City of North Vernon, Indiana

Preliminary Engineering Report
Long Term Control Plan Project

November, 2012

(Revision: February 22, 2013)

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1. GENERAL

Combined sewers are those that convey both sewage and storm runoff. During dry weather, combined sewers carry sewage from domestic, commercial, and industrial sources to the wastewater treatment plant (WWTP). During wet weather events, the same sewers also convey storm water and surface runoff collected from streets, lawns, parking lots, parks, etc. to the WWTP. When the capacity of the sewer system or the WWTP is exceeded, such as during heavy rainfall events, the excess water is occasionally allowed to overflow directly to surface water bodies, including the Vernon Fork of the Muscatatuck River, through the Combined Sewer Overflow (CSO) outfall listed in the City of North Vernon's NPDES Permits.

Combined sewer overflow discharges can potentially contain pollutants normally found in untreated sewage, including bacteria, pathogens, industrial pollutants, suspended solids, oil and grease, and other contaminants into rivers and streams. These contaminants can elevate bacteria levels and reduce oxygen (due to the oxygen demanding matter) in the water, creating conditions harmful to aquatic habitats, aquatic life and humans. CSO flows can also contain a variety of pollutants contributed from urban storm water runoff, including automotive fluids, household chemicals, and floating sewage and debris. Because of the potential presence of these substances, combined sewer overflows, in addition to storm water runoff and upstream pollution, can cause a variety of adverse impacts on the quality of the surface waters as well as the residents of the city.

It is proposed in this report to implement a series of improvements to the existing wastewater system as per the City of North Vernon's approved Long Term Control Plan (LTCP). This plan was revised February 27, 2012 and approved by Indiana Department of Environmental Management (IDEM) on May 2, 2012. After completion of the improvements associated with this Preliminary Engineering Report (PER), the city will have fulfilled its obligation as set forth in the LTCP to address sewage overflows at the project areas.

The project alternatives are divided into those associated with the Collection System and those associated with the Wastewater Treatment Plant. These alternatives were evaluated to determine the most cost-effective solution to the current and future needs for the project area.

The existing Collection System consists of multiple lift stations and their corresponding force mains. During significant rain events, surcharging occurs in the Northwest Lift Station and the Southwest Lift Station. Using Flow Data from in-place monitors in the system, theoretical models were developed to accurately characterize the systems. This can then be evaluated with simulated rain events to draw conclusions. Various alternatives were considered. The estimated project cost of the selected alternatives are $1,036,292.

The WWTP contains the one permitted CSO in the city. During significant rain events, many times throughout the year, this CSO experiences overflows. In 2011, there were 26 overflows. Similar to the evaluation of the lift stations, a theoretical model was developed using gathered flow data. The treatment system alternates considered address the rain event flows that the city experiences that currently burden the facility and cause CSO overflows. The selected alternative was the Mechanical Wet Weather Treatment – Vortex High Rate Clarifier. The estimated project cost of the proposed alternative is $5,172,420.

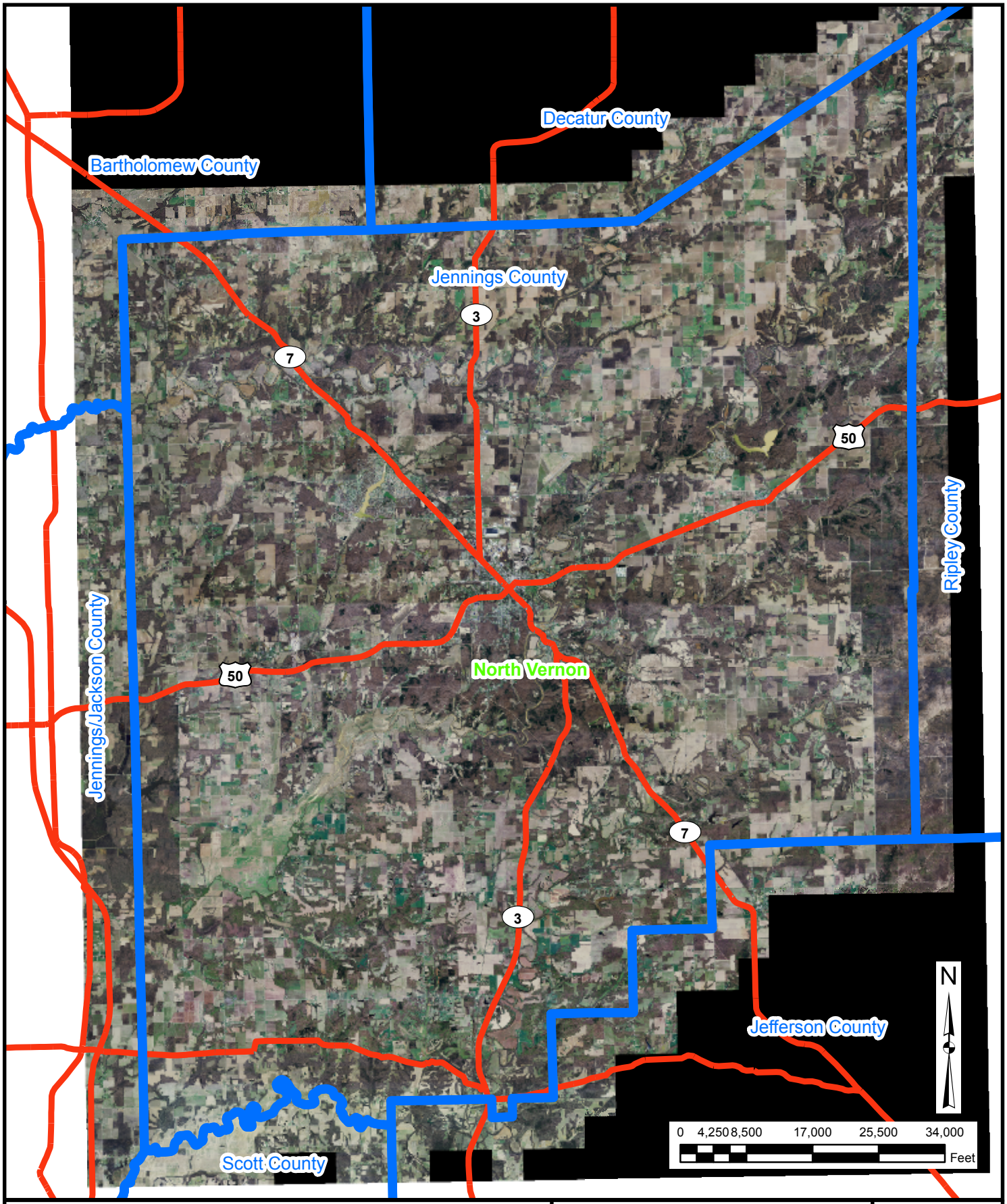
2. PROJECT PLANNING AREA

A. Location

The City of North Vernon is located in southeastern Indiana in Jennings County (See **Figure 1**). The City of North Vernon's wastewater is treated by a 2.2 MGD (average design flow) activated sludge type wastewater treatment plant with a peak design flow of 4.76 MGD. The wastewater treatment plant is regulated by the Indiana Department of Environmental Management (IDEM) under NPDES Permit No. IN0020451. (See **Appendix A**). The treatment plant discharges to the Vernon Fork of the Muscatatuck River.

The North Vernon collection system has approximately 38 miles of pipe, of which approximately 60% is combined. Six combined sewer overflow outfalls were removed from the collection system with the installation of storm sewers and other system improvements during the 1970s, leaving just one remaining overflow outfall at the wastewater treatment plant. This outfall is identified as CSO Outfall 002 and is located adjacent to the WWTP Outfall 001.

Figure 2 shows the three (3) project areas as they are located in the City of North Vernon.



LEGEND

Service Area

Highway

County Boundary

County Map
North Vernon, Indiana

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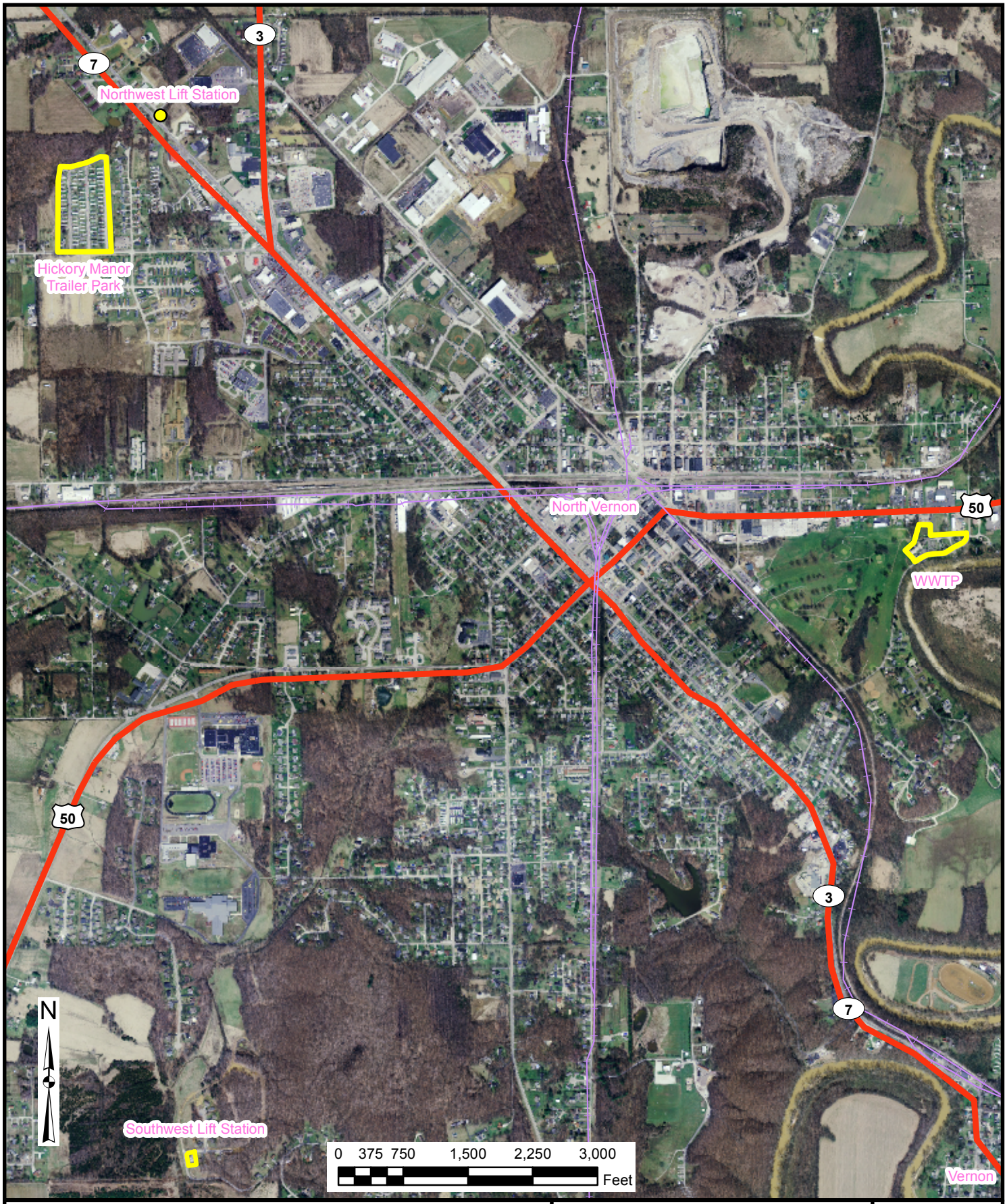
FIGURE: 1



LEGEND

Railroad

Highway

City Map
North Vernon, Indiana

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B. Environmental Resources Present

The proposed project is located within the boundaries of the city limits of North Vernon and also primarily located on, or adjacent to, previously disturbed land. No significant direct or indirect impacts to the environmental resources are anticipated. Information in greater detail with regard to environmental impacts can be found in the Environmental Report that has been prepared for this project.

C. Growth Areas and Population Trends

The North Vernon population is approximately 6,728 (2010 U.S. Census). The City of North Vernon has experienced a 3.3% increase in population from 2000 to 2010. This has been a typical population trend for most rural Indiana communities over the same time period, driven by the economy and availability of employment.

The following **Table 1** provides population statistics and projections for the City of North Vernon through the year 2040:

Table 1 Population Statistics and Projections

YEAR	POPULATION
1990	5,311
2000	6,515
2005	6,347
2008	6,296
2010	6,728
2020	6,950 (Projected)
2030	7,179 (Projected)
2040	7,394 (Projected)

Source: www.census.gov

The existing wastewater sewer system services 1,989 residential and 395 commercial users. The top ten largest contributors consist of the following:

- Sunoco/Hilex
- Lowe's
- Town of Vernon
- NVIC
- Davita, Inc.
- St. Vincent Hospital
- Metaldyne
- Martinrea
- Atmosphere Annealing
- Webster Packaging

3. EXISTING FACILITIES

A. Location Map

The proposed project is located in three (3) areas of the City of North Vernon, Center Township, Jennings County. One of these areas is associated with the problems at the Northwest Lift Station, one at the Southwest Lift Station, and one area is associated with the permitted CSO at the WWTP. These areas are described below:

1. Northwest Lift Station

   This lift station is also identified as Lift Station No. 10 and located in the northwest part of the city along State Road 7. See **Figure 2**.

2. Southwest Lift Station

   The Southwest Lift Station, also identified as Lift Station No. 22, is located in the southwest part of the city along West Base Road. It services all of the "Southwest Sub-basin" with an approximate area of 988 acres. This sub-basin is almost entirely residential development. See **Figure 2**.

3. Wastewater Treatment Plant (CSO Outfall 002)

   This facility is located in the southeast portion of the city and receives flow from all of the sub-basins. See **Figure 2**.

B. History

The North Vernon Wastewater Collection System was originally built in the 1930s with the construction of the "A" trunk sewer line and its tributary sewers. In the late 1950s, the City expanded both its collection and treatment systems by constructing approximately 22,500 linear feet of 12 inch to 36 inch interceptor sewer, two (2) new lift stations, a new "Main Intercepting Chamber", and a new 24 inch interceptor sewer. Seven (7) overflows were constructed: one (1) at each of the two main lift stations; five (5) in the collection system; including the one (1) at the "Main Intercepting Chamber" and one (1) at the treatment plant. The sewers built during this project were designed and constructed as combined sewers.

The City expanded and upgraded the treatment and collection system again in the late 1970s. Overflow structures were removed in the collection system by constructing storm sewers to eliminate the storm water inlets connected to the existing combined sewers. The "N" line was completely replaced and increased in size to handle the discharge from a new 1,400-gpm lift station. The Main Intercepting Chamber was modified to eliminate an overflow by the installation of a parallel 24-inch relief sewer from the chamber to the treatment plant. A

new storm water pump station and 1,000,000 gallon equalization basin were constructed to handle excess wet weather flow. An overflow from the storm water pump station wet well was constructed that is now designated as CSO No. 1 (Outfall 002), the city's only remaining overflow.

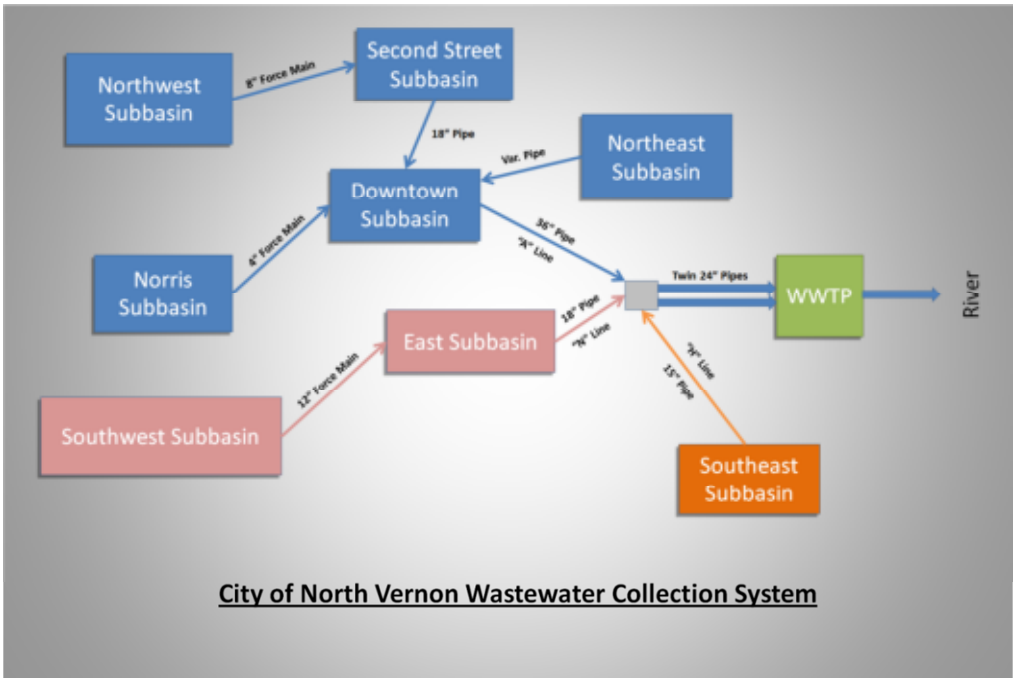
Three major trunk lines serve North Vernon. Each of these trunk lines represents the major service areas within the City. The "A" line collects flow from the northern portion of North Vernon and the downtown area. The "H" line serves the southern portion of North Vernon and the Town of Vernon. The "N" line serves the central portion of North Vernon. The following **Table 2** summarizes the three major trunk lines and sub basins contributing to each trunk line.

