PREPARED FOR:

West Point
UTAH

PREPARED BY:

BOWEN COLLINS
& ASSOCIATES

WEST POINT CITY
2021 SEWER STUDY

MAY 2022

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BACKGROUND

West Point City (City) retained Bowen Collins & Associates (BCA) to perform a sanitary sewer system alternative analysis of areas currently within City limits and in unincorporated Davis County that are not serviceable by the existing gravity sewer system (approximately 2,146 acres). At buildout, it is expected that this area will include approximately 4,722 residential units. The purpose of this study is to investigate various available technologies and options to provide sanitary sewer service to this area, select a recommended approach from the various options, and then develop a detailed plan for implementation of the recommended approach. This report summarizes the results of this study.

REPORT ORGANIZATION

The recommended plan for providing sewer service in this area was developed incrementally through the preparation of a series of technical memorandums. This report will provide a brief summary of each of the memorandums prepared and major conclusions from the analysis. For additional detail, the reader should reference the original technical memorandums attached as appendices to this report.

The following tasks were completed as part of this sewer alternative analysis and are summarized in the sections that follow:

- Preliminary Sewer Alternative Analysis (TM 01)
- Final Sewer Alternative Analysis (TM 02)
- Development of a Hydraulic Computer Model (TM 03)
- Development of Design Standards and Specifications
- Development of Implementation Policies and Regulations
- Preparation of an Impact Fee Facility Plan (IFFP) and Impact Fee Analysis (IFA)

SEWER SYSTEM ALTERNATIVE ANALYSIS

Preliminary Sewer Alternative Analysis

In discussions with the City, a total of 5 alternatives were identified to be studied for this analysis: traditional gravity sewer with lift stations, low pressure sewer system (LPS or grinder pumps), septic tank effluent pumping system (STEP or effluent only), vacuum sewer system, and a small area wastewater treatment plant. A preliminary high level analysis was performed to evaluat these alternatives. The purpose of the preliminary analysis was to narrow down the potential alternatives to the two most feasible, from which a more in-depth analysis could be performed. The preliminary high level analysis was based on high level capital cost, operation and maintenance (O&M) costs, life cycle costs, and other non-cost related factors.

Generally, the systems were divided into two categories, “centralized” and “de-centralized” systems. The centralized systems consisted of the traditional system, vacuum system, and small area treatment plant. The de-centralized systems consisted of the STEP system and LPS or grinder pump system. During this preliminary analysis the most promising centralized and de-centralized sewer system were selected for further consideration by the City. The two preferred alternatives that were selected are listed below:

1) **Traditional gravity sewer with lift stations (centralized system)** – This alternative was selected for further evaluation because it is historically the primary method used throughout the state of Utah (City familiar with system), it requires relatively low O&M costs, and is

reliable. This system would use gravity pipelines to collect wastewater and regional lift station in areas that are unable to gravity flow to the regional treatment plant.

2) **Septic Tank Effluent Pumping (STEP) system (de-centralized)** – This alternative was selected for further evaluation because it is easily phased with relatively low upfront capital costs and has relatively low O&M costs. This system would consist of individual septic tanks and effluent pumps at each residential connection. The septic tanks would collect the solids and then the effluent would be pumped through a series of force mains until it discharges into a gravity sewer line.

Additional details and information have been compiled in a technical memorandum documenting this analysis and can be found in Appendix A.

Final Sewer Alternative Analysis

With the alternatives narrowed down to the Traditional and STEP systems, a more in-depth analysis could then be performed. Each alternative was evaluated based on 4 key aspects; Capital Costs, Operation and Maintenance Costs, Life Cycle Costs, and other Non-Cost Factors. A summary of the key findings for each key aspect is listed below:

- **Capital Costs –** Detailed cost estimates were generated for each alternative. The STEP system total capital costs (including system and project level costs in 2021 dollar) are estimated at $92.9M. The traditional alternative was estimated at $96.6M. ***Conclusion: Capital costs for the STEP alternative are approximately 4% ($3.7M) less than the Traditional alternative.***
- **Operation and Maintenance Costs –** A detailed O&M analysis of each system based on end user data shows that the Traditional system would require approximately 1/3 of the annual expense to the City to operate when compared to the STEP system. The STEP alternative had approximately $870K in annual O&M costs at build out and the Traditional alternative was estimated at $320K in build out annual O&M costs. ***Conclusion: O&M costs for the Traditional alternative are approximately 63% less ($550,000/year) than the STEP system.***
- **Life Cycle Costs –** Capital costs and O&M costs have been combined to provide an estimated 60-year life cycle cost in present value dollars. That analysis shows that while the STEP system is less expensive to install initially, the Traditional system has an overall lower life cycle cost. ***Conclusion: The overall life cycle cost for the Traditional alternative provides an approximate 11% - 14% savings when compared to the STEP system (9MM to 15.5 MM depending on phasing).***
- **Non-Cost Factor Comparison –** An evaluation of each alternative's non-cost factor advantages and disadvantages was also performed. Ultimately, the Traditional system is the more established technology, used almost exclusively through-out the State, is familiar to the City, is more easily equipped with backup power, and has fewer restrictions to the residents. ***Conclusion: When considering all non-cost factors, the Traditional system is the preferred alternative in this comparison.***

In summary, the STEP System has the lowest capital costs while the Traditional System has the lowest O&M and life cycle costs. The Traditional system also ranked higher in the Non-Cost Factor comparison. Generally, the STEP system could provide sewer service to the study area at lower initial capital costs, but comes with significantly higher O&M expenses and life cycles cost for the City and has other non-cost factor disadvantages that would impact the City and residents.

This analysis was subsequently presented to the City Council on May 18th, 2021 from which the council decided that the traditional sewer system would best meet the City's needs in providing future sewer service to the study area. Additional details and information regarding this in-depth analysis have been compiled in a technical memorandum and can be found in Appendix B.

Sewer Model

A hydraulic gravity sewer model was developed to verify adequate gravity and pressure pipeline sizing. This sewer model incorporates key study parameters and assumptions (e.g. assumed development densities, average flow per unit, assumed pipeline diameter and slope). The results of the model allowed a system to be designed that will provide sufficient capacities for the study area. Additional details regarding these assumptions and results are summarized in a technical memorandum which can be found in Appendix C.

DESIGN DRAWINGS AND GENERAL SPECIFICATIONS

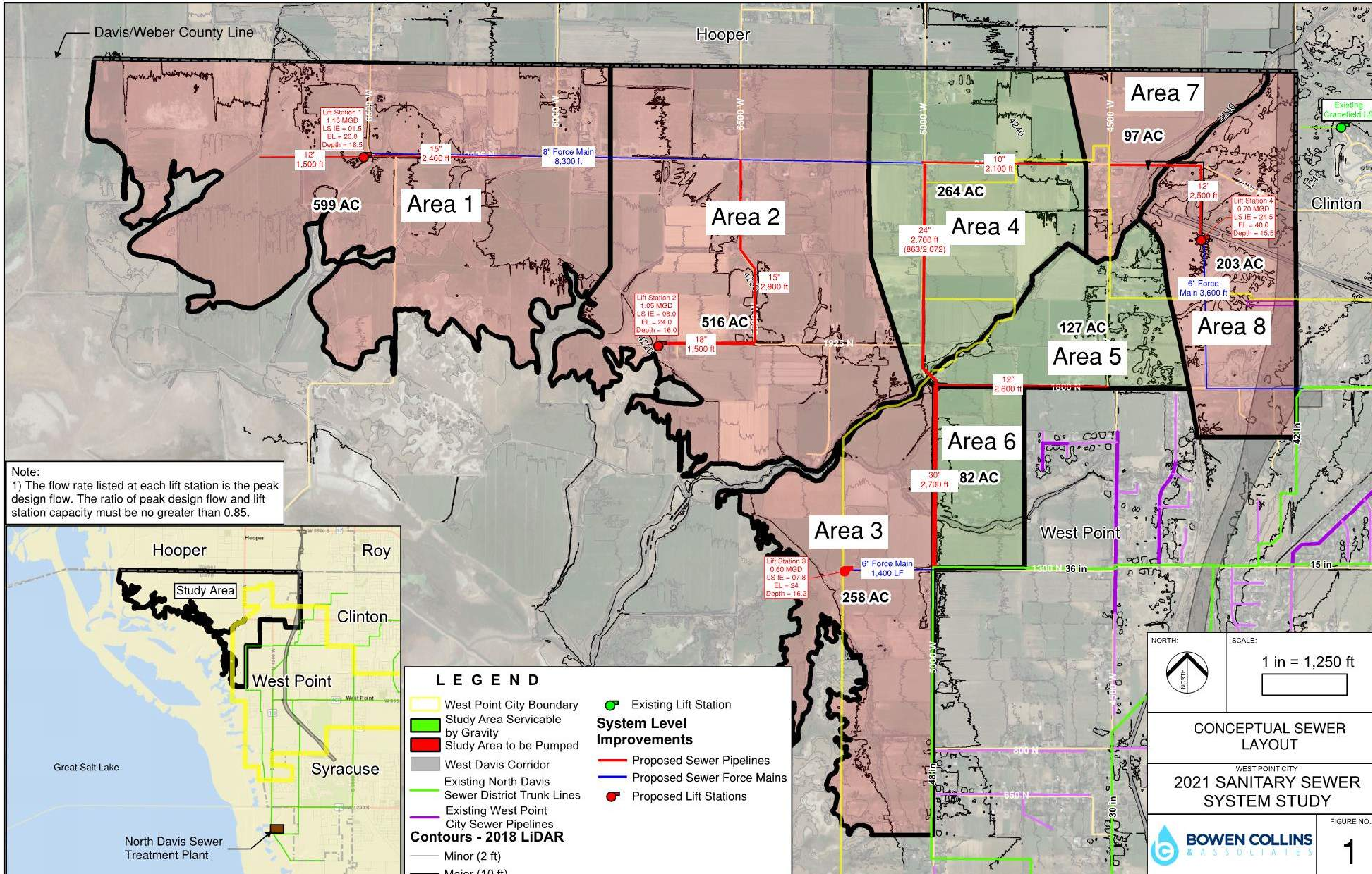
A conceptual layout of the proposed sewer system is shown in Figure 1. Details of the proposed plan are discussed below.

Gravity Pipelines

Preliminary design drawings have been developed for the proposed gravity sewer system showing the approximate horizontal and vertical profiles for each proposed system level improvement. These plan and profiles were created to generally convey the intent of the proposed sewer gravity system and accurately represent key design components (see Appendix D).

Below is a summary of the key design aspects and challenges associated with the proposed gravity sewer system:

- <u>5000 W Trunk Line</u>: Previous City master plans of this area have shown that all areas north of the Howard Slough would be serviced by regional lift stations. However, this study has shown that areas north of the Howard Slough can be serviced by gravity by extending the existing trunk line along 5000 W north. There are three main challenges that were addressed in this study for extending the 5000 W trunk line north and are summarize below:
    1. <u>Shallow Cover:</u> To maximize the amount of cover and the potential servable area to the north, this trunk line was increased in size to minimize the required slope. Preliminary profiles show minimum cover of approximately 4 feet south of Howard Slough. This is not ideal but appears to be adequate.
    2. <u>Drainage Crossing Conflicts:</u> Two drainage pipes crossing 5000 W (between 1300 N and 1800 N) will be in direct vertical conflict with this proposed pipeline. The drainage crossings will either need to be rerouted or siphoned underneath the sewer pipeline.
    3. <u>Howard Slough Crossing:</u> The proposed sewer pipeline appears to be in vertical conflict with the existing 10'x8' box culvert so options to go under or over the slough were evaluated. Due to the lack of available driving head, a potential siphon to cross under the slough does not appear to be feasible. The head loss induced by the syphon would drastically reduce the serviceable area by gravity to the north. A preferred option would be a sewer pipeline bridge as it would minimize losses resulting from this crossing. The bridge will need to be insulated to avoid freezing and easily accessible for ongoing maintenance.



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- Clinton Drain Crossing: A proposed gravity sewer pipe crossing under the Clinton Drain will be required to service portions of Area 8 north of the drain. Preliminary profiles show approximately 8 feet of clearance beneath the drain. Due to the depth, it is anticipated that this crossing will be installed using trenchless technologies. Coordination with the County and State will be required during the design of this section.
- Minimum Slopes: The minimum slopes used to maximize the potential area serviceable by gravity will reduce the velocities in the collection pipelines. This may result in more potential for solids deposition in the pipelines and could potentially create additional O&M for the City. A regular maintenance plan should be implemented to mitigate this concern.
- High Ground Water Table: Ground water is anticipated to be relatively high throughout the study area. Pipelines and manholes will need to be designed to resist all possible buoyant forces.

The City has discussed with Clinton City the possibility of using the existing Cranefield Lift Station to service portions of Area 7 and 8. This could potentially eliminate the need for the gravity pipeline that crosses the Clinton Drain, Howard Slough, and Hooper Canal near 4500 W and 2425 N. At this time, Clinton City has declined this proposal. If, in the future, Clinton City agrees to this arrangement, the proposed sewer infrastructure within Areas 7 and 8 will need to be reevaluated.

Discussions were held with North Davis Sewer District (NDSD) regarding this study and proposed improvements. The study area does not currently fall within NDSD's service area; however, NDSD is in the process of updating their master plan and it is anticipated that NDSD's service area will be updated to incorporate this study area. In addition, the available capacities of NDSD's trunk lines were to be evaluated as part of their ongoing master plan update. The proposed 5000 W trunk ownership was also discussed. Typically the sewer district does not maintain trunk lines that service only one municipality, but did not rule out the possibility that the sewer district could operate and maintain this trunk line after it was constructed. Additional coordination with the District will be needed to further coordinate these items.

Lift Stations and Force mains

Areas 1, 2, 3 and 7 / 8 will require a total of 4 regional lift stations and associated force mains to convey sewer flows to adjacent gravity trunk lines. Various lift station styles and options were discussed with the City and it was determined that a custom design Wet Well / Dry Pit style lift station would be the standard for all future regional lift stations for the City.

A Wet Well / Dry Pit style lift station offers the following advantages when compared to other lift station types:

- Pump, motor, and valving are not submerged in raw sewage. Maintenance personnel can more easily and safely inspect and maintain essential lift station components.
- High pump efficiencies will help reduce ongoing electrical costs to the City

To help standardize all of the proposed regional lift stations, conceptual lift station design drawing and general specifications were developed and can be found in Appendix E and Appendix F, respectively. These standards incorporate the key aspects required by State Code and requirements of the City. Below is a summary of some key aspects to be incorporated into each lift station (refer to the specifications in Appendix F for a more complete list):

- Custom Design – The City prefers the tailored options available in custom designs over available packaged lift station options.
- Stairs – Access to the dry pit is to be stairs with landings not to exceed 12 vertical feet. Ladders will not be used for primary access.
- Self-Cleaning Wet Well – The wet well style is to be a rectangular self-cleaning trench. High scouring velocities are achieved in this type of wet well, reducing required cleaning.
- Bridge Crane – An overhead bridge crane is to be supplied inside the dry pit to facilitate maintenance and ability to move pumps, motors, and/or valves.
- CMU Building – A building over the dry pit will cover the maintenance access hatches and have a separate partition and/or building to store the backup generator and electrical equipment. A roll up door or double doors will be required to facilitate access to both the maintenance building and electrical/generator building.

Below is a summary of the key design aspects and challenges associated with the proposed lift station and force main systems:

- <u>Deep excavation:</u> The sewer inverts into the lift stations range between 15 to 18.5 feet deep. Total excavation depths will exceed 20 feet. Dewatering and proper shoring will be critical during construction.
- <u>High ground water table:</u> Ground water is anticipated to be relatively high throughout the study area. All of the lift station buildings and vaults to be design to resist all possible buoyant forces.
- <u>Force main velocities:</u> Force mains should be sized based on build-out flow values while maintaining peak velocities below 7 ft/s. During design, minimum scouring velocities should also be evaluated to avoid septic conditions within the force main. Dual force mains may be needed to maintain minimum velocities (greater than 3 ft/s) prior to achieving build-out conditions.

IMPLEMENTATION PLAN AND CITY POLICIES

This section is intended to outline the City's implementation plan and policies regarding the appropriate phasing or construction sequencing. Responsibilities of both the City and residents regarding the proposed sewer system within the study area are also outlined in this section.

- **System vs. Project Level Improvements –** The City will be responsible for acquiring funding and constructing system level improvements as identified in the Impact Fee Facility Plan (IFFP) and Impact Fee Analysis (IFA). Developers and or new homeowners will be required to fund and construct project level improvements which would include collection pipelines and service laterals to buildings.

- **Project Timing –** As outlined in the IFA, it is anticipated that the system level infrastructure within Areas 2, 3, 4, 5, 6, and 7/8 will be needed within the upcoming 10 year planning window. Area 1 infrastructure is anticipated to be needed beyond this planning window within the next 15 to 25 years. Areas 3 and 7/ 8 can be constructed independent of the other area's infrastructure, as their force mains will discharge directly into existing NDSD trunk lines. The trunk line along 5000 W will need to be constructed prior to the operation of Area 1 and 2 lift stations, as their associated force mains will discharge into this new trunk line.

- **System Maintenance –** The City will implement a regular maintenance schedule for cleaning and maintaining the proposed lift stations and sewer pipelines. Due to the sewer pipeline minimum slopes, maintenance may be required more frequently than other existing gravity sewer pipelines. This gravity pipeline maintenance schedule is recommended to be more frequent initially and then adjusted in the future as needed.

- **Existing Residents on Septic Systems –** As the new sewer infrastructure is placed into service, existing home owners within the study area that are currently on private septic sewer systems, will be required to connect to the City sewer system once it is available within 300 feet of the structure (per City Code 17.130.100(C)]. Typically the lateral connection to the house is the responsibility of the homeowner, but the City may agree to cover these costs for home owners with existing septic tank systems only. The septic tank will need to be abandoned per County Health Department requirements.

- **Temporary Lift Stations –** Generally, the City will limit new development to areas where the system level sewer improvements have been constructed and are operational. On occasion, the City may consider exceptions to this rule on a case by case scenario. Any temporary lift station or dry sewer line proposal must be coordinated and approved by the City Engineer. Associated designs must also be reviewed and approved by the City or its consultant at the developers cost. All associated project costs related to these exceptions that are not listed in the IFFP, shall solely be the responsibility of the developer.

- **Developer Funding of System Level Improvements –** In the event that a developer wishes to fund the design and construction of a system level improvement prior to the City's planned schedule, a Pioneering agreement may be entered into with the City to facilitate the reimbursement of these projects. Developers will be able to finance system level improvements and be reimbursed by the City, as impact fees are collected from that specific area.

IMPACT FEES

An Impact Fee Facilities Plan (IFFP) and Impact Fee Analysis (IFA) were developed for the study area (see Appendix G). The IFFP identifies demands placed upon West Point City facilities by future development within the study area and evaluates how these demands will be met by the City. The IFFP is also intended to outline the improvements which may be funded through impact fees.

Due to the significant cost required to provide sewer service to the study area, the City decided that the Study area would have its own Sewer Impact Fee. The impact fee associated with this analysis was calculated by dividing the proportional cost of facilities required to service 10-year growth by the amount of growth expected over the next 10-years based on Equivalent Residential Units (ERUs). This is done for all of the needed gravity collection, lift station, and force main facilities within the study area. The calculated impact fee for the study area is summarized in Table 1.

Table 1
Impact Fee Calculation per ERU – West Point City Service Area

System Components	Total Cost of Component	% Serving 10-year Growth	Cost Serving 10-year Growth	10-year ERUs Served	Cost Per ERU
Collection Facilities					
10-Year Projects	$ 15,784,110	24.5%	$ 3,870,251	1049	$ 3,689
10-Year Project Interest Costs	$ 6,760,806	24.5%	$ 1,657,744	1049	$ 1,580
Subtotal	$ 22,544,916		$ 5,527,995		$ 5,269
Studies					
All Studies	$ 65,300	96.3%	$ 62,867	1049	$ 59.93
TOTAL	$ 22,610,216		$ 5,590,862		$ 5,329.71

In addition, a user fee credit was applied to the impact fee. This credit accounts for the portion of user fees that future users will pay that will be used to address existing deficiencies. That credit (which reduces over time) and resulting impact fee are shown below in Table 2 over the next 5 years. The total impact fee to be charged to new development is the calculated based impact fee minus the appropriate credit for any given year.

Table 2
Recommended Per ERU Impact Fee – West Point City Service Area

Maximum Allowable Impact Fee (Per ERU, by year)						
	2021	**2022**	**2023**	**2024**	**2025**	**2026**
Base Impact Fee (includes study costs)	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71
User Fee Credit	$ (128.96)	$ (122.73)	$ (116.80)	$ (111.16)	$ (105.78)	$ (100.67)
Total Overall Fee	$ 5,200.74	$ 5,206.97	$ 5,212.90	$ 5,218.55	$ 5,223.92	$ 5,229.04

It was assumed in the IFA that the City will finance the projects identified in the IFFP through bonding. Revenue from impact fees will then be used to service the bonds. In the event that other funding sources become available to fully or partially fund the proposed improvements, the IFA would need to be updated to reflect this change. The City would potentially need to refund all or portions of previously collected impact fees.

APPENDIX A

TM01 PRELIMINARY SEWER ALTERNATIVE ANALYSIS

TECHNICAL MEMORANDUM

TO:	Boyd Davis, P.E., West Point City Engineer
COPIES:	Kyle Laws, West Point City Manager File
FROM:	Tyler Seamons, P.E. and Keith Larson, P.E.
DATE:	December 17, 2020
SUBJECT:	2020 Sanitary Sewer System Study - Preliminary Sewer Alternative Analysis
JOB NO.:	668-20-01

INTRODUCTION

West Point City (City) has retained Bowen Collins & Associates (BCA) to perform a sanitary sewer system analysis of areas currently within City limits and in unincorporated Davis County that are not currently able to be serviced by the existing gravity sewer system due to insufficient elevation. The study area for this analysis is shown in Figure 1. At buildout, it is expected that this area will include approximately 5,200 residential units along with small amounts of supporting commercial and institutional development. As part of this study, the City has requested that BCA consider the following sewer systems: traditional gravity sewer with lift stations, low pressure sewer system (LPS or grinder pumps), septic tank effluent pumping system (STEP or effluent only), vacuum system, and a small area wastewater treatment plant. The purpose of the study is to provide a recommendation to the City for a preferred alternative to provide sewer service to these areas and guidelines to implement the recommendation.

This technical memorandum has been prepared as preliminary analysis of each alternative. The purpose of this memorandum is to provide a high level analysis of the advantages and disadvantages of each alternative in order to eliminate the alternatives that are least viable for the City. Based on this analysis and input from the City, only the most promising alternatives will be selected for more in-depth analysis and final recommendation for the City.

POTENTIAL ALTERNATIVES

As noted above, the City has requested that BCA consider the following sewer systems:

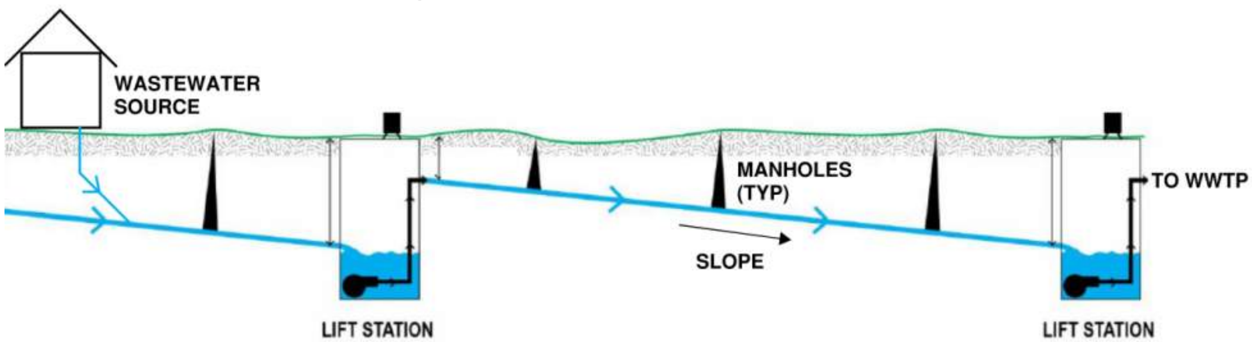
- Traditional gravity sewer with lift stations,
- Low pressure sewer system (LPS or grinder pumps),
- Septic tank effluent pumping system (STEP or effluent only),
- Vacuum sewer system, and
- Small area wastewater treatment plant.

A brief description of each alternative is listed below:

Traditional Gravity Sewer with Lift Stations: West Point City currently owns and operates a traditional gravity sewer system with one small lift stations servicing a couple subdivisions. This type of sewer conveyance system is by far the most widely used and time tested collection method. Each source is connected to collection and trunk lines that convey the wastewater to a centralized wastewater treatment plant (WWTP). Manholes are located throughout the system, allowing access for maintenance and observation. Centralized lift stations are used, as needed, when wastewater is not able to flow by gravity to the sewer trunk lines (see Figure 2). Since a majority of the study area is too low to be serviced by the existing trunk lines, it is anticipated that an additional 3-4 lift stations would be required to convey the wastewater.

Typically the gravity pipes are sized for build out and lift stations can be built in phases to accommodate phased growth of the study area. In this alternative, the wastewater would be treated at the regional North Davis Sewer Treatment Plant (NDSTP). Power backup is possible and in most cases required at the centralized lift stations. During a power outage, these systems can continue to operate. Capital costs tend to be higher than the other alternatives, as gravity pipelines require larger diameters and deeper excavations. Conversely, O&M costs are one of the lowest, as mechanical equipment are centrally located and well-designed gravity pipelines require minimal ongoing maintenance.

Figure 2: Traditional Gravity System



Low Pressure Sewer System (LPS or Grinder Pumps): The LPS system is a pressurized sewer conveyance system. In most LPS systems, a small sump and grinder pump are located at every house that pumps the wastewater into a pressurized force mains, typically HDPE (see Figure 3). Wastewater pumped into the force mains is conveyed to a point where traditional gravity trunk lines can again be used for conveyance.

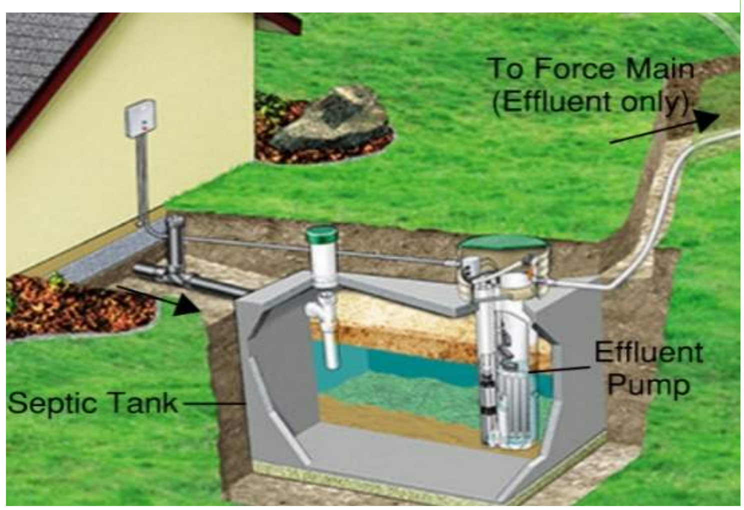
Figure 3: Low Pressure Sewer System

The force mains in this system are typically significantly smaller than traditional gravity sewer lines since they are pressurized and essentially eliminate Inflow and Infiltration (I&I). Installation of the pipeline is typically much shallower and more flexible to avoid other existing utilities. Instead of manholes, small clean outs are installed throughout the system for maintenance purposes. These pumps can either be privately or publicly owned and maintained. For the purposes of comparison with other alternatives in this study, it has been assumed that the City would own and maintain the sumps and grinder pumps.

Phasing of this system is moderately flexible, as pumps will only be installed as areas are developed, but force mains will need to be sized in phases (as minimum velocities are required to convey the solids within the wastewater), potentially creating parallel collection/trunk lines. Since this system is decentralized, typically there is no backup power on site. In the event of a power outage or pump failure, sewer storage is typically limited to 70 to 150 gallons. Capital costs are relatively low but O&M costs are higher than other alternatives. The grinder pumps are generally more expensive than effluent only pumps due to their higher horsepower requirements and ability to pump solids. This drives up O&M costs.

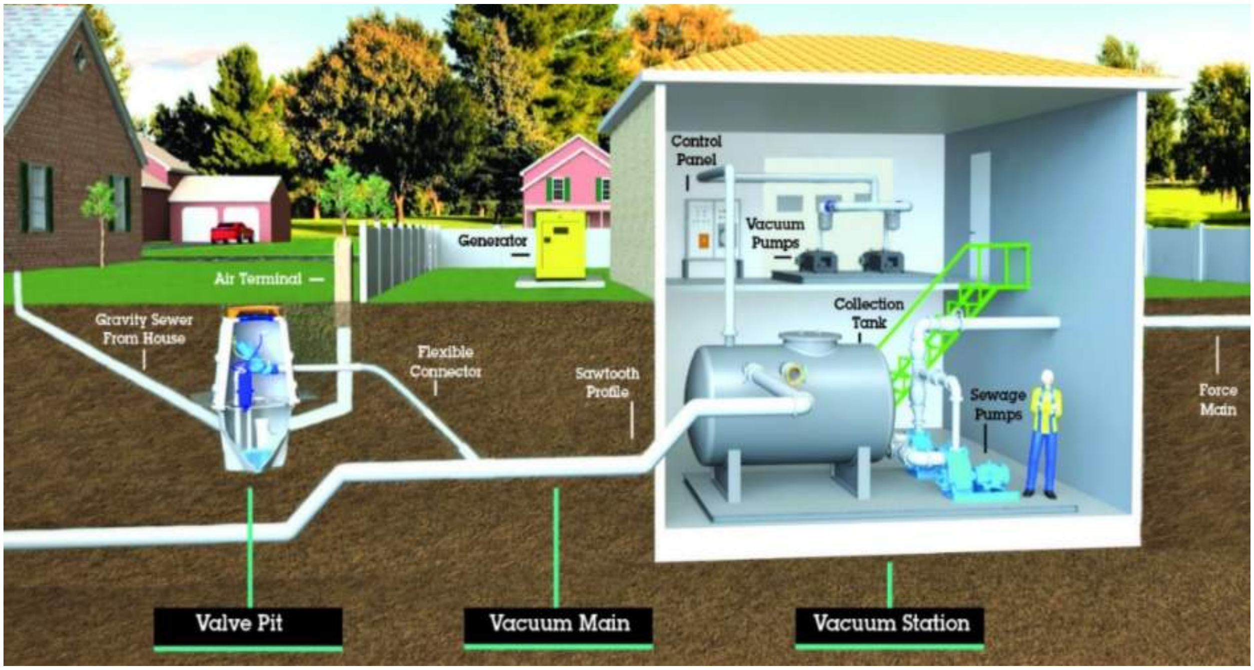
Septic Tank Effluent Pumping (STEP or Effluent Only): The STEP system is very similar to the LPS system, but differs in that the STEP system requires a septic tank at each house that removes the majority of the solids from the wastewater prior to pumping it into the force mains (see Figure 4). Without solids in the effluent, pumps are significantly smaller and more cost effective than grinder pumps. The septic tanks and effluent pumps are additional maintenance aspects of this system that are assumed to be owned and maintained by the City for this study. This alternative offers the greatest phasing flexibility as the force mains can be sized for buildout flows without concerns of solids settling out into the pipeline. Since this system is decentralized, typically there is no backup power on site. However, in the event of a power outage or pump failure, the septic tank can typically provide 24 hours of emergency storage. This alternative generally has low capital and O&M cost compared to other alternatives.

Figure 4: Septic Tank Effluent Pumping System (STEP)



Vacuum Sewer System: This system consists of a collection pit, vacuum main, and a centrally located vacuum pump stations. Sewer flows from the source by gravity to a collection pit, and after filling, opens a valve which sucks the sewer from the pit. Once the wastewater reaches the vacuum station, it is typically pumped into a force main to discharge into a gravity sewer trunkline (see Figure 5). Waste air from the vacuum station is then treated through a mulch media biofilter. This system requires collection pits for approximately every 4 homes and would likely require 2 to 3 vacuum pump stations to service the study area. Similar to the LPS and STEP systems, I&I is predominantly eliminated.

Figure 5: Vacuum Sewer System



This system was installed by Hooper City and has been in service for approximately 13 years. Conversations with the Publics Work Director provided valuable insight into their experience with the technology. The system works relatively well with little clogs or complaints from residents, however is significantly more complicated than a traditional system with lift stations. The initial capital costs were lower than a traditional system but ongoing maintenance is noticeably more than a traditional system with lift stations. A system tour would be beneficial if the City would like to further investigate this technology. This alternative has relatively high capital and O&M costs when compared to the other alternatives.

Small Area Treatment Plant: This alternative would consist of a gravity collection system and a small area WWTP along the northwestern boundary of the study area. Wastewater would flow by gravity to the new treatment plant. Based on estimated build out flow rates, this plant would be significantly larger than a typical "package" treatment product. Sewage lagoons would not be ideal either due to high ground water and the required footprint. Thus, this small area treatment plant would most likely be a traditional treatment facility consisting of primary and secondary treatment, nutrient removal (as required), and disinfection.

Capital and O&M costs of a small area treatment plant would be relatively high compared to other alternatives. A discharge permit from the State, which is highly regulated, would be required to discharge the treated effluent into the Great Salt Lake. Furthermore, the State of Utah would most likely require significant justification for the new treatment plant, with the existing regional plant nearby. The City would own and operate the treatment facility and be responsible to meet the stringent discharge requirements. This alternative would have similar costs to the traditional gravity system option but have a treatment plant instead of lift stations. Due to the complexity, regulatory requirements, and high costs of treatment facilities, use of small area treatment is typically a last resort in most service area evaluations, only considered after other options are exhausted.

PRELIMINARY ALTERNATIVE ANALYSIS

A high-level, preliminary analysis of the alternatives has been prepared and is summarized in Table 1. The purpose of this analysis is not to select a final alternative, but to identify the top two or three most promising alternatives for more detailed evaluation. The main selection criteria used to evaluate each of the alternatives are as follows:

- **Capital Costs –** Although developers or impact fees typically cover these costs, they are an important consideration for several reasons. First, keeping initial capital costs low is a benefit for the future City residents who will pay for the infrastructure through their home purchase costs. Second, higher capital costs now mean higher system replacement costs later which can increase the overall life cycle costs for the City. Included in Table 1 area are high level capital cost estimates. These estimates are based on a hypothetical 200 house system that was prepared by the Water Environment Research Foundation (WERF). ***It should be emphasized that these high-level costs are for comparison purposes only and do not represent final costs for the unique layout and size of the West Point service area.*** It was determined that this high level cost estimate would be appropriate at this stage of the study to give a relative cost comparison of each alternative. Detailed cost estimates will be generated during the next step of the analysis.
- **Operation and Maintenance Costs –** Initial construction costs are obviously not the only costs that should be considered. Table 1 includes an estimate of expected annual operation and maintenance (O&M) costs based on WERF research.
- **Life Cycle Costs –** Capital costs and O&M costs have been combined to provide an estimated 60-year life cycle cost in present value dollars.
- **Other Advantages and Disadvantages –** Beyond cost, there are a number of other non-cost considerations that should be factored into the final selection of an alternative. This includes:
    - maintenance considerations,
    - phasing capability,
    - system reliability,
    - performance, and
    - overall project feasibility.

  A brief description of the advantages and disadvantages of each alternative relative to these areas has been included in Table 1.

CONCLUSIONS AND RECOMMENDATIONS

Based on BCA's analysis of alternatives as summarized in Table 1, we would offer the following conclusions and recommendations:

1. **Eliminate the small area treatment plant from further consideration.** The small area treatment plant has the highest capital costs and O&M costs of any alternative. Wastewater treatment plants are highly regulated and complex. The associated advantages of a treatment plant do not appear to justify the added expense and complexity to the City's sewer system. For these reasons, it is recommended that this alternative be eliminated from further consideration.
2. **Proceed forward with further evaluation of the traditional gravity alternative as the most promising of the centralized maintenance alternatives.** Generally, the remaining conveyance systems fall within two categories, centralized maintenance (traditional gravity and vacuum) and decentralized maintenance (LPS and STEP). In the centralized category, the vacuum system involves significantly more mechanical features than the traditional system.

Specialized parts, higher O&M costs, and less district familiarity make this a less preferred alternative. A traditional sewer system has similar capital costs but once installed has relatively low O&M costs. The system is reliable and the City is familiar with its maintenance and operations. Lower O&M costs, reliability, and the City's familiarity with the traditional gravity system make this the preferred out of the centralized alternatives.

3. **Proceed forward with further evaluation of the STEP alternative as the most promising of the decentralized maintenance alternatives.** For the two decentralized maintenance alternatives, the STEP and LPS alternatives both benefit from smaller main line pipe sizing, shallow bury, and low installation costs. The main difference is that the STEP alternative, through the use of a septic tanks, removes the solids from the wastewater prior to pumping. This facilitates the alternative's ability to have maximum phasing flexibility during the buildout of the area. This means that the main lines of the STEP alternative can be sized for build out without minimum velocity requirements. The O&M costs are also less for the STEP alternative than the LPS alternative due to the less expensive effluent only pumps. This makes the STEP alternative preferred out of the decentralized maintenance alternatives.

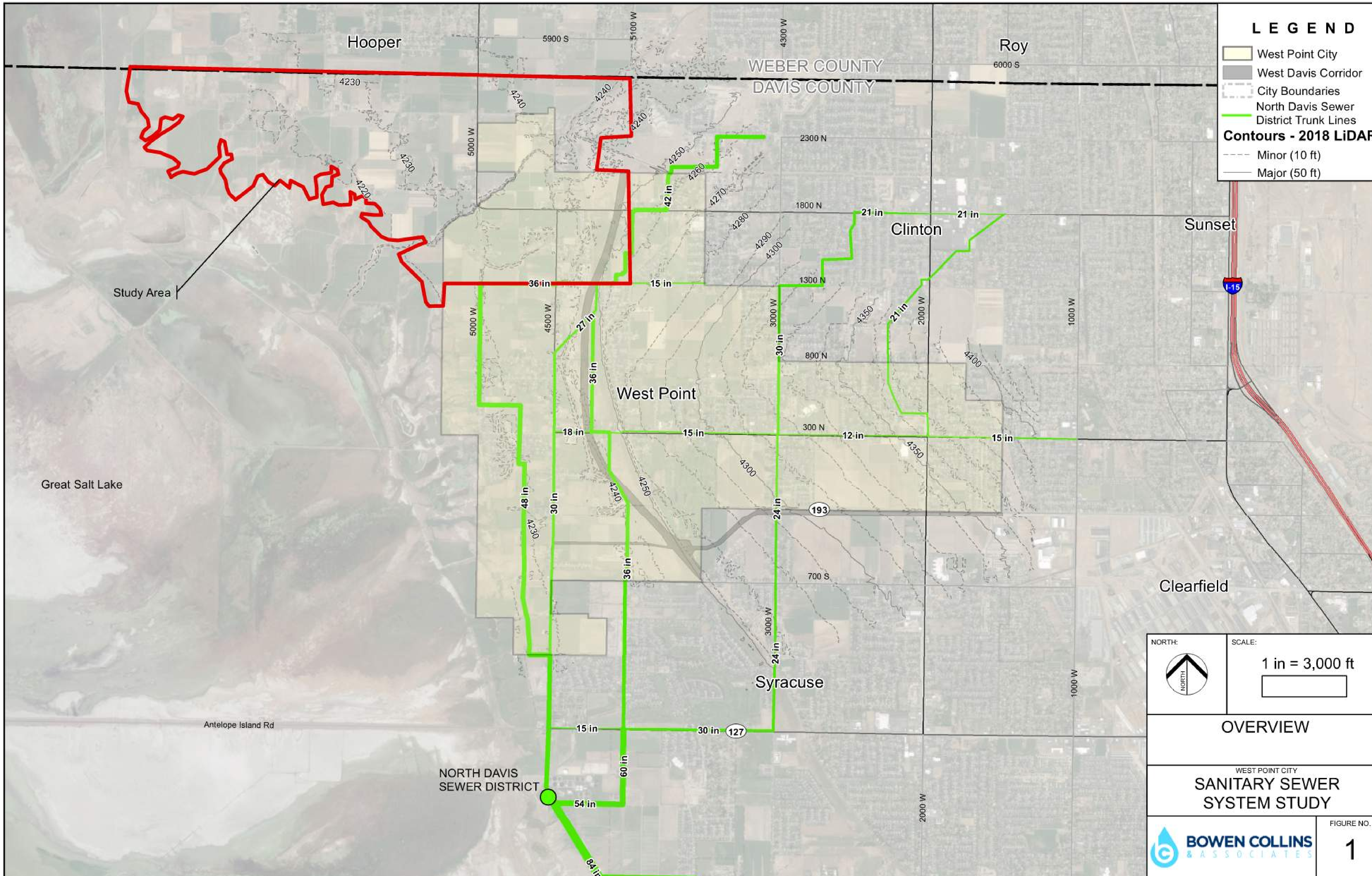
In summary, based on the information contained in this analysis and summarized in Table 1, it is recommended that the next phase of this study further analyze a Traditional Gravity System and Septic Tank Effluent Pump (STEP) system. These alternatives provide the City with consideration of the most promising of both the centralized and decentralized maintenance alternatives. They appear to be the most applicable and feasible alternatives to meet the City's needs in this service area.

BOWEN COLLINS & ASSOCIATES

Table 1
Summary of Sewer System Alternatives

Alternative	Capital Costs[1] (Millions)	Annual O&M Costs[1] (thousands)	60 year Life Cycle Costs[1] (Millions)	Advantages	Disadvantages
Traditional Gravity	$2.4 - $3.6	$65 - $97	$4.5 - $6.7	•Lower O&M costs •Same technology as current system (staff familiar with system) •Centralized lift stations •Back-up power during power outages •Easy to access and monitor collection system •Time-tested reliability	•Higher capital costs (large pipes, deep excavations, etc.) •Requires minimum grades to operate •Requires lift stations and associated maintenance •Infrastructure required upfront (regional pipeline and lift stations must all be built first. less flexible phasing) •Traditional I&I can be expected as system ages
Low Pressure Sewer System (LPS)	$1.3 - $2.0	$106 - $159	$4.7 - $6.1	•Lower capital costs (smaller collection lines, shallow bury, etc.) •No septic tank required on each lot •Pressure pipe force mains eliminate system I&I	•Higher O&M costs (higher pump replacement costs compared to effluent only pumps) •Decentralized pumping required (thousands of grinder pumps) •Little emergency storage (immediate operator response needed when problems occur) •Minimum velocities are required in collection lines to mobilize solids. This means less flexible trunkline phasing.
Septic Tank Effluent Pumping (STEP)	$0.9 - $1.4	$60 - $90	$2.5 - $3.7	•Lower capital costs (smaller collection lines, shallow bury, etc.) •Lower O&M costs (smaller effluent only pumps) •Pressure pipe force mains eliminate system I&I •Septic tank provides some emergency storage •No minimum velocities required in collection lines (allows for more flexible phasing of system)	•Decentralized pumping required (thousands of effluent only pumps and septic tanks) •Septic tank required (maintenance, periodic pumping, located on private property) •Disposal of septic tank waste
Vacuum Sewer System	$2.4 - $3.6	$92 - $137	$4.8 - $7.2	•Vacuum mains eliminate system I&I •Centralized vacuum and pump station •No air release valves required	•Higher capital costs (Cost savings of smaller collection lines, shallow bury, etc. are offset by more complicated vacuum system) •Higher O&M costs (large mechanical aspect to this system) •Collection valve pits required for every 3-4 homes •Little emergency storage (immediate operator response needed) •Minimum velocities required in collection lines (less flexible trunkline phasing) •High system complexity (valve pit, vacuum compressor, pumps, and biofilter) •Specialized parts and training required.
Small Area Treatment Plant[2]	Treatment $0.6 - $0.9 Treatment & Collection $3.0 - $4.5	Treatment $45 - $66 Treatment & Collection $110 - $163	Treatment $2.2 – $3.2 Treatment & Collection $6.7 - $9.9	•Can be located at low point in system •Minimizes number and size of lift stations required •Potential to reuse treated water	•Highest capital and O&M costs (this alternative requires the costs from the "Traditional Gravity" system and the "Small Area Treatment Plant") •Highly regulated - Utah Pollutant Discharge Elimination System (UPDES) Permit is required •Performance requirements – measurable and enforceable pollutant effluent levels must be met •Anticipated flows are significantly larger than what the state would typically allow for a "packaged" treatment plant •Significant increase in the City's wastewater responsibility. Would likely require multiple additional staff to operate the plant.

