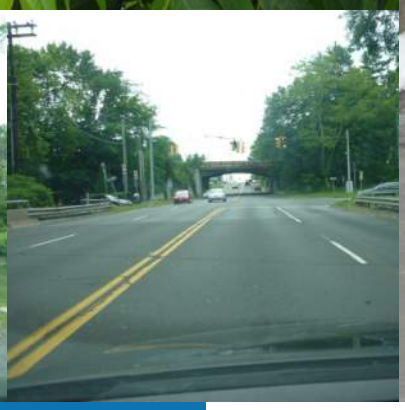

Perna Lane Area Sewers
Stamford, Connecticut

SANITARY SEWER ALTERNATIVES REPORT

Stamford Water Pollution Control Authority

October 7, 2019

Tighe&Bond
Engineers | Environmental Specialists

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Abbreviations

CTDPH	Connecticut Department of Public Health
CY	cubic yards
hrs	hours
LF	linear feet
LS	Lump Sum
MLSS	Minimum Leaching System Spread
NRCS	Natural Resources Conservation Service
OPCC	Opinion of Probable Construction Cost
ROW	Right of Way
SY	square yard
WPCA	Water Pollution Control Authority

Section 1
Introduction

1.1 Background

At the request of the Stamford WPCA, Tighe & Bond has evaluated additional options for providing sanitary sewer service to the Perna Lane area. The January 15, 2019 bid plans consisted of proposed mains from local streets feeding into a main trunkline proposed in High Ridge Road between Scofieldtown Road and Turn of River Road north of the Merritt Parkway. A new pump station would be constructed at the corner of Turn of River Road and High Ridge Road, where the force main would pump southward along High Ridge Road, connecting to the existing gravity sewer in High Ridge Road at Olga Drive.

The proposed sewer in High Ridge Road reached a depth of over 20 feet, and prospective bidders had concerns about traffic control during construction. Additionally, there are two large water transmission mains in High Ridge Road, which could also impact construction operations.

For this evaluation, Tighe & Bond evaluated layout options that would reduce the depth of sewer in High Ridge Road. This effort included re-evaluating options that were previously ruled out such as gravity sewers in easement areas and having multiple pump stations, as well as examining new options such as a low pressure sewer system serving the entire project area.

1.2 Purpose

We understand that the ultimate goal of this effort is to identify alternatives that will minimize the depth of the proposed sewer in High Ridge Road, thus lowering the construction cost of the project. Specific tasks include the following:

1.2.1 Gravity Sewer Alignments

Evaluate gravity sewer alignments and easement options that were ruled out early in the initial design process. Specifically, this includes determining if an easement connection between Somerset Lane or Hampton Lane to Willard Terrace is feasible and if it will help to address the depth concerns in High Ridge Road.

1.2.2 Gravity Sewer Alignments with Additional Pump Stations

Evaluate up to two gravity sewer options utilizing additional, localized pump stations to provide service to areas impacting the depth of the sewer in High Ridge Road. Specifically, these areas include Meredith Lane, the Perna Lane neighborhood, and residences on Opper Road south of Redmont Road.

1.2.3 Low Pressure Sewer Options

Prepare concept design layouts for a low pressure sewer system to provide service to the entire project area. Low pressure alternatives to be considered include a single low pressure line within High Ridge Road, as well as separate low pressure mains for the east and western sides of the project.

1.2.4 Combination of Alternatives

Evaluate additional options that may be a combination of two or three of the preceding options.

1.2.5 Opinions of Probable Cost

Tighe & Bond developed a total of six opinions of probable cost, as follows. More detail is presented in Section 5.

1. Gravity sewer system utilizing two additional pump stations (Alternate #7)
2. Gravity sewer system utilizing three additional pump stations (Alternate #8)
3. Low pressure sewer system – single pipe in High Ridge Road (Alternate #9)
4. Low pressure sewer system – two pipes in High Ridge Road for east and west sides of project (Alternate #10)
5. High Ridge Road Gravity/Low Pressure Combination (Alternate #11)
6. High Ridge Road Gravity/Perna Lane Pump Station/Low Pressure Combination (Alternate #12)

1.2.6 Sewershed Subsurface Sewage Disposal Systems

Tighe & Bond reviewed Stamford Health Department records for subsurface sewage disposal system failures in the area that have occurred in the past 5 to 10 years and developed a representative cost for the replacement of a single family residential subsurface sewage disposal system. Properties that were evaluated are generally representative of those within the Perna Lane project area.

1.3 System Overview

This report evaluates the feasibility of traditional gravity sewer systems, low pressure sewer systems, and combinations of each. A general description of each type of system is presented below:

1.3.1 Gravity Sewers

Gravity Sewer Systems provide sewer service through the installation of gravity sewer pipes within the roadway. Gravity sewers flow downhill to the nearest gravity connection point, or to a low point in a sewer service area where a pump station is required to lift the sewage up and move it to the nearest downstream gravity main.

Sewer service to individual homes is typically provided by a gravity pipe that runs from the house to the gravity main in the street. If a house is located below the elevation of the main in the street, a grinder pump is required for that specific house. Additional information on grinder pumps is presented below.

The minimum size of a gravity sewer main is 8” in diameter. Gravity pipes must be installed with enough slope to maintain a velocity of 2 feet per second within the pipeline.

1.3.2 Low Pressure Sewers

Low pressure sewer systems operate entirely under pressure and require the installation of a grinder pump at each house. A typical grinder pump consists of a 75 or 150 gallon tank that is connected directly to the pipe from the home. A pump inside the tank grinds up all sewage and pumps it to the low pressure line in the street. The grinder pump can be located either inside a home’s basement or outside in the yard. Grinder pump units typically are provided with a high water alarm and can also be provided with generator hookups to maintain services in the event of a power failure at the home.

Because all sewage is ground up, low pressure sewers are smaller in size than a gravity main. The minimum size of a low pressure sewer main is 1 ½". Low pressure sewer main sizing is based upon the total number of homes connected to a sewer system, thus low pressure sewer systems cannot be expanded as easily as gravity sewer systems.

Low pressure sewers are also capable of following existing terrain which allows them to be installed at an average depth of 5 feet. An overview of the differences between gravity and low pressure sewers is presented in Table 1-1 below.

Table 1-1
Gravity and Low Pressure Sewer System Comparison

Gravity Sewers	Low Pressure Sewers
• Gravity pipes in road	• Pressure lines in road
• Minimum 8" diameter	• Smaller diameter mains
• Gravity service to home	• Grinder pumps for all homes
• Greater Depth	• Shallower depth
• Pump Stations required at low points	• No pump stations required at low points
• Easier to extend system to additional areas	• Less flexibility in extending sewer service

1.4 Bid Drawings

The current design of the Perna Lane Sewers project that was bid in January 2019 consisted of a main trunk line that ran south along High Ridge Road from Scofieldtown Road to a proposed pump station at the intersection of High Ridge Road and Turn of River Road (north of the Parkway), which pumped via a force main to the existing sewer in High Ridge at Olga Drive. Between Willard Terrace and Scofieldtown Road, each of the local streets feed in to the proposed High Ridge Road trunk line. There is one easement proposed between Blue Ridge Drive and Marva Lane, serving the end of Blue Ridge Drive. Additionally, grinder pumps were stationed throughout the project as needed, particularly along the upper reaches of High Ridge Road and along Dzamba Grove. This final design resulted in a sewer that was deep in High Ridge Road, in some instances such as immediately south of Opper Road the sewer was over 20 feet deep. Please refer to **Figure 1-1** for the sewer depths under the Bid Drawings.

The original intent was to divide the project into three phases as depicted in **Figure 1-2**.

1.4.1 Areas Influencing Depth

Based upon our analysis, we identified the following areas as having the most influence on the depth of the sewer main in High Ridge Road:

- Stamford Nature Center and 1525 High Ridge Road residence
- Meredith Lane
- Perna Lane Neighborhood
- Opper Road

Section 2
Gravity Sewer Alternative Assessments

This section discusses the evaluation of gravity alternatives and combination gravity – force main alternatives to reduce the depth of the sewer in High Ridge Road. The assessment has been divided into two components. Alternatives 1 through 7 address reducing the sewer depth issues at the north end of the project, including Perna and Meredith Lanes, while Alternative 8 addresses the sewer depth issues influenced by Opper Road.

2.1 Alternative #1 – Hampton – Willard Easement

Recognizing that Perna Lane and Meredith Lane are significant drivers in the depth of the sewer in High Ridge Road, Alternative #1 would run the mainline sanitary sewer east down Perna Lane, south to Somerset Lane, then west along Hampton Lane. At the end of Hampton Lane, the sewer would run through a proposed easement across private property to the Willard Terrace cul-de-sac, then follow the length of Willard Terrace to its intersection with High Ridge Road. A layout of this alternative is shown in **Figure 2-1**.

This alternative assumes that the Meredith Lane area will discharge by gravity, resulting in a nearly 20 foot deep sewer at the intersection of Perna Lane and High Ridge Road. Although there is a significant topographic decrease eastward along Perna Lane, the sewer remains approximately 15 feet deep at its intersection with Somerset Lane. Grades rise along Somerset and Hampton Lanes, and at the cul-de-sac of Hampton Lane the sewer will be in excess of 30 feet deep. Following through the proposed easement and along Willard Terrace, the sewer is in excess of 30 feet deep through the easement. At the intersection of High Ridge Road, the sewer depth is approximately 15 feet deep, which is similar to what is currently shown in the Bid Drawings.

While this alignment would raise the segment of the sewer in High Ridge Road between Perna Lane and Opper Road, it does nothing to address the sewer depth issues in High Ridge Road north of Perna Lane.

We believe that this route is not feasible due to the excessive depth of the sewer.

Table 2-1
Alternative #1 Assessment

✗ NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Raises sewer in High Ridge Road between Perna Lane and Opper Road by 6 feet up to 14 feet	• Sewer depth exceeds 30 feet for a significant length • Does not address deep sewer in High Ridge Road north of Perna Lane • Easements required (2)

2.2 Alternative #2 – Low Route Along Rippowam River, Gravity

The residences along Hampton Lane and the northern part of Willard Terrace sit on a ridge and are therefore generally higher than the surrounding streets. Routing the sewer along these streets will result in deeper cuts because of the higher relative elevation of these streets.

Alternative #2 proposes to relocate the sewer alignment to parallel the Rippowam River, which is the topographically lowest area in the sewershed. The alignment is similar to Alternative #1, however, when moving upstream to downstream, instead of turning westward on Hampton, the sewer continues southward along Somerset, and then goes cross country along the Rippowam River, proceeding to an unimproved property at the 90 degree bend in Willard Terrace, where it turns westward, connecting into the main in Willard Terrace, and then directly to High Ridge Road, as shown in **Figure 2-2.**

The Alternative #2 alignment, where it runs along the river results in a much shallower sewer (less than ten feet deep) along the cross country route. However, the route is very close to the Rippowam River, and as a result a new inland wetland approval would be required. Significant sediment and erosion control and water handling measures would be needed during construction of the pipeline. In addition, approximately 14 private property easements would need to be obtained by the City if this were the alignment selected. Finally, the alignment/topography at the top of the river bank in this area would make construction and access for future maintenance difficult.

Like Alternative #1, the Alternative #2 alignment would raise the segment of the sewer in High Ridge Road between Perna Lane and Opper Road, but does nothing to address the sewer depth issues in High Ridge Road north of Perna Lane.

Since this alignment would only potentially provide service to residences on the east side of Willard Terrace, it would effectively add approximately 1,200 feet of additional pipe to the project, since it does not replace the need for a main in Willard Terrace to serve the west side of that roadway. It is likely that the depth of the gravity main within Willard Terrace main depth could be decreased since homes on the east side of the street could discharge into the new sewer main along the river.

We do not believe this alternative is feasible because of the number of easements and the difficult access.

Table 2-2
Alternative #2 Assessment

✗ NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Raises sewer in High Ridge Road between Perna and Opper by 6 feet up to 14 feet • Significantly reduced sewer depth along route, most of the sewer less than 10 feet deep	• Does not address deep sewer in High Ridge Road north of Perna Lane • Easements required (14)

• If the sewer along the river also serves the residents on the east side of Willard Terrace, the proposed sewer main in Willard Terrace can be reduced	• Access to portion of alignment along river would be difficult at best • Added cost of approximately 1,200 feet of 8" PVC sewer main • Environmental constraints of working inside riparian buffer

2.3 Alternative #3 – Local Pump Station Meredith Lane

Alternative 3 proposes construction of a localized pump station to serve the 11 residences on Meredith Lane, since the Meredith Lane connection at High Ridge Road is currently 16 feet deep. There is a wide right of way on the southeast corner of the intersection of Meredith and High Ridge that could support an ejector type pump station. The pump station was not located further east because of the floodplain location.