Table 2: Major Basins and Sub-Basins

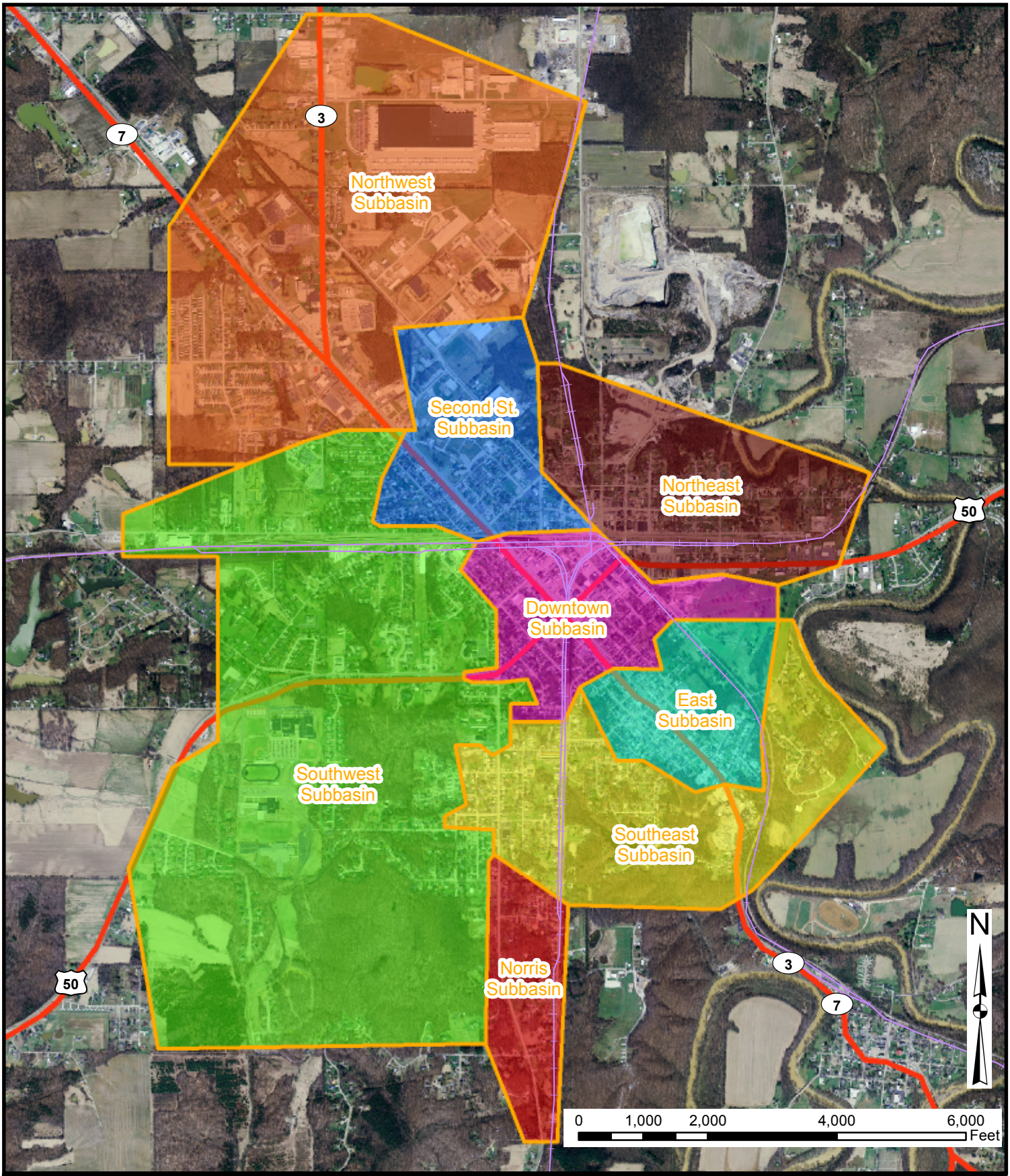
Trunk Line	Sub-Basin	Type of System	Service Area (Acres)
"A" Line	Downtown	Combined	171
"A" Line	Norris Avenue	Separate	101
"A" Line	Northeast	Combined	256
"A" Line	Northwest	Separate	704
"A" Line	Second Street	Combined	175
"N" Line	East	Combined	130
"N" Line	Platter	Combined	202
"N" Line	U.S. 50 West	Separate	176
"H" Line	Southwest	Combined	319
"H" Line	Long Street	Combined	384
"H" Line	Town of Vernon	Separate	128

The following **Figure 3** and **Figure 4** illustrate the wastewater collection system watersheds.

Figure 3. North Vernon Sewershed



Efforts to reduce inflows and infiltration into the system have been and continue to be made. To date, approximately $518,655 has been spent on 3,695 feet of sewer replacements and repairs along with the repair or replacement of fifteen (15) manholes, and an additional 5,317 feet of repair or replacement have been identified at an estimated cost of $505,910. The collection system investigation and evaluation is ongoing with additional repairs and replacements expected.



LEGEND

Railroad

Sewershed Areas

Highway

Sewershed Map
North Vernon, Indiana

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FIGURE: 4

The WWTP is the final component of the North Vernon wastewater system. It was originally constructed in 1934, and modified in 1979 and 1997. The improvements in 1997 involved new secondary clarifiers, a new intermediate pump station, replacement of diffusers, and other WWTP components. The headworks of the plant was renovated and completed in 2012 and serves to maximize the flow to the secondary treatment processes. This project included a new mechanically cleaned bar screen, new grit removal structure, and a flow control gate to accurately maximize and manage the flows entering the WWTP.

C. Condition of Facilities

This project consists of improvements to the existing collections system as well as the WWTP. Two (2) other lift stations that surcharge, the Norris L.S. and the Northeast L.S., are being addressed by the city independently of this PER and, therefore, are not included. The following describe the existing conditions of the subject facilities:

1. Northwest Lift Station

   The existing lift station consists of two (2) wet wells. The first wet well consists of one (1) pump rated at 20 hp and the associated 6" force main that terminates at a manhole located on the south edge of City Park and approximately 3,300 feet in length. This portion of the lift station was installed in 1978. The second wet well includes two (2) pumps rated at 15 hp and its associated 8" force main that terminates into a manhole located on Second Street. This force main is approximately 4,800 feet in length. This portion of the lift station was installed in 1995.

   This lift station receives flow from the "Northwest Sub-basin", with a service area of approximately 275 acres. It is mostly rural with a section of residential and some industrial development.

   During significant rain events, this lift station experiences surcharging (overflowing condition). This data is gathered by city personnel during these rain events (See **Appendix B**) and reported to IDEM.

2. Southwest Lift Station

   The existing lift station consists of one (1) wet well, three (3) pumps each rated at 25 hp, and the associated 12" force main that terminates at a manhole located at the intersection of Meloy Street and South State Street for an approximate length of 11,400 feet. This lift station and force main was installed in 2000.

   During significant rain events, this lift station experiences surcharging (overflowing condition). This data is gathered by city personnel during these rain events (See **Appendix B**) and reported to IDEM.

3. Wastewater Treatment Plant (CSO Outfall 002)

The City of North Vernon's wastewater is treated by an activated sludge type wastewater treatment plant. The facility has an average daily flow of 2.2 million gallons per day (MGD), a peak hydraulic design flow of 4.76 MGD, and an apparent maximum hydraulic capacity of 6.0 MGD. Wet weather flows are pumped to an Equalization Basin with a capacity of 1 million gallons. During significant rain events, flows in excess of these capacities are diverted to the permitted overflow (No. 002) and subsequently into the Vernon Fork of the Muscatatuck River. This data is gathered by city personnel and reported to IDEM (See **Appendix B**). While the current system's wet weather capability is adequate for smaller rain events, it cannot provide treatment for flows resulting from the larger rain events that is required from IDEM. **Table 3** summarizes some representative rain events and the corresponding flows and volumes entering the WWTP.

Table 3. Rain Events, WWTP

Rain Event	Rainfall	Actual Data (Peak Flow Rate)	Actual Data (Volume)
April 27th, 2011	0.51 inches, ½ hour	19 MGD	8.19 MG
June 21st 2011	0.60 inches, ½ hour	9.8 MGD	2.10 MG
December 20th 2011	0.54 inches, ½ hour	19 MGD	5.27 MG

As described in the North Vernon LTCP, this permitted overflow, the only remaining one in the city, must be addressed. No actions taken to alleviate the current situation will result in continued combined sewer overflows and pollution to the Muscatatuck River. The alternatives considered for the WWTP in this PER are summarized in **Section 5**.

D. Financial Status of Existing Facilities

Included in **Appendix C** is the City of North Vernon financial information.

4. NEED FOR THE PROJECT

A. Health, Sanitation and Security

Much of the existing sanitary sewer collection system in the City of North Vernon is combined storm and sanitary sewers. During significant rain events, the associated wet weather flows result in overflows in the system.

The collection system experiences surcharging (overflows) in the existing Northwest Lift Station and the Southwest Lift Station due to large wet weather flows. The surcharging occurs at the top of the lift station through the access covers and subsequently into the surrounding areas. This data is gathered by city personnel during these rain events (See **Appendix B**) and reported to IDEM. This raw sewage presents a negative health and sanitation problem for the local residents. If action is not taken to prevent this current situation, continued negative effects will impact the health and welfare of the residents of the city. In addition, these discharges are not permissible by IDEM.

The WWTP experiences overflows in the one (1) permitted overflow as a result of significant rain events. During these large rain events, flows in excess of the plant capacities are diverted and subsequently flow into the Vernon Fork of the Muscatatuck River. This data is gathered by city personnel and reported to IDEM (See **Appendix B**). Continued operation of the existing system will result in raw sewage to periodically be discharged into the river and negatively impact the residents of the city as well as downstream communities, such as the City of Vernon, to the south. The elimination of this overflow is stipulated by IDEM and addressed in the city's LTCP.

B. System Operation and Management (O&M)

In the City of North Vernon's LTCP, efforts to identify and eliminate infiltration in the collection system have been and continue to be implemented with the aid of such methods as sewer video recording. To date, approximately $518,655 has been spent by the city on 3,695 feet of sewer replacements and repairs along with the repair or replacement of fifteen (15) manholes. An additional 5,317 feet of repair or replacement for future have been identified at an estimated cost of $505,910. These improvements are not limited to any one sub-basin, but are city-wide, identification of which is made through smoke testing and video. Combined with $78,218 for the cost and maintenance of video equipment, the total projected costs are estimated to reach $1,102,783. The collection system investigation and evaluation is ongoing with additional repairs and replacements expected.

The problem with the existing Northwest Lift Station, as described in the above sections, presents a unique situation. The collected flow data suggest that replacement of the existing collection system at the Hickory Manor Trailer Park to reduce infiltration and inflows are the

solution (large differences between the average daily flows and the wet weather flows). Collected flow data from the downstream manhole is included in **Appendix B**.

The existing wastewater treatment plant is inadequate for the wet weather flows associated with significant rain events. Despite improvements to the existing collection system as described previously, significant flows from the combined sewer system will still burden the WWTP. Currently, the system manages wet weather flows with pumps and a 1 million gallon storage basin. When flows exceed the plant flow and the capacity of the pumps to the storage basin, an overflow to the river occurs. This can happen multiple times throughout the year; 26 overflow events occurred in 2011.

C. Growth

The projected growth of the City of North Vernon is described in **Table 1**. The proposed facilities as described in this PER all address the capabilities of the systems to manage wet weather flows. While considering the growth of the population of the city and its associated increase in anthropogenic sewer flows, emphasis is made on the significantly larger flows due to wet weather. The improvements at the WWTP are intended to manage wet weather flows and are independent of any effects due to population increases. The increased dry weather flows that may occur as a result of population increases are not in the scope of the city's CSO LTCP, but will be addressed separately in future project(s).

5. ALTERNATIVES CONSIDERED

The alternatives evaluated are divided into those associated with the Collection System and those associated with the Wastewater Treatment Plant. These alternatives were evaluated to determine the most cost-effective solution to the current and future needs for the project area. Construction bid prices on similar projects and equipment supplier budgets were used to derive the estimated costs for the various alternatives. Non-Construction Costs include costs such as Design, Construction Administration, Inspection, Legal services, Bond Administration, etc.

The Collection System proposals consist of two (2) alternates associated with the Northwest Lift Station (**Alternative "A" Hickory Manor Trailer Park: Low Pressure Sewers with Grinder Pumps System** and **Alternative "B" Hickory Manor Trailer Park: Gravity Sewers**) and two (2) associated with the Southwest Lift Station (**Alternative "C" Southwest Lift Station Wet Weather Pump Station** and **Alternate "D" Southwest Lift Station In-Line Storage**).

The proposals associated with the WWTP consist of three (3) alternates: **WWTP Alternate "A" Mechanical Wet Weather Treatment Facility – Chemically Enhanced High Rate Clarifier with Ultraviolet Disinfection**, **WWTP Alternate "B" Mechanical Wet Weather Treatment Facility – Vortex High Rate Clarifier with Chlorination Disinfection**, and finally **WWTP Alternate "C" Constructed Wetland**.

As described in **Section 4**, the City of North Vernon's efforts to identify and eliminate infiltration in the collection system have been and continue to be implemented with the aid of such methods as sewer video recording.

Collection System Alternatives

A. Alternative "A" Hickory Manor Trailer Park: Low Pressure Sewers with Grinder Pumps System

Description.

The Northwest Lift Station, also identified as Lift Station No. 10, is located in the Northwest Sub-basin, along State Road 7. This lift station services both residential and commercial users for an area of approximately 275 acres.

During significant rain events, this lift station experiences surcharging. This data is gathered by city personnel during these rain events (See **Appendix A**). A large portion of the flow to this lift station during wet weather events originates from the Hickory Manor Trailer Park.

The Hickory Manor Trailer Park is an existing development consisting of ninety (90) lots, as can be seen from **Figure 5**. One trailer is located on each lot with the associated utility hookups (water, gas, electric, and sanitary sewer). The park consists of three connected drives and utility easements located in the common areas between successive rows of lots.

The park currently has a conventional gravity sanitary sewer system to which each lot connects and discharges sewage. Through smoke testing and flow monitoring, it has been determined that this sewer system experiences significant wet weather infiltration and burdens the Northwest lift station, to which it flows. This excessive infiltration can contribute up to a third of all of the flow to this lift station during rain events. The existing sewers are failed in many areas, blocking camera usage and making rehabilitation (lining or pipe bursting, for example) unfeasible. Due to these poor conditions, the sewers must be replaced. Note that the existing sewer lines in blue color on **Figure 6** will not be replaced, they were replaced in a recent project.

This alternative involves the replacement of the existing sanitary sewers with a low pressure system. Low pressure sewers with grinder pumps use small pumps located in pump pits connected to one or more building laterals; one for every two lots, in this case. The pumps grind the sewage solids into small particles and then discharge into a collection system consisting of small pressure force mains, generally 1-¼" to 4" in diameter. The low pressure sewers follow the existing ground just below the frost line. Power for the pumps will come from a metered drop from the existing power pole along the easement.

See **Figure 6** for a preliminary layout. Construction cost estimates and O&M costs for this collection alternative are given by **Table 4** and **Table 5**, respectively.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

LEGEND

- Existing Manholes
- Existing Sewer

Northwest Lift Station Hickory Manor Existing
North Vernon, IN

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FIGURE: 5

LEGEND

- Grinder Pump
- Pressure Line
- Proposed Manholes
- Proposed Sewer
- Existing Manholes To Remain
- Existing Sewer To Remain

Northwest Lift Station - Hickory Manor Proposed
North Vernon, IN

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FIGURE: 6

Environmental Impacts.

The improvements associated with this alternative are located within easements and future right-of-ways. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Construction Problems.

This alternative does involve some complications to construction. Because access for this construction will be within congested easements (existing utilities), limited disturbances will be required.

Cost Estimate.

Table 4 summarizes the costs of this alternative.

Table 4. Alternative "A" Hickory Manor Trailer Park: Low Pressure Pumps System Cost

Item:	Quantity	Unit	Unit Cost	Cost
2" Low Pressure Sewer	1,900	Feet	$35	$66,500
8" Sewer Pipe (Gravity)	370	Feet	$40	$14,800
Sanitary Manhole	2	Each	$3,500	$7,000
Grinder Pump Assemblies	37	Each	$6,000	$222,000
6" Service Lateral	700	Each	$40	$28,000
Service Line Valves, etc.	37	Each	$300	$11,100
Electrical Services	37	Each	$500	$18,500
Bypass Pumping	1	Lump Sum	$7,000	$7,000
Traffic Control and Protection	1	Lump Sum	$7,500	$7,500
Mobilization/Demobilization	1	Lump Sum	$30,000	$30,000
			SubTotal:	$412,400
			Contingency (10%):	$41,240
			Total Construction Cost:	**$453,640**
			Non-Construction Cost:	$95,264
			Total Project Cost:	**$548,904**

Table 5. Alternative "A" Hickory Manor Trailer Park: Low Pressure Pumps System O&M Cost

Item	Annual Cost
Power	$1,222
Labor	$1,300
Maintenance	$440
Replacement (Short-Lived Assets)	$1,933
Total Annual O&M Costs:	**$4,895**

Advantages/Disadvantages.

With the implementation of this work, wet weather flows will be significantly reduced to the Northwest Lift Station. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The disadvantage to this system is the relatively high operation and maintenance costs. The individual grinder pumps require replacement after their useful life. Pump failure can result in environmental and public health hazards due to sewage overflows.

