorination, and ammonia procedures. He said there will be new, stricter regulations from EPA in March, must on the water testing. We may have to rechlorinate ourselves, and he is already looking into that.

John called for an executive session regarding personnel.

EXECUTIVE SESSION
5:57 P.M.

Trustee Matt Trout motioned to enter Executive Session at 5:57 p.m. citing personnel, 5 ILCS 120/2-(c)(1) and Trustee Lisa Meehling seconded the motion. All voting yea, the motion carried.

EXECUTIVE SESSION ENDED
6:04 P.M.

Trustee Ray Matchett motioned to end the Executive Session at 6:20 p.m. and Trustee Denise Albers seconded the motion. All voting aye, the motion carried. The committee meeting reconvened at 6:04 p.m.

B. NEW BUSINESS: None.

C. GENERAL CONCERNS: None.

D. PUBLIC PARTICIPATION: None.

E. ADJOURN: *Trustee Matt Trout motioned to adjourn the meeting at 6:05 p.m. and Trustee Lisa Meehling seconded the motion.* All voting aye, the motion carried.

Julie Polson,
Office Manager

Village of Freeburg

West Wastewater Treatment Facility
Project Plan

Village of Freeburg
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Freeburg, Illinois
62243

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FOR COMMENT

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Throughout this report, acronyms and abbreviations are utilized that may not be familiar to a non-wastewater oriented audience. To assist the reader in understanding the technical terms that are utilized, we have provided a Definition of Terms.

Definition of Terms

BOD_5	5-day Biochemical Oxygen Demand
BWF	Base Wastewater Flow
DAF	daily average flow
EPA	Environmental Protection Agency
gpd	gallons per day
gpm	gallons per minute
GWI	groundwater infiltration
hp	horsepower
IEPA	Illinois Environmental Protection Agency
I/I	infiltration/inflow
MGD	million gallons per day
mg/L	milligrams per liter
mL	milliliters
mm	millimeters
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
pH	acidity or alkalinity of an aqueous solution
psi	pounds per square inch
PWF	projected wastewater flow
RDI/I	rainfall dependent infiltration/inflow
SCADA	Supervisory Control and Data Acquisition (automated control system)
SS	suspended solids
TKN	total Kjeldahl nitrogen
TS	total solids
TSS	total suspended solids
UV	ultraviolet
WWTF	Wastewater Treatment Facility

I. INTRODUCTION

A. Background

The Village of Freeburg provides wastewater service for the residential, commercial, and light industrial customers that are located within the corporate limits of the Village.

The Village's wastewater collection system, consisting of various sized sewer mains, lift stations (pumping stations), and force mains, has experienced volumetric capacity issues at several locations in the system over the last few years. These capacity issues are due to growth of the area that contributed additional wastewater to the Village's collection system and the influx of flow to the system possibly due to inflow and infiltration throughout the collection system, such as locations where piping has failed or joints are offset and not water tight.

Wastewater flows are conveyed to the wastewater collection system for treatment at the Village's East Wastewater Treatment Facility or the West Wastewater Treatment Facility. The Illinois Environmental Protection Agency regulates the operation of both of the Village's Wastewater Treatment Facilities under its National Pollution Discharge Elimination System (NPDES) permits.

The East Wastewater Treatment Facility consists of a two cell aerated lagoon with tertiary effluent pressure filters. This permit allows the Village to process 0.31 million gallons per day (MGD) of wastewater for discharge to surface waters of the United States after treatment and removal of organic and chemical contaminants to levels approved by the IEPA. Wastewater is discharged into Lemen Branch, about 8000 feet upstream of Silver Creek.

The West Wastewater Treatment Facility consists of two activated sludge package treatment plants with a design capacity of 0.40 MGD. One package plant uses an extended aeration process, while the other plant uses a contact stabilization process. This facility also utilizes tertiary filters to filter the clarifier effluent from both treatment processes. The West Facility also utilizes an excess flow clarifier to aid in handling peak wet weather flows. Wastewater is discharged into Kinney Branch, which is tributary to Richland Creek.

In recent year, the IEPA has notified the Village that the effluent from the West Wastewater Treatment Facility has had excursions above the allowable discharge parameters specified in the IEPA NPDES permit. These excursions include volumetric (capacity) and organic/chemical loading violations. In the past two (2) years, the treatment facility has exceeded the permitted flow of 0.40 MGD twelve (12) times.

Given the issues associated with the wastewater collection system and wastewater treatment facility, the Village has begun this planning process to develop a strategy for upgrading the West Wastewater Treatment Facility. This process will focus on providing reliable sewer service, compliance with environmental regulations, provide for orderly and planned expansion of the system, and develop economical solutions for the sewer customers. The location of the Village's facilities relative to the community is shown on **Exhibit 1 – Freeburg Project Location Map.**

This document establishes a basis of planning that will provide the Village with a foundation for evaluating and selecting a strategy for future wastewater treatment. It will provide the Village with goals and objectives for the planning process, assess the character of the planning area, project future wastewater volumetric flows and loading, review the performance of the existing wastewater collection system, assess the performance of the existing wastewater treatment facilities and recommend upgrades to those facilities, establish costs for system improvements, review the existing user rate and recommend financial strategies for securing a low interest loan for the proposed upgrades.

B. Goals

The Village of Freeburg has established the following goals and objectives to guide the future improvements and expansion of the Village's wastewater treatment facilities:

- Provide reliable wastewater service for the residents for the proposed twenty (20) year planning period.
- Protect both surface water and groundwater resources.
- Determine wastewater treatment facility improvements to accommodate future development and expansion of the Village.
- Provide cost effective solutions for Village and customers.
- Ensure that the Village has the tools, resources, and authority to administratively meet future wastewater regulatory requirements and needs.
- Elicit approval of system recommendations by the public, elected officials, and regulatory agencies.

C. Objectives

1. Users

- Work with community leaders and incorporate their input
- Ensure that users expectations are fulfilled by providing solutions for known problems, keeping rates competitive, satisfying environmental regulations, and providing superior service to existing users and projected users

2. Financial Considerations

- Explore innovative financial mechanisms to assist with financing of wastewater treatment improvements

3. Regulatory Compliance

- Coordinate with IEPA to comply with existing regulations and discuss future changes to regulations that could impact design
- Incorporate flexibility into the design where possible to accommodate future regulatory changes that may be forthcoming

4. **Project Plan Approval**

- Comply with IEPA requirements for submittal of the Project Plan
- Gain IEPA approval to enable the Village to submit and qualify for the IEPA Revolving Loan Program or other available grants

5. **Schedule and Budget**

- Complete the Project Plan on time and within budget.

D. Public Involvement Program

Various public involvement opportunities may be offered during the overall planning process to inform the public, and stakeholders about the project, identify community issues of concern, and provide information to the project team that will help them develop recommendations that the community supports. Some of the public information and involvement opportunities that will be offered or conducted include:

- Updates or fact sheets that provide information on the planning process and the recommendations being considered.
- Meetings during the planning process to gather public comments.

II. PLANNING AREA FEATURES

A. Introduction

To establish a basis of planning for the wastewater treatment facility assessment, it is necessary to analyze and establish the character and physical limits of the area to be serviced. This section examines what comprises a facility planning area, the physical environment (location, climate, and wildlife habitat) of the planning area, and the associated human environment (land use, historic population assessment, and governmental structure).

B. Planning Area

The Illinois Environmental Protection Agency (IEPA) originally established Facility Planning Areas (FPA's) to define planning boundaries for wastewater jurisdictions so they could effectively plan and design wastewater improvements without oversizing or under sizing infrastructure. These boundaries were based on a twenty (20) year planning period. The Illinois Environmental Protection Agency is in the process of evaluating the way it defines boundaries for the wastewater treatment areas called Facility Planning Areas (FPA's) with its goal of doing away with FPA's as they currently exist. Originally, Illinois EPA's role in facilities planning was directed by Section 208 of the federal Clean Water Act (CWA). The FPA process was created largely to satisfy the requirements of the federal Construction Grants Program under Title II of the CWA.

Neither the federal program nor any similar state program exist today though Illinois EPA now administers a federal loan program -- the State Revolving Fund -- in which local government entities borrow money at a fixed rate of interest which is then paid back to the Illinois EPA. Faced with questions ranging from how to improve the program through how to eliminate the program, it is our understanding the Illinois EPA contracted with Consensus Solutions, Incorporated- an Atlanta based dispute resolution firm - to provide counsel on the future direction of FPAs and the FPA process. As of the date of this report, we do not believe the IEPA has resolved the FPA issue.

In lieu of the uncertainty of the FPA issue, we have worked with the Village to derive a 25-year wastewater planning boundary for future improvements of the wastewater treatment facility over the planning horizon required by the IEPA. This wastewater planning boundary is shown in **Exhibit 2A – Freeburg Wastewater Management Planning Area.**

C. Physical Environment

Physical characteristics of the planning area affect wastewater generation rates by shaping the nature and pattern of land use, as well as the location and density of population. The physical environment also affects the location and design of facilities for conveyance, treatment and disposal of wastewater.

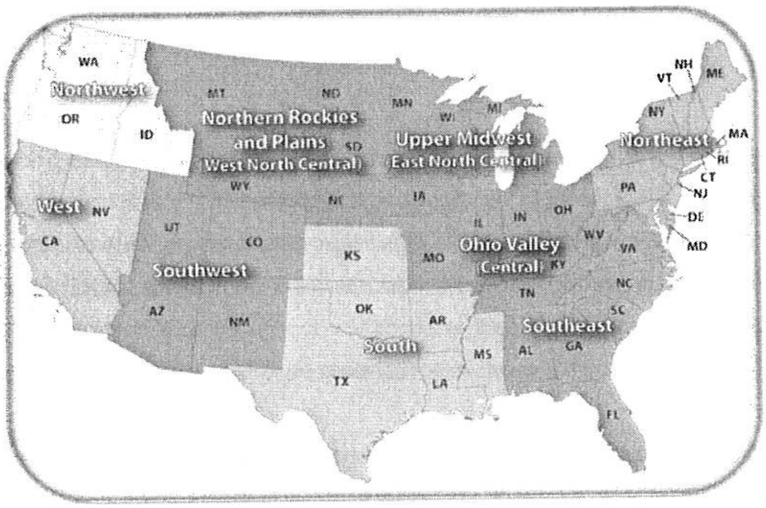
1. Location

The Village of Freeburg is located in St. Clair County approximately 15-20 miles southeast of St. Louis, Missouri. The area is located in an upland region between the Richland Creek and Silver Creek watersheds.

2. Climate

The planning area being near the geographic center of the continental United States is classified in the Ohio Valley (Central) region (based on the Köppen climate classification system) having a humid continental climate and subtropical climate. The climate is characterized by four seasons without prolonged periods of extreme heat or high humidity. Invasions of moist air from the Gulf of Mexico and cold air masses from Canada can produce a variety of weather conditions. The normal high temperature in July is 90° F and the normal low temperature in January is 21° F. The average annual precipitation for the planning area is 41.4 inches with the area having a maximum annual rainfall of 61.24 inches that was recorded in 2015, and a minimum annual rainfall of 20.69 inches recorded in 1953. The greatest rainfall typically occurs in the months of April and May followed by the period from late October to early December.

Figure 2C-1 - U.S. Climate Regions



3. Threatened and Endangered Species

The United States Fish and Wildlife Service has verified that several types of threatened and endangered species are located in St. Clair County. These include the following:

St. Clair County Endangered & Threatened Species			Table 2C-1
Common Name	**Species**	**Status**	**Habitat**
Northern Long-eared Bat	Myotis septentrionalis	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests and woods.
Indiana Bat	Myotis sodalis	Endangered	Caves, mines (hibernacula); small stream corridors with well developed riparian woods; upland forests (foraging)
Least tern	Sterna antillarum	Endangered	Bare alluvial and dredged spoil islands
Illinois cave amphipod	Gammarus acherondytes	Endangered	Streams primarily in dark zone of caves.
Pallid Sturgeon	Scaphirhynchus albus	Endangered	Large Rivers
Decurrent False Aster	Boltonia decurrens	Threatened	
Eastern Prairie Fringed Orchid	Platanthera leucophaea	Threatened	Mesic to wet prairies

While the habitats of some of these species are not present in the Village of Freeburg, it will still be necessary to conduct an Illinois Department of Natural Resources EcoCAT request to determine if any of these are located in the project areas proposed by this report once the report has been approved. This will ensure that the environmental acts are being adhered to including the Illinois Endangered Species Protection Act [520 ILCS 10/11(b)], the Illinois Natural Areas Preservation Act [525 ILCS 30/17] as set forth in procedures under Title 17 Ill. Admin. Code Part 1075, and the Interagency Wetland Policy Act of 1989 [20 ILCS 830] as set forth in procedures under Title 17 Ill. Admin. Code Part 1090.

These laws require state agencies and units of local governments to consider the potential adverse effects of proposed actions on Illinois endangered and threatened species and sites listed on the Illinois Natural Areas Inventory

D. Water Resources

1. Groundwater

No major groundwater aquifers are located in the Planning Area. The upland area comprising the Planning Area is composed of glacial drift that does not contain significant sand and gravel deposits which have the capability of yielding significant volumes of water. Due to the minimal yield of these deposits, the usage of groundwater is limited to local farmsteads or isolated homes which obtain their water supply from shallow wells. The Village of

Freeburg obtains its water supply from the Kaskaskia River Alluvial Aquifer that lies outside the Planning Area to the east. This aquifer is a high yield groundwater source.

2. Surface Water

The surface water resources in the planning area include small lakes/ponds. Other surface water features include small creeks with minimal flow. Most of these creeks have zero flow as established by the IEPA for a 7 day ten (10) year flow duration. The 7 day – 10 year low flow is a statistical estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years.

