CITY OF WASHINGTON, ILLINOIS
Committee of the Whole Agenda Communication

Meeting Date: 9-9-2024

Prepared By: Dennis Carr – City Engineer

Agenda Item: Preliminary Excess Flow Lagoon Feasibility Study

Discussion: The City contracted with Strand Associates to perform a preliminary feasibility study for a combination of excess flow lagoons that would act in a way that would remove the need for the recommended Farm Creek trunk sewer project.

The feasibility study is attached to the agenda and shows that the lagoons themselves would not relieve the need, but in fact, would also require 2,800+ feet of the Farm Creek trunk sewer Alignment B to be constructed to achieve the same goal as the replacement of the trunkline as was laid out by Strand in prior meetings.

Fiscal Impact: The construction of the two lagoons as well as the section of trunkline would come at a cost of over $16 million before adding the additional maintenance expense required to maintain the existing trunkline in its current position. The trunkline along Route B is estimated at nearly $10 million.

Action Requested: Due to the large difference in cost associated with the lagoon projects, Staff does not recommend moving forward with the more in-depth feasibility study.

Professional

Engineering

Services

Preliminary Excess Flow Lagoon Feasibility Study

Report

City of

Washington, IL

August 2024

STRAND ASSOCIATES

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Strand Associates, Inc.®
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Joliet, IL 60431
(P) 815.744.4200
www.strand.com

August 29, 2024

Mr. Dennis Carr, P.E., City Engineer
City of Washington
301 Walnut Street
Washington, IL 61571

Re: Preliminary Excess Flow Lagoon Feasibility Study

Dear Dennis,

Following is the Preliminary Excess Flow Lagoon Feasibility Study. Thank you for the opportunity to work with the City of Washington on this study.

Please call 815-744-4200 with questions.

Sincerely,

STRAND ASSOCIATES, INC.®

Michael R. Waldron, P.E.

Enclosure: Report

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Report for

City of Washington, Illinois

Preliminary Excess Flow Lagoon Feasibility Study

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8/29/24

EXP 11/30/25

Prepared by:

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August 2024

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PRELIMINARY EXCESS FLOW LAGOON FEASIBILITY STUDY

FIGURES

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BACKGROUND

The City of Washington, Illinois (City) owns and operates its own sanitary sewer conveyance and wastewater treatment facilities. A component of the City's system is the Farm Creek Trunk Sewer (FCTS) that conveys flow between decommissioned Sewage Treatment Plant No. 1 (STP-1) and active Sewage Treatment Plant No. 2 (STP-2). In 2016, the City hired Strand Associates, Inc.® (Strand) to study replacement of the FCTS to address decommissioning of STP-1, operation and maintenance (O&M) issues identified by City staff, current sewer flow capacity concerns, and anticipated future flow contributions from new development or redevelopment. The findings of this study were presented in the *Preliminary Engineering Study for the Farm Creek Trunk Sewer*, dated October 2019 (2019 Study).

The City authorized Strand to proceed with design of the FCTS Replacement Project for reconstruction of the existing trunk sewer between STP-1 and STP-2 according to the preferred new sewer Route B. Design progressed to approximately 80 percent complete before being put on hold. Subsequently, the City requested Strand perform a preliminary feasibility study to determine whether implementation of excess flow storage could address current sewer flow capacity concerns and anticipated future flow contributions instead of the FCTS Replacement Project.

The study and evaluations performed were based on the following information:

1. City-provided geographical information system (GIS) mapping and record drawings.
2. Flow metering data from a storm event on August 30, 2016, gathered by Strand as part of the 2019 Study.
3. Tazewell County topographic mapping.
4. Available soil data.

The following study discusses the feasibility of implementing excess flow lagoons at the decommissioned STP-1 site and a property identified by the City north of Glenwood Cemetery (Site B) to address sanitary sewer system needs instead of the FCTS Replacement Project. Supporting figures and tables are provided at the end of the study.

HYDRAULIC MODEL DEVELOPMENT

A series of dynamic hydraulic models were created using XP Stormwater Management Model™ (XPSWMM) computer modeling software. The following section presents the models that were built.

A. Extent of Modeling

Modeling of the City's sanitary sewer system was performed for the segments shown on Figure 1. This included the existing FCTS from STPs-2 to -1 and the existing collector sewer upstream of STP-1 to where it crosses the railroad near 406 Peoria Street. An XPSWMM model was also built for the proposed FCTS Replacement Project along Route B between STPs-2 and -1.

B. Modeling Data

The sanitary sewer system in the XPSWMM model was built using City-provided GIS mapping and record drawings. Existing FCTS manhole rim and invert data as well as sewer size and material type were taken from engineering record drawings by Austin Engineering, Co., Inc. Upstream of STP-1, collector sewer manhole rim and invert data as well as sewer size and material type were taken from engineering record drawings by KH&M Engineers, Inc. Manhole and sewer information on the STPs-1 and -2 sites was confirmed using survey data collected by Strand in 2020. Strand's 80 percent design drawings for the proposed FCTS Replacement along Route B were also used to build the proposed models.

Current influent pumping capacities at STP-2 were used for the existing conditions models. However, the future conditions models used the proposed new influent pumping station capacity detailed in the Phase 2A Improvements for STP-2 drawings designed by Strand.

Sanitary flow data used in the XPSWMM models were derived from flow meter data collected in 2016 by Strand as part of the 2019 Study. Figure 2 shows the flow meter locations. Normal dry and wet weather flows were inputted into the models. The wet weather flow data came from a storm event on August 30, 2016. This event produced approximately 2.14 inches of rain during a 4-hour period, which was the highest intensity rain event metered, slightly exceeding a Bulletin 70, 2-year recurrence storm event. Wet weather hydraulic modeling results discussed in this study are limited to the flow produced by this event.

To calculate future projected dry and wet weather flows, the 2016 flow meter data were scaled to match the projected total future average daily flow, projected total design maximum flow, and daily temporal variation from the 2019 Study for each flow meter.

Several assumptions were made in creating the XPSWMM models. Firstly, it was assumed that the sewer pipes were free from obstructions and there was no leakage out of the system through the pipes or manhole walls. It was also assumed that no flow was lost in the sewer segment between the flow meter and the modeled portions of trunk sewer in instances where the flow meter data came from a tributary sewer upstream of the trunk sewer.

HYDRAULIC MODEL RESULTS

Several modeling iterations were performed to evaluate the existing sewer system under current and projected future peak flow conditions. The following section presents the results of the modeling evaluations.

A. Existing Sewer System Under Current Flow Conditions

The existing sewer system was modeled under current peak flow conditions based on flow metering data gathered in August 2016 and presented in the 2019 report.

1. Existing System

Figure 3.0 shows the results of modeling the sanitary sewer system as it exists today, which includes the current influent pumping station capacity at STP-2. The existing sewer system also has a sluice gate immediately upstream of the influent pumping station meant to control flow into STP-2. However, this sluice gate is frozen in a partially closed position and creates a restriction in the sewer system. This restriction was included in this model.

Figure 3.0 shows sewer segments in orange where the sewer capacity is exceeded, which means flow in the sewer surcharges over the crown or top of the pipe. Figure 3.0 also shows red circles where the sewer system overflowed out a manhole. The City has historic records of overflows from manholes on the STP-1 site that did not show up in the modeling. These overflow locations are shown on Figure 3.0 and may have been due to storm events of greater intensity than the August 2016 event.

2. Existing System Without Sluice Gate

Figure 3.1 shows the results of modeling the existing sewer with the sluice gate removed. This recommended improvement reduces surcharging and potentially eliminates one of the overflow locations on the existing FCTS.

Figures 3.2 through 3.5 present the profile of the FCTS and upstream sewer and the water surface (hydraulic grade line) in the sewer system during the peak flow conditions of the August 30, 2016, storm event. These profiles correspond to Figure 3.0 and show the level of surcharging in the sewer as well as where the system overflows at the manholes.

These modeling evaluations indicate that the City's existing FCTS does not have sufficient capacity to convey current-day significant wet weather excess flow conditions.

Modeling also revealed the sanitary sewer upstream of STP-1 is also under capacity for these flows. Figure 3.5 shows the upstream sewer reduces from a 42-inch pipe to parallel 12- and 24-inch pipes. These parallel pipes are at an inverted siphon, which is a sag under an existing drainageway. This existing feature is discussed later in this study.

B. Existing Sewer System Under Future Flow Conditions

A series of model iterations were run to evaluate the extent of capacity issues in the existing sewer system under future projected flow conditions. In this evaluation it was assumed that the frozen sluice gate was removed and the influent pumping station at STP-2 was upgraded to meet future flow conditions as recommended in the 2019 Study.

1. Future Dry Weather Flow Conditions

Modeling indicates that the existing system can provide sufficient capacity for future dry weather flow conditions. While the sewers do surcharge over the top of the pipe during dry weather, no manholes overflow. Although surcharging in the trunk and collector sewer may not be a conveyance problem because these sewers are generally lower than the local sewers, it is not a recommended design standard for dry weather flows.

2. Future Wet Weather Flow Conditions

Figure 4 shows the results of modeling the existing sewer with future wet weather flows. The FCTS surcharges and four manholes overflow downstream of STP-1 under these conditions. Additionally, more than one-half of the sewers surcharge and two manholes overflow upstream of STP-1. It is clear from these results that even with removing the frozen sluice gate and upgrading the capacity of the influent pumping station at STP-2, the City's existing FCTS does not have sufficient capacity to convey future wet weather flows.

C. Proposed FCTS Route B Under Future Flow Conditions

The hydraulic model was used to confirm the proposed FCTS Replacement Project along Route B provides sufficient capacity to convey the future projected flow conditions. The FCTS replacement sewer was designed assuming the upstream flow would be tributary to this new sewer at STP-1. Because modeling revealed the existing sanitary sewer upstream of STP-1 is under capacity and would reduce flow to STP-1, the model was modified to allow the upstream flow to get to STP-1. Figure 5 suggests (as presented in the 2019 Study) that the proposed FCTS Replacement Project would provide sufficient capacity to convey future projected wet weather flow with surcharging in the pipe but without manhole overflows.

EXCESS FLOW LAGOON EVALUATION

The hydraulic modeling provided an understanding of the limited flow capacity in the existing sewer systems. The model was then used to perform a series of evaluations to determine whether excess flow lagoons at STP-1 and/or Site B could relieve capacity issues in the existing sewer systems under future wet weather flow conditions.

The hydraulic modeling was updated with a diversion structure having a broad crested weir in the existing sewer system adjacent to STP-1 and adjacent to Site B. When this weir is overtopped, it diverts excess flow from the sewer system to the lagoons. The elevation of the weir was set higher than the dry weather flow depth so the raw wastewater flow would be maintained in the sanitary sewer pipe and conveyed to STP-2 but an increase in flow because of wet weather would overflow the weir and divert to the respective excess flow lagoon. The following subsections describe the findings from these evaluations.

A. Excess Flow Lagoon at STP-1

The existing sanitary sewer system was modeled with a diversion structure and excess flow lagoon only at STP-1. As shown in Figure 6, the excess flow lagoon eliminates overflows at STP-1, but the sewers surcharge and two manholes continue to overflow downstream of STP-1 under these conditions. Additionally, the excess flow lagoon at STP-1 did nothing to relieve the sewer surcharges and manhole overflows upstream of STP-1.

Figure 6 also shows the footprint of the excess flow lagoon needed to hold the volume of diverted flow from the system. Because the diversion structure weir was set just above the dry weather flow depth it cannot be lowered further without diverting raw wastewater into the excess flow lagoon. The scope of this study was to evaluate an excess flow lagoon and not a wastewater lagoon; therefore, no further evaluation was performed to divert additional flow to the excess flow lagoon at STP-1.

These results indicate that an excess flow lagoon only at STP-1 will not significantly relieve capacity issues in the existing sewer systems.

B. Excess Flow Lagoon at Site B

The existing sanitary sewer system was modeled with an excess flow lagoon only at Site B. Figure 7 shows the excess flow lagoon eliminates overflows at STP-1, but the sewers surcharge and two manholes continue to overflow downstream of STP-1. However, the excess flow lagoon at Site B eliminated most of the sewer surcharging and all the overflows upstream of STP-1.

Figure 7 also shows the footprint of the excess flow lagoon needed to hold the volume of diverted flow from the system. Similar to the diversion weir at STP-1, the weir elevation was set just above the wet weather flow depth and cannot be lowered further without diverting raw wastewater into the excess flow lagoon on Site B. Ground elevations are also a concern at Site B. The excess flow lagoon shown is at the lowest elevation of the site in order to reduce the amount of earthwork required to build a lagoon. Moving or extending the lagoon will significantly increase earthwork and cost.

These results are positive with respect to conveyance issues upstream of STP-1. However, an excess flow lagoon only at Site B will not significantly relieve capacity issues in the existing sewer system downstream of STP-1.