B. Alternative "B" Hickory Manor Trailer Park: Gravity Sewers

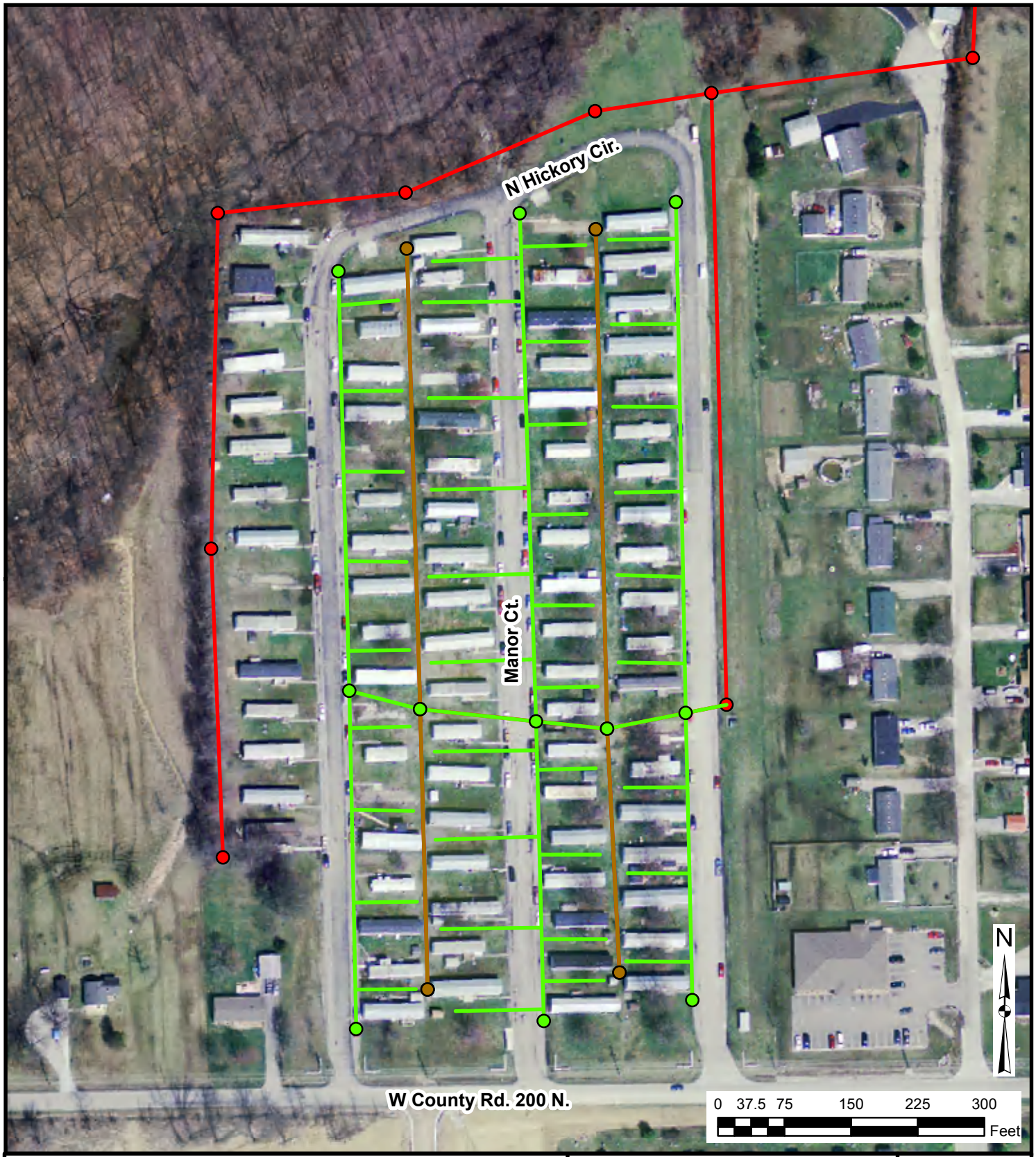
Description.

This Description is identical to the narrative of the above subsection for **Alternative "A" Hickory Manor Trailer Park: Low Pressure Sewers with Grinder Pumps System**. As such, it will not be repeated here.

This alternative involves the installation of a new sanitary sewer system to replace the existing, failing sewer system. The mainline piping will be constructed beside the roadways of the trailer park. The service laterals will be extended from the main line piping between the trailers. The existing piping and manholes will be abandoned. **Figure 7** illustrates this alternative.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.



LEGEND

- Proposed Gravity Manholes
- Proposed Gravity Sewers
- Existing Manholes (To Be Abandoned)
- Existing Sewer (To Be Abandoned)
- Existing Manholes
- Existing Sewer

Northwest Lift Station - Gravity Sewer Alternative
North Vernon, IN

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FIGURE: 7

Environmental Impacts.

The improvements associated with this alternative are located within easements and future right-of-ways. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Construction Problems.

This alternative does involve some complications to construction. The limited workspace between the trailers will slow production. Coordination with the residents of the trailer park will be necessary.

Cost Estimate.

Table 6 summarizes the costs of this alternative.

Table 6. Alternative "B" Hickory Manor Trailer Park: Gravity Sewers Cost

Item:	Quantity	Unit	Unit Cost	Cost
8" Sewer Pipe (Gravity)	3,135	Feet	$40	$125,400
Granular Backfill	1,500	CY	$25	$37,500
Sanitary Manhole	9	Each	$4,000	$36,000
6" Service Lateral	2,906	Feet	$28	$81,368
6" Service Lateral Dir. Bore	360	Feet	$38	$13,680
Lateral Connection	37	Each	$500	$18,500
Asphalt Street	500	Tons	$100	$50,000
Grass Restoration	3,300	SY	$1	$3,300
Traffic Control and Protection	1	Lump Sum	$7,500	$7,500
Mobilization/Demobilization	1	Lump Sum	$30,000	$30,000
			SubTotal:	$403,300
			Contingency (10%):	$40,330
			Total Construction Cost:	**$443,630**
			Non-Construction Cost:	$88,726
			Total Project Cost:	**$532,356**

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Advantages/Disadvantages.

With the implementation of this work, wet weather flows will be significantly reduced to the Northwest Lift Station. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The advantage to this alternative is low Operation and Maintenance Costs. In addition, the frequent point repairs to the existing system that currently burden the maintenance crew will be lessened.

The disadvantage to this system is the disturbance to the surroundings during construction. Coordination with the residents of the trailer park will be necessary.

C. Alternative "C" Southwest Lift Station Wet Weather Pump Station

The Southwest Lift Station, also identified as Lift Station No. 22, is located in the southwest part of the city along West Base Road. It services all of the "Southwest Sub-basin" with an approximate area of 988 acres. This combined sewer sub-basin consists almost entirely of residential development.

During significant rain events, this lift station experiences surcharging. This data is gathered and reported by city personnel during these rain events (See **Appendix B**).

Flow tests were conducted by the city personnel to establish the maximum output flow of the existing facility. After analysis it was determined that the associated force main, 12" in diameter, has capacity such that more flow can flow through it than what the existing pumps can produce.

This alternative involves the installation of a new lift station for the purpose of pumping the wet weather flows. This will increase the flow rate to better match the incoming flows.

As described in Section 4, the City of North Vernon's efforts to identify and eliminate infiltration in the collection system have been and continue to be implemented with the aid of such methods as sewer video recording and smoke testing. The collection system investigation and evaluation is ongoing with additional repairs and replacements expected.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

An important element in the analysis of the existing Wastewater Collection System is the development of an accurate theoretical model with which to draw conclusions. Wet weather flow rates and volumes were determined using the EPA approved XP-SWMM modeling program. This model was developed using flow data collected (analyzed with Flow Link Software) from city personnel in order to calibrate the model.

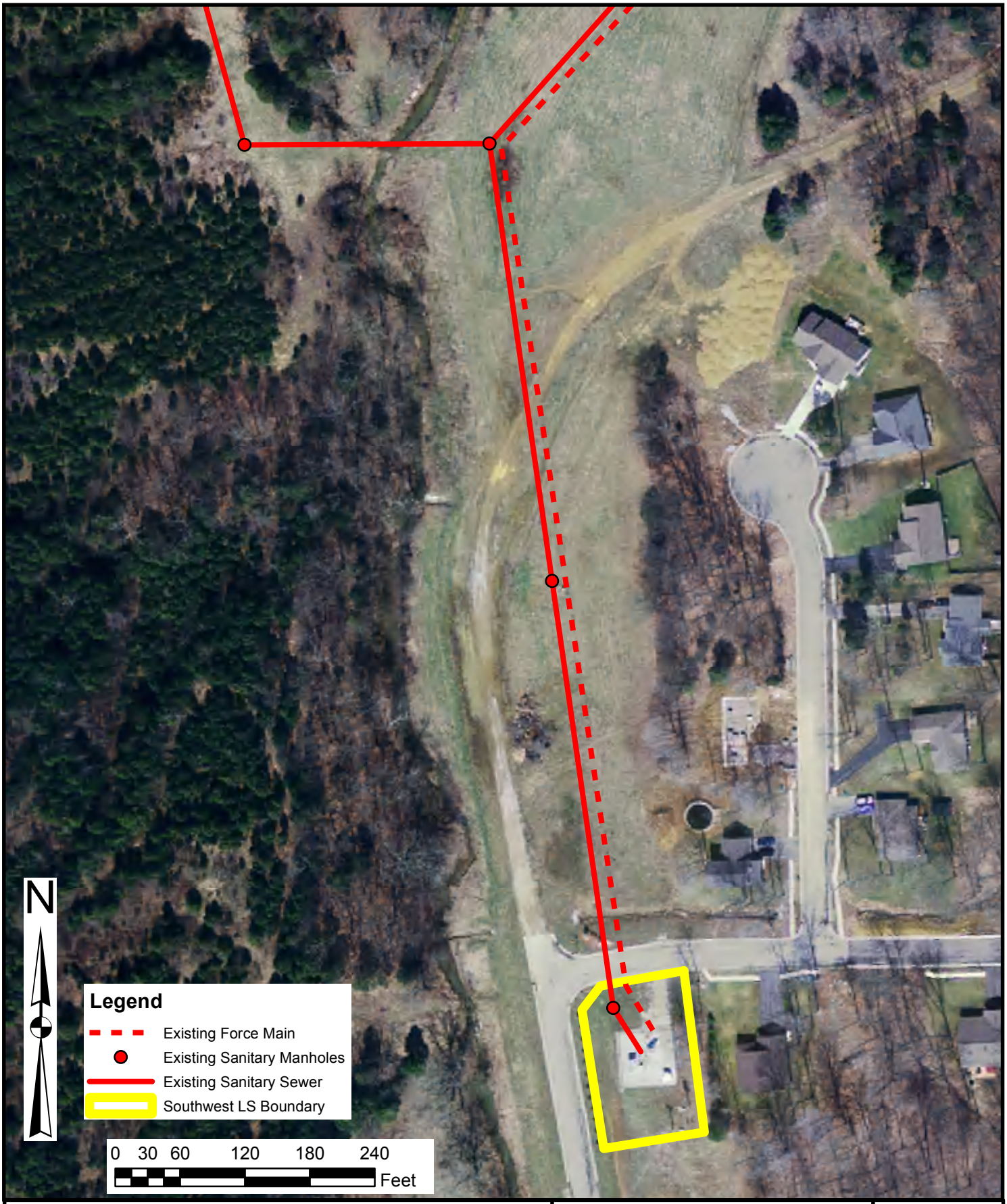
Flow monitoring has been installed at the upstream manhole from the lift station wet well. Real-time flow monitoring data has been and continues to be collected and analyzed to provide a more accurate understanding of the effects of wet-weather in this sub-basin. This data was subsequently used in the calibration of the XPSWMM model. This calibration to real data resulted in a model that includes all significant interceptors in the Southwest Sub-basin.

With the model calibrated, it can then be used to develop the effects of the required design rain event. This event is the 10 year, 1 hour.

An important consideration is the effect the additional wet weather flow will have on the receiving basin. The Southwest Lift Station force main discharges into a manhole located at the intersection of Meloy Street and South State Street, part of the "East Sub-basin". The additional wet weather flow that this alternative would provide, approximately 900 gallons per minute, enters this sub-basin and into the "N-Line" trunk line sewer with a diameter of 18". This trunk line sewer flows directly to the existing WWTP. A model was developed similar to that described above for the Southwest Sub-basin. The results indicate that the "N-Line" sewer will not be over-burdened by this additional flow from the Southwest Lift Station.

Map.

Figure 8 shows the existing conditions and **Figure 9** illustrates the proposed improvements.



Southwest Lift Station - Existing
North Vernon, IN

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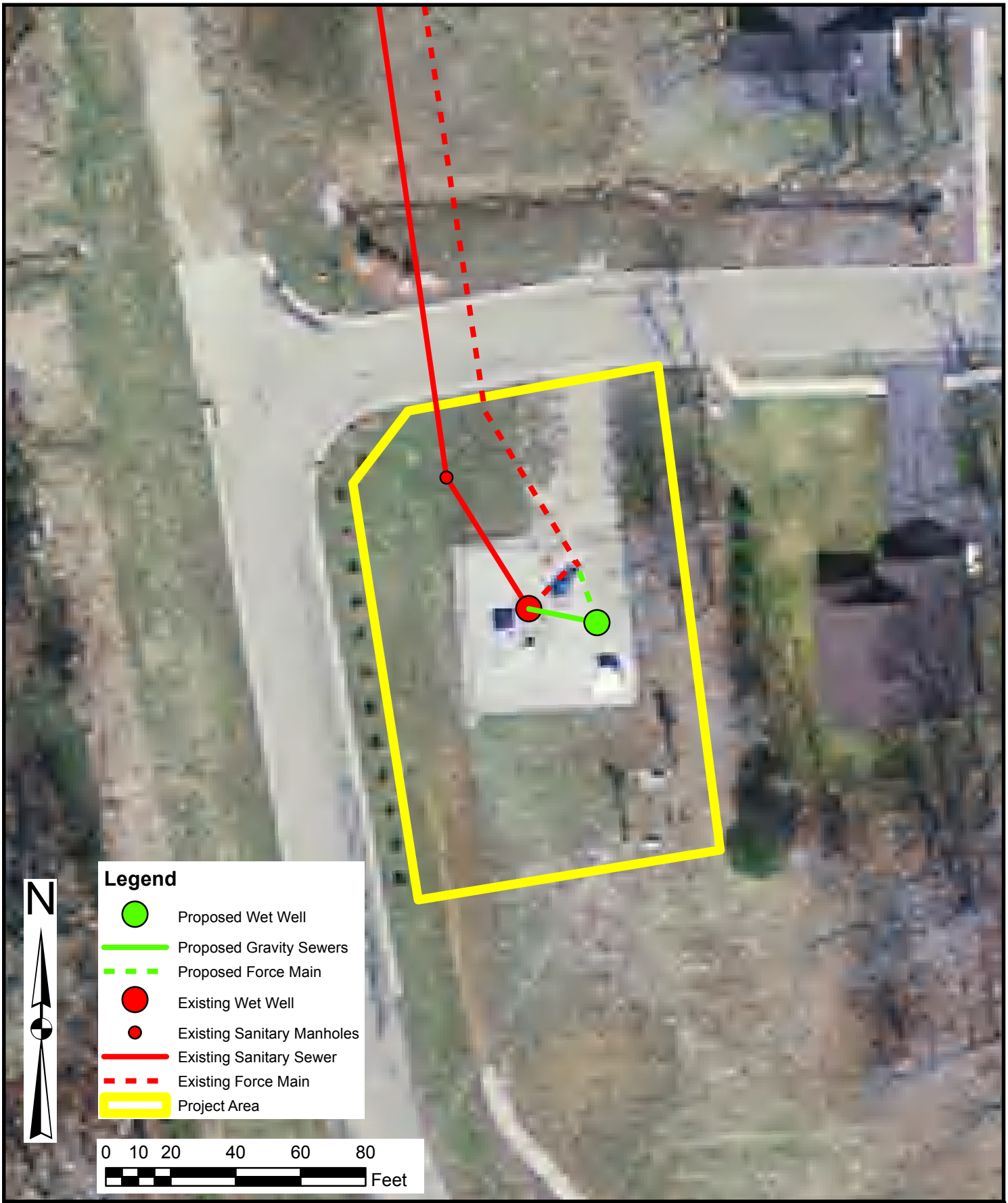
FIGURE: 8



Southwest Lift Station - Wet Weather Pump Station Alternative
North Vernon, IN

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FIGURE: 9

Environmental Impacts.

The improvements associated with this alternative are located within existing property owned by the City. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Construction Problems.

This alternative does involve some complications to construction. This lift station is an active facility. Coordination and planning will be necessary as well as possible bypass pumping to perform this work.

Cost Estimate.

Construction cost estimates for this collection alternative are given by **Table 7.**

Table 7. Alternative "C" Southwest Lift Station Wet Weather Pump Station Cost

Item:	Quantity	Unit	Unit Cost	Cost
Lift Station Pump (Package)	4	Each	$74,000	$296,000
Lift Station Piping	1	Lump Sum	$10,000	$10,000
Wet Well (Wet Weather)	1	Each	$40,000	$40,000
Bypass Pumping	1	Lump Sum	$10,000	$10,000
Site Concrete	1	Lump Sum	$15,000	$15,000
Seeding	1,111	SY	$2	$2,222
Fencing	150	Feet	$25	$3,750
Site Electrical/Instrumentation	1	Lump Sum	$100,000	$100,000
Mobilization/Demobilization	1	Lump Sum	$20,000	$20,000
			Subtotal:	$496,980
			Contingency (10%):	$49,698
			Total Construction Costs:	**$546,678**
			Non-Construction Costs:	$109,336
			Total Project Cost:	**$656,014**

Table 8. Alternative "C" Southwest Lift Station Wet Weather Pump Station O&M Costs

Item	Annual Cost
Power	$1,160
Labor	$5,000
Maintenance	$1,000
Replacement (Short-Lived Assets)	$17,000
Total Annual O&M Costs:	**$24,160**

Advantages/Disadvantages.