[1]Hypothetical costs for a 200 unit system from WERF "*Performance & Costs of Decentralized Unit Processes*", Water Environment Research Foundation, April 2010. For comparison purposes only, not actual costs.
[2]Assumed Primary Treatment and Fixed Growth Secondary Treatment (lower assumed costs than suspended growth treatment options) costs estimates have been combined from WERF "*Performance & Costs of Decentralized Unit Processes*", Water Environment Research Foundation, April 2010. Top costs are treatment only and bottom costs are treatment combined with traditional gravity system.



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APPENDIX B

TM02 FINAL SEWER ALTERNATIVE ANALYSIS

EXECUTIVE SUMMARY - 2021 SANITARY SEWER SYSTEM STUDY

West Point City (City) retained Bowen Collins & Associates (BCA) to perform a sanitary sewer system analysis of areas currently within City limits and in unincorporated Davis County that are not serviceable by the existing gravity sewer system. At buildout, it is expected that this area will include approximately 4,650 residential units.

A preliminary high level analysis was performed that evaluated a total of 5 different sewer conveyance systems. This preliminary analysis narrowed down the alternatives to two of the most feasible:

1) **Traditional gravity sewer with lift stations** – This system would use gravity pipelines to collect wastewater and regional lift stations to service areas below the serviceable gravity area.
2) **Septic Tank Effluent Pumping (STEP) system** – This system would consist of individual septic tanks and effluent pumps at each residential connection. The septic tanks would collect the solids and then the effluent would be pumped through a series of force mains until it discharges into a gravity sewer line.

These alternatives represent the most promising alternatives for both a centralized (Traditional) and decentralized (STEP) sewer conveyance system..

This technical memorandum was prepared to document the in-depth analysis performed on the Traditional and STEP systems. Key aspects of the analysis include the following four comparison categories:

- **Capital Costs –** Detailed cost estimates were generated for each alternative. The STEP system total capital costs (including system and project level costs in 2021 dollar) are estimated at $92.9M. The traditional alternative was estimated at $96.6M. ***Conclusion: Capital costs for the STEP alternative are approximately 4% ($3.7M) less than the Traditional alternative.***
- **Operation and Maintenance Costs –** A detailed O&M analysis of each system based on end user data shows that the Traditional system would require approximately 1/3 of the annual expense to the City to operate when compared to the STEP system. The STEP alternative had approximately $870K in annual O&M costs at build out and the Traditional alternative was estimated at $320K in build out annual O&M costs. It is estimated that at build-out, the STEP system would require a dedicated 4.5 full time person crew compared to 1 full time person crew for the Traditional system. ***Conclusion: O&M costs for the Traditional alternative are approximately 63% less ($550,000/year) than the STEP system.***
- **Life Cycle Costs –** Capital costs and O&M costs have been combined to provide an estimated 60-year life cycle cost in present value dollars. Two analyses were performed, a 'upfront capital' analysis and a 'phased capital and O&M' analysis. Both analyses show that, while the STEP system is less expensive to install initially, the Traditional system has an overall lower life cycle cost. The the Traditional system's higher capital costs are offset by its lower O&M costs over time. ***Conclusion: The Traditional alternative has significant overall cost advantages when life cycle, costs are evaluated.***
- **Non-Cost Factor Comparison –** An evaluation of each alternative's non-cost factor advantages and disadvantages was also performed. Ultimately, the Traditional system is the more

established technology, used almost exclusively through-out the State. It is familiar to the City, provides a means of backup power, and has fewer restrictions to the residents. The STEP system is a newer technology to the State and thus is unfamiliar to most residents and cities. The system has a capital cost savings and could potentially facilitate development with less upfront investment, but comes with use restrictions on residents (garbage disposals and water softeners would not be allowed) and is susceptible to potential problems if the City has a widespread, power outage emergency lasting more than 1 day. ***Conclusion: When considering all non-cost factors, the Traditional system is the preferred alternative in this comparison.***

In summary, the STEP System has the lowest capital costs while the Traditional System has the lowest O&M and life cycle costs. The Traditional system also is the preferred alternative in the Non-Cost Factor comparison. Generally, the STEP system could provide sewer service to the study area at lower initial capital costs, but comes with significantly higher O&M expenses and life cycles cost for the City and has other non-cost factor disadvantages that would be impact the City and residents.

TECHNICAL MEMORANDUM

TO:	Boyd Davis, P.E., West Point City Engineer
COPIES:	Kyle Laws, West Point City Manager File
FROM:	Tyler Seamons, P.E. and Cristina Nelson, P.E.
DATE:	May 10th, 2021
SUBJECT:	2021 Sanitary Sewer System Study – Tech Memorandum #2- Final Sewer Alternative Analysis
JOB NO.:	668-20-01

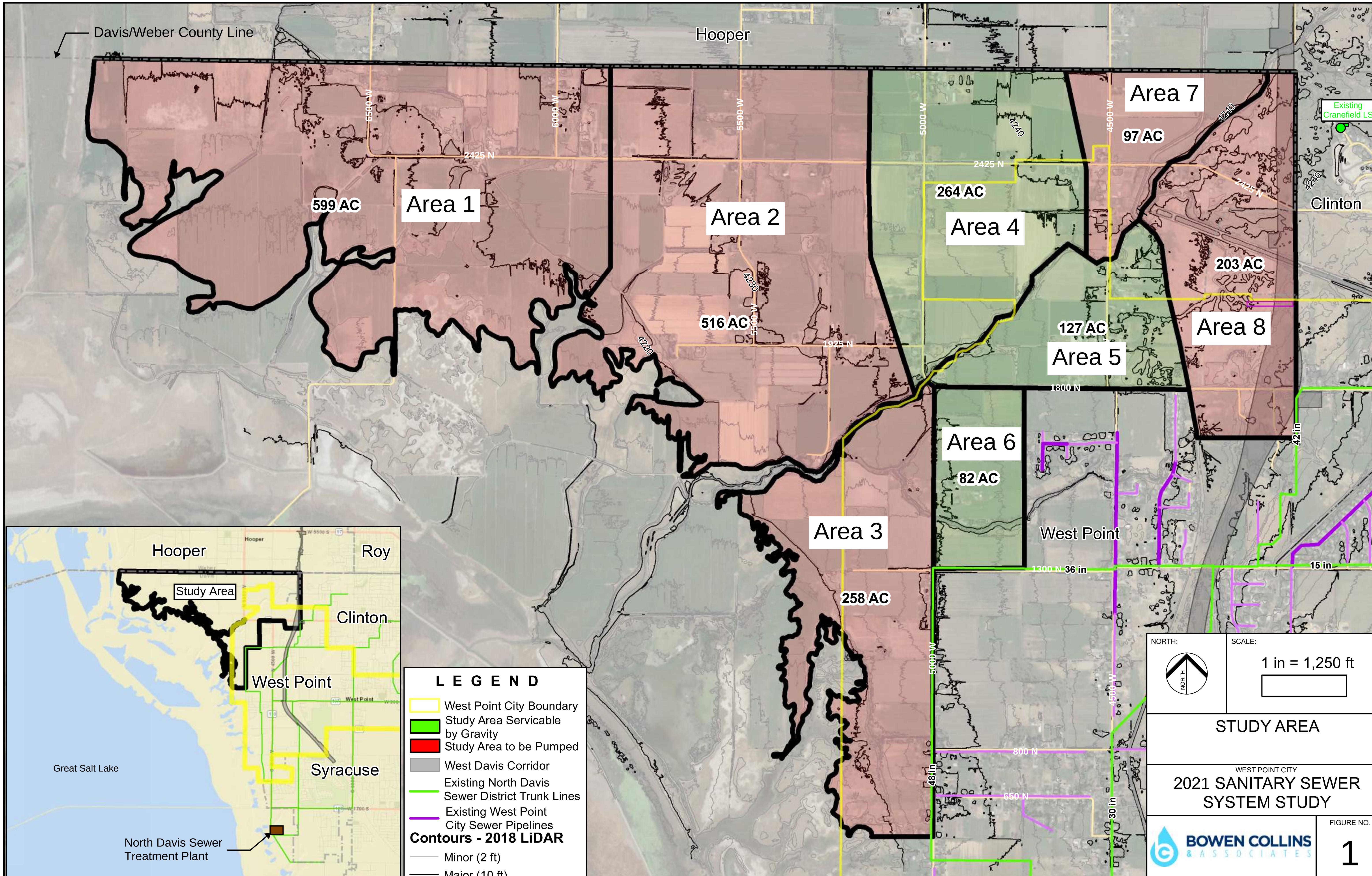
INTRODUCTION AND BACKGROUND

West Point City (City) has retained Bowen Collins & Associates (BCA) to perform a sanitary sewer system analysis of areas currently within City limits and in nearby areas of unincorporated Davis County that are not currently serviceable by the existing gravity sewer system. The study area for this analysis is shown in Figure 1. The current study area has been subdivided into eight smaller areas (numbered 1 to 8) for purposes of analysis and discussion. At buildout, it is expected that the study area will include approximately 4,722 residential units along with small amounts of supporting commercial and institutional development.

A preliminary study was previously performed by BCA that evaluated the following sewer systems: Traditional gravity sewer with lift stations, low pressure sewer system (LPS or grinder pumps), septic tank effluent pumping system (STEP or effluent only), vacuum system, and a small area wastewater treatment plant. This preliminary analysis analyzed each system's general costs, operations and maintenance (O&M), and other key non-cost factors. A technical memorandum dated December 17, 2020 was prepared outlining the results of this analysis. Based on these results and input from the City, it was determined to proceed with a more in-depth analysis of the Traditional gravity sewer system with lift stations and the STEP system. These alternatives provide the City with consideration of the most promising of both the centralized and decentralized sewer conveyance alternatives. They appeared to be the most applicable and feasible alternatives to meet the City's needs in this service area.

This technical memorandum was prepared to document the in-depth analysis performed on the Traditional and STEP system alternatives. Key aspects of the analysis include the following: capital costs, operations and maintenance costs, life-cycle costs, and other non-cost factors (backup power availability, phasing, system restrictions, system familiarity, …etc.).

Findings from this analysis will be presented to the City Council for their consideration and decision on a preferred sewer conveyance system for this study area.



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DATA SOURCES AND ASSUMPTIONS

Various data sources were used and compiled for this analysis. Key data sources used for this study are listed in Table 1. Data collected has been used to quantify actual capital costs, O&M costs, life cycle costs and other non-cost factors of each system.

Table 1
Data Sources

Item	Source	Description
2018 Northern Utah LiDAR Elevation Data	Utah AGRC	0.5-meter resolution LiDAR data flown in 2018 (contours generated from this data)
Sewer O&M Surveys (STEP)	Monticello City and South Alabama Utilities	Surveys were performed regarding various O&M aspects of their existing STEP systems.
Sewer O&M Survey (Traditional)	West Point City	Survey included actual and estimated O&M costs associated with the City's existing Traditional sewer system
Land Survey Points	West Point City	Various field investigation and survey of existing manholes and culverts
Construction and Master Plan Costs Estimates	Bowen Collins and Associates	Data from past construction projects throughout the state of Utah that have been compiled for master planning cost estimates
STEP System Capital Costs	Orenco Systems	Septic tank, pump, and replacement parts costs were provided in a bid format.
WPC Sewer Study (2007)	West Point City	A previous sewer study performed in 2007 presented a Traditional sewer solution for this study area. This study was used for reference only.

The following definitions are provided for clarification:

System Level Infrastructure – This represents the main infrastructure required throughout the study area (e.g., lift stations, gravity trunk lines above 12-inch, and force mains above 4-inch) and can be considered the backbone of the sewer system. These projects are typically funded through City bonding and repaid through impact fees.

Project Level Infrastructure – This represents all other sewer service connections and collection lines that are not considered system level infrastructure. These projects are typically constructed directly by the developer or individual homeowner. For the Traditional alternative this would include 8"-10" sewer mains and their manholes and the service laterals of each residence. For the STEP alternative this would include the septic tank and effluent pump at each residence and local pumped collector sewer lines less than 4" diameter .

ERU – Equivalent Residential Units –A unit of water that approximates the average residential flow, and in this case, sewer flows.

Major key assumptions used through this study are outlined below:

- **Gross Population Density – 2.2 ERUs per acre** – The current City plan is to zone all existing agricultural land within the study area and all future annexed areas into the City as R-1, which restricts development to a maximum gross density of 2.2 ERUs/ac. This assumption was used when sizing all system level lift stations and trunk lines. If actual development density changes significantly, an additional study would need to be performed to update/verify system level sizing is adequate.

- **Average Design Flows – 255 gpd/ERU** – Historic water consumption data gathered as part of the ongoing North Davis Sewer District (NDSD) Impact Fee Study was used to estimate average sewer flows, including allowance for inflow and infiltration (I&I). The following assumption of 220 gpd/ERU (single family residential flow) + 35 gpd/ERU (I&I) = 255 gpm/ERU was used as the average daily design flow. The STEP system was designed based on 220 gpd/ERU since I&I is essentially eliminated for this alternative.

- **Peak Design Flows** – Peaking factors used are based on the State of Utah Peak Instantaneous Demand equation (refer to Utah Code R309-105-9). Peaking factors were adjusted based on the contributing area size. Peaking factors ranged from 2.3 to 4.0 depending on the contributing area size.

- **Gravity Design Capacity - 75% design flow/design capacity** – The gravity sewer system lines were sized based on 75% of the maximum flow capacity of the pipeline. This is a conservative standard typically used when sizing system level sewer pipelines.

- **Minimum Slopes** – Due to the flat terrain and shallow existing sewer, all system level gravity trunk lines and most project level sewer pipelines were assumed to be installed at minimum slopes as defined by the Utah State required sewer pipeline slopes (see Table 2). If pipelines are installed at greater slopes, the serviceable area by gravity will be reduced.

Table 2
Utah Minimum Sewer Slope Requirements-Table R317-3-2.3(D)(4)

Pipe Diameter (inches)	Minimum Slope (ft/ft)
8	0.00330
10	0.00250
12	0.00195
15	0.00145
18	0.00115
21	0.00095
24	0.00077
30	0.00057

- **Sewer Level of Service –** The level of service or standard of service for this study is defined as the following: a residential sewer line invert must be at a minimum of 3-feet below the existing topography to be considered serviceable by the gravity pipeline. This was used to define the potential serviceable area by gravity only and was based on several existing communities near the study area. These communities had similar shallow sewer conditions which required the roadway and house to be built up from the existing grade. Most homes with basements in this situation are limited to daylight basements.

- **Ownership** – It was assumed that the City would own and operate all key aspects of each sewer system. For the Traditional system alternative, this included the regional lift stations, force mains, and gravity trunk lines. For the STEP system alternative, this included the septic tanks, effluent pumps and force mains.

- **Service Area** – The current study area includes areas not served by the sewer system currently within West Point City and nearby unincorporated areas of Davis County that may potentially be annexed by West Point City in the future. Generally, the service area is defined on the west by the Great Salt Lake floodplain boundary (officially the 4,217 contour), on the north by the Weber/Davis County line, on the east by the proposed West Davis Corridor, and the south does not extend further south than 500 N. Note: This study DOES NOT include areas in Weber County, specifically within Hooper City. If the future West Point City sewer system boundary changes significantly from the study area currently assumed, this study will need to be updated to verify sizing and recommendations.

- **Gravity Service** – West Point City's preferential method to provide sewer to its residents is by gravity sewer. If an area can be serviced by future gravity lines, then it must be serviced by gravity for both alternatives. This study shows it is possible to service these areas by connecting on to the NDSD trunkline at 5000 W and 1300 N and extending a sewer trunk line north along 5000 W to 2425 N. This specifically applies to Area 4, 5, and 6 (refer to Figure 1). The following analysis assumes both alternatives include gravity sewer mains in these areas.

ALTERNATIVE ANALYSIS

When comparing the advantages and disadvantages of each sewer system alternative, it is important to consider all factors to determine the most appropriate solution for the City and its residents. For this analysis, four main categories were chosen for comparison: 1) Capital Costs, 2) Operation and Maintenance Costs, 3) Total Life Cycle Costs and 4) Other Non-Cost Factors. In general, all costs were considered in the analysis regardless of who will actually pay for them in the future. A "total" system cost approach was taken to fully understand the entire impacts of each alternative. Ultimately all costs will be paid by the current and future residents of the City, in one way or another. The purpose of this analysis is to quantify each of these categories in such a manner to allow the City to more easily see the larger picture and choose the most feasible option for both the City and future residents.

1.0 Capital Costs: the capital costs of each alternative are presented below.

1.1 Capital Costs Traditional Gravity Sewer with Lift Stations: This type of sewer conveyance system is by far the most widely used and time-tested sewer conveyance method in the State. Each residence is connected to gravity collection system that conveys the wastewater to a regional waste water treatment plant. Manholes are located throughout the system, allowing access for maintenance and observation. Centralized lift stations are used, as needed, when wastewater is not able to flow by gravity to the sewer trunk lines. West Point City currently owns and operates a traditional gravity sewer system with one small regional lift station. This alternative would be an extension of the City's existing sewer system with similar technology.

It was determined that areas 4, 5, and 6 are able to be serviced by gravity sewer lines. Extending the 5000 W trunk line from 1300 N to approximately 2425 N would make this possible. The following conditions exist with this proposed 5000 W trunk line extension: minimum cover of approximately

4-feet would exist in portions of the pipeline; In between 1300 N and 1800 N there are two existing drainage culverts (15 and 36-inch) that cross 5000 W that would need to be looped or relocated; The sewer trunkline would need to cross the Howard Slough. It was assumed that the trunkline would cross in front of the existing Howard Slough 5000 W culvert by means of a pipe bridge (see Section 1 on Figure 2). Estimated costs have been included for the 5000 W trunkline and Howard Slough utility bridge in each of the sewer system alternatives. During some initial discussions with NDSD, ownership of the 5000 W trunkline could potentially be switched over to NDSD after construction is completed. Further discussion and coordination is needed regarding this possibility of ownership of the future 5000 W trunkline.

For the Traditional alternative, all other areas within the study area would need to be serviced by regional lift stations. Areas 1, 2, 3, 7 & 8 would be serviced by a total of 4 lift stations. Lift Station service area boundaries were generally delineated to minimize required lift station depths and minimize the total number of lift stations required. Refer to Table 3 for a summary of each service area and peak design flows used in the design and sizing of each lift station, force main, and gravity trunk line. Figure 2 summarizes this alternative and outlines approximate system and major project level sewer lines, force mains, and approximate lift station locations. System level costs include all main trunk lines, lift stations and force mains. Project level costs include all other collection lines, manholes and service connections.

Table 3
Traditional Alternative Summary

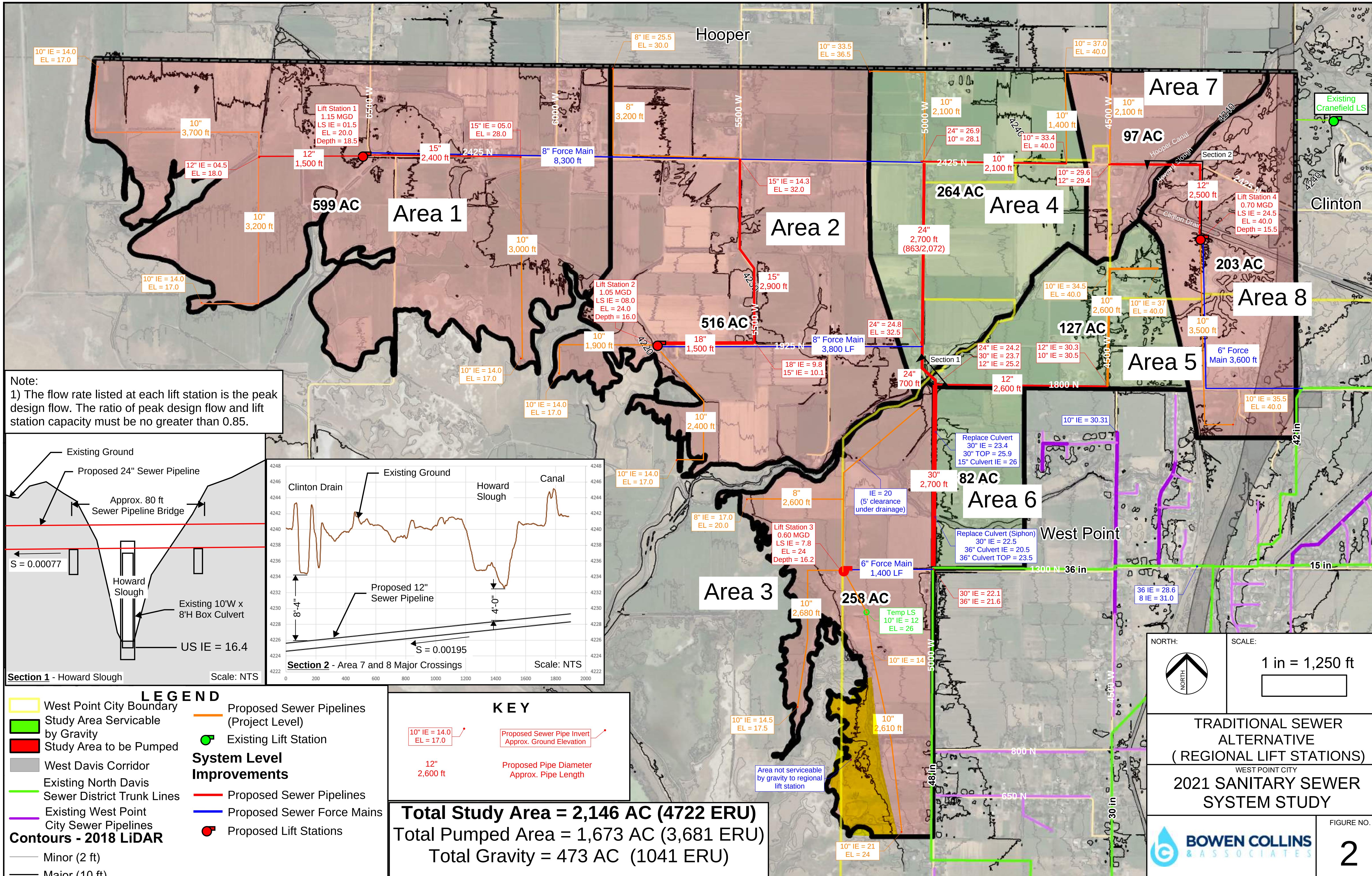
Location	Type of Service	Area (acres)	ERU	Peak Design Flow[1]	
				(mgd)	(gpm)
Area 1	Lift Station 1	599	1,318	1.15	797
Area 2	Lift Station 2	516	1,135	1.02	712
Area 3[2]	Lift Station 3	258	568	0.58	402
Area 4	Gravity	264	581	0.59	411
Area 5	Gravity	127	280	0.28	198
Area 6	Gravity	82	180	0.18	128
Area 7	Lift Station 4	97	213	0.67	468
Area 8	Lift Station 4	203	447		

[1]The ratio of peak design flow to lift station capacity must be no greater than 0.85, per City Standard
[2]A small portion (approximately 34 acres) on the SW corner of this area will not be able to flow by gravity to the regional lift station due to insufficiently deep collection lines south of this area. This area could still develop but would require an alternative solution to lift the sewage to the adjacent gravity sewer lines (e.g. privately owned sewer ejector pumps).

Capital costs for the sewer gravity lines, lift stations, and force mains were estimated at $96.6 million and are summarized in Table 5, a detailed breakdown of these system and project costs is provided within the Appendix.

Special considerations:

- Area 3 – A temporary lift station at approximately 5150 W and 1000 N was recently approved for the Sunview Estates Subdivision. The lift station will be decommissioned when the regional lift station is built.



Hooper
Clinton
West Point
Area 1
599 AC
Area 2
516 AC
Area 3
258 AC
Area 4
264 AC
Area 5
127 AC
Area 6
82 AC
Area 7
97 AC
Area 8
203 AC
Existing Cranefield LS
Lift Station 1
1.15 MGD
LS IE = 01.5
EL = 20.0
Depth = 18.5
Lift Station 2
1.05 MGD
LS IE = 08.0
EL = 24.0
Depth = 16.0
Lift Station 3
0.60 MGD
LS IE = 7.8
EL = 24
Depth = 16.2
Lift Station 4
0.70 MGD
LS IE = 24.5
EL = 40.0
Depth = 15.5
8" Force Main
8,300 ft
8" Force Main
3,800 LF
6" Force Main
1,400 LF
6" Force Main 3,600 ft
Temp LS
10" IE = 12
EL = 26
Replace Culvert
30" IE = 23.4
30" TOP = 25.9
15" Culvert IE = 26
Replace Culvert (Siphon)
30" IE = 22.5
36" Culvert IE = 20.5
36" Culvert TOP = 23.5
IE = 20
(5' clearance under drainage)
Area not serviceable by gravity to regional lift station
Section 1
Section 2
2425 N
1925 N
1800 N
1300 N
800 N
650 N
6500 W
6000 W
5500 W
5000 W
4500 W
Note:
1) The flow rate listed at each lift station is the peak design flow. The ratio of peak design flow and lift station capacity must be no greater than 0.85.
Existing Ground
Proposed 24" Sewer Pipeline
Approx. 80 ft
Sewer Pipeline Bridge
S = 0.00077
Howard Slough
Existing 10'W x 8'H Box Culvert
US IE = 16.4
Section 1 - Howard Slough
Scale: NTS
Existing Ground
Clinton Drain
Howard Slough
Canal
Proposed 12" Sewer Pipeline
8'-4"
4'-0"
S = 0.00195
Section 2 - Area 7 and 8 Major Crossings
Scale: NTS
LEGEND
West Point City Boundary
Study Area Servicable by Gravity
Study Area to be Pumped
West Davis Corridor
Existing North Davis Sewer District Trunk Lines
Existing West Point City Sewer Pipelines
Contours - 2018 LiDAR
Minor (2 ft)
Major (10 ft)
Proposed Sewer Pipelines (Project Level)
Existing Lift Station
System Level Improvements
Proposed Sewer Pipelines
Proposed Sewer Force Mains
Proposed Lift Stations
KEY
10" IE = 14.0
EL = 17.0
Proposed Sewer Pipe Invert
Approx. Ground Elevation
12"
2,600 ft
Proposed Pipe Diameter
Approx. Pipe Length
Total Study Area = 2,146 AC (4722 ERU)
Total Pumped Area = 1,673 AC (3,681 ERU)
Total Gravity = 473 AC (1041 ERU)
NORTH:
SCALE:
1 in = 1,250 ft
TRADITIONAL SEWER ALTERNATIVE
(REGIONAL LIFT STATIONS)
WEST POINT CITY
2021 SANITARY SEWER SYSTEM STUDY
BOWEN COLLINS & ASSOCIATES
FIGURE NO.
2
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- Areas 7 & 8 – Clinton City currently owns and operates the Cranefield lift station located just east of these areas (refer to Figure 2). Design drawings of this lift station (see appendix) indicate that it was originally designed with surplus capacity to service a very large area to the west (this was confirmed with the Clinton City Engineer). There is also a 24-inch gravity sewer line stubbed on the west side of the existing Crane Field Golf Course for this purpose. Preliminary analysis shows that Areas 7&8 can flow by gravity to this lift station.

  Clinton City raised concerns during discussions with West Point City regarding the feasibility of sharing this lift station's capacity. It was determined that for this study, a separate regional lift station will be required to service these areas. If the Cranefield lift station could become an option to operate as a shared cost or joint facility between Clinton City and West Point City in the future, this proposed regional lift station#4 would not be required. Note: To service Areas 7&8, the Cranefield lift station would most likely require additional or larger pumps and potentially an additional force main. It is recommended that West Point City continue in discussions with Clinton City to determine if a cost sharing agreement might be reached that allows areas 7& 8 to be serviced by the Cranefield lift station.

  Area 7 & 8 also requires sewer lines that cross the Clinton Drain, the Howard Slough, and the Hooper Canal. It appears that minimum clearance can be maintained beneath these crossings as shown in Section 2 on Figure 2. It was assumed that these lines will be bored or open cut and installed within a steel casing to facilitate future maintenance or replacement.

1.2 Capital Costs Septic Tank Effluent Pumping (STEP or Effluent Only): The STEP system consists of a septic tank and effluent only pump located at each residence or business. For this study, it was assumed that the City would own and operate all of the septic tanks and effluent pumps. The septic tank removes the majority of the solids from the wastewater prior to pumping the effluent into force mains that convey the wastewater to gravity sewer lines. Effluent only pumps are generally ½ HP and are capable of pumping up to 200-feet of head. A preliminary design was performed, and main collection force mains were sized to allow the use of the standard ½ HP pump. This alternative offers the greatest phasing flexibility since the required capital costs are generally smaller and the force mains can be sized for buildout flows without concerns of solids settling out into the pipeline. Project level costs are however relatively high due to the required tank and pump system at each residence.

The system level projects for this alternative include the gravity trunk line along 5000 W to provide service to Areas 4, 5, & 6 (including costs for the drainage crossings and bridge across the Howard Slough) and 4 major force mains (see Figure 3). These system costs are significantly less than the Traditional system but does require higher project level costs when compared to the Traditional system. Project level costs include the baffled septic tank / effluent pump package and small (typically 1-inch) service connections (which tend to be higher cost than the Traditional alternative). The service connections connect to slightly larger collector force mains (2 to 3-inch) which eventually connect to the system level force mains (4 to 10-inch). Refer to Table 4 for a summary of each service area and force main and its associated peak design flows. The typical force main will require similar appurtenances as other pressure water lines, namely; air valves at local high points, pigging ports along the main force mains, check valves, and isolation valving. It is recommended that the force mains be a fused HDPE pipe with a larger wall thickness (DR 11) to provide additional protection against potential leaks and contamination.

Table 4
STEP Alternative Summary

Location / Force Main	Type of Service	Cumulative Area (acres)	ERU	Peak Design Flow	
				(mgd)	(gpm)
A1	STEP	248	546	0.56	386
A2	STEP	540	1188	1.06	736
A3	STEP	842	1852	1.48	1027
B	STEP	273	601	0.61	425
C[1]	STEP	160	352	0.36	249
Area 4	Gravity	264	581	0.59	411
Area 5	Gravity	127	280	0.28	198
Area 6	Gravity	82	180	0.18	128
D1	STEP	97	214	0.22	151
D2	STEP	179	394	0.4	279
D3	STEP	300	660	0.67	468

[1]Excludes approximately 34 acres that is currently serviced by the existing Sunview Estates Lift Station.

Special considerations:

- Area 3 – The temporary lift station at the Sunview Estates Subdivision would turn into a permanent lift station. There is approximately 64-acres south of this development that will be serviced by the STEP system in this alternative (no system level pipes would be required).
- Areas 7 & 8 – As discussed previously, if the Cranefield lift station becomes a feasible option in the future, a STEP system in this area may not be required. The Cranefield alternative should be analyzed further if this becomes an option.

  Area 7 & 8 also requires force mains that cross the Clinton Drain, the Howard Slough, and the Hooper Canal. It was assumed that this portion of the force main will be installed within a steel casing to facilitate future maintenance and/or replacement.
- Septic Receiving Station - In discussions with North Davis Sewer District, it was determined that a septic receiving station would need to be constructed at the treatment plant for the STEP alternative. This station would receive the solids generated from cleaning and maintaining the septic tanks. The costs were included in the analysis since West Point City would be the primary motivation to build this receiving station and the District has indicated the City would be responsible for these costs.

System and Project Level capital costs for the STEP system and project costs including the gravity trunk line along 5000 W are shown in Table 5. A detailed breakdown of these costs is provided in the Appendix.

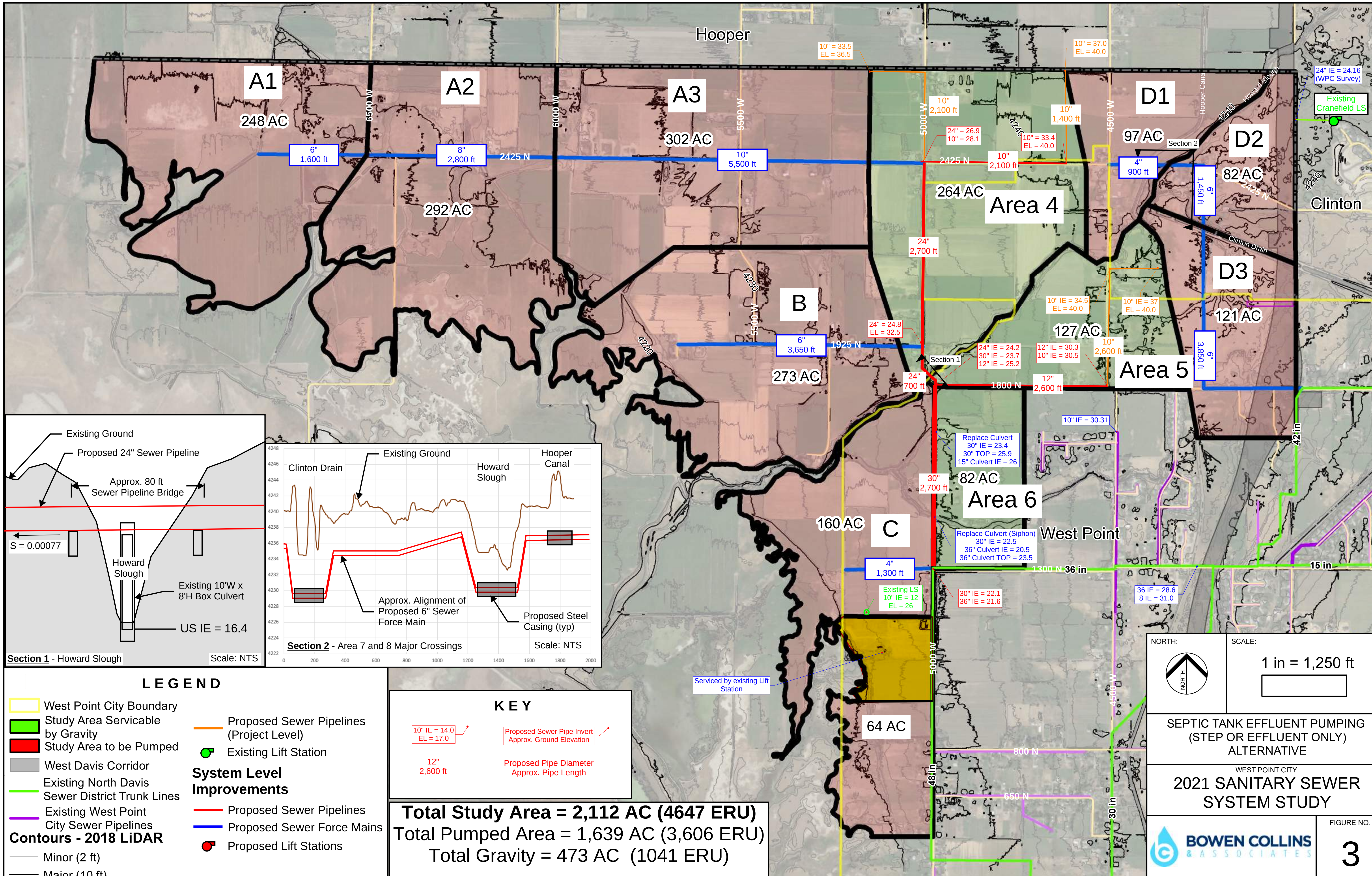

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Table 5
Capital Cost Summary

System Type	System Level Costs	Project Level Costs	Total Combined Cost
Traditional	$22,485,000	$74,131,000	$96,616,000
STEP	$9,832,000	$83,069,000	$92,901,000
(Traditional) – (STEP)	$12,653,000	-$8,938,000	$3,715,000

2.0 Operations and Maintenance Cost Estimates

Another key component is the ongoing operations and maintenance (O&M) costs associated with each alternative. Since both systems will be almost entirely owned and operated by the City, estimated O&M costs will have the largest impact on the City's future public works department budgeting and staffing requirements. A detailed analysis was performed to more fully understand the potential O&M impacts for each alternative and are outlined in this section.

2.1 O&M of Traditional Alternative: This alternative consists of 4 centrally located lift stations, force mains, and gravity trunk lines. O&M costs were estimated based on West Point City's historical O&M records of various expenses, manhours, and general O&M activities required to operate their existing system. The City currently owns and operates Traditional sewer pipelines that service approximately 3,200 ERUs and one lift station that services about 200 ERUs. These expenses were converted to a unit expense per ERU, which were then applied to the proposed Traditional alternative. The proposed Traditional alternative has approximately 4,722 ERUs being serviced by gravity sewer lines and 3,681 ERUs being serviced by regional lift stations (Note: ERUs within the lift station service areas were also included within the gravity sewer numbers, as gravity infrastructure will be required throughout the study area regardless if it is pumped or not). The O&M associated with this Traditional system was broken down into the following categories:

1. Gravity sewer pipeline maintenance (manhours): Includes the manhour time required to perform manhole inspections, spot cleanings, minor repairs, and addressing residential service calls.

2. Gravity sewer pipeline expenses (cost): This includes expenses incurred by the City to contract with third parties to clean and inspect the sewer pipelines throughout the City.

3. Lift station maintenance (manhours): Required manhours to provide general O&M to a centralized lift station.

4. Lift station expenses (cost): This includes expenses incurred by the City to contract with third parties to clean the wet well (vac truck), SCADA / electrical, maintain the onsite generator, and maintain the pumps and grinders.

5. and 6. Replacement of wear items (cost): This includes an estimated cost to replace the pumps and grinders within an assumed 10-year equipment service life. These replacement costs include estimates of the actual equipment and install.

7. Electrical usage (cost): This represents the estimated electrical costs associated with the normal operation of the regional lift stations. This value is based on historical data provided by West Point City.

Each of these categories and their estimated values are summarized in Table 6. A significant portion of the estimated O&M costs for the Traditional alternative are associated with the lift station. The gravity sewer lines typically require little to no ongoing maintenance. It is estimated that the Traditional system would require on average 1 full time City employee to operate and maintain the system.

Table 6
Traditional System Operations and Maintenance Cost Summary

Item #	Maintenance Category	Quantity/year		Unit Cost	Annual Cost
1	Gravity Sewer Manhours[1]	472	hr	$ 50.00	$ 23,595
2	Clean and Inspect Gravity Sewer Pipelines (sub-consultant)[1]	4,722	ERU	$ 6.25	$ 29,494
3	Lift Station Manhours[1]	1,840.5	hr	$ 50.00	$ 92,025
4	Clean Sump, Pump, and Generator Maintenance[1]	3,681	ERU	$ 28.50	$ 104,909
5	Pump Replacement	1.2	Pump	$30,000	$ 36,000
6	Grinder Replacement	0.4	Grinder	$30,000	$ 12,000
7	Electrical Costs	3681	ERU	$7.50	$ 27,608
Total Estimated Annual O&M					$325,630

[1]Average maintenance obtained from data provided by West Point City, see Appendix

2.2 O&M of Septic Tank Effluent Pumping (STEP) Alternative: This alternative consists of a decentralized system that has individual septic tanks and effluent pumps at each residence. Force mains collect the effluent discharged from each septic tank and conveys it to a gravity sewer trunkline. This STEP system is proposed to service approximately 3,600 ERUs and the remaining 1,050 ERUs will be serviced directly by gravity sewer. O&M costs for this system were generally estimated from input from two large scale end users of the STEP system. Each entity has serviced thousands of STEP systems for over 20-years and provides a good base line for these estimated costs. Both entities were questioned about specific O&M items and their historic expenses related to the O&M of their STEP system. Required manhours, number and nature of service calls, general equipment longevity, septic tank pumping frequency, and general advantages and disadvantages of the system were all discussed. A summary of these questionnaires can be found in the Appendix. To estimate the actual costs of the septic tank package (including the effluent pump, floats, filters, etc.) and replacement parts, Orenco Systems was contacted and provided a bid for these items (see Appendix). Orenco's costs were used as a basis for most of the specialized equipment associated with the STEP systems.

The associated O&M for this alternative are broken down into the following categories:

1. STEP system maintenance (manhours): Includes the manhour time required to perform service calls, minor pump/tank repair, tank inspections, and other ongoing system maintenance (filter cleaning, valve repair/replacement, and float repair/replacement).

2. Septic tank pumping (cost): This includes expenses incurred by the City to contract with third parties to periodically pump each septic tank. For the purposes of this study, it was assumed that each septic tank would be pumped on average every 10-years. This is not a set interval but an assumed average required pumping increment that could be expected. Pumping requirements may vary greatly based on each residents use of the sewer system.

3. Effluent pump liquid end replacement (cost): This includes the actual material costs to replace the liquid end of an effluent pump within an assumed 15-year equipment service life. Labor was included in the STEP system maintenance manhours category.

4. Effluent pump motor replacement (cost): This includes the actual material costs to replace the motor of an effluent pump within an assumed 20-year equipment service life. Labor was included in the STEP system maintenance manhours category.

5. Other service call materials (cost): This includes the actual material costs to replace miscellaneous wear parts of the system including; valving (check valve, air valve, isolation valves, gaskets, etc..), filters, mechanical floats, and electrical contactors. Input from the end user survey showed that approximately 60% of service calls required some type of equipment repair or replacement. This category was included for these miscellaneous material costs. Labor was included in the STEP system maintenance manhours category.

6. Gravity sewer pipeline expenses (cost): This includes expenses incurred by the City to contract with third parties to clean and inspect the sewer pipelines through the City. This was applied to the approximate 1,050 ERUs serviced by gravity only.

7. Gravity sewer pipeline maintenance (manhours): Includes the manhour time required to perform manhole inspections, spot cleanings, minor repairs, and addressing residential service calls. This was applied to the approximate 1,050 ERUs serviced by gravity only.

8. Electrical usage (cost): Electrical costs were estimated based on average daily flows, pump flow rates, motor electrical consumption, and current electrical costs in the area. It was determined that on average it would cost approximately $9.90 per year per ERU to operate each effluent pump.

Each of these categories and their estimated values are summarized in Table 7 below. A significant portion of the estimated O&M costs for the STEP alternative are associated with the manhours required to operate and maintain each of the 3,600 septic tanks and effluent pumps. It is estimated that the STEP system would require on average 4.5 full time City employees to operate and maintain the system at build-out.