Although Alternative #3 would significantly raise the sewer within Meredith Lane, this alternative does not help reduce the depth of the sewer further downstream of High Ridge Road. Please refer to **Figure 2-3.**

Therefore, a small pump station serving Meredith Lane alone would not address the depth issue along High Ridge Road and this alternative is not considered to be feasible.

Table 2-3
Alternative #3 Assessment

NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Potential to eliminate Meredith Lane in dictating downstream sewer elevations. • Sufficient right-of-way to site most of an ejector station.	• Alternative #3 alone does not address depth of sewer further down High Ridge Road. • Likely at least one easement required • Additional pump station to maintain

2.4 Alternative #4 – Northern Limit Grinder Pumps

As High Ridge Road approaches the northern limit of the project at Scofieldtown Road, the topography reaches a high point at the intersection of Meredith Lane and then descends 8 to 9 feet at the last manhole of the project located 100 feet north of the Scofieldtown Road intersection.

The last two manholes provide service to two facilities; the Stamford Nature Center and a private residence at 1525 High Ridge Road. If these two properties were converted to force mains and allowed to connect at Manhole #19 at the intersection of High Ridge and Meredith, the depth of the sewer can be reduced by approximately 9 feet. Please refer to **Figure 2-4**.

This alternative alone would not address the depth issues in High Ridge Road downstream of Manhole #19 because of the depth of the sewer within Meredith Lane. It will work well in combination with Alternative #3, but is considered not feasible because of the limited success in reducing the depth of the High Ridge Road sewer.

Table 2-4
Alternative #4 Assessment

✗ NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Eliminates the extreme northern limit of the project in dictating downstream sewer elevations.	• Alternative #4 alone does not address depth of sewer further down High Ridge Road • Long, pumped connections will be required from 1525 High Ridge Road and the Stamford Nature Center

2.5 Alternative #5 – Northern Limit Grinder Pumps, Meredith Lane Pump Station, Hampton – Willard Easement

Alternative #5 is a combination of Alternatives 1, 3, and 4. Under this alternative, the northernmost manhole in High Ridge Road will be at Meredith Lane and High Ridge Road, and the two properties north of this manhole would be connected via grinder pumps. Meredith Lane would be served by a small ejector type pump station to be located at the southwest corner of the High Ridge Road – Meredith Lane intersection. The pump station is located at the west end of Meredith Lane because of the floodplain on the eastern end, and there being a small area suitable within the right of way for a small pump station.

The gravity route within High Ridge Road would be up to 9 feet shallower, and the gravity main would follow the route described in Alternative 1: down Perna Lane, south on Somerset, and then turning west onto Hampton, and traversing a proposed easement to Willard Terrace, and then back out to High Ridge Road. Please refer to **Figure 2-5**.

Under Alternative 1, the invert elevation of the manhole at the intersection of Somerset Lane and Perna Lane would be approximately 144.6. Under Alternative 5 it is approximately 151.2, which is 6.6 feet higher than Alternative 1. Since the balance of the route downstream of Perna Lane is identical to Alternative 1, the depths along that route would be reduced by approximately 6.6 feet, meaning that through the proposed Hampton Road – Willard Terrace easement, the depth of the sewer main is approximately 23 feet. This is not feasible due to the proximity of residential structures.

Since the manhole at Somerset Lane and Perna Lane is at minimum depth, there are no further gravity options that would make the Hampton – Willard easement feasible.

Table 2-5
Alternative #5 Assessment

NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Potential to eliminate the extreme northern limit of the project, Meredith Lane, and High Ridge Road in dictating High Ridge Road sewer elevations. • Sufficient right-of-way to site most of an ejector station.	• Long, pumped connections will be required from 1525 High Ridge Road and the Stamford Nature Center • Additional pump station to maintain • Sewer depth exceeds 23 feet for a significant length • Easements required (3)

2.6 Alternative #6 – Perna Lane Pump Station

Alternative #6 explores a pump station to serve Perna Lane, Hampton Lane, Somerset Lane, and Dzamba Grove. Hampton Lane, Somerset Lane, and Dzamba Grove would discharge to Perna Lane as previously proposed, and a pump station would be located on Perna Lane to either pump up to High Ridge Road, or across the Hampton Lane – Willard Terrace easement.

Various locations were considered for a pump station on Perna Lane. The first was the site initially considered in the early stages of the project within the Perna Lane cul-de-sac. The primary benefit of locating a station at the cul-de-sac is that Perna Lane slopes from west to east, so the gravity sewer in Perna Lane could be installed following grade down to the cul-de-sac. This site was determined not to be feasible because it was located within the floodplain of the Rippowam River, and it is difficult to locate a pump station in the cul-de-sac without having an overly detrimental visual impact to the neighboring properties. Given the elevation of the floodplain, the top of the wet well at this location would be significantly above grade to comply with current design standards.

A second pump station location evaluated is at the rear of the property of 1415 High Ridge Road. This proposed location is on a far corner of the property and can be screened from view from adjacent properties. It is also outside the floodplain. Since the property is located on the west end of Perna Lane, the gravity sewer in Perna Lane would have to flow westward toward the pump station, bucking grade, and as a result, the gravity sewer would be deeper where it connects to the pump station. Siting the pump station at the west end of Perna Lane is still a better option because it is outside of the flood plain.

2.6.1 Alternative #6A – Hampton Lane – Willard Terrace Easement

Alternative 6A evaluates using the proposed Perna Lane pump station to pump via force main back down Perna Lane, south on Somerset, west and south along Hampton Lane, and then across the proposed easement described in Alternative 1 to the northernmost manhole in Willard Terrace, where the flow would transition to gravity, and follow the proposed Willard Terrace sewer to High Ridge Road. Under this alternative, the proposed pump station would be located at the west end of Perna Lane.

This alternative would eliminate the Perna Lane neighborhood as influencing the depth on High Ridge Road. However, this alternative alone would not improve the depth on High Ridge Road since it does not address the depth influence north end of the project area, nor does it address Meredith Lane. Please refer to **Figure 2-6A**.

This alternative results in a significant length of force main that runs parallel to the gravity sewer, since the gravity flow from the neighborhood is directed to the west end of Perna Lane from the neighborhood, and then pumped back up through the neighborhood, resulting in approximately 1,250 feet of force main that runs parallel with the proposed gravity mains. A larger pump will be required because of the distance pumped and significant changes in topography across the route.

Three easements would be required. One for the proposed pump station, and two for the route of the force main between Hampton Lane and Willard Terrace.

This option is not feasible on its own, but may be feasible in combination with other alternatives.

Table 2-6A
Alternative #6A Assessment

✗ NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Eliminates Perna Lane neighborhood influence over High Ridge Road sewer depths. • Reduces depth significantly across the proposed Hampton Lane – Willard Terrace easement	• Additional pump station to maintain • Does not address deep sewer in High Ridge Road north of Perna Lane • 1,250 lf of force main to be run parallel with gravity sewer • Larger pump will be required due to topography, friction loss across distance • Easements required (3)

2.6.2 Alternative 6B – Pump Direct to High Ridge Road

Alternative 6B evaluates using the proposed Perna Lane pump station to pump up to High Ridge Road versus across the potential Hampton Lane – Willard Terrance easement.

This alternative would eliminate the Perna Lane neighborhood as influencing the depth on High Ridge Road. However, this alternative alone would not improve the depth on High Ridge Road since it does not address the depth influence north end of the project area, nor does it address Meredith Lane. Please refer to **Figure 2-6B.**

This alternative eliminates the additional length of force main that is required for Alternative 6A.One easement is required to accommodate the proposed pump station.

This option is not feasible on its own, but may be feasible in combination with other alternatives, and is advantageous over Alternative 6A.

Table 2-6B
Alternative #6B Assessment

NOT FEASIBLE	
Positive Aspects	**Negative Aspects**
• Eliminates Perna Lane neighborhood influence over High Ridge Road sewer depths.	• Additional pump station to maintain • Does not address deep sewer in High Ridge Road north of Perna Lane • Easements required (1)

2.7 Alternative #7 – Perna Lane Pump Station with Meredith Lane Pump Station and Northern Limit Grinder Pumps

This alternative combines Alternative #6B with Alternatives #3 and #4. Under this alternative, the northernmost manhole in High Ridge Road will be at Meredith Lane and High Ridge Road, and the two properties north of this manhole will be connected via grinder pumps. Meredith Lane would be served by a small ejector type pump station to be located at the southwest corner of the High Ridge Road – Meredith Lane intersection. The Perna Lane neighborhood would be served by its own pump station that would discharge to a manhole located at the intersection of High Ridge Road and Perna Lane.

The gravity route down High Ridge Road would be up to 9 feet shallower.

This alternative introduces two new pump stations and would require easements to accommodate the pump station sites. However, it is the only alternative of the previous ones studied that reduces the depth of the sanitary sewer in High Ridge Road without resulting in depth or cost issues elsewhere. Please refer to **Figure 2-7.**

Table 2-7
Alternative #7 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Eliminates Perna Lane neighborhood influence over High Ridge Road sewer depths • Eliminates northern limit of project influence over High Ridge Road sewer depths • Eliminates Meredith Lane influence over High Ridge Road sewer depths • Sufficient right-of-way to site pump stations	• Two additional pump station to maintain • Long, pumped connections will be required from 1525 High Ridge Road and the Stamford Nature Center • Easements required (2)

2.7.1 Alternate #7A

Alternate #7A is substantially the same as Alternate #7, but reflects the addition of Pine Hill Terrace into Phase 1. Alternate #7A is also considered to be feasible.

2.8 Alternative #8 – Redmont Road Slope Adjustments, Opper Road Grinder Pumps

The intersection of Opper and Redmont Roads lies 8 feet below the intersection of Opper and High Ridge Roads and the current design provides for gravity service for the entire area. As a result, the Bid Drawings show that the Opper / High Ridge Road intersection has the deepest sewer in the entire project.

Compounding the adverse grade situation between Redmont and High Ridge Roads are three properties on Opper Road, two of which sit below grade. Gravity connections to these properties require the sewer at Opper and Redmont Roads to be 13 feet deep. If the three properties on Opper Lane are served by grinder pumps, the entire system can be raised to limit depths, but due to topography, depths at High Ridge and Opper will be between 20 and 21 feet. Please refer to **Figure 2-8**.

In combination with the proposed improvements in Alternative #7, sewer depths in High Ridge Road can be limited to 10 feet north of the intersection.

Table 2-8
Alternative #8 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Eliminates Perna Lane neighborhood influence over High Ridge Road sewer depths • Eliminates northern limit of project influence over High Ridge Road sewer depths • Eliminates Meredith Lane influence over High Ridge Road sewer depths • Eliminates Opper Lane Influence over High Ridge Road sewer depths • Sufficient right-of-way to site pump stations	• Two additional pump station to maintain • Long, pumped connections will be required from 1525 High Ridge Road and the Stamford Nature Center • Three pumped connections on Opper Road • Easements required (2)

2.8.1 Alternate #8A

Alternate #8A is substantially the same as Alternate #8, but reflects the addition of Pine Hill Terrace into Phase 1. Alternate #8A is also considered to be feasible.

Section 3
Low Pressure Sewer Alternative Assessments

3.1 Alternative #9 - Low Pressure Sewer System, Single Pipe

This alternative layout was developed based upon the assumption that all homes within the project area would connect to one low pressure sewer trunk line proposed to be located within High Ridge Road. The trunk sewer on High Ridge Road is proposed to follow the road topography, with depth adjustments made where needed to avoid existing utilities.

Individual side streets would connect to this trunk line at junction manholes. The layout is very similar to the original gravity sewer system. Air release valves are likely to be required at many connection points due to the fact that the side streets elevations are lower than the pipe within High Ridge Road and the connection point to the High Ridge Road main creates a high point in the system. All homes will require a grinder pump connection. Construction of the Turn of River pump station is not required under this Alternative.