With the implementation of this work, significant wet weather flows to the Southwest Lift Station will be pumped. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The disadvantage to this alternative is the increased operation and maintenance costs. In addition, the larger pumps require an increased power to operate.

The advantage to this alternative is the ability to reuse the existing facilities. The existing wet well and valve vault will remain and used for the "low flow" conditions. The existing force main will be reused, handling low flows as well as the wet-weather flows.

D. Alternate "D" Southwest Lift Station In-Line Storage

The Southwest Lift Station, also identified as Lift Station No. 22, is located in the southwest part of the city along West Base Road. It services all of the "Southwest Sub-basin" with an approximate area of 988 acres. This combined sewer sub-basin consists almost entirely of residential development.

During significant rain events, this lift station experiences surcharging. This data is gathered and reported by city personnel during these rain events (See **Appendix B**).

This alternative involves the installation of two sections of twin 48" diameter pipes. This new piping will temporarily store the wet weather volume upstream of the Southwest Lift Station. After the initial "surge" of flow caused by the design rain event has occurred, this stored volume will flow to and be pumped by the existing lift station.

As described in Section 4, the City of North Vernon's efforts to identify and eliminate infiltration in the collection system have been and continue to be implemented with the aid of such methods as sewer video recording and smoke testing. The collection system investigation and evaluation is ongoing with additional repairs and replacements expected.

Design Criteria.

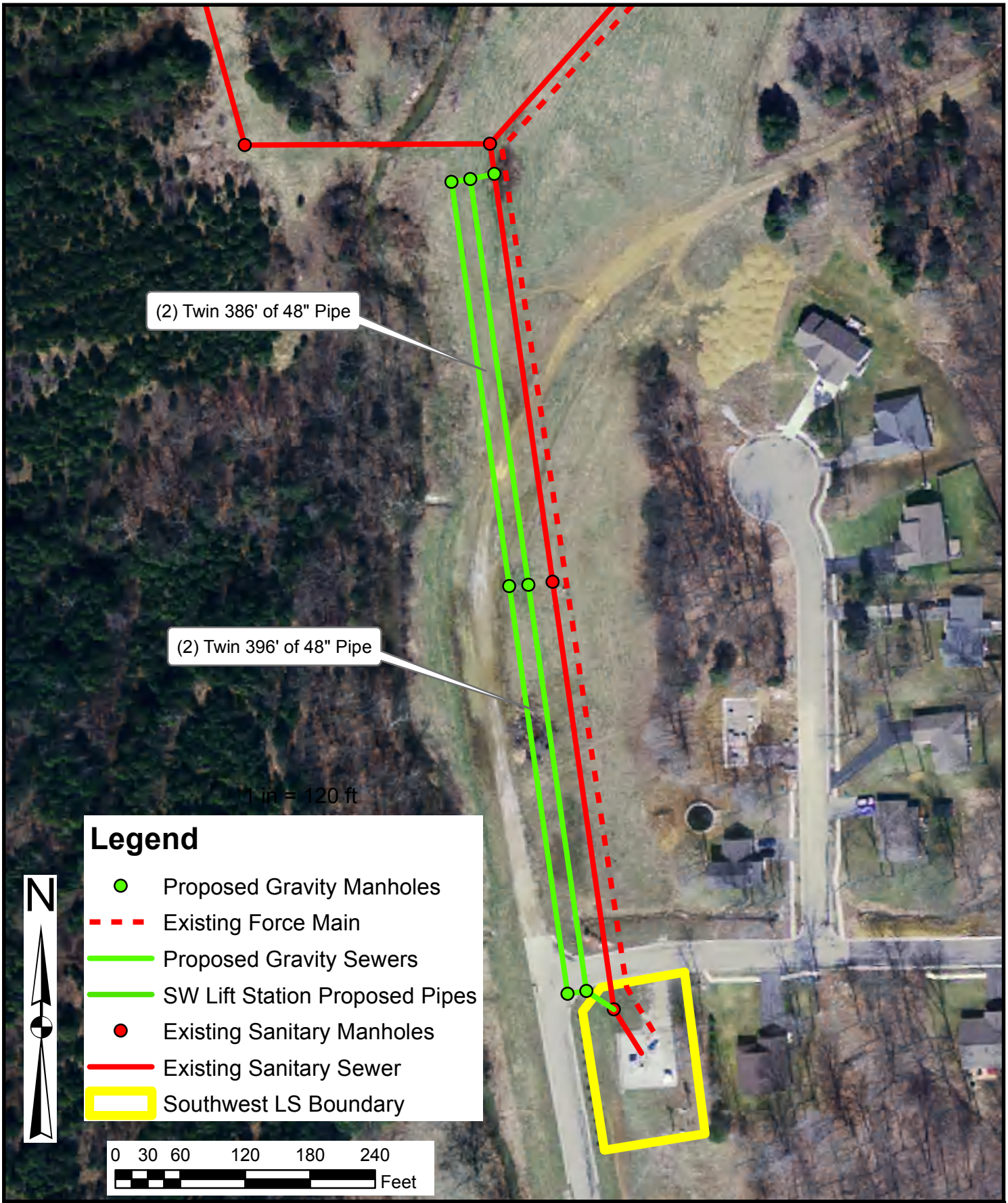
The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

The development of a theoretical computer model is discussed in the above Design Criteria section of **Alternative "C" Southwest Lift Station – Wet Weather Pump Station**. As such, it will not be repeated here.

With the model calibrated, it can then be used to develop the effects of the required design rain event. This event is the 10 year, 1 hour. The storage volume required for this rain event, while taking into account the existing pumping capacity, is 128,000 gallons. The volume provided in the proposed pipes result in over 147,000 gallons of storage.

Map.

Figure 10 illustrates the proposed improvements.



Southwest Lift Station - In Line Storage Alternative
North Vernon, IN

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FIGURE: 10

Environmental Impacts.

The improvements associated with this alternative are located within existing property owned by the City. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Construction Problems.

This alternative does involve some complications to construction. This lift station is an active facility. Coordination and planning will be necessary as well as possible bypass pumping to perform this work.

Cost Estimate.

Construction cost estimates for this collection alternative are given by **Table 9**.

Table 9. Alternate "D" Southwest Lift Station In-Line Storage Cost

Item:	Quantity	Unit	Unit Cost	Cost
Excavate	830	CY	$15	$12,450
Rock Excavation	2,100	CY	$65	$136,500
48" Pipe	1,600	Feet	$85	$136,000
Structure Bedding/Backfill	520	CY	$35	$18,200
Manhole Structure	6	Each	$6,500	$39,000
Bypass Pumping	1	Lump Sum	$6,500	$6,500
Asphalt Pavement	17	Tons	$160	$2,720
Seeding	2700	SY	$2	$5,400
Construction Engineering	1	Lump Sum	$8,000	$8,000
Mobilization/Demobilization	1	Lump Sum	$17,000	$17,000
			Subtotal:	$381,770
			Contingency (10%):	$38,177
			Total Construction Costs:	**$419,947**
			Non-Construction Costs:	$83,989
			Total Project Cost:	**$503,936**

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Advantages/Disadvantages.

With the implementation of this work, significant wet weather flows to the Southwest Lift Station will be pumped. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The advantage to this alternative is the relative simplicity of the system; there are no mechanical/electrical/controls systems. The Operation and Maintenance costs are low. The other advantage to this alternative is the ability to reuse the existing facilities. The existing wet well, valve vault, and force main will remain in operation.

Wastewater Treatment Plant Alternatives

A. WWTP Alternative "A" Mechanical Wet Weather Treatment Facility-CEHRC with UV Disinfection

Description.

When rain events occur such that the flows entering the existing WWTP exceed the maximum hydraulic capacity of the system, an overflow takes place. As described above, this untreated sewage enters the Muscatatuck River with the potential for negative impacts to the health and welfare of the public and the environment.

This Alternative uses a chemically-enhanced, coagulant-based, high rate clarification system (CEHRC) followed by a Ultra-Violet (UV) Disinfection system to treat the CSO volume greater than the "First Flush", or initial pollutant surge, volume. The volumes equal to or less than the "First Flush" volume will be captured and fully treated.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

An important element in the analysis of the existing Wastewater Collection System is the development of an accurate theoretical model with which to draw conclusions. Wet weather flow rates and volumes were determined using the EPA approved XP-SWMM modeling program. This process included dividing the overall watershed drainage area into "sub-basins" for the purpose of providing a more accurate representation of the watershed, as shown in **Figures 3 and 4**. This model was developed using flow data collected using Flow Link Software from city personnel to calibrate the model. This flow data was gathered from July, 2010 to the present.

Flow monitors have been placed at the exit of the twin 24" pipes entering into the plant upstream of the headworks at the WWTP. Real-time flow monitoring data has been and continues to be collected and analyzed to provide a more accurate understanding of the

effects of wet-weather in the City of North Vernon. This data was subsequently used in the calibration of the XPSWMM model. This calibration to real data resulted in a model that includes all significant interceptors in the collection system.

To create this model, real flow data is gathered from the various rain events during the monitoring period from July 2010 to February 2012. A selection process was undertaken to isolate real rain events similar to the Design Storms. The following **Table 11** illustrates some of the storm events used in the selection process. Selection factors upon which to base the choosing of appropriate storm events for model calibration include the following:

1. Choosing a storm event that closely matches the parameters of the "Design Storms" ("Rainfall Frequency Atlas of the Midwest" by Floyd A. Huff and James R. Angel, Bulletin 71):

   1-year/1-hour: 1.16 inches
   10-year/1-hour: 2.08 inches

2. Occurrence of a storm event after an extended dry period, so that the effects of rainfall-induced Infiltration and Inflow (I/I) would be limited;
3. Selection of a storm event that is concentrated over a relatively short time period;
4. Selection of a storm event that produces sufficient precipitation for providing reliable model results.

After selection of the appropriate representative rain events, the model can be calibrated. Using the SWMM software, an iterative process is performed to closely match the model's flow results to the actual flow garnered from the meter data. The following table illustrates the results of the calibrations:

	Model (Peak Flow Rate, Volume)	Actual Data (Peak Flow Rate, Volume)
April 27th, 2011	19.4 MGD/8.5 MG	19 MGD/8.19 MG
June 21st 2011	9.1 MGD/2.41 MG	9.8 MGD/2.10 MG
December 20th 2011	18.7 MGD/5.63 MG	19 MGD/5.27 MG

With the model calibrated, it can then be used to develop the effects of the required design rain events. These events are the 1 year, 1 hour and the 10 year, 1 hour. The results are shown in **Table 10**:

Table 10. SWMM Model Results

Design Event	Peak Flow	Volume
1 year, 1 hour	21 MGD	5.2 MG
10 year, 1 hour	40 MGD	13.6 MG

In lieu of storing and treating the flow volume resulting from the 1 year, 1 hour event, an alternative is the storing and treating of the "first flush", or initial pollutant surge. This method has been reviewed and accepted by IDEM.

The City has implemented a sampling program for measuring pollutant concentrations in the CSO effluent during wet weather. The pollutant sampling device was placed at the Headworks of the plant. During a wet weather event, samples are collected every 15 minutes. Pollutants are measured in concentrations of milligrams per liter (mg/l) and include total suspended solids (TSS), ammonia (NH_3) and biochemical oxygen demand (BOD).

Appendix E shows the pollutographs in comparison to the hydrographs for various rain events. For the May 26th 2011 storm event, samples were collected every 15 minutes from 11:28 p.m. to 4:14 a.m. BOD and TSS concentration decreased to less than 100 ppm within a short period of time during which the cumulative overflow volume was 475,000 gallons. As another example, the relationship between the hydrograph and pollutograph for the April 27th 2011 storm event results in a total First Flush volume of 541,667 gallons. A plot of those results gives similar results as the plot created for May 26th event. Another six (6) rain events were evaluated and the average first flush volume resulted in approximately 606,000 gallons (See **Table 11**). This analysis verifies that these sampling results quantify first-flush occurring within the first 606,000 gallons of flow volume as a result of rain events.

Table 11. First Flush Volumes

Date	Volume (gal.)
April 9, 2011	667,000
April 11, 2011	656,000
April 27, 2011	542,000
May 26, 2011	475,000
June 18, 2011	625,000

June 21st 2011	662,500
November 14, 2011	656,250
November 21, 2011	562,500
Average:	606,000

With the collection of this pollutant data and the analysis performed as described above, significant cost savings can be realized. Instead of the storing and full treatment of the entire flow volume resulting from the design storm event (1 year, 1 hour) of 5.2 million gallons, only the volume resulting from the "first flush" of 606,000 gallons is required. This optimization can then be made tangible with a project that is the most modest in design, size and cost while still meeting regulatory requirements and protecting the environment and the citizens of North Vernon.

Map.

Figure 11 shows the existing project area. **Figure 12** illustrates the layout of the proposed alternate.

LEGEND

WWTP Boundary

Project Area - WWTP
North Vernon, Indiana

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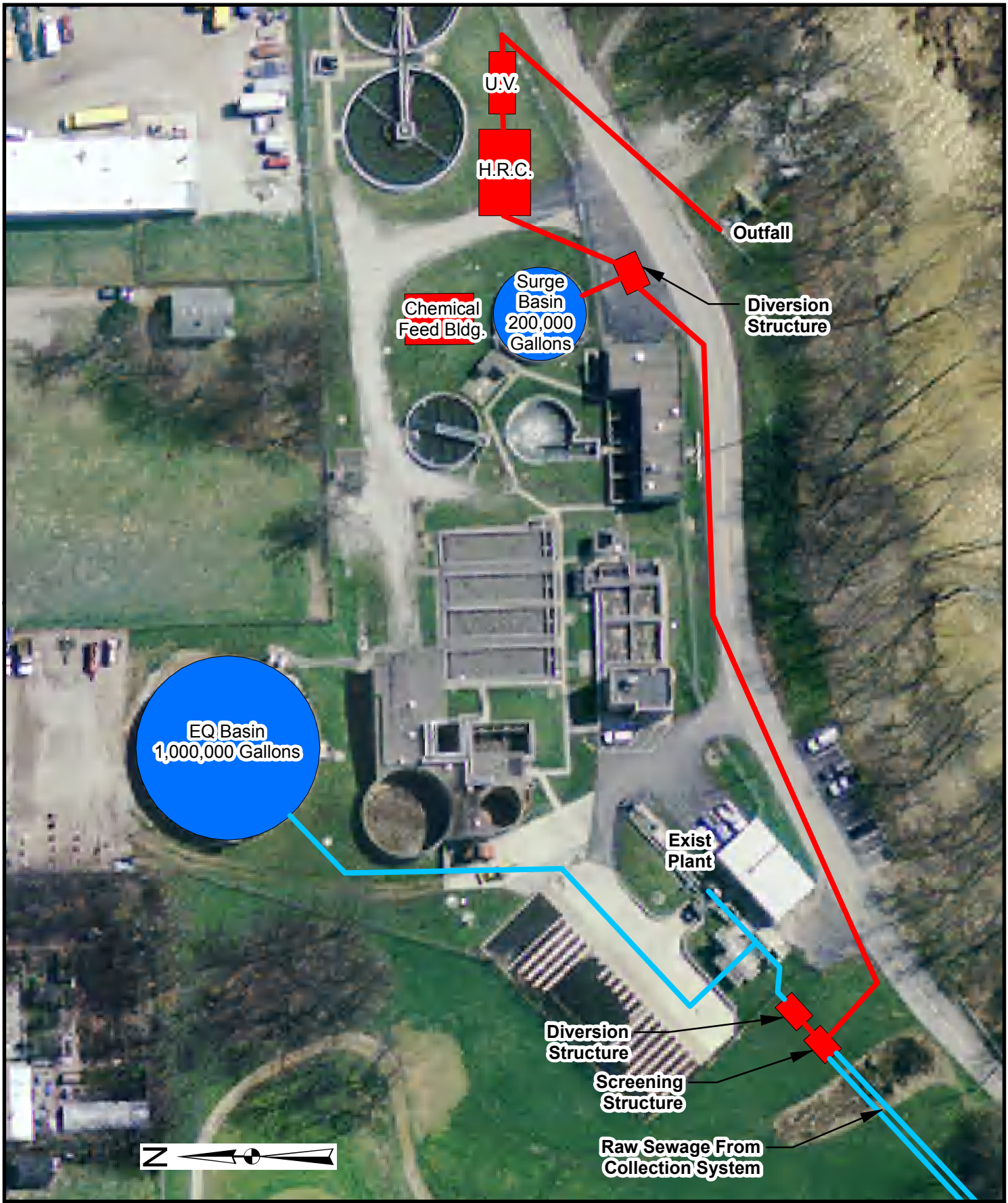

LEGEND

- Existing Components
- Proposed Compenents

WWTP - CEHRC with UV Disinfection Alternative
North Vernon, IN

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DATE: 11/28/2012

PROJECT NO.: 212-0061

FIGURE: **12**

Environmental Impacts.

The improvements associated with this alternative are located within the confines of the existing WWTP property. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Land Requirements.