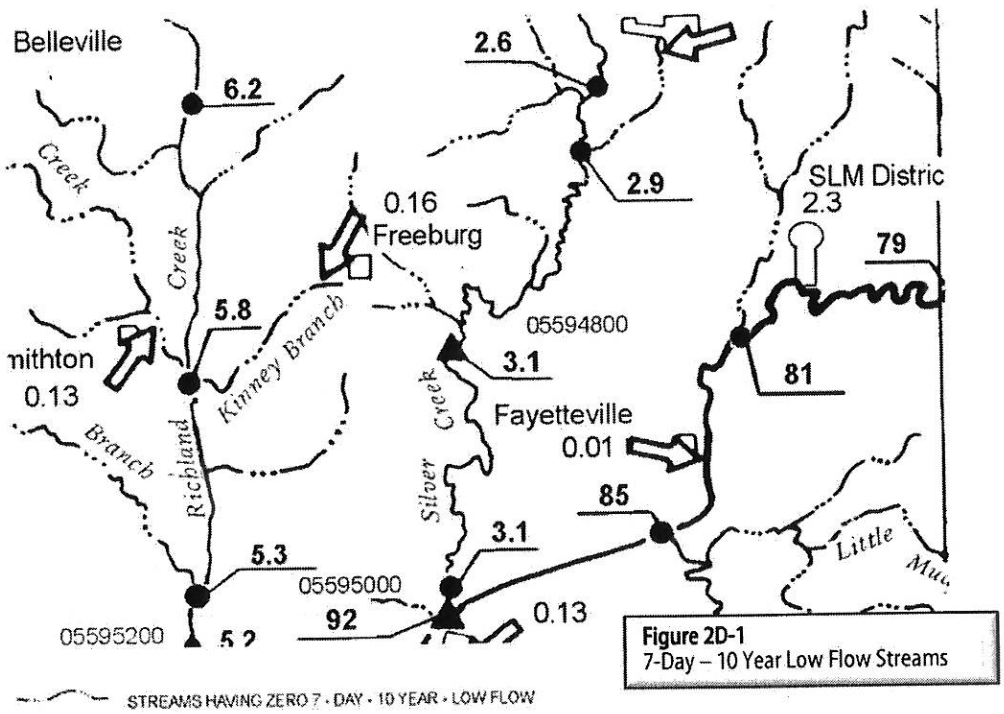


Figure 2D-1
7-Day – 10 Year Low Flow Streams

3. Flood Hazards

Floodplain locations for the community have been identified by the Federal Emergency Management Agency (FEMA) as part of their National Flood Insurance Program: Flood Hazard Mapping. The Planning Area is located in FEMA Map Panels 17163C0335D and 17163C0345D. **Exhibit 2B – Freeburg Wastewater Planning Area – Flood Mapping** illustrates the location of the flood plain that affects the Planning Area.

4. Wetlands

Wetland areas as defined by the U.S. Fish and Wildlife Service are sporadically prevalent throughout the Planning Area. Most wetlands consist of small ponds or lakes and are designated by classification code PUBGh or PUBGx. This classification refers to Palustrine areas that include all non-tidal wetlands dominated by trees, shrubs, emergents, mosses or lichens having unconsolidated bottoms with a water regime intermittently exposed. PUBGh also refers to wetlands created or modified by a man-made barrier or dam which obstructs the inflow or outflow of water, and PUBGx refers to wetlands that lies within a basin or channel that was dug, gouged, blasted, or suctioned through artificial means by man. Other specific wetland areas are found along the Kinney Branch and Silver Creek channel and overbank areas. These wetlands are primarily classified as PFO1A, being Palustrine forested with broad leaved deciduous trees having a temporary flooded water regime. The east part of the planning area near Silver Creek also contains lakes classified as L1UBHh or L1UB1Hx. These classifications refer to a Lacustrine wetland and deepwater habit, which is situated in a topographic depression or damned river channel that lacks trees, shrubs, persistent emergents, emergent mosses or lichens, and also has a total area less than 20 acres.

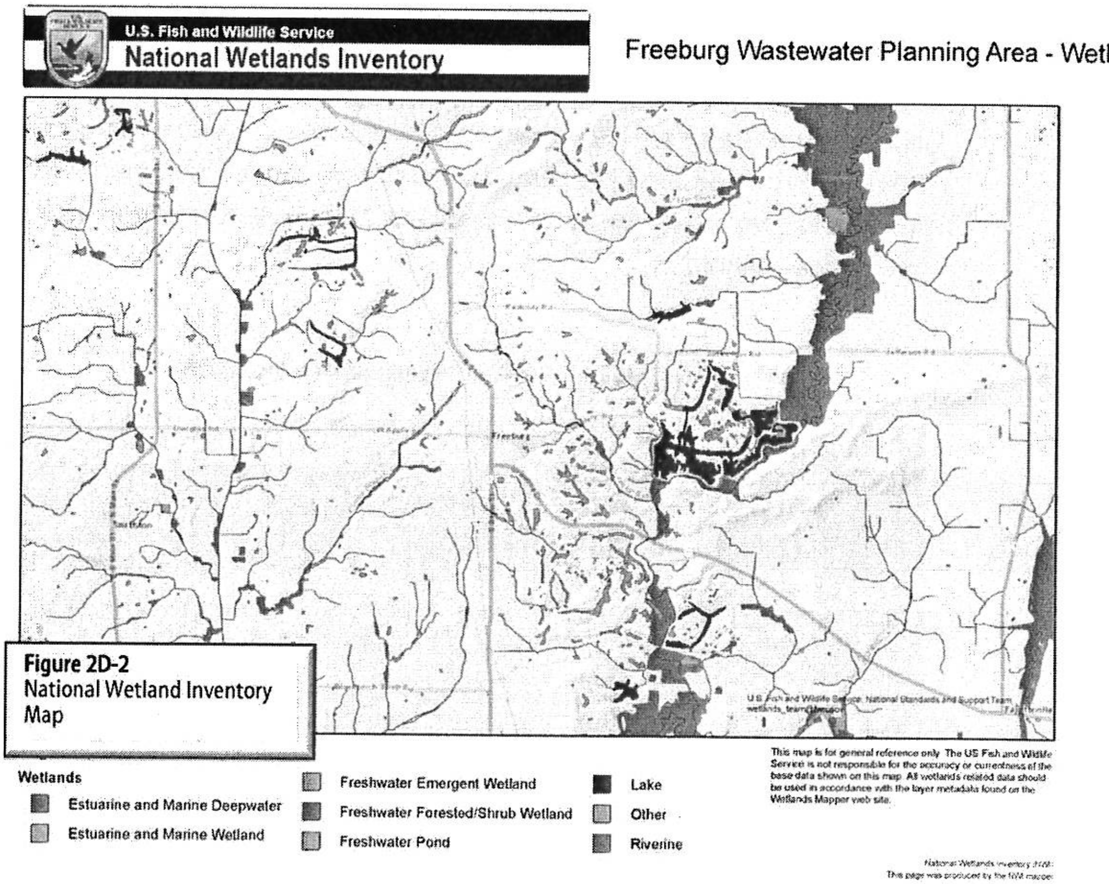


Figure 2D-2
National Wetland Inventory Map

5. Health Issues

While there are minimal major health issues in the Planning Area, the potential for contamination of surface water exists. Any contamination could cause health issues by persons coming into direct contact with the wastewater or more probable, the breeding of mosquitoes carrying pathogenic diseases. With the present global concern over mosquitoes transmitting the West Nile and Zika viruses, every effort should be made to provide public sewer services to all un-sewered areas of the Planning Area and prevent sanitary sewer overflows.

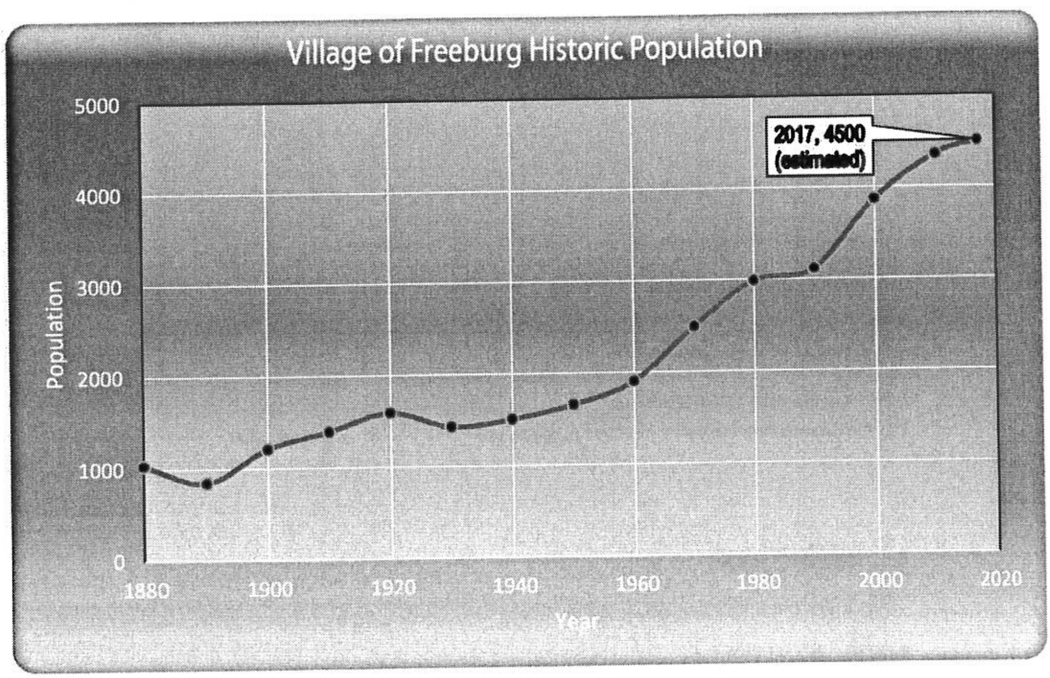
E. Human Environment

This section details historic population, land use, economic development, cultural and archaeological resources and governmental structure of the Planning Area.

1. Historic Population

From 1880 to as late as 1960, the Village of Freeburg experienced very modest growth with the population reaching 1,908 in 1960. Refer to **Figure 2E-1 – Village of Freeburg Historic Population.** It was not until the late 1960's that the rate of growth dramatically increased with the development of the U.S. Interstate system that spurred the growth of the Village. With Freeburg being located on Illinois State Route 15, the Village developed as a "bedroom community" from the 1970's to the present day. In the last few years, the Village's growth rate has moderated somewhat due to the economic uncertainty of the state, but is still steadily increasing in population. The Village's 2010 population was 4,354 as recorded in the latest U.S. Census. It is estimated that as of 2017, the Village has grown to approximately 4,500. This population increase is due to growth in the newer development areas of the Village.

Figure 2E-1 – Village of Freeburg Historic Population



2. Land Use

The Village of Freeburg and its Planning Area are beginning to grow as an economic center for transportation oriented businesses due to its proximity to Illinois Route 15. With the recent construction along Route 15; its close proximity to St. Louis; and large tracts of undeveloped land, the area has the essential components to see an increase in commercial development and residential growth.

The zoning map for the Village of Freeburg and comprehensive planning map for the Village and environs illustrate the existing land uses and anticipated land uses as the Village develops. These are shown in **Exhibits 3A and 3B – Freeburg Zoning Maps and Exhibit 4 – Freeburg Comprehensive Plan.** As can be seen on these maps, the Planning Area has a core business district that extends along Illinois Route 15. Commercial and light industrial development may also occurred in this area. The Village has traditionally been a "bedroom community" due to its residences seeking the quality of life in the Village of Freeburg while still making the commute to St. Louis to find employment. Areas external to the business corridors are primarily single family residential subdivisions, the original town residential areas, or agricultural parcels.

3. Agricultural Resources

The Comprehensive Land Use Plan for the Village of Freeburg establishes the projected land use for most of the Planning Area. The Comprehensive Plan calls for the majority of agricultural land in the Planning Area to be dedicated to residential, commercial, office park, industrial or other public uses. There are no environmentally significant agricultural lands as defined in the EPA's *Policy to Protect Environmentally Significant Agricultural Lands.* That is, no agricultural lands within the Planning Area are defined as unique, of statewide importance or local importance.

4. Archeological, Historic and Cultural Resources

The National Register of Historic places does not identify any locations in the Planning Area.

III. PLANNING PROJECTIONS

A. Introduction

This section details the methodology and analysis for the projection of population growth, wastewater flow, and wastewater loading through the planning horizon.

B. Planning Horizons

The Illinois Environmental Protection Agency requires that project plans assess wastewater management needs spanning a minimum twenty (20) year planning period. Due to the time for review and approval of the Project Plan, preparation of construction documents, and completion of construction, we propose to review a planning period from year 2018 to 2050.

C. Population and Land Use Forecasts

1. Current Base Conditions

Population in the Planning area encompasses several U.S. Census Tracts as reported by the U.S. Census Bureau in their decennial 2010 census. These tracts include portions of census tract number 5039.03, 5039.05, and 5039.06. The Census Bureau reported that the Village of Freeburg had a 2010 population of 4,354 and the area outside the Village but within the surrounding area had a population of approximately 4,729.

2. Future Population and Development to 2045

Several statistical methodologies are utilized to project population growth. These typically include linear (straight line) growth analysis, exponential growth analysis or analysis based on best fit of curves to match past historic population trends. In examination of the historic growth of the Village, the most representative and consistent growth rate for the purpose of projecting population trends occurred between 1960 and 2017.

Village of Freeburg Population 1960 - 2017	Table 3C-1
Year	**Population**
1960	1,908
1970	2,495
1980	2,989
1990	3,115
2000	3,872
2010	4,354
2017	4,500

By utilization of this historic data, we developed three population projection analysis for the Village of Freeburg population growth. The model that most closely emulates the population growth of the Village is the Second

Order Polynomial Growth Analysis that utilizes a second order polynomial equation to match the historic population data. This analysis when used to compute the projected Village population in the year 2045 and when similarly used to project the entire Surrounding Area growth model indicates that the projected population of the Village in 2045 is anticipated to be 5,770 and the projected population of the Surrounding Area is anticipated to be 6,295, as shown below.

Figure 3C-1 – Freeburg Polynomial Growth Model

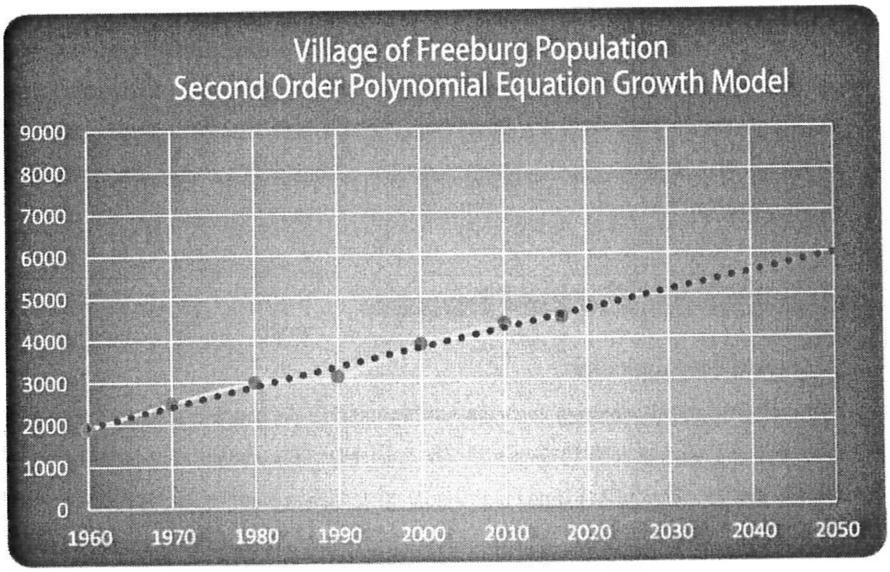
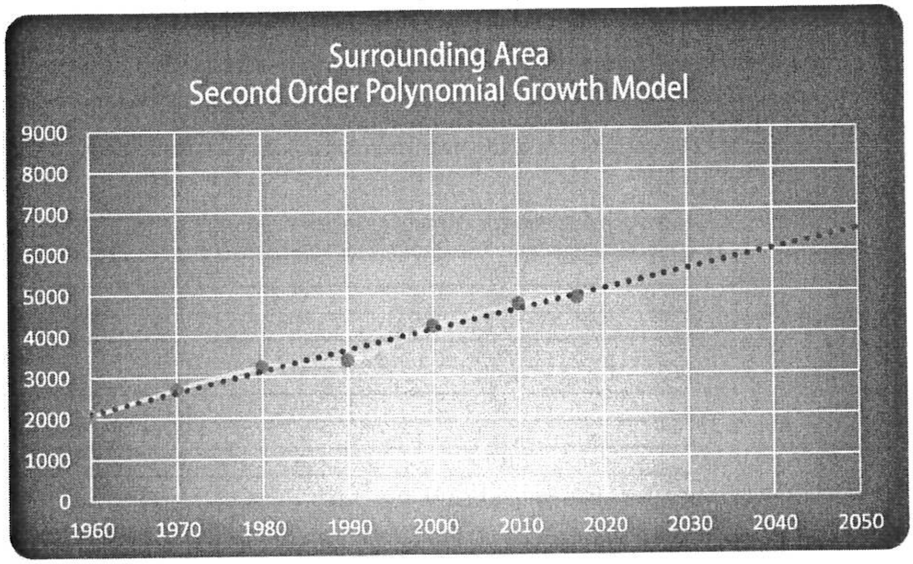


Figure 3C-2 – Surrounding Area Polynomial Growth Model



D. Wastewater Flow Projections

1. Wastewater Flow Components

Wastewater flow is generally divided into four (4) categories: base wastewater flow (BWF), projected wastewater flow (PWF), ground water infiltration (GWI), and rainfall dependent infiltration/inflow (RDI/I). This section of the report defines each of these components and establishes values for the determination of design average flows for the proposed wastewater treatment facility.