In order to maintain adequate velocities within this single pipe system, it would be recommended that service to the entire project area be provided under a single construction contract.

A layout of this option is presented in **Figure 3-1**.

Table 3-1
Alternative #9 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Minimal depth on all streets • Eliminates need for pump stations	• All homes require a grinder pump • Entire area should be constructed under one contract

3.2 Alternative #10 - Low Pressure Sewer System, Double Pipe

This alternative is similar to the single pipe low pressure sewer system, however, this alternative proposes the installation of two low sewer pressure mains within High Ridge Road: one to provide service to streets on the eastern side of the project and the second to provide service to the streets on the western side. Lateral stubs for all streets would be extended as needed during the first phase of construction to be out of the State Road

ROW. One junction manhole would be proposed to be installed to house both of the High Ridge Road trunk lines as well as lines from any side streets to help minimize the total number of manholes required.

Construction of the Turn of River pump station is not required under this Alternative.

By installing two low pressure mains in High Ridge Road, this option allows the project to be constructed in two phases. The first phase would allow the High Ridge Road trunk mains and streets on the east side of the project area to be constructed immediately. Sewer service to the western side of the project could then be constructed at a later date as part of a separate contract.

A layout of this option is presented in **Figure 3-2**.

Table 3-2
Alternative #10 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Minimal depth on all streets • Eliminates need for pump stations • Allows for phasing of construction	• All homes require a grinder pump • Dual force main in High Ridge Road increases overall footage of pipe

Section 4
Combination Alternatives

4.1 Alternative #11 - High Ridge Gravity

Alternative #11 is a combination alternative that assumes that a gravity sewer will be installed along High Ridge Road at a minimum depth ranging from 5' – 8' deep. Gravity service is maintained to those streets that can flow into the new gravity sewer including most of the western side streets. Low pressure sewers are proposed where a gravity connection to High Ridge Road cannot be obtained. Diamondcrest Drive, Blue Ridge Drive, Marva Lane, and Pine Hill Terrace would all connect directly to High Ridge Road via gravity. All other side streets would be a low pressure sewer connection.

This alternative requires the construction of the Turn of River pump station to pump flow further south on High Ridge Road.

A layout of this option is presented in **Figure 4-1**.

Table 4-1
Alternative #11 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Minimal depth on all streets • Gravity service along High Ridge Road • Allows for phasing of construction	• Turn of River Pump Station still required • Grinder pumps required for some homes

4.2 Alternative #12 – High Ridge Gravity with Perna Lane Pump Station

Alternative #12 is a combination alternative that assumes that a gravity sewer will be installed along High Ridge Road at a minimum depth ranging from 5' – 8' deep. Gravity service is maintained to those streets that can flow into the new gravity sewer including most of the western side streets. In addition, the Perna Lane neighborhood would flow by gravity to a pump station at the corner of High Ridge Road and Perna Lane. Low pressure sewers are proposed where a gravity connection to High Ridge Road cannot be obtained, including Meredith Lane, Diamondcrest Lane, Redmont Road, Opper Road, Willard Terrace, and Brantwood Lane.

This alternative requires the construction of the Turn of River pump station to pump flow further south on High Ridge Road.

A layout of this option is presented in **Figure 4-2**.

Table 4-2
Alternative #12 Assessment

FEASIBLE	
Positive Aspects	**Negative Aspects**
• Minimal depth on all streets • Gravity service along High Ridge Road • Allows for phasing of construction	• Two pump stations required • Grinder pumps required for some homes

Section 5
Cost Comparisons

5.1 Background

Opinions of probable construction cost were developed for the six alternatives determined to be feasible, as follows:

1. Gravity sewer system utilizing two additional pump stations (Alternate #7)
2. Gravity sewer system utilizing three additional pump stations (Alternate #8)
3. Low pressure sewer system – single pipe (Alternate #9)
4. Low pressure sewer system – two pipes for east and west sides of project (Alternate #10)
5. High Ridge Road Gravity/Low Pressure Combination (Alternate #11)
6. High Ridge Road Gravity/Perna Lane Pump Station/Low Pressure Combination (Alternate #12)

Unit price estimates were based upon bids received for similar construction contracts, adjusted as necessary to account for construction within the High Ridge Road area.

5.2 Disclaimer

The costs presented are an engineer's Opinion of Probable Construction Cost. Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of the Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost.

5.3 Assumptions

In preparing the opinions of probable cost (OPCC), the following assumptions were made:

1. The extent of roadway restoration work required for each alternative would be the same. Local roadways will be milled and overlaid curb-to-curb, and the extent of milling and paving in High Ridge Road at the conclusion of pipeline installation would be the same for all alternatives.

2. All drainage improvements proposed as part of the original design contract would be required and constructed for all alternatives.

3. A unit cost of $6,000 was used for each grinder pump required on low pressure sewer system alternatives. It was assumed that the cost of the grinder pump installation would be the homeowner's responsibility. For the gravity alternatives, a unit cost of $10,000 per pump was assumed as the lower number of pumps is expected to raise the individual pump cost.

4. An allowance of 4% was applied to each OPCC for the maintenance and protection of traffic.

5. Allowances of 6% for mobilization/demobilization and 2% clearing/grubbing were added to each OPCC.

6. Hourly estimates were also made for uniformed officers expected to be required for traffic control when sewer construction is taking place. We assumed a production rate of 80 LF/day for gravity sewers, 100 LF/day for double and 150 LF/day for single low pressure sewers and force main construction.

7. A 15 percent construction contingency was applied to all OPCCs.

8. Opinion of Probable Construction Cost covers all three phases of the project.

5.4 Opinion of Probable Construction Cost

A summary of the OPCCs developed for each Alternative is summarized in **Table 5-1**. Detailed breakdowns are included in Appendix B.

Table 5-1
Opinion of Probable Construction Cost Comparison

Alternative	Type	Opinion of Probable Construction Cost
1	Gravity	Not Feasible
2	Gravity	Not Feasible
3	Gravity	Not Feasible
4	Gravity	Not Feasible
5	Gravity	Not Feasible
6A	Gravity	Not Feasible
6B	Gravity	Not Feasible
7	Gravity	$ 13,376,000
8	Gravity	$ 13,548,000
9	Low Pressure	$ 9,035,000
10	Low Pressure	$ 9,899,000
11	Combination	$ 9,673,000
12	Combination	$ 9,925,000

Section 6
Septic System Repair Feasibility

6.1 Background

One of the primary reasons for the Stamford WPCA undertaking the Perna Lane Sewer project was the number of septic system failures, the ages of the septic systems, and the small lot sizes within the project area.

Sewer service was preferred because in many instances, replacement septic systems cannot meet the setback requirements of the Connecticut Department of Public Health Technical Standards for Subsurface Sewage Disposal Systems, Effective January 1, 2018, outlined in **Table 6-1** below.

Table 6-1
Required Subsurface Sewage Separation Distances

Item	Separation
Building served	10 feet
Storm drain inlet or solid piping solid	25 feet
Groundwater drain	50 feet downgradient 25 feet upgradient or on sides
Top of embankment	10 feet
Property Line	15 feet upgradient 25 feet downgradient
Below Ground swimming pool	25 feet
Above ground swimming pool	10 feet
Accessory structure	10 feet
Open Watercourse	50 feet

6.2 Case Studies

Tighe & Bond obtained records from the City of Stamford Health Department from randomly selected properties on each of the streets in the project area. Since detailed soil testing is required for the design of septic system replacements, these assessments should not be considered definitive and were instead based upon most current available information. We specifically looked at the potential for replacement systems to serve the properties listed in the following subsections.

6.2.1 81 Willard Terrace

Given the property setbacks, and setbacks from the house and watercourse the only feasible area is a narrow 12’ wide strip in the front yard. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group B soils, so an infiltration rate of 20 minutes per inch was assumed.

Tighe & Bond evaluated a replacement system using traditional trenches, 36" wide x 18" deep. 44 feet is the maximum trench length available, thus, 6 rows would be required to serve the four bedroom home. There is insufficient space for the primary system, since the rows must be set 8 feet on center, therefore at least 51 feet of width will be required. Only 12 feet of width is available.

A proprietary GST 6236 system was also evaluated for this property, and there is sufficient space to install a GST 6236 system.

Since bedrock and groundwater data were unavailable, we did not assess any Minimimum Leaching System Spread (MLSS) requirement.

6.2.2 15 Hampton Lane

Given the property setbacks and setbacks from the house, the only feasible area is in the rear yard. Because the rear yard is upgradient from the house, a pumped system is required. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group B soils, so an infiltration rate of 20 minutes per inch was assumed.

We evaluated a replacement system using traditional trenches, 36" wide x 18" deep. 40 feet is the maximum trench length available, and 7 rows would be required to serve the four bedroom home. There is insufficient space for the primary system, since the rows must be set 8 feet on center, therefore at least 59 feet of width will be required. Only 45 to 56 feet of width are available.

We evaluated a proprietary GST 3724 system. We used a shallower depth because boring information in Hampton Lane suggests bedrock may be restrictive in this area. There is sufficient space for the GST 3724.

Since bedrock and groundwater data were unavailable, we did not assess any MLSS requirement.

6.2.3 11 Perna Lane

Given the property setbacks, and setbacks from the house, there are two feasible areas, one each in the front and back yards. We opted to evaluate the back yard are because it was larger and located downgradient of the residence. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group A soils, so an infiltration rate of 10 minutes per inch was assumed.

We evaluated a replacement system using traditional trenches, 36" wide x 18" deep. 43 feet is the maximum length available, and 5 rows would be required to serve the four bedroom home. There is insufficient space for the primary system, since the rows must be set 8 feet on center, therefore at least 43 feet of width will be required. Only 24 feet of width is available.

We evaluated a proprietary GST 6236 system. There is sufficient space for the GST 6236.

Since bedrock and groundwater data were unavailable, we did not assess any MLSS requirement.

6.2.4 22 Brantwood Drive

Given the property setbacks, and setbacks from the house, there are two feasible areas, one each in the front and back yards. The available area in the rear of the house is much larger than that in the front. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group D soils, so an infiltration rate of 45 minutes per inch was assumed.

We evaluated a replacement system using traditional trenches, 36" wide x 18" deep. 54 feet is the maximum length available, and 6 rows would be required to serve the three bedroom home. There is sufficient space for a traditional trench system.

The reserve area would need to be a more compact system. We evaluated a proprietary GST 3724 system. There is sufficient space for the GST 3724 to serve the property.

Since bedrock and groundwater data were unavailable, we did not assess any MLSS requirement.

6.2.5 7 Dzamba Grove

Given the property setbacks, and setbacks from the house and open watercourse, there are no feasible areas. The entire property is encumbered by at least one setback area.

6.2.6 33 Somerset Lane

Given the property setbacks, and setbacks from the house, there are two feasible areas, one each in the front and back yards. The available area in the rear of the house is much larger than that in the front, which is only 50 square feet. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group B soils, so an infiltration rate of 20 minutes per inch was assumed.

We evaluated a replacement using traditional trenches, 36" wide x 18" deep. 38 feet is the maximum length available, and 7 rows would be required to serve the four bedroom home. There is not sufficient space for a trench system, so we evaluated a proprietary GST 6224 system. There is sufficient space for the GST 6224 to serve the property.

Since bedrock and groundwater data were unavailable, we did not assess any MLSS requirement.

6.2.6 19 Meredith Lane

Given the property setbacks, and setbacks from the house, there are two feasible areas, one each in the front and back yards. The available area in the rear of the house is much larger than that in the front. The NRCS Soil Survey shows that the area is in Hydrologic Soil Group A soils, so an infiltration rate of 10 minutes per inch was assumed.

We evaluated a replacement system using traditional trenches, 36" wide x 18" deep. 60 feet is the maximum length available, and 4 rows would be required to serve the four bedroom home. There is not sufficient space for a trench system, so we evaluated a proprietary GST 6236 system. There is sufficient space for the GST 6236 to serve the property.

Since bedrock and groundwater data were unavailable, we did not assess any MLSS requirement.

6.3 Overview

We looked at all of the Phase I properties which include all lots on and east of High Ridge Road to determine the overall potential for a replacement system to be sited using the criteria in Table 6-1.

Based on the general criteria above, we anticipate the following suitability of replacement systems as shown in **Tables 6-2** through **6-4,** and illustrated in **Figure 6-1**.