The improvements associated with this alternative are located within the confines of the existing WWTP property. No additional property, easements, or right-of-ways will be necessary.

Construction Problems.

This alternative does involve some complications to construction. The subsurface conditions include bedrock (limestone). The excavation of this material to install the proposed facilities will be necessary. Because this is an existing facility, the current operations cannot be interrupted during construction. Bypass pumping and other temporary measures will be necessary to prevent disruptions.

Cost Estimates.

Table 12 summarizes the cost of this alternative.

Table 12. WWTP Alternative "A" CEHRC with UV Disinfection Cost

Item:	Cost
Conveyance Piping	$420,000
Clarification Unit	$3,094,000
UV Disinfection System	$480,000
Chemical Feed Building	$210,000
Surge Basin (Convert Existing Clarifier)	$110,000
Site Electrical/Instrumentation/SCADA	$527,000
Diversion Structure	$154,000
Mobilization/Demobilization	$264,000
Subtotal:	$5,259,000
Contingency (10%):	$525,900
Total Construction Costs:	**$5,784,900**
Non-Construction Costs:	$1,214,829
Total Project Cost:	**$6,999,729**

Table 13 summarizes the expected annual Operation and Maintenance Costs.

Table 13. WWTP Alternative "A" CEHRC with UV Disinfection O&M Costs

Item:	Cost
Electricity	$10,095
Chemicals	$24,800
Replacement (Short-Lived Assets)	$29,625
Maintenance (Personnel, Equipment, etc.)	$55,000
Total Operation and Maintenance Costs:	**$119,520**

Advantages/Disadvantages.

With the implementation of this work, no effluent will discharge to the receiving waters, the Muscatatuck River, without undergoing wet weather treatment processes below the 10 year, 1 hour flow. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The main advantage to this system is the high pollutant removal rates, specifically Total Suspended Solids (TSS). The process removes up to 90% of the TSS from wet weather flows.

The disadvantage of this system involves the large operational and maintenance cost due to its complexity. The electrical costs are high from the UV disinfection system as well as the clarifier mechanisms. Labor costs resulting from training and regular maintenance is comparatively high with this alternative.

B. WWTP Alternative "B" Mechanical Wet Weather Treatment Facility-Vortex HRC with Chlorination Disinfection

Description.

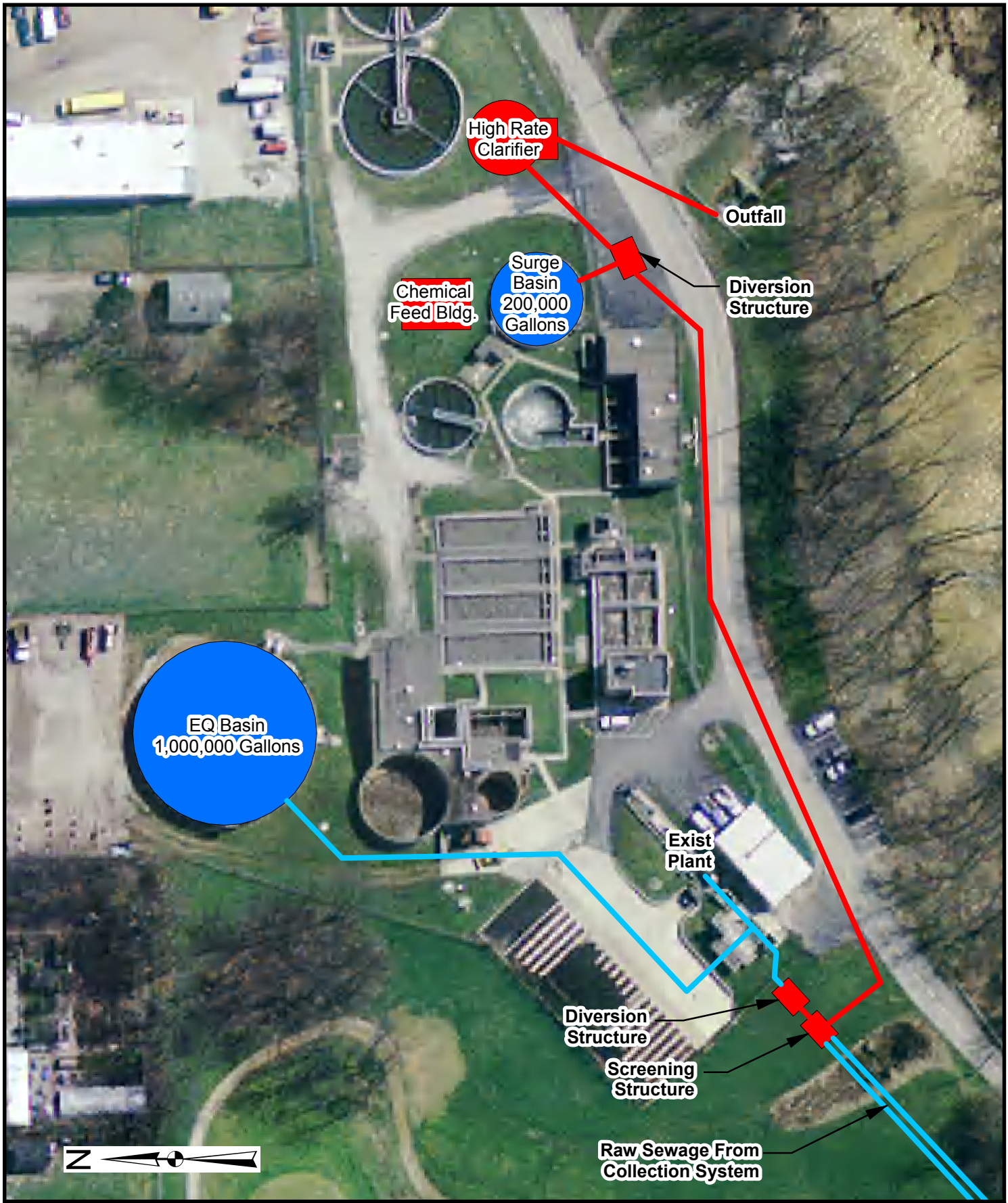
This Alternative is similar to **WWTP Alternative "A" Mechanical Wet Weather Treatment Facility – CEHRC with UV Disinfection** as described above. This alternative, however, uses a vortex-type, high rate clarification system (VHRC) to treat the CSO volume greater than the "First Flush", or initial pollutant surge, volume followed by chlorine disinfection. The "First Flush" will be captured and fully treated.

Design Criteria.

This discussion is identical to the "Design Criteria" as illustrated in the above **WWTP Alternative "A" Mechanical Wet Weather Treatment Facility – CEHRC with UV Disinfection** and will not be repeated here. Refer to that section for complete information.

Map.

Figure 13 illustrates the layout of the proposed alternate.



LEGEND

- Existing Components
- Proposed Compenents

WWTP- Vortex HRC with Chlorination Alternative
North Vernon, IN

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FIGURE: 13

Environmental Impacts.

The improvements associated with this alternative are located within the confines of the existing WWTP property. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Land Requirements.

The improvements associated with this alternative are located within the confines of the existing WWTP property. No additional property, easements, or right-of-ways will be necessary.

Construction Problems.

This alternative does involve some complications to construction. The subsurface conditions include bedrock (limestone). The excavation of this material to install the proposed facilities will be necessary. Because this is an existing facility, the current operations cannot be interrupted during construction. Bypass pumping and other temporary measures will be necessary to prevent disruptions.

Cost Estimates.

Table 14 summarizes the cost of this alternative.

Table 14. WWTP Alternative "B" Vortex HRC with Chlorination Cost

Item:	Cost
Conveyance Piping	$420,000
Clarifier Unit	$2,259,500
Chemical Feed Building	$210,000
Chlorination System Upgrade	$95,000
Surge Basin (Convert Existing Clarifier)	$110,000
Site Electrical/Instrumentation/SCADA	$490,000
Diversion Structure	$154,000
Mobilization/Demobilization	$180,000
Subtotal:	$3,918,500
Contingency (10%):	$391,850
Total Construction Costs:	**$4,310,350**
Non-Construction Costs:	$862,070
Total Project Cost:	**$5,172,420**

Table 15 summarizes the expected annual Operation and Maintenance Costs.

Table 15. WWTP Alternative "B" Vortex HRC with Chlorination O&M Costs

Item:	Cost
Electricity	$3,044
Chemicals	$8,000
Equipment Replacement (Short-Lived Assets)	$17,125
Maintenance (Personnel, Equipment, etc.)	$10,000
Total Operation and Maintenance Costs:	**$38,169**

Advantages/Disadvantages.

With the implementation of this work, no effluent will discharge to the receiving waters, the Muscatatuck River, without undergoing wet weather treatment processes below the 10 year, 1 hour flow. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The main advantage to this system is the relative simplicity of the operation. The vortex-type motion within the clarifier is induced by the geometry of the internal static components. This system has a much lower electrical demand because of the static nature of the design. The operation and maintenance costs are subsequently low.

The disadvantage of this system is the slightly less efficient removal of Total Suspended Solids (TSS) compared to **WWTP Alternative "A"**. While still meeting IDEM quality requirements to provide primary treatment equivalency, the removal of TSS is 50%. The pollutant data show that this removal efficiency is adequate and still meets IDEM standards.

C. WWTP Alternative "C" Constructed Wetland

Description.

This alternative involves the installation of a Constructed Wetland facility. This wetland would accept the volumes of flow caused by the design storm events.

Integral to the viability of this alternative are the flows, the volume of sewage created due to the design rain events, as well as the location of the wetland. Due to the nature of constructed wetland treatment, a large physical footprint would need to be acquired for this facility. Additionally, transport of the wet weather flow (pumping, force mains, etc.) would be necessary. Because the elevation of the WWTP is lower than most of the surrounding city, this wet weather flow would need to be pumped with a new, large pumping station and conveyed through a force main(s).

As a result of the analysis, it was determined that the design storm (10 year, 1 hour event) created over 8 million gallons of water over and above that which would flow directly into and be treated through the standard facility processes. It would be necessary to transport this wastewater to the wetland facility for treatment. This volume of wastewater would require a wetland of approximately 6 ½ acres.

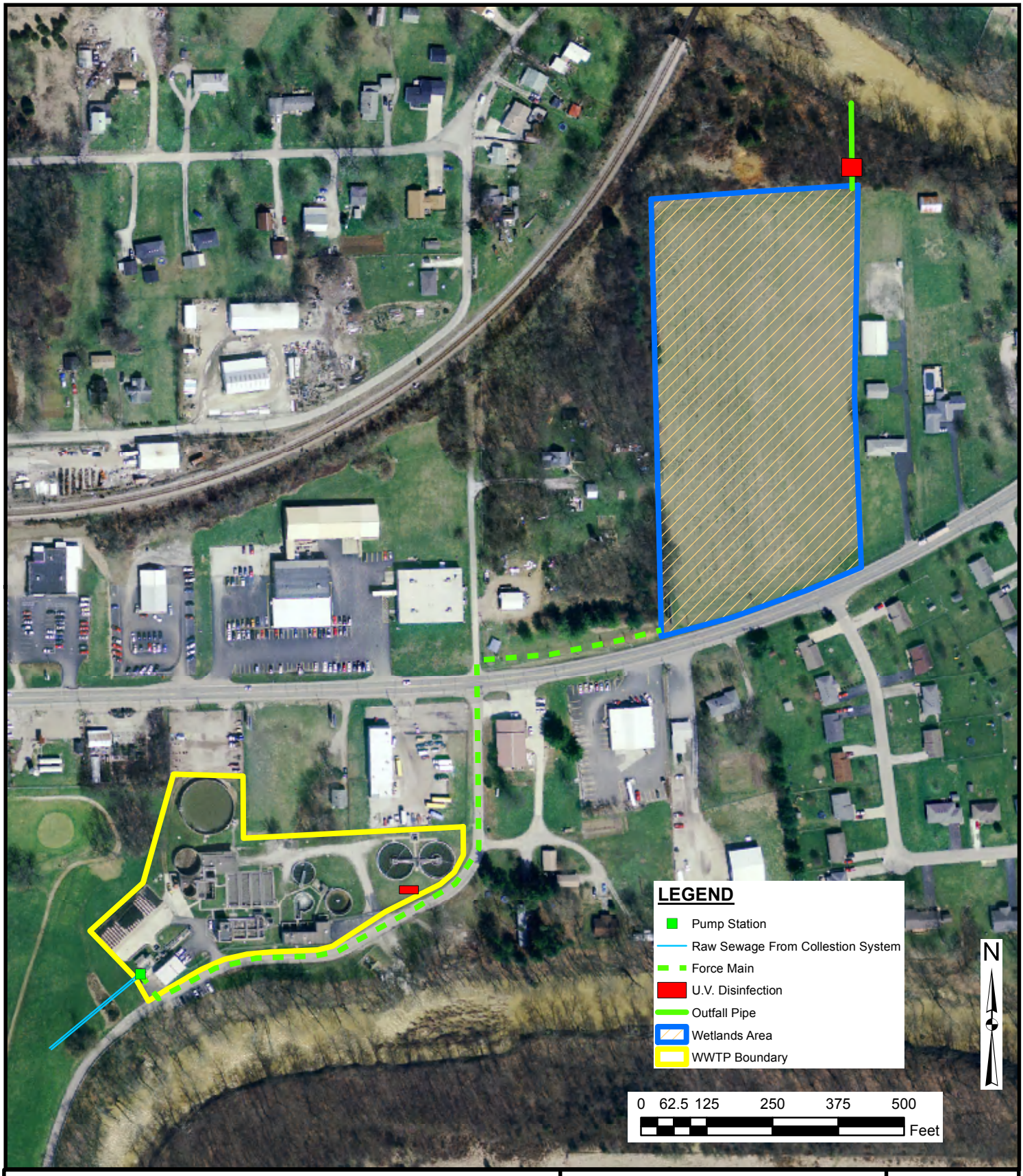
The cost for this option, including the Wet Weather Pump Station, force main, wetland, and UV Disinfection, is estimated in **Tables 16 and 17**. However, beyond the costs for this option are qualitative factors that would need to be considered. The Environmental issues and impacts may limit the wetland site location and the outfall into a receiving body of water, for example.

Design Criteria.

The Design Criteria used in the analysis of this alternative is identical to that of **WWTP Alternatives "A" and "B"** above. Refer to those sections for complete information.

Map.

Figure 14 illustrates the layout of this alternate.



WWTP - Constructed Wetland Facility
North Vernon, IN

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Environmental Impacts.

The improvements associated with this alternative are located within the confines of the existing WWTP property, areas for the wetland, and areas for the conveyance piping. The impacts to environmental factors (floodplains, wetlands, endangered species, historical and archaeological properties, etc.) are summarized in the Environmental Report (See **Appendix D**).

Land Requirements.

The improvements associated with this alternative are located within the confines of the existing WWTP property, areas for the wetland, and areas for the conveyance piping. Additional property and easements will be necessary for this alternative.

Construction Problems.

This alternative does involve some complications to construction. The subsurface conditions include bedrock (limestone). The excavation of this material to install the proposed facilities will be necessary.

Cost Estimate.

Table 16. WWTP Alternative "C" Constructed Wetland Facility Cost

Item:	Cost
Pump Station	$1,200,000
Force Main	$920,000
Constructed Wetland	$875,000
Screening	$370,000
UV Disinfection	$540,000
Land Acquisition	$130,000
Mobilization/Demobilization	$200,000
Subtotal:	$4,235,000
Contingency (10%):	$423,500
Total Construction Costs:	**$4,658,500**
Non-Construction Costs:	$931,700
Total Project Cost:	**$5,590,200**

Table 17. WWTP Alternative "C" Constructed Wetland Facility O&M Costs

Item:	Cost
Electricity	$17,786
Equipment Replacement (Short-Lived Assets)	$32,000
Maintenance (Personnel, Equipment, etc.)	$10,000
Total Operation and Maintenance Costs:	**$59,786**

Advantages/Disadvantages.

With the implementation of this work, no effluent will discharge to the receiving waters, the Muscatatuck River, without undergoing wet weather treatment processes below the 10 year, 1 hour flow. This will result in compliance with IDEM and the completion of the city's approved LTCP.

The main advantage to this alternative is the environmentally sustainable nature of the Constructed Wetland. This process treats the effluent naturally prior to discharge into the receiving body.

The disadvantages to this alternative lie in the uncertain environmental factors. These issues and impacts may limit the wetland site location and the outfall into a receiving body of water, for example. An additional disadvantage is the required pumping of the storm event flows to this wetland facility as the WWTP elevation is lower than the surrounding areas. Simple gravity flow, as in Alternatives "A" and "B", is not possible for this alternative. The need for pumping adds complication regarding maintenance and emergency situations.

6. SELECTION OF AN ALTERNATIVE

A. Collection System Alternatives (Northwest Lift Station)

The following **Table 18** evaluates and compares the Present Worth (Life Cycle) costs of the two (2) alternatives from the above discussion. These alternatives are: **Alternative "A" Hickory Manor Trailer Park: Low Pressure Sewers with Grinder Pumps System** and **Alternative "B" Hickory Manor Trailer Park: Gravity Sewers**. This analysis compares these options and relates the initial Capital Costs with the Operation and Maintenance costs to reveal the most beneficial alternative.