C. Excess Flow Lagoons at STP-1 and Site B

The existing sanitary sewer system was modeled with excess flow lagoons at STP-1 and Site B under the same parameters previously discussed. Unfortunately, both lagoons do not fully relieve flow capacity issues in the sewer system downstream of STP-1. Figure 8 shows that while most sewer surcharges and the manhole overflows were eliminated upstream of STP-1, the sewers surcharge and two manholes continue to overflow downstream of STP-1 under these modeled conditions.

This model iteration was further modified by raising the lid elevations of the overflow manholes; however, this moved the overflow locations to other points in the system so that overflows could not be fully eliminated.

ANCILLARY SEWER SYSTEM IMPROVEMENTS AND EXCESS FLOW LAGOON LAYOUT

The hydraulic modeling and excess flow lagoon evaluations revealed that excess flow lagoons at STP-1 and Site B alone do not address anticipated future flow conditions. Additional modeling was performed to evaluate whether ancillary improvements to the existing FCTS system along with an excess flow lagoon could address these concerns. The following is a discussion of the required FCTS system improvements and parameters of the excess flow lagoon at STP-1.

A. Farm Creek Trunk Sewer Replacement

Modeling was performed to evaluate whether construction of a portion of the proposed FCTS Replacement Project along Route B in addition to constructing excess flow lagoons at STP-1 and Site B would address the remaining capacity concerns. Figure 9 shows the modeling results indicating that construction of approximately 2,850 feet of the proposed 42-inch-diameter FCTS Replacement Project along Route B along with excess flow lagoons at STP-1 and Site B provides sufficient capacity to convey the future projected flow conditions. Model results shown in Figure 9 also reflect raising the lid elevation of six existing manholes to keep them from overflowing.

B. STP-1 Excess Flow Lagoon Preliminary Layout

Figure 10 shows a preliminary layout for an excess flow lagoon at STP-1. The area of this lagoon would cover approximately 2.28 acres and provide 6.07 acre-feet (1.98 million gallons [MG]) of storage volume. For this study, the storage volume is 25 percent greater than the excess volume identified by the model to account for unknown site conditions and conveyance issues in the sewer system. This preliminary lagoon sizing is based upon the lagoon at Site B also being constructed.
Fortunately, the existing sanitary sewer on the east side of the STP-1 site is relatively shallow to the ground surface and the sewer falls approximately 15 feet from east to west across the site. This allows excess flow to be diverted by gravity from the sewer on the east side of the site into the lagoon and then returned by gravity to a downstream sewer segment. Figure 12 shows conceptual diversion and release structure the excess flow lagoons. The STP-1 site would have a release structure with a normally closed sluice gate. Following an excess flow event and return of the sewer system to normal flow conditions, the sluice gate would be opened, and the stored excess flow returned to the sewer system.

Review of geotechnical data for STP-1 indicates shallow groundwater at 4 to 6 feet below grade, which will be within the strata of the proposed lagoon. Additionally, the site is underlaid by gravelly clays. These two characteristics indicate that construction of an impermeable liner will be required for the lagoon on STP-1.

C. Site B Excess Flow Lagoon Preliminary Layout

Figure 11 shows a preliminary layout for an excess flow lagoon at Site B. The area of this lagoon would cover approximately 5.27 acres and provide 30.84 acre-feet (10.05 MG) of storage volume, which is 25 percent greater than the excess volume identified by the model to account for unknown site conditions and conveyance issues in the sewer system.

It is strongly recommended that diversion of flow from the sewer system to an excess flow facility be via gravity and not pumping. Pumping requires dependance on mechanical and electrical systems to remain operable during potentially extreme weather conditions. A gravity diversion is significantly more reliable and does not require human interface to operate properly. Unfortunately, the existing sanitary sewer around Site B is very deep, requiring significant earth excavation to allow for a gravity diversion.

The existing sanitary sewer around Site B is also flat, unlike that of STP-1. Therefore, while a gravity diversion is possible, release flows will need to be pumped from the lagoon back into the sanitary sewer. Figure 12 shows a conceptual diversion structure and a pumping station for a release structure at the excess flow lagoon on Site B. The pumping station would be sized as needed to return flows to the sanitary sewer system following an excess flow event and return of the sewer system to normal flow conditions.

A search was performed for geotechnical data or well records for Site B to determine the subsoil conditions that might impact construction of a lagoon, but nothing definitive was found. The Tazewell County Soil Survey seems to indicate similar soil conditions at STP-1 and Site B, but the data is only for the top several feet of ground. However, with the proximity of the sites to each other and to Farm Creek, it is assumed Site B will require construction of an impermeable liner for the lagoon similar to STP-1.

EXISTING CAPACITY ISSUES UPSTREAM OF STP-1

As previously noted, modeling of the sewer system upstream of STP-1 revealed surcharged sewers and one overflow under current wet weather flow conditions as shown in Figures 3.0 and 3.1. These capacity concerns are increased under future wet weather flow conditions, as shown in Figure 4. While addressing issues in this upstream sewer system was not part of the original scope of this study, some cursory investigations were performed to identify potential improvements to eliminate these capacity issues.

Figure 3.0 identifies an inverted siphon in the sewer system upstream of STP-1. Figure 3.5 shows a profile of this inverted siphon, which is where the existing 42-inch sanitary sewer reduces to parallel 12- and 24-inch pipes that drop under an existing drainageway. These smaller pipes create a restriction in the sewer system.

Figure 7 shows that construction of an excess flow lagoon at Site B upstream of the inverted siphon eliminates the identified overflows and reduces sewer surcharging upstream of STP-1. However, Figure 8 shows that even with an excess flow lagoon at STP-1, the capacity issues downstream of STP-1 are not resolved.

Modeling was performed of the existing sewer system under future flow conditions but with the 12- and 24-inch siphon pipes replaced with a 42-inch pipe. Under this scenario, the sewer upstream of STP-1 is still surcharged, in some instances very close to the ground surface, but the overflows are eliminated, indicating there is potential for existing sewer improvements to address the capacity issues upstream of STP-1. However, this effectively removes the existing sewer restriction and sends all flow downstream creating more problems between STPs-1 and -2. Under this scenario, the excess flow lagoon at STP-1 would increase from approximately 2 to 10 MG making the lagoon significantly larger, deeper, and more expensive, and there will still be surcharging and overflows downstream of STP-1.

A final modeling scenario was performed with the proposed FCTS Replacement Project along Route B and the existing 24- and 12-inch siphon pipes replaced with a 42-inch pipe. As previously noted, this eliminates the overflows in this upstream sewer system by removing the existing sewer restriction and sending flow downstream to STP-1. However, in this scenario, as shown in Figure 5, the proposed FCTS Replacement Project can handle the increased flow conditions.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST (OPCC)

Preliminary OPCCs were developed for construction of excess flow lagoons on STP-1 and Site B. These OPCCs were based on mass earthwork projects recently constructed in 2022 and 2023. OPCCs were also developed for construction of a portion of the proposed FCTS along Route B. These FCTS OPCCs were based on the unit prices in the latest OPCC for the FCTS Replacement Project.

The OPCCs were escalated to 2024 dollars based on construction cost indices compiled by Construction Analytics. These indices are shown on the OPCC details provided at the end of this study. A summary of the OPCCs is provided in the following.

- Excess Flow Lagoon at STP-1 $2,073,220
- Excess Flow Lagoon at Site B $11,479,700
- Construct Segment of FCTS Route B $2,576,660

- Proposed FCTS Replacement Project Route B $9,766,880

OTHER CONSIDERATIONS

If excess flow lagoons are implemented to address existing and future projected flow conditions in the existing FCTS between STPs-1 and -2, there will still be other system improvements required.

1. Sluice gate–The existing frozen sluice gate at STP-2 must be removed. The existing conditions modeling showed the detrimental impact this sluice gate has on current flow conditions. Removal of this structure and replacement with a manhole is estimated at approximately $40,000.

2. Existing FCTS protection where it crosses Farm Creek–Approximately 22 sections of the existing FCTS cross Farm Creek. The crossings are not all exposed but still need to be protected and stabilized with creek riffles similar to what was recommended in the FCTS Replacement Project. Each crossing is estimated at $5,400 for a total cost of approximately $118,800. This cost does not include clearing and tree removal costs to gain access to the existing crossings.

3. Raising existing manhole lids–At a minimum, it is recommended that the lids of existing manholes along the FCTS be raised to an elevation higher than the Farm Creek 100-year floodplain to reduce creek inflow into the system. Each manhole adjustment is estimated at $3,200. There are approximately 30 existing manholes that may have to be raised for a total cost of approximately $96,000. This cost does not include clearing and tree removal costs to gain access to the manholes.

4. Televising existing trunk sewer–The condition of the existing trunk sewer is unclear, and it is recommended that the sewer be televised to identify structural failures, blockages, or infiltration points. The estimated cost to televise the existing trunk sewer is $395,000. Detail of this estimate is provided at the end of this study. This cost does not include clearing and tree removal costs to gain access to the televising access points.

5. Lining existing trunk sewer–Depending on the findings of the sewer televising, it may be necessary to line portions or all the existing sewers. It is very difficult to estimate the cost to line this sewer due to its location, extremely limited accessibility, difficulty transporting the liner to the access points, significant bypass pumping, and unknown internal sewer wall condition, among other potential issues. The cost to line the existing sewer is approximately $6,730,000. This cost does not include clearing and tree removal costs to gain access to the lining and retrieval points. Details of this OPCC are provided at the end of this study; however, it is highly recommended the City seek assistance from experienced sewer lining contractors to obtain an estimate of cost.

6. Odor control–There could potentially be odor concerns with the excess lagoon flows that may require installation of odor control systems and increased O&M efforts to manage.

7. Access and O&M–As noted in the 2019 Study, there are impediments to City staff access and O&M of the existing FCTS. There would also be additional general maintenance required for the excess flow lagoons, sluice gate, and pumping facility. Because of the infrequency and unpredictable use of the sluice gate and pumping facility, these structures will require additional exercise and maintenance.

CONCLUSIONS

The results of this study show the City's existing FCTS system between STPs-1 and -2 does not have sufficient capacity to convey current or future projected wet weather flows. Implementation of excess flow lagoons at STP-1 and Site B alone do not eliminate these conveyance issues. Ancillary improvements including removing the frozen sluice gate at STP-2 and constructing a portion of the proposed FCTS Replacement Project along Route B will also be required to convey future projected flows. Based on the OPCC's developed, implementation of excess flow lagoons and the ancillary improvements will cost approximately $16,169,600.

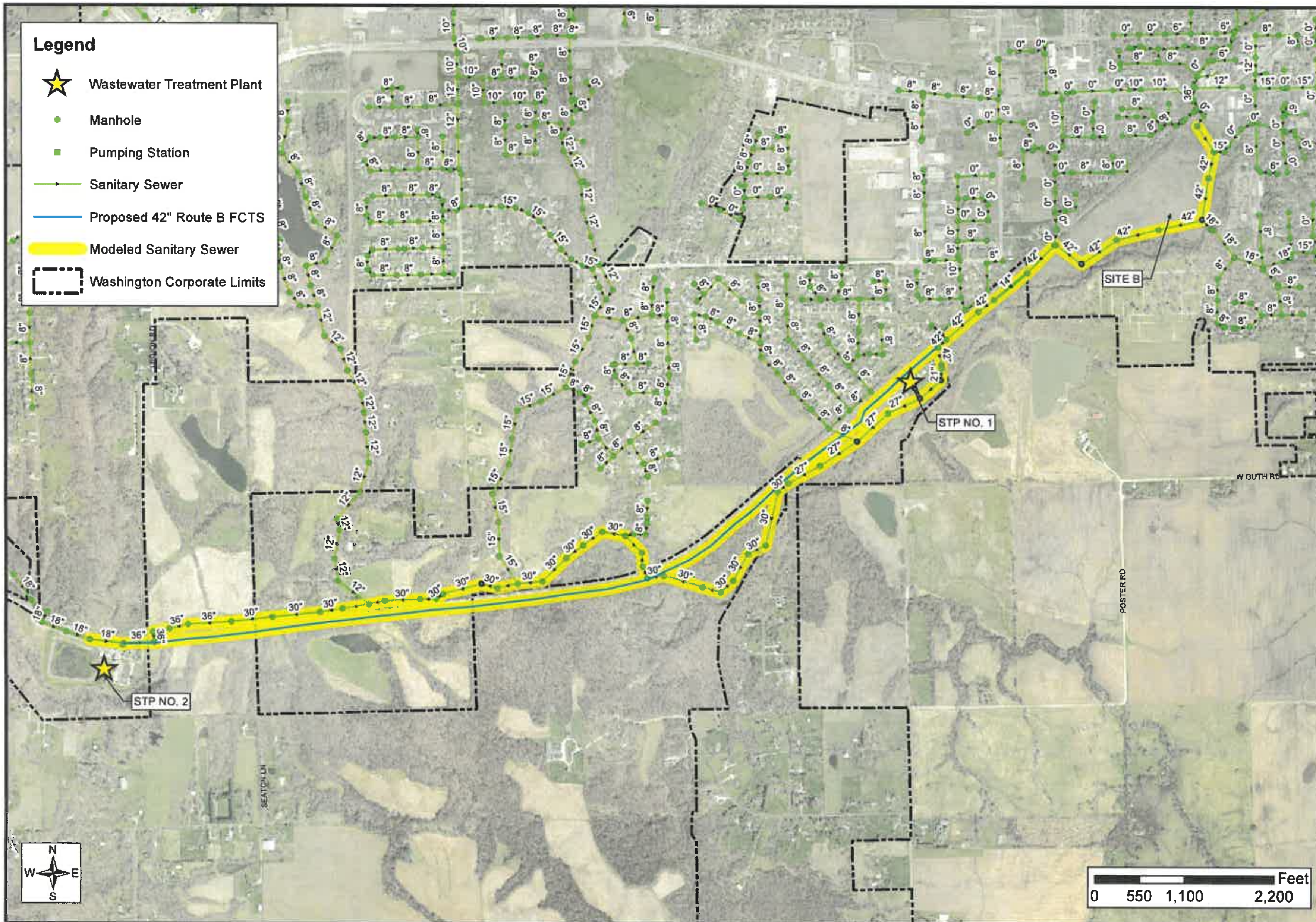
If excess flow lagoons are implemented, other system improvements must also be considered. These include protecting the existing FCTS where it passes under the creek, raising manhole lids above flood elevation, and televising the existing FCTS to verify structural integrity and flow conditions. Furthermore, depending on the conditions of the existing FCTS, lining of the pipes may be required. These activities will require clearing and tree removal along the existing FCTS. The City will also need to consider whether odor controls are necessary at each lagoon and the continuing O&M issues that retaining the existing trunk sewer in and adjacent to Farm Creek will impart.