Table 6-2
Replacement System Feasibility: Phase 1 Area

Street	Total No. of Properties	Traditional Trenches Feasible	Only Alternative Technology Feasible	No Suitable System Feasible
Brantwood Lane	8	1	4	3
Dzamba Grove	8	0	1	7
Hampton Lane	10	0	6	4
High Ridge Road	51	15	20	16
Perna Lane	16	0	8	8
Somerset Lane	14	0	6	8
Turn of River Road	1	1	0	0
Willard Terrace	34	4	15	15
Total	**142**	**21**	**60**	**61**
Percent		**14.8%**	**42.2%**	**43.0%**

Table 6-3
Replacement System Feasibility: Phase 2 Area

Street	Total No. of Properties	Traditional Trenches Feasible	Only Alternative Technology Feasible	No Suitable System Feasible
Blue Ridge Drive	16	16	0	0
Diamondcrest Ln	14	14	0	0
High Ridge Road	12	4	5	3
Marva Lane	14	4	4	6
Meredith Lane	11	0	4	7
Pine Hill Terrace	6	0	0	6
Total	**73**	**38**	**13**	**22**
Percent		**52.0%**	**17.8%**	**30.2%**

Table 6-4
Replacement System Feasibility: Phase 3 Area

Street	Total No. of Properties	Traditional Trenches Feasible	Only Alternative Technology Feasible	No Suitable System Feasible
Diamondcrest Lane	9	9	0	0
Opper Road	6	6	0	0
Redmont Road	29	29	0	6
Total	**44**	**44**	**0**	**0**
Percent		**100%**	**0%**	**0%**

Based on our analysis, we believe that close to half of the properties in the Phase 1 area (High Ridge north to Perna Lane, and all streets east of High Ridge between Perna Lane and the Merritt Parkway) cannot be served with a compliant subsurface sewage disposal system that meets the current CTDPH requirements. Another similar number of properties are encumbered enough that a traditional trench system cannot serve them, and instead alternative technologies are required. In the Phase 2 area, the smaller lots on Marva Lane and Pine Hill Terrace cannot support any code conforming septic system, but the larger lots on Blue Ridge Drive can support traditional trench systems. The Phase 3 area has larger lots, which all can theoretically accommodate a code compliant septic system.

6.4 Septic System Replacement Costs

Based upon information compiled from recent projects, we estimate that the cost to replace a subsurface sewage disposal system may range from $ 20,000 for a traditional trench type system to over $ 30,000 for an alternative technology system. The costs are highly variable depending on soil type, depth to restrictive layer, and other site conditions.

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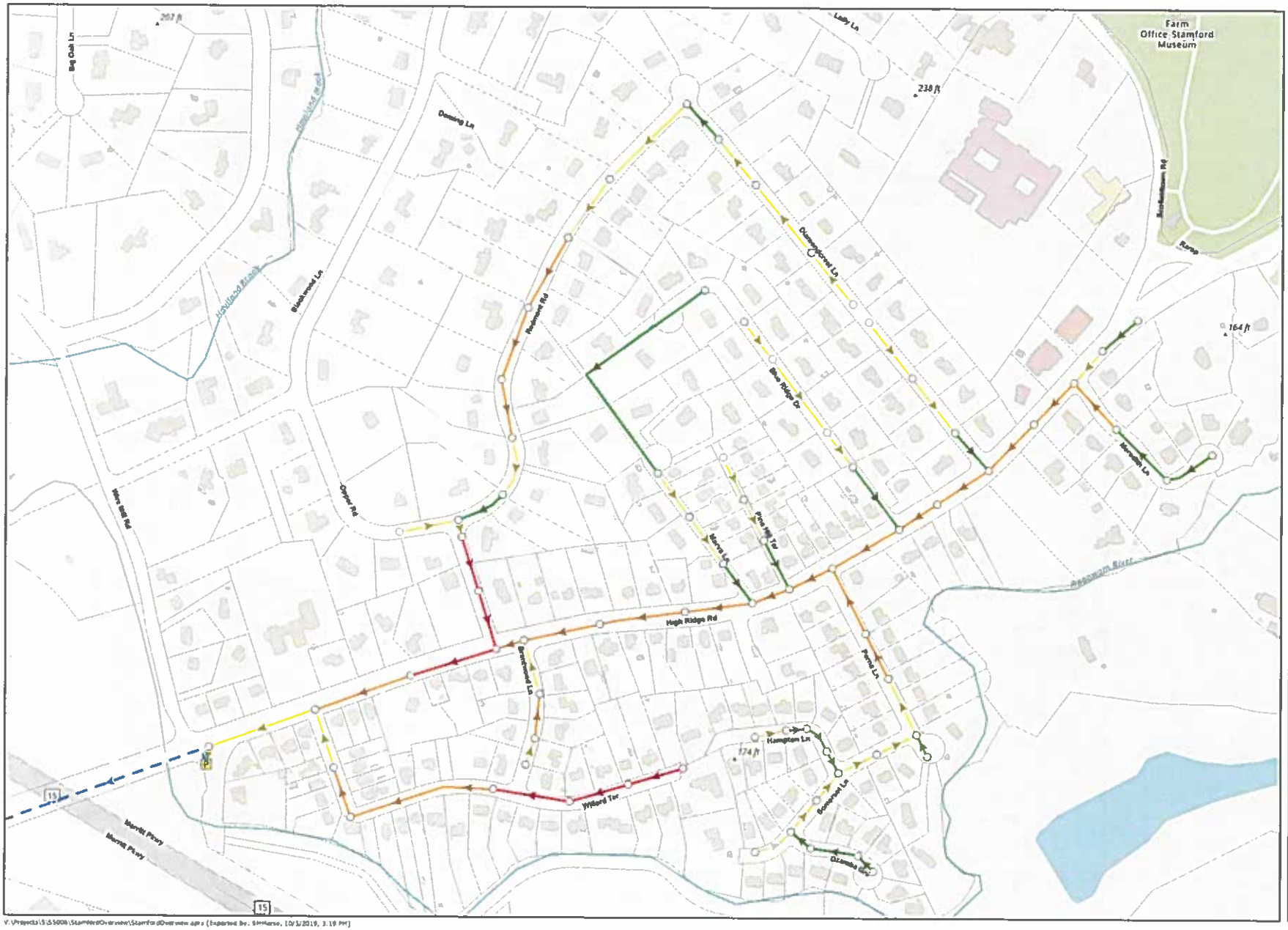

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FIGURE 1-1
SEWER DEPTH, BID DRAWINGS

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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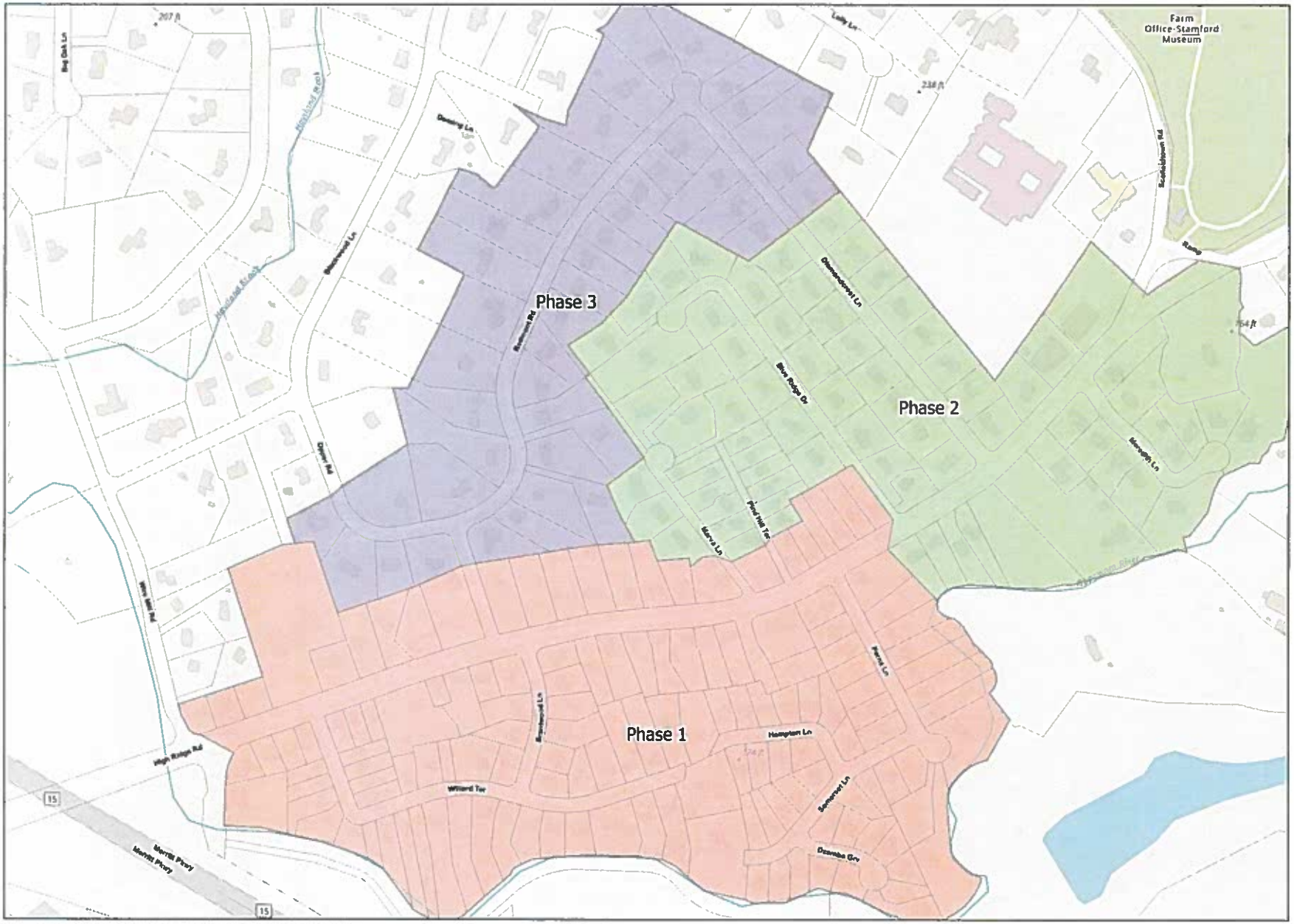