Table 7
STEP System Operations and Maintenance Cost Summary

Item #	Maintenance Category	Quantity/year		Unit Cost	Annual Cost
1	STEP System Manhours[1]	9,286	hr	$ 50.00	$ 464,300
2	Pump Septic Tanks[1]	361	Tanks	$ 415.00	$ 149,815
3	Liquid End Replacement[1]	240	EA	$ 400.00	$ 96,000
4	Motor Replacement	180	Motor	$ 500.00	$ 90,000
5	Other Service Call Expenses[1]	587	Other	$ 100.00	$ 58,700
6	Clean and Inspect Gravity Sewer Pipelines (sub-consultant)[2]	1041	ERU	$ 6.25	$ 6,502
7	Gravity Sewer Manhours[2]	104	hr	$ 50.00	$ 5,202
8	Electrical Costs	3606	ERU	$ 9.90	$ 35,713
Total Estimated Annual O&M					$ 870,519

[1]Average maintenance obtained from data collected from two large STEP end users, see Appendix
[2]Average maintenance obtained from data provided by West Point City, see Appendix

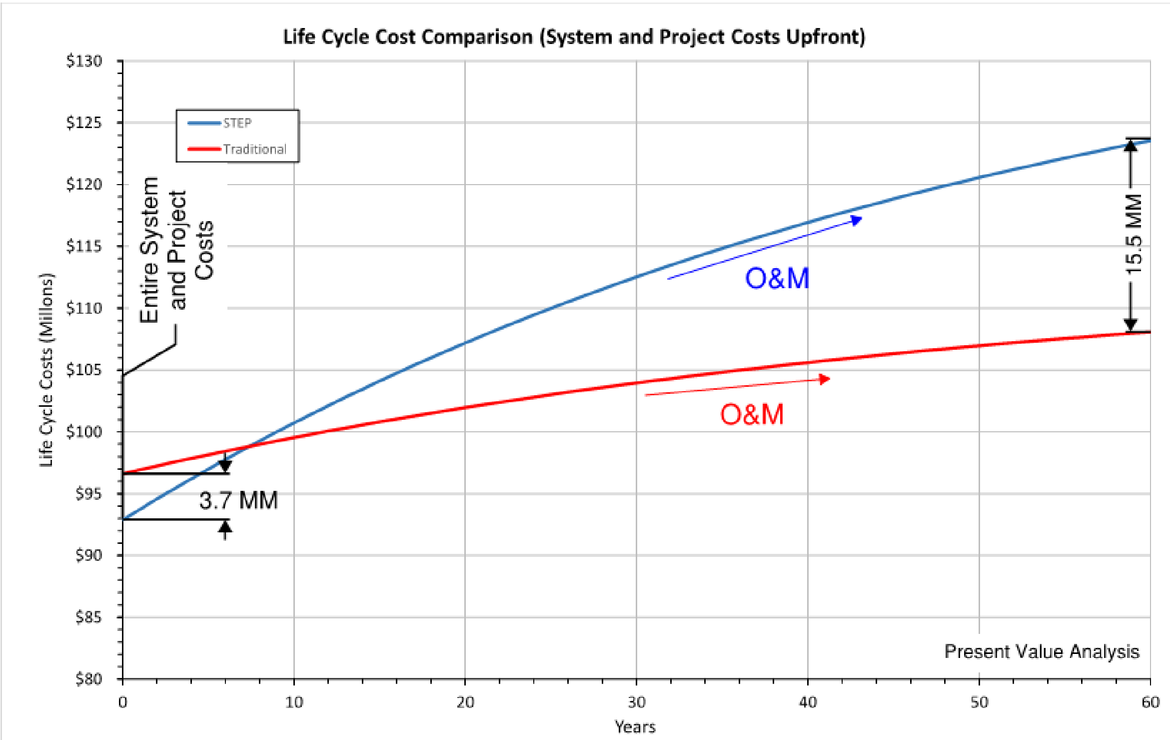
3.0 Life cycle Costs

When comparing Traditional gravity sewer with lift stations (Traditional system) with the septic tank effluent pumping (STEP) system it was important to consider all costs associated with each alternative over the life cycle of the systems. It was determined that a representative life cycle of 60-years would be appropriate in evaluating each alternative. Two present value life cycle analyses were performed to better understand the actuals costs of each system, they are listed below:

1) **Upfront Capital Analysis** – This analysis assumed that all system and project level costs occurred at the beginning (year-0). Full O&M costs were then applied each year over the 60-year life cycle of the alternatives. This evaluation highlights the total differences between the capital and maintenance costs but is not the most representative analysis of the timing of when costs may occur in the future. Figure 4 shows the upfront capital life-cycle analysis in present value basis. Refer to the appendix for a detailed cost breakdown.
2) **Phased Capital and O&M Analysis** – This analysis was performed to more accurately show the capital and maintenance costs ramp up over an assumed build-out period. Build-out of the study area was assumed to occur over the first 30-years of the 60-year life cycle. Generally, projects associated with the gravity serviceable areas were assumed to develop first. This includes Areas 4, 5, 6, 7 & 8. All system level costs associated with these areas were assumed to happen at year-0. At year-5, all system costs of Area 2 were applied, at year 10 all system costs of Area 3 were applied, and at year-20, all system costs of Area 1 were applied. Project level costs were applied incrementally between years 0 to 30, after which it was assumed the study area was completely built-out. O&M costs were also gradually implemented until the project area was assumed to be built-out, at which point the full O&M costs for the entire system were applied annually for the remainder of the life of the

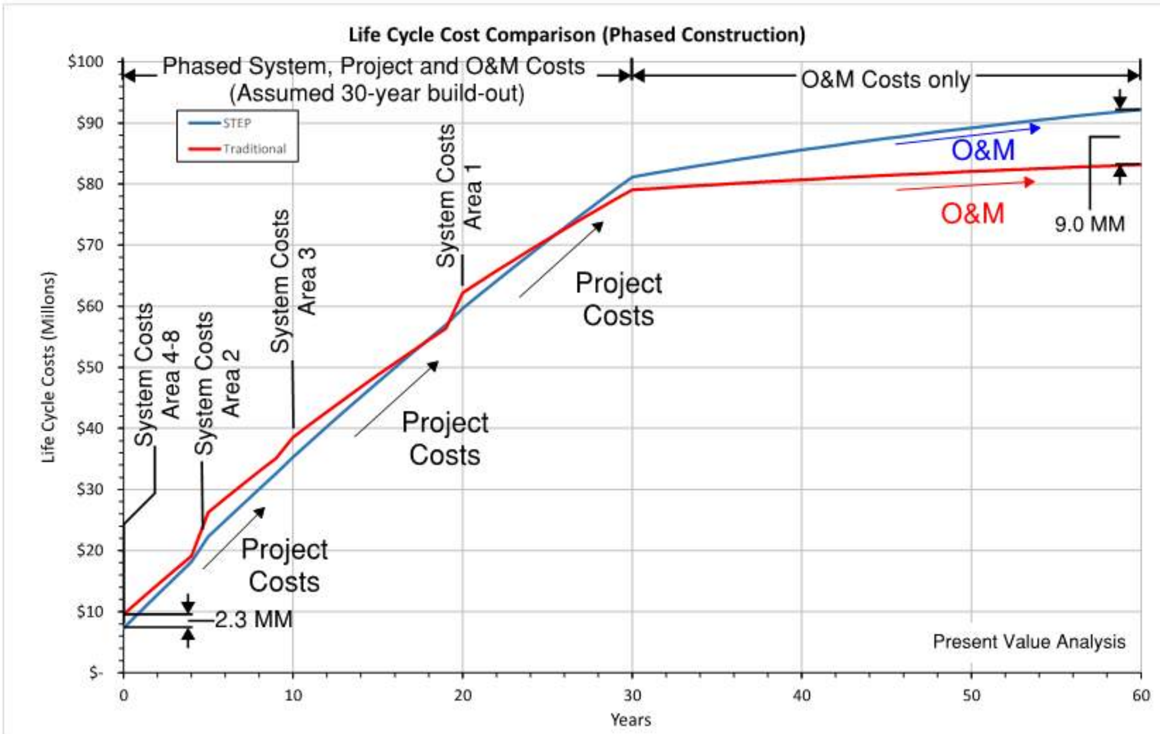
system. This analysis more closely approximates the actual phasing and incurred costs associated with each alternative over time. Figure 5 shows the phased capital and O&M life-cycle analysis in present value. Refer to the appendix for a detailed cost breakdown.

Figure 4 - Life Cycle Costs (Capital Costs Upfront)



From Figure 4 it can be seen that if the sewer system were built-out in year zero the STEP alternative would be able to be constructed for approximately $3.7 million less than the traditional alternative. This initial construction cost advantage is eliminated after approximately 7 years of O&M costs are incurred by the City. Overtime the 60 life cycle the O&M cost advantage of the traditional system would create an overall $15.5 million savings to the City over the STEP alternative.

Figure 5 - Life Cycle Costs (Capital and O&M Phased over 30-years)



From Figure 5 it can be seen that if the sewer system were built-out over 30 years the STEP alternative would be more cost effective to construct. This STEP alternative's construction cost advantage is eliminated as the system approaches build-out as higher O&M costs are incurred by the City. Over the 60 year life cycle the O&M cost advantage of the traditional system would create an overall $9.0 million savings to the City/Residents over the STEP alternative.

4.0 Non-Cost Factors

Each alternative has its own advantages and disadvantages that cannot easily be assigned a quantitative value but will still play a significant role in the selection process. In an effort to organize, rank, and assign importance to each category, a qualitative analysis was performed. A ranked and weighted scoring system was developed where each alternative's non-cost factor was assigned a score between 1-5, 1 being the worst and 5 being the best. These scores were then weighted as to their general importance to the City. A combined weighted average score was then calculated based on this scoring method. Below is a list of the non-cost factors considered in this analysis:

- Backup Power : How does this system perform during an extended power outage?

  The Traditional system is able to provide services to the residents in the event of an extended power outage. Each regional lift station is equipped with a backup generator that is capable of providing power to the lift station for an extended period of time. These generators are typically powered by either natural gas or propane or in some cases both. They require regular maintenance to ensure proper operation.

  The STEP systems rely on the power source from each resident. During a power outage, the effluent pump will not operate, but the septic tank is capable of providing approximately 1-

day of emergency storage. After the septic tank is filled, the waste water would then back-up into the house. Residents should limit their water consumption during power outages to conserve available septic tank storage (e.g., limited showers, tubs, laundry, dish washer, or other high wastewater activities). The City may also see a significant number of requests to pump septic tanks during an extended power outage. This would be a huge task for the City O&M staff to undertake during this type of situation and would most likely not be feasible.

- Restrictions : Are there any restrictions associated with the use of either sewer system?

  The typical restrictions as to what is allowed in the Traditional system also apply to the STEP system. However, some additional restrictions apply specifically to the STEP system, namely it is not recommended that the residents own and operate a garbage disposal or have a water softener backwash discharge into the STEP system. The use of these items are not recommended as they will potentially reduce the effectiveness of the septic tank and increase the required maintenance on the system. It would be in the City's best interest to restrict the use of these items to protect the STEP system and its proper operation.

- Phasing Capability : How easily can this system accommodate development?

  The STEP system excels in this category. Minimal system costs (smaller force mains) allow this alternative to expand rapidly to service areas potentially much sooner than a Traditional system. Since the STEP system effectively removes a majority of the solids from the trunk lines, the force mains would be able to be sized for build-out flows from the beginning. There would be no minimum velocities within these trunk force mains, as there is no concern of solids settling out of suspension.

  The Traditional system requires the regional lift station to be constructed at the beginning of any development. The lift station pumps and potentially force mains would need to be installed in phases to accommodate future flows. Minimum velocities within the force main would need to be maintained in this scenario.

- City Familiarity : How familiar is the City and maintenance staff with this technology?

  The City currently owns and operates a regional lift station with another one coming into service soon. The staff is familiar and comfortable with the O&M required to keep this system operational.

  The STEP system is a new concept to the City and maintenance staff. There are no large scale STEP systems within the state of Utah. As discussed in the O&M section above, the STEP system would require significantly more O&M effort from the City. Training and education would be required at the implementation of this system.

- Constructability : How easy is this system to construct?

  The STEP system's main advantage is the ability to use smaller, shallow buried force mains instead of larger/deeper gravity lines to collect and convey the effluent. The STEP system allows the collection lines to be buried at a minimum depth of approximately 4-feet and can more easily avoid other utility crossings or other obstructions, because these force mains are pumped they do not have to maintain a set grade or elevation.

- Standard of Conveyance : What is the tried and true method?

  The Traditional system is by far the most widely used conveyance method within the intermountain west. The regional lift station approach has a long tract record within the state of Utah and Traditional gravity collection lines are almost entirely maintenance free.

- Residents Familiarity : How familiar are the residents with this technology?

  Generally, residents with the State of Utah are familiar with regional collection systems, in the fact that they typically never have to worry about the proper operation of the sewer collection system. The STEP system would require more resident involvement and understanding. Educational methods would need to be implemented at a regular basis to keep residents well informed as to how their sewer system works and what to do when there are issues.

  Since the City would own the septic tank and effluent pumps, an easement would be required to operate and maintain each of the STEP systems on each resident's lot.

- System Reliability and Performance : How well does this system perform and how much down time does this system experience?

  Based on interviews with end-users for both systems, it was determined that they both performed well in these two categories. Either alternative would be considered a reliable option with minimal downtime and exceptional performance.

The main advantages of the Traditional system were the following: backup power, minimal restrictions, City and Residents Familiarity, and it is the standard method of sewer conveyance. The main advantages of the STEP system are its ability to be easily phased and constructability. Table 8 summaries each of these non-cost factors and their associated weighting factor based on City input.

Table 8
Non-Cost Factors Comparison

	Backup Power	Restrictions	Phasing Capability	City Familiarity	Constructability	Standard of Conveyance	Residents Familiarity	System Reliability	System Performance	Weighted Average
STEP	1	1	5	1	5	1	1	4	4	**2.5**
Traditional	3	4	1	5	2	5	4	5	4	**3.3**
Weight (out of 100)	20	15	15	15	15	5	5	5	5	

From Table 8 it can been seen that weighted average of the non-cost factor scoring results in a higher score from the traditional alternative with the STEP alternative being less advantageous when non-cost factors are considered. The key disadvantages of the STEP alternative of not having the ability to operate the system through back-up power under extended power outage/emergency scenarios and the need to place water softener and garbage disposal restrictions on homeowners are key disadvantages of the system that should not be overlooked.

CONCLUSIONS

A detailed sewer alternative analysis was performed looking into two different alternatives to provide sewer service to areas within West Point City and unincorporated Davis County that are not able to be serviced by gravity. The two alternatives studied in this detailed analysis are a centralized and decentralized alternative. The centralized alternative is the Traditional sewer conveyance system with regional lift stations and the decentralized alternative is the Septic Tanks Effluent Pumping (STEP) system with septic tanks and effluent pumps at each residence. The purpose of this detailed analysis was to help the City identify the most feasible alternative to provide sewer service to the study area. The main conclusions determined from this alternative study are summarized below:

- **Capital Costs –** Detailed cost estimates were generated for each alternative that incorporated all associated system level and project level costs. The STEP system total capital costs are estimated at approximately 4% ($3.7MM) less than the Traditional system. The STEP system has the lowest required capital costs of out the alternatives.
- **Operation and Maintenance Costs –** A detailed O&M analysis of each system based on end user data shows that the Traditional system would require approximately 1/3 of the annual expense to the City to operate when compared to the STEP system. It is estimated that at build-out, the STEP system would require a dedicated 4.5 full time person crew compared to a 1 full time person crew for the Traditional system.
- **Life Cycle Costs –** Capital costs and O&M costs have been combined to provide an estimated 60-year life cycle cost in present value dollars. Two analyses were performed, a 'upfront capital' analysis and a 'phased capital and O&M' analysis. Both analyses show that the Traditional system has an overall lower life cycle cost. This analysis shows that the Traditional system's higher capital costs are offset by its lower O&M costs over time.
- **Non-Cost Factor Comparison –** Ultimately the Traditional system is the tried and true system almost exclusively used through-out the State. It is familiar to the City, provides a means of backup power, and has fewer restrictions to the residents. The STEP system is a newer technology to the State and thus is unfamiliar to most residents and Cities. The system has a significant upfront cost savings and could potentially facilitate faster development demands. When considering all non-cost factors, the Traditional system is the preferred alternative in this comparison.

In summary, the STEP System has the lowest capital costs while the Traditional System has the lowest O&M and life cycle costs. The Traditional system also is the preferred alternative in the Non-Cost Factor comparison. Generally, the STEP system can provide sewer service to the study area at a much quicker rate and at relatively lower capital costs but comes with significantly higher O&M expenses for the City overtime and has other non-cost factor disadvantages.

Recommendations*:* While the traditional system alternative does require a higher initial capital investment to construct the system, the annual O&M cost advantages of the traditional system make it the most cost-effective solution for West Point City(as seen in both the upfront and phased versions of a life cycle analysis). In addition, the non-cost factor comparison also shows the traditional system alternative will provide West Point City the better long term sewer system solution. The final study recommendations will be coordinated with City Council and City Staff.

Appendix A

End User System Surveys

Tim Lee
South Alabama Utilities
Wastewater Manager
(251) 895-4115

Orenco System Questionnaire

Municipality or Service District: S. Alabama Utilities   Total number of Orenco systems: 3,000 to 3,500

Total number of sewer connections: 1,000   Length of Ownership (years): 20+ years

Does the City own and operate the actual pump and septic tank (yes or no): yes - they own and maintain. No additional charge for service calls

Estimated manhours required to service Orenco System Only or number of employees required: 10 employees total. 3 - responsible for service calls and repairs, 5 - part of construction crew to install tanks and pumps for new builds, and 2 supporting staff

Required training for workers (estimated upfront or ongoing costs): minimal

Number of Service Calls (# of calls / month or year): 100 calls per month total. about 85 of those there is something to fix with the system. They have somebody on call 24/7

Nature of Service Calls (e.g. pump issues, pump septic tank, etc)

60% are bad floats, 40% are clogged filters. Pumping tanks is sparatic. They pump as needed (not on a schedule). They pump approx. 50 tanks a year. They have to rebuild liqued end of the pumps every 5 to 20 years. Motors are rare to go bad.

Parts availability (lead time on pumps, septic tanks, or other replacement parts):

They order parts in bulk and keep on hand about 10-20 liquid ends, 10-20 spare pumps (motor and pump), spare electrical components

Specialized tools required (any estimated costs to the City?) Nothing special. Very straight forward to maintain or rebuild

City owned equipment (what and estimated costs) No vac truck. They may have to wait 1-2 days

Other O&M costs the City would like to share: covered above.

General ADVANTAGES to the City owning and operating Orenco Systems:

- Customer Service of Orenco is exceptional. This utility specifies only Orenco for their system

General DISADVANTAGES to the City for owning and operating Orenco Systems:

- If installed poorly by contractor, then may have issues down the road. Thats why this utility decided to be the installer. To ensure it is done properly.

Overall City Experience Owning and Operating Orenco Effluent Only Systems (would you do it again and why)?

If installed poorly by contractor, then may have issues down the road. Thats why this utility decided to be the installer. To ensure it is done properly.

Norm Case
City of Montesano
Collection System Supervisor
ncase@montesano.us
(360) 470-2417

Orenco System Questionnaire

Municipality or Service District: Montesano

Total number of Orenco systems: 1480

Total number of sewer connections: -

Length of Ownership (years): Since 1991 (30 years)

Does the City own and operate the actual pump and septic tank (yes or no): Yes

Estimated manhours required to service Orenco System Only or number of employees required: 2

Required training for workers (estimated upfront or ongoing costs): Electrical training, some mechanical

Number of Service Calls (# of calls / month or year): 25/month

Nature of Service Calls (e.g. pump issues, pump septic tank, etc)

Floats, Pumps plug, Need to replace 4-8 Replacement Pumps/month (about a 20 yr average)

Parts availability (lead time on pumps, septic tanks, or other replacement parts):

Order in bulk - no issues

Specialized tools required (any estimated costs to the City?)

City owned equipment (what and estimated costs) No - contract. Spend about $90,000/yr on vac truck at about 0.28/gal

Other O&M costs the City would like to share:

General ADVANTAGES to the City owning and operating Orenco Systems:

- Overall generally pleased with the systm

General DISADVANTAGES to the City for owning and operating Orenco Systems:

- Consumer habits are the biggest issue - flushable wipes, garbage disposables, water softener use
- Apartments and Rentals biggest issues

Overall City Experience Owning and Operating Orenco Effluent Only Systems (would you do it again and why)?

Estimates WPC would need about 4 people full time plus 1 guy running the vac truck.

Traditional System end-user Survey

The following data was collected from West Point City regarding their current O&M costs relating to their gravity lines and lift station.

WPC current ERUs within City
3202 residential sewer connections
61 commercial sewer connections (not sure how many ERU's this represents. I can calculate it if needed)

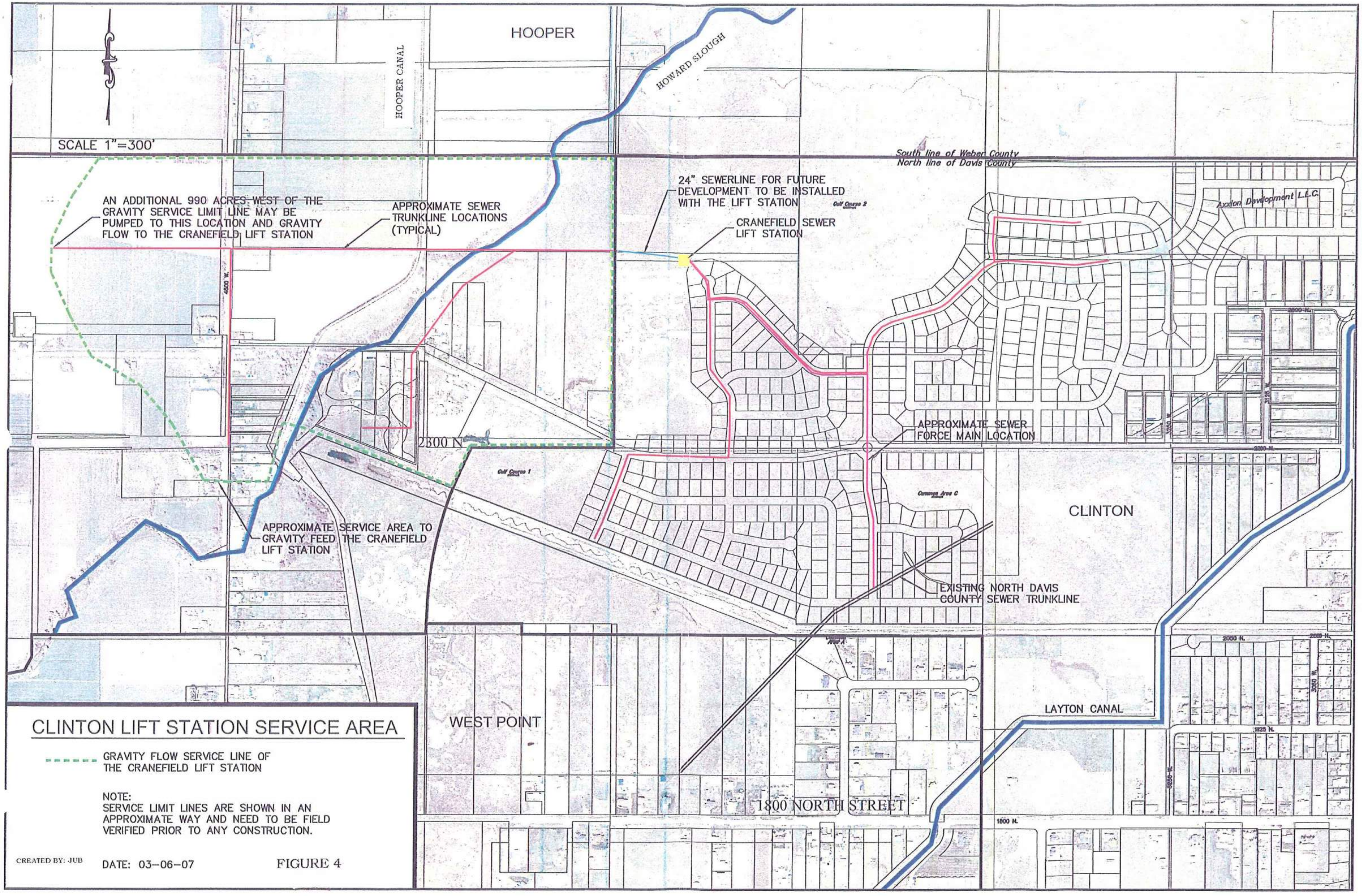
WPC manhours required to maintain existing gravity system (clean sewer pipelines, manhole maintenance, etc)
220 manhours/yr for manhole inspections (estimate from PW department)
100 manhours/yr for spot cleaning, repairs, address complaints, etc (estimate from PW department)
$6,000/yr general cleaning (contracted with Pro-Pipe)
$14,000/yr acoustic pipe inspections (contracted with RH Borden Co.)

WPC manhours to maintain and operate existing lift station
100 manhours/yr general maintenance
30 manhours/yr vac truck/cleaning (contracted with Pro-Pipe, about $1600/yr)
10 manhours/yr SCADA system maintenance (contract with SKM, about $2,000/yr)
5 manhours/yr pump and electrical component maintenance (contracted with Johnson Electric, about $600/yr)
5 manhours/yr backup generator maintenance (contracted, about $1,500/yr)

Parts (pumps, grinder, sensors, etc)
$250/yr miscellaneous parts
$50/yr rental fees for propane tank
$1,200/yr Rocky Mt. Power bill

Appendix B

Cranefield Lift Station Drawings



CLINTON LIFT STATION SERVICE AREA

NOTE:
SERVICE LIMIT LINES ARE SHOWN IN AN APPROXIMATE WAY AND NEED TO BE FIELD VERIFIED PRIOR TO ANY CONSTRUCTION.

CREATED BY: JUB

DATE: 03-06-07

FIGURE 4

Appendix C

STEP Component Costs

Jex Environmental Solutions

PO Box 3603
Logan, UT 84323

Quote

ADDRESS
Contractor - UT

QUOTE	1036
DATE	03/26/2021
EXPIRATION DATE	04/26/2021

SALES REP
Richard

	DESCRIPTION	QTY	RATE	AMOUNT
Prelos1000-36A	Orenco Prelos processing tank, 1000 g., pump discharge, 36" riser, pre-assembled	1	5,214.00	5,214.00T
Prelos1500-36A	Orenco Prelos processing tank, 1500 g., pump discharge, 36" riser, pre-assembled	1	6,000.00	6,000.00T
PF100511-CLK	10 GPM Pump, Click Tight Connector	1	736.34	736.34T
MF1P-CLK	Mechanical Float, Normally Open w/ Collar; ClickTight Connector	1	62.14	62.14T
FLD24G	Fiberglass Lid, DuraFiber, 24" W/ Urethane Gasket; 4 bolts	1	84.59	84.59T
FLD30G	Fiberglass Lid, Durafiber, 30" W/Urethane Gasket; 4 Bolts	1	160.50	160.50T
EP-CONTACTOR-17A	13-16-16-1304; Contactor; 18A, 3P, 110 - 120V, 50/60 HZ	1	90.64	90.64T
PFM0511	Franklin Motor; 1/2Hp, 115V, 60HZ,1 Phase,W/O Pump Lead	1	469.19	469.19T
PFL1005	PF-Series Liquid End; 10gpm, 1/2Hp, 60HZ	1	363.76	363.76T
PFR1005	PF-Series Rebuild Kit; 10gpm,1/2Hp,60Hz for pumps w/ S.S. suction connection	1	134.47	134.47T

SUBTOTAL	13,315.63
TAX (7%)	932.09
TOTAL	**$14,247.72**

Accepted By

Accepted Date

Appendix D

Detailed Cost Tables

Preliminary Opinion of Probable Construction Cost

BOWEN COLLINS & ASSOCIATES

Project:	West Point City Sanitary Sewer System Study 2020			*Date:*	April 2021
Desc.:	Traditional Lift Stations - Upfront Capital			*Prepared by:*	TS

No.	Item	Quantity	Units	Unit Cost	Cost
1	30-inch PVC Sewer Pipeline	2,700	LF	$ 395	$ 1,066,500
2	24-inch PVC Sewer Pipeline	3,400	LF	$ 340	$ 1,156,000
3	18-inch PVC Sewer Pipeline (deeper excavation)	1,500	LF	$ 330	$ 495,000
4	15-inch PVC Sewer Pipeline (deeper excavation)	5,300	LF	$ 308	$ 1,632,400
5	12-inch PVC Sewer Pipeline	2,600	LF	$ 205	$ 533,000
6	12-inch PVC Sewer Pipeline(deeper excavation)	4,000	LF	$ 285	$ 1,140,000
7	10-inch PVC Sewer Pipeline	2,100	LF	$ 183	$ 384,300
8	Asphalt Replacement for Gravity Sewer Pipelines only	25,333	SY	$ 49	$ 1,241,333
9	Sewer Manholes (assumed standard 5-foot diameter)	65	EA	$ 8,000	$ 518,400
10	Loop/Relocate 36" and 15" Drain Pipes (5000 W)	2	LS	$ 15,000	$ 30,000
11	24-inch Pipe Bridge (80' bridge)	1	LS	$ 250,000	$ 250,000
12	Area 1 Lift Station (1.2 MGD)	1.15	MGD	$ 1,650,000	$ 1,897,500
13	Area 2 Lift Station (1.0 MGD)	1.05	MGD	$ 1,650,000	$ 1,732,500
14	Area 3 Lift Station (0.6 MGD)	0.60	MGD	$ 1,650,000	$ 990,000
15	Area 7&8 Lift Station (0.7 MGD)	0.70	MGD	$ 1,650,000	$ 1,155,000
16	8-inch Force Main - Area 1 (DR11 HDPE) w/ Asphalt	8,300	LF	$ 131	$ 1,087,300
17	8-inch Force Main - Area 2 (DR11 HDPE) w/ Asphalt	3,800	LF	$ 131	$ 497,800
18	6-inch Force Main - Area 3 (DR11 HDPE) w/ Asphalt	1,400	LF	$ 120	$ 168,000
19	6-inch Force Main - Area 7&8 (DR11 HDPE) w/ Asphalt	3,600	LF	$ 120	$ 432,000
20	Steel Casing (Area 7&8)	420	LF	$ 590	$ 247,800
21	Surface Street Sewer Lines (8 and 10-inch PVC) 2,112 ac	308,238	LF	$ 130	$ 40,070,999
22	Gravity Sewer Service Connections	4,646	ERU	$ 2,000	$ 9,292,800
23	Sewer Manholes (assumed standard 4-foot diameter)	925	EA	$ 6,000	$ 5,548,292
				Subtotal	**$71,566,924**
	Miscellaneous Unlisted			***20%***	***$14,313,400***
	Engineering and Administration			***15%***	***$10,735,100***
	Total System and Project Cost (rounded to nearest $1,000)				**$96,616,000**

This opinion of probable construction is based on experience with past projects of similar construction. It is understood that Bowen Collins & Associates has no control over economical factors or unknown conditions that may have a significant impact on actual project costs. Bowen Collins & Associates does not guarantee its cost estimates and accepts no liability for problems created by the difference in actual costs and this opinion of probable construction cost.

Preliminary Opinion of Probable Construction Cost

BOWEN COLLINS & ASSOCIATES

Project: West Point City Sanitary Sewer System Study 2020 — *Date:* April 2021
Desc.: Traditional Lift Stations - Phased Capital — *Prepared by:* TS

No.	Item	Quantity	Units	Unit Cost	Cost
	System Costs - Year 0 (Areas 4, 5, 6, 7 and 8)				
1	30-inch PVC Sewer Pipeline	2,700	LF	$ 395	$ 1,066,500
2	24-inch PVC Sewer Pipeline	3,400	LF	$ 340	$ 1,156,000
3	12-inch PVC Sewer Pipeline(deeper excavation)	2,500	LF	$ 285	$ 712,500
4	12-inch PVC Sewer Pipeline	2,600	LF	$ 205	$ 533,000
5	10-inch PVC Sewer Pipeline	2,100	LF	$ 183	$ 384,300
6	Sewer Manholes (assumed standard 5-foot diameter)	40	EA	$ 8,000	$ 319,200
7	Asphalt Replacement for Gravity Sewer Pipelines only	16,267	SY	$ 49	$ 797,067
8	Area 7&8 Lift Station (0.7 MGD)	0.70	MGD	$ 1,650,000	$ 1,155,000
9	6-inch Force Main - Area 7&8 (DR11 HDPE) w/ Asphalt	3,600	LF	$ 120	$ 432,000
10	Loop/Relocate 36" and 15" Drain Pipes (5000 W)	2	LS	$ 15,000	$ 30,000
11	24-inch Pipe Bridge (80' bridge)	1	LS	$ 250,000	$ 250,000
12	Steel Casing (Area 7&8)	420	LF	$ 590	$ 247,800
Subtotal				**Subtotal**	**$7,083,367**
	Miscellaneous Unlisted			***20%***	***$1,416,700***
	Engineering and Administration			***15%***	***$1,062,600***
	Areas 4 to 8 System Cost (rounded to nearest $1,000)				**$9,563,000**
	System Costs - Year 5 (Area 2)				
13	18-inch PVC Sewer Pipeline (deeper excavation)	1,500	LF	$ 330	$ 495,000
14	15-inch PVC Sewer Pipeline (deeper excavation)	2,900	LF	$ 308	$ 893,200
15	Asphalt Replacement for Gravity Sewer Pipelines only	5,867	SY	$ 49	$ 287,467
16	Sewer Manholes (assumed standard 5-foot diameter)	13	EA	$ 8,000	$ 105,600
17	Area 2 Lift Station (1.0 MGD)	1.05	MGD	$ 1,650,000	$ 1,732,500
18	8-inch Force Main - Area 2 (DR11 HDPE) w/ Asphalt	3,800	LF	$ 131	$ 497,800
				Subtotal	**$4,011,567**
	Miscellaneous Unlisted			***20%***	***$802,400***
	Engineering and Administration			***15%***	***$601,800***
	Area 2 System Cost (rounded to nearest $1,000)				**$5,416,000**
	System Costs - Year 10 (Area 3)				
19	Area 3 Lift Station (0.6 MGD)	0.60	MGD	$ 1,650,000	$ 990,000
20	6-inch Force Main - Area 3 (DR11 HDPE) w/ Asphalt	1,400	LF	$ 120	$ 168,000
					$1,158,000
	Miscellaneous Unlisted			***20%***	***$231,600***
	Engineering and Administration			***15%***	***$173,700***
	Area 3 System Cost (rounded to nearest $1,000)				**$1,563,000**
	System Costs - Year 20 (Area 1)				
21	15-inch PVC Sewer Pipeline (deeper excavation)	2,400	LF	$ 308	$ 739,200
22	12-inch PVC Sewer Pipeline(deeper excavation)	1,500	LF	$ 285	$ 427,500
23	Asphalt Replacement for Gravity Sewer Pipelines only	3,200	SY	$ 49	$ 156,800
24	Sewer Manholes (assumed standard 5-foot diameter)	12	EA	$ 8,000	$ 93,600
25	Area 1 Lift Station (1.2 MGD)	1.15	MGD	$ 1,650,000	$ 1,897,500
26	8-inch Force Main - Area 1 (DR11 HDPE) w/ Asphalt	8,300	LF	$ 131	$ 1,087,300
				Subtotal	**$4,401,900**
	Miscellaneous Unlisted			***20%***	***$880,400***
	Engineering and Administration			***15%***	***$660,300***
	Area 1 System Cost (rounded to nearest $1,000)				**$5,943,000**
	Total System Costs				**$22,485,000**
	Project Costs				
27	Surface Street Sewer Lines (8 and 10-inch PVC) 2,112 ac	308,238	LF	$ 130	$ 40,070,999
28	Gravity Sewer Service Connections	4,646	ERU	$ 2,000	$ 9,292,800
29	Sewer Manholes (assumed standard 4-foot diameter)	925	EA	$ 6,000	$ 5,548,292
				Subtotal	**$54,912,091**
	Miscellaneous Unlisted			***20%***	***$10,982,500***
	Engineering and Administration			***15%***	***$8,236,900***
	Total Project Cost (rounded to nearest $1,000)				**$74,131,000**
	Total System and Project Costs				**$96,616,000**

This opinion of probable construction is based on experience with past projects of similar construction. It is understood that Bowen Collins & Associates has no control over economical factors or unknown conditions that may have a significant impact on actual project costs. Bowen Collins & Associates does not guarantee its cost estimates and accepts no liability for problems created by the difference in actual costs and this opinion of probable construction cost.

Preliminary Opinion of Probable Construction Cost

BOWEN COLLINS & ASSOCIATES

Project: West Point City Sanitary Sewer System Study 2020 — *Date:* April 2021
Desc.: Septic Tank Effluent Pumping (STEP) - Upfront Capital — *Prepared by:* TS

No.	Item	Quantity	Units	Unit Cost	Cost
1	30-inch PVC Sewer Pipeline	2,700	LF	$ 395	$ 1,066,500
2	24-inch PVC Sewer Pipeline	3,400	LF	$ 340	$ 1,156,000
3	12-inch PVC Sewer Pipeline	2,600	LF	$ 205	$ 533,000
4	10-inch PVC Sewer Pipeline	2,100	LF	$ 183	$ 384,300
5	Sewer Manholes (assumed standard 5-foot diameter)	32	EA	$ 8,000	$ 259,200
6	Asphalt Replacement for Gravity Sewer Pipelines only	14,400	SY	$ 49	$ 705,600
7	4-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	2,200	LF	$ 110	$ 242,000
8	6-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	5,650	LF	$ 120	$ 678,000
9	6-inch Sewer Force Main (DR 11 HDPE) w/o Asphalt	4,900	LF	$ 80	$ 392,000
10	8-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	2,800	LF	$ 131	$ 366,800
11	10-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	5,500	LF	$ 143	$ 786,500
12	Loop 36" and 15" Drain Pipes (5000 W)	2	LS	$ 15,000	$ 30,000
13	24-inch Pipe Bridge (80' bridge)	1	LS	$ 250,000	$ 250,000
14	Steel Casing (Area 7&8 Clinton Drain, Howard Slough & Hooper Canal crossings)	420	LF	$ 590	$ 247,800
15	Septic Dump at North Davis Sewer TP	1	EA	$ 185,000	$ 185,000
16	Surface Street Sewer Lines (8 and 10-inch PVC) 473 ac	69,033	LF	$ 130	$ 8,974,234
17	Gravity Sewer Service Connections	1,041	ERU	$ 2,000	$ 2,081,200
18	Sewer Manholes (assumed standard 4-foot diameter)	207	EA	$ 6,000	$ 1,242,586
19	Surface Street Force Mains (2-3 inch HDPE) 1,639 ac	239,206	LF	$ 40	$ 9,568,235
20	Septic Tank and Install	3,606	EA	$ 10,600	$ 38,223,600
21	STEP Service Connection (1" service)	3,606	EA	$ 400	$ 1,442,400
				Subtotal	**$68,814,956**
	Miscellaneous Unlisted			***20%***	***$13,763,000***
	Engineering and Administration			***15%***	***$10,322,300***
	Total System and Project Cost (rounded to nearest $1,000)				**$92,901,000**

This opinion of probable construction is based on experience with past projects of similar construction. It is understood that Bowen Collins & Associates has no control over economical factors or unknown conditions that may have a significant impact on actual project costs. Bowen Collins & Associates does not guarantee its cost estimates and accepts no liability for problems created by the difference in actual costs and this opinion of probable construction cost.

Preliminary Opinion of Probable Construction Cost

BOWEN COLLINS & ASSOCIATES

Project: West Point City Sanitary Sewer System Study 2020 — *Date:* April 2021
Desc.: Septic Tank Effluent Pumping (STEP) - Phased — *Prepared by:* TS

No.	Item	Quantity	Units	Unit Cost	Cost
	System Costs - Year 0 (Areas 4, 5, 6, 7 and 8)				
1	30-inch PVC Sewer Pipeline	2,700	LF	$ 395	$ 1,066,500
2	24-inch PVC Sewer Pipeline	3,400	LF	$ 340	$ 1,156,000
3	12-inch PVC Sewer Pipeline	2,600	LF	$ 205	$ 533,000
4	10-inch PVC Sewer Pipeline	2,100	LF	$ 183	$ 384,300
5	Sewer Manholes (assumed standard 5-foot diameter)	32	EA	$ 8,000	$ 259,200
6	Asphalt Replacement for Gravity Sewer Pipelines only	14,400	SY	$ 49	$ 705,600
7	Loop 36" and 15" Drain Pipes (5000 W)	2	LS	$ 15,000	$ 30,000
8	24-inch Pipe Bridge (80' bridge)	1	LS	$ 250,000	$ 250,000
9	4-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	900	LF	$ 110	$ 99,000
10	6-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	1,950	LF	$ 120	$ 234,000
11	6-inch Sewer Force Main (DR 11 HDPE) w/o Asphalt	3,350	LF	$ 80	$ 268,000
12	Steel Casing (Area 7&8 Clinton Drain, Howard Slough & Hooper Canal crossings)	420	LF	$ 590	$ 247,800
13	Septic Dump at North Davis Sewer TP	1	EA	$ 185,000	$ 185,000
				Subtotal	**$5,418,400**
	Miscellaneous Unlisted			***20%***	***$1,083,700***
	Engineering and Administration			***15%***	***$812,800***
	Areas 4 to 8 System Cost (rounded to nearest $1,000)				**$7,315,000**
	System Costs - Year 5 (Areas 2)				
14	6-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	3,650	LF	$ 120	$ 438,000
15	10-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	5,500	LF	$ 143	$ 786,500
				Subtotal	**$1,224,500**
	Miscellaneous Unlisted			***20%***	***$244,900***
	Engineering and Administration			***15%***	***$183,700***
	Area 2 System Cost (rounded to nearest $1,000)				**$1,654,000**
	System Costs - Year 10 (Areas 3)				
16	4-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	1,300	LF	$ 110	$ 143,000
				Subtotal	**$143,000**
	Miscellaneous Unlisted			***20%***	***$28,600***
	Engineering and Administration			***15%***	***$21,500***
	Area 3 System Cost (rounded to nearest $1,000)				**$194,000**
	System Costs - Year 20 (Areas 1)				
16	6-inch Sewer Force Main (DR 11 HDPE) w/o Asphalt	1,600	LF	$ 80	$ 128,000
17	8-inch Sewer Force Main (DR 11 HDPE) w/ Asphalt	2,800	LF	$ 131	$ 366,800
				Subtotal	**$494,800**
	Miscellaneous Unlisted			***20%***	***$99,000***
	Engineering and Administration			***15%***	***$74,300***
	Area 1 System Cost (rounded to nearest $1,000)				**$669,000**
	Total System Costs				**$9,832,000**
	Project Costs				
18	Surface Street Sewer Lines (8 and 10-inch PVC) 473 ac	69,033	LF	$ 130	$ 8,974,234
19	Gravity Sewer Service Connections	1,041	ERU	$ 2,000	$ 2,081,200
20	Sewer Manholes (assumed standard 4-foot diameter)	207	EA	$ 6,000	$ 1,242,586
21	Surface Street Force Mains (2-3 inch HDPE) 1,639 ac	239,206	LF	$ 40	$ 9,568,235
22	Septic Tank and Install	3,606	EA	$ 10,600	$ 38,223,600
23	STEP Service Connection (1" service)	3,606	EA	$ 400	$ 1,442,400
				Subtotal	**$61,532,256**
	Miscellaneous Unlisted			***20%***	***$12,306,500***
	Engineering and Administration			***15%***	***$9,229,900***
	Total Project Cost (rounded to nearest $1,000)				**$83,069,000**
	Total Combined Costs				
	Total System and Project Costs				**$92,901,000**

This opinion of probable construction is based on experience with past projects of similar construction. It is understood that Bowen Collins & Associates has no control over economical factors or unknown conditions that may have a significant impact on actual project costs. Bowen Collins & Associates does not guarantee its cost estimates and accepts no liability for problems created by the difference in actual costs and this opinion of probable construction cost.

APPENDIX C

TM03 HYDRAULIC MODEL

TECHNICAL MEMORANDUM

TO:	Boyd Davis, P.E., West Point City Engineer
COPIES:	Kyle Laws, West Point City Manager
FROM:	Tyler Seamons, P.E. and Keith Larson, P.E.
DATE:	May 2, 2022
SUBJECT:	Sanitary Sewer System Study - Sewer Hydraulic Model
JOB NO.:	668-20-01

SEWER MODEL INTRODUCTION

West Point City (City) has retained Bowen Collins & Associates (BCA) to perform a sanitary sewer system analysis of areas currently within City limits and in nearby areas of unincorporated Davis County that are not currently serviceable by the existing gravity sewer system. Various alternatives were analyzed as part of this study, with the traditional gravity sewer system with lift stations being chosen as the preferred alternative. A sewer hydraulic model was then developed to verify adequate gravity and pressure pipeline sizing of all system level infrastructure. This Technical Memorandum was written to document the assumptions and results of the hydraulic model and its development.

MODEL SOFTWARE

This sewer model was developed using the software program InfoSWMM by Innovyze (an extension within ArcGIS). The software was chosen as it is a widely accepted sewer modeling software and integrates well with existing or future GIS networks. The City will be provided with an electronic copy of the program in EPA SWMM (City currently does not maintain a InfoSWMM license).

PERFORMANCE STANDARDS

The hydraulic sewer model was developed based on the following performance standards established by the City in the Sewer Impact Fee Facility Plan (IFFP) dated September 2021:

1. **Peak Design Flows** – Individual gravity pipelines, force mains and lift stations were designed based on the governing peaking factor calculated from the State of Utah peak instantaneous demand guidelines (refer to Utah Code R309-510-9) and the Recommended Standards for Wastewater Facilities (2014 edition). Peaking factors ranged from 2.7 to 4.0 depending on the contributing area size of each system component. For the purpose of the hydraulic model, an "average" peaking factor was applied to a typical diurnal pattern to all flow input locations. This "average" peaking factor was adjusted until the observed peak flow at the sewer outfall approximated the calculated peaking factor value. The "average" peaking factor of 3.0 was selected and used within the hydraulic model. Additional details are discussed in the section below.
2. **Gravity Pipeline Capacity** – City standards require that all gravity driven sewer mains be designed such that the peak flow in the pipe is less than or equal to 75 percent of the pipe's full capacity using a manning's roughness factor of 0.013.

3. **Gravity Pipeline Slopes** – Due to the flat terrain and shallow existing sewer, nearly all system level gravity trunk lines and most project level sewer pipelines will need to be installed at minimum slopes as defined by the State of Utah [R317-3-2.3(D)(4)], see Table 1. If pipelines are installed at greater slopes, the serviceable area by gravity would be reduced. In addition, some sewer pipes were upsized to maximize the area serviceable by gravity. Due to the gravity pipelines being installed at the minimum allowable slopes, velocities in the pipelines will be generally lower than velocities observed in areas with greater slope. Thus, the City may experience the need for increased operation and maintenance (O&M) activities associated with the gravity pipelines within this study area. It is the City's preference to maximize the serviceable area by gravity.

4. **Force main capacity -** City standards require that all force mains be designed such that the maximum flow velocity is no greater than 7 feet per second.

5. **Lift stations -** City standards require that all lift stations be designed such that the maximum ratio of the peak flow to pumping capacity is no greater than 0.85.

Table 1
Utah State Code Minimum Slope [Table R317-3-2.3 (D) (4)]

Diameter (in)	Slope (feet/feet)
8	0.00334
10	0.00248
12	0.00194
15	0.00144
18	0.00113
21	0.00092
24	0.00077
30	0.00057

MODEL INPUTS

In the development of a hydraulic sewer model, the following key parameters must be defined: 1) sewer inflows, 2) gravity pipeline characteristics, and 3) lift station and force main characteristics. This section summarizes these 3 key parameters and their associated assumptions.