If the City chooses to pursue implementation of excess flow lagoons, it is recommended that an additional study be performed, and a final basis of design be developed. The flow data used in this study is limited to the intensity of the August 30, 2016, storm event and needs to be updated to better quantify existing flow conditions as well as collect additional, more intense wet weather data. Additional site survey and geotechnical investigations need to be performed to better characterize earthwork needs at each lagoon site. Finally, more detailed modeling should be performed to verify hydraulic conditions under the final basis of design.

This study also confirmed that the proposed FCTS Replacement Project along Route B has sufficient capacity to convey current and future projected wet weather flows based on the August 30, 2016, storm event.

Furthermore, this study identified potential sewer surcharging and overflows upstream of STP-1 likely because of a sewer restriction at an existing inverted siphon. An excess flow lagoon at Site B or removal of this flow restriction appears to address these problems. However, removal of the flow restriction will create additional problems between STP-1 and STP-2. Implementation of the proposed FCTS Replacement Project along Route B can handle the increased flow if the flow restriction is removed.

FIGURES



MODELED SANITARY SEWER SYSTEM
EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

STRAND ASSOCIATES

FIGURE 1
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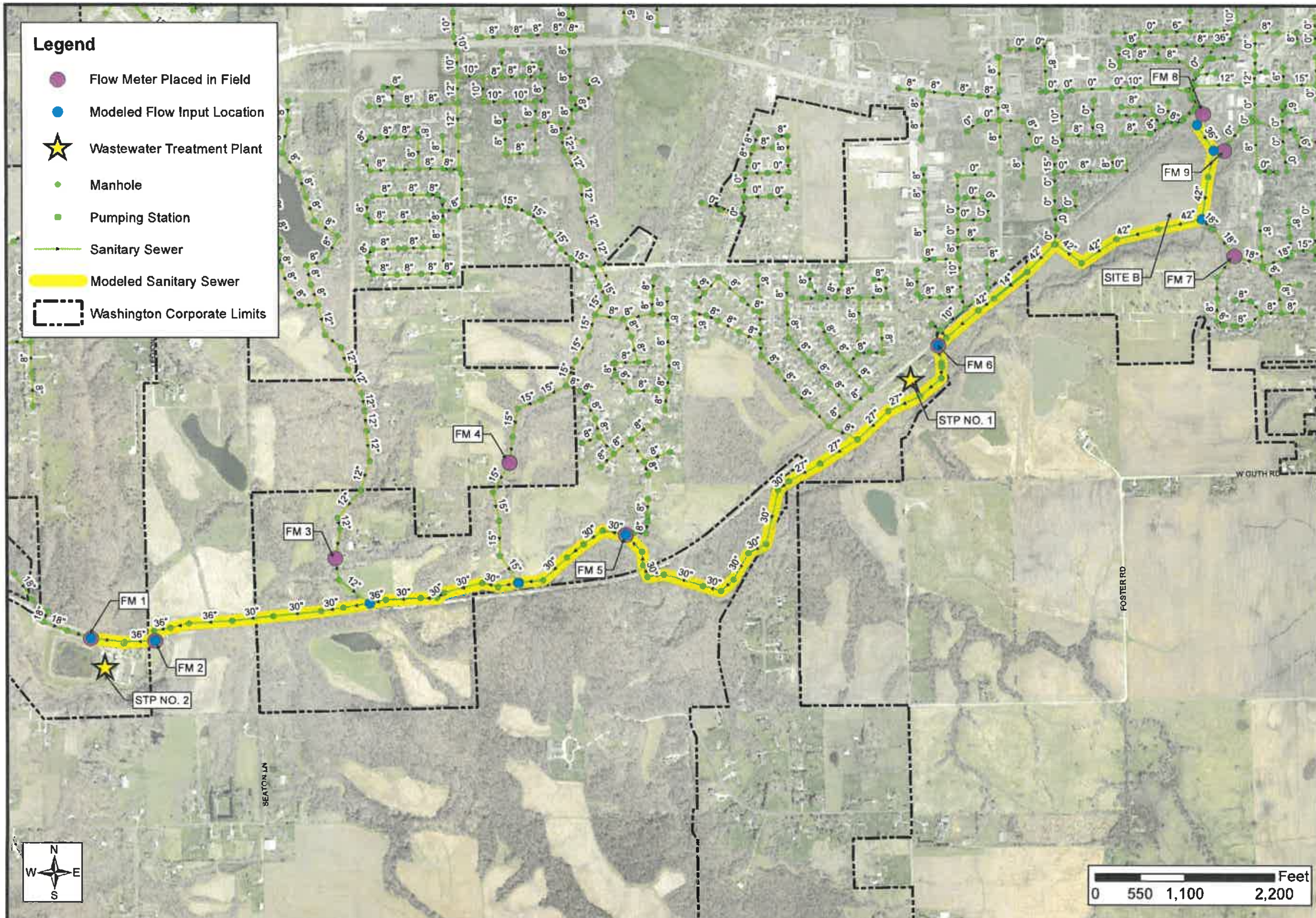
Path: S:\JCL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 1_Overall Plan View.mxd User: Mirandag Date: 6/11/2024 Time: 1:26:36 PM



FLOW METERING LOCATIONS
EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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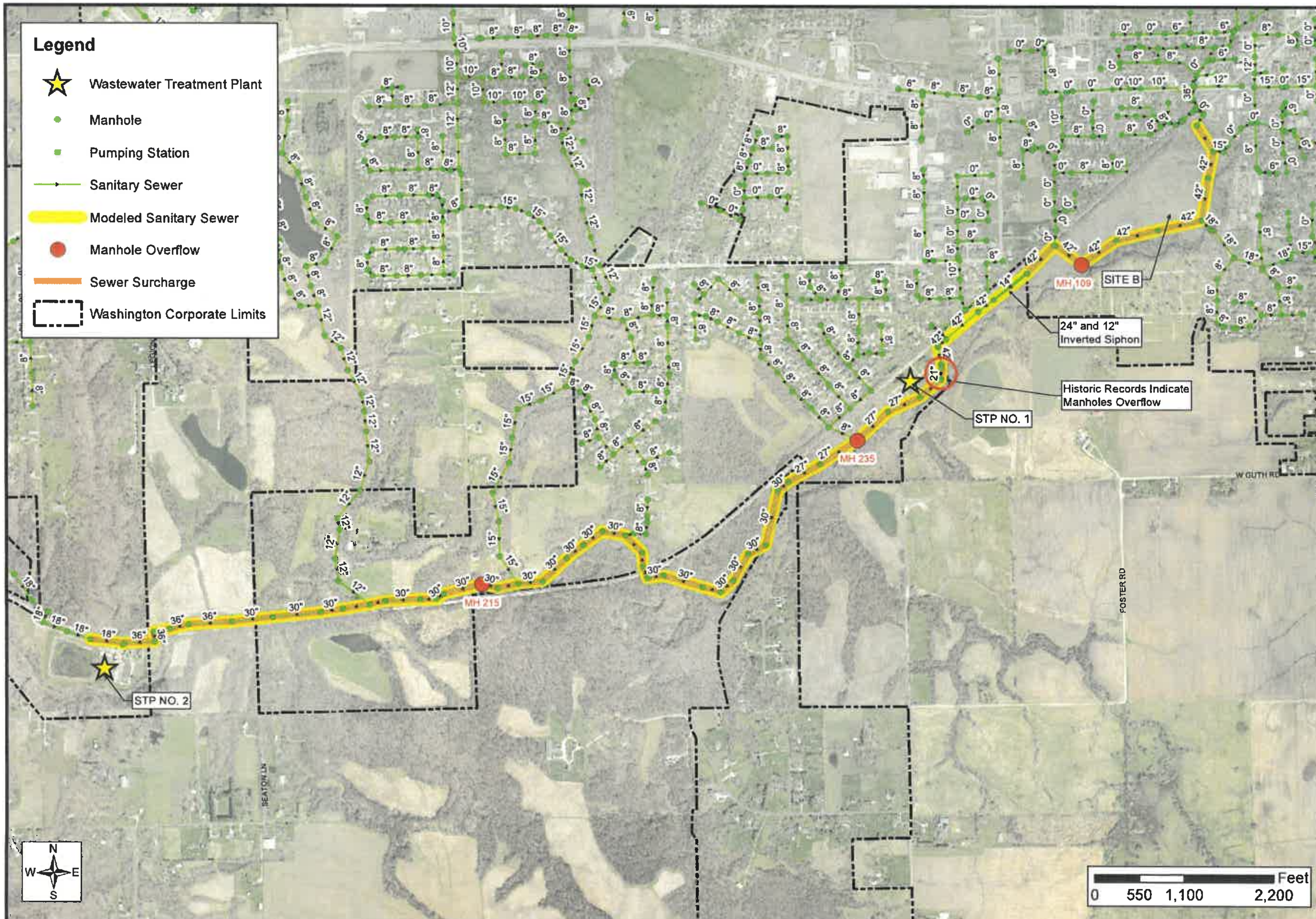
FIGURE 2
1879.028

Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 2_Flow Meter Location.mxd User: MirandaG Date: 8/26/2024 Time: 4:06:20 PM