FIGURE 1-2
PROJECT PHASING

LEGEND

- Phase 1
- Phase 2
- Phase 3
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1 : 3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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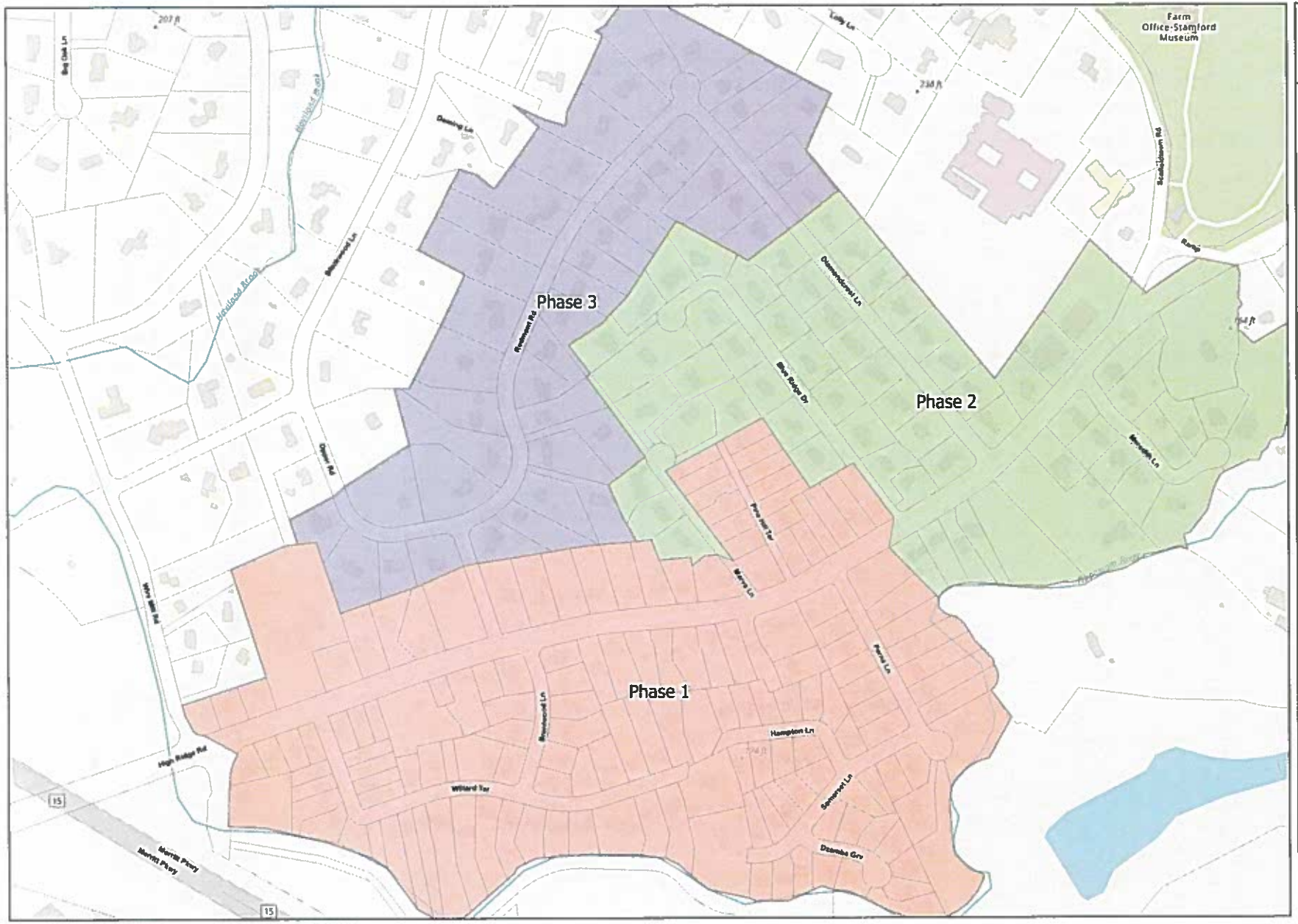

FIGURE 1-2A
REVISED
PROJECT PHASING

LEGEND

- Phase 1
- Phase 2
- Phase 3
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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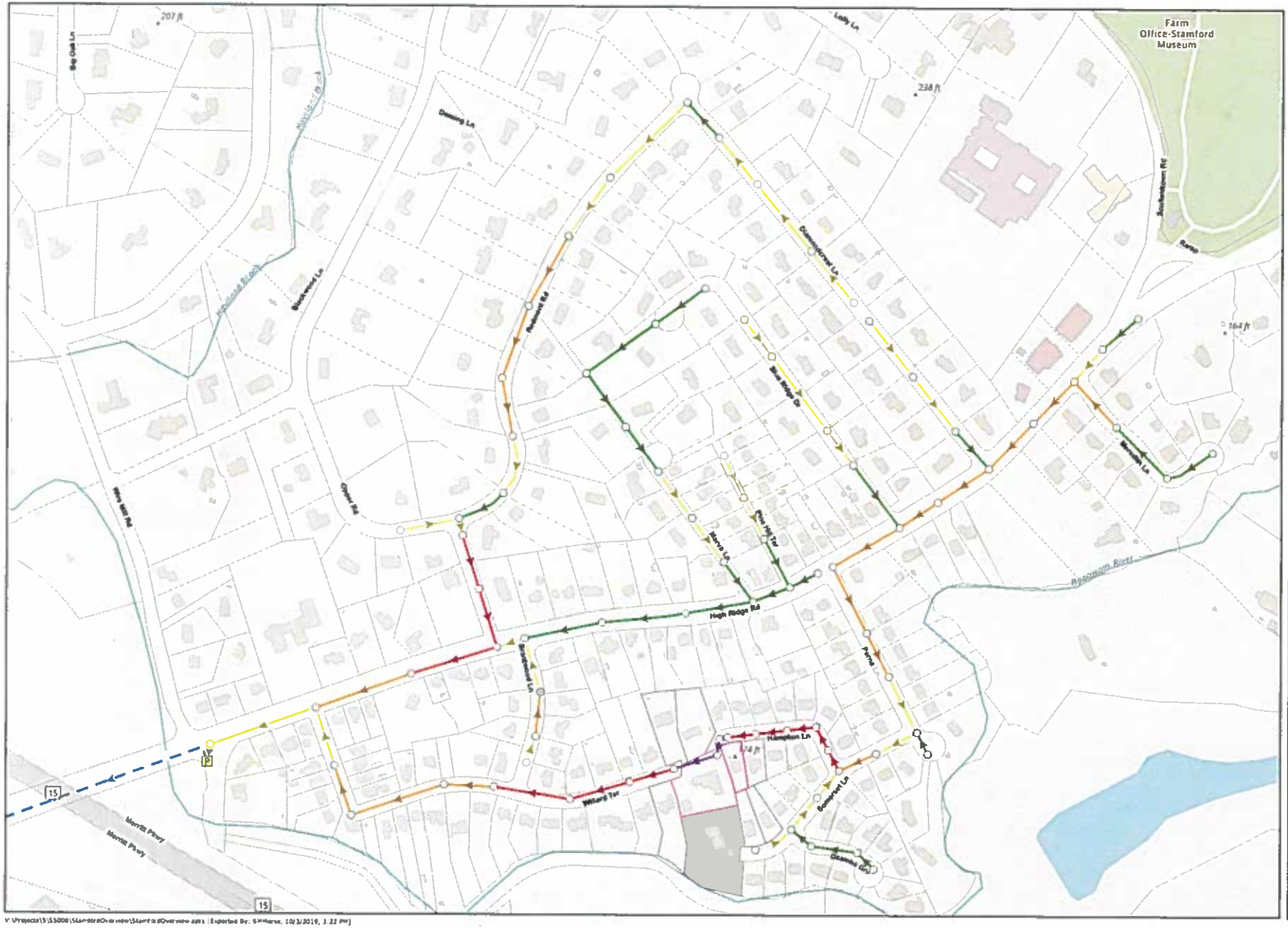

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FIGURE 2-1
ALTERNATE #1

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1 : 3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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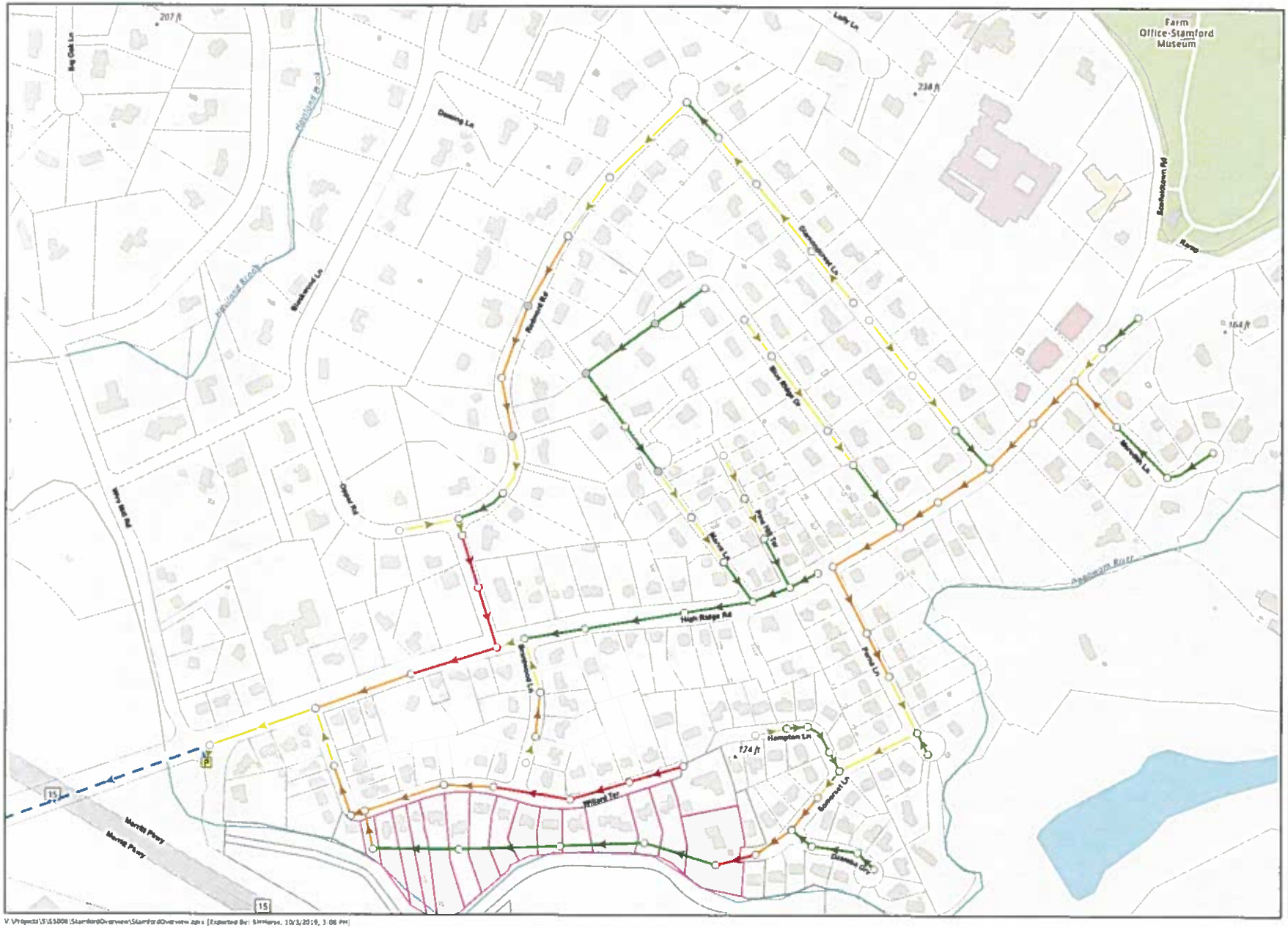

FIGURE 2-2
ALTERNATE #2

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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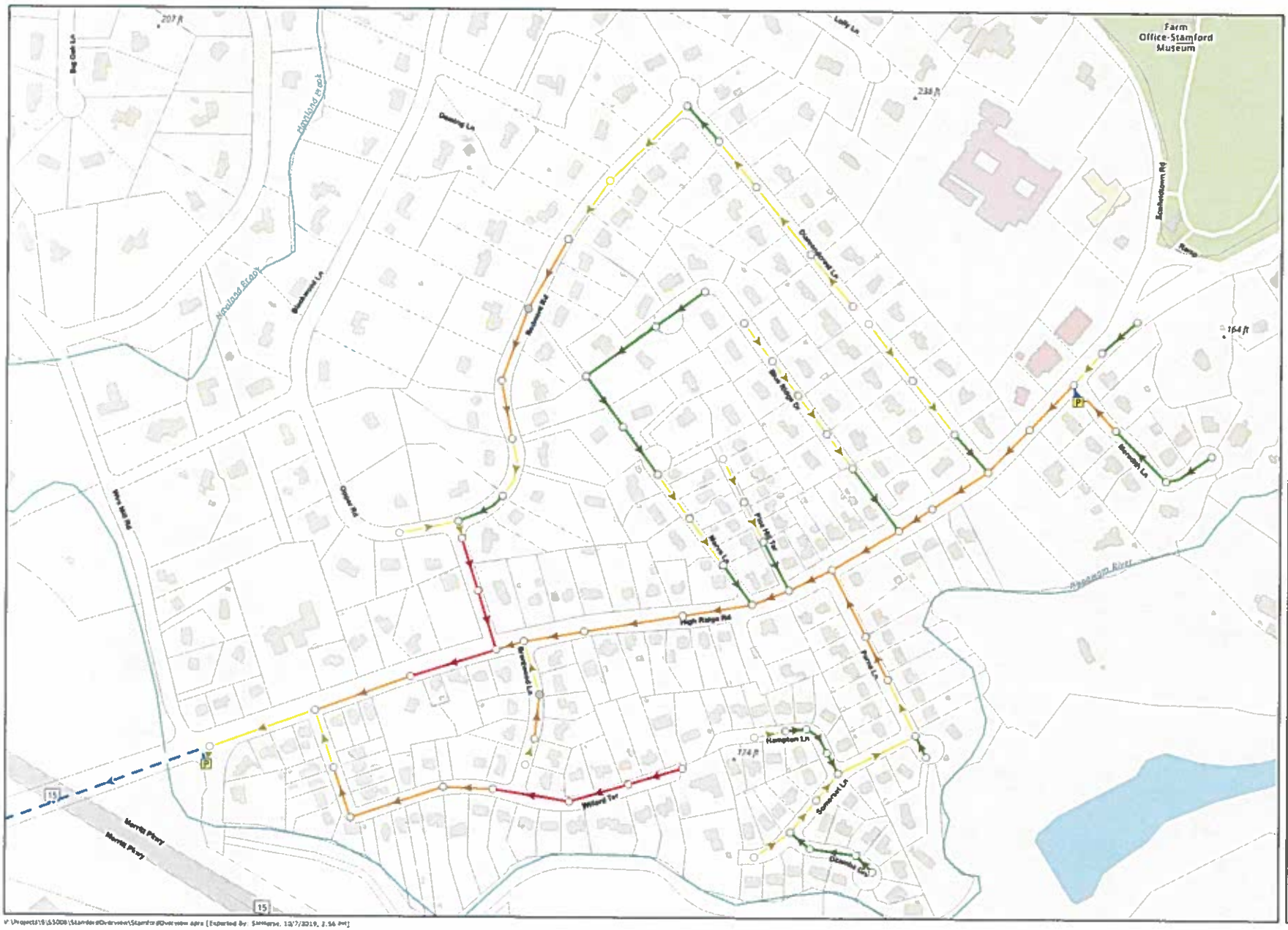