Sewer Inflows

The average design sewer flows, gross population density, and peaking factors were used to calculate the peak sewer design flows to be used as inputs within the hydraulic sewer model. Below is a summary of the keep assumptions:

- **Average Design Flows – 255 gpd/ERU** – Historic water consumption data gathered as part of the ongoing North Davis Sewer District (NDSD) Impact Fee Study was used to estimate average sewer flows, including allowance for inflow and infiltration (I&I). The following assumption of 220 gpd/ERU (single family residential flow) + 35 gpd/ERU (I&I) = 255 gpm/ERU was used as the average daily design flow.

- **Gross Population Density – 2.2 ERUs per acre** – The current City plan is to zone all existing agricultural land within the study area and all future annexed areas into the City as R-1, which restricts development to a maximum gross density of 2.2 ERUs/ac. This assumption was used when sizing all system level lift stations and trunk lines. If actual development density changes significantly, an additional study would need to be performed to update/verify system level sizing is adequate.

- **Average Peaking Factor – 3.0** - The sewer system was modeled using an extended period simulation, which allowed the application of a diurnal pattern to the inflows. The diurnal pattern applies different peaking factors at different hours of the day to more fully represent the actual daily peaking demands on a sewer system. The diurnal pattern for the study area was approximated based on data collected from another study area with a similar size and density. The diurnal peaking factor applied to the model inflows was adjusted until the resulting peaking factor observed at the model's outfall (intersection of 1300 N and 5000 W) approximated the calculated peaking factor for that trunk line. The resulting diurnal pattern, with a peaking factor of 3.0, was applied to the model at all inflow locations and is shown below in Figure 1.

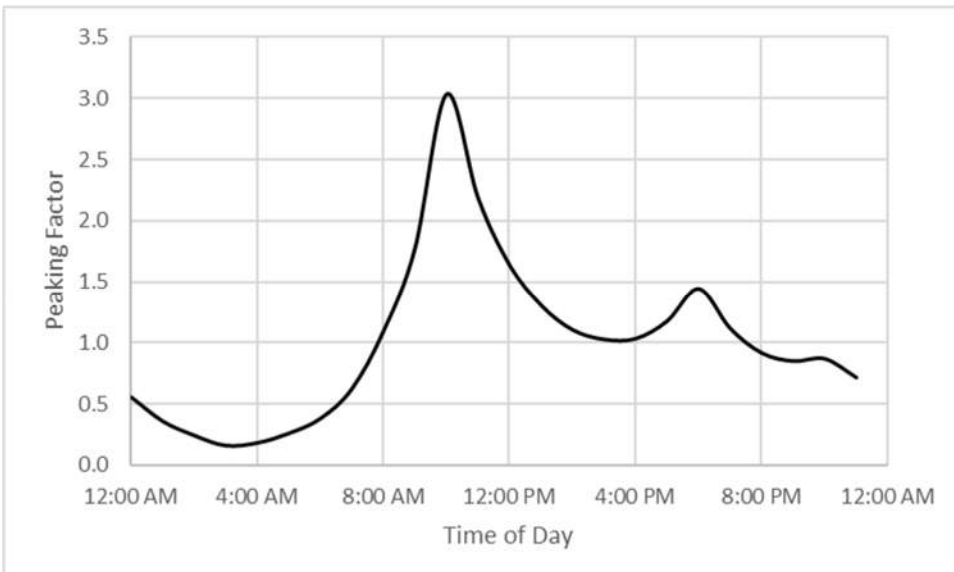


Figure 1. Diurnal Pattern with Average Peaking Factor used in sewer model

Gravity Pipeline

Below is a brief summary of the key assumptions used for the gravity pipeline network:

- A Manning's n roughness coefficient of 0.013 was used in the hydraulic model. This is the recommended roughness coefficient referenced in Utah State Code R317-3-2.

- All gravity pipelines slopes were assumed to be at the State's minimum required slopes, as discussed previously.

- The model's main downstream boundary condition, the outfall located at 1300 N and 5000 W, was conservatively assumed to be 0.75% full during the entire model run.

A summary of the system level gravity pipelines within the study area and the peak flow results at buildout are summarized below in Table 2. As can be seen from this table, there is adequate pipeline capacity for all pipelines listed. Due to the minimum slopes assumed, it will be essential for the City to develop and maintain an effective maintenance plan to avoid accumulation of sediment within these collection and trunk pipelines.

Table 2
Sewer Pipe Summary

Pipe	Length (ft)	Dia (in)	Slope (ft/ft)	Pipe Full Capacity (cfs)	Peak Flow (cfs)	Peak Flow/Capacity
AREA 1 2425 N WEST	1500	12	0.195	1.59	0.68	0.43
AREA 1 2425 N EAST	2400	15	0.145	2.47	0.87	0.35
AREA 2 1925 N	1500	18	0.115	3.64	1.32	0.36
AREA 2 5500 W	2900	15	0.145	2.46	1.01	0.41
AREA 6 5000 W	2700	30	0.057	9.99	3.79	0.38
AREA 4 5000 W	2700	24	0.077	6.38	2.19	0.34
AREA 4 2425 N	2100	10	0.250	1.10	0.31	0.28
AREA 4&5 5000 W	700	24	0.077	6.34	3.38	0.53
AREA 5 1800 N	2600	12	0.195	1.58	0.32	0.20
AREA 8 CLINTON DRAIN	2500	12	0.195	1.58	0.46	0.29

Lift Stations and Force mains

Below is a brief summary of the key assumptions used for the lift station and force main modeling parameters:

- A conservative Hazen-Williams roughness coefficient of 120 was used to estimate headloss based on Utah State Code R317-3-3.
- Force main diameters were selected such that maximum velocities do not exceed 7 ft/s based on an inside diameter associated with DR 11 HDPE pipe. It may be possible to downsize some pipes depending on the pipe material ultimately selected.
- Ideal pumps were used to represent the proposed lift stations. This means all water that flows into the lift station is discharged to the force mains at a rate that matches the water entering the lift station. Actual operation of the pumps may be different than this, but this approach adequately captures peak capacity needs and simplifies modeling.
- The ratio between peak flow and design capacity will be no less than 0.85, for all lift stations.

The hydraulic model results for the proposed force mains are listed in Table 3. Due to the higher required pumping heads observed for the Area 1 and Area 7&8 force mains, consideration of either a larger diameter force main or dual force mains may be necessary. Dual force mains could provide additional advantages in reducing total required pumping head at the lift stations while also being able to more efficiently handle the lower flows experienced during the development of each area.

Table 4 summarizes the results from the model for each lift station location.

Table 3
Force main Summary

Pipe	Length (ft)	Pipe Dia. (in)	Max Velocity (ft/s)	Peak Flow (cfs)	Friction Loss (ft)
AREA 1 FM	8300	8	5.81	1.55	224
AREA 2 FM	3800	8	4.95	1.32	87
AREA 3 FM	1400	6	4.43	0.68	42
AREA 7 & 8 FM	3600	6	5.06	0.78	145

Table 4
Lift Station Summary

Location	Approx. Depth to Pipe Invert1 (ft)	Peak Instantaneous Flow (MGD)	Lift Station Design Capacity2 (MDG)
Area 1	18.5	1.15	1.35
Area 2	16.0	1.05	1.24
Area 3	16.2	0.60	0.71
Area 7 & 8	15.5	0.70	0.82

[1]Approximate depth from ground surface to sewer pipe invert at lift station. Total depth of lift station and wet well will be deeper. Actual total depth will depend on specific site conditions and wet well design.
[2]City standards require that the ratio of peak flow to pumping capacity be no greater than 0.85.

RESULTS

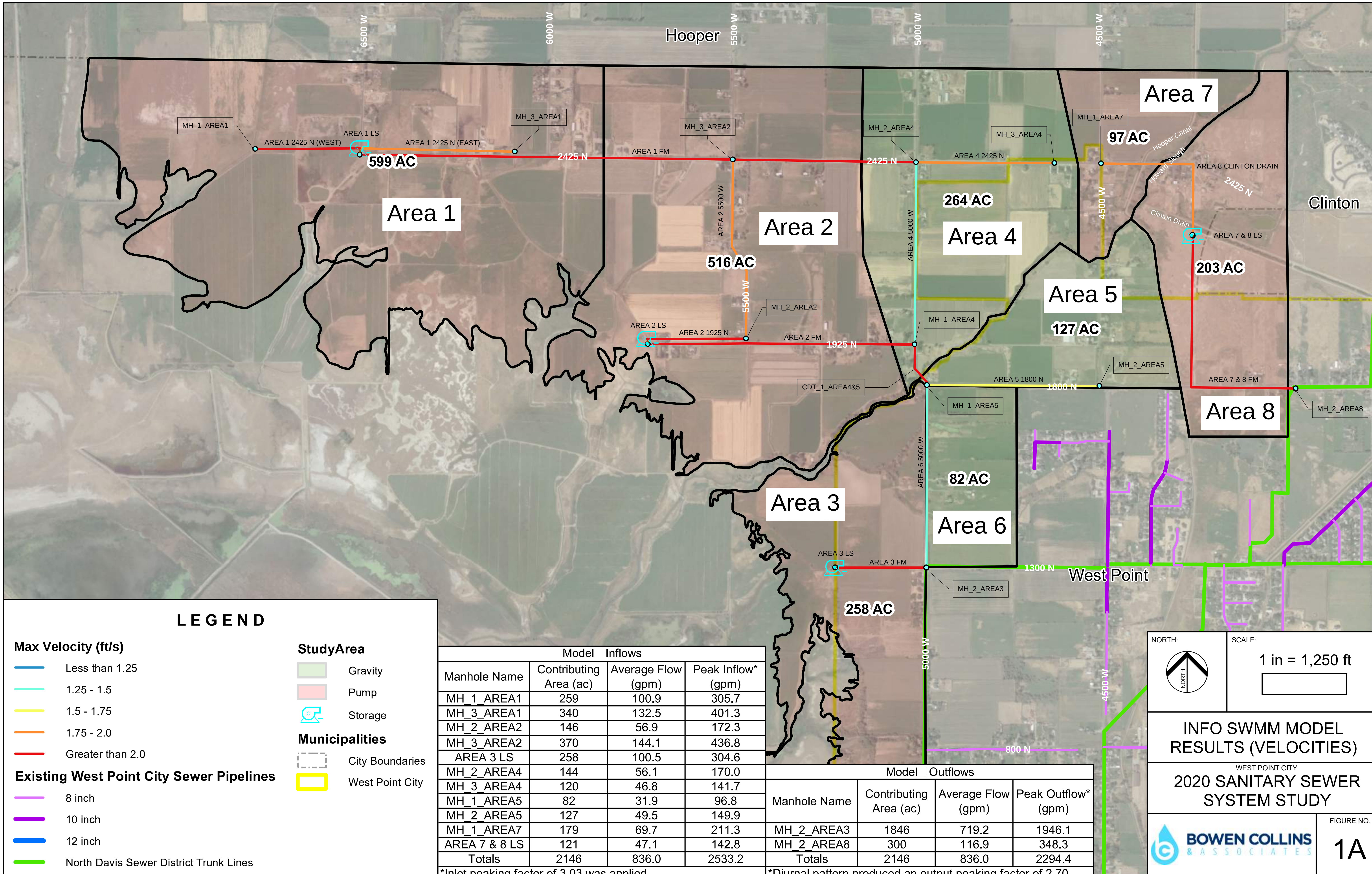
One of the City's priorities for this study has been to maximize the serviceable area by gravity sewer lines. This results in a reduced number of lift stations, minimum ongoing maintenance costs, and reduced power usage costs for the proposed lift stations. The gravity service area was maximized for this study area by assuming all gravity pipelines will be installed at the minimum allowable slopes. This could potentially create additional ongoing maintenance for the City along the gravity trunk lines servicing Areas 4, 5, and 6. The City is aware of the potential increase in maintenance for these gravity sewer lines but has concluded that the benefits of having fewer lift stations outweighs the disadvantages of potential increased maintenance in the gravity pipelines.

The proposed force mains were sized to not exceed 7 feet per second maximum velocities during the peak buildout design event. During the design phase, dual force mains should be considered to reduce total head requirements (if needed by the pump selection) and maintain minimum velocities prior to buildout.

In addition to the summary tables presented above, figures and hydraulic profiles have been prepared to display the results of the hydraulic model. These figures and profiles can be found in an appendix to this memorandum. Figures 1A and 2A summarize the resulting maximum calculated velocities and percent of total capacity for both the gravity trunk lines and force mains. Figures 3A to 10A are hydraulic profiles showing the calculated water surface and hydraulic grade line.

Appendix

Hydraulic Model Results



LEGEND

Max Velocity (ft/s)

- Less than 1.25
- 1.25 - 1.5
- 1.5 - 1.75
- 1.75 - 2.0
- Greater than 2.0

Existing West Point City Sewer Pipelines

- 8 inch
- 10 inch
- 12 inch
- North Davis Sewer District Trunk Lines

StudyArea

- Gravity
- Pump
- Storage

Municipalities

- City Boundaries
- West Point City

Model Inflows			
Manhole Name	Contributing Area (ac)	Average Flow (gpm)	Peak Inflow* (gpm)
MH_1_AREA1	259	100.9	305.7
MH_3_AREA1	340	132.5	401.3
MH_2_AREA2	146	56.9	172.3
MH_3_AREA2	370	144.1	436.8
AREA 3 LS	258	100.5	304.6
MH_2_AREA4	144	56.1	170.0
MH_3_AREA4	120	46.8	141.7
MH_1_AREA5	82	31.9	96.8
MH_2_AREA5	127	49.5	149.9
MH_1_AREA7	179	69.7	211.3
AREA 7 & 8 LS	121	47.1	142.8
Totals	2146	836.0	2533.2

*Inlet peaking factor of 3.03 was applied.

Model Outflows			
Manhole Name	Contributing Area (ac)	Average Flow (gpm)	Peak Outflow* (gpm)
MH_2_AREA3	1846	719.2	1946.1
MH_2_AREA8	300	116.9	348.3
Totals	2146	836.0	2294.4

*Diurnal pattern produced an output peaking factor of 2.70.

NORTH:

SCALE: 1 in = 1,250 ft

INFO SWMM MODEL RESULTS (VELOCITIES)

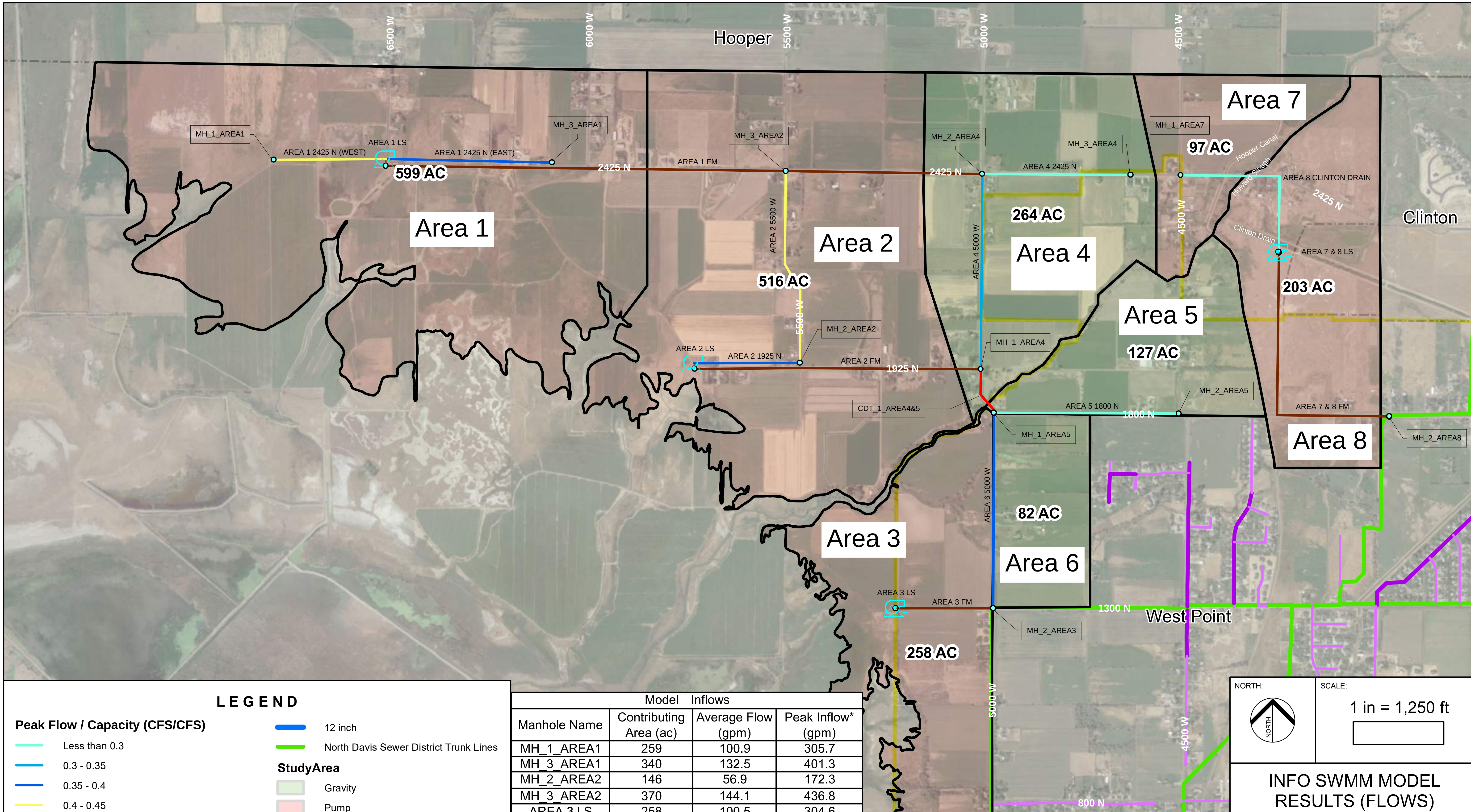
WEST POINT CITY

2020 SANITARY SEWER SYSTEM STUDY

BOWEN COLLINS & ASSOCIATES

FIGURE NO. 1A

P:\West Point City\668-20-01 2020 Sanitary Sewer System Study\4.0 GIS\WPC INFOSMM COMPLETE\WPC INFOSWMM MaxVel.mxd kgrover 4/22/2022



LEGEND

Peak Flow / Capacity (CFS/CFS)
- Less than 0.3
- 0.3 - 0.35
- 0.35 - 0.4
- 0.4 - 0.45
- 0.45 - 0.5
- 0.5 - 0.55
- Greater than 0.55

Existing West Point City Sewer Pipelines
- 8 inch
- 10 inch
- 12 inch
- North Davis Sewer District Trunk Lines

StudyArea
- Gravity
- Pump
- Storage

Municipalities
- City Boundaries
- West Point City

Model Inflows

Manhole Name	Contributing Area (ac)	Average Flow (gpm)	Peak Inflow* (gpm)
MH_1_AREA1	259	100.9	305.7
MH_3_AREA1	340	132.5	401.3
MH_2_AREA2	146	56.9	172.3
MH_3_AREA2	370	144.1	436.8
AREA 3 LS	258	100.5	304.6
MH_2_AREA4	144	56.1	170.0
MH_3_AREA4	120	46.8	141.7
MH_1_AREA5	82	31.9	96.8
MH_2_AREA5	127	49.5	149.9
MH_1_AREA7	179	69.7	211.3
AREA 7 & 8 LS	121	47.1	142.8
Totals	2146	836.0	2533.2

*Inlet peaking factor of 3.03 was applied.

Model Outflows

Manhole Name	Contributing Area (ac)	Average Flow (gpm)	Peak Outflow (gpm)
MH_2_AREA3	1846	719.2	1946.1
MH_2_AREA8	300	116.9	348.3
Totals	2146	836.0	2294.4

NORTH:

SCALE: 1 in = 1,250 ft

INFO SWMM MODEL RESULTS (FLOWS)

WEST POINT CITY

2020 SANITARY SEWER SYSTEM STUDY

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FIGURE NO. 2A

P:\West Point City\668-20-01 2020 Sanitary Sewer System Study\4.0 GIS\WPC INFOSMM COMPLETE\WPC INFOSWMM Max Flow over Capacity.mxd kgrover 4/22/2022

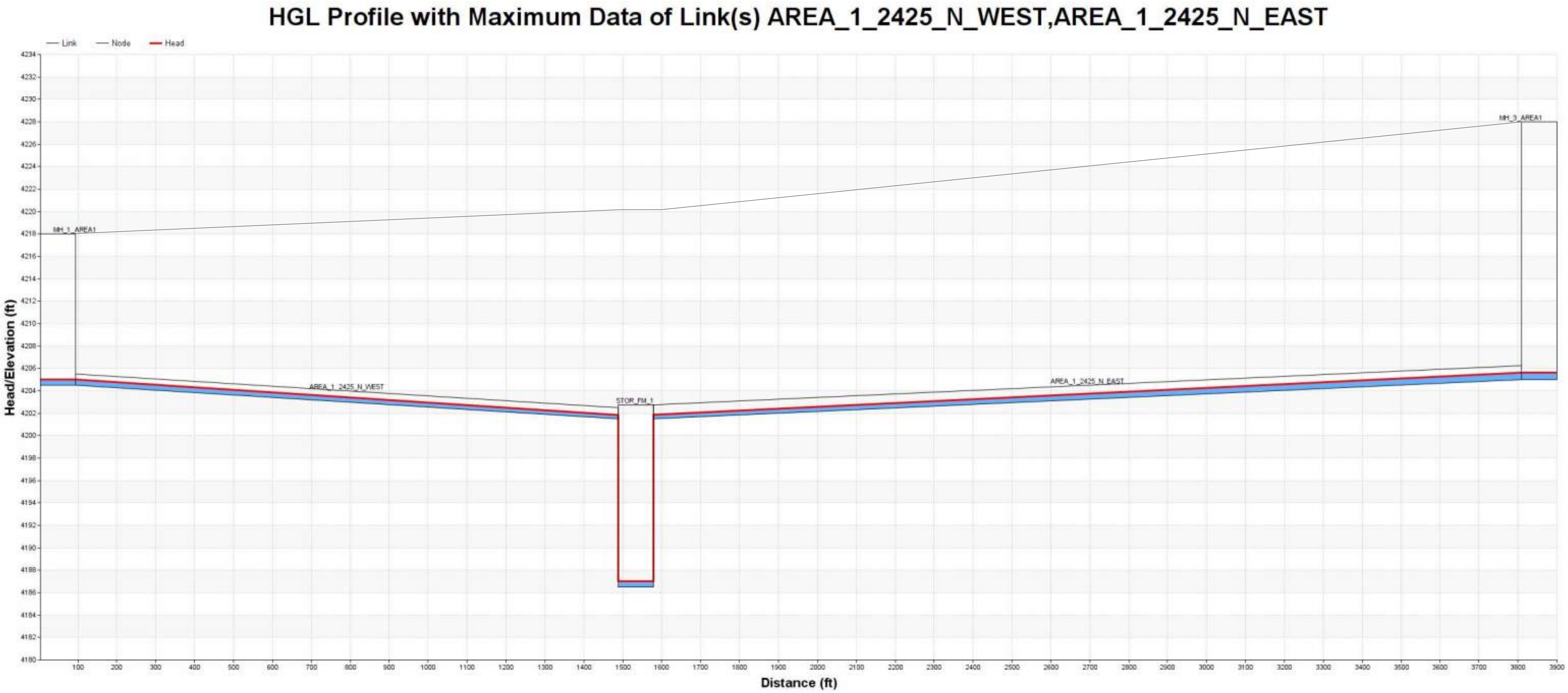


Figure 3A - Gravity Profiles for Area 1

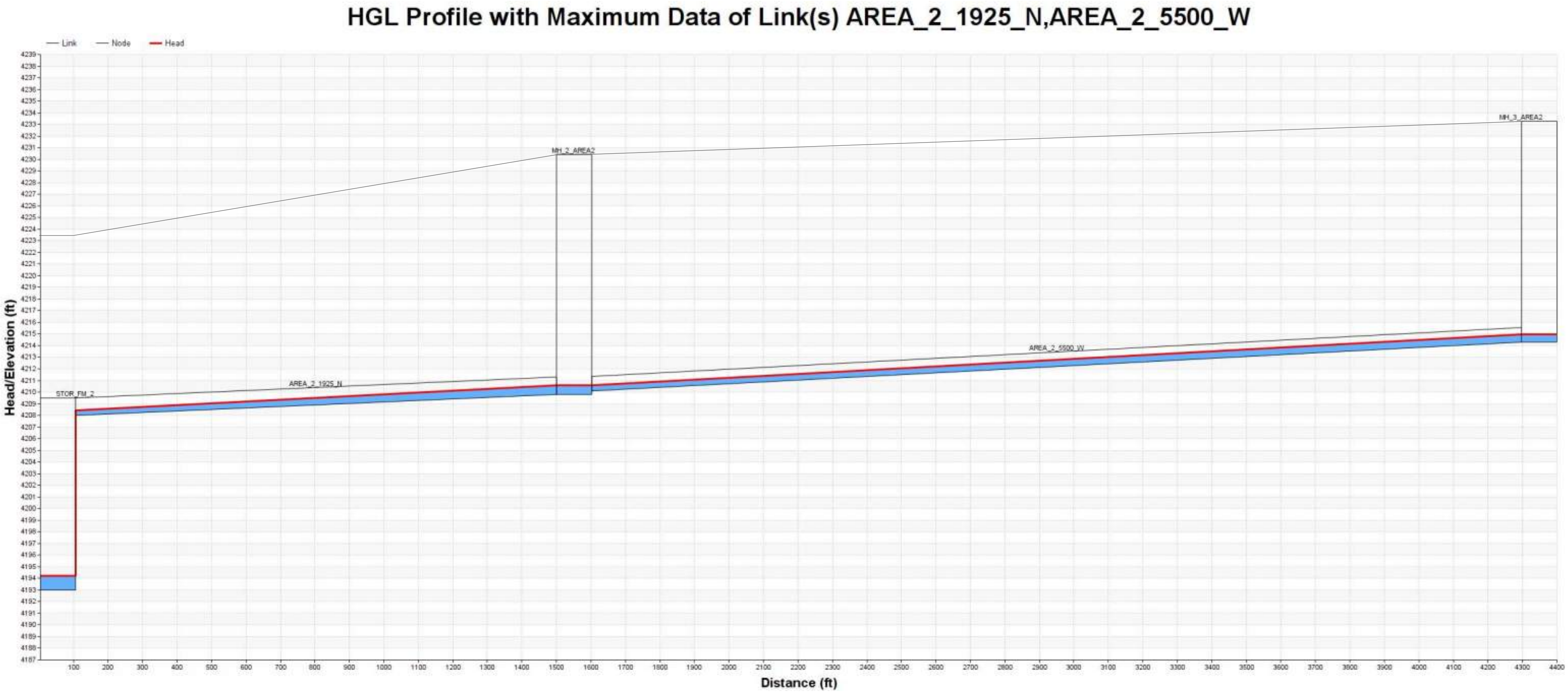


Figure 4A - Gravity Profiles for Area 2

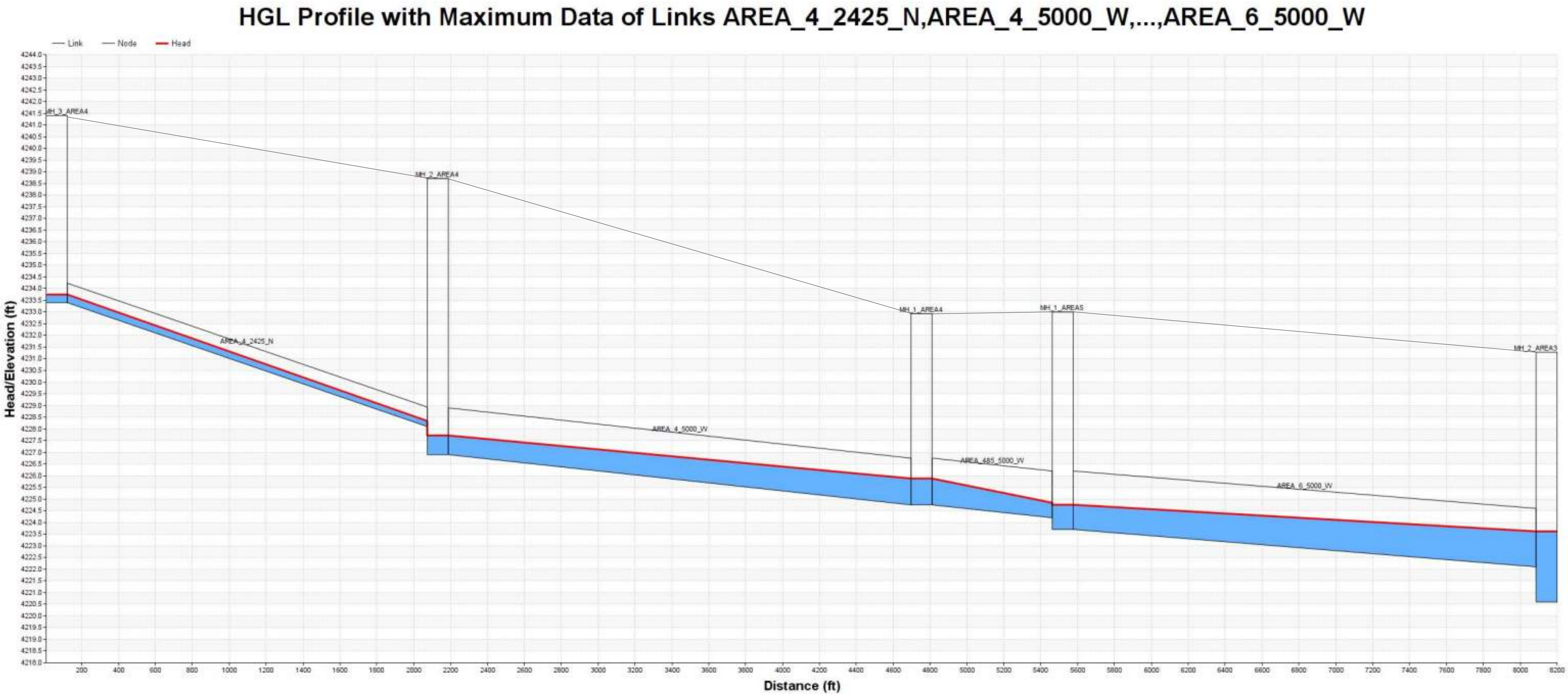


Figure 5A - Gravity Profile for Areas 3, 4, 5 & 6

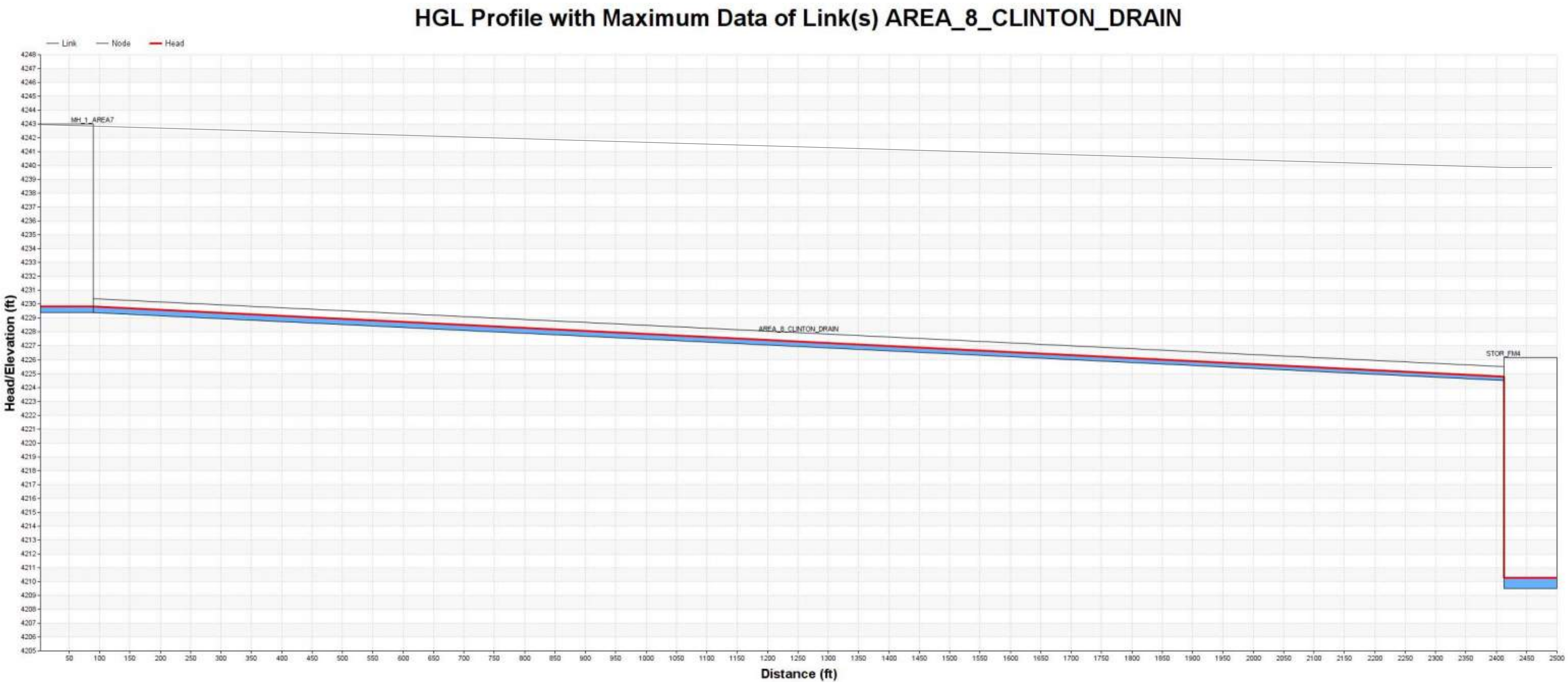


Figure 6A - Gravity Profile for Area 7 & 8

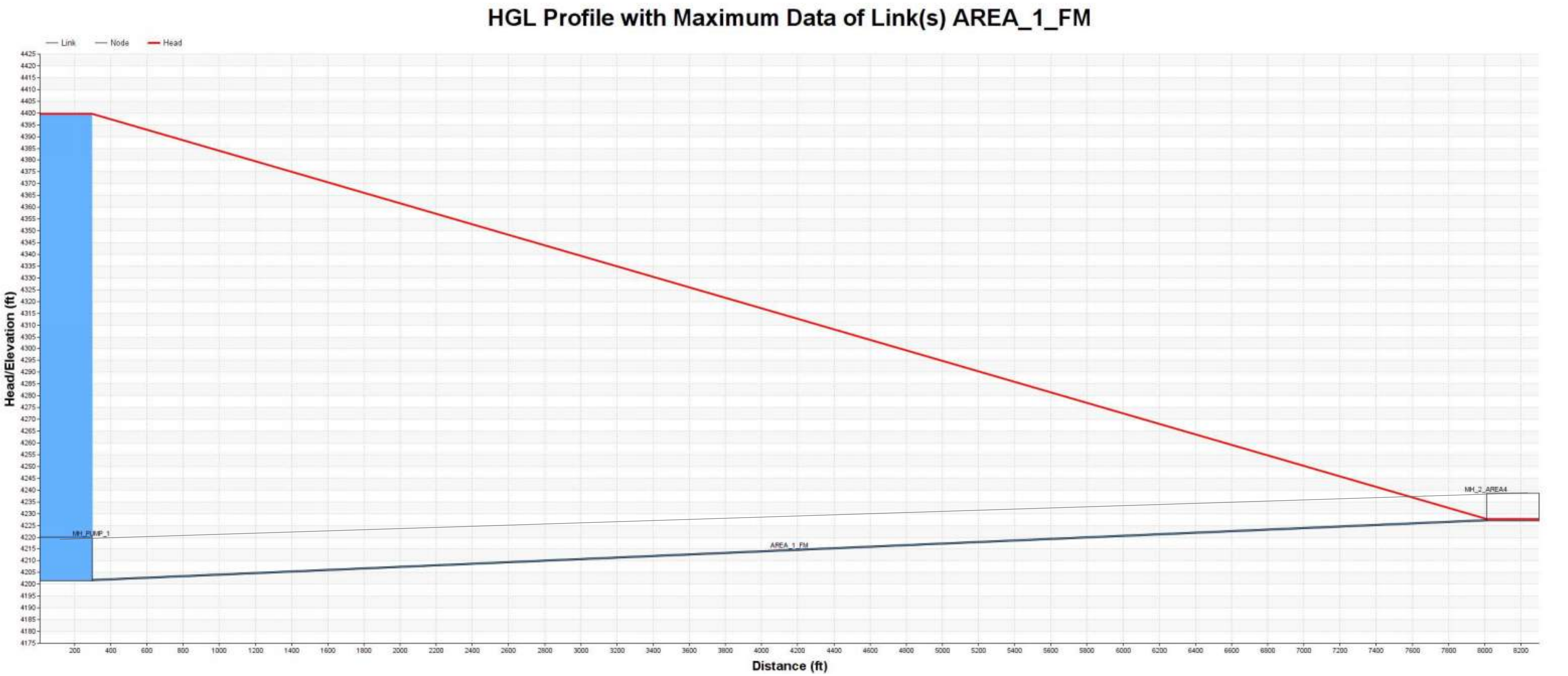


Figure 7A - HGL for Area 1 Force Main

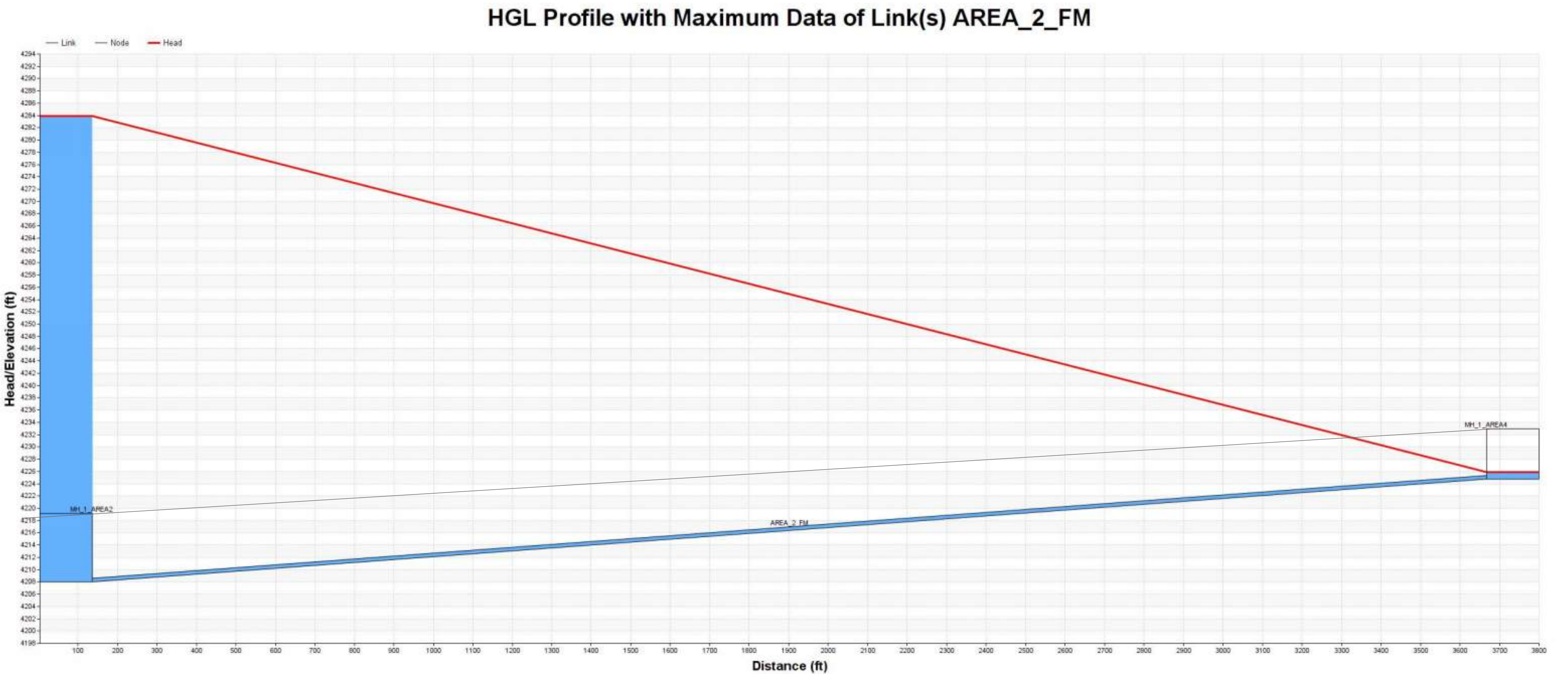


Figure 8A - HGL for Area 2 Force Main

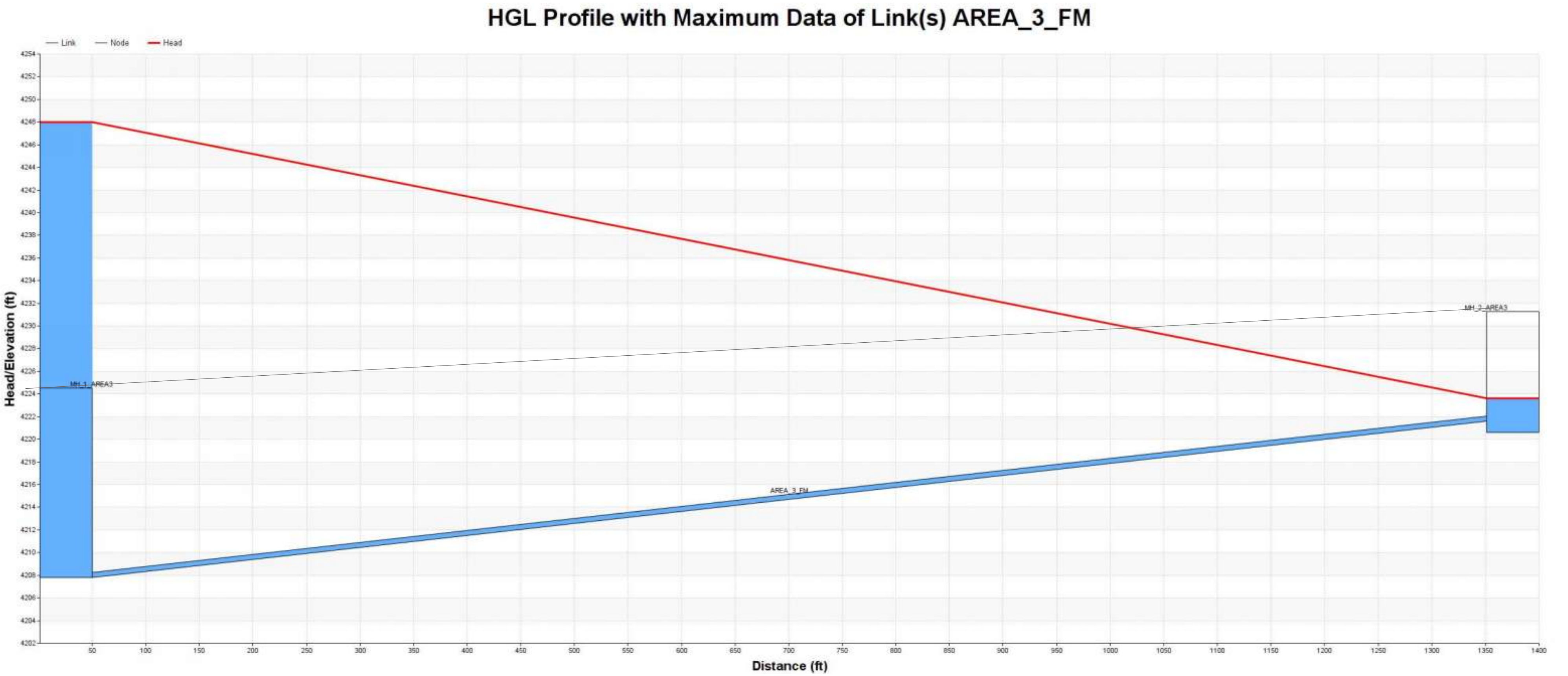


Figure 9A - HGL for Area 3 Force Main

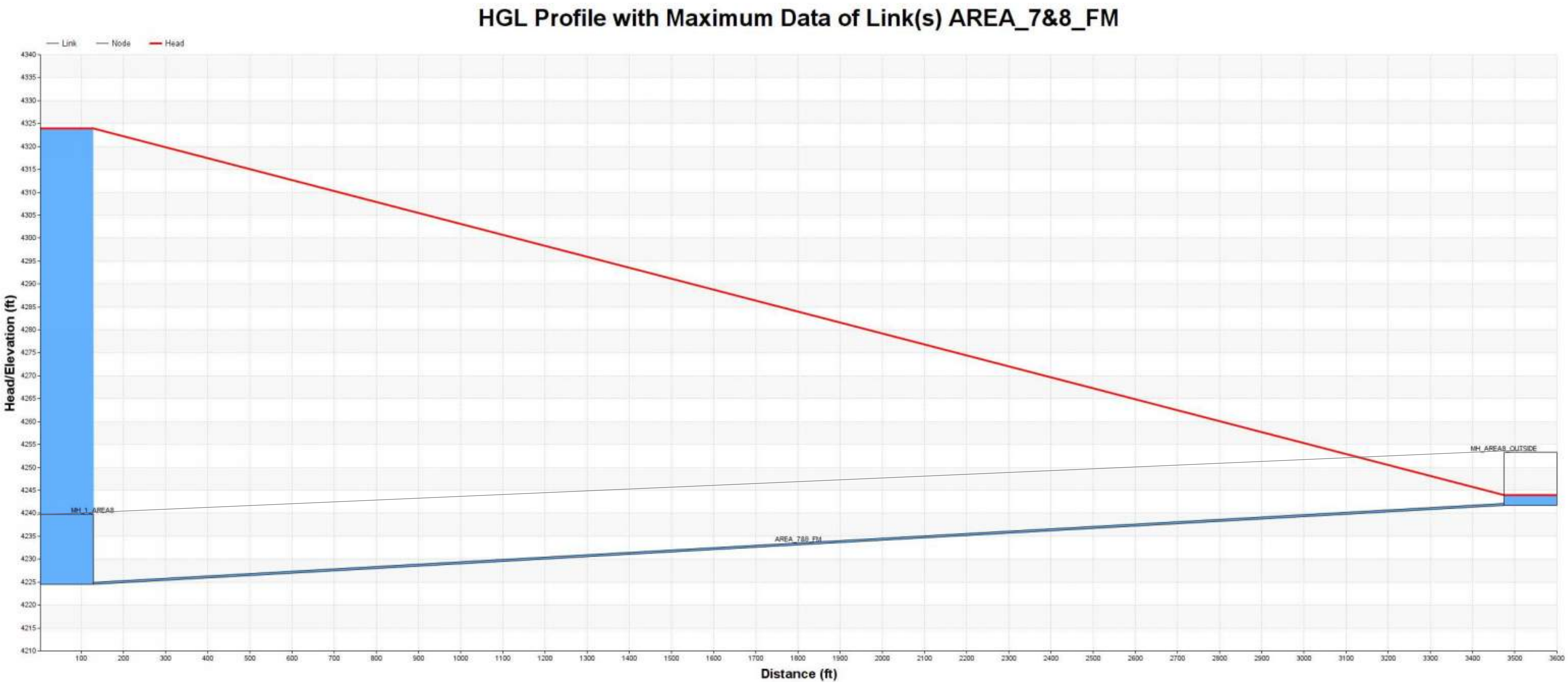
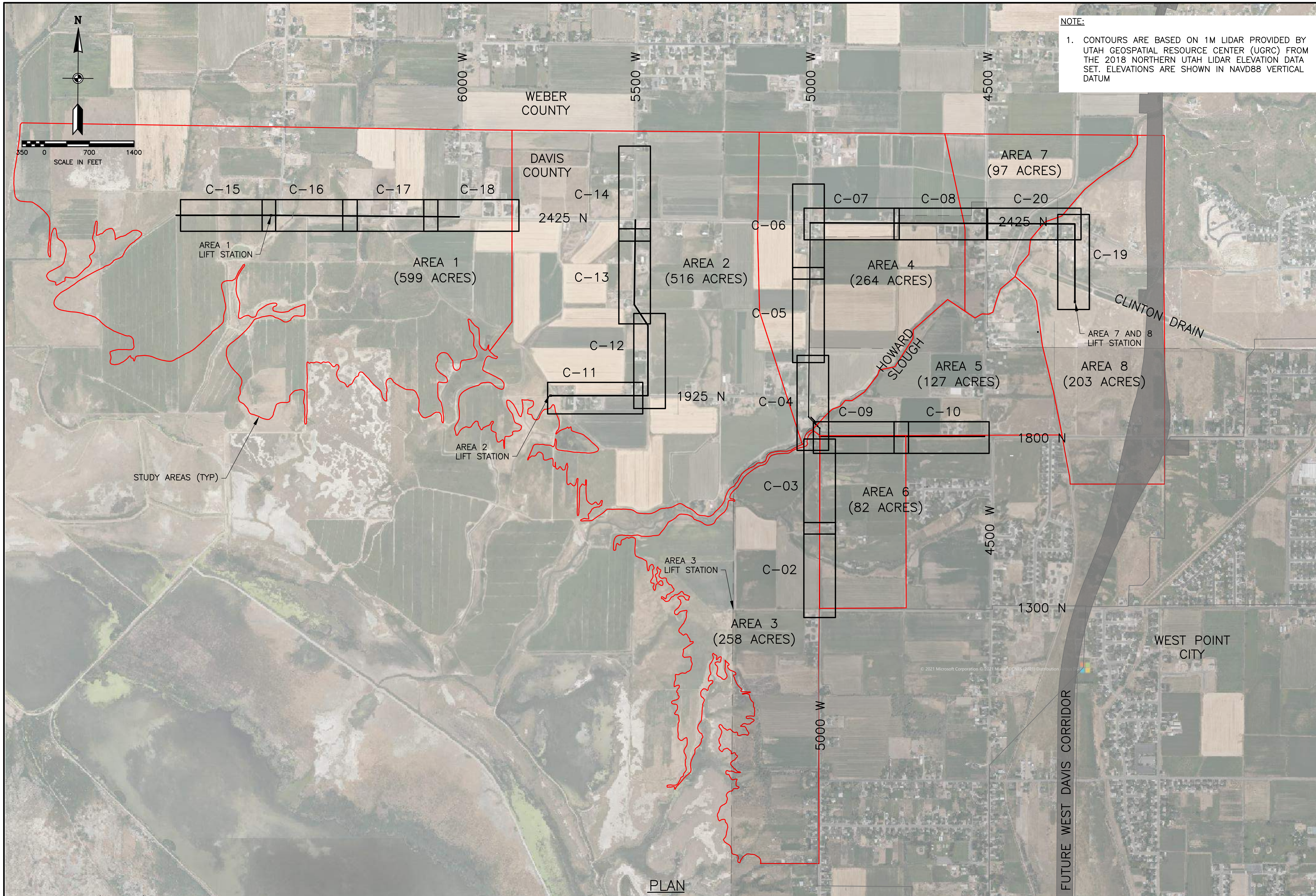