2. Base Wastewater Flows (BWF)

Base wastewater flow (BWF) generated by the Village of Freeburg and areas on the sewer system outside the Village of Freeburg consists of residential, commercial, institutional (churches and schools) wastewater flows, as well as light industrial wastewater flows. The wastewater generation rate is affected by the population and land uses of the area and is variable in nature in response to personal habits and business operations.

The Village staff has provided data that shows the wastewater system as of October, 2017 had 1,651 sewer customers. These include 98 users classified as commercial customers, 18 classified as industrial, and 1,535 classified as residential customers. The approximate daily water usage by these sewer customers is 229,000 gallons per day.

3. Projected Wastewater Flows (PWF)

Projected wastewater flows consist of future flows that are generated by an increase in population over the planning period (these include residential areas such as platted lots that are not yet constructed, and projected potential residential service areas of undeveloped land); or existing areas within the planning limits that may not presently have sewer but are potential candidate areas for sewer service.

The projected population of the Village of Freeburg and the Surrounding Area in 2045 is anticipated to increase by approximately 1,320 people. Along with the current population in existing areas that do not presently have sewer service, this would result in approximately 250,000 gallons per day of additional flow.

4. Ground Water Infiltration (GWI)

a. General

Groundwater Infiltration (GWI) is defined as groundwater entering the collection system through defective pipes, pipe joints, and leakage through leaking manhole walls. The magnitude of GWI depends on the depth of the groundwater table above the pipelines, the percentage of the system that is submerged, and the physical condition of the sewer system. The variation in groundwater levels in the study area, and hence the amount of GWI, is seasonal in nature. While GWI is also affected by rainfall, it responds gradually and is not directly related to any individual rainfall event. It is evidenced by a general increase in wastewater flow that persists for periods of many days or weeks. From a practical standpoint, it is often not possible to differentiate infiltration of groundwater (saturated zone) from infiltration due to long-term drainage of unsaturated soils, and the term GWI is used in this report to describe both types of flow.

Groundwater depths experienced in the majority of the Planning Area are extremely shallow as determined by the USDA Soil Conservation Service. Many areas have groundwater depths as shallow as 18 inches to three (3) feet particularly during periods of the year subject to high groundwater levels. For this reason, infiltration of groundwater into the collection system is problematic.

b. Groundwater Infiltration Metrics

One typical industry standard threshold to determine whether infiltration is excessive in a wastewater collection system is normalizing wastewater flow by population. Infiltration is classified as excessive if flow exceeds 125 gallons per capita per day (gpcpd). With a wastewater service population of approximately 3,840 and a year 2016 three (3) month daily average low flow (DAF) rate of 0.318 million gallons per day (MGD), the gallons per capita per day computes to 83. This is below what would be considered excessive infiltration. It should be noted that infiltration that enters the sanitary sewer system at a location distant from the treatment plant or into a sewer with limited capacity may present a greater problem than that entering a sewer near the treatment plant and/or a sewer with excess capacity. Portions of the system, especially the older portions of the system may have excessive infiltration problems, but on a global basis, this metric does not infer that infiltration is excessive in the total system.

5. Rainfall Dependent Infiltration/Inflow (RDI/I)

a. General

Rainfall Dependent Infiltration/Inflow (RDI/I) refers to storm water that enters the sanitary sewer system in direct response to the intensity and duration of rainfall events. RDI/I can be further broken down into storm water inflow (SWI) and rainfall-dependent infiltration (RDI), based upon the pathways through which the flow enters the sewers or manholes. SWI reaches the collection system by direct connections rather than by first percolating through the soil. SWI sources may include roof downspouts illegally connected to the sanitary sewers, sump pumps, yard and area drains, holes in manhole covers, cross-connections with storm drains, or catch basins. RDI includes all other rainfall-dependent flow that enters the collection system, including storm water that enters defective pipes, pipe joints, and manhole walls after percolating through the soil.

b. Rainfall Dependent Infiltration/Inflow Metrics

Per EPA's "Quick Guide for Estimating Infiltration and Inflow", excessive inflow is defined as 275 gallons per capita per day (gpcpd). This value is determined by dividing the daily average wet weather wastewater flow (WWF) during a period of significant rainfall by the population served. As applied to the Village of Freeburg's wastewater treatment facility average wet weather flow of 1.25 MGD, this computes to 326 gpcpd. Based on this analysis, inflow into the Freeburg wastewater collection system would be classified as excessive.

The Village may explore the possibility of conducting smoke testing of suspect sewer mains to identify any possible sources of direct connection to the wastewater collection system in the future. By implementing these types of changes and some rehabilitation, the Village hopes to reduce the amount of I/I; however, an allowance of approximately 321,000 GPD is included in the projected average daily wastewater flow.

6. Projected Average Daily Wastewater Flow

The projected wastewater flow for the Planning Area can be summarized from the projected flows computed above. This adjusts the flows as shown.

Projected Average Daily Flow Volumes	Table 3D-1
Average Daily Water Consumption	229,000
Future Flow from Population Growth	250,000
Allowance for Uncontrolled Infiltration	-
Allowance for Rainfall Dependent Infiltration/Inflow	321,000

7. Peak Flow Projections

The Illinois Recommended Standards for Sewage Works recommends a peaking factor based on population. The formula is given as:

$\{18 + \sqrt{P}\}/\{4 + \sqrt{P}\}$ Where P is population in thousands

Based on the Planning Area's projected future population the following peaking factor and peak flow would be derived:

Peak Flow Based on IEPA Peaking Factor			Table 3D-2
Population	**Peaking Factor**	**Projected DAF**	**Projected Peak Flow**
Future Planning Area Population 6,295 (Year 2045)	3.15	0.80 MGD	2.52 MGD

E. Wastewater Loading and Projected Loading

1. Current NPDES Permit Effluent Standards

The National Pollutant Discharge Elimination System (NPDES) originated as part of the Federal Clean Water Act. This program requires permits for the discharge of treated municipal effluent which establish the conditions under which discharges may occur as well as establishing monitoring and reporting requirements. This permit is necessary for modifications to the Freeburg Wastewater Treatment Facilities.

The Village's East and West Wastewater Treatment Facility's existing NPDES permit have both recently expired. Both NPDES permits have had renewal applications submitted to the IEPA for review and approval. The East

WWTF permit number is NPDES Permit No. IL00207538 and had a Draft Permit sent to the Village on August 3, 2017. This document specifies the following standards that must be met for discharge of wastewater by the Village of Freeburg for the East WWTF as shown in **Table 3D-1**. For discharge point 001 STP Outfall:

East WWTF – IEPA - NPDES Effluent Parameters – 001 STP Outfall — Table 3E-1

Parameter	Load Limits (lbs/day) DAF (DMF)*			Concentration Limits (mg/l)		
	Monthly Ave.	Weekly Ave.	Daily Maximum	Monthly Ave.	Weekly Ave.	Daily Maximum
Five-Day Carbonaceous Biochemical Oxygen Demand (CBOD$_5$**, mg/l	65 (162)	103 (259)		25	40	
Total Suspended Solids (TSS), mg/l	96 (239)	116 (291)		37	45	
pH	Shall be in the range of 6 to 9 standard units					
Fecal Coliform***	Monitor and Report (May thru October)					
Chlorine Residual						0.05
Ammonia Nitrogen as (N)	Monitor Only					
Dissolved Oxygen				Monthly Ave not less than	Weekly Ave. not less than	Daily Minimum
March-July				-	6.0	5.0
August-February				5.5	4.0	3.5

The West WWTF permit number is NPDES Permit No. IL0032310 was last approved by the IEPA on June 14, 2012. A renewal application was submitted to the IEPA on June 13, 2017. A draft permit is expected soon that will specify the standards that must be met for discharge of wastewater by the Village of Freeburg for the West WWTF. The standards from the last approved NPDES Permit are shown in **Table 3D-2**. For discharge point 001 STP Outfall:

West WWTF - IEPA - NPDES Effluent Parameters – 001 STP Outfall — Table 3E-2

Parameter	Load Limits (lbs/day) DAF (DMF)*			Concentration Limits (mg/l)		
	Monthly Ave.	Weekly Ave.	Daily Maximum	Monthly Ave.	Weekly Ave.	Daily Maximum
Five-Day Carbonaceous Biochemical Oxygen Demand (CBOD$_5$**, mg/l	33 (83)		67 (167)	10		20
Total Suspended Solids (TSS), mg/l	40 (100)		80 (200)	12		24
pH	Shall be in the range of 6 to 9 standard units					
Fecal Coliform***	Monitor and Report (May thru October)					
Ammonia Nitrogen as (N)						
April-May/Sept.- Oct.	5.0 (13)	13 (32)	23 (58)	1.5	3.8	6.9
June-August	5.0 (13)	13 (32)	30 (74)	1.5	3.8	8.9
Nov.-Feb.	45 (130)		18 (45)	1.9		5.4
March	5.0 (13)	13 (32)	18 (45)	1.5	3.8	5.4
Total Phosphorus	Monitor Only					
Dissolved Oxygen				Monthly Ave not less than	Weekly Ave. not less than	Daily Minimum
March-July				-	6.0	5.0
August-February				5.5	4.0	3.5

For discharge point A01 Excess Flow Clarifier Outfall:

West WWTF - IEPA - NPDES Effluent Parameters – A01 Excess Flow Clarifier Outfall	Table 3E-3
Parameter	**Concentration Limits (mg/l)**
BOD_5	30
Suspended Solids	30
Fecal Coliform	Daily Maximum shall not exceed 400 per 100 mL
pH	Shall be in the range of 6 to 9 standard units
Chlorine Residual	0.75

2. Existing Wastewater Raw Sewage Characteristics

The Village of Freeburg conducts analysis of its influent wastewater parameters weekly.

Current Raw Wastewater Influent Quality (Average)	Table 3E-4
East WWTF Parameter	**Concentration**
Five-Day Biochemical Oxygen Demand, mg/l	107
Total Suspended Solids (TSS), mg/l	74
Ammonia-N, mg/l	Not Monitored
Total Kjeldahl Nitrogen (TKN), mg/l	Not Monitored
West WWTF Parameter	**Concentration**
Five-Day Biochemical Oxygen Demand, mg/l	83
Total Suspended Solids (TSS), mg/l	68
Ammonia-N, mg/l	Not Monitored
Total Kjeldahl Nitrogen (TKN), mg/l	Not Monitored

3. Projected Average Wastewater Characteristics

The Illinois Environmental Protection Agency has established a flow rate based on population of 100 gallons per person per day for the design of wastewater treatment facilities and collection systems. This volume accounts for normal wastewater production and normal infiltration/inflow into the sanitary sewer system.

The Village has had excursions above the allowable discharge parameters specified in the IEPA NPDES permit for the East and West Wastewater Treatment Facilities. These excursions include volumetric (capacity) and organic/chemical loading violations. In the past two (2) years, the East WWTF has exceeded the permitted design maximum flow of 0.775 MGD five (5) times. In the past two (2) years, the West WWTF has exceeded the permitted design average flow of 0.40 MGD twelve (12) times and the design maximum flow of 1.0 four (4) times.

Given the issues associated with the wastewater collection system and West WWTF, the Village has begun this planning process to develop a strategy for upgrading the West WWTF. Several different growth scenarios were analyzed using the Village's population trends. The total projected population in Village's Planning Area by the year 2045 due to additional development is expected to be 6,295 people.

The design capacity for the proposed Village of Freeburg West Wastewater Treatment Facility upgrade was determined based on the projection for total population within the Planning Area for year 2045, plus the current rate of inflow and infiltration.

The average design flow to the upgraded West WWTF is 0.80 MGD

The effluent standards for the facility are as follows:

BOD5	10	mg/l
Suspended Solids	12	mg/l
Phosphorus	1	m g/l

The Project Plan, determined that the most cost effective wastewater treatment facility for the Village of Freeburg is the Sequencing Batch Reactor Process followed by cloth media tertiary filters and ultra-violet light disinfection. This type of treatment process was determined to more cost effective than several other alternatives analyzed.

Since we concur that this type of facility is the most cost effective, we are proposing the upgrade proceed.

4. Peaking Factors

As previously calculated, based on the West WWTF Planning Area's projected future population the peaking factor and peak flow are 3.15 and 2.52 MGD, respectively.

5. Summary of Projected Loadings

The table below shows the expected loadings. These parameters are the basis for the calculations for all the treatment processes.

Summary of Projected Loadings of West WWTF — Table 3E-5

Parameter	Average Loading (Influent)	Expected Effluent
Flow, MGD	0.80 MGD (ADF) 2.0 (MDF) 2.52 MGD - Peak Hyd. Flow	0.80 MGD (ADF) 2.0 MGD (MDF) 2.52 MGD - Peak Hyd. Flow
Five-Day Biochemical Oxygen Demand, mg/l	146.6	5
Five-Day Biochemical Oxygen Demand, lb/day	978	33.4
Ammonia Nitrogen, mg/l-N	30	1
Ammonia Nitrogen, #/day	200.2	6.7
Total Nitrogen, mg/l	Not Monitored	10
Total Inorganic Nitrogen, mg/l	Not Monitored	8
Phosphorus, mg/l	7	1
Total Suspended Solids (TSS), mg/l	145.2	6
Total Suspended Solids (TSS), #/day	969	40.0

IV. Wastewater Collection System

A. Existing Wastewater Collection System

The purpose of the wastewater collection system is to convey wastewater to the East and West Wastewater Treatment Facilities where it can be treated to remove organic and chemical constituents and safely discharged to the environment. The Village of Freeburg's collection system, as most municipalities, has expanded over the years to accommodate growth and re-development, and has been modestly rehabilitated and upgraded due to its deterioration with age.