EXISTING SEWER CAPACITY UNDER CURRENT WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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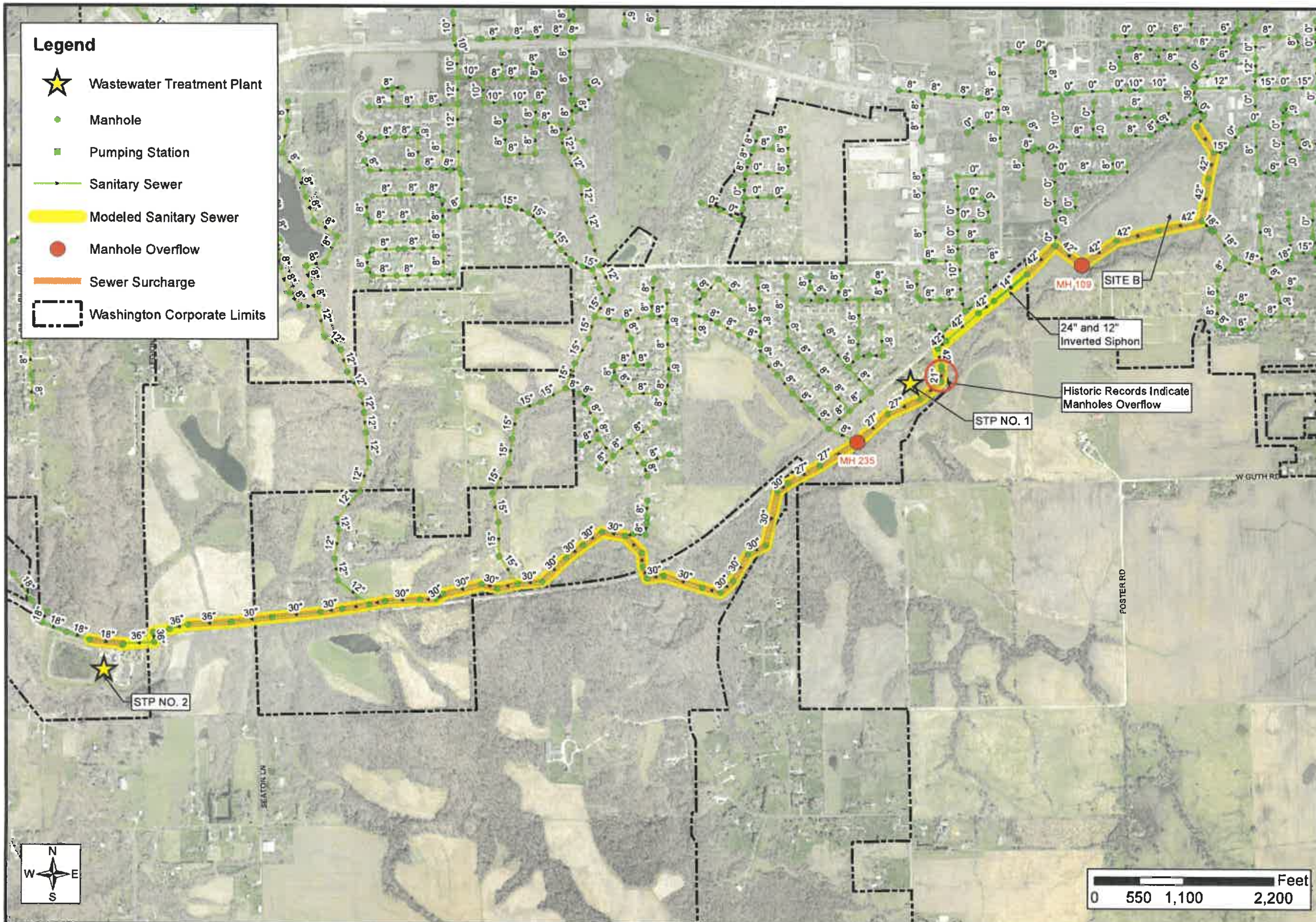
FIGURE 3.0
1879.028

Path: S:\JOL\1800—1899\1879\028\Drawings\GIS\Maps\Figure 3_Existing Conditions Wet Weather.mxd User: MaundaG Date: 8/27/2024 Time: 10:16:29 AM



EXISTING SEWER CAPACITY UNDER CURRENT WET WEATHER FLOWS WITHOUT SLUICE GATE

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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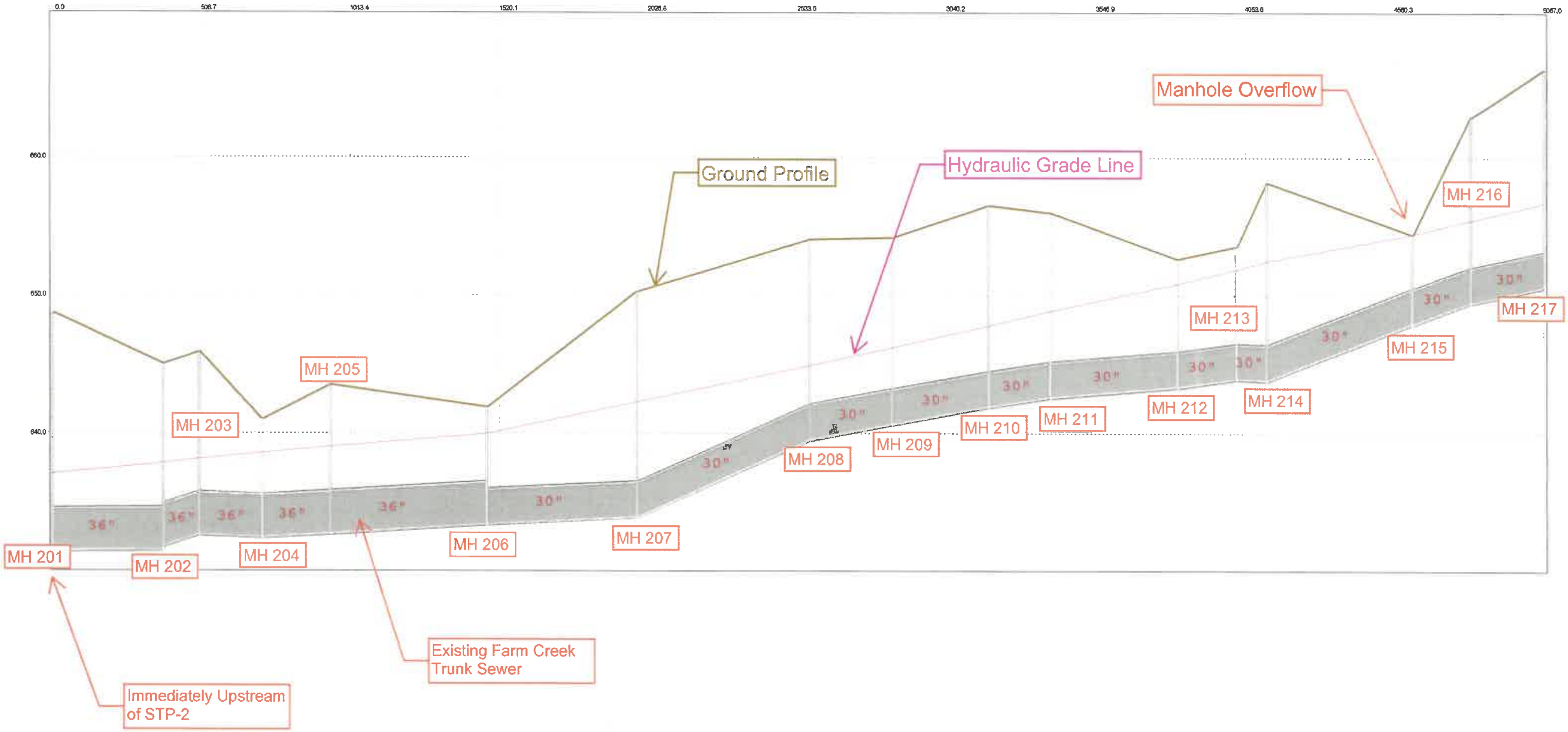
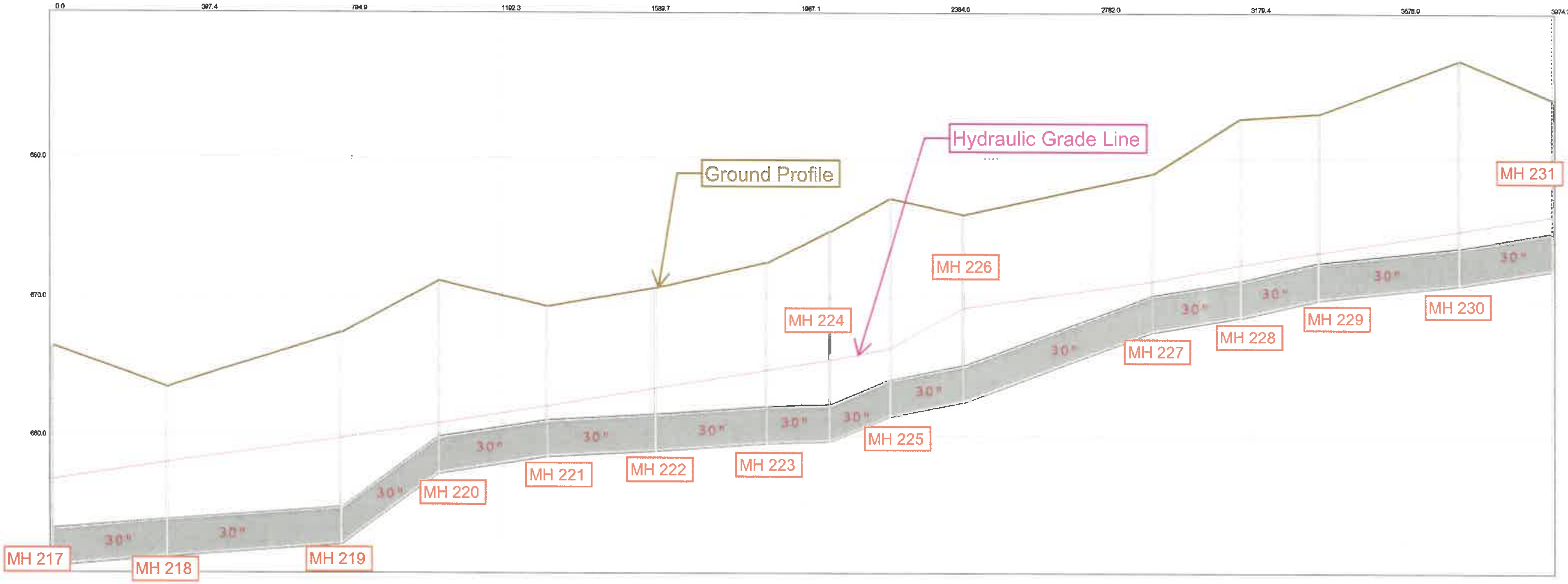
FIGURE 3.1
1879.028

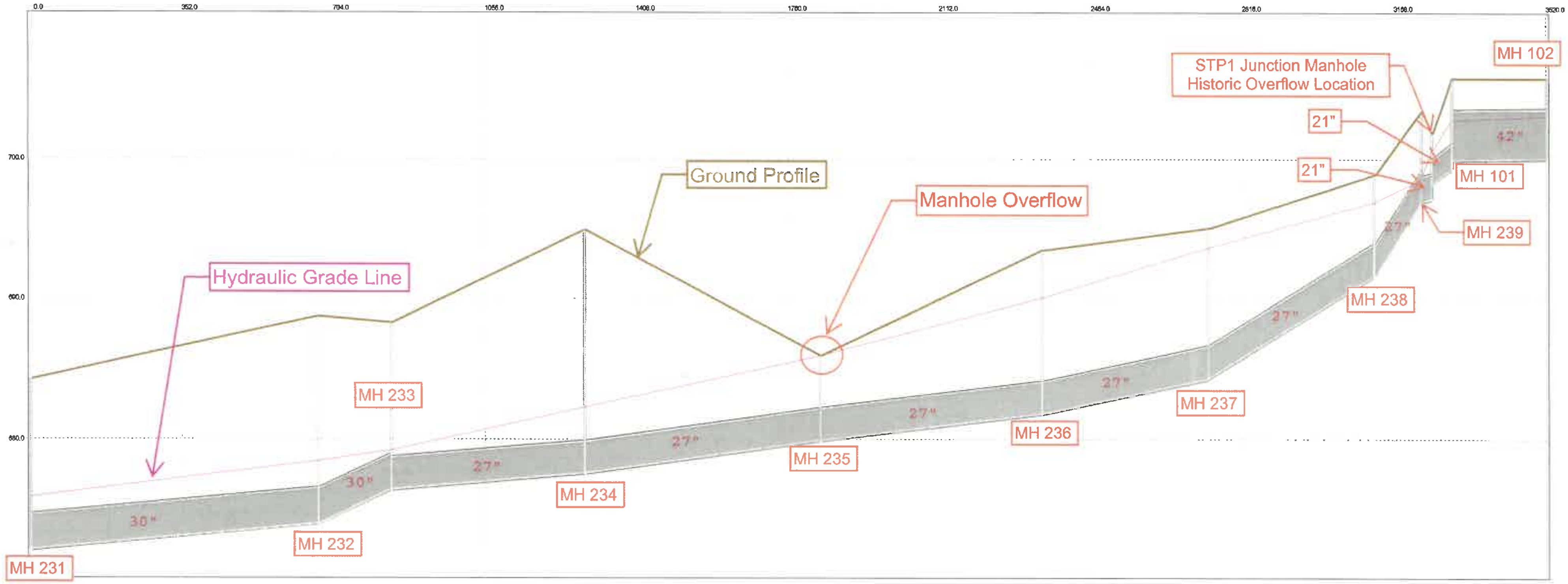
Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 3.1_Existing Conditions No Sluice Gate Wet Weather.mxd User: MirandaG Date: 8/27/2024 Time: 10:21:04 AM