Table 18. Northwest Lift Station Alternatives - Life Cycle Cost Analysis

Parameter	Alternative "A" Grinder Pumps System	Alternative "B" Gravity Sewer
Planning Period, years	40	40
Discount Rate, %	1.7	1.7
Electricity Cost per KW-Hr, cents	10	10
Capital Cost	$548,904	$532,356
Installation Cost	$0	$0
Annual Value Capital Cost	$19,025	$18,451
Present Value Capital Cost	**$548,904**	**$532,356**
Cost for Electricity per Year	$222	$0
Present Value Electricity Cost	**$6,405**	**$0**
Annual Regular Maintenance	$2,300	$0
Present Value Maintenance Cost	**$66,359**	**$0**
Annual Equipment Replacement Cost	$1,933	$0
Present Value Replacement Cost	**$55,770**	**$0**
Salvage Value	**$3,820**	**$14,500**
Life Cycle Cost		
Total Life Cycle Cost - Present Value	**$674,000**	**$518,000**

B. Collection System Alternatives (Southwest Lift Station)

The following **Table 19** evaluates and compares the Present Worth (Life Cycle) costs of the two (2) alternatives from the above discussion. These alternatives are: **Alternative "C" Southwest**

Lift Station: Wet Weather Pump Station and **Alternate "D" Southwest Lift Station: In-Line Storage**. This analysis compares these options and relates the initial Capital Costs with the Operation and Maintenance costs to reveal the most beneficial alternative.

Table 19. Southwest Lift Station Alternatives - Life Cycle Cost Analysis

Parameter	Alternative "C" Wet Weather Pump Station	Alternative "D" In-Line Storage
Planning Period, years	40	40
Discount Rate, %	1.7	1.7
Electricity Cost per KW-Hr, cents	10	10
Capital Cost[1]	**$656,014**	**$503,936**
Installation Cost[2]	$0	$0
Annual Value Capital Cost	$22,737	$17,466
Present Value Capital Cost	$656,014	$503,936
Power Cost		
Annual KW-Hrs	11,602	**0**
Cost for Electricity per Year	$1,160	$0
Present Value Electricity Cost	$33,473	$0
Annual Regular Maintanence	$6,000	$0
Present Value Maintanence Cost	$173,110	$0
Annual Replacement Cost	$17,000	$0
Present Value Replacement Cost	$490,479	$0
Salvage Value	$87,000	$21,600
Life Cycle Cost		
Total Life Cycle Cost - Present Value	**$1,266,000**	**$482,000**

C. Wastewater Treatment Plant Alternatives

The following **Table 20** evaluates and compares the Present Worth (Life Cycle) costs of the three (3) viable alternatives from the above discussion. These alternatives are: 1) **WWTP Alternate "A" Mechanical Wet Weather Treatment Facility - CEHRC with UV Disinfection**, 2) **WWTP Alternate "B" Mechanical Wet Weather Treatment Facility – Vortex HRC with Chlorination Disinfection**, and 3) **WWTP Alternate "C" Constructed Wetland Facility**. This analysis compares these options and relates the initial Capital Costs with the Operation and Maintenance costs to reveal the most beneficial alternative.

Table 20. WWTP Alternatives Life Cycle Cost Analysis

Parameter	Alternative A CEHRC	Alternative B Vortex HRC	Alternative C Constructed Wetland
Planning Period, years	40	40	40
Discount Rate, %	1.7	1.7	1.7
Electricity Cost per KW-Hr, cents	10	10	10
Capital Cost	$6,999,729	$5,172,420	$5,590,200
Installation Cost	$0	$0	$0
Annual Value Capital Cost	$242,610	$179,276	$193,756
Present Value Capital Cost	**$6,999,729**	**$5,172,420**	**$5,590,200**
Wet-Weather Treatment System			
Annual KW-Hrs	100,953	30,437	177,859
Cost for Electricity per Year	$10,095	$3,044	$17,786
Present Value Electricity Cost	**$291,267**	**$87,815**	**$513,154**
Chemical Usage for New System			
Annual Chemicals Use per event, ton	4	2	0
Cost of Chemicals per event, $/ton	$310	$200	$0
Chemical Cost per Year	$24,800	$8,000	$0
Present Value Chemical Cost	**$715,523**	**$230,814**	**$0**
Annual Equipment Replacement Cost	$29,625	$17,125	$32,000
Present Value Eqmt. Repl. Cost	**$854,732**	**$494,086**	**$923,255**
Annual Regular Maintenance	$55,000	$10,000	$10,000
Present Value Maintenance Cost	**$1,586,845**	**$288,517**	**$288,517**
Salvage Value	**$88,333**	**$88,333**	**$332,000**
Life Cycle Cost			
Total Life Cycle Cost - Present Value	**$10,360,000**	**$6,185,000**	**$6,983,000**

7. PROPOSED PROJECTS (RECOMMENDED ALTERNATIVES)

A. Collection System (Northwest Lift Station)

The recommended alternative for the Northwest Lift Station is **Alternative "B": Hickory Manor Trailer Park: Gravity Sewers**). With the implementation of this work, wet weather flows will be significantly reduced to the Northwest Lift Station. This will result in compliance with IDEM and the guidelines of the city's approved LTCP. This is the preferred alternative because it addresses the needs of the City while remaining modest in design, size, and cost.

Project Design.

As described in Section 5, Alternatives Considered, this alternative involves the replacement of the sanitary sewer system in the Hickory Manor Trailer Park subdivision. It includes the installation of approximately 3,100 LF of 8" mainline piping, approx. 3,300 LF of 6" service lateral piping, and 9 manholes. The following **Figure 7** illustrates these improvements.

Total Project Cost Estimate.

The following **Table 21** summarizes the costs associated with the selected alternative:

Table 21. Northwest Lift Station Rec. Alt. "B": Hickory Manor Gravity Sewers

Item:	Quantity	Unit	Unit Cost	Cost
8" Sewer Pipe (Gravity)	3,135	Feet	$40	$125,400
Granular Backfill	1,500	CY	$25	$37,500
Sanitary Manhole	9	Each	$4,000	$36,000
6" Service Lateral	2,906	Feet	$28	$81,368
6" Service Lateral Dir. Bore	360	Feet	$38	$13,680
Lateral Connection	37	Each	$500	$18,500
Asphalt Street	500	Tons	$100	$50,000
Grass Restoration	3,300	SY	$1	$3,300
Traffic Control and Protection	1	Lump Sum	$7,500	$7,500
Mobilization/Demobilization	1	Lump Sum	$30,000	$30,000
			SubTotal:	$403,300
			Contingency (10%):	$40,330
			Total Construction Cost:	**$443,630**
			Non-Const. Cost (Note 1):	$88,726
			Total Project Cost:	**$532,356**

1. Non-construction costs include $44,400 (10.0%) for Design & Construction Administration, $26,600 (6.0%) for Resident Project Representation, $8,900 for Grant Administration, $7,100 for Bond Counsel, and $1,800 for Financial. Total Project Cost rounded up to nearest $1,000.

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

B. Collection System (Southwest Lift Station)

The recommended alternative for the Southwest Lift Station is **Alternative "D": In-Line Storage**. With the implementation of this work, wet weather flows will be stored prior to flow into the Southwest Lift Station. This will relieve the burden on the pumps and result in compliance with IDEM and the guidelines of the city's approved LTCP. This is the preferred alternative because it addresses the needs of the City while remaining modest in design, size, and cost.

Project Design.

As described in Section 5, Alternatives Considered, this alternative involves the installation of approximately 1,600 feet of 48" diameter piping to provide storage for the wet weather flows that currently burden the pumps at the downstream lift station. **Figure 10** illustrates these improvements.

Total Project Cost Estimate.

The following **Table 22** summarizes the costs associated with the selected alternative:

Table 22. Southwest Lift Station Rec. Alt. "D": In-Line Storage

Item:	Quantity	Unit	Unit Cost	Cost
Excavate	830	CY	$15	$12,450
Rock Excavation	2,100	CY	$65	$136,500
48" Pipe	1,600	Feet	$85	$136,000
Structure Bedding/Backfill	520	CY	$35	$18,200
Manhole Structure	6	Each	$6,500	$39,000
Bypass Pumping	1	Lump Sum	$6,500	$6,500
Asphalt Pavement	17	Tons	$160	$2,720
Seeding	2700	SY	$2	$5,400
Construction Engineering	1	Lump Sum	$8,000	$8,000
Mobilization/Demobilization	1	Lump Sum	$17,000	$17,000
			Subtotal:	$381,770
			Contingency (10%):	$38,177
			Total Construction Costs:	**$419,947**
			Non-Const. Costs (Note 1):	$83,989
			Total Project Cost:	**$503,936**

1. Non-construction costs include $42,000 (10.0%) for Design & Construction Administration, $25,200 (6.0%) for Resident Project Representation, $8,400 for Grant Administration, $6,700 for Bond Counsel, and $1,700 for Financial. Total Project Cost rounded up to nearest $1,000.

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

C. Wastewater Treatment Plant

The recommended alternative for the Wastewater Treatment Plant is **Alternative "B", Mechanical Wet Weather Treatment Facility – Vortex HRC with Chlorination Disinfection**. With the implementation of this work, no effluent will discharge to the receiving waters, the Muscatatuck River, without undergoing wet weather treatment processes below the 10 year, 1 hour flow. This will result in compliance with IDEM and the completion of the city's approved LTCP. This is the preferred alternative because it addresses the needs of the City while remaining modest in design, size, and cost.

Project Design.

Based on the flow sampling results, the "first-flush", the initial pollutant surge, produces a volume of 610,000 gallons at a peak flow of 30 MGD. Due to the limited abilities of the

existing components to manage this flow, the proposed improvements associated with this alternative will provide the necessary additional treatment capacity. The "first-flush" volume will be captured by way of three (3) paths (Refer to **Figure 15** for illustration):

- The **first path**, with flow rates up to 4.76 MGD (208,000 gallons), flow will be sent directly through the WWTP.
- The **second path** utilizes the existing EQ Basin and its pumping station. The capacity of the pumps is 7 MGD. Therefore, for flow rates greater than 4.76 MGD (see first path, above) and less than 11.76 MGD, flow will be sent for storage in the EQ Basin and subsequently full-treatment (220,000 gallons). Flows will continue to be sent to the EQ Basin past the capture of the first-flush up to its capacity of 1 million gallons.
- The **third path** captures the remaining "first-flush" flow that the first and the second paths cannot. This would be for flows in excess of 11.76 MGD and up to 30 MGD. The volume associated with this path is 182,000 gallons. This volume will be stored with a Surge Tank located near the Vortex High Rate Clarifier. There is an existing 50 foot diameter clarifier that has been abandoned in place. This clarifier will be modified into a storage/surge tank with pumps. Pumps in the surge tank will pump raw wastewater to the EQ tank after the storm event from where it will be sent to the WWTP by gravity for full-treatment.

Figure 15 illustrates the three flow paths for this "First Flush" situation. **Table 23** summarizes the flow scenarios.

Table 23. WWTP Wet Weather Facility Flow Paths

Scenario	FlowRate (MGD)	Systems In Use
1	0 – 4.76	WWTP Plant Flow
2	4.76 – 11.76	WWTP Plant Flow + EQ Basin
3	11.76 – 30	WWTP Plant Flow + EQ Basin + Surge Basin
4	30 – 40	WWTP Plant Flow + EQ Basin + Surge Basin + Vortex HRC
*4a	4.76 – 40	WWTP Plant Flow + Vortex HRC

*4a – This scenario occurs when the EQ Basin and the Surge Basin are full.

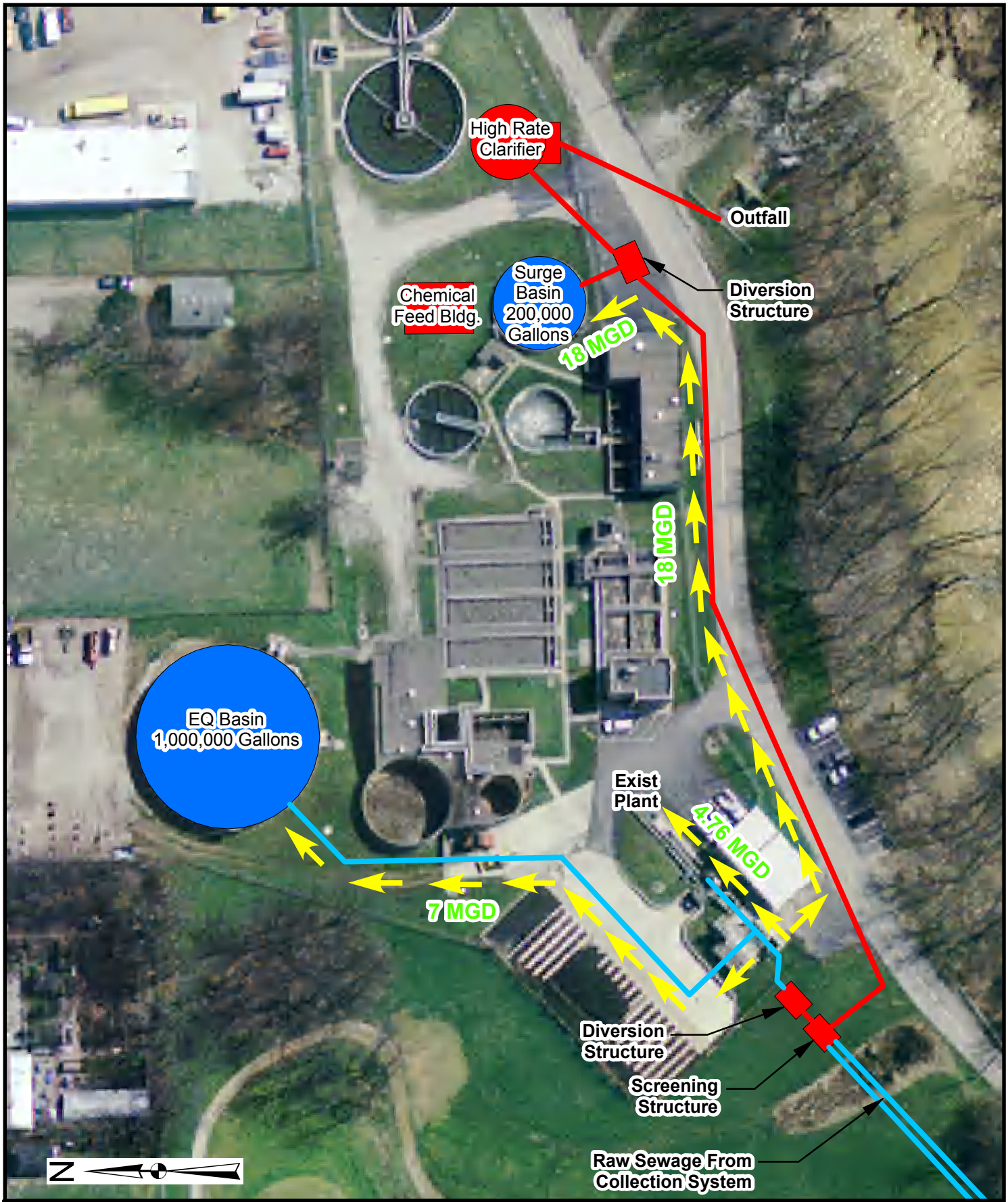
After the existing EQ Basin becomes full (1 million gallons), and the Surge Basin becomes full (0.2 million gallons), the remaining excess flow will be sent to the high rate clarifier. This is indicated in the above **Table 23** as Scenario 4a. **Figure 16** illustrates this Post-"First

Flush" situation. The model indicates that the flows continue to increase to a maximum of 40 MGD after capture of the "first flush".

A wet-weather treatment facility rated at a peak flow of 35 MGD will consist of a mechanical fine screen (Screening Structure), a surge tank (as described above), a vortex high rate clarifier, and chlorination disinfection. The mechanical screen will be a chain and rake type with 6 mm openings.

The new Vortex High Rate Clarification unit will provide primary equivalent treatment. All of the diverted wet weather flows will be treated by the system. This system involves pollutant removal utilizing vortex-type technology to achieve 50% TSS removal and 95% grit removal. Effluent is treated with a Chlorination/Dechlorination disinfection system prior to discharging to the Muscatatuck River. A new Chemical Feed Building will be constructed to house the necessary equipment and supplies for the disinfection system.

With the collection of this pollutant data and the analysis performed as described above, significant cost savings can be realized. Instead of the storing and full treatment of the entire flow volume resulting from the design storm event (1 year, 1 hour) of 5.2 million gallons, only the volume resulting from the "first flush" of 606,000 gallons is required. This method has been approved by IDEM. This optimization can then be made tangible with a project that is the most modest in design, size and cost while still meeting regulatory requirements and protecting the environment and the citizens of North Vernon.