The Village of Freeburg owns, operates, and maintains the Village's wastewater collection system which is comprised of an extensive infrastructure network of gravity sewer mains and manholes; lift stations and force mains; and smaller lateral mains located within right-of-way areas. The system provides sanitary sewer service within the corporate limits of the Village.

The Village's wastewater collection system is not a combined sanitary sewer system meaning it does not have extraneous storm sewer piping or inlets that convey storm water flows directly to the sanitary system for transport and discharge to waterways. A schematic of the major sewer main conveyance infrastructure is shown in **Exhibit 5 – Village of Freeburg Existing Wastewater Collection System**.

The Village's collection system is divided into two sections, directing flow to either the East Wastewater Treatment Facility or the West Wastewater Treatment Facility. The East WWTF receives flow from the portion of the system that mainly lies on the east side of State Street (Illinois Route 13/15) north to approximately Koesterer Street and also includes the industrial park to the south. The West WWTF serves the remainder of the Village west of State Street, including most of the developed area north of Koesterer Street. The West WWTF serves at least 2/3 of the Village.

The Village's collection system experiences significant infiltration and inflow (I&I) problems during wet weather periods, as is common with older sewer systems. The East WWTF experiences significant I&I problems, as witnessed over the last several years. The Maximum Daily Flow Rate in 2016 was 12 times the Annual Average Daily Flow Rate. In 2015, the Maximum Daily Flow Rate was over 11 times the Annual Average Flow Rate. The West WWTF has a lower peaking factor for its I&I problems; however, it was over 4 times in 2016 and 3 times in 2015.

In the past, the Village has tried to correct their I&I problems. In the late 1970's, the Village rehabilitated manholes and replaced or rehabilitated some sections of sewer lines. Unfortunately, the rehabilitation work did not result in a significant reduction to the I&I on the system. Since then, the Village has continued to attempt to identify and correct sources of I&I.

The Village's collection system also consists of ten lift stations. The East collection system contains seven of these lift stations, which are identified as Pitts Street, Palomar Mobile Home Park, Woodsview, Industrial Park, Estates at Woods Edge, Swimming Pool, and East WWTF Terminal. The West collection system include the other three lift stations, which are called West Street, Meadow Brook, and West WWTF Terminal.

The lift stations range in age from 5 to 45 years. All lift stations receive routine maintenance and are generally in good to adequate operating condition, with the Pitts Street and Swimming Pool Lift Station being in poor condition.

V. Existing Wastewater Treatment Facilities

A. East WWTF

1. Description

The East WWTF serves approximately the eastern 1/3 of the Village. This facility is located on the southeast side of the Village to the south of Illinois Route 15, as shown on **Exhibit 6 – Village of Freeburg Existing East WWTF**. The East WWTF is a two-cell lagoon system that was originally constructed in 1968. The Village added tertiary filters in 1973 and replaced the influent terminal lift station and installed four surface aerators in 1993. The East WWTF also had the sludge removed from both lagoon cells recently.

Wastewater is pumped into the first cell of the two cell lagoon system from the East Terminal Lift Station located on the north side of the first cell. The lift station was installed in 1993 and consists of two 10 HP Flygt submersible pumps. Each pump has a capacity of 690 gpm at a total dynamic head of 32 feet. The first lagoon cell has a water surface area of approximately 8 acres (352,700 sf) with an average operating depth of 5 feet. The second lagoon cell has a water surface area of approximately 1.3 acres (56,000 sf) with an average operating depth of 5 feet. The first cell has four 7.5 HP aspirating type surface aerators to provide aeration and mixing of the cell with two 10 HP conventional surface aerators as backup. The second cell contains one 10 HP conventional surface aerator for aeration of the cell.

The tertiary filtration system consists of an effluent structure, chemical addition manhole, settling basin, tertiary filter pumping station, five pressure tertiary filters with automatic valves and backwash control, air scour blower, pre- and post-chlorination equipment, and a chlorine contact tank. Each of the five Kisco Boiler and Engineering Company pressure tertiary filters is 66-inch in diameter, 8.5 feet tall steel cylinder with 23.75 square feet of filter area per pressure filter. The total filter surface is 118.75 square feet, so the filtration rate is 1.81 gallons per minute per square foot at the average design flow of 0.31 MGD. See Table 5A.1 below for design criteria for the East WWTF.

Village of Freeburg – East WWTF	Table 5A-1
Design Criteria	
Daily Average Design Flow	0.31 MGD
Peak Design Flow	0.775 MGD
Design Organic Load	527 lbs/day
Equipment	
No. of Influent Pumps	2
Capacity per Influent Pump	690 gpm at 32 feet TDH
Pump Horsepower	10 HP
Approximate First Cell Lagoon Volume	6,600,000 gallons
Detention Time of First Cell at Average Design Flow	21.4 Days
No. of Tertiary Filters	5

Total Filtration Area	118.75 square feet
Filtration Rate at Average Design Flow Rate	1.81 gpm per square foot

2. Evaluation

The East WWTF has an average design flow capacity of 0.31 MGD and a maximum design flow rate of 0.775 MGD. During the period of 2015 and 2016, the average annual flow rate was 0.107 MGD in 2015 and 0.137 MGD in 2016. During the same period the average monthly flow rate exceed the average design flow capacity in May of 2015 (0.569 MGD) and December of 2015 (0.558 MGD). The maximum design flow rate of exceeded during the months of May, June, and December of 2015 and August and September of 2016.

This facility has operated satisfactorily since the recent improvements removed the sludge for both cells and should continue for the foreseeable future. Recently, the facility performed in compliance with its NPDES permits limits, with the exception of one excursion for suspended solids in February of 2015 and a few exceedances of the maximum design flow rates previously mentioned. Table 5A-2 shows more detailed operating reports for the East WWTF in 2015 and 2016.

Freeburg East WWTF Flow Data — Table 5A-2

2016	Dec-16	Nov-16	Oct-16	Sep-16	Aug-16	Jul-16	Jun-16	May-16	Apr-16	Mar-16	Feb-16	Jan-16	Average	Maximum	3-month low flow
Influent BOD	99	74	120	61	102	157	150	63	148	36	138	138	107.16	157	
Influent SS	29	62	52	55	72	128	75	76	87	51	102	102	74.25	128	
Ave. Inf. Flow	0.136	0.14	0.14	0.183	0.19	0.135	0.151	0.252	0.195	0.19	0.192	0.184	0.174	0.252	0.137
Max. Inf. Flow	0.176	0.344	0.617	0.781	0.911	0.256	0.441	0.491	0.554	0.311	0.454	0.286		0.911	
Eff. DO	10	9.8	9.1	8.5	9	8	8.1	8.1	9.7	8.5	9.9	9.9	9.05	10	
Eff. pH	7.6	7.3	7.6	7.5	7.7	7.5	7.6	7.7	7.4	7.7	7.6	7.6	7.5666	7.7	
Eff. TSS	4	22	18	11	16	2	8	10	21	6	11	11	11.66	22	
Eff. Fecal			6400	1600	20000	540	130	7000					5945	20000	
Eff. BOD	5.5	5.3	7.3	4.4	4.6	2.9	3.5	5.1	9.9	2.2	7	7	5.3916	9.9	
2015	Dec-15	Nov-15	Oct-15	Sep-15	Aug-15	Jul-15	Jun-15	May-15	Apr-15	Mar-15	Feb-16	Jan-15	Average	Maximum	3-month low flow
Influent BOD	133	47	174	43	19	123	22	43	129	66	95	80	81.166	174	
Influent SS	65	97	49	74	94	67	16	132	19	38	71	48	64.166	132	
Ave. Inf. Flow	0.558	0.165	0.091	0.109	0.138	0.22	0.329	0.569	0.247	0.247	0.126	0.122	0.2434	0.569	0.1073
Max. Inf. Flow	1.369	0.676	0.118	0.256	0.273	0.437	1.147	0.827	0.651	0.609	0.223	0.33		1.369	
Eff. DO	8.9	9.4	8.8	8.7	9.4	8.4	9	8.5	8.9	9	11	9.3	9.1083	11	
Eff. pH	7.6	7.6	7.1	7.6	7.3	7.8	7.3	7.9	7.7	7.7	8.2	7.7	7.625	8.2	
Eff. TSS	5	8	9	7	16	5	14	15	9	19	42.7	15	13.725	42.7	
Eff. Fecal			750	300	106000	610	410	900					18161.6	106000	
Eff. BOD	3.8	6.9	3	5.5	7.1	3.4	1.8	7.3	6.9	4.8	14.7	13.2	6.5333	14.7	

* indicates excursion from NPDES limits (shaded cells)

B. West WWTF

1. Description

The West WWTF serves approximately the western 2/3 of the Village. This facility is located on the southwest side of the Village to the south of Illinois Route 15, as shown on **Exhibit 7 – Village of Freeburg Existing West WWTF**. The West WWTF was originally constructed in 1973.

The terminal lift station consists of two 10HP pumps that are each capable of pumping 694 gpm at 32 feet TDH. The terminal lift station pumps the influent flow to two 0.20 mgd average design flow package treatment plants, which were originally designed for the contact stabilization activated sludge process. The east Unit A still operates with the original contact stabilization process, while the west Unit B has been modified to operate as an extended aeration activated sludge process. The aeration system for the two plants include two 60 HP centrifugal blowers that are located in the control building. The effluent from the package plants are blended to try to allow the plant to meet its ammonia nitrogen effluent limits. Each package plant also contains a rapid sand tertiary filter section where the flow enters after the clarification process. The filter media consists of 2 to 3 mm sand and 5/16 to 1½ inch gravel. Filter backwash is sent to the terminal lift station wet well, while the filter effluent flows through the chlorine contact tank of each unit before discharging to the Kinney Branch. The filter effluent is not disinfected in the chlorine contact tank because the West WWTF has a disinfection exemption.

The sludge from each plant's aerobic digester is handling by dewatering the liquid sludge on four sludge drying beds located west of Unit B or can be wet hauled in the Village's liquid sludge tank truck for injecting into agricultural land. See Table 5B.1 below for design criteria for the West WWTF.

Village of Freeburg – West WWTF	Table 5B-1
Design Criteria	
Daily Average Design Flow	0.40 MGD
Peak Design Flow	1.0 MGD
Design Organic Load	680 lbs/day (4,000 PE)
Equipment	
Influent Pumps	Two–10 HP with 694 gpm pumping capacity at 32' TDH
Package Treatment Plant Average Design Flow (ADF)	0.20 mgd (each)
Normal Water Depth	15'-0" with 1'-6" freeboard
Total Aeration Volume per Package Plant	75,800 gallons (9 hours of Detention Time at ADF)
Clarifier	22'-8" in diameter (4.5 hours of Detention Time at ADF)
Clarifier Surface Settling Rate	500 gpd/sf
Aerobic Digester Volume	6,000 cf
Aeration Blowers	Two – 60 HP with 1,050 cfm capacity at 7 psi
Tertiary Filters	Two cells per plant with 35 sf/cell (Total of 140 sf)
Filtration Rate	0.5 gpm/sf at ADF & 1.25 gpm/sf at MDF
Sludge Handling (Four Sludge Drying Beds)	2,500 sf per Bed (Total Area of 10,000 sf)
Excess Flow Clarifier Pumps	Two-10HP with 950 gpm at 26' TDH
Excess Flow Clarifier	40' in diameter with 10' side water depth

2. Evaluation

The West WWTF has an average design flow capacity of 0.40 MGD and a maximum design flow rate of 1.0 MGD. During the period of 2015 and 2016, the average annual flow rate was 0.416 MGD in 2015 and 0.406 MGD in 2016. During the same period the average monthly flow rate exceed the average design flow capacity in 12 of 24 months. The maximum design flow rate of exceeded during the months of June and December of 2015 and August and September of 2016.

This facility is well maintained and operated for is age; however, some significant operational and maintenance are present due to the age of the plant. Recently, the facility has not performed in compliance with its NPDES permits limits, specifically meeting the ammonia-nitrogen effluent requirements. The effluent ammonia-nitrogen permit limits were exceeded in 10 of 24 months in 2015 and 2016. The effluent BOD and TSS from the excess flow clarifier also exceeded permit limits in January and February of 2015. Tables 5B-2 and 5B-3 show more detailed operating reports for the West WWTF in 2016 and 2015.

Freeburg West WWTF Flow Data - 2016 — Table 5B-2

2016	Dec-16	Nov-16	Oct-16	Sep-16	Aug-16	Jul-16	Jun-16	May-16	Apr-16	Mar-16	Feb-16	Jan-16	Average	Max.	3-month low flow
Influent BOD	87.3		75.25	67	78.38	98.25	70.7	59.75	67.63	68.9	63.2	73.25	73.600	98.25	
Influent SS	68		69.63	73.3	67.63	79.25	54.7	54.25	82.75	57.1	69	65.88	67.408	82.75	
Ave. Inf. Flow	0.342		0.297	0.425	0.394	0.315	0.355	0.572	0.463	0.461	0.428	0.412	0.4058	0.572	0.318
Max. Inf. Flow	0.442	0.783	0.738	1.251	1.067	0.632	0.831	0.971	0.925	0.745	0.904	0.64		1.251	
Eff. DO	11.14	10.28	10.03	9.33	9.79	9.7	9.53	9.7	9.7	9.5	9.91	10.54	9.929	11.14	
Eff. pH	7.3	7.5	7.4	7.2	7.4	7	7.4	7.4	7.3	7.3	6.9	7.1	7.266	7.5	
Eff. TSS	3.04	1.98	1.38	2.72	2.05	2.83	3.01	5.25	5.58	3.44	4.51	1.58	3.114	5.58	
Eff. Ammonia	1.39	1.7	1.15	1.1	1.13	1.4	1.47	4.04	1.19	2.39	3.35	2.24	1.879	4.04	
Eff. P	0.889	0.134	0.443	0.424	2.14	1.33	1.96	1.55	0.238	1.46	1.07	0.884	1.0435	2.14	
Chlorine Residual		0.02	0.02	0.02	0.02		0.01	0.02	0.02		0.04		0.02125	0.04	
Eff. Fecal			67000	32000	20000	20000	200000	200000					89833.3	200000	
Eff. BOD	3.8	2.5	2.2	2.7	2.67	4.6	2.7	3.3	2.9	4	5.8	3.9	3.4225	5.8	
Excess Flow															
Eff. BOD		39	14	14.7	14.5		62	27	10		18.33		24.94	62	
Eff pH		7.5	7.3	7.3	7.2		7.4	7.2	7.1		7		7.25	7.5	
Eff. TSS		21	6	9.7	10.5		23	9	9		46.26		16.81	46.26	
Chlorine Residual		0.02	0.01	0.02	0.02		0.01	0.02	0.02		0		0.015	0.02	
Eff. Fecal		10	10	10	320		10	150	10		10		66.25	320	
Days Discharge		1	1	3	4		1	1	1		3		1.875	4	
Average Daily Flow		0.715	0.854	0.550	0.552		0.24	0.278	0.691		0.384		0.533	0.854	