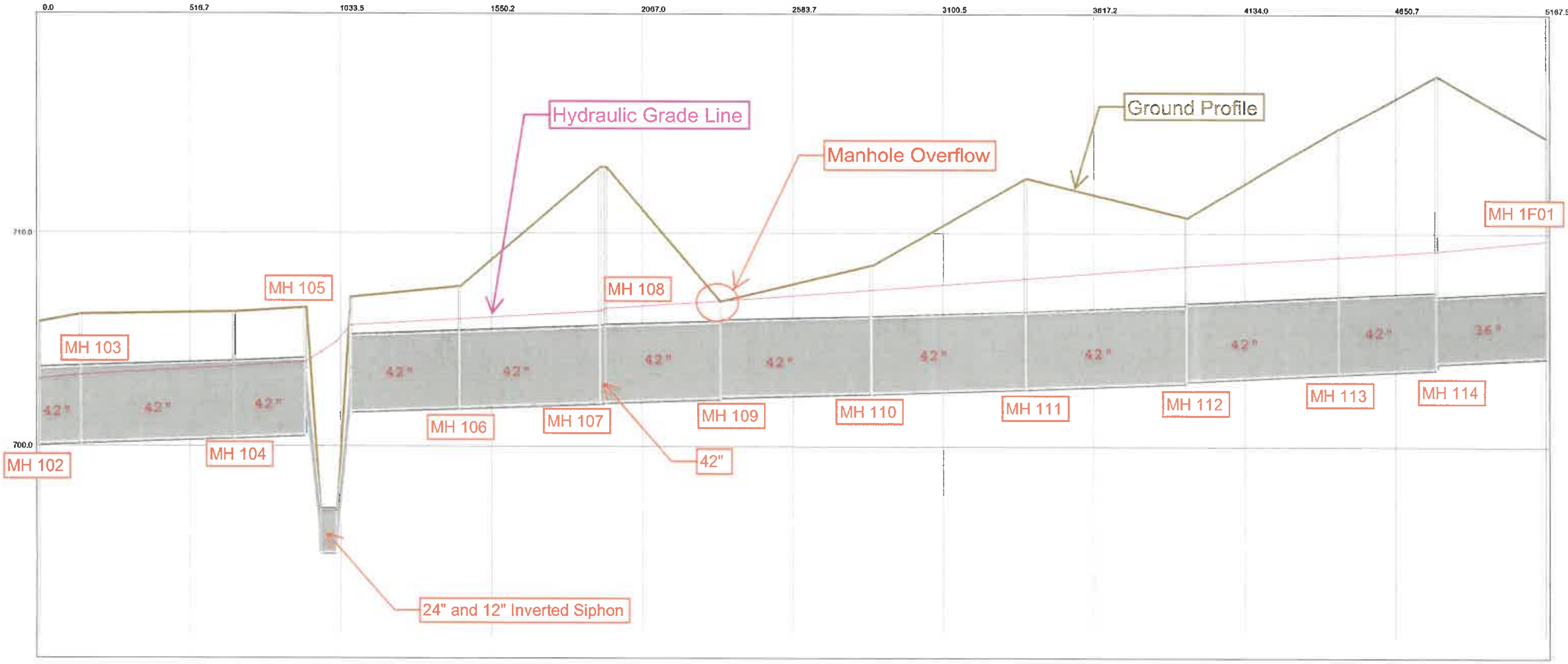
EXISTING SEWER MODEL PROFILE UNDER
CURRENT WET WEATHER FLOWS - 1
FIGURE 3.2



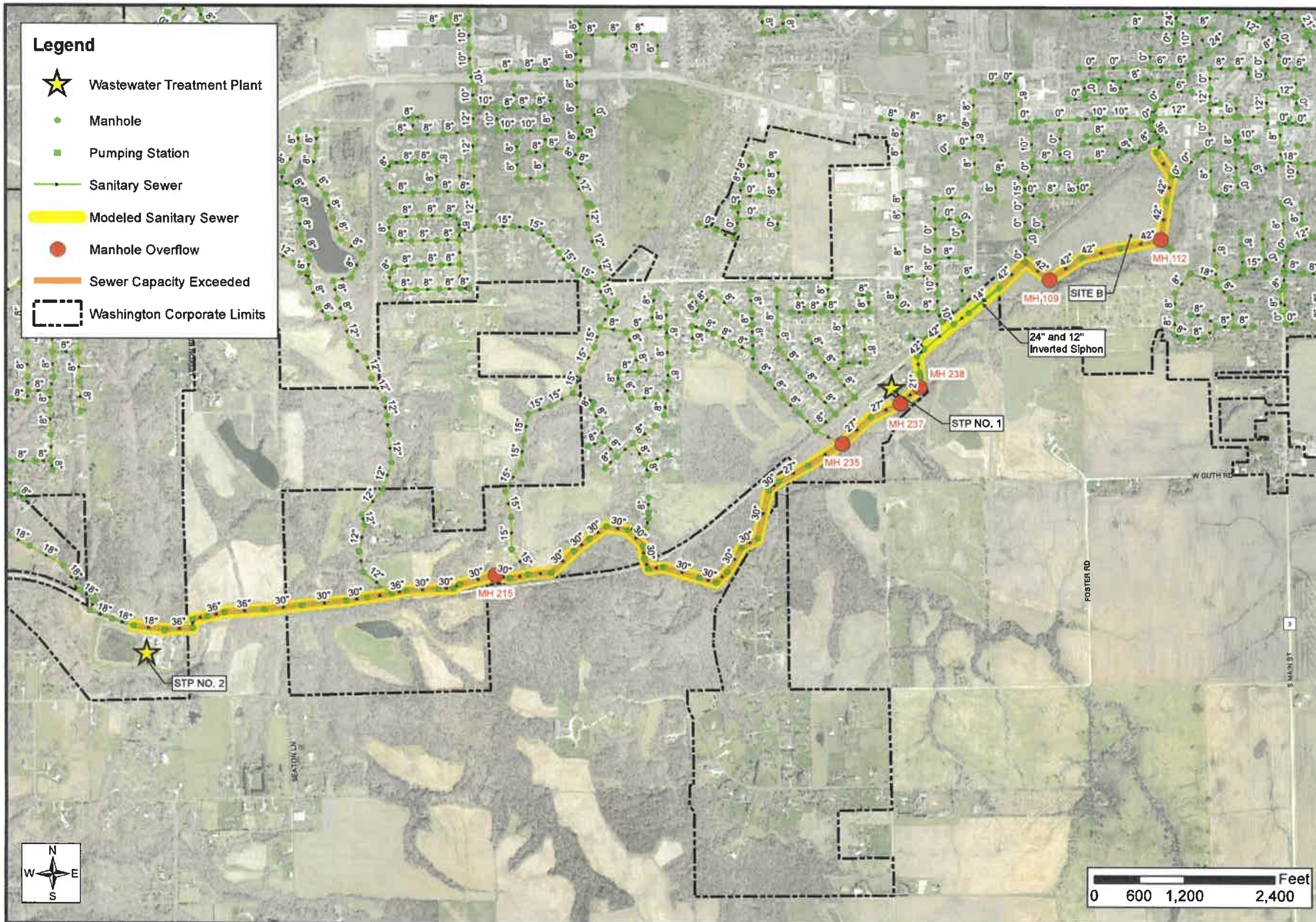
EXISTING SEWER MODEL PROFILE UNDER
CURRENT WET WEATHER FLOWS - 2
FIGURE 3.3



EXISTING SEWER MODEL PROFILE UNDER
CURRENT WET WEATHER FLOWS - 3
FIGURE 3.4



EXISTING SEWER MODEL PROFILE UNDER
CURRENT WET WEATHER FLOWS - 4
FIGURE 3.5



EXISTING SEWER CAPACITY UNDER FUTURE WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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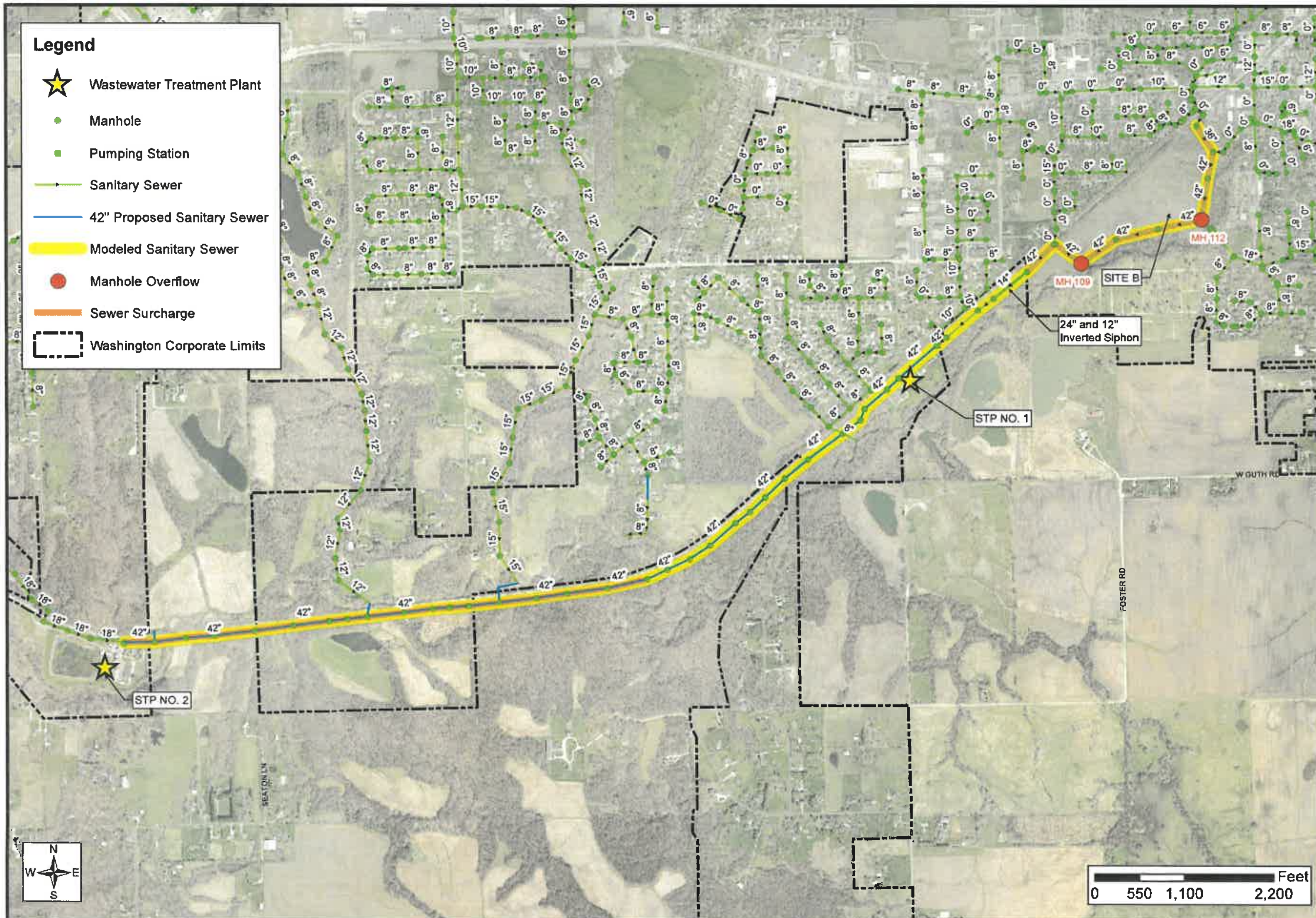
FIGURE 4
1879.028