FIGURE 2-3
ALTERNATE #3

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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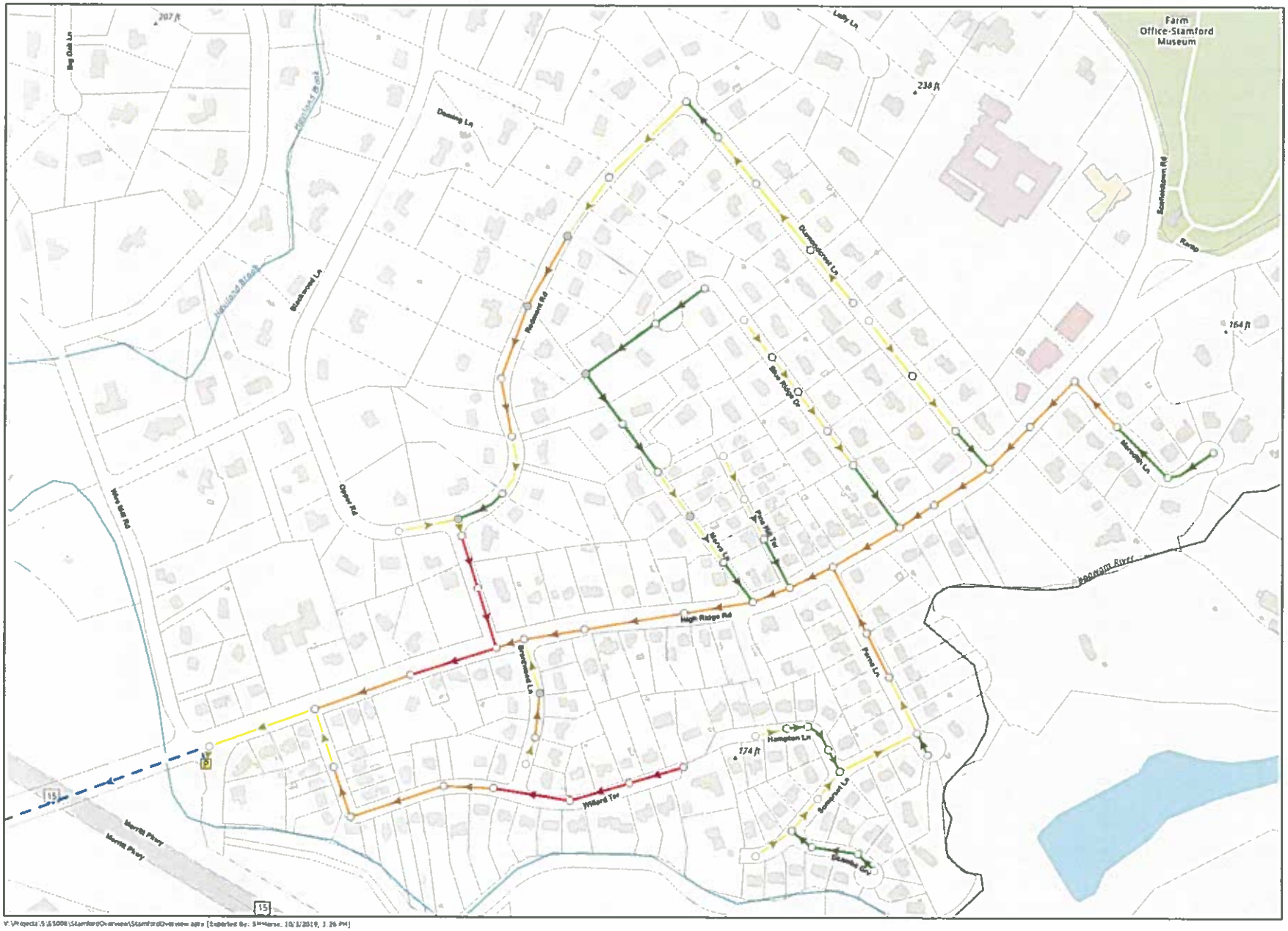

FIGURE 2-4
ALTERNATE #4

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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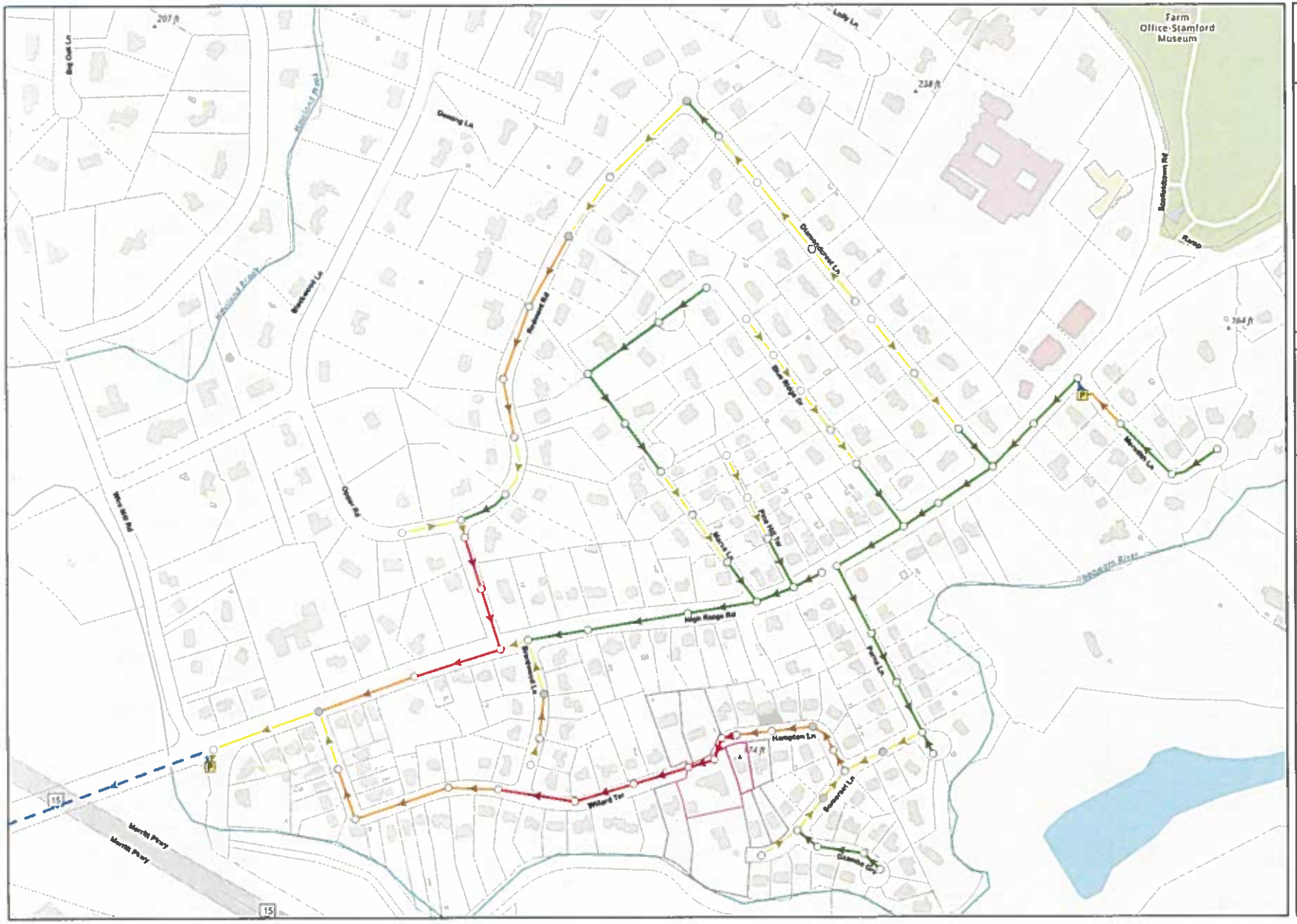

FIGURE 2-5
ALTERNATE #5

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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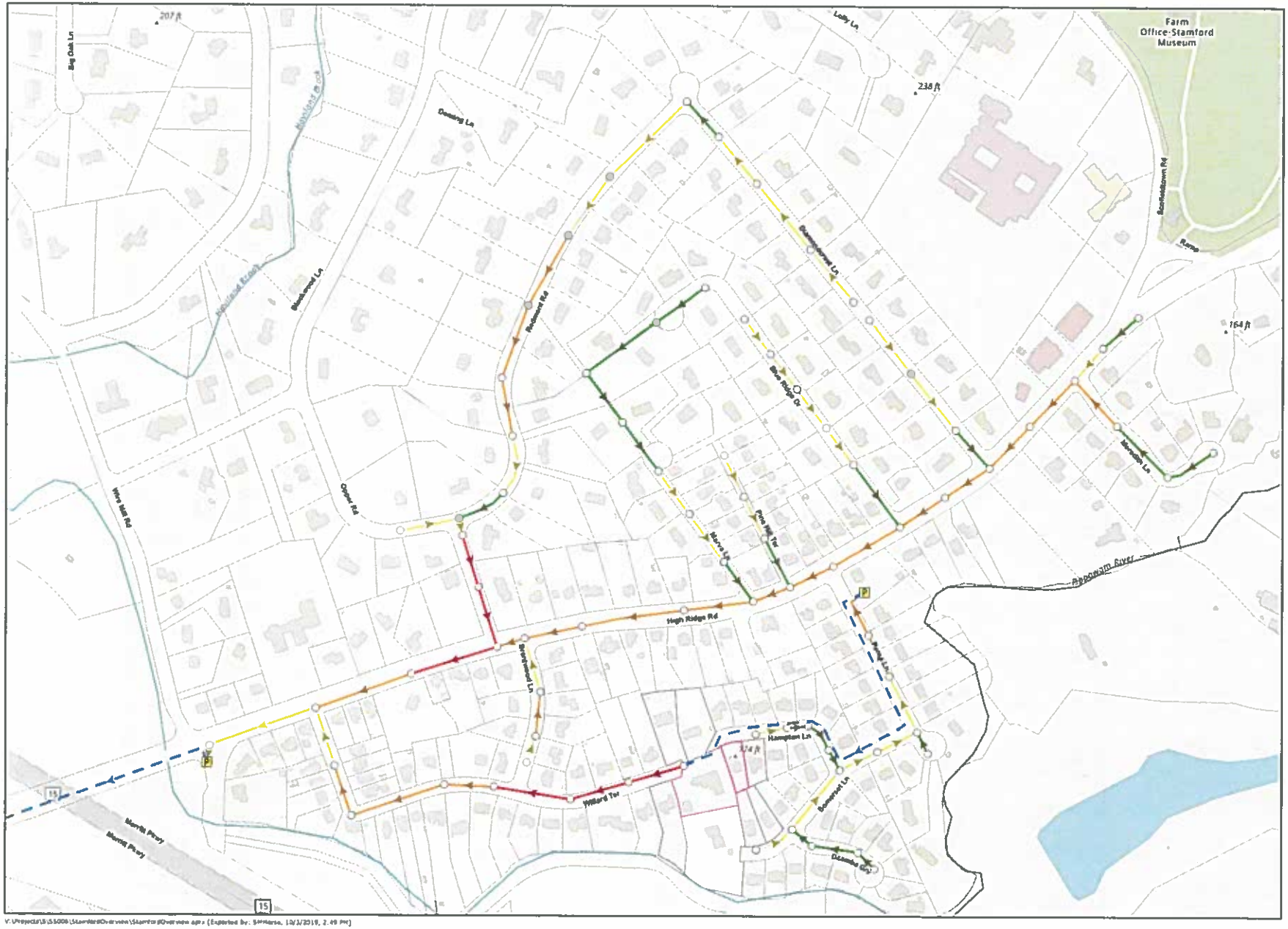