(shaded box) * indicates excursion from NPDES limits

Freeburg West WWTF Flow Data - 2015														Table 5B-3	
2015	Dec-15	Nov-15	Oct-15	Sep-15	Aug-15	Jul-15	Jun-15	May-15	Apr-15	Mar-15	Feb-15	Jan-15	Average	Max.	3-month low flow
Influent BOD	85.9	113.8	104.5	91.5	132.2	85.6	62.13	89.78	80.25	78.44	96.25	80.38	91.738	132.25	
Influent SS	78.4	105	91.5	68.75	65.63	57.2	47	47.44	52	43	76.75	96.88	69.129	105	
Ave. Inf. Flow	0.491	0.371	0.202	0.243	0.315	0.464	0.571	0.507	0.538	0.566	0.344	0.375	0.4155	0.571	0.253
Max. Inf. Flow	1.039	0.922	0.343	0.459	0.518	0.797	1.03	0.976	0.843	0.978	0.467	0.647		1.039	
Eff. DO	11.36	11.06	10.24	10.33	9.6	9.95	11	10.4	8.2	7	10.69	10.11	9.995	11.36	
Eff. pH	6.8	6.9	7.2	7.2	7.1	7.1	7.2	7.3	7.4	7.4	7.4	7.5	7.208	7.5	
Eff. TSS	3.16	2.85	1.98	2.66	2.75	2.22	3.45	2.1	1.84	4.38	3.3	2.48	2.764	4.38	
Eff. Ammonia	1.54	1.45	1.29	4.2	3.05	4.04	1.19	1.77	1.88	1.37	1.34	3.53	2.220	4.2	
Eff. P	2.02	1.93	1.44	5.17	0.791	0.349	0.346	0.504	0.524	1	0.686	0.98	1.311	5.17	
Chlorine Residual	0.02	0.04			0.02	0.04	0.028	0.04	0.04	0.2	0.1	0.2	0.0728	0.2	
Eff. Fecal			20000	148000	4000	20000	20000	93000					50833.3	148000	
Eff. BOD	4.9	2.9	3	4	3	3.2	3.4	4.4	4	5	3.8	3.7	3.775	5	
Excess Flow															
Eff. BOD	12.6	20.5			6	5	17	19.3	13	27	98	66	28.44	98	
Eff pH	6.6	7.1			7.4	7.1	7.2	7.4	7.7	7.4	7.6	7.4	7.29	7.7	
Eff. TSS	7.16	13.75			12	10	16.14	14.3	21	13	37	38	18.235	38	
Chlorine Residual	0.02	0.03			0.02	0.04	0.028	0.04	0.2	0.2	0.1	0.2	0.0878	0.2	
Eff. Fecal	10	10			320	10	100	10	10	10	20	10	51	320	
Days Discharge	6	2			1	1	7	3	1	2	1	1	2.5	7	
Average Daily Flow	1.241	0.993			0.585	0.998	0.6994	1.56	0.188	0.252	0.148	0.485			

[shaded box] * indicates excursion from NPDES limits

VI. West Wastewater Treatment Facility Expansion Concept

A. General

The existing Freeburg West Wastewater Facility is in need of replacement and expansion to process a portion of the Planning Area's wastewater over the next twenty (20) years. The existing package plant tankage can be reused and incorporated into the expansion to provide sludge digestion treatment, thus cost effectively saving the Village money rather than constructing a totally new aerobic digesters to handle all of the Village's sludge handling.

The major problem with the existing plant is that the plant is near, or exceeding its hydraulic capacity according to flow data, as shown in the preceding chapters. The hydraulic flow data indicates that the Village's Treatment Plant could be placed on a critical review or restricted status. Restricted status means the facility has loadings at or above the design capacity of the system, and that the Illinois Environmental Protection Agency may not issue permits for additional loadings. This includes permits for the construction of new sewers, and for additional connections. Critical review means that the facility has loadings exceeding 80 percent of the design capacity of the system, and the Agency will very carefully review applications for additional loading, including permits for the construction of new sewers, and for additional connections.

In addition to the lack of hydraulic capacity, the wastewater treatment facility has trouble meeting ammonia-nitrogen effluent limits. In the sections that follow, the chosen alternative method to solve the wastewater problem of the Village of Freeburg's facility will be presented to provide adequate treatment capacity and meet permit limits.

Conceptually, the expansion of the wastewater treatment plant can best be accomplished by constructing a new treatment process adjacent to the existing plant. The Village has acquired available land across Kinney Branch and adjacent to the existing treatment plant site to construct the facility to accommodate expansion of the plant, as shown on **Exhibit 8 – Proposed Freeburg West Wastewater Treatment Facility**.

VII. ALTERNATIVE WASTEWATER TREATMENT TECHNOLOGIES

A. Activated Sludge Treatment

1. Oxidation Ditches

The installation of an oxidation ditch is an alternative for expansion of the West Wastewater Treatment Facility. It would be necessary to utilize a more advanced oxidation ditch process to improve removal of nutrients, such as nitrogen and phosphorus to comply with anticipated regulatory changes that will continue to minimize allowable discharges of these nutrients. Typically, oxidation ditches are configured to use the modified Lutzack-Ettinger process to improve nutrient removal. This process consists of the modification of the conventional activated sludge process where an anoxic zone is created or added upstream of the aerobic zone. The process uses an internal recycle that carries nitrates created in the nitrification process in the aerobic zone along with the mix liquor to the influent of the anoxic zone for mixing. The amount of nitrates potentially removed in the anoxic zone depends on the recycle flow and availability of influent BOD.

2. Sequencing Batch Reactors (SBR)

Sequencing batch reactors are a specialized form of activated sludge treatment in which all of the treatment process takes place in the reactor tanks and secondary clarifiers are not required. A SBR process utilizing three (3) basins would be constructed, each handling one-third of the projected flow. The SBR process was chosen in part because of its ability to handle wet weather flows. A post-equalization tank would most likely be required because hydraulics may not allow the SBR decant to flow by gravity to the proposed filter building. A preliminary design proposal from one SBR manufacturer (Sanitaire ICEAS SBR) is shown in **Exhibit 9**, as well as the cycle charts for the daily average flow and for storm flow.

In a typical SBR process, wastewater is introduced into the tank during the "mix-filling" stage and mixes with the biomass in the tank that had settled during the previous cycle. The "react" stage introduces air to then promote biological growth and facilitate waste reduction. During the next stage, "settlement", the mixing and aeration are stopped to allow solids to settle to the bottom of the tank. After a period of time, the process enters the "decant"

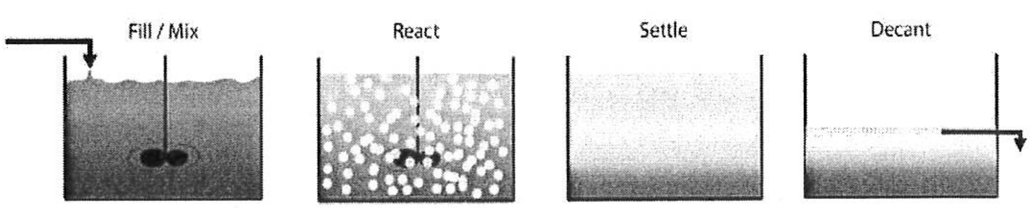


Figure 7A-1 – Sequence Batch Reactor Process stage where the clarified effluent is decanted off of the top of the settled solids. A final "idle" stage enables waste activated sludge to be removed from the tank as necessary.

The advantage of SBR units are their ability to remove nutrients from the wastewater with nitrogen removal at levels less than 3 mg/l and phosphorus removal at less than 0.3 mg/l. Phosphorus removal is achieved by extending the "mix-fill" stage to create anaerobic conditions where phosphorus accumulating organisms (PAO) release the phosphorus in the wastewater where it is taken up during aeration. Also during the mix-fill stage anoxic conditions are developed which removes residual nitrites/nitrates (NO_x) and the anoxic conditions to some degree control some types of filamentous organisms.

Activated Sludge Treatment Processes
Advantages / Disadvantages

Table 7A-1

Treatment Technology	Advantages	Disadvantages
Oxidation Ditches	Ability to achieve removal performance objectives with low operational requirements and operation & maintenance costs	Effluent suspended solids concentrations are relatively high compared to other activated sludge processes
	Reliability and performance over other biological processes due to constant water level and continuous discharge that eliminates periodic surges common to other biological processes.	Requires a larger land area than other activated sludge processes
	Long hydraulic retention time and complete mixing minimize the impact of a shock load or hydraulic surge.	Typically will not meet effluent requirements that may be stipulated in the future, including phosphorus or nitrogen.
	Produces less sludge than other biological treatment processes due to extended biological activity during the activated sludge process	
	Energy efficient operations result in reduced energy costs	
Sequencing Bath Reactors (SBRs)	Equalization, primary clarification, biological treatment, and secondary clarification can be achieved in a single reactor vessel.	A higher level of sophistication is required (compared to conventional systems), especially for larger systems, of timing units and controls.
	Operational flexibility & control	Higher level of maintenance (compared to conventional systems) associated with more sophisticated controls, automated switches, and automated valves.
	Minimal Footprint	Potential of discharging floating or settled sludge during the DRAW or decant phase with some SBR configurations.
	Capital cost savings by elimination of clarifiers and other equipment	Potential plugging of aeration devices during selected operating cycles, depending on the aeration system used by the manufacturer.
		Potential requirement for equalization after the SBR, depending on the downstream processes.

B. Tertiary Filtration Technologies

1. Depth Filtration

Depth filtration is one of the most common methods used for filtration of effluents from treatment processes. The four types of depth filters used most commonly for wastewater filtration are:

- Conventional down flow filters (mono, dual, and multi-media)
- Deep-bed down flow filters
- Deep-bed upflow continuous backwash filters
- Traveling bridge filters

Filters that must be taken off-line periodically for backwash are classified as semi-continuous filters, whereas filters in which backwash and filtration operation occurs simultaneously are classified as continuous filters.

a. Conventional Down Flow Filters

Flow containing suspended matter is applied to the top of the filter bed. Single, dual, and multi-medium filter materials can be used. Sand and/or anthracite are the most common types used for reuse applications. Head loss buildup occurs as the filtration takes place, and the system must be backwashed routinely one filter cell at a time. They are semi-continuous filters.

b. Deep-bed Down Flow Filters

The deep-bed filters are similar to conventional filters with the exception that the filter medium depth and the size of filtering medium are greater than those values in conventional filters. Because of greater depth and larger medium size, more solids can be stored within the filter bed; and the filter run length can be extended. The maximum depth of filter medium depends on the ability to backwash the filter. These filters are not generally fluidized completely during backwash, thereby requiring air scour plus water for effective cleaning. They are also semi-continuous filters.

c. Deep-bed Up-flow Continuous Backwash Filters

Deep-bed up-flow continuous backwash filters require the chemically preconditioned wastewater to be introduced from the bottom of the filter where it flows upward through a series of riser tubes and is distributed evenly into the sand bed through the open bottom of an inlet distribution hood. The water flows upward through the downward-moving sand. Clean filtrate exits from the sand bed, overflows to a weir, and is discharged from the filter. Sand and trapped solids are drawn downward at the same elevation into the suction of an airlift pipe that is in the center of the filter. Compressed air is introduced to the bottom of the airlift to uplift sand and solids containing water. It is possible to get sand blow-off in the effluent, which can impact the downstream disinfection.

d. **Traveling Bridge Automatic Backwash Filters**

The travelling bridge automatic backwash filters are continuous down flow, automatic backwash, low head, and granular medium depth filters. The filter bed is horizontally divided into long independent cells that treat the wastewater as it flows through them by gravity. A traveling bridge assembly is used to backwash each cell individually while other cells remain in service. Water used for backwashing is pumped directly from the clear well plenum up through the medium and deposited in a backwash trough. Because the backwashing is performed on an "as-needed" basis, the backwash cycle is termed semi-continuous.

2. Surface Filtration

Surface filtration involves the removal of suspended materials by mechanical sieving by passing the liquid through a thin septum. Filter materials include cloth fabrics, woven metal fabrics, and a variety of synthetic materials. The two common types of systems used in surface filtration are the cloth media filter and disk filters.

a. **Disk Filtration**

Disk filtration is a type of surface filtration where water enters a feed tank and flows through a series of submerged cloth media via an inside-out feed regime. The resulting filtrate is collected into a filtrate header where it flows to final discharge over an overflow weir in the effluent channel. As solids accumulate in the cloth media, resistance to flow or head loss increases. When the head loss through the cloth media reaches a predetermined set value, the disks are backwashed. Backwashing is performed routinely to clean both sides of each disk. Disks are typically cleaned two at a time while the disks rotate slowly.

b. **Cloth Media Filtration**

A Cloth Media Filter System is typically arranged as vertical disks in concrete or fabricated steel or stainless-steel tanks. The system is outside-in fed, and is designed to backwash automatically based upon water differential while maintaining continuous filtration during backwash. This vertical media orientation allows for a large amount of filter area in a very small footprint (up to 75 percent less than typical filters). The filter is completely static during filtration with the disks only rotating during the backwash process. Typical backwash is less than 2 to 3 percent, with a typical recovery time of less than 3 minutes. A preliminary design proposal from Ashbrook-Simon Hartley (AS-H) is shown in **Exhibit 10.**

Tertiary Treatment Processes Advantages / Disadvantages		Table 7B-1
Treatment Technology	**Advantages**	**Disadvantages**
Sand Media Filters	Most common technology & proven effective	Technology history supports operational efficiency decline within years of initial operation.
	O & M operator familiarity	Reduced backwash recovery time.
		Requires additional footprint for plant expansion.
		Produces large volumes of backwash water that requires treatment.
Cloth Media Filters	Reduced backwash water volume	
	Increased backwash recovery time	
	Reduced footprint. Can use same building.	
	Less Maintenance than sand filters	

C. Evaluation of Options

The Village has several options to consider in meeting the future treatment requirements of the facility planning area, namely;

1. No action
2. Optimize operation of existing facilities
3. Upgrade existing facilities

1. No Action

The "no-action" plan is not a viable alternate as the existing wastewater treatment facility will not be capable of consistently meeting NPDES permit limits or handling the additional flows that are tributary to the Freeburg facility, thereby placing the Village on restricted status. A restricted status designation will limit or stop growth within the planning area. No action is not a viable alternative.

2. Optimize Operation of Existing Facilities

Daily average flows nearing or exceeding design capacity and peak flows over 1.00 MGD for extended periods of time have been effectively managed by the operating personnel. The plant has been well maintained; however, there are operational problems that prohibit the effluent from meeting ammonia-nitrogen limits. As described previously, the plant has reached its hydraulic capacity.