PROPOSED FCTS ROUTE B CAPACITY UNDER FUTURE WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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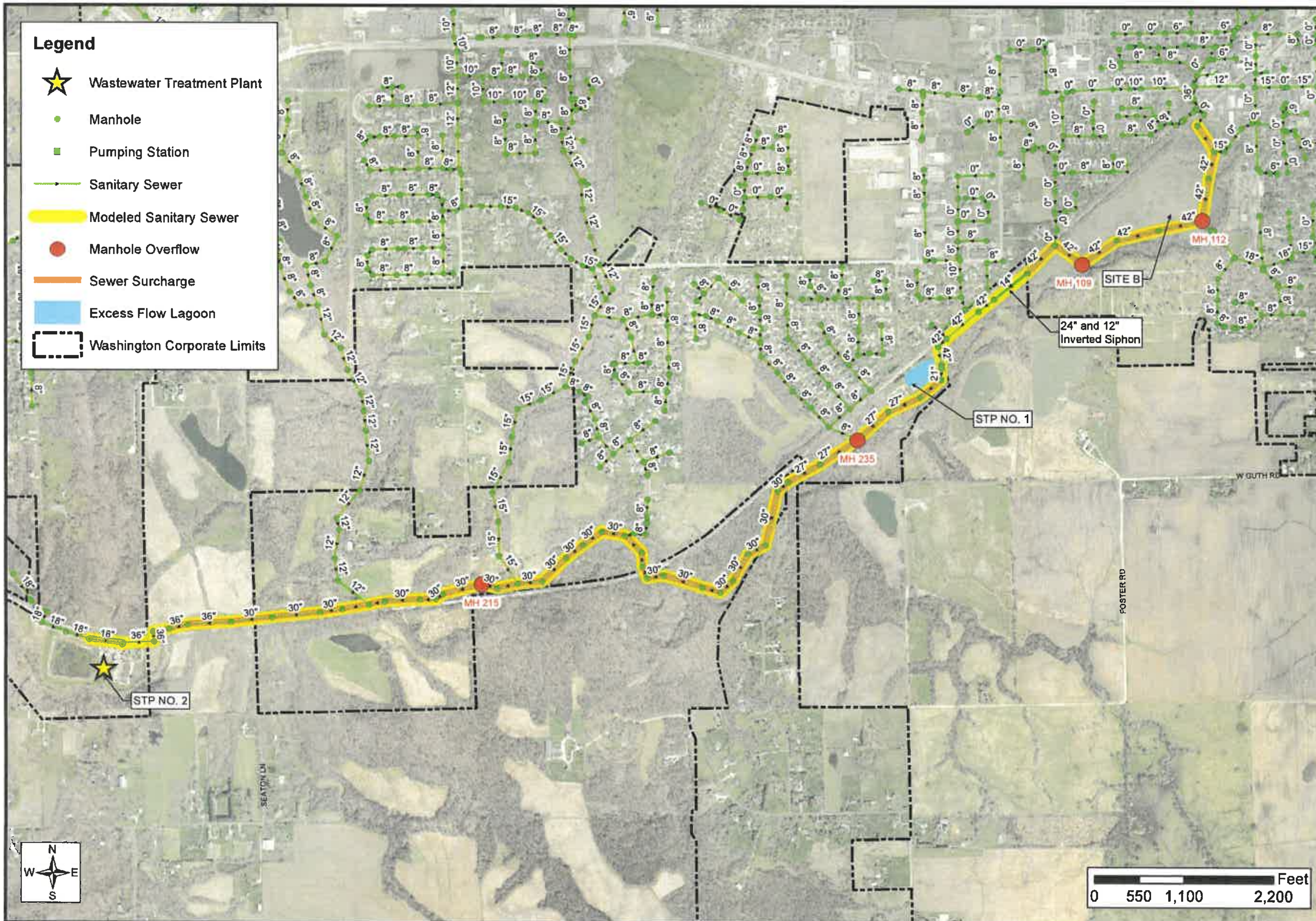
FIGURE 5
1879.028

Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 5_Alt B Future Wet Weather.mxd User: MirandaG Date: 8/27/2024 Time: 1:38:59 PM



EXISTING SEWER CAPACITY WITH EXCESS FLOW LAGOON
AT STP 1 UNDER FUTURE WET WEATHER FLOWS
EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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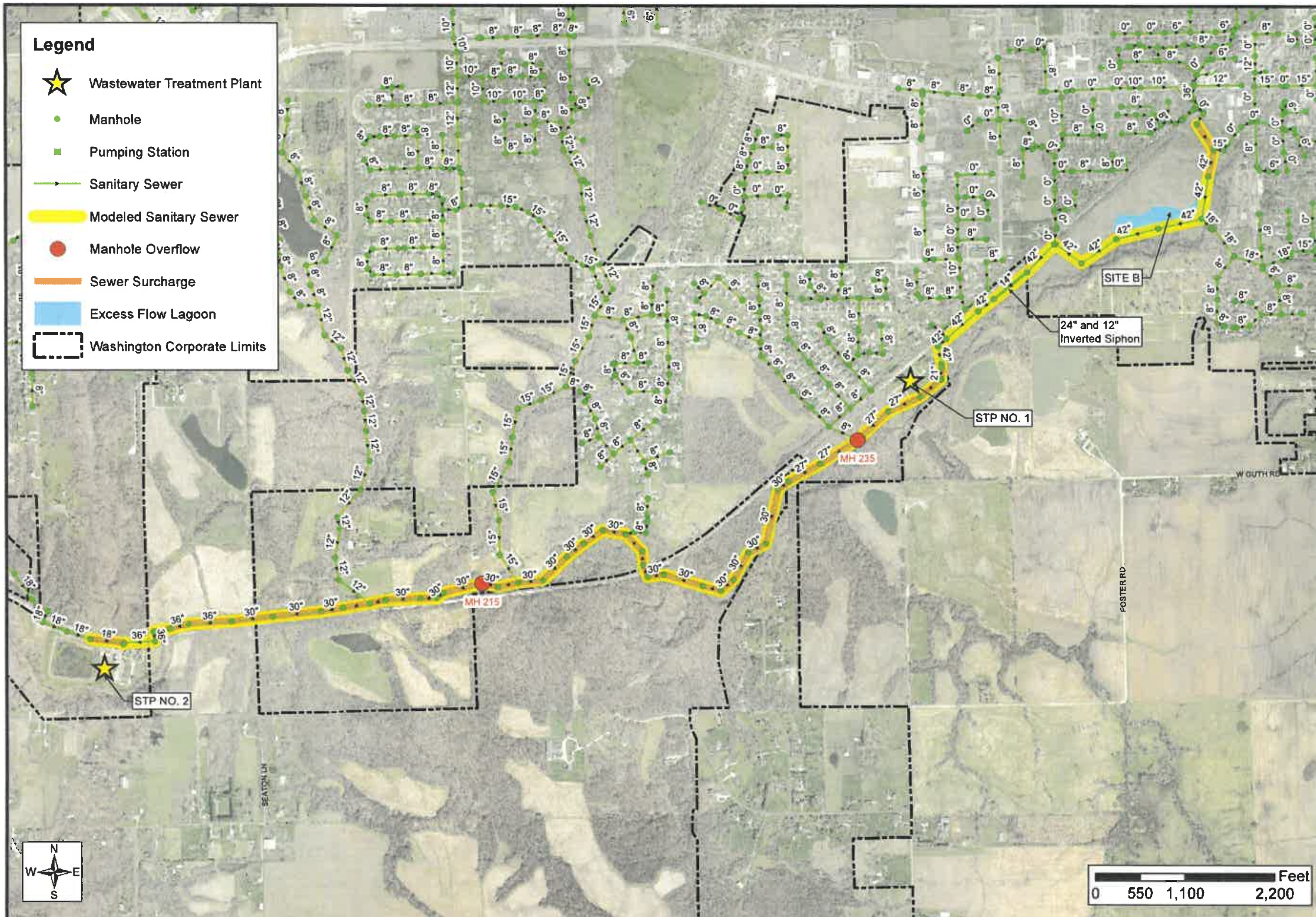
FIGURE 6
1879.028



EXISTING SEWER CAPACITY WITH EXCESS FLOW LAGOON AT SITE B UNDER FUTURE WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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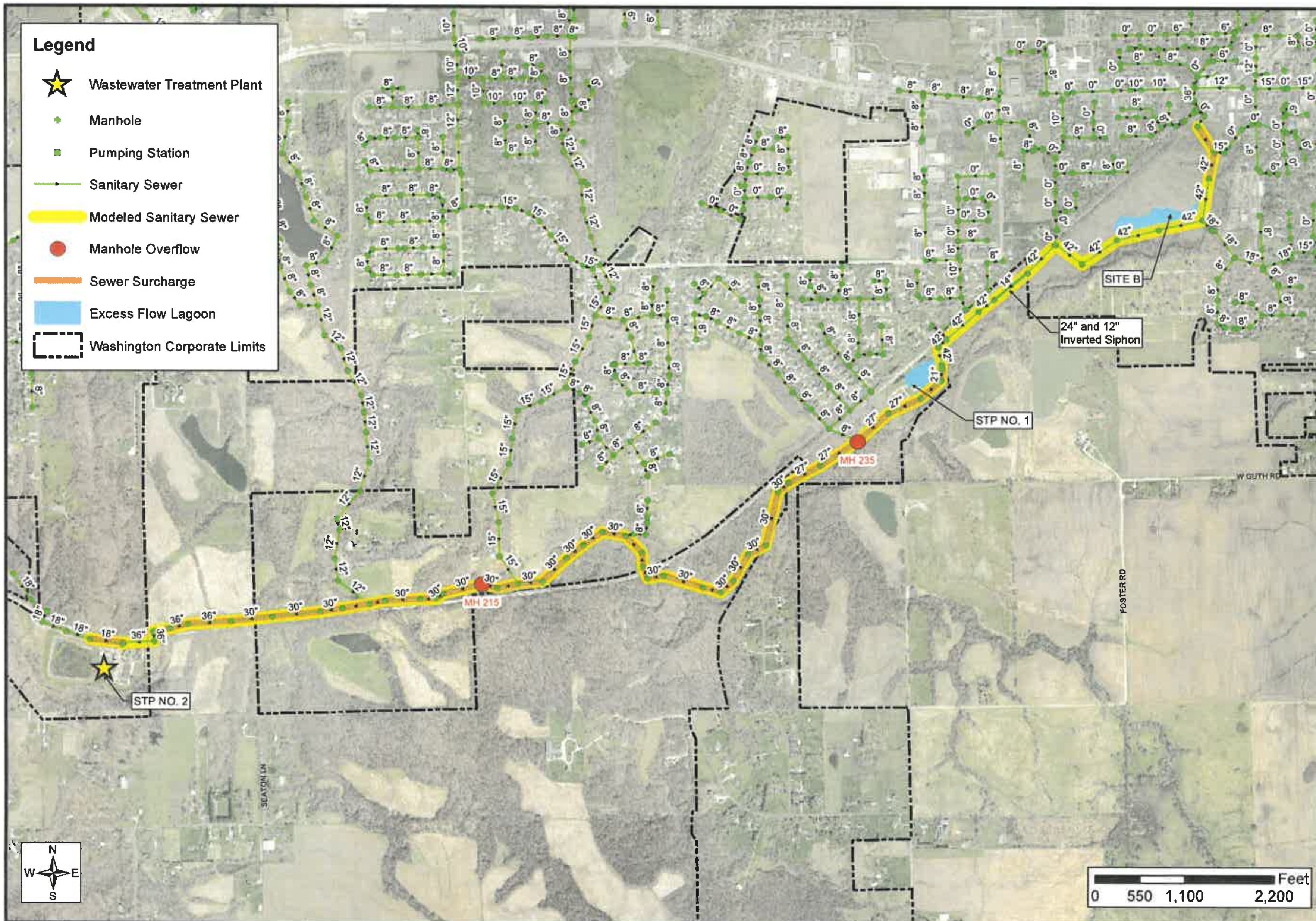
FIGURE 7
1879.028

Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 7_Excess Flow Site B Future Wet Weather.mxd User: MirandaG Date: 8/27/2024 Time: 10:38:16 AM



EXISTING SEWER CAPACITY WITH EXCESS FLOW LAGOONS AT STP1 & SITE B UNDER FUTURE WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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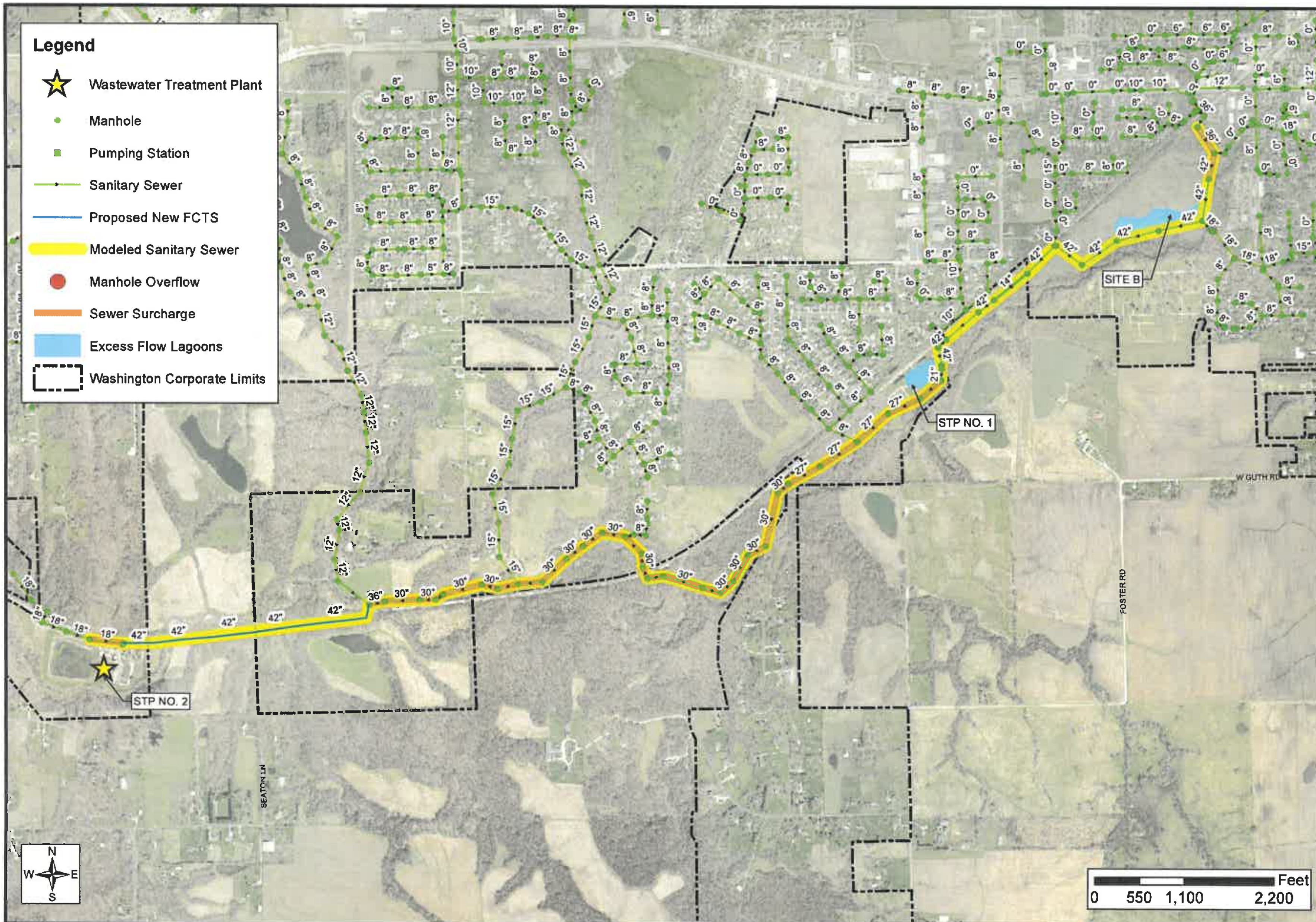
FIGURE 8
1879.028

Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 8_Excess Flow STP 1 & Site B Future Wet Weather.mxd User: MirandaG Date: 8/27/2024 Time: 10:39:26 AM



SEWER CAPACITY WITH A PORTION OF NEW FCTS AND EXCESS FLOW LAGOONS AT STP1 & SITE B UNDER FUTURE WET WEATHER FLOWS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

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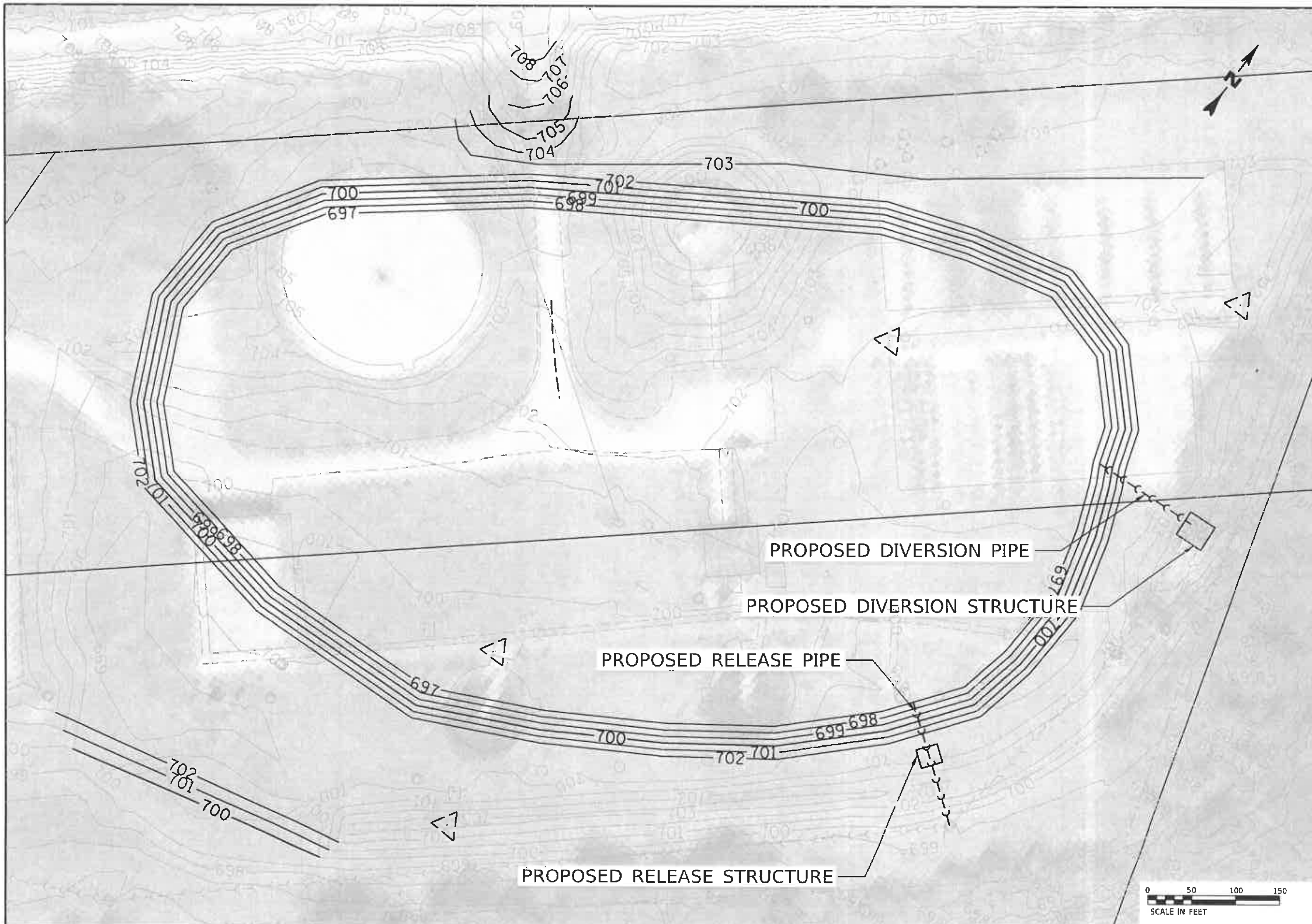
FIGURE 9
1879.028

Path: S:\JOL\1800--1899\1879\028\Drawings\GIS\Maps\Figure 9_Excess Flow STP 1 & Site B and Pudik Replace Future Wet Weather.mxd User: MirandaG Date: 8/26/2024 Time: 3:59:11 PM



DATE | REVISIONS | NO.

STP-1 EXCESS FLOW LAGOON
PRELIMINARY SITE LAYOUT

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

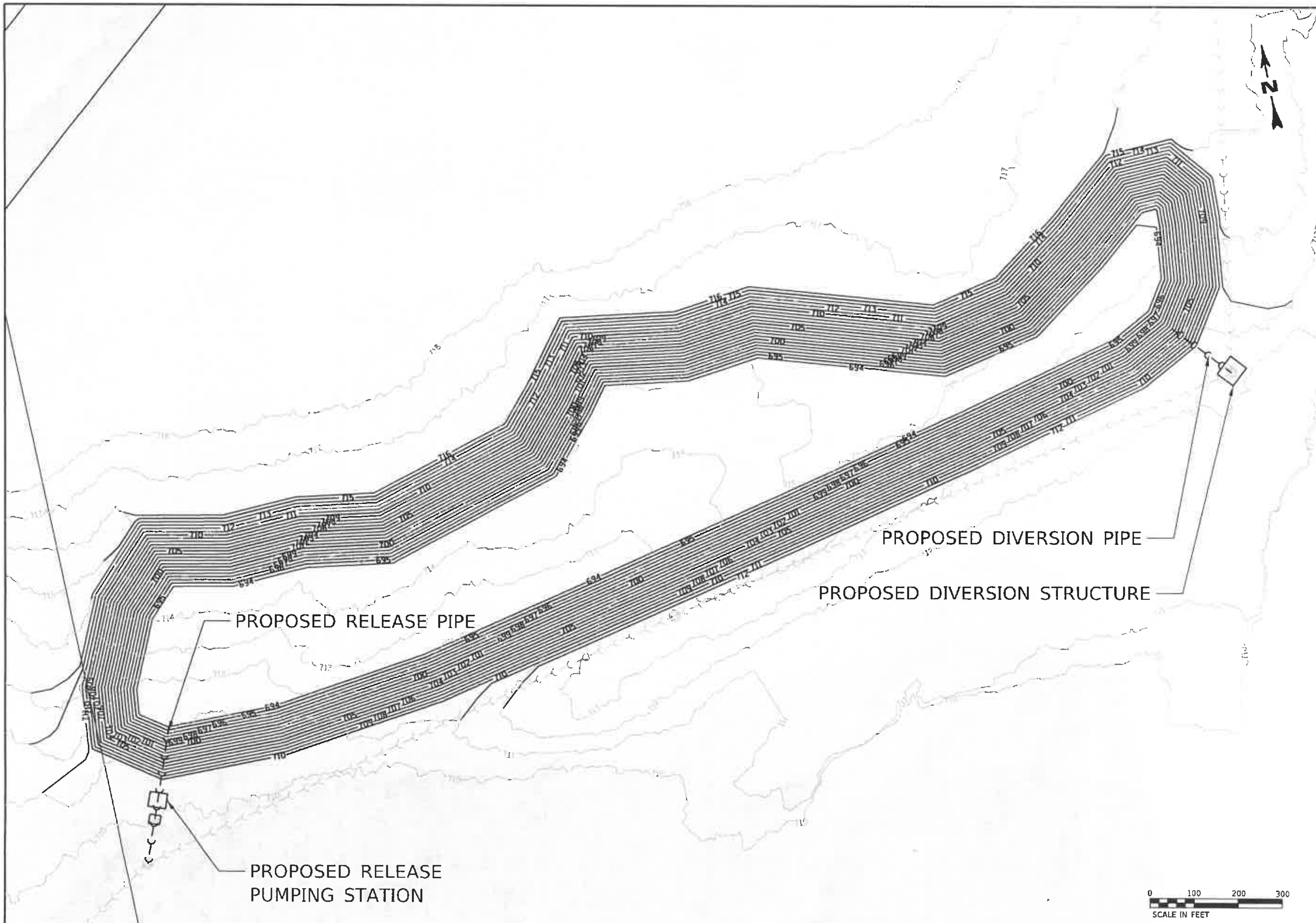
JOB NO.
1879.028

PROJECT MGR.
MRW

STRAND
ASSOCIATES®

SHEET
FIGURE 10

S:\JOL\1800--1899\1879\026\Micros\CADD_Sheets\1879026-sht-ExcessFlow-STP1.dgn MirandaO 8/23/2024 4:01:57 PM



NO. | REVISIONS | DATE

SITE B EXCESS FLOW LAGOON PRELIMINARY SITE LAYOUT

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

JOB NO. 1879.028

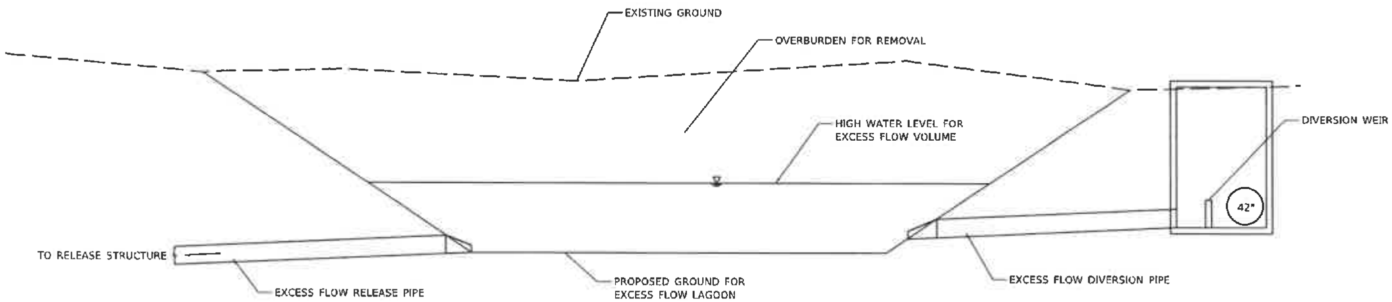
PROJECT MGR. MRW

STRAND ASSOCIATES®

SHEET

FIGURE 11

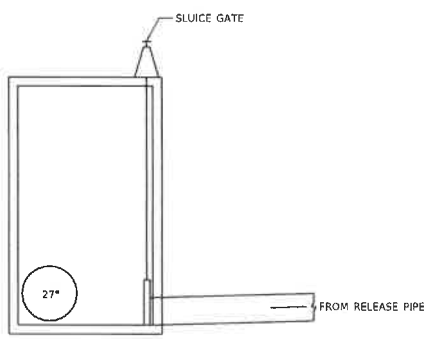
S:\JDL\1800--1899\1879\028\Micros\CADD_Sheets\1879028-sht-ExcessFlow-SiteB.dgn Mirandag 6/11/2024 2:20:12 PM