Figure 10A - HGL for Area 7 & 8 Force Main

APPENDIX D

GRAVITY PIPELINE CONCEPTUAL DRAWINGS



NOTE:

1. CONTOURS ARE BASED ON 1M LIDAR PROVIDED BY UTAH GEOSPATIAL RESOURCE CENTER (UGRC) FROM THE 2018 NORTHERN UTAH LIDAR ELEVATION DATA SET. ELEVATIONS ARE SHOWN IN NAVD88 VERTICAL DATUM

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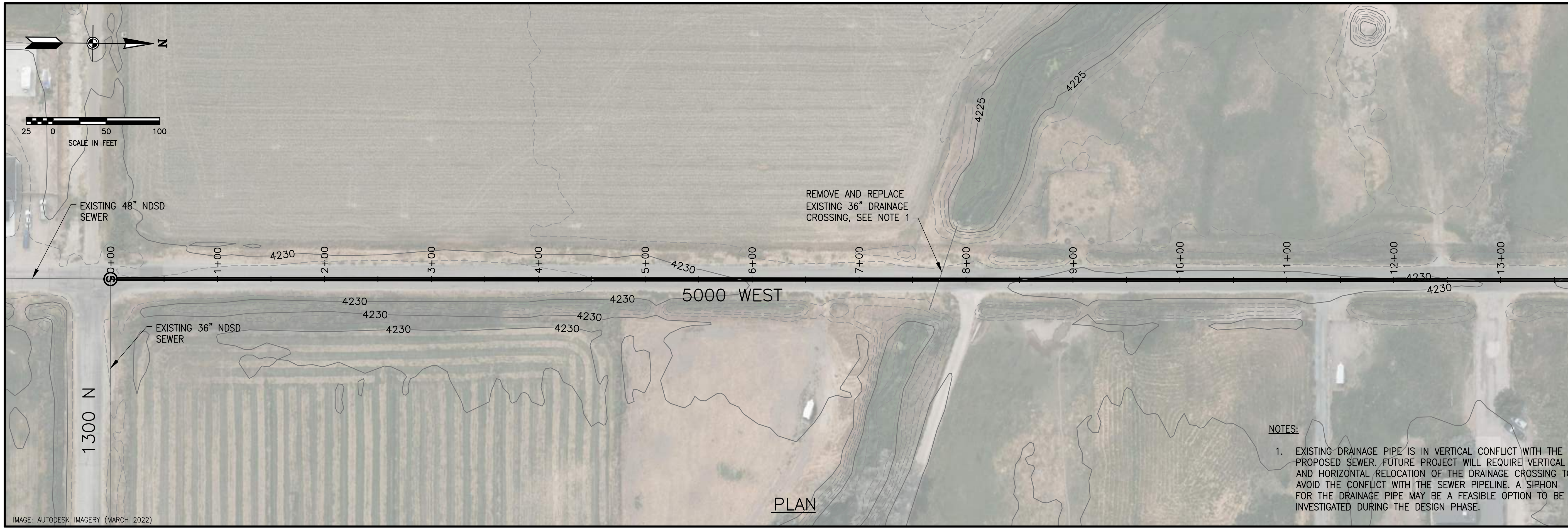
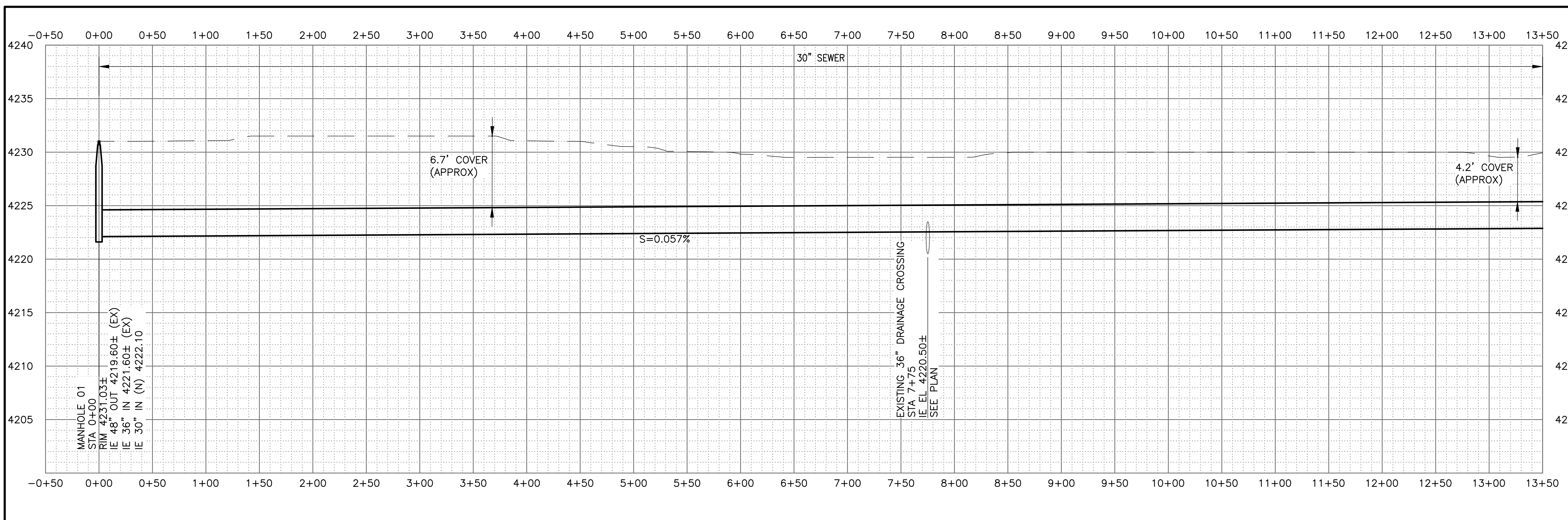


NOTES:

1. EXISTING DRAINAGE PIPE IS IN VERTICAL CONFLICT WITH THE PROPOSED SEWER. FUTURE PROJECT WILL REQUIRE VERTICAL AND HORIZONTAL RELOCATION OF THE DRAINAGE CROSSING TO AVOID THE CONFLICT WITH THE SEWER PIPELINE. A SIPHON FOR THE DRAINAGE PIPE MAY BE A FEASIBLE OPTION TO BE INVESTIGATED DURING THE DESIGN PHASE.



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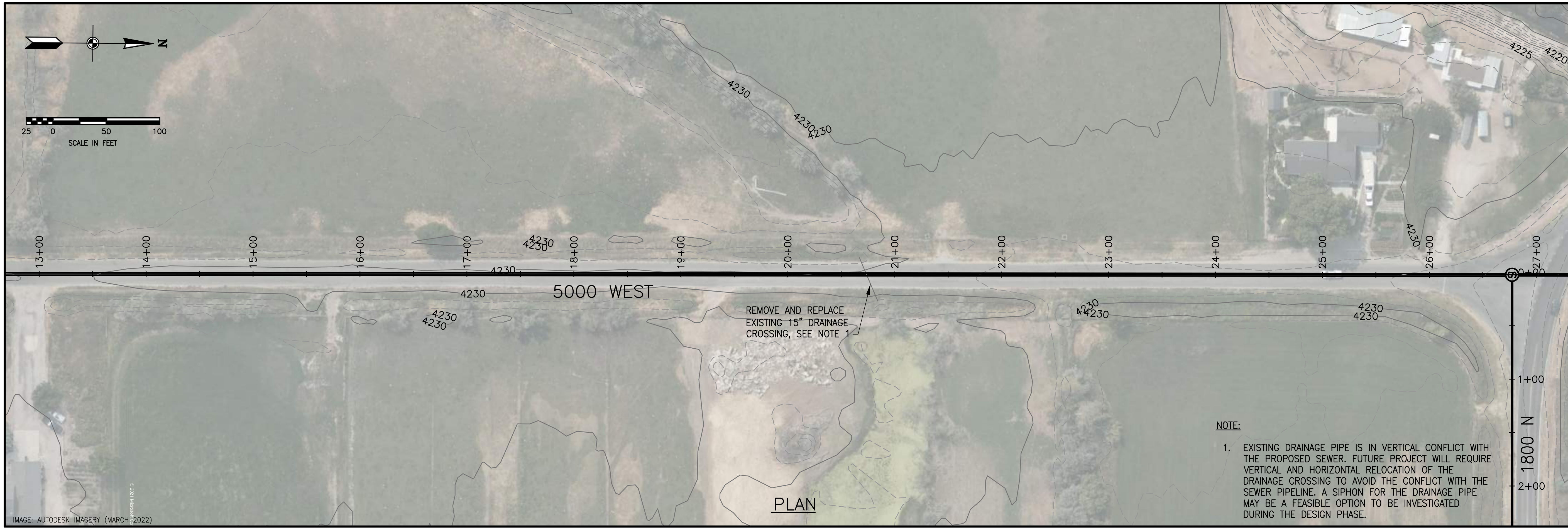

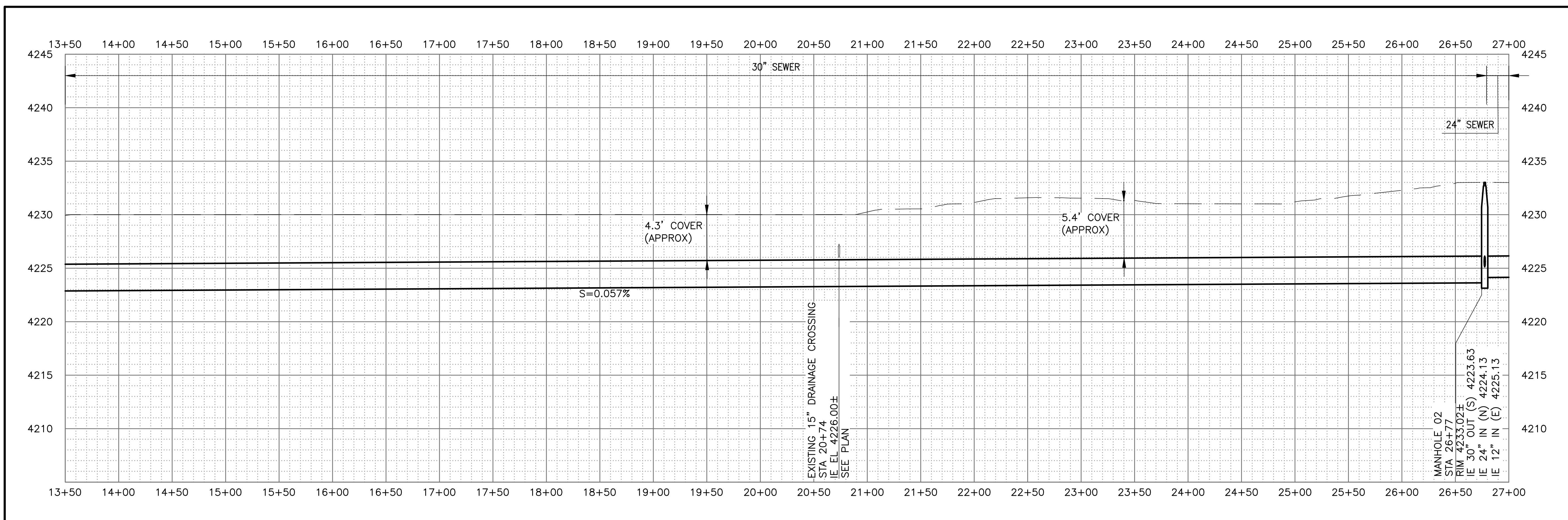

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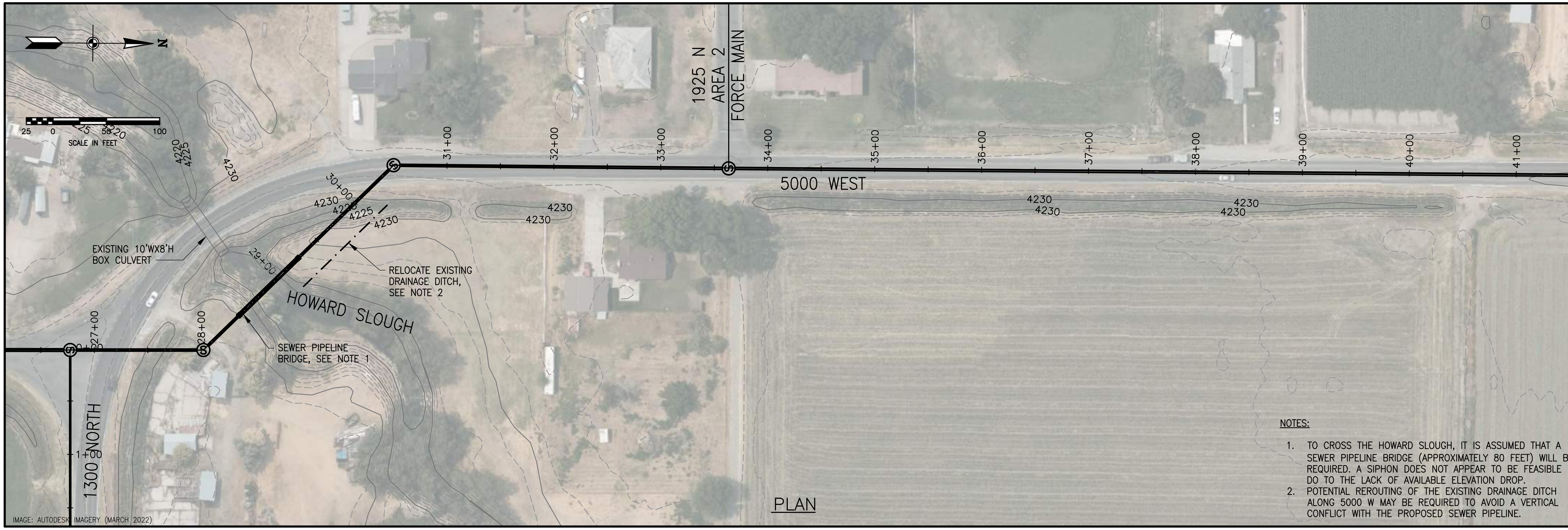

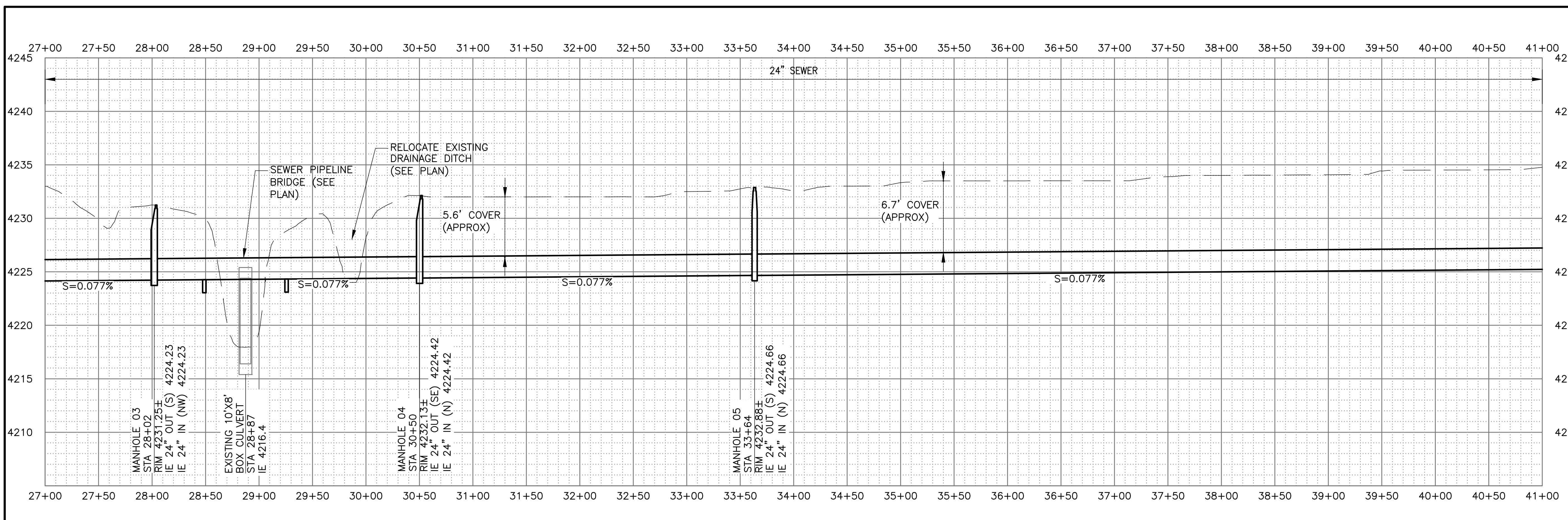

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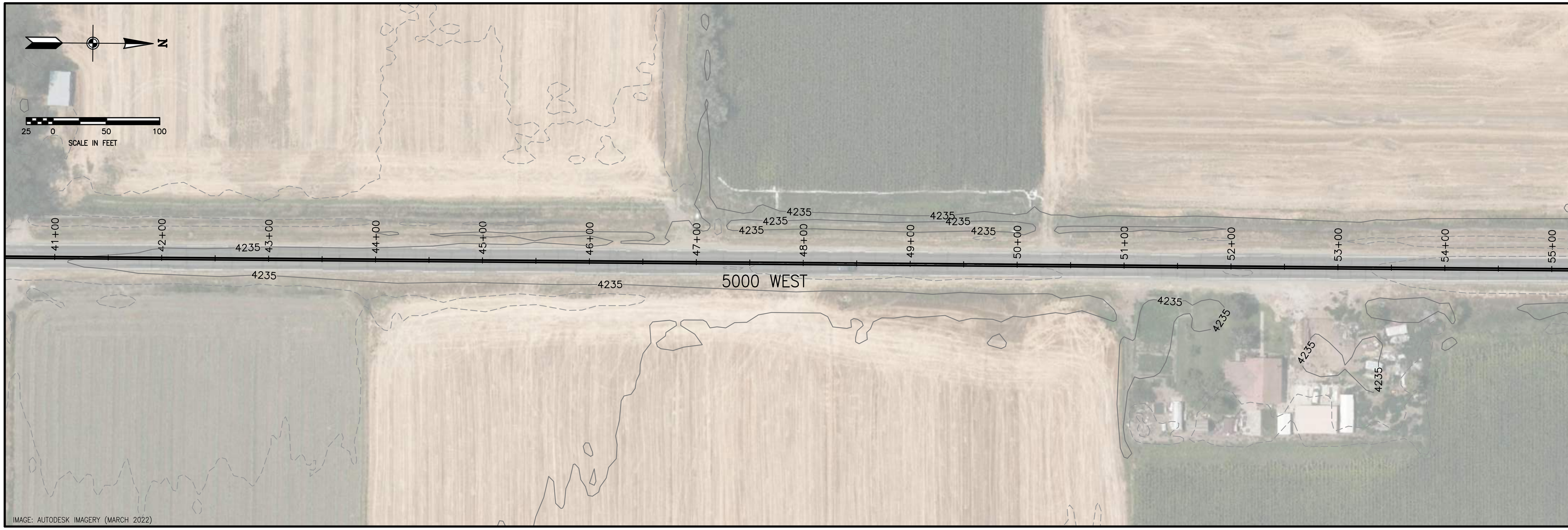

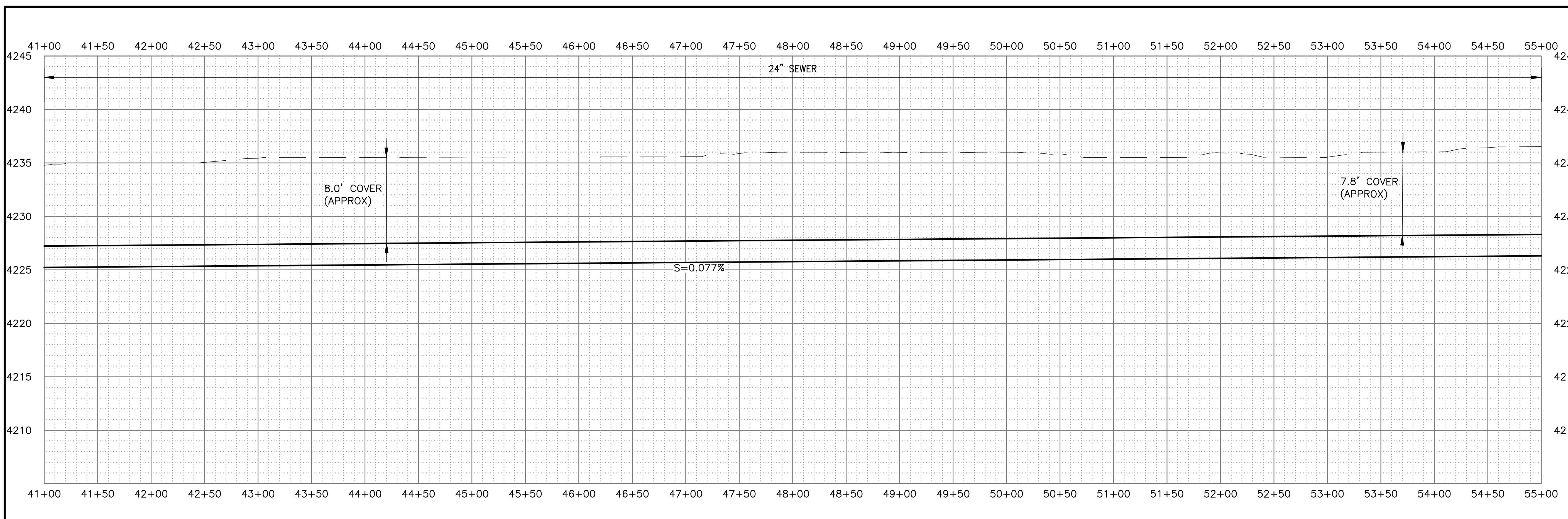

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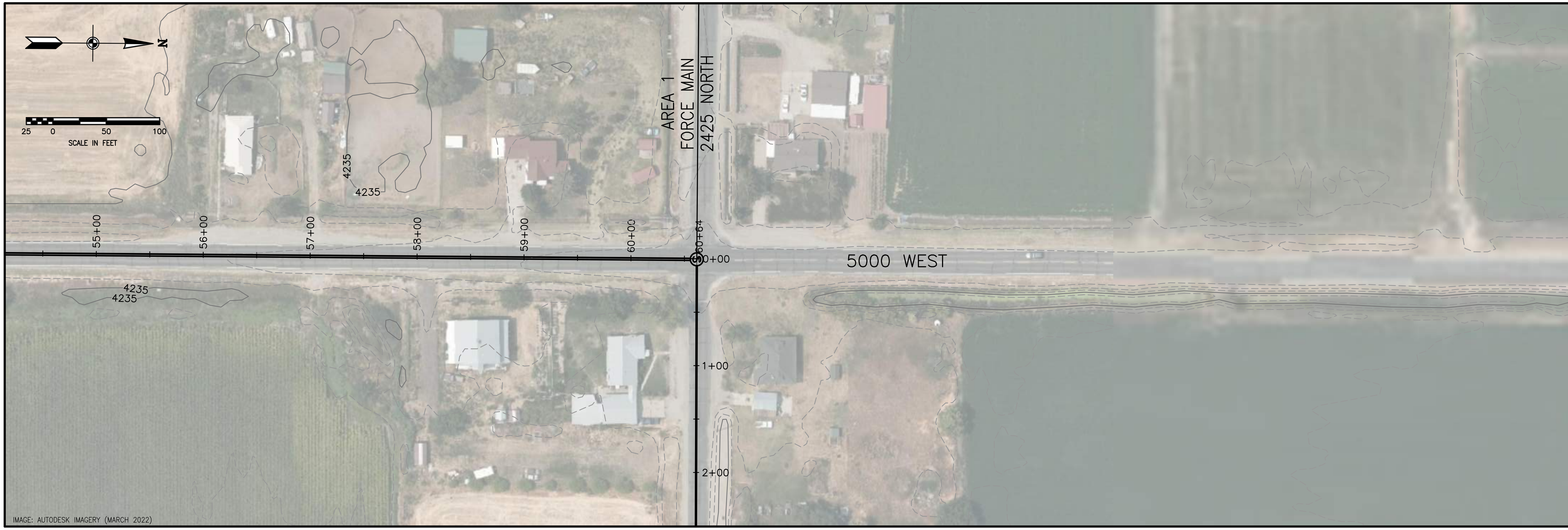

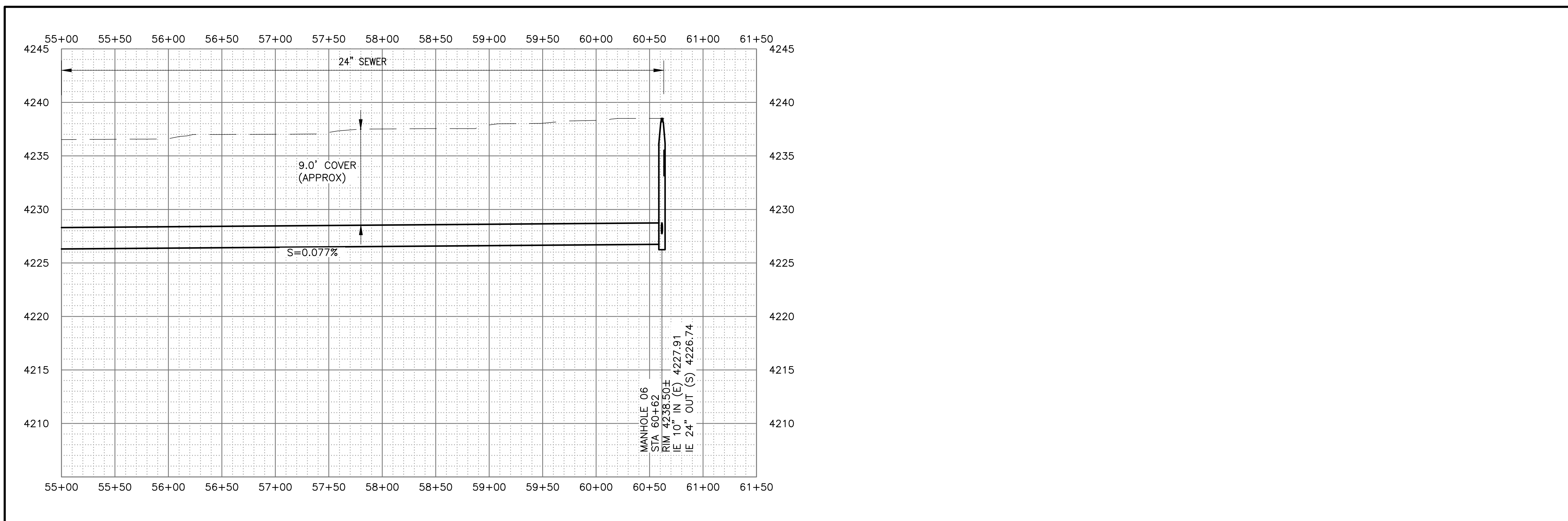

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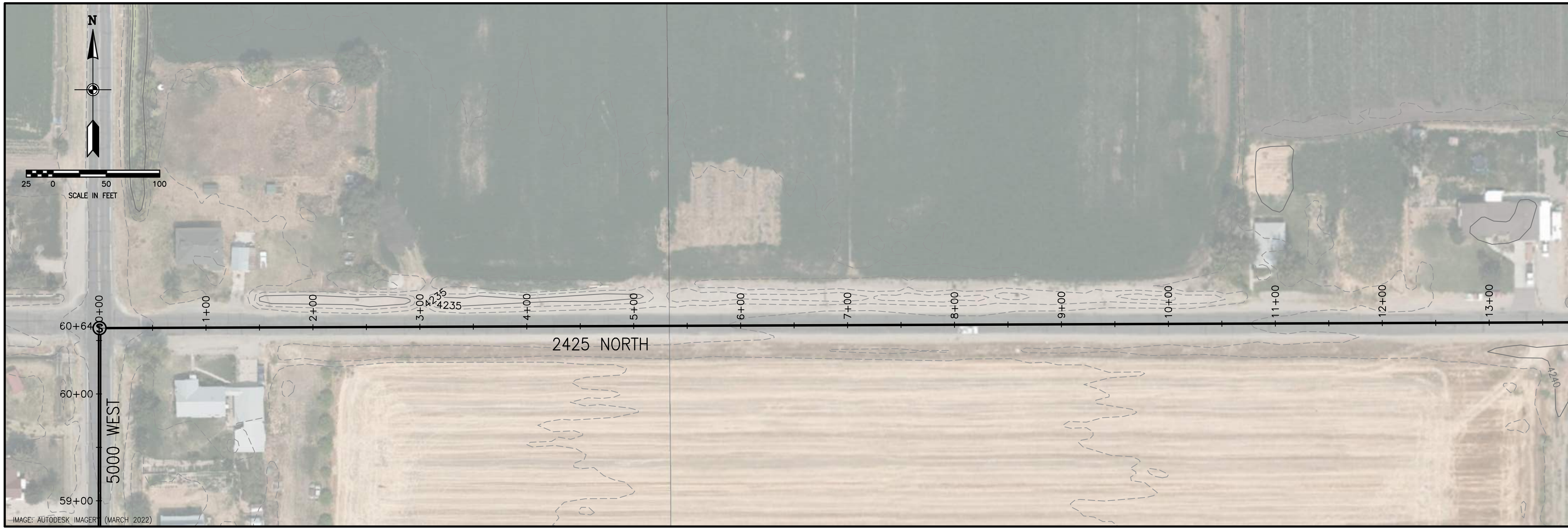

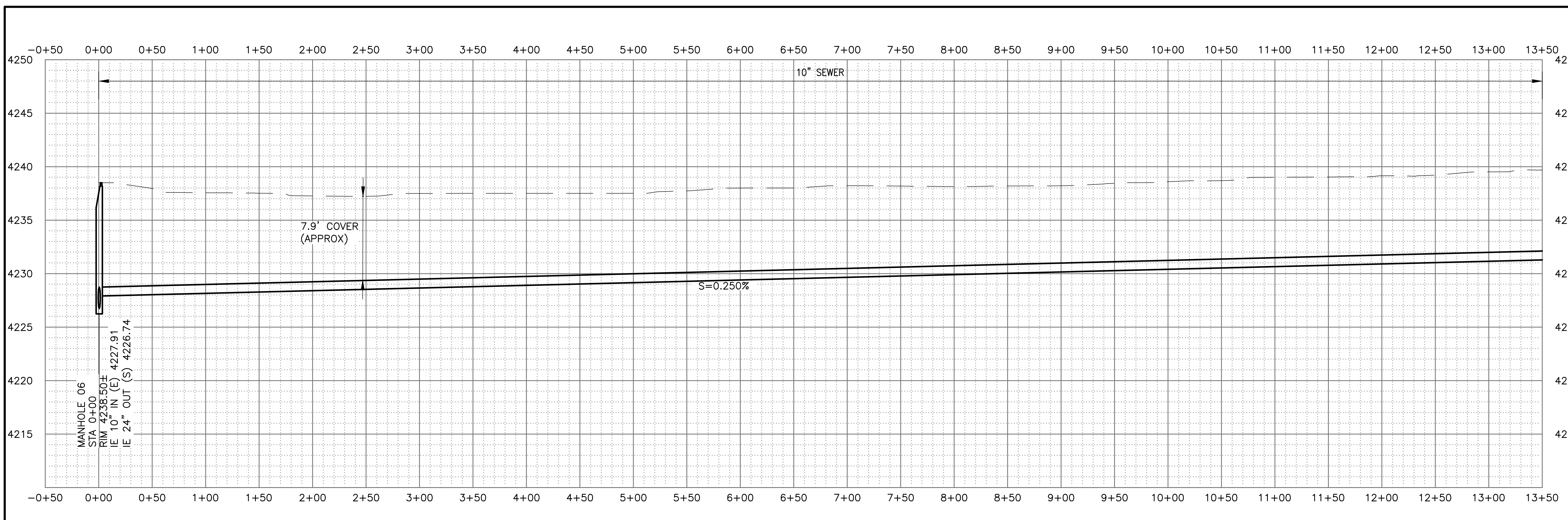

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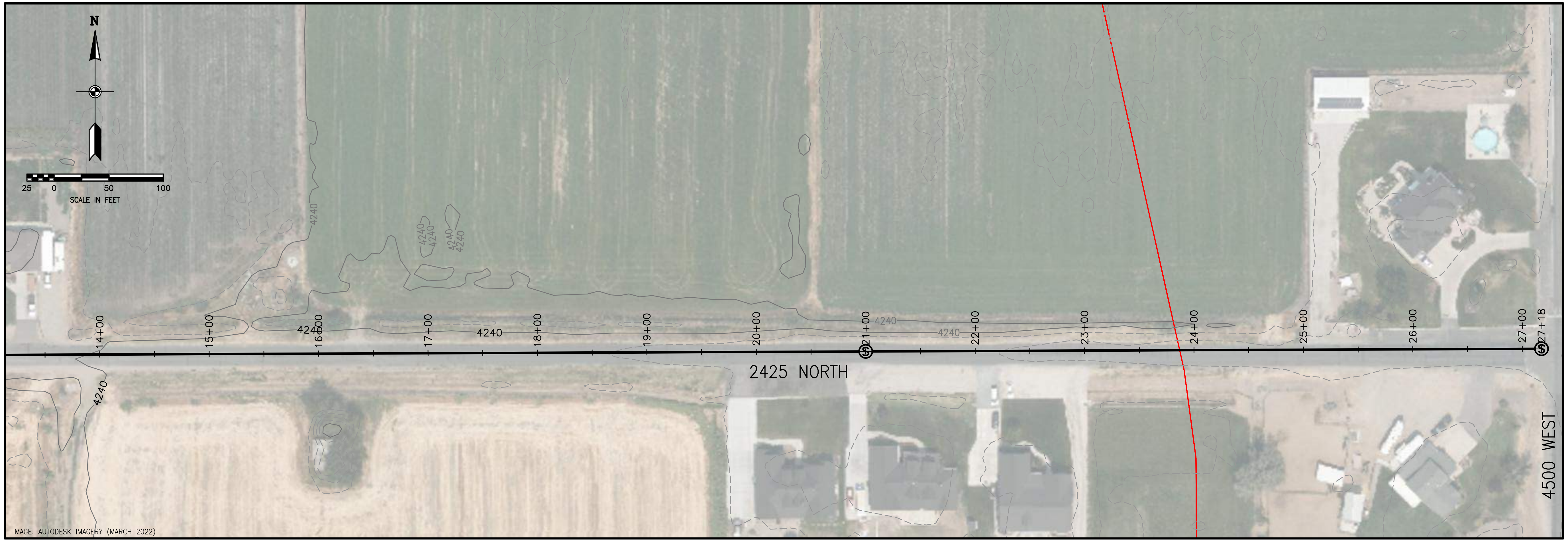

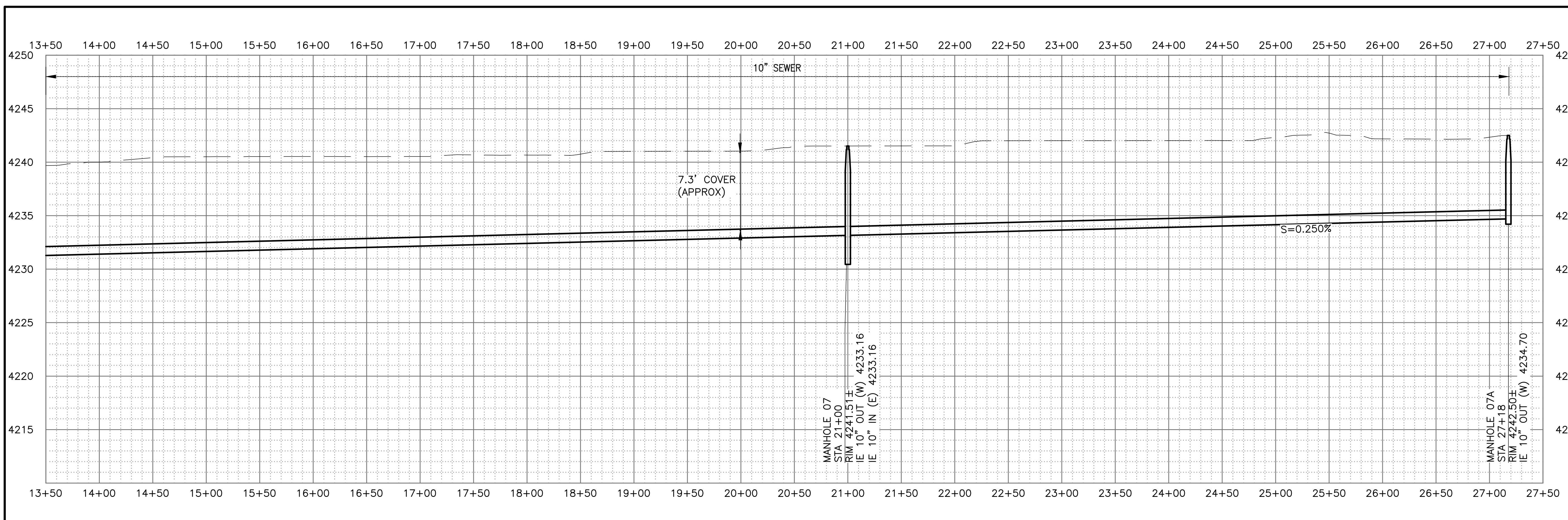

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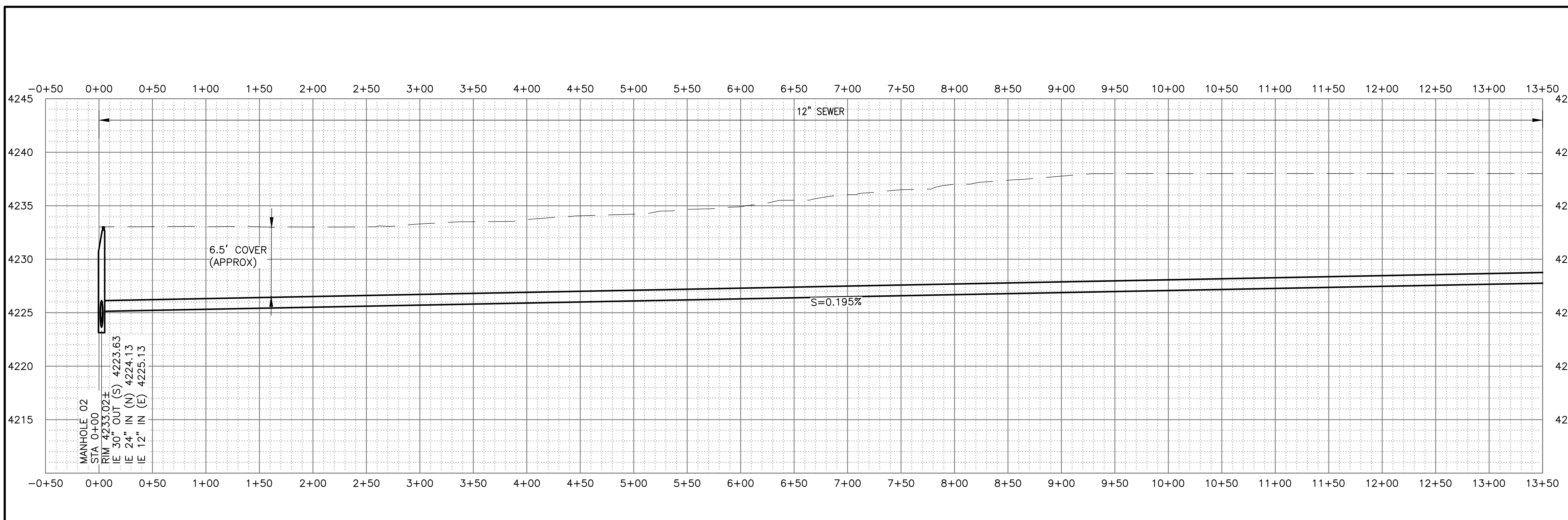