3. Upgrade existing facilities

Upgrading the Village of Freeburg West WWTF appears to be the viable means of continually meeting NPDES permit limitation and avoiding impending restricted status. Such an undertaking would preserve and improve the water quality of the Kinney Branch.

D. Alternative Wastewater Treatment Systems

When choosing among design alternatives to meet the needs of a facility planning area, one must consider methods to reduce three (3) major components in raw wastewater. These components are the 5-day biochemical oxygen demand, the total suspended solids, and the ammonia-nitrogen concentrations. (pH and fecal coliform limitations must also be considered; but do not govern the general design concept of a domestic treatment facility).

The Engineering Report as required by 35 Ill. Adm. Code Section 370.210, should include items outlined in Section 370.210(a) and (b) and should address all applicable discharge and water quality standards including the recently expanded anti-degradation provisions of the Illinois Pollution Control Board regulations at 35 Ill. Code 302.105 (see attachment). As a minimum, the report should contain a discussion of the following:

Reduced discharge options must be evaluated in detail. These must consider initial cost, operation and maintenance costs, and monthly cost to the average user. The options considered must include, but not limited to, spray irrigation of a portion of the discharge, constructed wetland that reduces the flow by evapo-transpiration, providing a higher degree of treatment which would reduce the total pounds of pollutants discharge per a give flow rate.

In keeping within the requirements of an IEPA approved project plan, three basic wastewater treatment alternatives in the realm of Best Practical Waste Treatment Technology (BPWTT) will be considered for the Village of Freeburg West Wastewater Treatment Facility.

1. Treatment and Re-use/Spray Irrigation
2. Land Application/Constructed Wetland
3. Higher Degree of Effluent

1. Treatment and Re-use/Spray Irrigation

<u>Treatment and Re-use</u>

Treatment and re-use does not appear to be a possible alternative for the Village of Freeburg West Wastewater Treatment Facility since no known industries exist in the immediate vicinity that would be interested in utilizing re-cycled water for their process operations, and no other users are known for re-cycled water. In addition, no distribution system currently exists for re-cycled water.

Spray Irrigation

As previously discussed in the project plan, due to the close proximity of the plant to developed areas and the price of real estate in the area, land application of effluent is not a viable option. In addition to expanding the treatment plant, the Village would also have to install a spray irrigation system in which to spray the effluent and find available land onto which it could be applied as discussed below.

Consistent with IEPA Guidelines – Part 372, adequate storage for the wettest year must be provided. According to data for the Illinois State Climatologist, the wettest year in the past 20 years was 1993, with 53.92 inches of rainfall for the year. In September, 9.07" of rain fell in the area and 6.65" in the following November. Regulations also require that adequate storage volume be provided to hold flows during the following periods:

A. When the soil is frozen, including subsoil frost layers;
B. When there is an ice or snow cover on the ground;
C. When the soil temperature at 4" depth is less than 40°F or the mean air temperature is less than 35°F;
D. When the ground is saturated or there is standing water (as from late winter snowmelt or spring rains);
E. When the groundwater table is within 4 feet of the surface;
F. During days when precipitation exceeds 0.1 inch;
G. During agricultural and horticultural practices;
H. During days set aside for equipment maintenance;
I. During days when the design maximum wind velocity is exceeded; and
J. When the soil is barren, except for seeded areas, areas with growing crops, or areas with a trashy cover to prevent erosion.

Based on the data from the Illinois State Climatologist and these guidelines, it would appear that the Village of Freeburg would need to provide wastewater storage for 187 days. This is based on average number of days that the temperatures are below 32°F and the number of days when precipitation occurred during the last 20 years. The anticipated flow to the new facility is 0.80 MGD. For 187 days of storage, a lagoon would need to hold 150 million gallons. Assuming an average depth of ten (10) feet, the surface area of the storage lagoon would be 46 acres. Even if the land were available and using a rate of $10,000 per acre, the Village would need $460,000 just for land acquisition.

This coupled with fact that nearby residents may find it to be offensive give way to this being not a viable option.

2. Land Application of Effluent/Constructed Wetland

Three (3) types of land application systems utilized for the purpose of wastewater treatment are commonly practiced in the United States; namely, irrigation, infiltration percolation and overland flow.

Land Application

Irrigation is the controlled discharge of secondary effluent by sprinkling or surface spreading onto land to support plant growth. The wastewater is assimilated into plant tissue, evaporated and percolated through the soil. The irrigation system is generally considered superior to other land application systems with regard to reliability and treated effluent quality.

Infiltration-percolation, also known as rapid infiltration land treatment, involves the transfer of applied secondary effluent through the soil to the groundwater aquifers. Wastewater is ordinarily applied to the soil by sprinkling or spreading basins, and vegetation is not ordinarily cultivated. This system always has the threat of groundwater pollution.

Overland flow involves the application of secondary effluent to the upper perimeters of a sloping terrace and allowing the wastewater to flow across a vegetated surface to runoff collection ditches. Wastewater treated by this method is purified by physical, chemical and biological means as it flows in a thin film down relatively impermeable sloped terraces. The efficiency of this system is affected somewhat by the short hydraulic detention time and problems with inadequately treated surface runoff.

Constructed Wetland

The use of a constructed wetland for small communities can be a cost-effective treatment alternative for BOD and suspended solids, but is not very effective in phosphorus removal and some of the other nutrients. Typically, any nutrient removal must be provided for prior to discharge to the wetland. This is a viable option, provided there is appropriate land for construction of the wetland. In areas where land is not readily available for construction, other means must be explored.

Typically, constructed wetlands that discharge to surface water require 4 to 10 times more land area than a conventional wastewater treatment facility. Zero-discharge constructed wetlands require 10 to 100 times the area of a conventional wastewater treatment facility.

The following are suggested criteria for constructed wetlands. According to the EPA Design Manual for "Constructed Wetlands and Aquatic Plant Systems for Municipal Wastewater Treatment", suggested loading rates are given for hydraulic and organic design of a wetlands system. These are as follows:

Organic Loading

There are two goals for organic loading in a constructed wetland. There must be a carbon source for denitrifying bacteria and secondly, control of the organic loading to prevent overloading of the oxygen transfer ability of emergent plants in the wetland system. If a carbon source is not available, then overall nitrogen removal is lower. However, a heavy organic loading, especially if not evenly distributed, will cause plant die off and odors. A mass organic loading rate of about 100 lb/ac – d is a typical upper limit. Using this and the expected design effluent parameters for the facility, this equates to 1 acre of land that is needed. This is the amount of land needed if the effluent is treated by a process before discharge to the wetland. If no process is preceding the discharge, the organic loading will require 7 acres. However, the hydraulic loading will govern as follows.

Hydraulic Loading

Site specific conditions must be considered in establishing the hydraulic loading rate. A suggested loading rate of 21,000 gpd/ac generally will provide maximum treatment efficiencies. Applying this to the proposed flows, the

Village would need 39 acres, meaning that the hydraulic loading would govern. If a decreased discharge or no discharge is required, this requirement could increase. Other items that must be considered are as follows:

- Some types of constructed wetlands may provide breeding grounds for disease producing organisms and insects and may generate odors if not properly managed.
- The soil must be tested to determine if the soil will support wetland vegetation, or if a soil enhancement plan needs to be developed before seeding/planting the wetland.
- The wetland should be irregular in shape, with a length to width ratio of at least 2:1 preferably 4:1. Inlets and outlets must be placed far apart to avoid short-circuiting.

Two (2) major problems limit the use of land application techniques for upgrading the Village's West WWTF.

1. Land Availability. The possibilities of acquiring the vast amount of land needed for land application are slim. In addition, an attempt to install a land application process in town would certainly be met with much public resistance.
2. Storage Capacity. There is only limited room at the existing treatment facility site for expansion. The amount of land needed for storage during adverse weather and winter weather is simply not available. Furthermore, designing the proposed facility to provide complete treatment during periods when land application is impossible would not be cost effective.

3. Treatment and Discharge of Effluent Waters

After carefully considering the alternatives, a recommendation is hereby made to maintain the Village of Freeburg's West Wastewater Treatment Facility as a "treatment and discharge" facility. Treatment and discharge facilities, such as the Freeburg West WWTF, process domestic wastewater to meet specific quality standards, and then discharge the water to receiving streams or bodies of water.

The proposed process would need to be operated such that the total loading will be lower then what the existing facilities of the same size are currently discharging to meet antidegradation requireemnts. The process must address phosphorus and nitrogen removal, as well as being able to lower BOD and Suspended solids concentrations. Although phosphorus can be removed biologically, provisions would be made to mechanically remove phosphorus. The tertiary filter system proposed would also be designed to produce a quality effluent that is suitable for reuse. The cost estimate that is presented in the facility plan reflects this.

E. Alternative Wastewater Treatment Facilities Compatible with the Village of Freeburg West Wastewater Treatment Facility

To provide expansion of the Village of Freeburg West Wastewater Treatment Facility, the alternatives were evaluated earlier in this chapter with regard to economic feasibility and compatibility with the existing plant:

Increase the plant's hydraulic capacity by constructing a three (3) basin sequencing batch reactor system was determined to be the preferred alternative. This would include construction of a new headworks and terminal lift station, conversion of existing package plants to aerobic digesters, and new cloth filter filtration. The construction of a new SBR system would become the primary treatment process. The following preliminary calculations are for the SBR and other processes:

SBR Units

Because the IEPA has not published design criteria for SBR units, TWM, Inc. has worked with various manufacturers of SBR equipment. Design calculations, as prepared by Sanitaire for their ICEAS system, working in conjunction with TWM are attached. Including detailed aeration calculations for the ICEAS SBR System. The facility would be designed to treat an influent with the following characteristics.

Parameter	Average Loading (influent)	Expected Effluent
Flow, MGD	0.80 MGD (ADF) 2.00 MGD (MDF) 3.00 MGD - Peak Hyd. Flow	0.80 MGD (ADF) 2.00 MGD (MDF) 3.00 MGD - Peak Hyd. Flow
BOD_5, mg/l	150	5
BOD_5, #/day	1,001	33
Ammonia Nitrogen, mg/l-N	30	1
Ammonia Nitrogen, #/day	200	7
Total Nitrogen	----	10
Total Inorganic Nitrogen	----	8
Phosphorus	7	1
Total Suspended Solids, mg/l	300	6
Total Suspended Solids, #/day	2,000	40

While there exists no published IEPA design criteria for the hydraulic loading to SBR units, the process is basically a form of the extended aeration process. Design criteria for extended aeration is 15 lb BOD5/1,000 ft^3 of aeration volume.

The minimum total SBR volume required is calculated as follows:

(Influent BOD5)/(15 lb BOD5/1,000 ft3) = 66,720 ft^3

Constructing three (3) new tanks and a fourth tank to be used as a digester, the tank sizing is as follows:

Depth = 16 feet
Length = 79.90 feet
Width = 28 feet

Total Volume = 107,386 ft3

The hydraulic detention time at the DAF of 0.80 MGD = 1.00 days
= 24.10 hours

Clarification

The ICEAS system is a modified batch process that allows influent flow at all times. The inclusion of actuated slide gates will allow the system to operate as a true batch SBR system if necessary. The aeration unit becomes a clarifier when the aeration cycle ends. The IEPA design criteria for secondary clarifier surface is 1,000 gpd/ft^2 at peak hourly flow (3.0 MGD). The minimum surface area required is

3,000,000 gpd / 1,000 gpd/ ft^2= 3,000 ft2
3 units = 6,712 ft^2 OK

At design flow, 5 batches per day per SBR unit will be required. The total settling time-decant time per unit per day will be ten (10) hours.

Waste activated sludge will flow from the SBR unit to the aerobic digesters.

Aerobic Digestion

The IEPA design criteria for aerobic digestion is 4.5 ft3 /PE. The hydraulic loading PE to the SBR units is 8,000 PE, and the organic loading PE, is 5,887 PE. One new digester basin will be constructed and two existing aeration basins will be converted to aerobic digesters, as based upon the hydraulic loading PE is as follows:

	Design PE =	8,000	PE	
	Design PE * 4.5 ft3 / PE * 1.25(decanting to occur in digesters) =	45,000	ft^3	
	Total Digester Volume =	45,000	ft^3	
(New Digester)	51.9 ft * 28 ft * 16 ft =	23,251	ft^3	
(Converted Tanks)	2 x 48 ft in dia. and 13 ft deep =	47,048	ft^3	
	TOTAL=	70,300		OK

Sludge Handling

The Village of Freeburg has existing sludge drying beds. Using the previous years sludge production records for the facility and the IEPA design criteria, the loading is as follows:

Organic PE x 0.16 dry lbs/d-PE = 941.93 dry lb/day

The volume of a sludge may be computed with the following expression:

$$V = \frac{M_s}{\rho_w S_{sl} P_s}$$

where
- M_s = mass of dry solids, lb dry solids/day
- ρ_w = density of water, 62.4 lb/ft3
- S_{sl} = specific gravity of the sludge = 1.02
- P_s = percent solids expressed as a decimal = 0.2

The Village will utilize a sludge dewatering screw press, which should generate a sludge product with 20% solids. Using the above formula, this equates to a volume as follows:

$$V = \frac{942 \text{ dry lb/day}}{(62.4 \text{ lb/ft}^3)(1.02)(0.20)}$$

V = 74 ft^3/day

Required Storage for 150 days = 11,099 ft^3

Assuming the sludge product can be stored 6' high, the area required will be

$$\frac{11{,}099}{6} = 1{,}850 \text{ ft}^2$$

The Village would construct a sludge storage canopy 50'(L)x40'(W)x6'(H) with a storage volume 12,000 ft^3. This satisfies the IEPA requirement with slightly more additional storage. An inclined screw sludge press would be installed in a new building adjacent to the sludge canopy. A conveyor system would also be installed to transport the sludge from the screw press to the canopy.

Tertiary Filtration Design Calculations

TWM, Inc. has worked with various manufacturers of tertiary filter equipment. Design calculations, as prepared by Ashbrook Simon-Hartley, working in conjunction with TWM are attached. The facility has been designed to treat an influent into the filters with the following characteristics.