LEGEND

- Existing Components
- Proposed Compenents
- First Flush Flow

WWTP - First Flush Capture
North Vernon, IN

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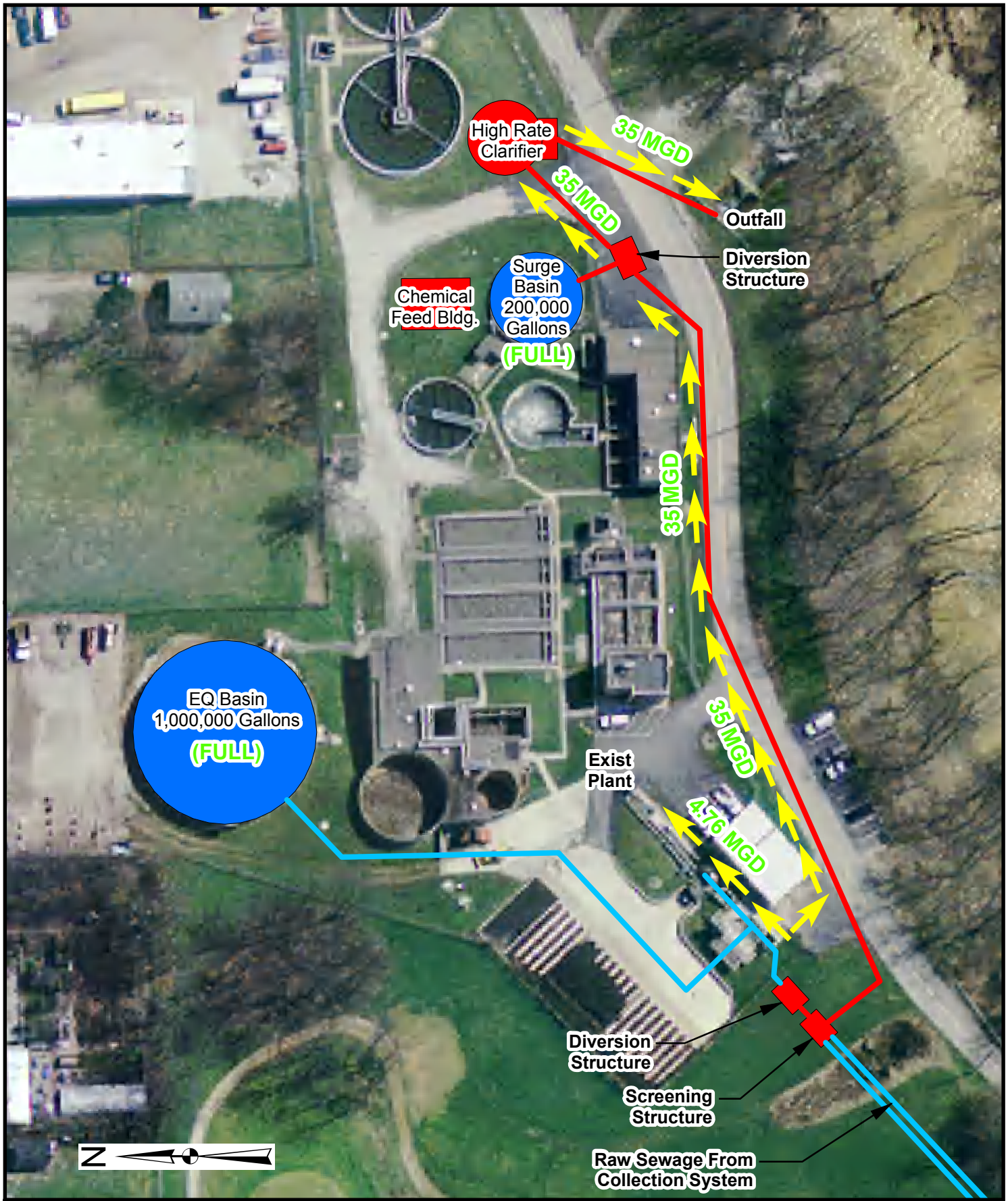
FIGURE: 15



LEGEND

Existing Components

Proposed Compenents

Flow

WWTP - Post First Flush Capture
North Vernon, IN

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FIGURE: 16

Cost Estimates.

Table 24 summarizes the cost of this alternative.

Table 24. WWTP Rec. Alt. - Mech. Wet Weather Treatment - Vortex HRC

Item:	Cost
Conveyance Piping	$420,000
Vortex Clarifier Unit	$2,259,500
Chemical Feed Building	$210,000
Chlorination System Upgrade	$95,000
Surge Basin (Convert Existing Clarifier)	$110,000
Site Electrical/Instrumentation/SCADA	$490,000
Diversion Structure	$154,000
Mobilization/Demobilization	$180,000
Subtotal:	$3,918,500
Contingency (10%):	$391,850
Total Construction Costs:	**$4,310,350**
Non-Const. Costs (Note 1):	$862,070
Total Project Cost (Note 2)**:**	**$5,172,420**

1. Non-construction costs include $431,000 (10.0%) for Design & Construction Administration, $258,000 (6.0%) for Resident Project Representation, $85,000 for Grant Administration, $71,000 for Bond Counsel, and $17,000 for Financial. Total Project Cost rounded up to nearest $1,000.
2. Refer to Appendix F for a more detailed cost summary.

D. Total Project Cost

The proposed projects, as described above, are summarized as follows:

Table 25. Total Project Costs

Item:	Cost
Collection System (Northwest Lift Station) Alternative "B": Hickory Manor Trailer Park: Gravity Sewer	$532,356
Collection System (Southwest Lift Station) Alternative "D": In-Line Storage	$503,936
WWTP Alternative "B": Mechanical Wet Weather Treatment Facility: Vortex HRC with Chlorination Disinfection	$5,172,420
Grand Total:	$6,208,712

1. Costs include all non-construction costs and contingencies.

Annual Operating Budget.

See **Appendix C** for the financial information.

8. CONCLUSIONS AND RECOMMENDATIONS

It has been proposed in this Preliminary Engineering Report alternatives for the implementation of improvements to the collection system and the WWTP of the City of North Vernon to remain in compliance with IDEM and the city's approved CSO Long Term Control Plan.

The recommended alternative for the Collection System (Northwest Lift Station), "**Alternative B Hickory Manor Trailer Park: Gravity Sewer**", will significantly reduce wet weather flows to the Northwest Lift Station. Currently, significant rain events cause surcharging of the wet well.

The recommended alternative for the Collection System (Southwest Lift Station), "**Alternative D In-Line Storage**", will significantly reduce wet weather flows to the Southwest Lift Station. Currently, significant rain events cause surcharging of the wet well.

The recommended alternative for the WWTP, "**Alternative B Mechanical Wet Weather Treatment Facility – Vortex HRC with Chlorine Disinfection**", will treat wet weather flows from the entire collection system up to the 10 year, 1 hour rain event.

9. ADDITIONAL PROJECTS

This section describes projects that, if funding permits, could be implemented. These projects would improve the health and welfare of the residents of the City of North Vernon as well as reduce deleterious effects to the environment. **Figure 17** shows the location of these projects.

A. Jennings Street Area Sanitary Sewer Improvements

Description.

This area of North Vernon is bounded by the streets of Jackson Street, Chestnut Street, Jennings Street, and College Street. The existing sanitary sewer system, a part of the Downtown Sub-basin, and part of the oldest area of the city, is in disrepair. The material of the sewer, vitrified clay piping, allows storm water infiltration into the system, burdening the function. In addition, this same characteristic of the failing sewer allows the exfiltration of raw sewage into the surrounding soil.

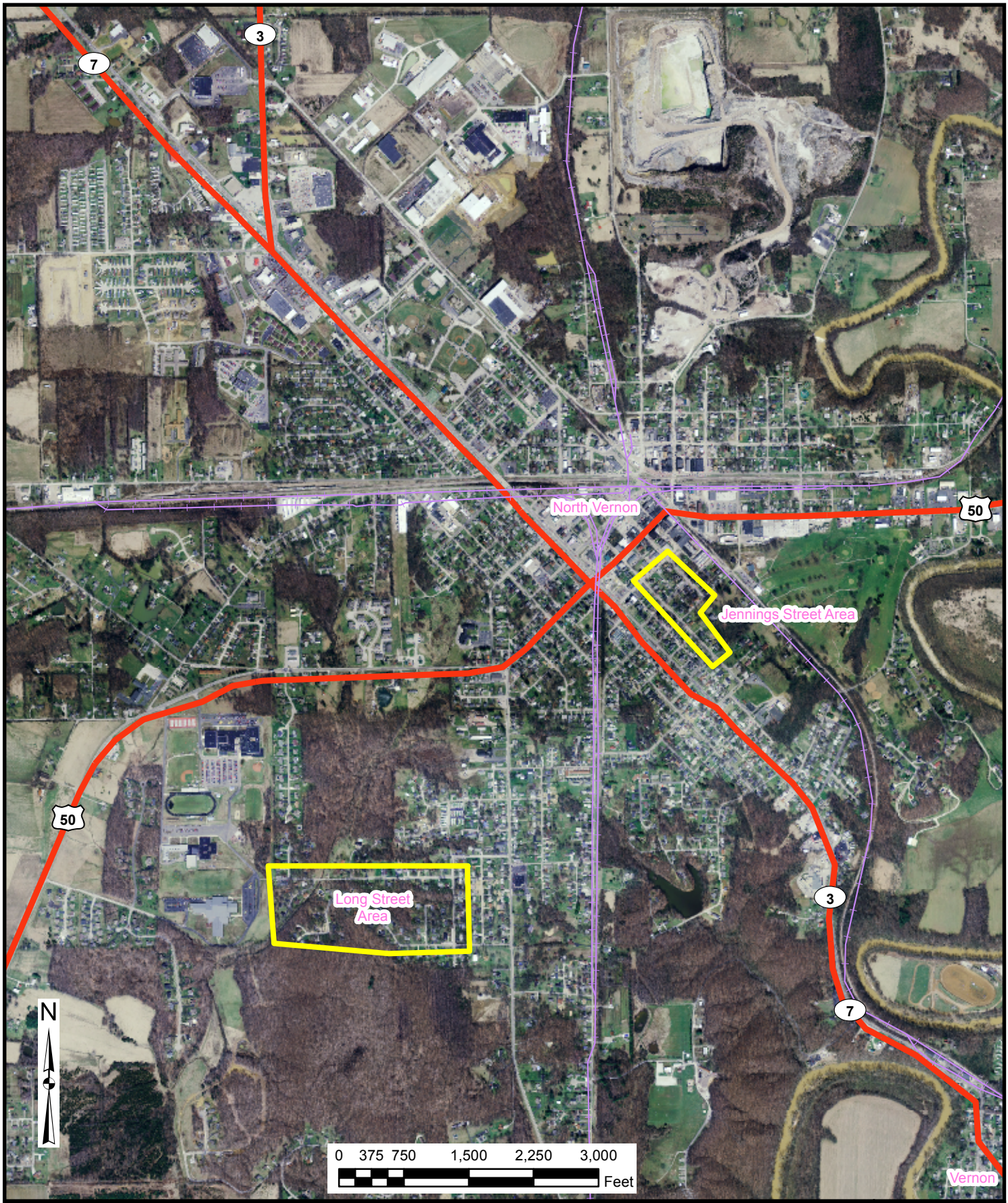
The two (2) alternatives associated with the improvements to the sewer system in this area involve the replacement or rehabilitation of the existing main line sewer, replacement of the existing manholes, and the replacement or rehabilitation of the sewer service laterals to the right of way lines.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

Map.

Figure 18 illustrates the existing sanitary sewer system and **Figure 19** shows the proposed improvements.



LEGEND

- Railroad
- Highway
- Jennings Street Area
- Long Street Area

City Map
North Vernon, Indiana

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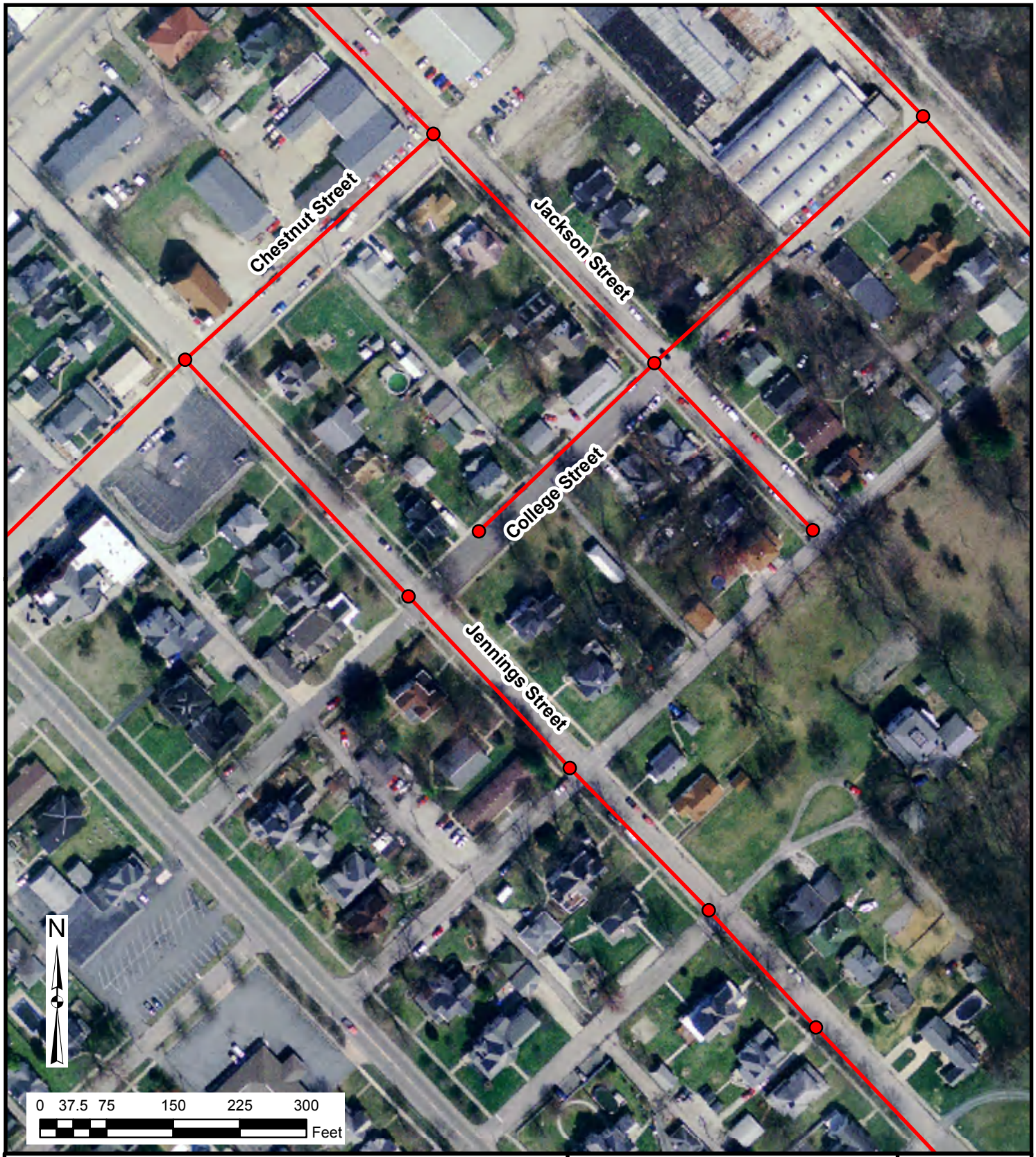

LEGEND

- Existing Sanitary Manholes
- Existing Sanitary Sewer

Jennings Area Sewer System - Existing
North Vernon, IN

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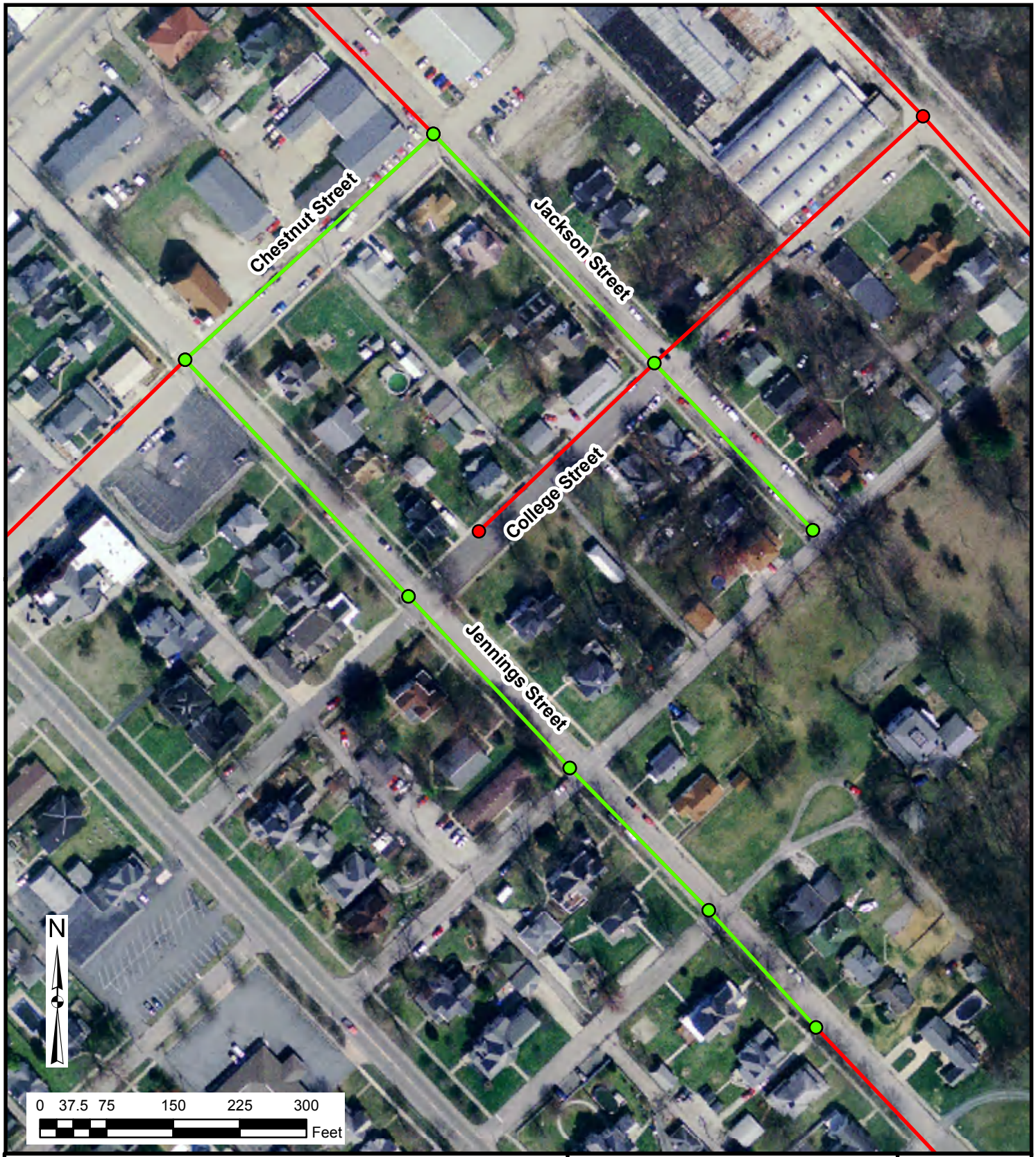
FIGURE: **18**



LEGEND

- Proposed Gravity Manholes (Replacement)
- Proposed Gravity Sewer (Replacement)
- Existing Sanitary Manholes
- Existing Sanitary Sewer

Jennings Area Sewer System - Proposed Improvements
North Vernon, IN

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FIGURE: 19

Environmental Impacts.