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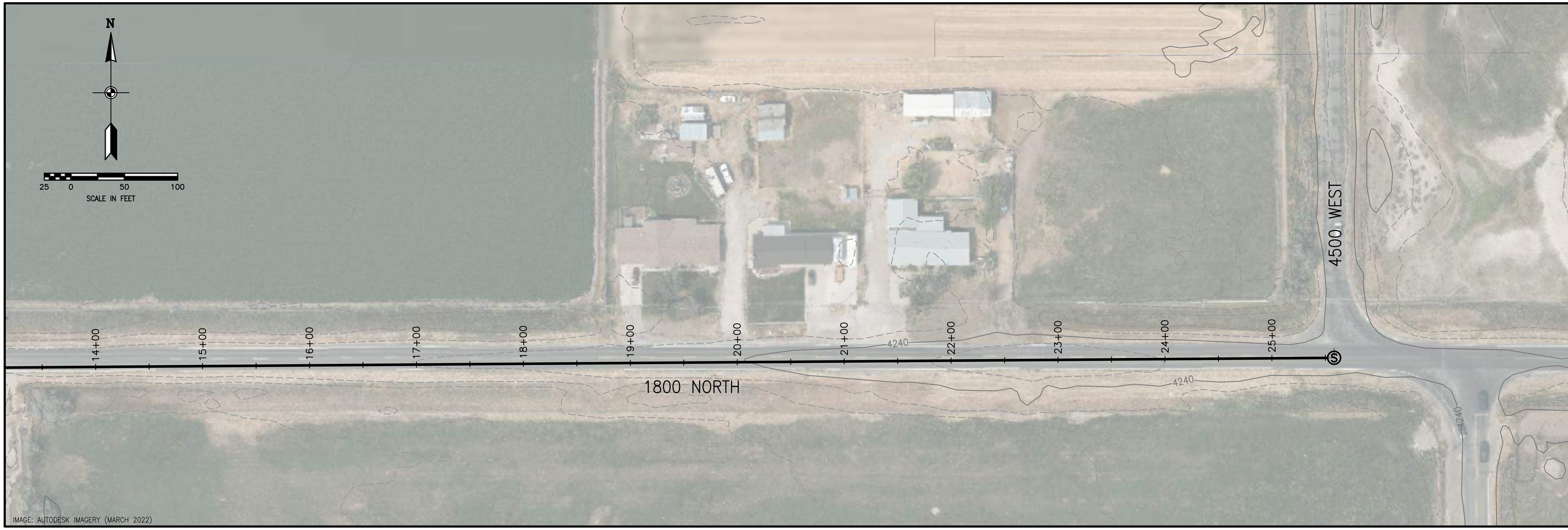

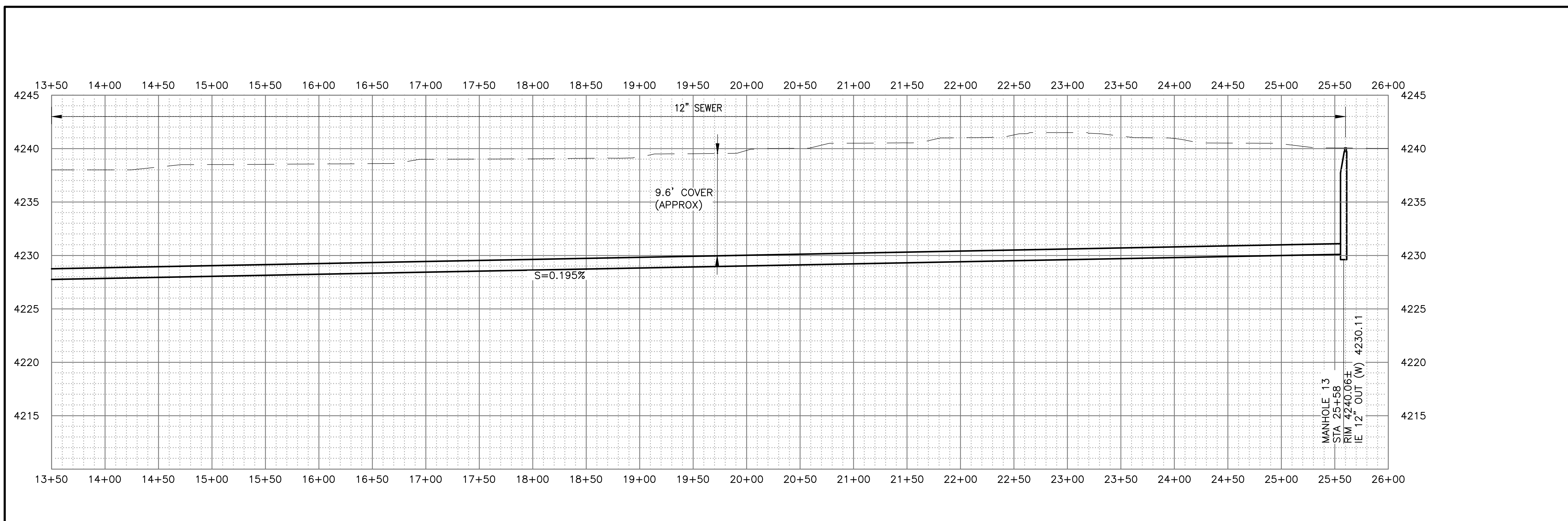

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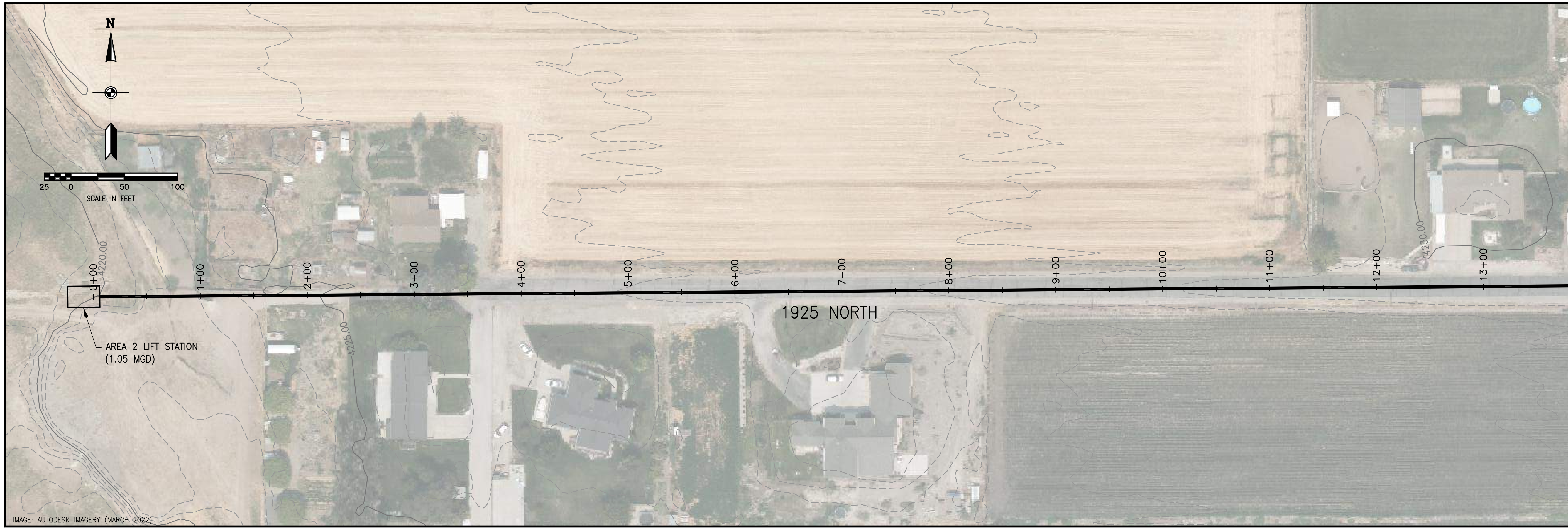

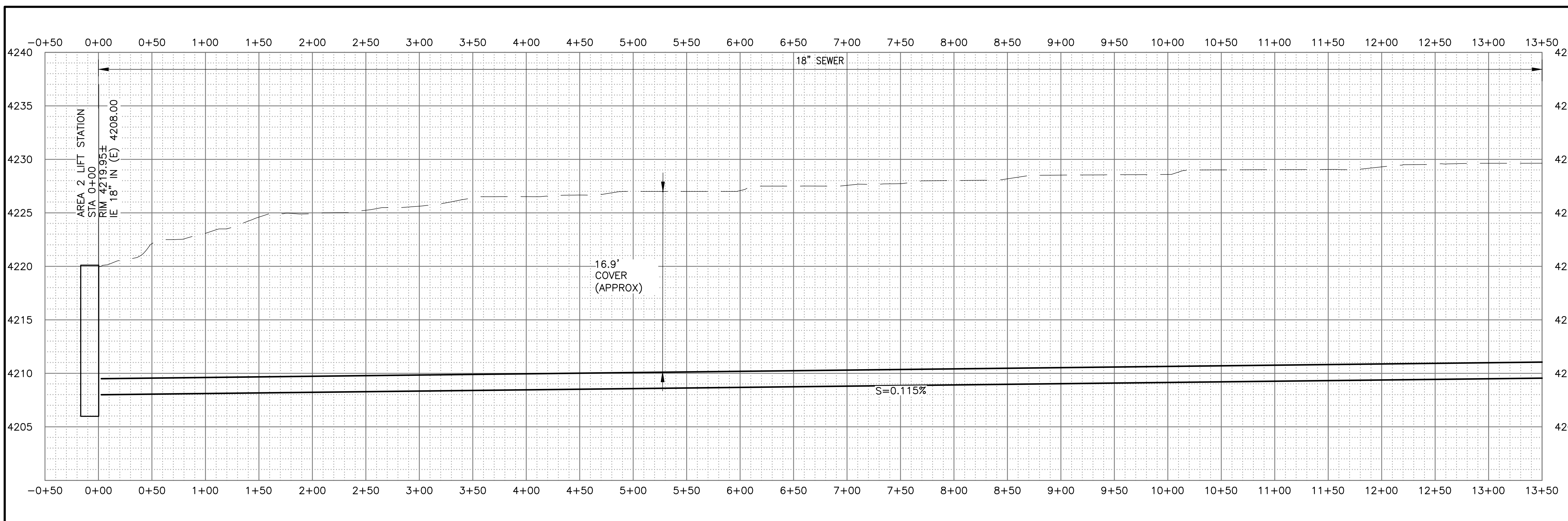

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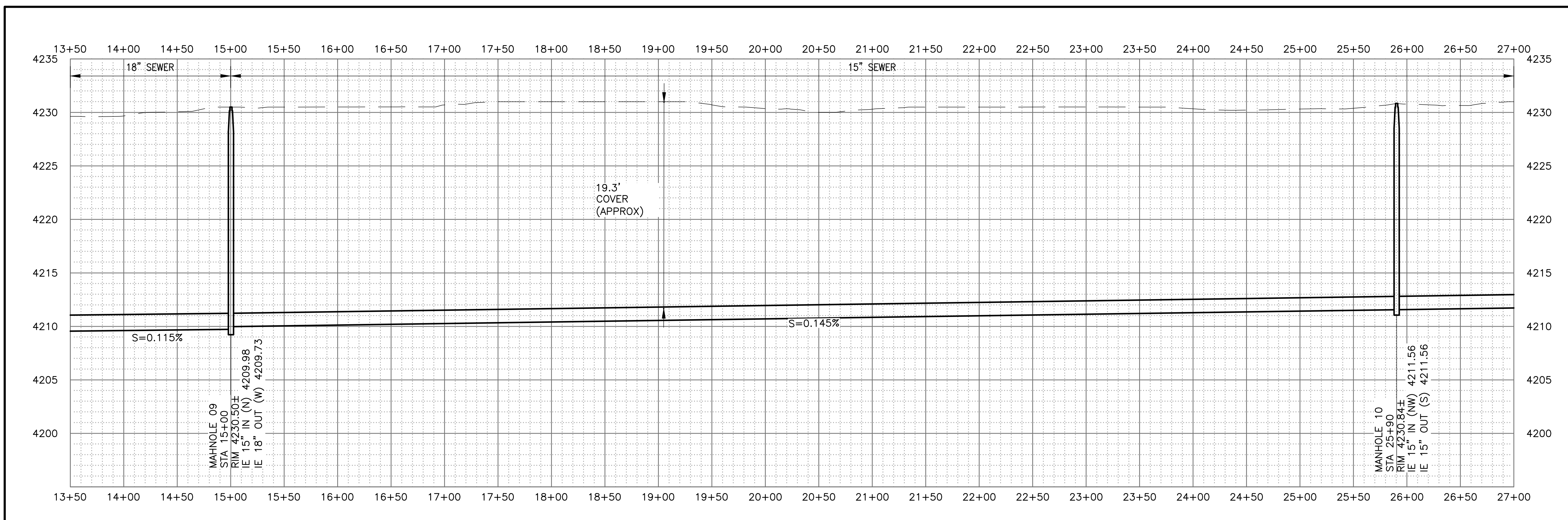

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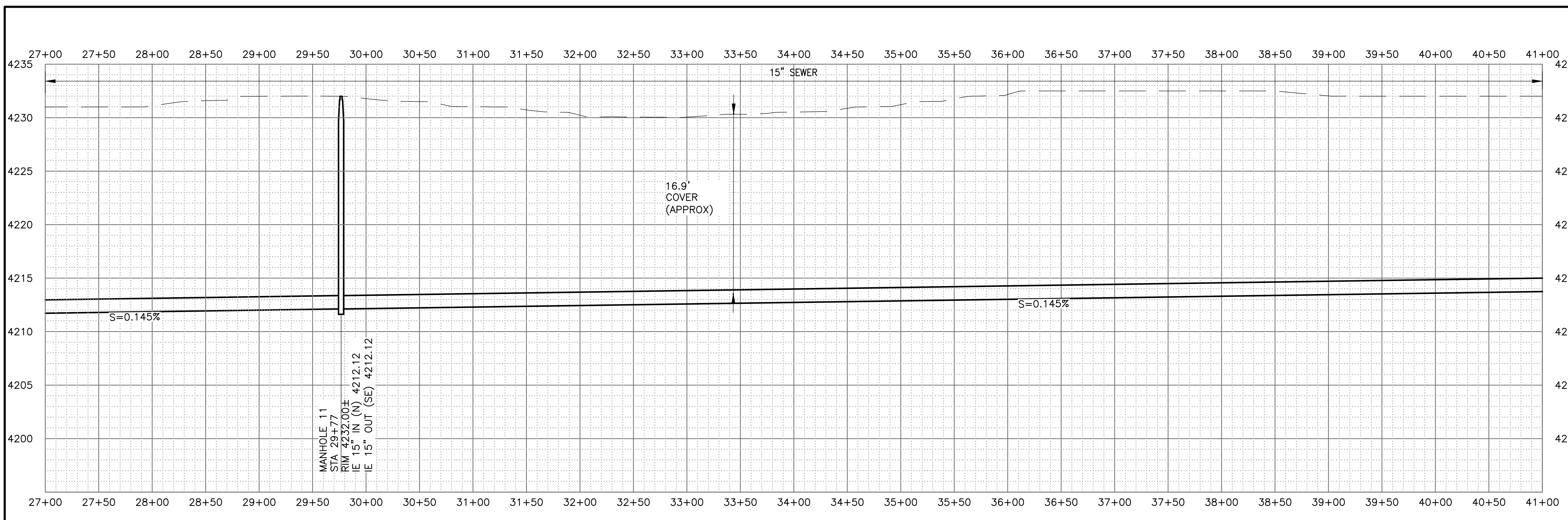

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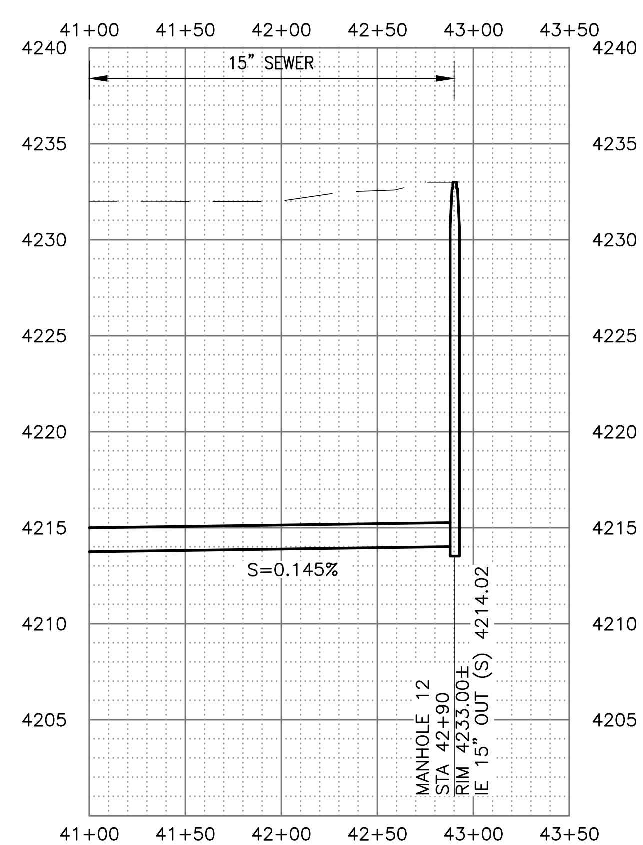

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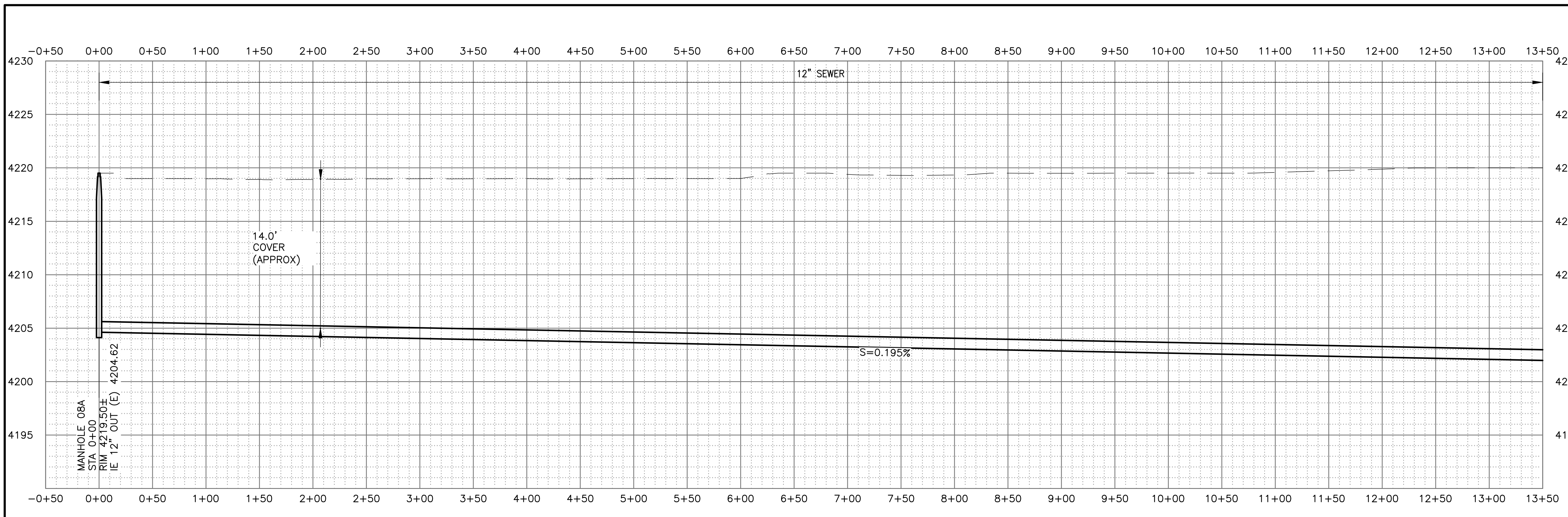

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2021 SANITARY SEWER SYSTEM STUDY
GRAVITY IMPROVEMENTS
WEST POINT CITY, UTAH

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN T. SEAMONS
DRAWN S. DUCKWORTH

REVIEW
CHECKED C. NELSON
APPROVED N/A

CIVIL

PLAN AND PROFILE - 14

PROJECT NUMBER 668-20-01

DATE: MARCH 2022

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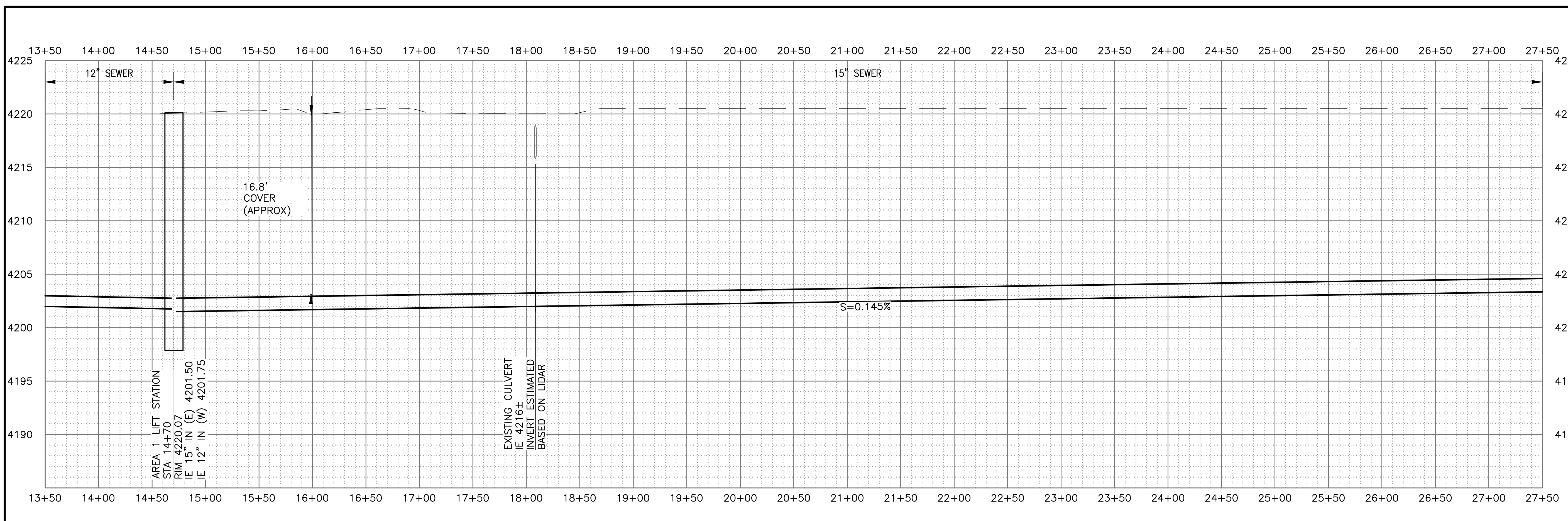
C-15

SHEET 15 OF 20



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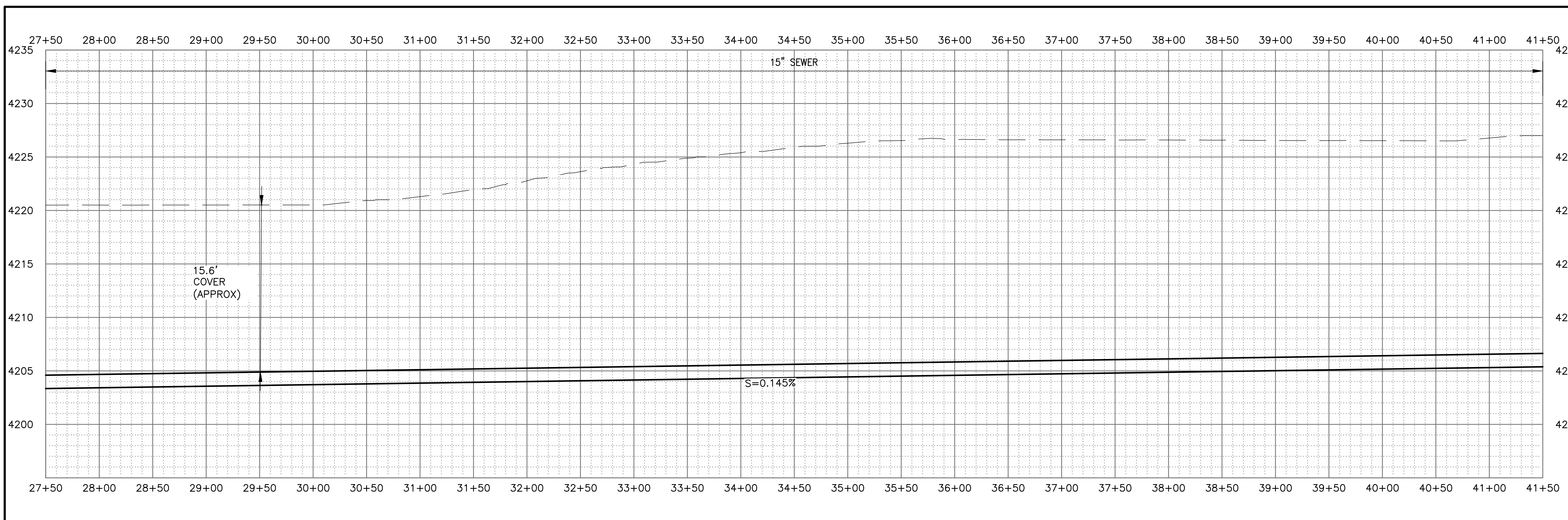

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PROJECT NUMBER 668-20-01
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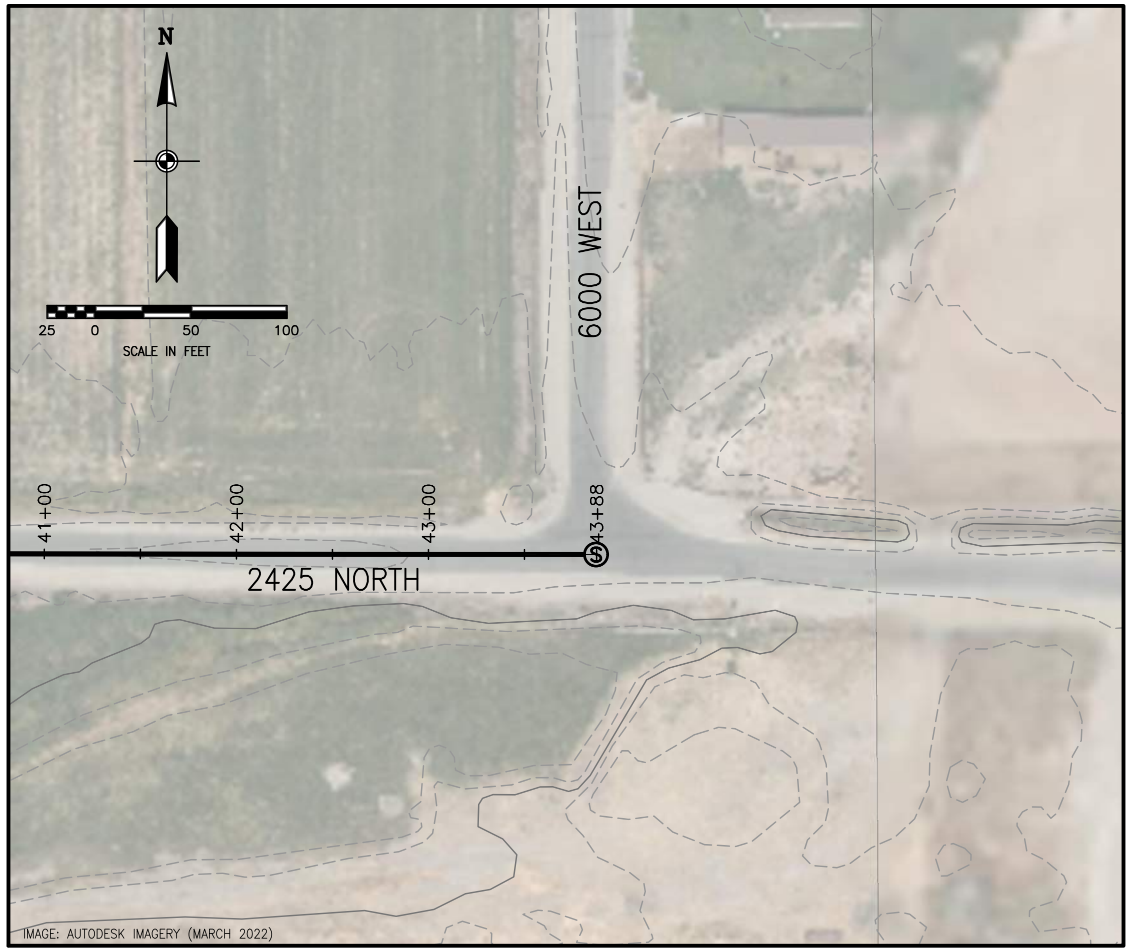

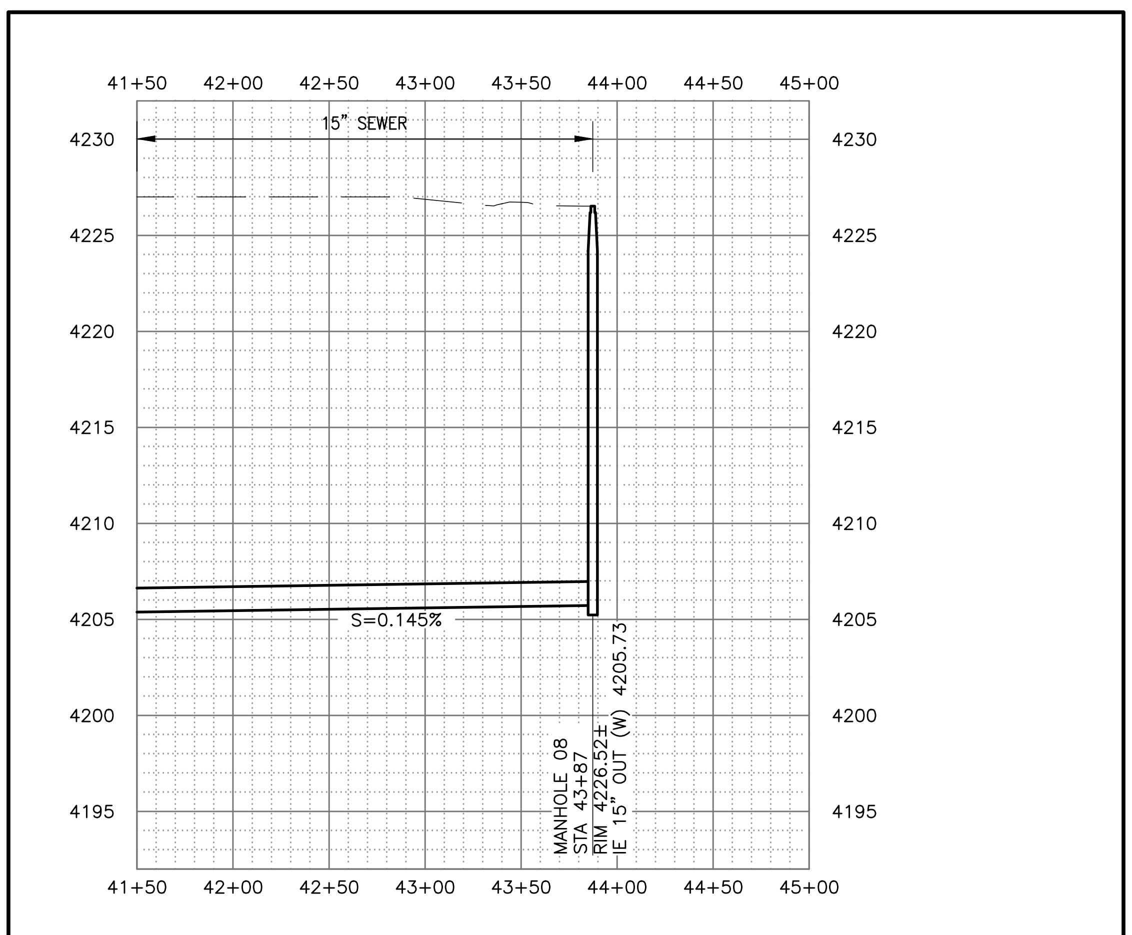

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PROJECT NUMBER 668-20-01

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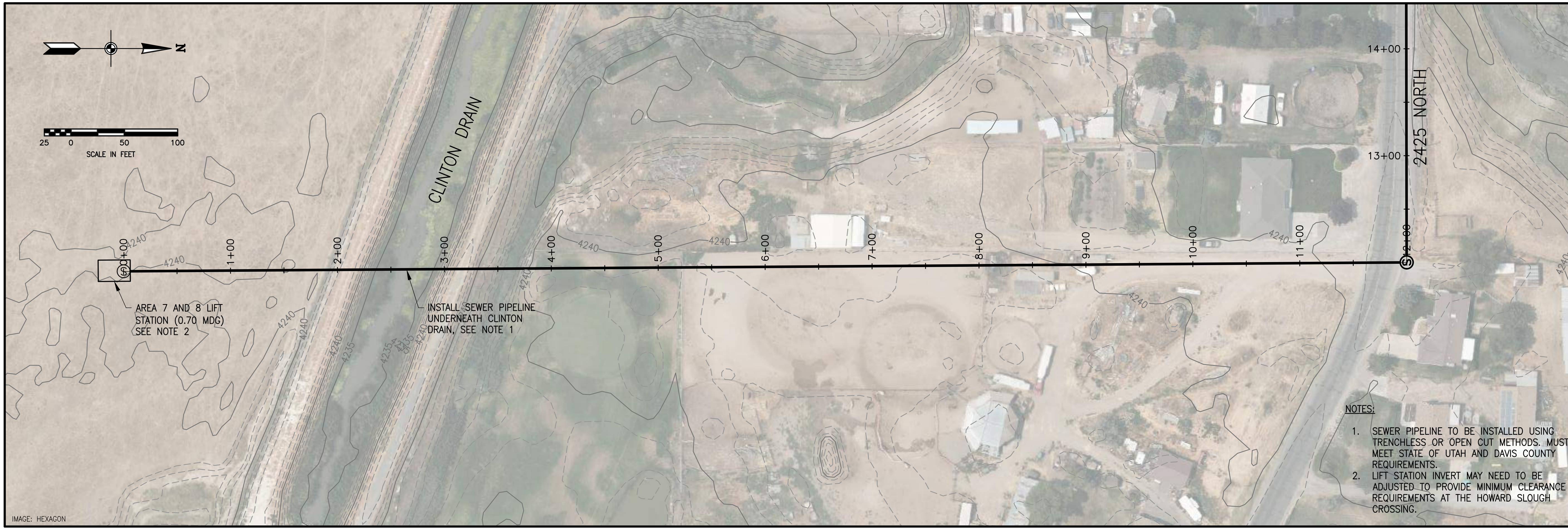
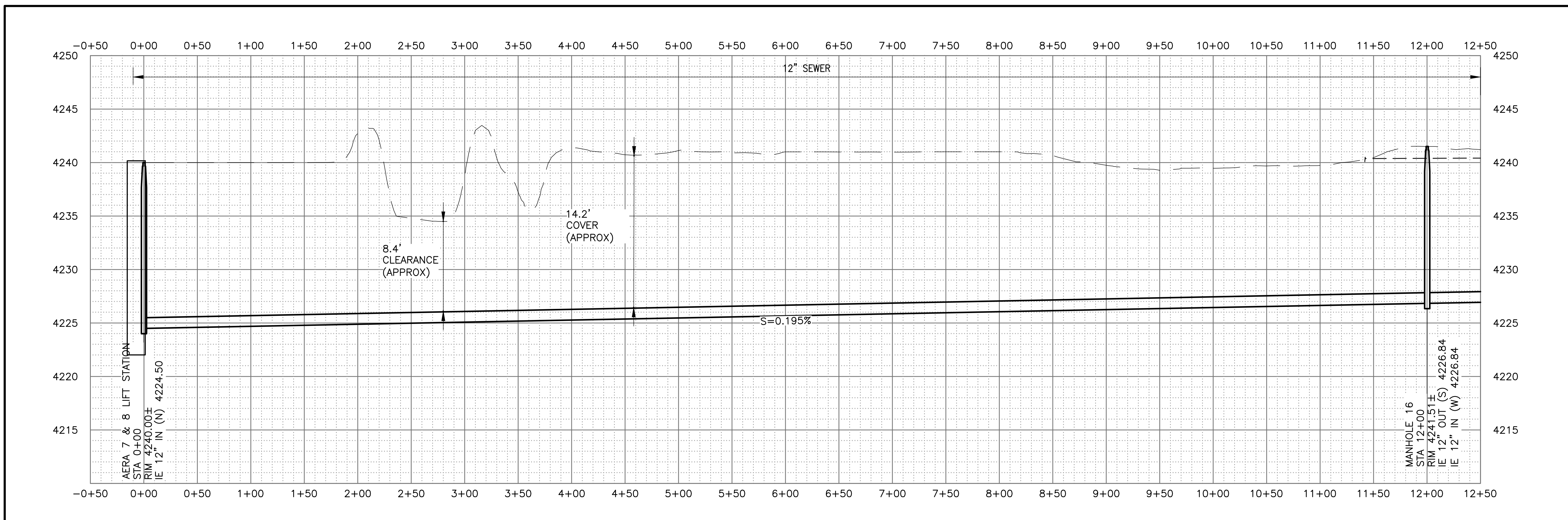


NOTES:

1. SEWER PIPELINE TO BE INSTALLED USING TRENCHLESS OR OPEN CUT METHODS. MUST MEET STATE OF UTAH AND DAVIS COUNTY REQUIREMENTS.
2. LIFT STATION INVERT MAY NEED TO BE ADJUSTED TO PROVIDE MINIMUM CLEARANCE REQUIREMENTS AT THE HOWARD SLOUGH CROSSING.



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PROJECT NUMBER 668-20-01

DATE: MARCH 2022

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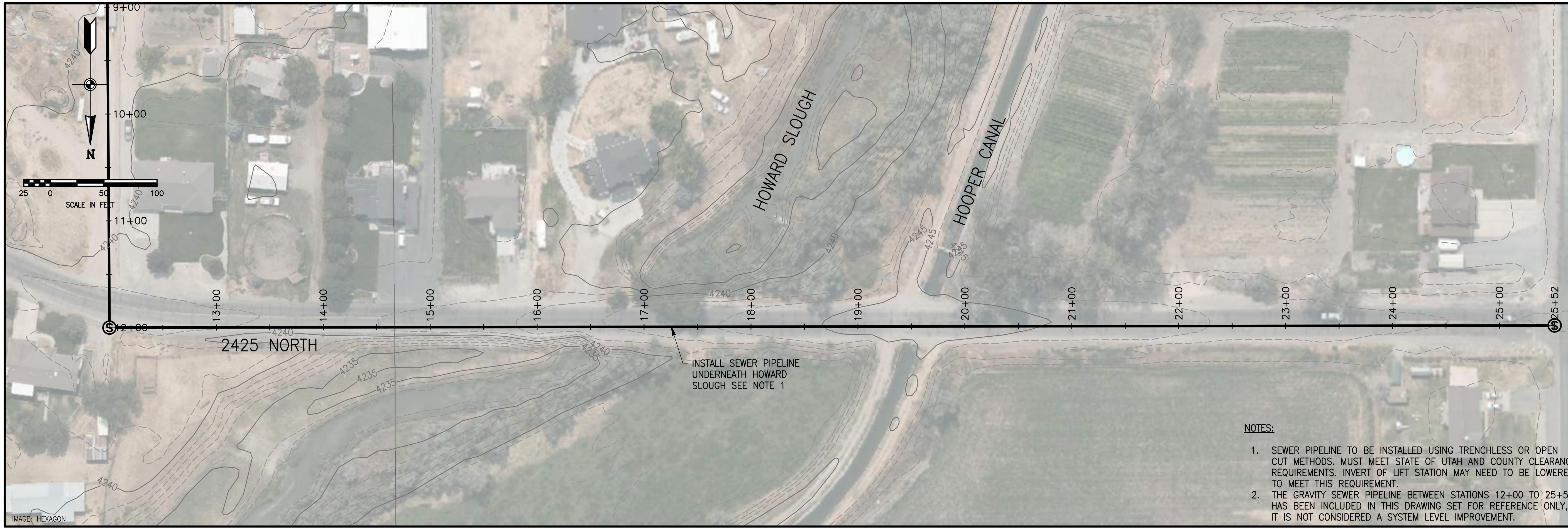

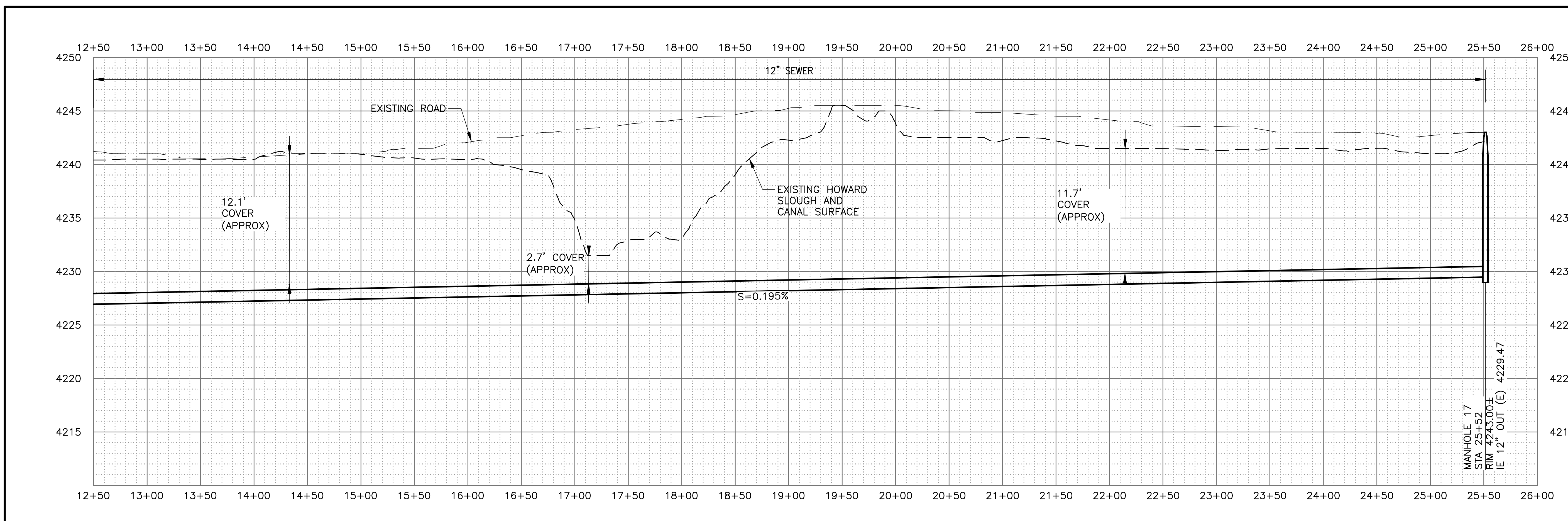

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PLAN AND PROFILE - 19

PROJECT NUMBER 668-20-01

DATE: MARCH 2022

DRAWING NO.
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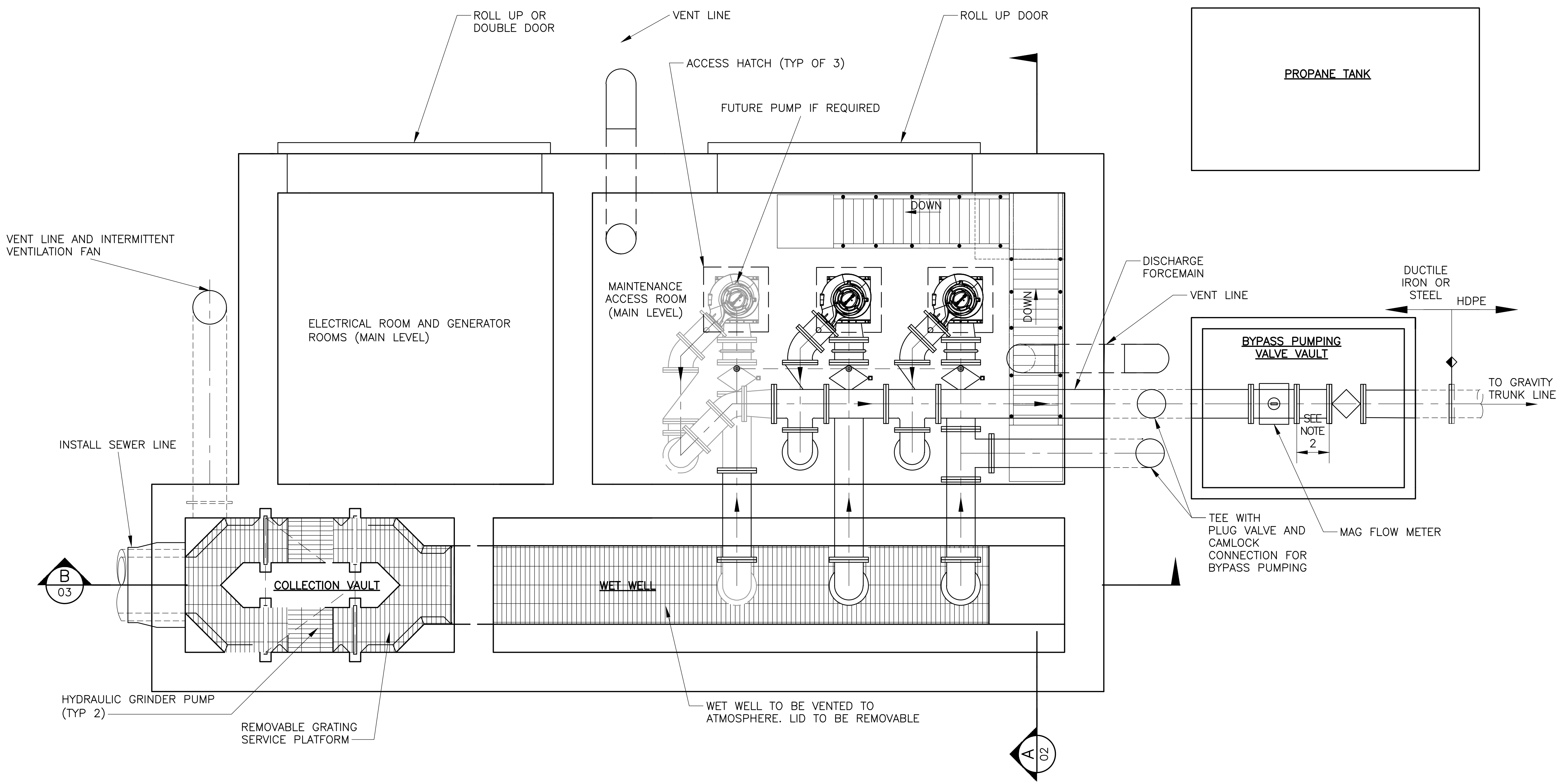
APPENDIX E

LIFT STATION CONCEPTUAL DRAWINGS



PLAN
SCALE: NTS

NOTES:

1. CONCEPTUAL LIFT STATION DESIGN IS INTENDED TO CONVEY GENERAL KEY FEATURES DESIRED BY WEST POINT CITY TO BE INCORPORATED INTO EACH REGIONAL LIFT STATION. REFER TO CITY STANDARD SPECIFICATIONS AND STATE REQUIREMENTS FOR ADDITIONAL GENERAL REQUIREMENTS.