Parameter	Average Loading (flow to Filters)	Expected Effluent
Flow, MGD	0.80 MGD (ADF) 2.00 MGD (MDF) 3.00 MGD - Peak Hyd. Flow	0.80 MGD (ADF) 2.00 MGD (MDF) 3.00 MGD - Peak Hyd. Flow
BOD_5, mg/l	10	5
BOD_5, #/day	67	33
Ammonia Nitrogen, mg/l-N	30	1
Total Suspended Solids, mg/l	12	6
Total Suspended Solids, #/day	80	40

UV Light Disinfection

Average Daily Flow = 0.800 MGD
Peak instantaneous daily Flow = 3.0 MGD
Peak Flow = 2.0 MGD

Average Effluent BOD/TSS = 10/12 mg/l
Maximum Daily Effluent BOD/TSS = 20/24 mg/l

Design Required Effluent Fecal Coliform

Weekly Maximum Limitation (Geometric Mean) (N) = 400 per 100 ml
Average Monthly Limitation (Geometric Mean)

Disinfection System Influent Fecal Coliform

Geometric Mean Concentration (Daily) (N0) = 1.00×10^6
Maximum Concentration (7-day mean)
Maximum Concentration (30-day mean)

UV Transmission (% at 253.7nm)

Daily Average = 70%
Minimum 30-day Average = 65%
Minimum 7-day Average = 60%
End-of-Life Factor = 0.70
Fouling Factor = 0.80

Phosphorus Removal

SBR systems are typically designed for biological phosphorus removal. Biological removal rates can be estimated based on process factors. Plant specific information is as follows:

Flow (ADF) = 0.80 MGD

Flow (MDF) =	2.0 MGD
Daily WAS volume =	1,280.00 lbs/day
Basins =	3
Cycles per day/basin =	5 CPD
Phosphorus (inf) =	7 mg/l
Phosphorus (eff) =	1 mg/l
Pump run time/cycle =	5 minutes

Given the sludge waste production as shown above and assuming a 3% total Phosphorus concentration in the WAS, expected Phosphorus removal is equal to:

Phosphorus Removal =	(WAS x Percentage of Phosphorus)/(8.34 x Flow - MGD)
Phosphorus Removal =	5.76 mg/l

Assuming an influent concentration of 7 mg/l, the anticipated effluent Total Phosphorus is equal to 1 mg/s.

Phosphorus to be removed =	6.00 mg/l
Pounds of Phosphorus =	40.03 lbs Phosphorus/day

The required chemical (alum) addition, feed rate requirements are as follows:

Assuming that 1.2 lbs Al^{+3} are needed per lb. Phosphorus removed, that 9.1% of alum is available as Al^{+3}, and that there are 11.1 lbs alum/gallon of liquid, the alum requirement is:

Pounds of Al^{+3} =	(Pounds of Phosphorus/day) x (1.2 lbs Al^{+3})
Pounds of Al^{+3} =	48.04 lbs Al+3/day
Pounds of Alum =	(Pounds of Al^{+3} /day)/(% Al^{+3} /lb of Alum)
Pounds of Alum =	527.9 lbs alum/day
Gallons of Alum =	(Pounds of alum/day)/(11.1 lbs. Alum/gallon)
Gallons of Alum =	47.6 gallons/day
Gallons of Alum =	11.9 gallons/day/basin

Note that this is the estimated maximum dosage of alum required per day. It is anticipated that some biological removal will occur. However, alum pumps would be sized to accomplish full Phosphorus removal as a safety measure. This would result in 47.6 gallons of alum per day (11.9 gallons per basin per day) as a maximum. Given 5 CPD operation and a pump run time of 5 minutes per cycle, this equates to a pumping rate of 0.48 gpm total.

The removal of Phosphorus with alum results in a consumption of approximately 0.50 pounds of alkalinity per pound of alum added. This results in an alkalinity requirement of:

Alkalinity Requirement =	(0.50 lbs alkalinity/lb alum) x (Pounds of alum)
Alkalinity Requirement =	263.9 lbs alkalinity consumed per day
Alkalinity Requirement =	66.0 lbs alkalinity consumed per day/basin

VIII. COST ESTIMATES FOR CHOSEN TREATMENT OPTION

A. General

Cost estimates were developed by obtaining budgetary-level equipment costs from the equipment suppliers, utilization of RS Means Cost Works™ estimating software, and calculating facility costs based on TWM's past experience for the design and construction of similar type of facilities in this region of the country. The cost estimates developed for this analysis provide a relative comparison of the chosen treatment alternative and are considered "budget" estimates as defined by ANSI Standard Reference Z94.2-1989. A "budget" cost estimate is defined as "an estimate prepared to form the basis for budget appropriation, and/or funding." The Association for the Advancement of Cost Engineering (AACE) International defines preliminary cost estimate costs as *Class 3* cost estimates that "usually involve more deterministic estimating methods than stochastic methods. They usually involve a high degree of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring and other stochastic methods may be used to estimate less-significant areas of the project. The estimates shown, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared to guide project evaluation and implementation from the information available at the time of cost estimation. The expected accuracy ranges for a Class 3 cost estimates are –10 to –20 percent on the low side and +10 to +30 percent on the high side. The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors.

Capital costs, herein, reflects construction costs for the facilities and do not include legal fees. The following markups and contingencies were included in the facility costs:

- Bond/Permits and Insurance: 3%
- Project Contingency: 10%

B. West Wastewater Treatment Plant Improvement Costs

West Wastewater Treatment Facility Improvement Costs

Table 8B-1

Headworks/Terminal Lift Station			Capital Cost, $
Bar Screen			
	Bar Screen Building/Structure	$	125,000.00
	Automatic Bar Screen & Washer/Compactor	$	200,000.00
	Controls / Electrical	$	50,000.00
Terminal Lift Station			
	Wet well and valve vault structure	$	400,000.00
	Influent Lift Station Pumps	$	150,000.00
	Controls / Electrical / Back-up Generator	$	100,000.00
SBR System			
	Concrete Basins	$	750,000.00
	SBR Equipment	$	1,125,000.00
Tertiary Filters			
	Cloth Media Filtration Equipment	$	750,000.00
	Tertiary Filter Building	$	150,000.00
UV Disinfection			
	UV Disinfection System and Controls	$	250,000.00
Effluent Parshall Flume			
	Install new flow sensor metering system	$	25,000.00
Convert Existing Tanks to Sludge Storage			
	Sandblast and Paint Steel Tank	$	50,000.00
	Replace Aeration System	$	200,000.00
Sludge Processing			
	Sludge Press Building / Canopy	$	400,000.00
	Install Sludge Screw Press	$	200,000.00
	Sludge Pumps and piping	$	150,000.00

Digester Aeration			Capital Cost, $
	Replace Existing Aeration Blowers	$	125,000.00
	Repair Existing Blower Building	$	50,000.00
Laboratory / Control Building			
	Laboratory / Control Building	$	200,000.00
	Electrical Service / SCADA System	$	500,000.00
	Chemical Feed System	$	75,000.00
	Process Aeration Blowers	$	200,000.00
	Generator	$	500,000.00
Site Work			
	Piping and pipe fitting	$	750,000.00
	Box Culvert to cross creek	$	150,000.00
	Pavement	$	400,000.00
	Seeding/Landscaping	$	50,000.00
	Total Construction Cost without Mark-ups or Contingencies	$	8,075,000.00
	Mark-ups and Contingencies		
	Project Contingency, 10% of the Sub-Total	$	807,500.00
	Total Construction Cost	$	8,882,500.00
	Engineering		
	Surveying & Design Engineering	$	666,187.50
	Construction Engineering	$	355,300.00
	Total Capital Cost	$	9,903,987.50

IX. Financial Funding Mechanisms

A. General

The cost for the Village of Freeburg to provide wastewater infrastructure for its existing customers and future customers will require an outlay of significant funds to finance the capital improvements. This can be a daunting challenge to apply for and secure the funding, but also to assemble the political support necessary to bring the funding to fruition. The success of the funding process may depend upon the financial portfolio of funding mechanisms that will provide the fairest and most equitable, and politically acceptable assignment of capital improvement costs to the appropriate sewer customers.

In the infancy of municipally formed utilities, funding was generated by the issuance of general obligation bonds to finance capital infrastructure. After the post war years, the most common and traditional way of financing wastewater infrastructure became utility rate fees. With the introduction of municipal enterprise funds, utility rate fees have become the basic pledge for issuance of municipal revenue bonds for utility construction.

In the 1970's the federal government along with the Illinois EPA developed state revolving funds (SRF's) for financing of wastewater infrastructure. Today's State Revolving Funds (SRF) are co-funded by the federal government (80%) and the state government (20%) and provide loan assistance in furtherance of Clean Water Act (CWA) compliance. The SRF program provides assistance in constructing publicly owned municipal wastewater treatment plants, implementing nonpoint pollution management programs, and developing and implementing management plans under the National Estuary Program.

Although these traditional funding methods have successfully funded many wastewater infrastructure projects, other funding methodologies have been explored to address growth related utility rate increases. These include sewer connection fees and impact fees.

The information provided herein details the specific mechanisms that have been utilized to secure additional funding for wastewater infrastructure capital improvements.

B. Usage/Capital Recovery Fees

Sewer use charges are primarily designed to recover the operating costs of the water reclamation facility and wastewater collection system (operations, maintenance and limited component replacement), and is charged only to those customers that actually discharge wastewater flows to the sewer system. This funding supports minor capital funding (e.g. sewer lining, short sewer extensions, etc.), and is typically not suitable for major treatment facilities.

C. Sewer Connection Fees

Sewer Connections fees are fees paid to capital accounts to fund required sewer system improvements. These fees are a reliable source of funding during upswings in the economy when development is flourishing, however in slower economic environments or recessionary times they are not a significant source of revenue. Reliance on connection fees for any debt service payments is risky.

D. Bonds and Loans

Bonds and loans are typically utilized for large capital projects. This funding involves annual debt service payments that are easier to manage cash flow. Typical bonding utilized for wastewater facilities include General Revenue or General Obligation Bonds. Loans that fund wastewater facilities are typically funded by the Illinois Environmental Protection Agency under the Water Pollution Control Loan Program (WPCLP). The (WPCLP) is administered in accordance with 35 Illinois Administrative Code Par 365 "Procedures for Issuing Loans from the Water Pollution Control Loan Program". Per the Illinois Environmental Protection Agency, The Loan Rules provide for a fixed loan rate that shall be established annually at one-half the market interest rate. Specifically, the fixed loan rate is defined by rule as one-half the mean interest rate of the 20 General Obligation Bond Buyer Index, from July 1 to June 30, in the preceding year, rounded to the nearest .01%. Current Loan Rules establish a new interest rate each July 1 for the following federal fiscal year. The fixed loan rate for loans executed by IEPA from July 1, 2017 through June 30, 2018 is 1.76%. The fixed loan rate is a simple, annual rate.

Loan awards will typically have a term of 20 years from the initiation of operation, with initial repayments of principal to commence within one year of the initiation of operation.

We would note that the Water Resources Reform and Development Act of 2014 amended the Clean Water Act (CWA) by modifying the act to allow loan terms up to thirty (30) years, but not exceeding the useful life of the project. The IEPA has recently begun to offer a loan term up to thirty (30) years.

E. Impact Fees

The American Planning Association defines Impact Fees as follows, "Impact fees are payments required by local governments of new development for the purpose of providing new or expanded public capital facilities required to serve that development. The fees typically require cash payments in advance of the completion of development, are based on a methodology and calculation derived from the cost of the facility and the nature and size of the development, and are used to finance improvements offsite of, but to the benefit of the development.

Local government experimentation with impact fees has been paralleled by increasing state court involvement in the review of these fees. A general trend in the state courts has been to require a "rational nexus" between the fee and the needs created by development and the benefits incurred by the development. This analysis is a moderate position between a standard that requires that the fee be "specifically and uniquely attributable" to the needs created by new development, and the relaxed standard that the fee be "reasonably related" to the needs created by development."

It is recommended by the American Planning Association that impact fees follows guidelines to comply with legal statutes. These guidelines are listed herein:

- The imposition of a fee must be rationally linked (the "rational nexus") to an impact created by a particular development and the demonstrated need for related capital improvements pursuant to a capital improvement plan and program.
- Some benefit must accrue to the development as a result of the payment of a fee.
- The amount of the fee must be a proportionate fair share of the costs of the improvements made necessary by the development and must not exceed the cost of the improvements.
- A fee cannot be imposed to address existing deficiencies except where they are exacerbated by new development.
- Funds received under such a program must be segregated from the general fund and used solely for the purposes for which the fee is established.
- The fees collected must be encumbered or expended within a reasonable timeframe to ensure that needed improvements are implemented.
- The fee assessed cannot exceed the cost of the improvements, and credits must be given for outside funding sources (such as federal and state grants, developer initiated improvements for impacts related to new development, etc.) and local tax payments which fund capital improvements, for example.
- The fee cannot be used to cover normal operation and maintenance or personnel costs, but must be used for capital improvements, or under some linkage programs, affordable housing, job training, child care, etc.
- The fee established for specific capital improvements should be reviewed at least every two years to determine whether an adjustment is required, and similarly the capital improvement plan and budget should be reviewed at least every 5 to 8 years.
- Provisions must be included in the ordinance to permit refunds for projects that are not constructed, since no impact will have manifested.
- Impact fee payments are typically required to be made as a condition of approval of the development, either at the time the building or occupancy permit is issued.

x. Wastewater System User Charges

The evaluation of the cost implications of the proposed wastewater treatment facility improvements requires examination of the financial condition of the Village's current sewer fund, the existing user charge system, capital costs of the proposed facilities, operation and maintenance costs associated with the existing and proposed facilities, and outstanding debt incurred.

A. Existing Wastewater Fund Expenditures

The viability of the Village's sewer fund requires that revenues be sufficient to meet total expenditures or cash obligations. This revenue includes all incurred costs related to operation and maintenance, capital improvement programs, and principle and interest on existing or proposed debt. The Village of Freeburg's sewer fund expenditures can generally be categorized into six classifications: (1) Personnel Services; (2) Contractual Services and Other; (3) Supplies and Materials; (4) Heat, Light and Power; (5) Depreciation; (6) Debt Service (Principal & Interest). The distribution of these varying expenditure categories are shown in Figure 10A-1 below for fiscal year 2017.