FIGURE 2-6A
ALTERNATE #6A

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1 : 3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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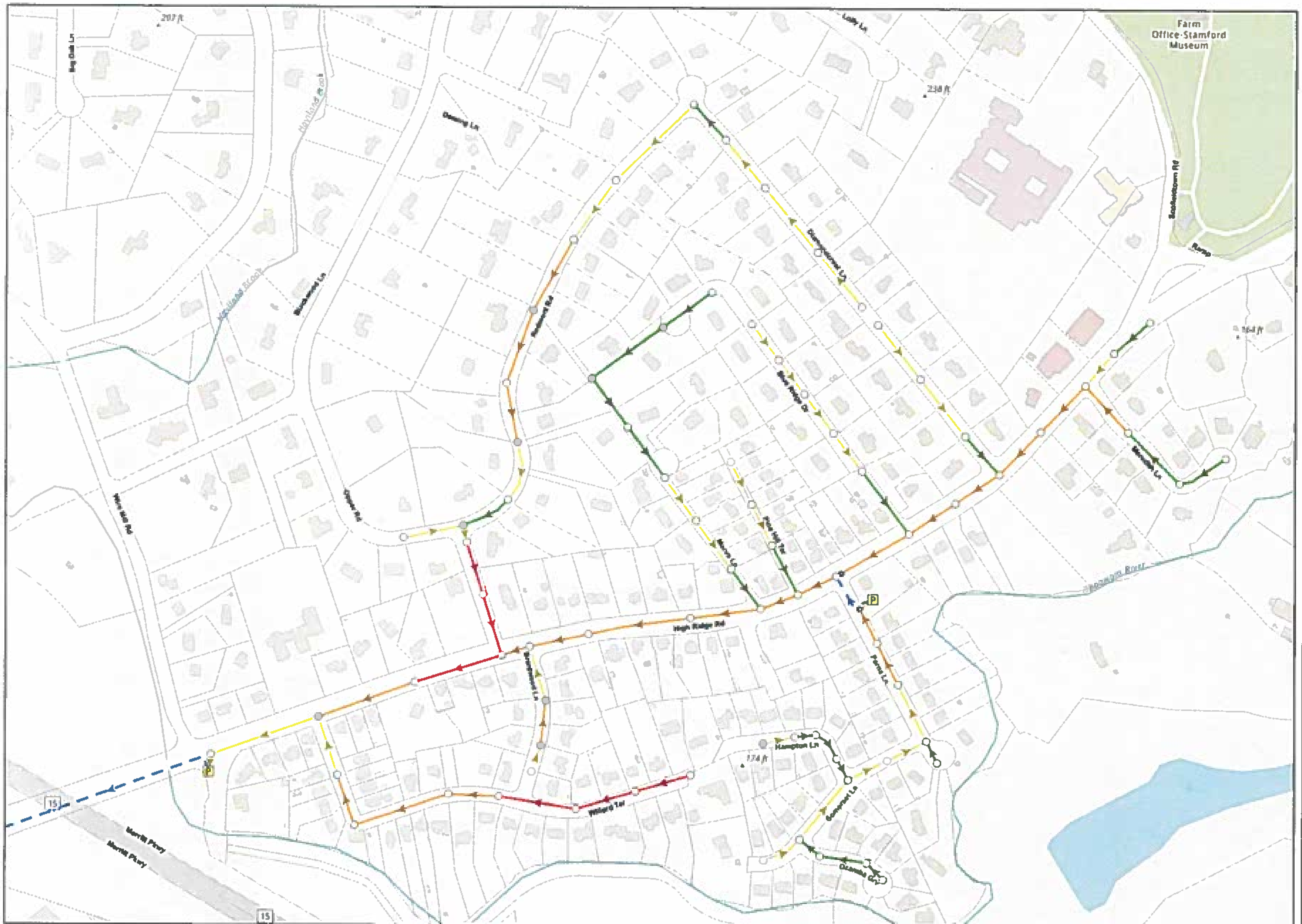


FIGURE 2-6B
ALTERNATE #6B

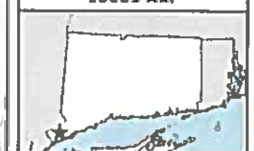
LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP



0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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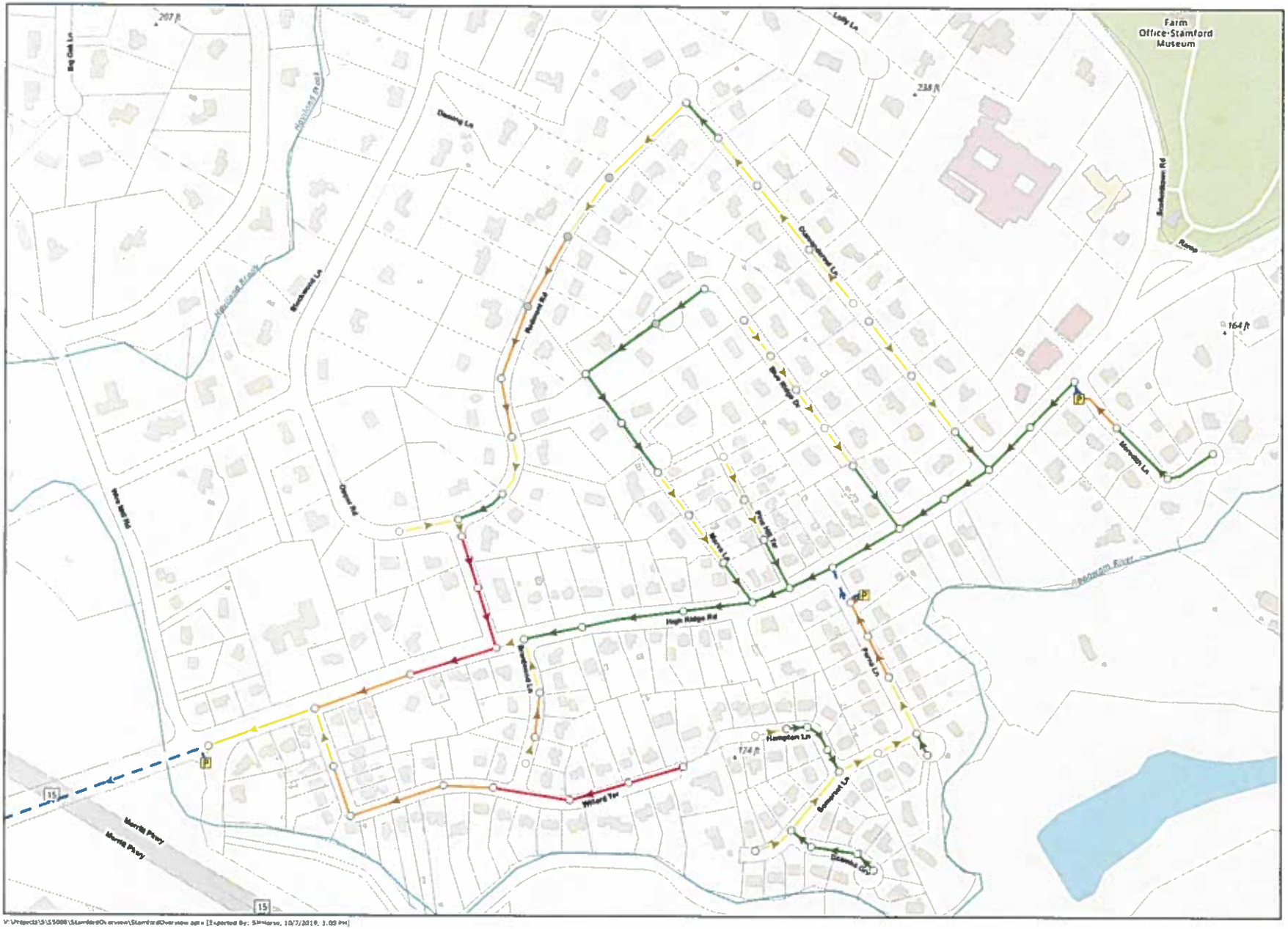

FIGURE 2-7
ALTERNATE #7

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" dep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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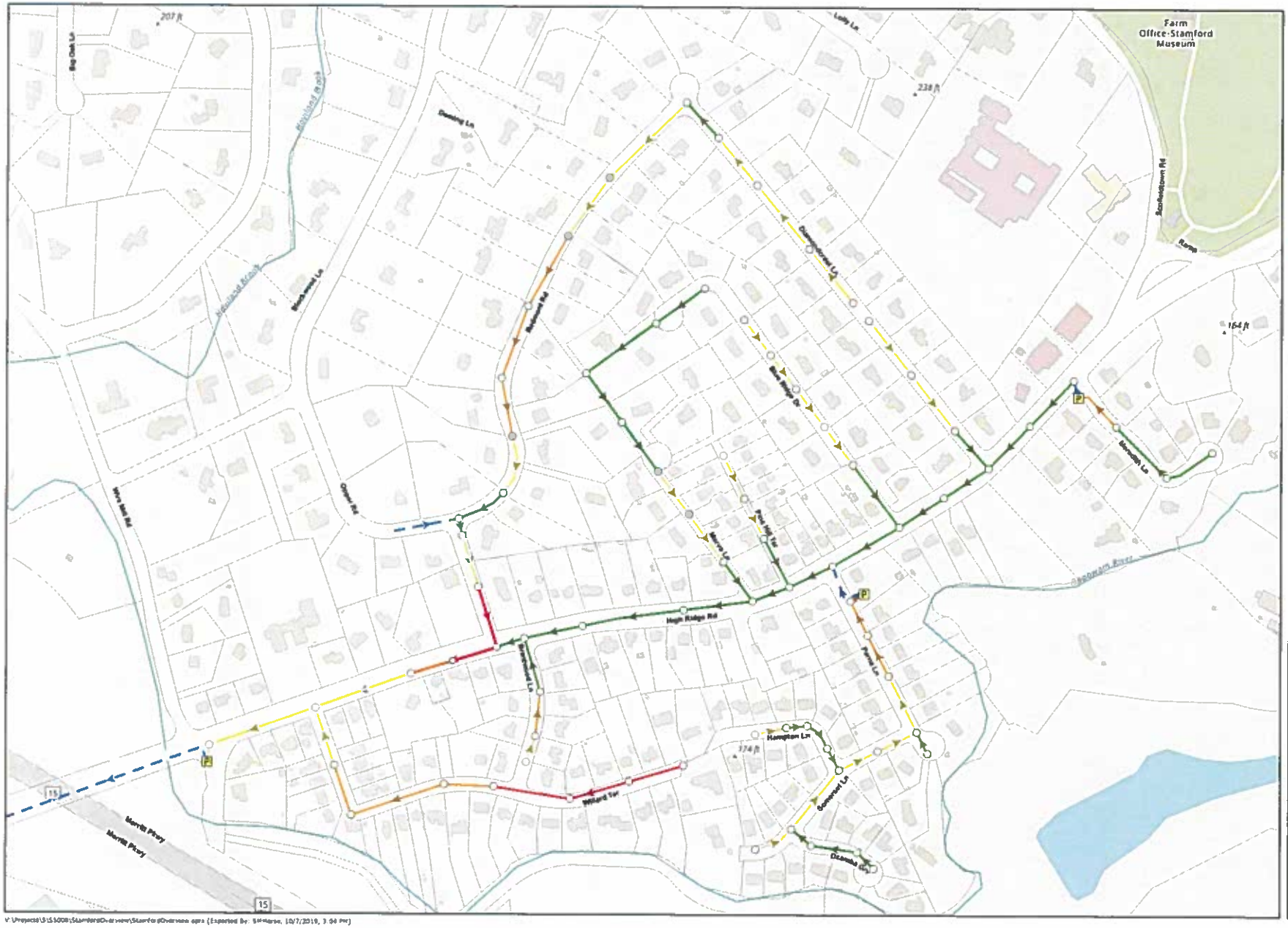