2. UPSTREAM AND DOWNSTREAM DISTANCES TO MEET OR EXCEED MANUFACTURER REQUIREMENTS.

3. ELECTRICAL AND GENERATOR ROOM TO BE COMPLETELY SEPARATE AND SEALED FROM MAINTENANCE ACCESS ROOM. THE ELECTRICAL AND GENERATOR ROOMS MAY BE LOCATED IN THE SAME OR SEPARATE BUILDING AS THE MAINTENANCE ACCESS ROOM DEPENDING ON ACTUAL PUMP STATION LAYOUT AND ELECTRICAL EQUIPMENT SIZING REQUIREMENTS.

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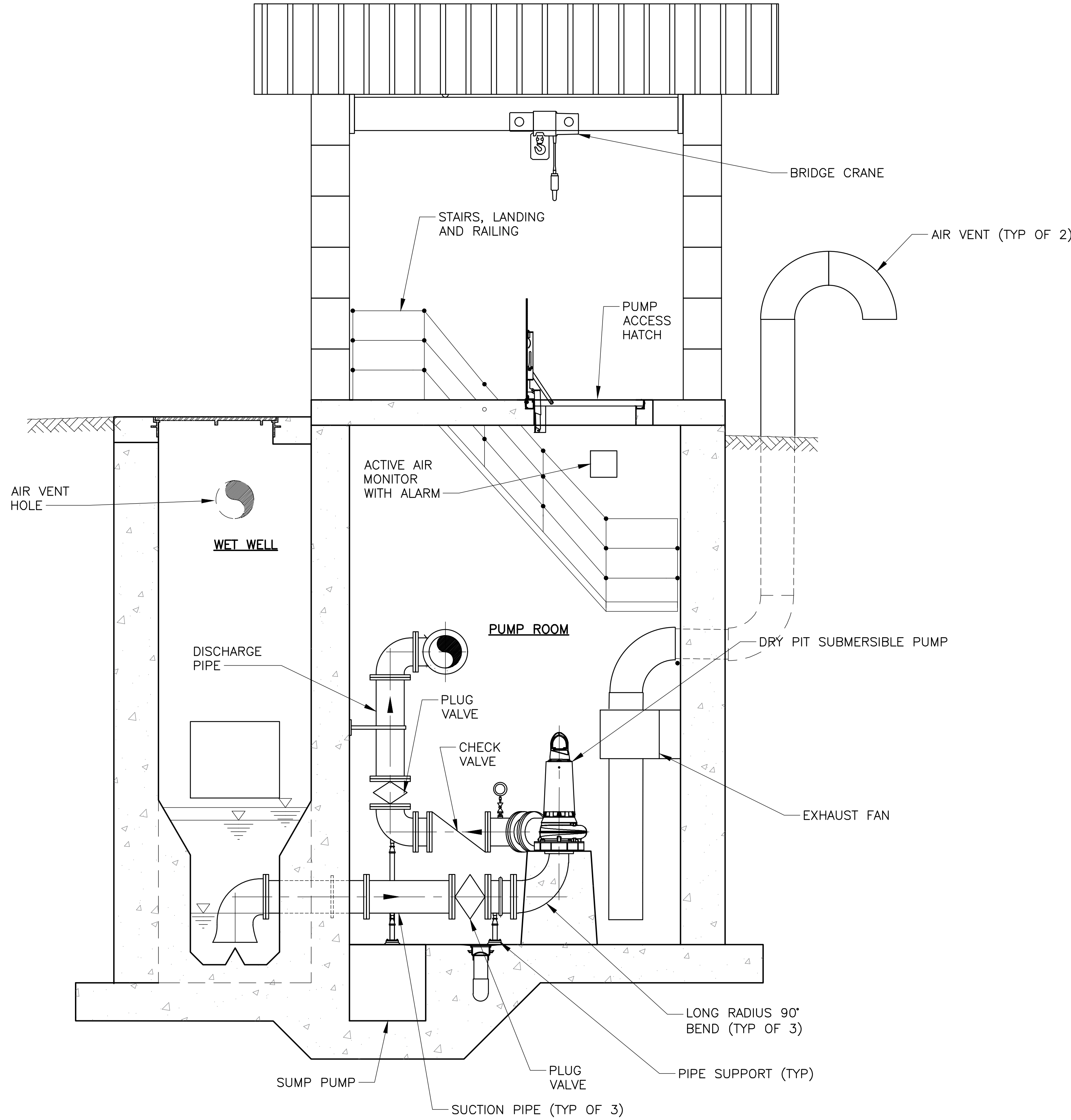
FIGURE 01 – LIFT STATION CONCEPTUAL LAYOUT



SECTION A 01
SCALE: NTS

WEST POINT CITY
2021 WEST POINT CITY SEWER STUDY

FIGURE 02 – LIFT STATION CONCEPTUAL LAYOUT

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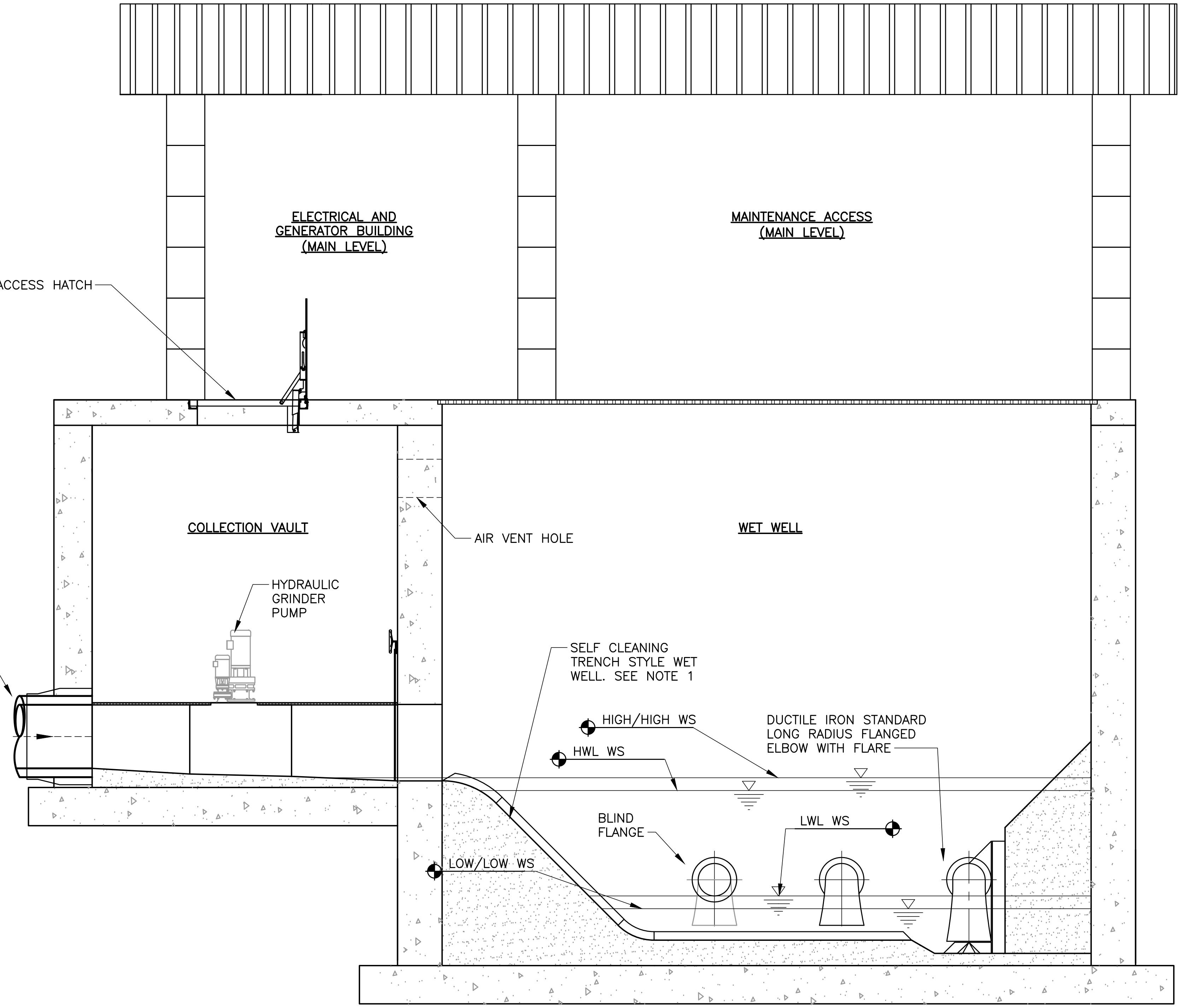

SECTION B 01
SCALE: NTS

NOTES:

1. THE SELF CLEANING WETWELL DIMENSIONS SHALL BE DESIGNED IN ACCORDANCE WITH THE HYDRAULIC INSTITUTES PUMP INTAKE DESIGN STANDARD. RAMP DIMENSIONS, TRENCH WIDTH, TRENCH DEPTHER, AND SUCTION PIPE SPACING TO CONFORM WITH THIS STANDARD.

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WEST POINT CITY
2021 WEST POINT CITY SEWER STUDY

FIGURE 03 – LIFT STATION CONCEPTUAL LAYOUT

APPENDIX F

LIFT STATION DESIGN SPECIFICATIONS

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Wastewater Lift Stations

1.1 Wastewater Lift Stations General:

1.1.1 All wastewater lift stations shall meet the requirements of the latest edition of the Utah Administrative Code, Section R317-3 "Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal Systems," sub-section R317-3-3 "Sewage Pumping Stations."

1.1.2 City Wastewater Facilities Design Criteria:

A. Maximum Average Daily Flow per Equivalent Residential Unit (ERUs) = 255 gallons per day (gpd/ERU).

B. Assumed gross population density = 2.2 ERUs per acre.

C. Wastewater lift station capacity shall be determined as follows:

Lift Station	Assumed Contributing ERUs	Peak Instantaneous Flow (MGD)[1]	Lift Station Capacity (MGD)[2]
Area 1	1,318	1.15	1.35
Area 2	1,135	1.05	1.25
Area 3	568	0.60	0.71
Area 7/8	660	0.70	0.82

[1]If actual contributing ERUs differ from assumed contributing ERUs, assume a peaking factor of 4.0 to determine peak instantaneous flow
[2]The ratio of peak instantaneous flow to pumping capacity shall not be greater than 0.85

1.1.3 Pioneering Agreement:

A. The City has plans to finance and build all system level improvements (major trunk lines, lift stations, and force mains) within the City and unincorporated Davis County to be annexed into the City. Development will be restricted to areas with operational system level improvements in place.

B. If a developer wishes to construct system level improvements prior to the City's planned schedule, it will be the developer's sole responsibility to finance and build all system level improvements required to service the proposed development as outlined in the City's 2021 Sewer Master Plan. The City will then enter into a "Pioneering Agreement" with the developer to reimburse the developer, through the collection of impact fees, for the construction costs of the system level improvements only. Only impact fees collected from the specific area serviced by these improvements can be used for reimbursements.

1.2. Site Requirements:

1.2.1. The site shall be adjacent to a public road or have a paved access from the public road to the site.

1.2.2. Lift stations shall be readily accessible by maintenance vehicles during all weather conditions. Easements shall be granted to the City and shall be sufficient to allow access by maintenance vehicles.

1.2.3. Flood lights shall be provided on site for nighttime emergency operations that is tied into the onsite power and generator. The switch shall be in the enclosed electrical panel.

1.2.4. The site shall facilitate access to wet well to allow for future cleaning and maintenance.

1.2.5. Paved access shall be provided from the gate to access the wet well, maintenance access building, and the electrical/generator building. Parking lot to provide adequate turn around space and ability to exit the lift station easily.

1.2.6. A black vinyl coated chain link fence with privacy slats shall be installed around the perimeter of the site. A 14’ wide opening with a lockable gate shall be provided.

1.2.7. There shall be no overhead obstructions over the site.

1.3 Lift Station:

1.3.1: All City regional lift stations shall be wet well – dry pit style lift stations. Pre-manufactured packaged lift stations will not be accepted.

1.3.2: Wet Well:

A. The wet well shall be a self cleaning trench style wet well as described in section 9.8.4 of the Hydraulic Institute Standard “Rotodynamic Pumps for Pump Intake Design”. The wet well’s inlet transition, trench dimensions, suction pipe spacing and offsets, and other transitions shall meet the recommendations listed in this section. The design shall reduce the accumulation of solids within the wet well.

B. The wet well size and level control settings shall be appropriate to avoid heat buildup in the pump motor due to frequent starting (short cycling), and septic conditions due to excessive detention time. Sufficient storage shall be provided to limit pump starts to no more than 6 per hour. For pumps with VFDs, maximum number of starts may be calculated based on the minimum flow rate within the operable range of the pump.

C. The wet well shall be vented to atmosphere and covered by traffic rated grating. The wet well shall also be equipped with a removable concrete lid, to facilitate its replacement if odor control is needed in the future.

1.3.3: Dry Pit (pump room):

A. The dry pit, including it’s superstructure, shall be completely separated from the wet well. Common walls shall be gas tight.

B. The dry pit shall be equipped with active air monitoring equipment and alarm.

1.3.4 Ventilation:

A. Permanently installed ventilation shall be provided to dry and wet wells and collection vaults containing mechanical equipment requiring inspection or maintenance.
   1. There shall be no interconnection between the wet well and dry well ventilation systems.
   2. Switches for operation of ventilation equipment should be marked and located for convenient operation from outside of the enclosed environment.
   3. All intermittently operated ventilation equipment shall be interconnected with the respective pit lighting system.
   4. Automatic heating and dehumidification equipment shall be provided in all dry wells.
   5. Wet Well ventilation if continuous, shall provide at least 12 complete air changes per hour; if intermittent, at least 30 complete air changes per hour.
   6. Dry wells ventilation if continuous, shall provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour.

1.3.5 Buildings:

A. A CMU building shall be constructed above the dry pit to contain a maintenance access area. The electrical room and generator shall be located inside a separate room within this building or inside a separate attached CMU building.
   1. The maintenance access room shall have a roll up door adequate to allow a utility truck access to the maintenance hatch.
   2. The electrical and generator equipment shall be located in a room that is separated and sealed from the maintenance access room and dry pit. The City may elect to have the electrical equipment in its own dedicated room or separate building.
   3. The generator building shall have a roll up door or double door adequate for generator installation and/or removal.

B. The building(s) shall have a pitched roof and architectural treatment similar to planned development.

C. The building shall be built according to Uniform Building Code, latest edition.

1.3.6 Backup Power:

A. A backup power generator shall be provided that is sufficiently sized to provide power to all necessary operating features, e.g. grinders, pumps (operating at design capacities), emergency lighting, controls, etc.

D. The generator shall operate on propane fuel.

E. A propane tank shall be provided on site and sized to provide a minimum of 72 hours of continuous operation of the generator.

F. The generator shall be located within an enclosed heated building with adequate ventilation of fuel vapors and exhaust gases.

1.3.7 A bridge crane and track system shall be built over the dry pit within the maintenance access building with sufficient clearance and size to freely remove the pumps with motors from the dry pit.

1.3.8 Stairs, railings, and landings shall be provided for access to the dry pit. Landings shall be provided at a minimum of every 12 vertical feet.

1.3.9 A sump pump equipped with dual check valves shall be provided in the dry well to remove leakage or drainage with discharge above the maximum high water level of the wet well.

1.3.10 A hose bib connection shall be provided on the site that is connected to the culinary water system for year-round water supply.

1.3.11 High groundwater is anticipated at all regional sewer lift station locations. All structures shall be designed to resist buoyancy forces. Ground water shall be assumed at ground level for associated buoyancy calculations. Provide calculations to City for review and approval.

1.3.12 All homes that are serviced by the lift station shall have backflow preventers on the sewer lateral to the home.

1.3.13 The developer shall have the lift station designed by a licensed professional engineer.

1.3.14 All lift station designs shall be submitted to the City for approval. Submittals for design approval shall include design calculations, pump data and curves, projected energy consumption calculations, control sequence of operations, etc.

1.3.15 The city shall approve the design and have it reviewed by a third-party engineer at the developer's cost.

1.5 Mechanical Equipment Requirements:

1.5.1 Dry Pit Submersible Pumps:

A. A minimum of two pumps shall be installed at all lift stations. If the flows exceed 1 million gallons per day then three pumps shall be required.

B. Pumps shall be capable of passing spheres of at least 3 inches in diameter, and pump suction and discharge piping shall be at least 4 inches in diameter.

C. Pump motors shall be designed to operate in the dry pit and submerged scenario (dry pit submersible style).

D. Provisions shall be made to facilitate removing pumps, motors and other mechanical and electrical equipment. The removal of any equipment shall not interfere with the continued operation of remaining pumps.

E. The pumps shall be automated and level controlled using ultra-sonic level sensors. Floats shall be installed as a backup system

1.5.2 Hydraulic Grinders:

A. Two hydraulic grinders shall be provided to City for each lift stations.

B. A collection vault shall be provided with dual channels.

C. Hydraulic motors to be located in generator room.

D. Grinders to be mounted on railing system to be easily removed for maintenance

1.5.3 All lift stations shall be provided with a spare pump equal in size to the largest pump at the lift station. The spare pump shall be labeled to show what lift station it corresponds to and shall be stored in the location directed by the City.

1.5.4 A bypass suction and discharge connection shall be provided to facilitate bypass pumping. A quick connect cam lock coupling shall be provided and accessible at the ground level.

1.5.5 The main discharge force main shall be equipped with a magnetic flow meter.

1.6 Electrical:

1.6.1 The electrical panel shall be designed by the city's electrical contractor

1.6.2 3 phase power shall be provided to the site

1.6.3 Variable Frequency Drives (VFD) shall be provided for each pump. The VFD selected shall be approved by the City based upon expected loads and ampacity.

1.6.4 The panel shall have a hand/auto/off switch for each pump.

1.6.5 Electrical supply, control and alarm circuits shall be designed to allow for disconnection of the equipment from the dry pit and electrical room.

1.6.6 The electrical panel shall be located within a fully enclosed building

A. The panel shall have readout for the current level in the wet well, hour meters for each pump, pump running indicator and be equipped with a 120V outlet.

1.6.7 The site shall be equipped with a visual and audio alarm.

1.6.9 Alarm systems should be connected to a backup power source.

1.6.9 The alarm shall be telemetered, including identification of the alarm condition to the operating agency's facility during normal working hours and to the home of the person(s) responsible during off-duty hours.

1.6.10 SCADA:

A. Lift stations shall have Supervisory Control and Data Acquisition (SCADA) capability and compatible with the City's SCADA system. SCADA consists of monitoring equipment, signal wiring, RTU's, radio transmitters, modems, battery backup, antennas, masts, wiring, repeaters, wiring, computers, software, and other miscellaneous and appurtenant equipment used to remotely monitor and operate pumping facilities.

B. The SCADA system shall be designed a contractor selected by the City.

C. System and power supply shall be enclosed in a NEMA 4X enclosure.

D. Power supply shall include 120 V, single phase AC and 24 V DC power.

E. Battery backup via a suitably sized uninterruptible power supply capable of 1 hour backup shall be supplied.

F. RTU's shall have power fail functions.

G. The SCADA system shall monitor and transmit signals including, but not be limited, to the following: Pump on (for each pump), Pump fail (for each pump), Motor Overheat (for each motor), Low water level, Power failure, Generator on, Generator fail, High water level (wet well and dry pit), Grinder Motor Overheat (for each motor), Flow Metering, and Access/Entry Alarm.

1.7 Force Mains:

1.7.1 Force mains shall be constructed of solid wall HDPE pipe, SDR 11 or other approved pipe by the City Engineer.

1.7.2 Force mains must maintain a velocity of not less than 2 feet per second at the average design flow and should avoid velocities above 7 feet per second.

1.7.3 The minimum force main diameter for raw wastewater shall not be less than 4 inches.

1.7.4 An automatic air relief valve shall be placed at high points in the force main to prevent air locking.

1.7.5 Force mains should enter the gravity sewer system at a point not more than 2 foot above the flow line of the receiving manhole.

1.7.6 Force mains shall be designed to withstand normal pressure and pressure surges (water hammer).

1.7.7 Force mains shall be designed with smooth radiuses and full port valves to accommodate pigging in the future.

1.7.8 Acceptance Tests: The preferred testing medium is clean water. Use of other testing medium to be approved by City Engineer. Testing procedure to be as follows:

A. Fill test section completely with water. During filling operation vent off air from pipeline.

B. Pressurize test section to 1.5 times the anticipated operating pressure. Over 3 hour period add water to maintain 1.5 time operating pressure to account for expansion in pipeline.

C. Reduce test pressure by 10 psi and observe for a 1 hour period. A successful test is achieved if pressure is maintained within 5% of testing pressure.

<u>1.8 Approvals:</u> Acceptance of the lift station by the City shall require the following:

1.8.1 All sewage lift stations and their operators must be supplied with a complete set of operational instructions, including emergency procedures, maintenance schedules, special tools, and necessary spare parts. Six copies of the operation and maintenance manuals and control and wiring diagrams.

1.8.2 Four hours (minimum) of operation and maintenance training for City personnel.

1.8.3 Start-up of all major equipment in the lift station shall be by each equipment manufacturer, followed by a report from the manufacturer that the installation complies with their requirements. The City shall be notified 48 hours prior to start-up and testing so that City personnel may attend.

1.8.4 All major equipment shall have a two-year warranty.

1.8.5 The lift station shall operate for 72 hours (minimum) without any failure.

1.8.6 Force main to be acceptance tested per previous specification 1.7.8

- END OF SECTION -

APPENDIX G

IMPACT FEES

PREPARED FOR:

PREPARED BY:

WEST POINT CITY

SEWER IMPACT FEE FACILITIES PLAN and IMPACT FEE ANALYSIS

SEPTEMBER 2021

SEWER IMPACT FEE FACILITIES PLAN

SEPTEMBER 2021

Prepared for:

West Point Utah

Prepared by:

Bowen Collins & Associates

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EXECUTIVE SUMMARY
SEWER IMPACT FEE FACILITIES PLAN

The purpose of an Impact Fee Facilities Plan (IFFP) is to identify demands placed upon West Point City facilities by future development within the city and future annexation areas and to evaluate how these demands will be met by West Point City. The IFFP is also intended to outline the improvements which may be funded through impact fees.

WHY IS AN IFFP NEEDED

The IFFP provides a technical basis for assessing updated impact fees throughout West Point City. This document addresses the future infrastructure needed to serve the study area within West Point City, see Figure 1. The existing and future capital projects documented in this IFFP will ensure that level of service standards is maintained for all existing and future residents who reside within the service area. Local governments must pay strict attention to the required elements of the Impact Fee Facilities Plan which are enumerated in the Impact Fees Act.

PROJECTED FUTURE GROWTH

Before evaluating system capacity, it is first necessary to calculate the demand associated with existing development and projected growth. Using available information for existing development and growth projections from City Officials it was determined that 104.9 ERUs would be developed each year. Projected growth in system demand is summarized in Table ES-1 in terms of Equivalent Residential Units (ERUs).

Table ES-1
West Point Service Area Projections

Year	Connected Service Area ERUs	Estimated Dry Weather Sewer Flows (MGD)
2021	0	0.00
2031	1,049	0.27
2041	2,098	0.53
2051	3,147	0.80
2061	4,196	1.07
2066	4,721	1.20

An ERU represents the demand that a typical single-family residence places on the system. Service Area ERUs shows the existing ERUs within the study area. The basis of an ERU for historical flow rates is summarized in Table ES-2.

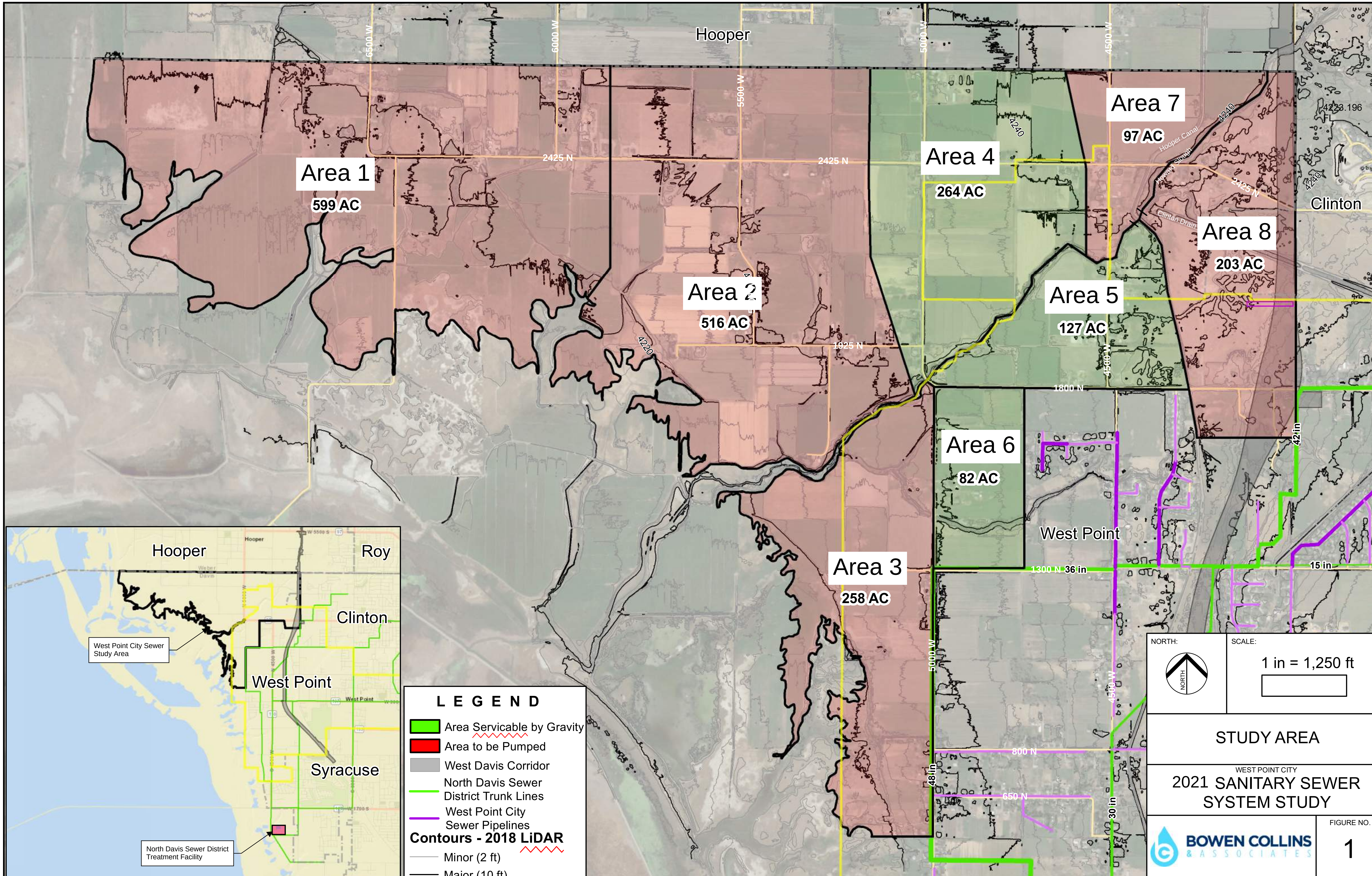

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Table ES-2
Service Area Historic Flows

Item	Value for Existing Conditions[1]	Value for 10-Year Growth	Total 10-Year Conditions
Equivalent Residential Connections (ERUs)	n/a	1,049	1,049
Domestic Wastewater Production (mgd)	n/a	0.23	0.23
Infiltration, Maximum Month (mgd)	n/a	0.04	0.04
Average Day, Maximum Month Flow (mgd)	n/a	0.27	0.27
Peak Hour Flow (mgd)	n/a	0.84	0.84
Flows per ERU			
Domestic Wastewater Production (gpd/ERU)	220	220	220
Average Day, Maximum Month Flow (gpd/ERU)	255	255	255
Peak Hour Flow (gpd/ERU)	800.7	800.7	800.7

[1]There is no existing regional sewer collection system within the study area. All existing residents are serviced by individual septic systems or temporary lift stations. Residents are anticipated to connect to a regional sewer system as it becomes available.

LEVEL OF SERVICE

Level of service is defined in the Impact Fees Act as "the defined performance standard or unit of demand for each capital component of a public facility within a service area". Summary values for both existing and proposed levels of service are contained in Table ES-3.

Table ES-3
Sanitary Sewer Level of Service

	Existing Level of Service[2]	Proposed Level of Service
Gravity Lines - Maximum Ratio of Flow[1] to Pipeline Capacity/Percent of Collection System that Meets the Standard	n/a	0.75/100%
Force Mains - Maximum Velocity (ft/s)/Percent of Collection System that Meets the Standard	n/a	7/100%
Lift Station - Maximum Ratio of Peak Flow to Pumping Capacity/Percent of Collection System that Meets the Standard	n/a	0.85/100%
Design Flow - Average Day, Peak Month Flow (gpd per ERU)	n/a	255

[1] Peak hour, dry weather flow

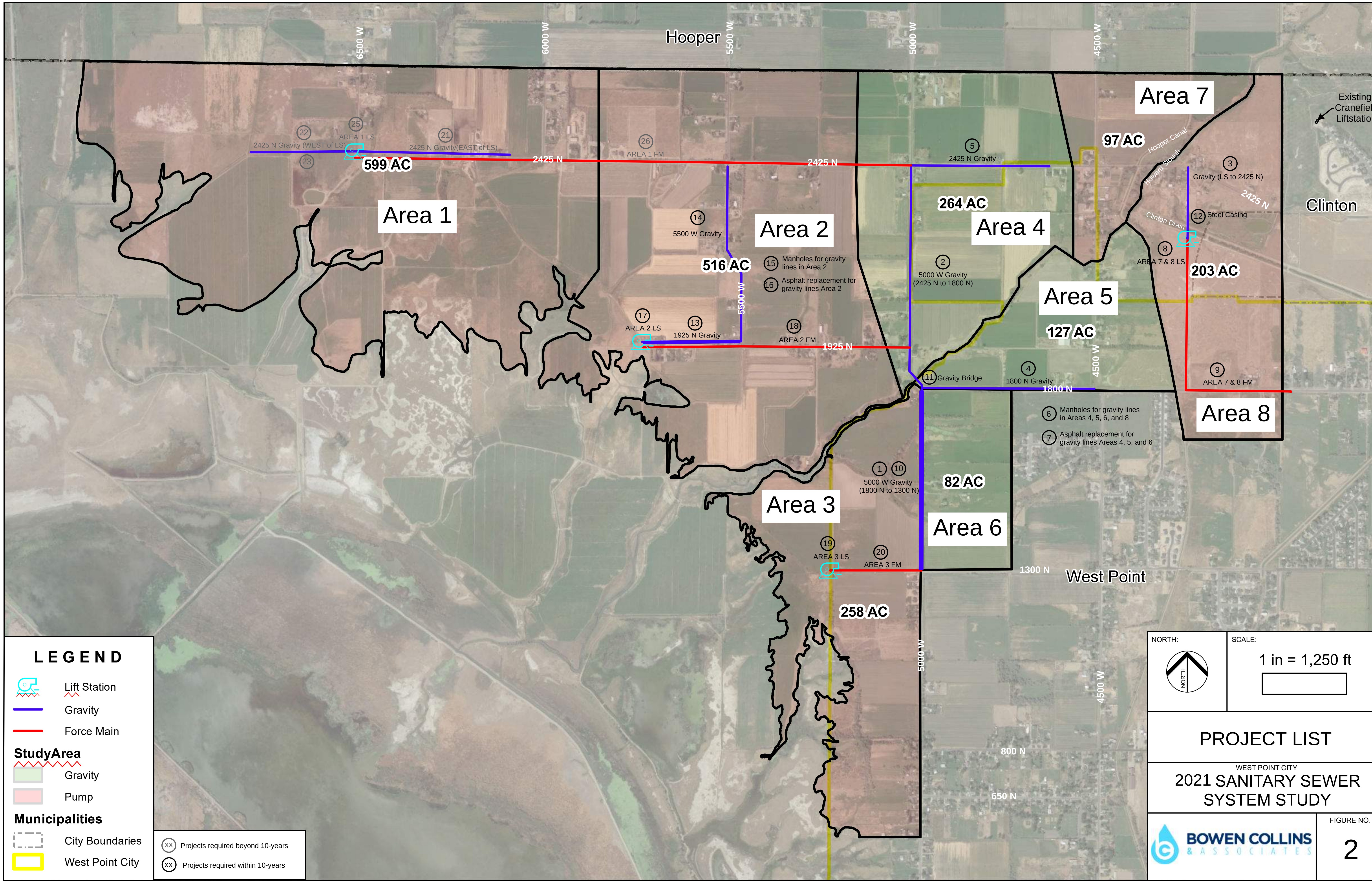
[2]No existing level of service within study area because there is no existing sewer collection system. The level of service was determined based on industry standards, other existing sewer collection within West Point City (outside of the study area) and input from West Point City.

EXISTING CAPACITY AVAILABLE TO SERVE FUTURE GROWTH

There is currently no existing system capacity in the area. Projected future growth will be met through construction of additional system level capacity through new facilities.

REQUIRED SYSTEM IMPROVEMENTS

Additional improvements required to serve new growth are summarized in Table ES-4. To satisfy the requirements of state law, Table ES-4 provides a breakdown of the percentage of the project costs attributed to future users of the system. For future use, capacity has been divided into capacity to be used by growth within the 10-year planning horizon of this IFFP and capacity that will be available for growth beyond the 10-year horizon. These project components' locations are displayed in Figure 2. The order of the projects shown in Table ES-4 are non-consequential and do not represent a chronological order of when projects would be needed. Project order will most likely be determined by specific growth demands and needs of the City. If projects change significantly from what is shown, the IFFP and IFA will need to be updated to reflect these changes.



Hooper
6500 W
6000 W
5500 W
5000 W
4500 W
Area 1
599 AC
Area 2
516 AC
Area 3
258 AC
Area 4
264 AC
Area 5
127 AC
Area 6
82 AC
Area 7
97 AC
Area 8
203 AC
Existing Cranefield Liftstation
Clinton
West Point
2425 N
1925 N
1800 N
1300 N
800 N
650 N
Hooper Canal
Howard Slough
Clinton Drain
22 2425 N Gravity (WEST of LS)
23
25 AREA 1 LS
21 2425 N Gravity (EAST of LS)
26 AREA 1 FM
14 5500 W Gravity
15 Manholes for gravity lines in Area 2
16 Asphalt replacement for gravity lines Area 2
17 AREA 2 LS
13 1925 N Gravity
18 AREA 2 FM
5 2425 N Gravity
2 5000 W Gravity (2425 N to 1800 N)
11 Gravity Bridge
4 1800 N Gravity
3 Gravity (LS to 2425 N)
12 Steel Casing
8 AREA 7 & 8 LS
9 AREA 7 & 8 FM
6 Manholes for gravity lines in Areas 4, 5, 6, and 8
7 Asphalt replacement for gravity lines Areas 4, 5, and 6
1 10 5000 W Gravity (1800 N to 1300 N)
19 AREA 3 LS
20 AREA 3 FM
LEGEND
Lift Station
Gravity
Force Main
StudyArea
Gravity
Pump
Municipalities
City Boundaries
West Point City
XX Projects required beyond 10-years
XX Projects required within 10-years
NORTH:
SCALE:
1 in = 1,250 ft
PROJECT LIST
WEST POINT CITY
2021 SANITARY SEWER SYSTEM STUDY
BOWEN COLLINS & ASSOCIATES
FIGURE NO.
2
P:\West Point City\668-20-01 2020 Sanitary Sewer System Study\4.0 GIS\WPC INFOSMM COMPLETE\WPC INFOSWMM IFFP Project List.mxd kgrover 7/1/2021

Table ES-4
Project Costs Allocated to Projected Development, 10 Year Planning Horizon

Project ID	Year	Project Location	Contributing Areas	Project	Total Project Cost	Percent to Existing	Percent to 10 Year Growth	Percent to Growth 2031 through Buildout	Cost to Existing	Cost to 10 Year Growth	Cost to Growth 2031 through Buildout
Gravity Line Projects											
1 & 10	2021	6	1, 2, 4, 5 & 6	5000 W: 30-inch PVC Sewer Pipeline & Drainage Pipe Loops	$ 1,480,275	2.8%	17.9%	79.3%	$ 41,448	$ 264,969	$ 1,173,858
2	2021	4	1, 2 & 4	5000 W: 24-inch PVC Sewer Pipeline	$ 1,560,600	2.4%	15.5%	82.1%	$ 37,454	$ 241,893	$ 1,281,253
3	2021	8	7 & 8	Clinton Drain Crossing: 12-inch PVC Sewer Pipeline(deeper excavation)	$ 461,700	5.0%	33.2%	61.8%	$ 23,085	$ 153,284	$ 285,331
4	2021	5	5	1800 N: 12-inch PVC Sewer Pipeline	$ 719,550	7.9%	32.2%	59.9%	$ 56,844	$ 231,696	$ 431,010
5	2021	4	4	2425 N: 10-inch PVC Sewer Pipeline	$ 518,805	2.9%	34.0%	63.1%	$ 15,045	$ 176,394	$ 327,366
6	2021	4,5,6, & 8	1, 2, 4, 5, 6, 7 & 8	Sewer Manholes (assumed standard 5-foot diameter) Area 4, 5, 6, and 8 Only	$ 388,800	3.1%	20.3%	76.6%	$ 12,053	$ 78,926	$ 297,821
7	2021	4,5, & 6	1, 2, 4, 5 & 6	Asphalt Replacement for Gravity Sewer Pipelines in Areas 4, 5, and 6 only	$ 1,076,040	2.8%	17.9%	79.3%	$ 30,129	$ 192,611	$ 853,300
11	2021	4 & 5	1, 2 & 4	24-inch Pipe Bridge (80' bridge)	$ 337,500	2.4%	15.5%	82.1%	$ 8,100	$ 52,313	$ 277,088
12	2021	7 & 8	7 & 8	Steel Casing (Clinton Drain)	$ 119,475	5.0%	33.2%	61.8%	$ 5,974	$ 39,665	$ 73,836
13	2026	2	2	1925 N: 18-inch PVC Sewer Pipeline (deeper excavation)	$ 668,250	2.9%	24.3%	72.8%	$ 19,379	$ 162,385	$ 486,486
14	2026	2	2	5500 W: 15-inch PVC Sewer Pipeline (deeper excavation)	$ 1,205,820	2.9%	24.3%	72.8%	$ 34,969	$ 293,014	$ 877,837
15	2026	2	2	Asphalt Replacement for Gravity Sewer Pipelines in Area 2 Only	$ 388,080	2.9%	24.3%	72.8%	$ 11,254	$ 94,304	$ 282,522
16	2026	2	2	Sewer Manholes(assumed standard 5-foot diameter) Area 2 Only	$ 142,560	2.9%	24.3%	72.8%	$ 4,134	$ 34,642	$ 103,784
				Subtotal	$ 9,067,455.0				$ 299,868	$ 2,016,096	$ 6,751,492
Lift Stations & Force Mains Projects											
8	2021	7 & 8	7 & 8	Lift Station (0.7 MGD)	$ 1,559,250	5.0%	33.2%	61.8%	$ 77,962	$ 517,671	$ 963,617
9	2021	7 & 8	7 & 8	FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 583,200	5.0%	33.2%	61.8%	$ 29,160	$ 193,622	$ 360,418
17	2026	2	2	Area 2 Lift Station (1.0 MGD)	$ 2,338,875	2.9%	24.3%	72.8%	$ 67,827	$ 567,721	$ 1,703,327
18	2026	2	2	Area 2 FM: 8-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 672,030	2.9%	24.3%	72.8%	$ 19,489	$ 163,123	$ 489,418
19	2031	3	3	Area 3 Lift Station (0.6 MGD)	$ 1,336,500	6.0%	26.4%	67.6%	$ 80,190	$ 352,243	$ 904,067
20	2031	3	3	Area 3 FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 226,800	6.0%	26.4%	67.6%	$ 13,608	$ 59,775	$ 153,417
				Subtotal	$ 6,716,655				$ 288,236	$ 1,854,155	$ 4,574,264
				Total	$ 15,784,110				$ 588,104	$ 3,870,251	$ 11,325,756

IMPACT FEE FACILITIES PLAN (SEWER)

INTRODUCTION

West Point City has retained Bowen Collins & Associates (BC&A) to prepare an Impact Fee Facilities Plan (IFFP) for sewer collection services provided by the City. The purpose of an IFFP is to identify demands placed upon the City's facilities by future development and evaluate how these demands will be met by the City. The IFFP is also intended to outline the improvements which may be funded through impact fees.

Much of the analysis forming the basis of this IFFP has been taken from the City's 2021 Sewer Study conducted by BC&A. The reader should refer to this document for additional discussion of planning and evaluation methodology beyond what is contained in this report.

SERVICE AREA

The service area for the IFFP and subsequent IFA is defined as the same study area as the 2021 Sewer Study. The current study area includes areas not served by the sewer system currently within West Point City and nearby unincorporated areas of Davis County that may potentially be annexed by West Point City in the future. Generally, the service area is defined on the west by the Great Salt Lake floodplain boundary (officially the 4,217 contour), on the north by the Weber/Davis County line, on the east by the proposed West Davis Corridor, and the south does not extend further south than 500 N (see Figure 1). This study area will be treated as a single service area for the calculation of the Impact Fee. The remainder of the City will not be impacted by this new Impact Fee Study.