The improvements associated with these alternatives are located within right-of-ways. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report.

Construction Problems.

These alternatives do involve some complications to construction. The site is an existing neighborhood. Bypass pumping will be necessary. Coordination with the residents of the area will be imperative as well as traffic control.

Cost Estimate, Alternative "A"(Jennings Area, Complete Replacement).

This alternate involves the complete replacement of the existing mainline sanitary sewer, manholes, and sewer service laterals.

Table 26 summarizes the costs of this alternative.

Table 26. Jennings Area Alternative "A" – Gravity Sewer Replacement

Item:	Quantity	Unit	Unit Cost	Cost
10" Sewer Pipe	774	Feet	$54	$41,796
12" Sewer Pipe	655	Feet	$62	$40,610
18" Sewer Pipe	383	Feet	$74	$28,342
Granular Backfill	3,610	CY	$25	$90,259
Sanitary Manhole Replacement	8	Each	$7,500	$60,000
6" Service Lateral Replacement	1,250	Feet	$40	$50,000
Asphalt Street	735	Tons	$120	$88,174
Grass Restoration	889	SY	$2	$1,778
Bypass Pumping	1	Lump Sum	$18,000	$18,000
Traffic Control and Protection	1	Lump Sum	$12,000	$12,000
Mobilization/Demobilization	1	Lump Sum	$23,000	$23,000
			SubTotal:	$454,000
			Contingency (10%):	$45,400
			Total Construction Cost:	**$499,400**
			Non-Construction Cost:	$99,880
			Total Project Cost:	**$599,280**

Because this system is a gravity system, the operation and maintenance costs for this

alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Cost Estimate, Alternative "B" (Jennings Area, Mainline Sewer Rehabilitation – Pipe Bursting).

This alternate involves the rehabilitation of the existing mainline sanitary sewer by the "pipe-bursting" method, manhole replacements, and sewer service lateral replacements by the "directional bore" method.

Table 27 summarizes the costs of this alternative.

Table 27. Jennings Area Alternative "B" - Sewer Rehabilitation

Item:	Quantity	Unit	Unit Cost	Cost
10" Sewer Pipe (Pipe Bursting)	774	Feet	$106	$82,044
12" Sewer Pipe (Pipe Bursting)	655	Feet	$112	$73,360
18" Sewer Pipe (Pipe Bursting)	383	Feet	$130	$49,790
Granular Backfill	296	CY	$25	$7,407
Sanitary Manhole Replacement	8	Each	$7,500	$60,000
6" Service Lateral Rep. (Dir. Bore)	1,250	Feet	$49	$61,250
Lateral Connections	40	Each	$700	$28,000
Asphalt Street	71	Tons	$120	$8,538
Grass Restoration	889	SY	$2	$1,778
Bypass Pumping	1	Lump Sum	$18,000	$18,000
Traffic Control and Protection	1	Lump Sum	$12,000	$12,000
Mobilization/Demobilization	1	Lump Sum	$22,000	$22,000
			SubTotal:	$424,200
			Contingency (10%):	$42,420
			Total Construction Cost:	**$466,620**
			Non-Construction Cost:	$93,324
			Total Project Cost:	**$559,944**

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Advantages/Disadvantages.

The advantages to these alternatives are low Operation and Maintenance Costs. In addition, the frequent point repairs to the existing system that currently burden the maintenance crew will be lessened. The Rehabilitation Alternative "B", involving pipe-bursting/directional

boring, will reduce the impacts to the existing surfaces (asphalt pavement, sidewalk, and turf).

The disadvantage to the Replacement Alternative "A" is the larger disturbance to the existing surfaces.

Recommended Alternative.

Two (2) alternatives have been considered for the Jennings Area Sanitary Sewer System. Both involve a gravity sewer system similar to the existing situation. The differences lie in the method of installation.

The recommended alternative is **Alternative "B" (Jennings Area, Mainline Sewer Rehabilitation – Pipe Bursting)**. This work will cause less of a disturbance to the existing surroundings as well as provide the least expensive option.

B. Long Street Area Sanitary Sewer Improvements

Description.

This area of North Vernon is bounded by the streets of Long Street, Harms Street, and Oakridge Drive. **Figure 17** describes the location. The existing sanitary sewer system, a part of the Southwest Sub-basin, is in disrepair. The material of the sewer, vitrified clay piping, allows storm water infiltration into the system, burdening the function. In addition, this same characteristic of the failing sewer allows the exfiltration of raw sewage into the surrounding soil.

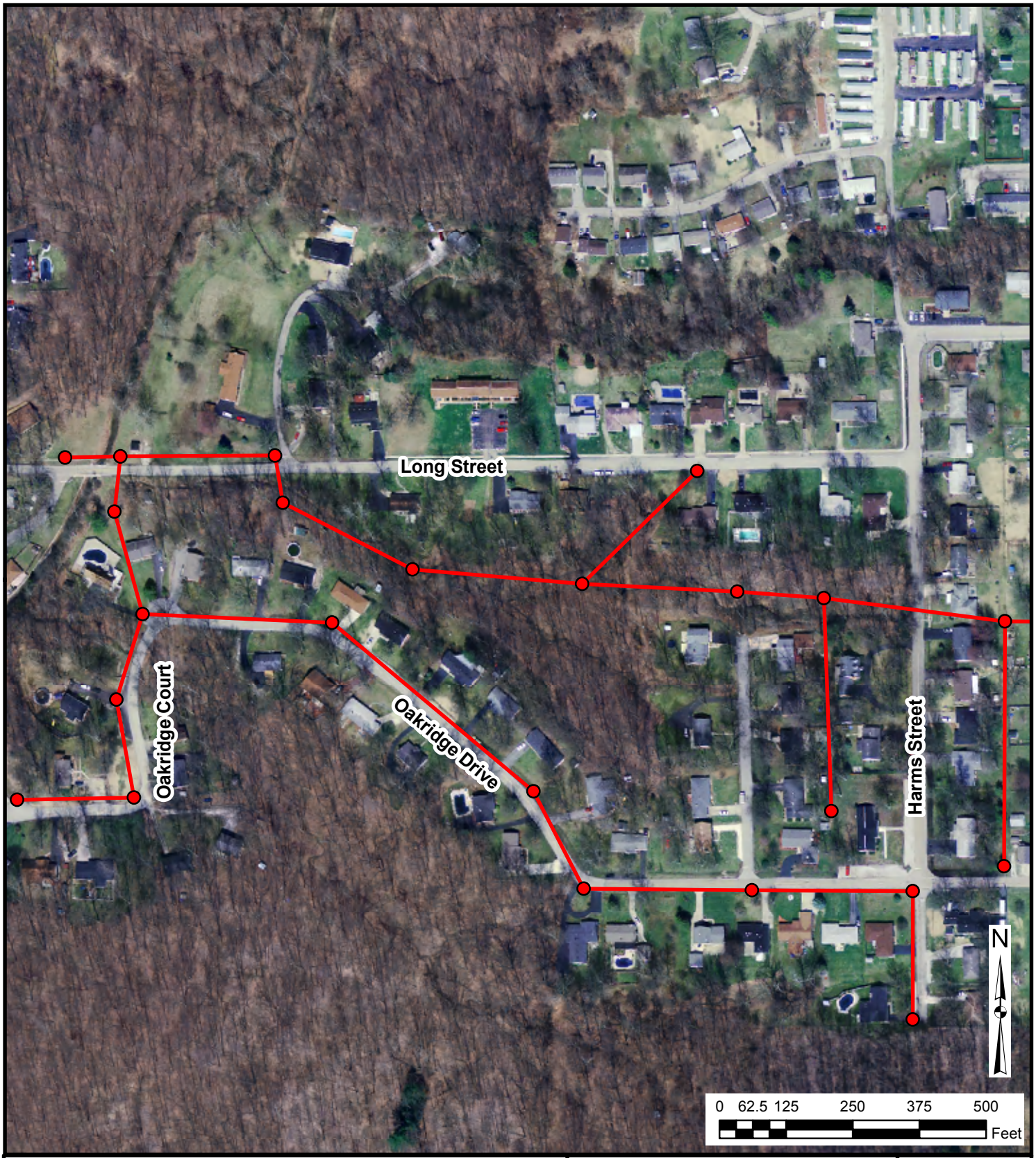
The two (2) alternatives associated with the improvements to the sewer system in this area involve the replacement or rehabilitation of the existing main line sewer.

Design Criteria.

The design of the proposed sewer system will be in accordance with RUS design policies (7 CFR 1780.57), IDEM requirements, and Indiana Administrative Code.

Map.

Figure 20 illustrates the existing sanitary sewer system and **Figure 21** shows the proposed improvements.



LEGEND

- Existing Sanitary Manholes
- Existing Sanitary Sewer

Long Street Area Sewer - Existing
North Vernon, IN

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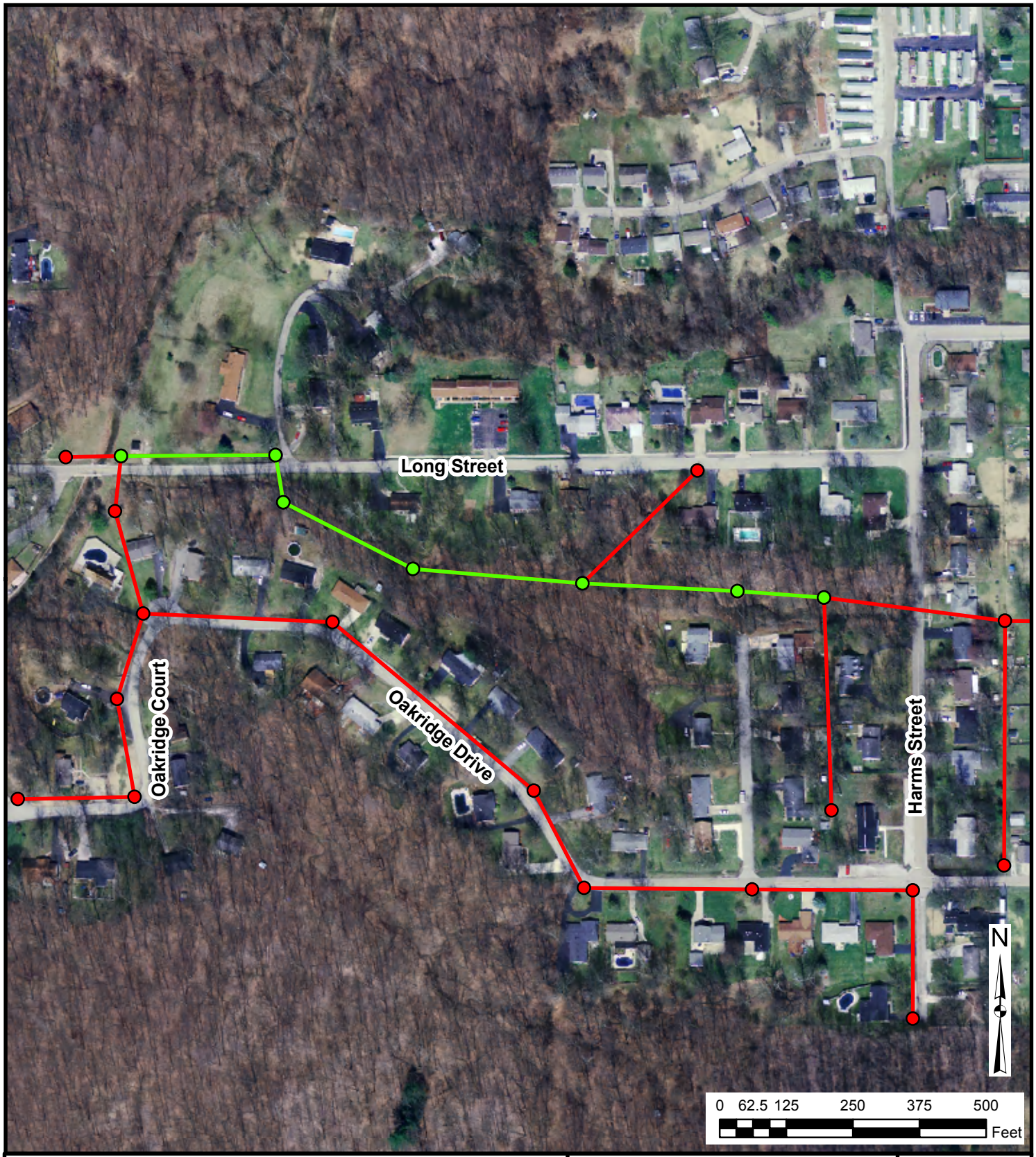
PROJECT NO.: 212-0061

FIGURE: **20**



LEGEND

- Proposed Gravity Manholes (Rehab)
- Proposed Gravity Sewer (Rehab)
- Existing Sanitary Manholes
- Existing Sanitary Sewer

Long Street Area Sewer - Proposed
North Vernon, IN

PREPARED BY:

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DATE: 12/10/2012

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FIGURE: **21**

Environmental Impacts.

The improvements associated with these alternatives are located within right-of-ways. No additional lands will need to be acquired. There will be no direct or indirect effects with respect to the environment (floodplains, wetlands, endangered species, historical and archaeological properties, etc.). See **Appendix D** for the Environmental Report. However, some clearing of existing trees and brush will be necessary.

Construction Problems.

These alternatives do involve some complications to construction. The sewer is a trunk-line, carrying flows from several areas. Bypass pumping will be necessary. Coordination with the residents of the area will be imperative as well as traffic control.

Cost Estimate, Alternative "A"(Long Street Area, Complete Replacement).

This alternate involves the complete replacement of the existing mainline sanitary sewer.

Table 28 summarizes the costs of this alternative.

Table 28. Long Street Alternative "A" - Sewer Replacement

Item:	Quantity	Unit	Unit Cost	Cost
8" Sewer Pipe	1,200	Feet	$50	$60,000
Clearing	1	Lump Sum	$8,000	$8,000
Grass Restoration	2,667	SY	$2	$5,333
Bypass Pumping	1	Lump Sum	$12,000	$12,000
Traffic Control and Protection	1	Lump Sum	$2,000	$2,000
Mobilization/Demobilization	1	Lump Sum	$6,000	$6,000
			SubTotal:	$93,400
			Contingency (10%):	$9,340
			Total Construction Cost:	**$102,740**
			Non-Construction Cost:	$20,548
			Total Project Cost:	**$123,288**

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Cost Estimate, Alternative "B" (Long Street Area, Mainline Sewer Rehabilitation – Cured-in-Place Pipe).

This alternate involves the rehabilitation of the existing mainline sanitary sewer by the "Cured-in-Place" method.

Table 29 summarizes the costs of this alternative.

Table 29. Long Street Area Alternative "B" - Sewer Rehabilitation

Item:	Quantity	Unit	Unit Cost	Cost
8" Sewer Pipe (CIPP)	774	Feet	$35	$27,090
Sanitary Manhole Rehabilitation	6	Each	$2,500	$15,000
Clearing	1	Lump Sum	$4,500	$4,500
Grass Restoration	889	SY	$2	$1,778
Bypass Pumping	1	Lump Sum	$12,000	$12,000
Traffic Control and Protection	1	Lump Sum	$2,000	$2,000
Mobilization/Demobilization	1	Lump Sum	$5,000	$5,000
			SubTotal:	$67,400
			Contingency (10%):	$6,740
			Total Construction Cost:	**$74,140**
			Non-Construction Cost:	$14,828
			Total Project Cost:	**$88,968**

Because this system is a gravity system, the operation and maintenance costs for this alternative will be minimal. The costs will be incurred in the current budget for general city-wide maintenance.

Advantages/Disadvantages.

The advantages to these alternatives are low Operation and Maintenance Costs. In addition, the frequent point repairs to the existing system that currently burden the maintenance crew will be lessened. The Rehabilitation Alternative "B", involving the installation of a Cured-in-Place liner, will reduce the impacts to the existing environment.

The disadvantage to the Replacement Alternative "A" is the larger disturbance to the existing trees and surrounding environment.

Recommended Alternative.

Two (2) alternatives have been considered for the Long Street Area Sanitary Sewer System. Both involve a gravity sewer system similar to the existing situation. The differences lie in the method of installation.

The recommended alternative is **Alternative "B" (Long Street Area, Mainline Sewer Rehabilitation – Cured-in-Place Pipe)**. This work will cause less of a disturbance to the existing surroundings as well as provide the least expensive option.