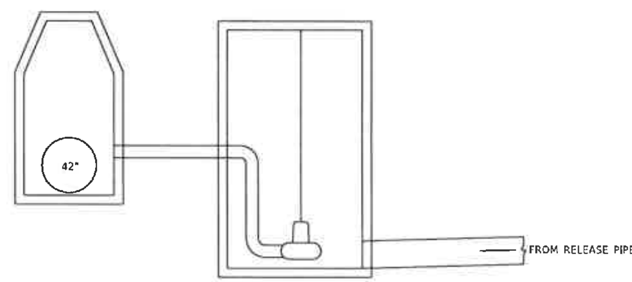
EXCESS FLOW RELEASE STRUCTURE
NO SCALE

EXCESS FLOW LAGOON
NO SCALE

EXCESS FLOW DIVERSION STRUCTURE
NO SCALE



STP-1 EXCESS FLOW RELEASE STRUCTURE
NO SCALE



SITE B EXCESS FLOW PUMPING STATION
NO SCALE

NO.	REVISIONS	DATE

PRELIMINARY EXCESS FLOW LAGOON AND RELEASE STRUCTURE CONCEPTS

EXCESS FLOW LAGOON FEASIBILITY STUDY
CITY OF WASHINGTON
TAZEWELL COUNTY, ILLINOIS

JOB NO. 1879.028

PROJECT MGR. MRW

STRAND ASSOCIATES®

SHEET
FIGURE 12

S:\JOL\1000--1099\1879\028\Micros\CADD_Sheets\1879028-sht-sso-STP1-Excess-Flow-Lagoon.dgn MirandaD 8/23/2024 4:07:48 PM

TABLE

Excess Flow Lagoon at STP-1
City of Washington

Description	Units	ENGINEER'S OPCC Estimated Quantity	Estimated Unit Cost	Opinion of Probable Cost
Earth Excavation - Overburden	CY	7,624	$50.00	$381,200.00
Earth Excavation - Lagoon Storage	CY	9,785	$50.00	$489,250.00
Clay Fill and Liner, 24"	SY	12,139	$25.00	$303,474.72
Stripping, Transferring, and Stockpiling of Topsoil	CY	4,046	$5.75	$23,266.40
Topsoil Placement	SY	12,139	$2.20	$26,705.78
Restoration-Seed	SY	12,139	$3.20	$38,844.76
Erosion Control Blanket	SY	12,139	$1.88	$22,812.25
Diversion Structure	VLF	8.00	$7,250.00	$58,000.00
Discharge/Screen Structure	VLF	10.00	$8,500.00	$85,000.00
Sanitary Sewer, 42" HOBAS	FT	50.00	$425.00	$21,250.00
Discharge Pumping Station	LSUM	0.00	$900,000.00	$0.00
Storm Sewer Force Main, 12"	FT	0.00	$250.00	$0.00
Ancillary Items - Mobilization, Tree Removal, Erosion Controls	LSUM	10%		$144,980.39
TOTAL BASE PROJECT				**$1,594,784.29**
Contingencies	LSUM	30%		$478,435.29
TOTAL BASE PROJECT PLUS CONTINGENCIES				**$2,073,219.58**

Excess Flow Lagoon at Site B
City of Washington

Description	Units	ENGINEER'S OPCC Estimated Quantity	Estimated Unit Cost	Opinion of Probable Cost
Earth Excavation - Overburden	CY	70,497	$50.00	$3,524,850.00
Earth Excavation - Lagoon Storage	CY	49,756	$50.00	$2,487,800.00
Clay Fill and Liner, 24"	SY	28,084	$25.00	$702,102.50
Stripping, Transferring, and Stockpiling of Topsoil	CY	9,361	$5.75	$53,827.86
Topsoil Placement, 6"	SY	28,084	$2.20	$61,785.02
Restoration-Seed	SY	28,084	$3.20	$89,869.12
Erosion Control Blanket	SY	28,084	$1.88	$52,777.16
Diversion Structure	VLF	10.00	$7,250.00	$72,500.00
Discharge/Screen Structure	VLF	6.00	$8,500.00	$51,000.00
Sanitary Sewer, 42" HOBAS	FT	50.00	$425.00	$21,250.00
Discharge Pumping Station	LSUM	1.00	$900,000.00	$900,000.00
Storm Sewer Force Main	FT	40.00	$250.00	$10,000.00
Ancillary Items - Mobilization, Tree Removal, Erosion Controls	LSUM	10%		$802,776.17
TOTAL BASE PROJECT				**$8,830,537.83**
Contingencies	LSUM	30%		$2,649,161.35
TOTAL BASE PROJECT PLUS CONTINGENCIES				**$11,479,699.18**

Farm Creek Trunk Sewer Replacement
City of Washington Illinois
Construct Portion of FCTS Replacement Along Route B

		ENGINEER'S OPCC SEGMENT OF FCTS ROUTE B		
Description	Units	Estimated Quantity	Estimated Unit Cost	Estimated Probable Cost
FOUNDATION MATERIAL	CY	40	$52.00	$2,096.62
RESTORATION-SEED, class 4/5 (topsoil,fertilizer,excelsior blanket, mulch incidental)	ACRE	2.5	$9,655.00	$24,390.18
RESTORATION-SEED, class 4B/5B (topsoil,fertilizer,excelsior blanket, mulch incidental)	ACRE	2.5	$9,655.00	$24,390.18
PERIMETER EROSION BARRIER	FT	2200.8	$4.00	$8,803.20
TREE REMOVAL (OVER 6 UNITS DIAMETER)	EA	2200.8	$12.00	$26,409.60
STABILIZED CONSTRUCTION ACCESS	EA	2	$6,000.00	$12,000.00
WORK SHAFT - TRENCHLESS CONSTRUCTION - 42" SANITARY SEWER	EA	2	$12,000.00	$24,000.00
SANITARY SEWER, 42-IN HOBAS - OPEN CUT	LF	2751	$350.00	$962,850.00
SANITARY SEWER, 42-IN HOBAS - TRENCHLESS	LF	200	$900.00	$180,000.00
TRENCHLESS CONSTRUCTION, 42-IN SANITARY SEWER WITH 72-IN STEEL CASING	LF	160	$1,500.00	$240,000.00
PROTECT EXISTING SANITARY SEWER AT CROSSINGS	EA	0	$4,000.00	$0.00
ABANDONMENT OF EXISTING SANITARY MANHOLES	EA	7	$2,000.00	$14,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, LESS THAN 20' DEEP	EA	9	$9,000.00	$81,000.00
OUTSIDE DROP MANHOLE CONNECTION, 18"	EA	0	$8,000.00	$0.00
TEMPORARY BYPASS PUMPING	DAYS	6	$4,136	$24,816.00
SUBTOTAL CONSTRUCTION				**$1,624,755.78**
MOBILIZATION (CONTRACTOR PROFIT, BONDS, INSURANCE)	LS	2%		$32,495.12
ENGINEERING AND LEGAL	LS	5%		$81,237.79
TOTAL BASE PROJECT				$1,738,488.69
Contingencies - Base		10%		$173,848.87
Total - Base Project w/ Contingencies				**$1,912,337.55**

CONSTRUCTION COST ESCALATION *

2021 to 2022	111.13%	$2,125,220.41
2022 to 2023	117.80%	$2,503,509.65
2023 to 2024	102.92%	$2,576,664.15

* From Construction Analytics

Farm Creek Trunk Sewer Replacement
City of Washington Illinois
OPCC - July 2021

		ENGINEER'S OPCC (ROUTE B)		
Description	Units	Estimated Quantity	Estimated Unit Cost	Estimated Probable Cost
FOUNDATION MATERIAL	CY	469	$52.00	$24,401.00
RESTORATION-SEED, class 2 (topsoil,fertilizer,excelsior blanket, mulch incidental)	ACRE	4.3	$9,655.00	$41,709.60
RESTORATION-SEED, class 4/5 (topsoil,fertilizer,excelsior blanket, mulch incidental)	ACRE	4.3	$9,655.00	$41,709.60
RESTORATION-SEED, class 4B/5B (topsoil,fertilizer,excelsior blanket, mulch incidental)	ACRE	4.3	$9,655.00	$41,709.60
PERIMETER EROSION BARRIER	FT	7508	$4.00	$30,032.00
TREE REMOVAL (OVER 6 UNITS DIAMETER)	EA	7508	$12.00	$90,096.00
WORK SHAFT - TRENCHLESS CONSTRUCTION - 42" SANITARY SEWER	EA	14	$12,000.00	$168,000.00
SANITARY SEWER, 42-IN HOBAS - OPEN CUT	LF	9385	$350.00	$3,284,750.00
SANITARY SEWER, 42-IN HOBAS - TRENCHLESS	LF	1775	$900.00	$1,597,500.00
SANITARY SEWER, 12-IN PVC SDR 26 - OPEN CUT	LF	25	$80.00	$2,000.00
SANITARY SEWER, 18-IN PVC SDR 26 - OPEN CUT	LF	150	$140.00	$21,000.00
TRENCHLESS CONSTRUCTION, 18-IN SANITARY SEWER WITH 30-IN STEEL CASING	LF	305	$450.00	$137,250.00
NEW 12-IN INSIDE EXISTING 30-IN	LF	135	$500.00	$67,500.00
PROTECT EXISTING SANITARY SEWER AT CROSSINGS	EA	3	$4,000.00	$12,000.00
ABANDONMENT OF EXISTING SANITARY MANHOLES	EA	39	$2,000.00	$78,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, LESS THAN 20' DEEP	EA	11	$9,000.00	$99,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, 20' TO 25' DEEP	EA	11	$12,000.00	$132,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, 25' TO 30' DEEP	EA	7	$15,000.00	$105,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, 30' TO 35' DEEP	EA	3	$18,000.00	$54,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, 35' TO 40' DEEP	EA	1	$21,000.00	$21,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA, 45' TO 50' DEEP	EA	1	$26,000.00	$26,000.00
SANITARY MANHOLE, TYPE A, 6-FT DIA CONSTRUCTED ON EXISTING SEWER PIPE	EA	3	$12,000.00	$36,000.00
SANITARY MANHOLE, TYPE A, 8-FT DIA JUNCTION MANHOLE	EA	2	$20,000.00	$40,000.00
OUTSIDE DROP MANHOLE CONNECTION, 18"	EA	1	$8,000.00	$8,000.00
SUBTOTAL CONSTRUCTION				**$6,158,657.80**
MOBILIZATION (CONTRACTOR PROFIT, BONDS, INSURANCE)	LS	2%		$123,173.16
ENGINEERING AND LEGAL	LS	5%		$307,932.89
TOTAL BASE PROJECT				$6,589,763.85
Contingencies - Base		10%		$658,976.38
Total - Base Project w/ Contingencies				**$7,248,740.23**

CONSTRUCTION COST ESCALATION *

2021 to 2022	111.13%	$8,055,675.46
2022 to 2023	117.80%	$9,489,585.70
2023 to 2024	102.92%	$9,766,878.78

* From Construction Analytics

Farm Creek Trunk Sewer Replacement
City of Washington Illinois
Existing Trunk Sewer Televising

Description	Units	ENGINEER'S OPCC SELECT FCTS RECONSTRUCT		
		Estimated Quantity	Estimated Unit Cost	Estimated Probable Cost
SEWER TELEVISING, 30-IN	LF	12280	$12.92	$158,623.43
HEAVY CLEANING - 50%	LF	6140	$7.78	$47,767.28
ROOT CUTTING - 25%	LF	3070	$4.40	$13,519.04
TEMPORARY BYPASS PUMPING OR FLOW CONTROL	DAYS	15	$4,136	$63,422.68
SUBTOTAL CONSTRUCTION				**$283,332.43**
MOBILIZATION (CONTRACTOR PROFIT, BONDS, INSURANCE)	LS	2%		$5,666.65
ENGINEERING AND LEGAL	LS	5%		$14,166.62
TOTAL BASE PROJECT				$303,165.70
Contingencies - Base		30%		$90,949.71
Total - Base Project w/ Contingencies				**$394,115.41**

Farm Creek Trunk Sewer Replacement
City of Washington Illinois
Existing Trunk Sewer Lining

Description	Units	ENGINEER'S OPCC SELECT FCTS RECONSTRUCT		
		Estimated Quantity	Estimated Unit Cost	Estimated Probable Cost
SEWER LINING, 30-IN	LF	12280	$312.34	$3,835,501.82
PROTRUSION REMOVAL, ASSUMES 2 PER SEGMENT	EA	80	$2,839.43	$227,154.39
SEALING VOIDS, ASSUMES 0.5 PER SEGMENT	EA	20	$13,061.38	$261,227.54
TEMPORARY BYPASS PUMPING, ASSUMES 1 SEGMENTS PER DAY	DAYS	62	$6,204	$382,190.57
SUBTOTAL CONSTRUCTION				**$4,706,074.33**
MOBILIZATION (CONTRACTOR PROFIT, BONDS, INSURANCE)	LS	5%		$235,303.72
ENGINEERING AND LEGAL	LS	5%		$235,303.72
TOTAL BASE PROJECT				$5,176,681.76
Contingencies - Base		30%		$1,553,004.53
Total - Base Project w/ Contingencies				**$6,729,686.28**

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