IMPACT FEE FACILITY PLAN COMPONENTS

Requirements for the preparation of an IFFP are outlined in Title 11, Chapter 36a of the Utah Code Annotated (the Impact Fees Act). Under these requirements, an IFFP shall accomplish the following for each facility:

1. Identify the existing level of service
2. Establish a proposed level of service
3. Identify excess capacity to accommodate future growth at the proposed level of service
4. Identify demands placed upon existing public facilities by new development
5. Identify the means by which demands from new development will be met
6. Consider the following additional issues:
   a. revenue sources to finance required system improvements
   b. necessity of improvements to maintain the proposed level of service
   c. need for facilities relative to planned locations of schools

The following sections of this report have been organized to address each of these requirements.

EXISTING LEVEL OF SERVICE – Utah Code Annotated 11-36a-302(1)(a)(i)

Level of service is defined in the Impact Fees Act as "the defined performance standard or unit of demand for each capital component of a public facility within a service area". This section discusses the level of service being currently provided to existing users.

Unit of Demand

For the purposes of this analysis, it is useful to define these various demands in terms of Equivalent Residential Units (ERUs). An ERU represents the demand that a typical single-family residence places on the system. Historic water consumption and sewer flow data gathered as part of the ongoing North Davis Sewer District (NDSD) Impact Fee Study was used to estimate average sewer flows for the study area, including allowance for inflow and infiltration (I&I). Based on this data an assumed 220 gpd/ERU (domestic wastewater production) + 55 gpd/ERU (I&I) = 255 gpm/ERU was used as the average day, maximum month domestic wastewater flow. This is summarized in Table 1.

Table 1
Service Area Historic Flows and Definition of an ERU

Item	Value for Existing Connections[1]	Value for 10-Year Growth (connected to system)	Total 10-Year Conditions
Equivalent Residential Connections (ERUs)	n/a	1,049	1,049
Domestic Wastewater Production (mgd)	n/a	0.23	0.23
Infiltration, Maximum Month (mgd)	n/a	0.04	0.04
Average Day, Maximum Month Flow (mgd)	n/a	0.27	0.27
Peak Hour Flow (mgd)	n/a	0.84	0.84
Flows per ERU			
Domestic Wastewater Production (gpd/ERU)	220	220	220
Average Day, Maximum Month Flow (gpd/ERU)	255	255	255
Peak Hour Flow (gpd/ERU)	800.7	800.7	800.7

[1]There is no existing system level sewer collection system in the study area.

Included in the table is the flow per ERU in terms of both average and peak flows. Conveyance pipelines, lift stations, and force mains must be designed based on peak hour flow (function of daily flow and diurnal flow variation).

Performance Standard

Performance standards are those standards that are used to design and evaluate the performance of facilities. This section discusses the existing performance standards for the study area.

1. **Peak Design Flows** – Peaking factors used are based on the State of Utah Peak Instantaneous Demand equation (refer to Utah Code R309-105-9). Peaking factors were adjusted based on the contributing area size. Peaking factors ranged from 2.3 to 4.0 depending on the

contributing area size. Gravity pipelines, force mains and lift stations were designed based on these peaking factors.

2. **Gravity Pipeline Capacity** – City standards require that all gravity driven sewer mains be designed such that the peak flow in the pipe is less than or equal to 75 percent of the pipe's full capacity using a manning's roughness factor of 0.013.
3. **Gravity Pipeline Slopes** – Due to the flat terrain and shallow existing sewer, the City's standards require that all system level gravity trunk lines and most project level sewer pipelines be installed at minimum slopes as defined by the State of Utah [R317-3-2.3(D)(4)]. If pipelines are installed at greater slopes, the serviceable area by gravity will be reduced. Some sewer pipes were upsized to minimize the required slope and maximize the area serviceable by gravity. These upsized pipes can potentially create additional operation and maintenance (O&M) costs for the City. These potential increases in O&M were discussed with City officials and were determined to be an economical solution to service the study area.
4. **Force main capacity -** City standards require that all force mains be designed such that the maximum flow velocity is no greater than 7 feet per second.
5. **Lift stations -** City standards require that all lift stations be designed such that the maximum ratio of the peak flow to pumping capacity is no greater than 0.85.

These design standards were used as the level of service for the system evaluation.

Existing Level of Service Summary

Currently, there is no existing system level sewer service in the City's study area. The level of service was determined based on industry standards, other existing sewer collection within West Point City (outside of the study area) and input from City personnel. The majority of the existing residents in the study area rely on septic systems for the disposal and treatment of their wastewater. There is a small subdivision (Sunview Estates) within the study area that has a temporary lift station, that will eventually be replaced by a regional lift station, that conveys wastewater to an existing gravity line. As the development is not currently complete (as of this study), it was assumed that 15 out of the 30 possible units would be existing for the purposes of the Impact Fee calculations.

PROPOSED LEVEL OF SERVICE - Utah Code Annotated 11-36a-302(1)(a)(ii)

The proposed level of service is the performance standard used to evaluate system needs in the future. The Impact Fee Act indicates that the proposed level of service may:

1. diminish or equal the existing level of service; or
2. exceed the existing level of service if, independent of the use of impact fees, the City implements and maintains the means to increase the level of service for existing demand within six years of the date on which new growth is charged for the proposed level of service.

In the case of this IFFP, no changes are proposed to the existing level of service for design standards. Thus, future growth will essentially be evaluated based on the same design standards level of service as identified for existing.

Proposed Level of Service Summary

The resulting proposed level of service for the City is summarized in Table 2.

Table 2
Proposed Sanitary Sewer Level of Service

	Existing Level of Service[2]	Proposed Level of Service
Gravity Lines - Maximum Ratio of Flow[1] to Pipeline Capacity/Percent of Collection System that Meets the Standard	n/a	0.75/100%
Force Mains - Maximum Velocity (ft/s)/Percent of Collection System that Meets the Standard	n/a	7/100%
Lift Station - Maximum Ratio of Peak Flow to Pumping Capacity	n/a	0.85/100%
Design Flow - Average Day, Peak Month Flow (gpd per ERU)	n/a	255

[1]Peak hour, dry weather flow
[2]No existing system level City sewer within the study area.

EXCESS CAPACITY TO ACCOMMODATE FUTURE GROWTH - Utah Code Annotated 11-36a-302(1)(a)(iii)

There is no existing system level sewer service in the study area. As such, there is no excess capacity in the current system to accommodate for future growth. All future growth capacity will be accommodated by the future system level sewer system.

DEMANDS PLACED ON FACILITIES BY NEW DEVELOPMENT - Utah Code Annotated 11-36a-302(a)(iv)

Growth within the City's study area, and projections of sewer flows resulting from said growth is discussed in detail in the City's Sewer Study. Growth in terms of both Equivalent Residential Units and corresponding sewer flows is summarized in Table 3.

Table 3
West Point Projections of Growth

Year	Total Area ERUs[1]	Connected ERUs[2]	Domestic Wastewater (MGD)	Max Month Infiltration (MGD)	Total Max Month, Average Day Flow (MGD)	Peak Hour Flows - City Area (MGD)
2021	164	0	0.00	0.00	0.00	0.00
2031	1,158	1,049	0.23	0.04	0.27	0.84
2041	2,176	2,098	0.46	0.07	0.53	1.68
2051	3,194	3,147	0.69	0.11	0.80	2.52
2061	4,211	4,196	0.92	0.15	1.07	3.36
2066	4,721	4,721	1.04	0.17	1.20	3.78

[1] Total area ERUs are the total number of ERUs within the study area. There are approximately 164 existing ERUs that will connect to the system as the system is built out. For this study, it was assumed that 15 out of the 30 total units of the Sunview Estates Subdivision were considered existing.
[2] This column represents the assumed total ERUs connected to the City's sewer system within the study area.

It is important to track the existing ERUs connecting to the system as the City has not yet fully decided whether existing residents will be required to pay impact fees. However, for the purposes of this analysis, it has been assumed that existing residents will not be required to pay the sewer impact fee. This will result in a slightly lower impact fee for all users than if they were included in the impact fee calculation. If the City does want to collect impact fees from existing residents within the study area, the impact fee would need to be updated to reflect this change.

INFRASTRUCTURE REQUIRED TO MEET DEMANDS OF NEW DEVELOPMENT – Utah Code Annotated 11-36a-302(1)(a)(v)

To satisfy the requirements of state law, demands placed upon existing system facilities by future development was projected using the process outlined below. Each of the steps were completed as part of this plan's development:

1. **Existing Demand** – There is no existing demand that will be placed on the City's system level sewer system. The existing ERUs in the study area will connect to the system as it becomes available but is currently being served by individual septic systems or a temporary lift station.
2. **Existing Capacity** – There is no existing system level capacity, as the City currently has no existing system level collection system facilities within the study area.
3. **Existing Deficiencies** – There is no existing deficiencies, as the existing ERUs are serviced by individual septic tanks or a temporary lift station.
4. **Future Demand** - The demand future development will place on the system was estimated based on development projections (See the 2021 Sewer Study).
5. **Future Deficiencies** – There will be no future deficiencies within the study area because the sewer system will be initially built for build-out conditions.
6. **Recommended Improvements** – Needed system improvements were identified to meet demands associated with future development.

The steps listed above "identify demands placed upon existing public facilities by new development activity at the proposed level of service; and… the means by which the political subdivision or private entity will meet those growth demands" (Section 11-36a-302(1)(a) of the Utah Code Annotated).

10 Year Improvement Plan

In the City's 2021 Sewer Study, capital facility projects needed to provide service to customers of the study area were identified. Some of the projects identified in the study will not be needed within the next 10 years. Only infrastructure to be constructed within a 10-year horizon will be considered in the calculation of impact fees to avoid uncertainty surrounding improvements further into the future. Table 4 summarizes the components of projects identified in the sewer study that will need to be constructed within the next ten years. These project components' locations are displayed in Figure 2.

Table 4
Project Costs Allocated to Projected Development, 10 Year Planning Horizon

Project ID	Year	Project Location	Contributing Areas	Project	Total Project Cost	Percent to Existing	Percent to 10 Year Growth	Percent to Growth 2031 through Buildout	Cost to Existing	Cost to 10 Year Growth	Cost to Growth 2031 through Buildout
Gravity Line Projects											
1 & 10	2021	6	1, 2, 4, 5 & 6	5000 W: 30-inch PVC Sewer Pipeline & Drainage Pipe Loops	$ 1,480,275	2.8%	17.9%	79.3%	$ 41,448	$ 264,969	$ 1,173,858
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6	2021	4,5,6, & 8	1, 2, 4, 5, 6, 7 & 8	Sewer Manholes (assumed standard 5-foot diameter) Area 4, 5, 6, and 8 Only	$ 388,800	3.1%	20.3%	76.6%	$ 12,053	$ 78,926	$ 297,821
7	2021	4,5, & 6	1, 2, 4, 5 & 6	Asphalt Replacement for Gravity Sewer Pipelines in Areas 4, 5, and 6 only	$ 1,076,040	2.8%	17.9%	79.3%	$ 30,129	$ 192,611	$ 853,300
11	2021	4 & 5	1, 2 & 4	24-inch Pipe Bridge (80' bridge)	$ 337,500	2.4%	15.5%	82.1%	$ 8,100	$ 52,313	$ 277,088
12	2021	7 & 8	7 & 8	Steel Casing (Clinton Drain)	$ 119,475	5.0%	33.2%	61.8%	$ 5,974	$ 39,665	$ 73,836
13	2026	2	2	1925 N: 18-inch PVC Sewer Pipeline (deeper excavation)	$ 668,250	2.9%	24.3%	72.8%	$ 19,379	$ 162,385	$ 486,486
14	2026	2	2	5500 W: 15-inch PVC Sewer Pipeline (deeper excavation)	$ 1,205,820	2.9%	24.3%	72.8%	$ 34,969	$ 293,014	$ 877,837
15	2026	2	2	Asphalt Replacement for Gravity Sewer Pipelines in Area 2 Only	$ 388,080	2.9%	24.3%	72.8%	$ 11,254	$ 94,304	$ 282,522
16	2026	2	2	Sewer Manholes(assumed standard 5-foot diameter) Area 2 Only	$ 142,560	2.9%	24.3%	72.8%	$ 4,134	$ 34,642	$ 103,784
				Subtotal	$ 9,067,455.0				$ 299,868	$ 2,016,096	$ 6,751,492
Lift Stations & Force Mains Projects											
8	2021	7 & 8	7 & 8	Lift Station (0.7 MGD)	$ 1,559,250	5.0%	33.2%	61.8%	$ 77,962	$ 517,671	$ 963,617
9	2021	7 & 8	7 & 8	FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 583,200	5.0%	33.2%	61.8%	$ 29,160	$ 193,622	$ 360,418
17	2026	2	2	Area 2 Lift Station (1.0 MGD)	$ 2,338,875	2.9%	24.3%	72.8%	$ 67,827	$ 567,721	$ 1,703,327
18	2026	2	2	Area 2 FM: 8-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 672,030	2.9%	24.3%	72.8%	$ 19,489	$ 163,123	$ 489,418
19	2031	3	3	Area 3 Lift Station (0.6 MGD)	$ 1,336,500	6.0%	26.4%	67.6%	$ 80,190	$ 352,243	$ 904,067
20	2031	3	3	Area 3 FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 226,800	6.0%	26.4%	67.6%	$ 13,608	$ 59,775	$ 153,417
				Subtotal	$ 6,716,655				$ 288,236	$ 1,854,155	$ 4,574,264
				Total	$ 15,784,110				$ 588,104	$ 3,870,251	$ 11,325,756

Project Cost Attributable to Future Growth

To satisfy the requirements of state law, Table 4 provides a breakdown of the capital facility projects and the percentage of the project costs attributed to existing and future users. As defined in Utah Code Annotated 11-36a-102(15), the Impact Fee Facilities Plan should only include the proportionate share of "the cost of public facilities that are roughly proportionate and reasonably related to the service demands and needs of any development activity." Some projects identified in the table are required solely to meet future growth, but some projects also provide a benefit to existing users. Projects that benefit existing users include those projects addressing existing capacity needs and maintenance related projects.

All projects within the City's study area needed to service existing residents and new growth, costs have been divided proportionally between existing and future users based on their use of the facility. A few additional notes regarding specific projects are as follows:

Project Cost Attributable to 10 Year Growth

Included in Table 4 is a breakdown of capacity use associated with growth both through the next 10 years and for growth beyond 10 years. A challenge of sewer infrastructure is that it is not cost effective to add capacity in small increments. Once a pipeline is being built, it needs to be built to satisfy long term capacity needs. As a result, the improvements proposed in the Impact Fee Facility Plan will include capacity for growth beyond the 10-year planning window. To most accurately evaluate the cost of providing service for growth during the next ten years, added consideration has been given to evaluating how much of each improvement will be used in the next 10 years. This has been done following the same methodology as described above.

Basis of Construction Cost Estimates

The costs of construction for projects to be completed within ten years have been estimated based on past BC&A experiences with projects of a similar nature. Pipeline project costs are based on average per foot costs for pipes of a similar nature. Lift Station project costs include consideration of other components of the sanitary sewer system including manholes and surface restoration as appropriate for each project. Details of the cost estimates can be found in the City's 2021 Sewer Study.

ADDITIONAL CONSIDERATIONS

MANNER OF FINANCING – Utah Code Annotated 11-36a-302(2)

The City may fund the infrastructure identified in this IFFP through a combination of different revenue sources.

Federal and State Grants and Donations

West Point City is pursuing grant donations but have not secured any at this time. Impact fees cannot reimburse costs funded or expected to be funded through federal grants and other funds that the City has received for capital improvements without an obligation to repay. Grants and donations are not currently contemplated in this analysis. If grants become available for constructing facilities, impact fees will need to be recalculated and an appropriate credit given.

Bonds

None of the costs contained in this IFFP include the cost of bonding. The cost of bonding required to finance impact fee eligible improvements identified in the IFFP may be added to the calculation of the impact fee. This will be considered in the impact fee analysis.

User Rate Revenue

Because infrastructure must generally be built ahead of growth, there often arises situations in which projects must be funded ahead of expected impact fee revenues. In some cases, the solution to this issue will be bonding. In others, funds from existing user rate revenue will be used to complete initial construction of impact fee eligible projects and will be reimbursed later as impact fees are received. Consideration of potential use of user rate revenue to pay for impact fee eligible expenditures will be included in the impact fee analysis and should also be considered in subsequent accounting of impact fee expenditures.

Impact Fees

It is recommended that impact fees be used to fund growth-related capital projects as they help to maintain the proposed level of service and prevent existing users from subsidizing the capital needs for new growth. Based on this IFFP, an impact fee analysis will be able to calculate a fair and legal fee that new growth should pay to fund the portion of the existing and new facilities that will benefit new development.

Developer Dedications and Exactions

Developer exactions are not the same as grants. Developer exactions may be considered in the inventory of current and future infrastructure. If a developer constructs facilities or dedicates land within the development for the construction of facilities identified in this IFFP, the value of the dedication is credited against that particular developer's impact fee liability.

If the value of the dedication/exaction is less than the development's impact fee liability, the developer will owe the balance of the liability to the City. If the value of the improvements dedicated is worth more than the development's impact fee liability, the City must reimburse the difference to the developer from impact fee revenues collected from other developments.

It should be emphasized that the concept of impact fee credits pertains to system level improvements only. For project level improvement (i.e. projects not identified in the Impact Fee Facility Plan), developers will be responsible for the construction of the improvements without credit against the impact fee.

NECESSITY OF IMPROVEMENTS TO MAINTAIN LEVEL OF SERVICE - Utah Code Annotated 11-36a-302(3)

According to State statute, impact fees cannot be used to correct deficiencies in the City's system and must be necessary to maintain the proposed level of service established for all users. Only those facilities or portions of facilities that are required to maintain the proposed level of service for future growth have been included in this IFFP. This will result in an equitable fee as future users will not be expected to fund any portion of the facilities that will benefit existing residents.

SCHOOL RELATED INFRASTRUCTURE - Utah Code Annotated 11-36a-302(2)

As part of the noticing and data collection process for this plan, information was gathered regarding future school District and charter school development. The locations of schools are unknown; however, the study did account for 3 schools within the study area. Where the City is aware of the planned location of a school, required public facilities to serve the school have been included in the Impact Fee Facility Plan.

NOTICING AND ADOPTION REQUIREMENTS - Utah Code Annotated 11-36a-502

The Impact Fees Act requires that entities must publish a notice of intent to prepare or modify any IFFP. If an entity prepares an independent IFFP rather than include a capital facilities element in the general plan, the actual IFFP must be adopted by enactment. Before the IFFP can be adopted, a reasonable notice of the public hearing must be published in a local newspaper at least 10 days before the actual hearing. A copy of the proposed IFFP must be made available in each public library within the City during the 10-day noticing period for public review and inspection. Utah Code requires that the City must post a copy of the ordinance in at least three places or on the City's website. These places may include the City offices and the public libraries within the City's jurisdiction. Following the 10-day noticing period, a public hearing will be held, after which the City may adopt, amend and adopt, or reject the proposed IFFP.

IMPACT FEE CERTIFICATION - Utah Code Annotated 11-36a-306(1)

This IFFP has been prepared in accordance with Utah Code Annotated Title 11, Chapter 36a (the "Impact Fees Act"), which prescribes the laws pertaining to the imposition of impact fees in Utah. The accuracy of this IFFP relies in part upon planning, engineering, and other source data, provided by the City and its designees.

In accordance with Utah Code Annotated, 11-36a-306(1), Bowen Collins & Associates makes the following certification:

I certify that the attached Impact Fee Facilities Plan:

1. Includes only the costs of public facilities that are:
   a. allowed under the Impact Fees Act; and
   b. actually incurred; or
   c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include:
   a. costs of operation and maintenance of public facilities;
   b. cost for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; or
   c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every relevant respect with the Impact Fees Act.

Keith Larson, P.E.

SEWER IMPACT FEE ANALYSIS

SEPTEMBER 2021

Prepared for:

West Point Utah

Prepared by:

Bowen Collins & Associates

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EXECUTIVE SUMMARY
SEWER IMPACT FEE ANALYSIS

The purpose of the impact fee analysis (IFA) is to calculate the allowable impact fee that may be assessed to new development in accordance with Utah Code.

WHY ASSESS AN IMPACT FEE?

Until development utilizes the full capacity of existing facilities, West Point City can assess an impact fee to recover its cost of latent capacity available to serve future development. The general impact fee methodology divides the available capacity of existing and future capital projects between the number of existing and future users. Capacity is measured in terms of Equivalent Residential Units, or ERUs, which represents the demand that a typical single-family residence places on the system.

HOW ARE IMPACT FEES CALCULATED?

A fair impact fee is calculated by dividing the cost of existing and future facilities by the amount of new growth that will benefit from the unused capacity. Only the capacity that is needed to serve the projected growth within in the next ten years is included in the fee. Costs used in the calculation of impact fees include:

- New facilities required to maintain (but not exceed) the proposed level of service in the system; only those expected to be built within ten years are considered in the final calculations of the impact fee.
- Historic costs of existing facilities that will serve new development
- Cost of professional services for engineering, planning, and preparation of the Impact Fee Facilities Plan and impact fee analysis

Costs not used in the impact fee calculation

- Operational and maintenance costs
- Cost of facilities constructed beyond 10 years
- Cost associated with capacity not expected to be used within 10 years
- Cost of facilities funded by grants, developer contributions, or other funds which West Point City is not required to repay
- Cost of renovating or reconstructing facilities which do not provide new capacity or needed enhancement of services to serve future development

IMPACT FEE CALCULATION

Impact fees for this analysis were calculated by dividing the proportional cost of facilities required to service 10-year growth by the amount of growth expected over the next 10-years based on ERUs. This is done for all of the needed gravity collection, lift station, and force main facilities within the study area. Calculated impact fees by component are summarized in Table ES-1.

Table ES-1
Impact Fee Calculation per ERU – West Point City Service Area

System Components	Total Cost of Component	% Serving 10-year Growth	Cost Serving 10-year Growth	10-year ERUs Served	Cost Per ERU
Collection Facilities					
10-Year Projects	$ 15,784,110	24.5%	$ 3,870,251	1049	$ 3,689
10-Year Project Interest Costs	$ 6,760,806	24.5%	$ 1,657,744	1049	$ 1,580
Credit for User Fees Paid Toward Existing					$ (128.96)
Subtotal	$ 22,544,916		$ 5,527,995		$ 5,141
Studies					
All Studies	$ 65,300	96.3%	$ 62,867	1049	$ 59.93
TOTAL	$ 22,610,216		$ 5,590,862		$ 5,201

RECOMMENDED IMPACT FEE

The total calculated impact fees are summarized in Table ES-2. Included in this table is the appropriate user fee credit and corresponding overall fee. The calculated user fee credit associated with the impact fees will decrease over time. As a result, the allowable impact fee will increase over time as shown in the table. This is the legal maximum amount that may be charged as an impact fee. A lower amount may be adopted if desired, but a higher fee is not allowable under the requirements of Utah Code.

Table ES-2
Recommended Per ERU Impact Fee – West Point City Service Area

	Maximum Allowable Impact Fee (Per ERU, by year)					
	2021	**2022**	**2023**	**2024**	**2025**	**2026**
Base Impact Fee (includes study costs)	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71
User Fee Credit	$ (128.96)	$ (122.73)	$ (116.80)	$ (111.16)	$ (105.78)	$ (100.67)
Total Overall Fee	$ 5,200.74	$ 5,206.97	$ 5,212.90	$ 5,218.55	$ 5,223.92	$ 5,229.04

IMPACT FEE ANALYSIS (SEWER)

INTRODUCTION

West Point City has retained Bowen Collins & Associates (BC&A) to prepare an impact fee analysis (IFA) for its sewer system based on a recently completed impact fee facilities plan. An impact fee is a one-time fee, not a tax, imposed upon new development activity as a condition of development approval to mitigate the impact of the new development on public infrastructure. The purpose of an IFA is to calculate the allowable impact fee that may be assessed to new development in accordance with Utah Code.

Service Areas

The service area for the IFA is defined as the same study area as the IFFP and the 2021 Sewer Study. The current study area includes areas not served by the sewer system currently within West Point City and nearby unincorporated areas of Davis County that may potentially be annexed by West Point City in the future. Generally, the service area is defined on the west by the Great Salt Lake floodplain boundary (officially the 4,217 contour), on the north by the Weber/Davis County line, on the east by the proposed West Davis Corridor, and the south does not extend further south than 500 N (see Figure 1). This study area will be treated as a single service area for the calculation of the Impact Fee. The remainder of the City will not be impacted by this new Impact Fee Study.

Requirements

Requirements for the preparation of an IFA are outlined in Title 11, Chapter 36a of the Utah Code (the Impact Fees Act). Under these requirements, an IFA shall accomplish the following for each facility:

1. Identify the impact of anticipated development activity on existing capacity
2. Identify the impact of anticipated development activity on system improvements required to maintain the established level of service
3. Demonstrate how the impacts are reasonably related to anticipated development activity
4. Estimate the proportionate share of:
    a. Costs of existing capacity that will be recouped
    b. Costs of impacts on system improvements that are reasonably related to the new development activity
5. Identify how the impact fee was calculated
6. Consider the following additional issues
    a. Manner of financing improvements
    b. Dedication of system improvements
    c. Extraordinary costs in servicing newly developed properties
    d. Time-price differential

The following sections of this report have been organized to address each of these requirements.

IMPACT ON SYSTEM - 11-36A-304(1)(A)(B)

Growth within West Point City's service area, and projections of sewer flows resulting from said growth is discussed in detail in the City's Impact Fee Facilities Plan. For the purposes of impact fee calculation, growth in the system has been expressed in terms of equivalent residential units (ERUs). An ERU represents the demand that a typical single-family residence places on the system. Growth in ERUs projected for the service area is summarized in Table 1.

Table 1
Projected West Point Water Sewer System Growth – Flow ERUs

Year	Connected Service Area ERUs	Estimated Dry Weather Sewer Flows (MGD)
2021	0	0.00
2031	1,049	0.27
2041	2,098	0.53
2051	3,147	0.80
2061	4,196	1.07
2066	4,721	1.20

As indicated in the table, projected growth for the 10-year planning window of this impact fee analysis is 1,049 ERUs or about 105 ERUs per year. New facilities will be constructed to increase capacity to meet the needs of future projected growth. These required system improvements are detailed in the Impact Fee Facilities Plan.

RELATION OF IMPACTS TO ANTICIPATED DEVELOPMENT - 11-36A-304(1)(C)

To satisfy the requirements of state law, it is necessary to show that all impacts identified in the impact fee analysis are reasonably related to the anticipated development activity. This has been documented in detail in the Impact Fee Facilities Plan. In short, only that capacity directly associated with demand placed upon existing system facilities by future development has been identified as an impact of the development. The steps completed to identify the impacts of anticipated development are as follows.

1. **Existing Demand** – There is no existing demand that will be placed on the City's system level sewer system. The existing ERUs in the study area will connect to the system as it becomes available but is largely currently being served by individual septic systems. There is one small subdivision (Sunview Estates) within the study area this is currently being constructed and will be serviced by a temporary lift station, that will eventually be replaced by a regional lift station. As this development is not currently complete (as of this study), it was assumed that 15 out of the 30 possible units would be existing for the purposes of the Impact Fee calculations.
2. **Existing Capacity** – There is no existing system level capacity, as the City currently has no existing system level collection system facilities within the study area.
3. **Existing Deficiencies** – There is no existing deficiencies, as the existing ERUs are serviced by individual septic tanks or a temporary lift station.
4. **Future Demand** - The demand future development will place on the system was estimated based on development projections as discussed in the Impact Fee Facilities Plan.

5. **Future Deficiencies** – There will be no future deficiencies within the study area because the sewer system will be initially built for build-out conditions.
6. **Recommended Improvements** – Needed system improvements were identified to meet demands associated with future development.

Proportionate Share Analysis – 11 – 36A-304(D)

A comprehensive proportionate share analysis associated with anticipated future development and its impact on the system was completed as part of the Impact Fee Facilities Plan. A summary of that analysis is contained here with additional discussion of the costs of facilities impacted by growth.

Excess Capacity to Accommodate Future Growth

There is no existing sewer collection service within the West Point City study area. This means that there is no excess capacity in the current system to accommodate for future growth. The residents in the area rely on septic systems for the disposal of wastewater. The needs of projected future growth will be met solely through construction of additional capacity in new facilities.

Existing System Infrastructure Costs

West Point City currently has no existing infrastructure costs; the city currently has no existing sewer collection system in the study area.

Reimbursement Agreements

There are no current reimbursement agreements existing within West Point City's system that have not already been accounted for in the existing infrastructure analysis.

Future Improvements

All demand within the study area associated with projected future development will be met through the construction of additional capacity in new facilities. A primary focus of the Impact Fee Facilities Plan was the identification of projects required to serve new development. The results of the Impact Fee Facilities Plan are summarized in Table 2. Included in the table are the costs of each required project and the portion of costs associated with development for the 10-year planning window. All cost estimates contained in this IFA have been taken directly from the IFFP. The basis of these estimates is documented in the IFFP.

Table 2
Impact Fee Eligible Capital Projects

Project ID	Year	Project Location	Contributing Areas	Project	Total Project Cost	Percent to 10-Year Growth	Cost to 10-Year Growth
Gravity Line Projects							
1 & 10	2021	6	1, 2, 4, 5 & 6	5000 W: 30-inch PVC Sewer Pipeline & Drainage Pipe Loops	$ 1,480,275	17.9%	$ 264,969
2	2021	4	1, 2 & 4	5000 W: 24-inch PVC Sewer Pipeline	$ 1,560,600	15.5%	$ 241,893
3	2021	8	7 & 8	Clinton Drain Crossing: 12-inch PVC Sewer Pipeline(deeper excavation)	$ 461,700	33.2%	$ 153,284
4	2021	5	5	1800 N: 12-inch PVC Sewer Pipeline	$ 719,550	32.2%	$ 231,696
5	2021	4	4	2425 N: 10-inch PVC Sewer Pipeline	$ 518,805	34.0%	$ 176,394
6	2021	4,5,6, & 8	1, 2, 4, 5, 6, 7 & 8	Sewer Manholes (assumed standard 5-foot diameter) Area 4, 5, 6, and 8 Only	$ 388,800	20.3%	$ 78,926
7	2021	4,5, & 6	1, 2, 4, 5 & 6	Asphalt Replacement for Gravity Sewer Pipelines in Areas 4, 5, and 6 only	$ 1,076,040	17.9%	$ 192,611
11	2021	4 & 5	1, 2 & 4	24-inch Pipe Bridge (80' bridge)	$ 337,500	15.5%	$ 52,313
12	2021	7 & 8	7 & 8	Steel Casing (Clinton Drain)	$ 119,475	33.2%	$ 39,665
13	2026	2	2	1925 N: 18-inch PVC Sewer Pipeline (deeper excavation)	$ 668,250	24.3%	$ 162,385
14	2026	2	2	5500 W: 15-inch PVC Sewer Pipeline (deeper excavation)	$ 1,205,820	24.3%	$ 293,014
15	2026	2	2	Asphalt Replacement for Gravity Sewer Pipelines in Area 2 Only	$ 388,080	24.3%	$ 94,304
16	2026	2	2	Sewer Manholes(assumed standard 5-foot diameter) Area 2 Only	$ 142,560	24.3%	$ 34,642
				Subtotal	$ 9,067,455		$ 2,016,096
Lift Stations & Force Mains Projects							
8	2021	7 & 8	7 & 8	Lift Station (0.7 MGD)	$ 1,559,250	33.2%	$ 517,671
9	2021	7 & 8	7 & 8	FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 583,200	33.2%	$ 193,622
17	2026	2	2	Area 2 Lift Station (1.0 MGD)	$ 2,338,875	24.3%	$ 567,721
18	2026	2	2	Area 2 FM: 8-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 672,030	24.3%	$ 163,123
19	2031	3	3	Area 3 Lift Station (0.6 MGD)	$ 1,336,500	26.4%	$ 352,243
20	2031	3	3	Area 3 FM: 6-inch Force Main - (DR11 HDPE) w/ Asphalt	$ 226,800	26.4%	$ 59,775
				Subtotal	$ 6,716,655		$ 1,854,155
				Total	$ 15,784,110		$ 3,870,251

Planning and Impact Fee Studies

Utah Code allows for the cost of planning and engineering associated with impact fee calculations to be recovered as part of an impact fee. The final impact fee will include the cost of this study and recommended planning projects in the next ten years as summarized in Table 3.

Table 3
Impact Fee Costs Associated with Studies per ERU

System Components	Total Cost of Component	% Serving 10-Year Growth	Cost Serving 10-Year Growth	10-Year ERUs Served	Cost Per ERU
2021 Sewer Impact Fee Facility Plan & Sewer Study	$ 54,000	96.3%	$ 51,988	1,049	$ 49.56
2021 Impact Fee Analysis	$ 11,300	96.3%	$ 10,879	1,049	$ 10.37
Subtotal	$ 65,300		$ 62,867		$ 59.93

IMPACT FEE CALCULATION - 11-36A-304(1)(E)

Using the information contained in the previous sections, impact fees can be calculated by dividing the proportional cost of facilities required to service 10-year growth by the amount of growth expected over the next 10-years. Calculated impact fees by component are summarized in Table 4 for West Point City.

Table 4
Impact Fee Calculation per ERU – West Point City Service Area

System Components	Total Cost of Component	% Serving 10-year Growth	Cost Serving 10-year Growth	10-year ERUs Served	Cost Per ERU
Collection Facilities					
10-Year Projects	$ 15,784,110	24.5%	$ 3,870,251	1049	$ 3,689
10-Year Project Interest Costs	$ 6,760,806	24.5%	$ 1,657,744	1049	$ 1,580
Credit for User Fees Paid Toward Existing					$ (128.96)
Subtotal	$ 22,544,916		$ 5,527,995		$ 5,141
Studies					
All Studies	$ 65,300	96.3%	$ 62,867	1049	$ 59.93
TOTAL	$ 22,610,216		$ 5,590,862		$ 5,201

Bonding Interest Costs

In addition to construction costs, Table 4 includes the cost of bond interest expense where applicable. This includes both historic interest costs on existing facilities where new growth will benefit from excess capacity (does not apply to this specific IFA) and future interest costs for bonds required to build projects needed for growth as identified in the Impact Fee Facilities Plan. Similar to project construction costs, only that portion of interest expense associated with capacity for growth is included in the impact fee calculation. In the case of West Point City's wastewater system, the following bonds were included in the study

- **Future 2021 Wastewater Bond** – This is the recommended bond that the City would need to fully fund the system level projects to service Areas 4, 5, 6, 7 and 8. For this study it was assumed that these projects would be fully funded through bonding. Based on guidance from the City, it is expected that this bond will be issued in 2021 or 2022 and would be a 20-year bond at 3.5 percent interest. This brings the total bond payment to $12,576,723. This was included in the table above and impact fee calculation.
- **Future 2026 Wastewater Bond** – This is the recommended bond that the City would need to fully fund the system level projects to service Area 2. For this study it was assumed that these projects would be fully funded through bonding. Based on guidance from the City, it is expected that this bond will be issued in 2026 or 2027 and would be a 20-year bond at 3.5 percent interest. This brings the total bond payment to $7,735,285. This was included in the table above and impact fee calculation.
- **Future 2031 Wastewater Bond** – This is the recommended bond that the City would need to fully fund the system level projects to service Areas 3. For this study it was assumed that these projects would be fully funded through bonding. Based on guidance from the City, it is expected that this bond will be issued in 2031 or 2032 and would be a 20-year bond at 3.5 percent interest. This brings the total bond payment to $2,232,908. This was included in the table above and impact fee calculation.

This equates to a total bond payment of $22,544,916.

Credit for User Fees

As currently structured, future users will pay for their portion of capacity via impact fees. They cannot also be expected to pay through user rates the portion of future bonds that will be used to build capacity for existing users. This creates the need for a credit for future users. Calculation of this credit is summarized in Table 5. These tables include the following information:

- **Existing Portion of Loan Paid Through User Fees** – This represents the total amount paid each year by West Point City toward the portion of any loans used to build capacity for existing users.
- **Cost Per ERU** – This column takes the total amount paid and divides it by the number of ERUs projected for each year. This represents the amount paid in each year by each ERU.
- **Present Value Cost per ERU** – This column takes into account the time value of money assuming a rate of return of 2 percent annually.
- **Total User Fee Credit** – At the bottom of the table, the present value costs for all future years are added together to develop the total user fee credit.

It will be noted that, because the user fee credit is the summation of user fees paid toward existing deficiencies in each year, a new user who joins the system in five or ten years will pay less in total user fees than someone who joins the system next year. Thus, the user fee credit will decrease over time. The appropriate user fee can be calculated by adding the present value cost for all years subsequent to a new user's connection to the system.

Table 5
Credit for User Fees Paid Toward Existing – West Point City Collection System

Year	West Point ERUs	Existing Capacity Portion of Loans Paid Through User Fees	Cost Per ERU	Present Value Cost Per ERU
2021	3579	n/a	n/a	n/a
2022	3687	$ 23,430	$ 6.36	$ 6.23
2023	3797	$ 23,430	$ 6.17	$ 5.93
2024	3911	$ 23,430	$ 5.99	$ 5.65
2025	4028	$ 23,430	$ 5.82	$ 5.37
2026	4149	$ 23,430	$ 5.65	$ 5.11
2027	4274	$ 37,841	$ 8.85	$ 7.86
2028	4402	$ 37,841	$ 8.60	$ 7.48
2029	4534	$ 37,841	$ 8.35	$ 7.12
2030	4670	$ 37,841	$ 8.10	$ 6.78
2031	4810	$ 37,841	$ 7.87	$ 6.45
2032	4955	$ 42,000	$ 8.48	$ 6.82
2033	5103	$ 42,000	$ 8.23	$ 6.49
2034	5256	$ 42,000	$ 7.99	$ 6.18
2035	5414	$ 42,000	$ 7.76	$ 5.88
2036	5576	$ 42,000	$ 7.53	$ 5.60
2037	5744	$ 42,000	$ 7.31	$ 5.33
2038	5916	$ 42,000	$ 7.10	$ 5.07
2039	6093	$ 42,000	$ 6.89	$ 4.83
2040	6276	$ 42,000	$ 6.69	$ 4.59
2041	6465	$ 42,000	$ 6.50	$ 4.37
2042	6658	$ 18,570	$ 2.79	$ 1.84
2043	6858	$ 18,570	$ 2.71	$ 1.75
2044	7064	$ 18,570	$ 2.63	$ 1.67
2045	7276	$ 18,570	$ 2.55	$ 1.59
2046	7494	$ 18,570	$ 2.48	$ 1.51
2047	7719	$ 4,160	$ 0.54	$ 0.32
2048	7951	$ 4,160	$ 0.52	$ 0.31
2049	8189	$ 4,160	$ 0.51	$ 0.29
2050	8435	$ 4,160	$ 0.49	$ 0.28
2051	8688	$ 4,160	$ 0.48	$ 0.26
Total User Fee Credit			$ 161.92	$ 128.96

Recommended Impact Fee

The total calculated impact fees are summarized in Table 6. Included in this table is the appropriate user fee credit and corresponding overall fee. This is the legal maximum amount that may be charged as an impact fee. A lower amount may be adopted if desired, but a higher fee is not allowable under the requirements of Utah Code.

Table 6
Recommended Per ERU Impact Fee – West Point City Service Area

Maximum Allowable Impact Fee (Per ERU, by year)						
	2022	**2023**	**2024**	**2025**	**2026**	**2027**
Base Impact Fee (includes study costs)	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71	$ 5,329.71
User Fee Credit	$ (128.96)	$ (122.73)	$ (116.80)	$ (111.16)	$ (105.78)	$ (100.67)
Total Overall Fee	$ 5,200.74	$ 5,206.97	$ 5,212.90	$ 5,218.55	$ 5,223.92	$ 5,229.04

As discussed previously, the calculated user fee credit associated with the impact fees will decrease over time. As a result, the allowable impact fee will increase over time as shown in the table. Impact fees beyond 2026 can be calculated by reducing the user fee credit by the amount shown for each successive year in Table 5.

Calculation of Non-Standard Impact Fees

The calculations above have been based on an ERU. The Impact Fee Enactment should include a provision that allows for calculation of a fee for customers other than typical residential connections. Consistent with the level of service standards established in the Impact Fee Facilities Plan, the following formula may be used to calculate an impact fee for a non-standard user based on the calculated daily indoor water use for an average residential connection[1].

$$\frac{Estimated\ Indoor\ Water\ Use}{220\ gallons\ per\ day} X\ Impact\ Fee\ per\ ERU = Impact\ Fee$$

Calculation all non-standard impact fees should be completed by City personnel using the formula above based on information regarding water use as provided for each non-standard use. This approach will be used for all commercial and industrial development.

[1] Based on average annual domestic water usage of 220 gpd/ERU and an average day maximum month flow of 240 gpd/ERU, this equates to a domestic wastewater production of 220 gpd/ERU. With an additional 35 gpd/ERU for I&I, total domestic wastewater flow is equal to 255 gpd/ERU, consistent with previous calculations.

ADDITIONAL CONSIDERATIONS - 11-36A-304(2)

MANNER OF FINANCING - 11-36A-304(2)(A-E)

As part of this impact fee analysis, it is important to consider how each facility has been or will be paid for. Potential infrastructure funding includes a combination of different revenue sources.

User Charges

Because infrastructure must generally be built ahead of growth, there often arises situations in which projects must be funded ahead of expected impact fee revenues. In some cases, the solution to this issue will be bonding. In others, funds from existing user rate revenue will be loaned to the impact fee fund to complete initial construction of the project and will be reimbursed later as impact fees are received. Interfund loans should be considered in subsequent accounting of impact fee expenditures.

Special Assessments

Where special assessments exist, the impact fee calculation must take into account funds contributed. No special assessments currently exist in the West Point City wastewater system.

Pioneering Agreements

Where pioneering agreements exist, the impact fee calculation must take into account payback requirements under each pioneering agreement. West Point City currently does not have any pioneering agreements.

Bonds

Where West Point City financial plans identify bonding will be required to finance impact fee eligible improvements, the portion of bond cost and interest expense attributable to future growth has been added to the calculation of the impact fee.

General Taxes

If taxes are used to pay for infrastructure, they should be accounted for in the impact fee calculation. Specifically, any contribution made by property owners through taxes should be credited toward their available capacity in the system. In this case, no taxes are proposed for the construction of infrastructure.

Federal and State Grants and Donations

West Point City is pursuing grant donations but have not secured any at this time. Impact fees cannot reimburse costs funded or expected to be funded through federal grants and other funds that the City has received for capital improvements without an obligation to repay. Grants and donations are not currently contemplated in this analysis. If grants become available for constructing facilities, impact fees will need to be recalculated and an appropriate credit given.

DEDICATION OF SYSTEM IMPROVEMENTS - 11-36A-304(2)(F)

Developer exactions are not the same as grants. If a developer constructs a system improvement or dedicates land for a system improvement identified in this IFFP or dedicates a public facility that is recognized to reduce the need for a system improvement, the developer may be entitled to an appropriate credit against that particular developer's impact fee liability or a proportionate reimbursement.

If the value of the credit is less than the development's impact fee liability, the developer will owe the balance of the liability to West Point City. If the recognized value of the improvements/land dedicated is more than the development's impact fee liability, West Point City may be required to reimburse the difference to the developer.

It should be emphasized that the concept of impact fee credits pertains to system level improvements only. Developers will be responsible for the construction of project improvements (i.e. improvements not identified in the Impact Fee Facilities Plan) without credit against the impact fee.

EXTRAORDINARY COSTS - 11-36A-304(2)(G)

The Impact Fees Act indicates the analysis should include consideration of any extraordinary costs of servicing newly developed properties. In cases where one area of potential growth may cost significantly more to service than other growth, a separate service area may be warranted. No areas with extraordinary costs have been identified as part of this analysis.

TIME-PRICE DIFFERENTIAL - 11-36A-304(2)(H)

Utah Code allows consideration of time-price differential in order to create fairness for amounts paid at different times. To address time-price differential, this analysis includes a conversion to present value cost for future expenditures. In the case of future construction costs, it has been assumed that the return rate on investment will be roughly equivalent to construction inflation and current construction estimates have been used in the calculation of impact fees. Per the requirements of the Code, existing infrastructure cost is based on actual historical costs without adjustment.

IMPACT FEE CERTIFICATION - 11-36A-306(2)

This report has been prepared in accordance with Utah Code Title 11, Chapter 36a (the "Impact Fees Act"), which prescribes the laws pertaining to the imposition of impact fees in Utah. The accuracy of this IFFP relies in part upon planning, engineering, and other source data, provided by West Point City and its designees.

In accordance with Utah Code Annotated, 11-36a-306(2), Bowen Collins & Associates makes the following certification:

I certify that the attached impact fee analysis:

1. Includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs of qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; or
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every relevant respect with the Impact Fees Act.

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