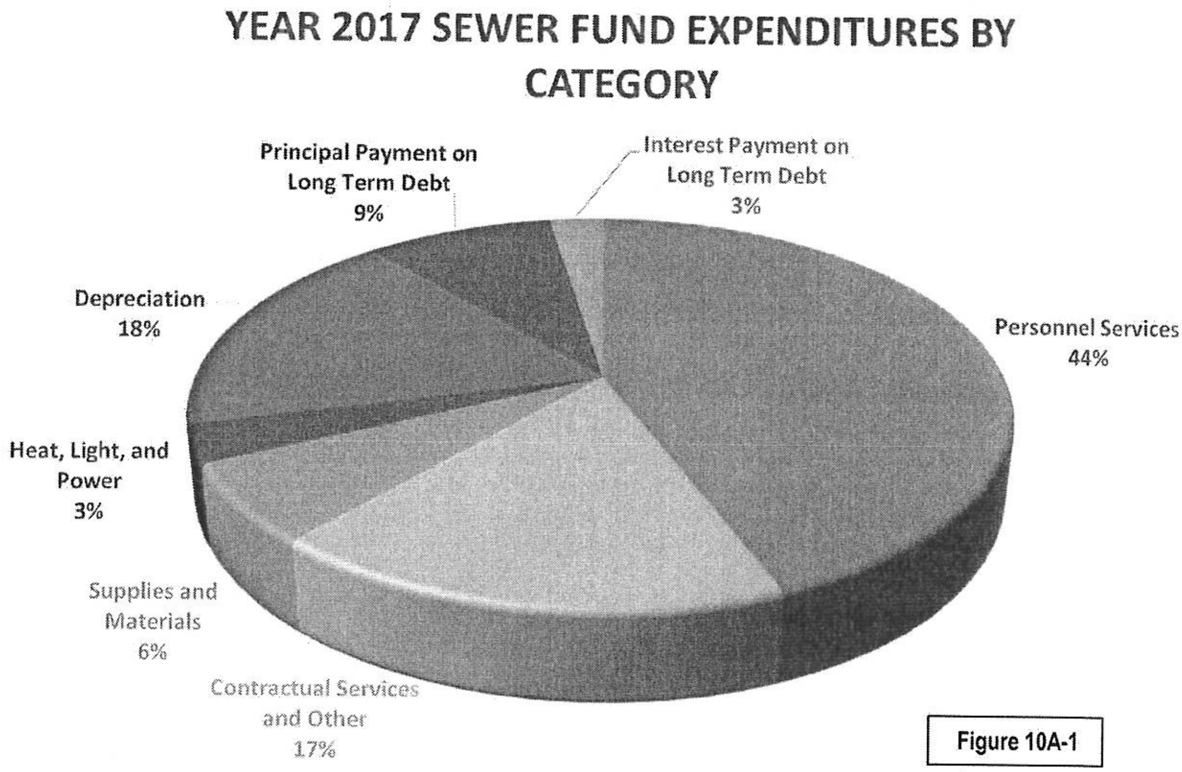


Figure 10A-1

Existing debt service costs (principal & interest) for the sewer fund are related to repayment of three (3) Illinois Environmental Protection Agency (IEPA) loans that were received previously. A fourth IEPA loan will begin repayment in fiscal year 2018. The repayment for these four loans will require $129,222 per year (principal & interest)

B. Existing Wastewater User Charge System

The Village of Freeburg's current wastewater user rates are described below. These rates went into effect in January of 2017.

Wastewater Rate Schedule		Table 10B-1
Within Village Corporate Limits	Facility Charge	$5.00
	First 1,000 gallons of usage	$7.00
	Calculated Rate for Water Usage over 1,000 gallons	$7.00 per 1,000 gallons
Outside Village Corporate Limits	Facility Charge	$7.00
	First 1,000 gallons of usage	$8.00
	Calculated Rate for Water Usage over 1,000 gallons	$8.00 per 1,000 gallons

Wastewater Collection System – Connection Fees		Table 10B-2
Within Village Corporate Limits	Residential Sewer Connection	$750 per unit
	Commercial or Industrial	$750 per unit
	Apartments	$750 per unit
	Mobile Home	$750 per unit
	Schools, Hospitals, Churches, Parks & Public Buildings	$750 per unit
Outside Village Corporate Limits	Residential Sewer Connection	$1,500 per unit
	Commercial or Industrial	$1,500 per unit
	Apartments	$1,500 per unit
	Mobile Home	$1,500 per unit
	Schools, Hospitals, Churches, Parks & Public Buildings	$1,500 per unit

For fiscal year 2017 ending March 31, 2017, the Village's user charge system generated $539,624.00.

C. Allocation of Operation, Maintenance, & Replacement (O, M & R) Costs by Unit Process & O, M & R User Charge Computation

Operation, Maintenance, & Replacement Budget Items	Estimated Budget Cost		Cost per 1,000 Gallons*	
Personnel Services	$	271,785.00	$	3.25
Contractual Services and Other	$	107,916.00	$	1.29
Supplies and Materials	$	40,181.00	$	0.48
Heat, Light and Power	$	19,365.00	$	0.23
Depreciation	$	109,303.00	$	1.31
Principal on Long Term Debt	$	100,344.00	$	1.20
Interest on Long Term Debt	$	28,878.00	$	0.35
TOTAL O, M & R BUDGET	$	677,772.00		
TOTAL O, M & R CHARGE PER 1,000 GALLONS	**$**	**8.11**		

Cost per 1,000 Gallons* - Based on an approximate annual water usage of 83,585,000 gallons

D. Proposed User Charge System

As explained in Section VIII, the estimated cost that The Village of Freeburg will have to absorb is $9,903,987.50. Most certainly, the Village does not have this amount of capital available. Freeburg would like to pursue a low interest loan from the IEPA Revolving Loan Program to finance the proposed debt service. Assuming that the Village finances the total cost of construction, the annual debt service would be as follows:

ESTIMATED ANNUAL COST OF DEBT SERVICE

The cost of the debt service assumes:

1. The proposed IEPA Low Interest Loan will be for $9,903,987.50
2. The loan will be retired over Twenty (20) year life of the project.
3. The annual interest rate will be 1.76% compounded semiannually

$$\text{Annual Estimated Principal \& Interest Payments} = \frac{\$9{,}903{,}987.50\ (0.0088)^{*}(1.0088)^{40}}{(1.0088)^{40} - 1}$$

$$= \$\ 252{,}091.92 \quad \text{semiannually}$$

Total Annual Principal and Interest Payment: **= $ 504,183.85**

Operations, Maintenance and Replacement Costs

With the enlarged capacity of the proposed plant and replacement account obligations, the annual estimated cost of O, M & R is $677,772.00 which does not include new debt service. C, above, describes all the items contributing to the O, M & R and Debt Service:

Projected Sewer Rates Necessary to Own and Operate the Proposed Facility

Many municipalities base their rate on a fixed charge plus a charge per gallon or per cubic feet for customers per billing period. Currently, the monthly charges for residential customers inside the Village are a $5.00 facility charge, a minimum charge of $7.00 for the first 1,000 gallons of usage, and $7.00 / 1,000 gallons of water consumption over 1,000 gallons. The monthly charge to residential customers outside of the Village are a $7.00 facility charge, a minimum charge of $8.00 for the first 1,000 gallons of usage, and $8.00 / 1,000 gallons of water consumption over 1,000 gallons.

Based on the data presented in this report, customers of the Village of Freeburg consume an average of 4,200 gallons of water per month per customer. The table below shows two different scenarios if different loan periods are used. To finance the total estimated annual cost, several preliminary user charge methods shall be examined:

A. All users pay a flat fee that covers 100% of the loan payment necessary to repay the loan. The Cost per 1,000 finances the OMR costs.

100% Debt Service Flat Fee

Semi- Annual Payment	Loan Amount	Semi-Annual Interest Rate	Payments	All Users pay 100% Debt Service per month*	OMR Cost per 1,000 Gallons	Average Bill - 3,000 gallons per month	Average Bill - 6,000 gallons per month	Average Bill - 10,000 gallons per month
$252,091.92	$9,903,987.50	0.88%	40	$ 25.45	$ 8.11	$ 49.78	$ 74.11	$ 106.55
$169,535.16	$9,903,987.50	0.88%	60	$ 17.11	$ 8.11	$ 41.44	$ 65.77	$ 98.21

B. All users pay a flat fee that covers 75% of the loan payment necessary to repay the loan. The Cost per 1,000 gallons finances the OMR costs and the remaining debt service payment

75% Debt Service Flat Fee

Semi- Annual Payment	Loan Amount	Semi-Annual Interest Rate	Payments	All Users pay 75% Debt Service per month*/**	Additional Cost per 1000 gallons	Total Cost per 1,000 Gal Including OMR Costs	Average Bill - 3,000 gallons per month	Average Bill - 6,000 gallons per month	Average Bill - 10,000 gallons per month
$252,091.92	$9,903,987.50	0.88%	40	$ 19.09	$ 1.51	$ 9.62	$ 47.94	$ 76.79	$ 115.27
$169,535.16	$9,903,987.50	0.88%	60	$ 12.84	$ 1.01	$ 9.12	$ 40.21	$ 67.58	$ 104.08

C. All users pay a flat fee that covers 50% of the loan payment necessary to repay the loan. The Cost per 1,000 gallons finances the OMR costs and the remaining debt service payment

50% Debt Service Flat Fee

	Semi- Annual Payment	Loan Amount	Semi-Annual Interest Rate	Payments	All Users pay 50% Debt Service per month*/**	Additional Cost per 1000 gallons	Total Cost per 1,000 Gal Including OMR Costs	Average Bill - 3,000 gallons per month	Average Bill - 6,000 gallons per month	Average Bill - 10,000 gallons per month
20 yr	$252,091.92	$9,903,987.50	0.88%	40	$ 12.72	$ 3.02	$ 11.13	$ 46.10	$ 79.48	$ 123.98
30 yr	$169,535.16	$9,903,987.50	0.88%	60	$ 8.56	$ 2.03	$ 10.14	$ 38.97	$ 69.39	$ 109.94

#12 plus

D. All users pay a flat fee that covers 25% of the loan payment necessary to repay the loan. The Cost per 1,000 gallons finances the OMR costs and the remaining debt service payment

25% Debt Service Flat Fee

Semi- Annual Payment	Loan Amount	Semi-Annual Interest Rate	Payments	All Users pay 25% Debt Service per month*/**	Additional Cost per 1000 gallons	Total Cost per 1,000 Gal Including OMR Costs	Average Bill - 3,000 gallons per month	Average Bill - 6,000 gallons per month	Average Bill - 10,000 gallons per month
$252,091.92	$9,903,987.50	0.88%	40	$ 6.36	$ 4.52	$ 12.63	$ 44.26	$ 82.17	$ 132.70
$169,535.16	$9,903,987.50	0.88%	60	$ 4.28	$ 3.04	$ 11.15	$ 37.74	$ 71.19	$ 115.80

With regard to rate structure "A", all customers would pay the same fixed rate regardless of usage. This would place a much higher burden on residential users who use lower volumes than commercial customers.

Rate structures "B", "C" and "D" place a higher burden on customers who use much larger volumes of water per month. Rate Structure "C" seems to be a more fair distribution for all customers in the Village and was used to project future operating revenue.

Assuming an annual usage of 83,585,000 gallons and 1,651 customers, the following is an estimate of the proposed revenue.

Village of Freeburg – Estimated Proposed Revenue with Rate Increase	Table 10D-1
Operating Revenue	
Charges for Sewer Service	$1,174,020.00
Tap-on Fee Charges	$10,000.00
Total Operating Revenue	**$1,184,020.00**
Other Revenue	
Interest Income	$10,000.00
Total Revenue	**$1,189,020.00**

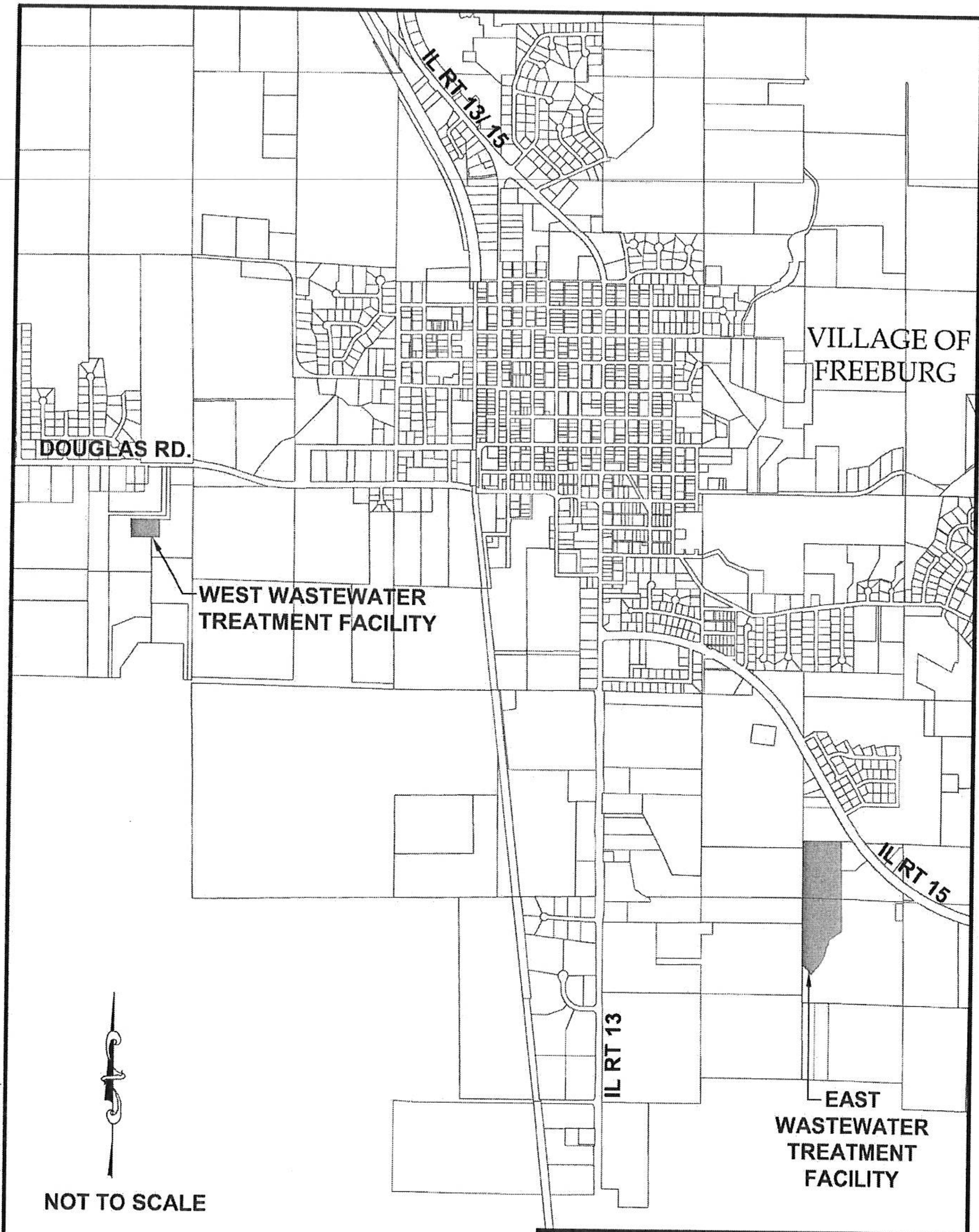
XI. PROJECT PLAN IMPLEMENTATION SCHEDULE

A. West Wastewater Treatment Facility Schedule

The Village would like to proceed with this project as soon as possible. An implementation schedule for the project is presented in Table 11A-1. This schedule delineates steps from design through facilities start-up.

Village of Freeburg – Preliminary Project Schedule	Table 11A-1
Field Surveying and Investigation	May 2018
Preliminary Design	November 2018
Final Design	May 2019
Permitting	June 2019
Construction Bidding and Award of Contract	October 2019
Infrastructure Construction	December 2019
Infrastructure Completion	December 2021

Appendix



THOUVENOT, WADE & MOERCHEN, INC.
ENGINEERS ◆ SURVEYORS ◆ PLANNERS
TWM

EXHIBIT 1 - FREEBURG PROJECT LOCATION MAP

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Plotted By: rmasterson 12/08/2017 12:34pm