FIGURE 2-8
ALTERNATE #8

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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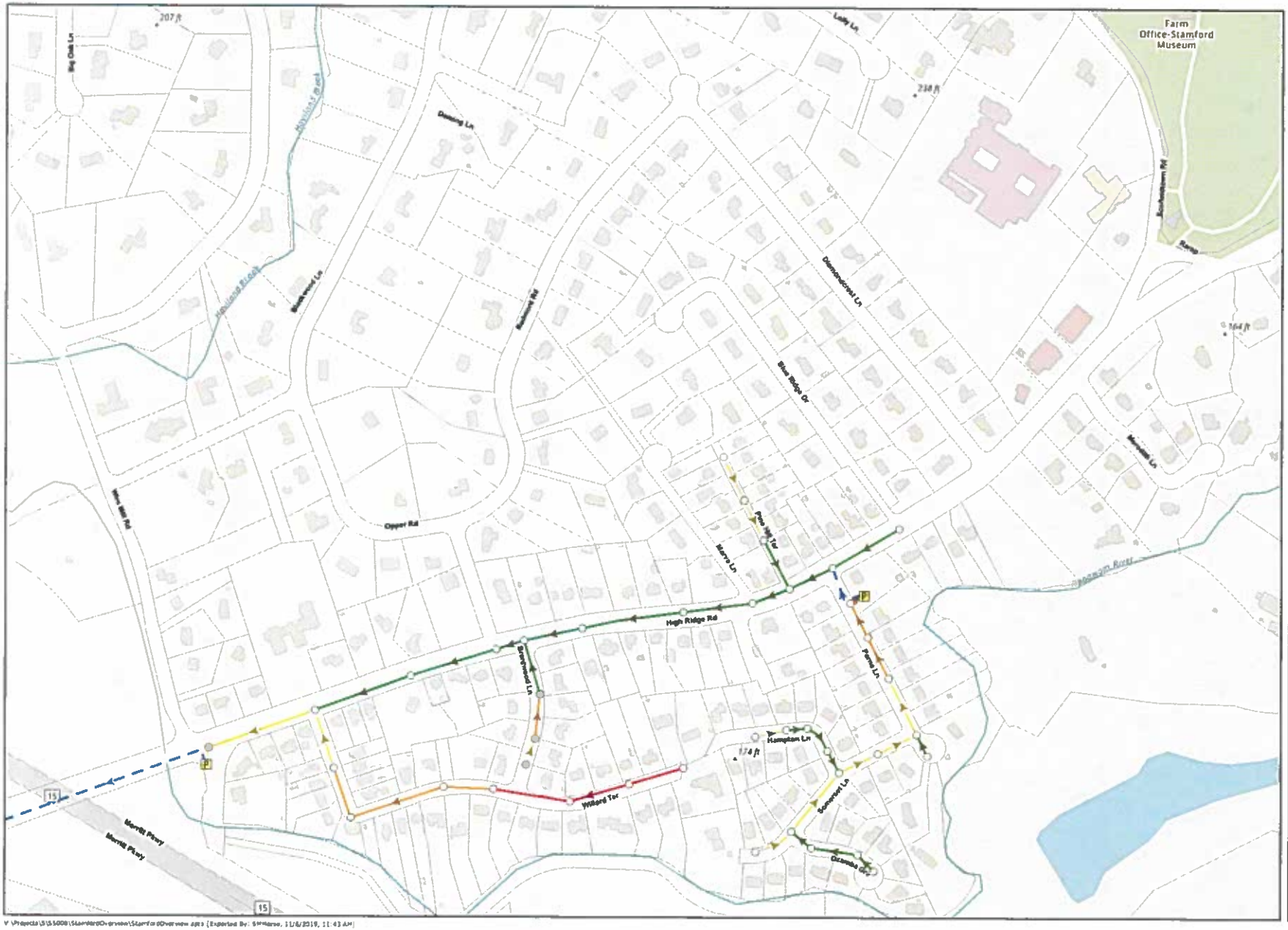

FIGURE 2-8A
REVISED
ALTERNATE #8A

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary
- Property Requiring Easement

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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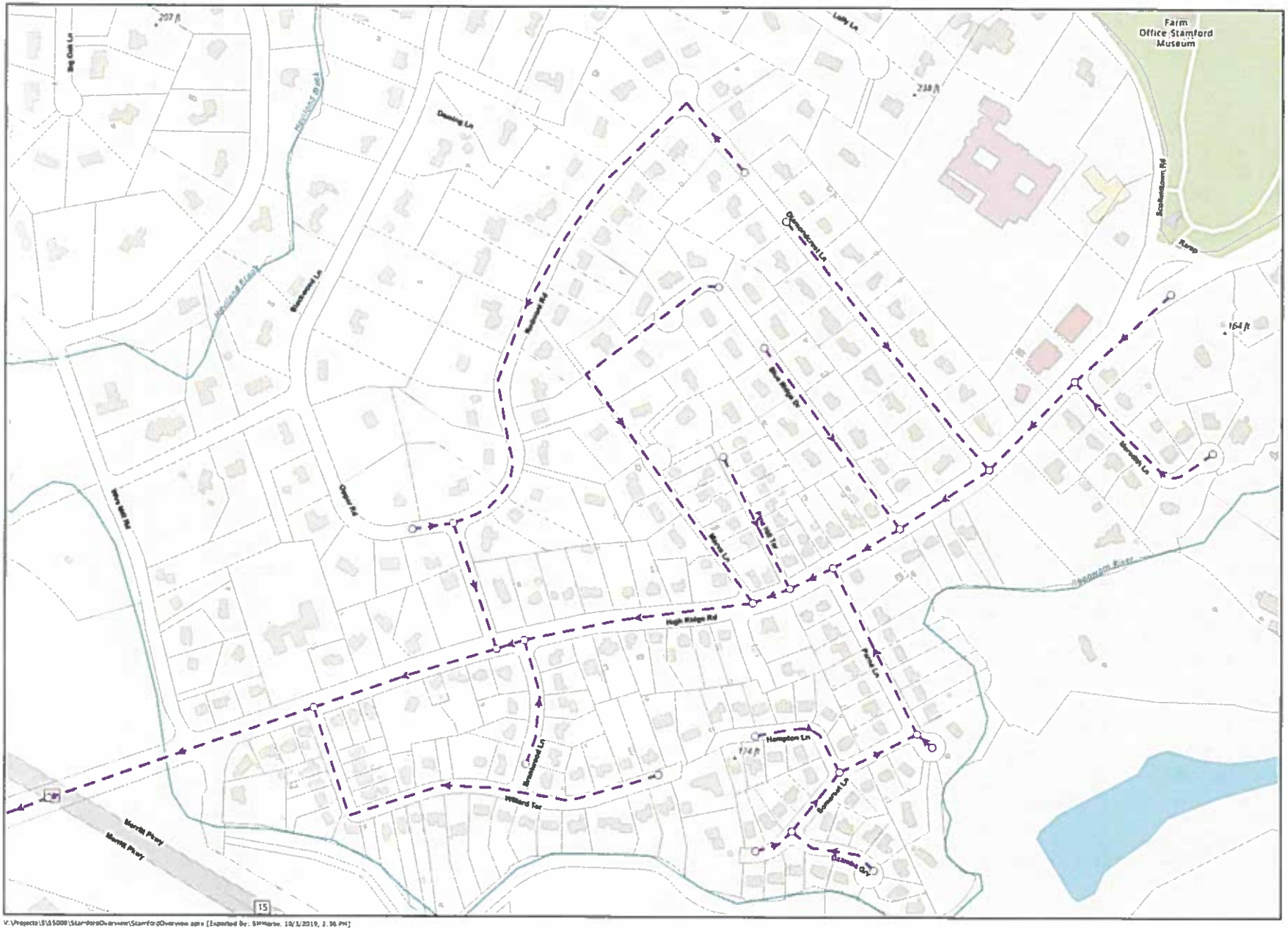

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FIGURE 3-1
ALTERNATE #9

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)
- Low Pressure Sewer (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

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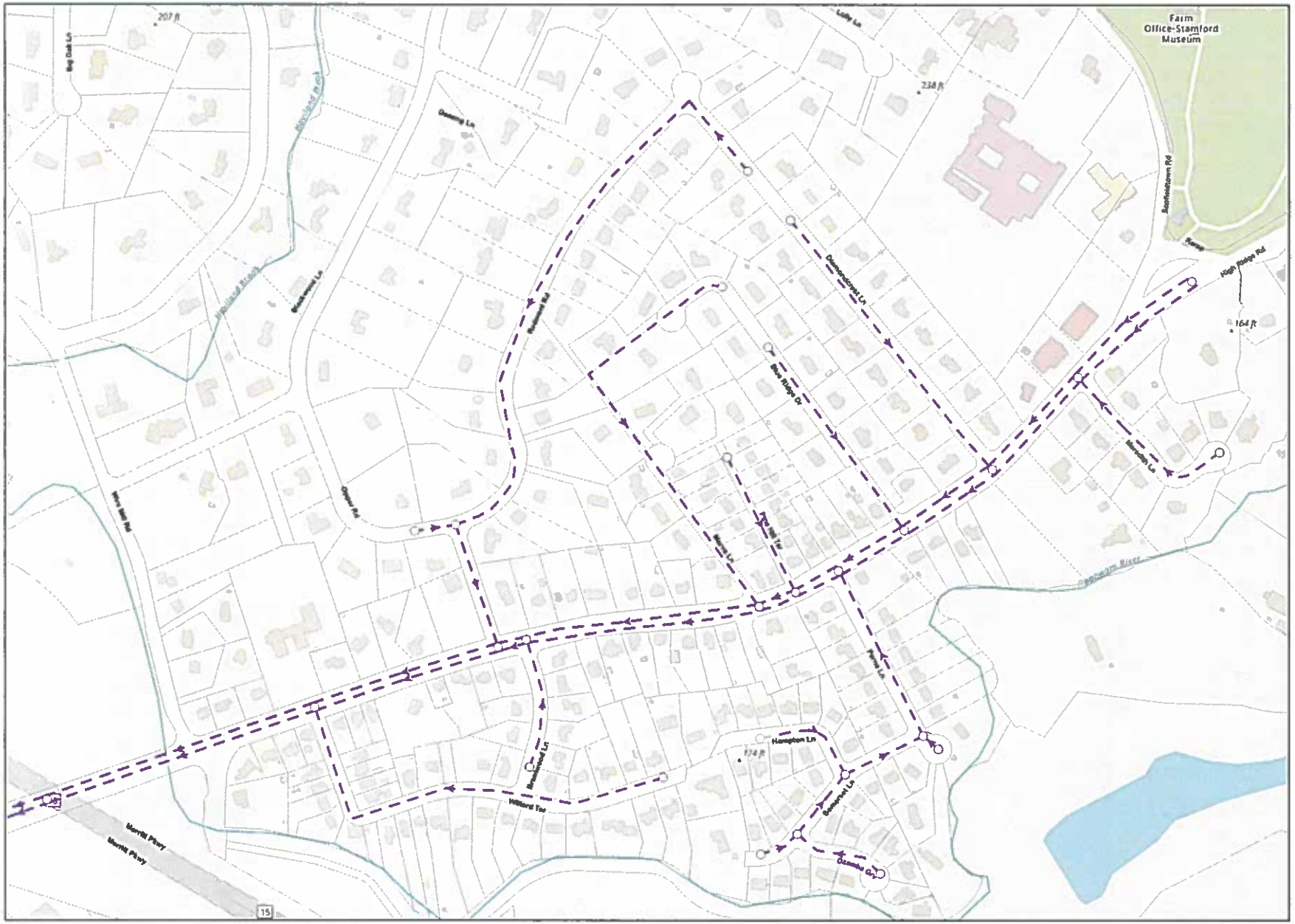

FIGURE 3-2
ALTERNATE #10

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)
- Low Pressure Sewer (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

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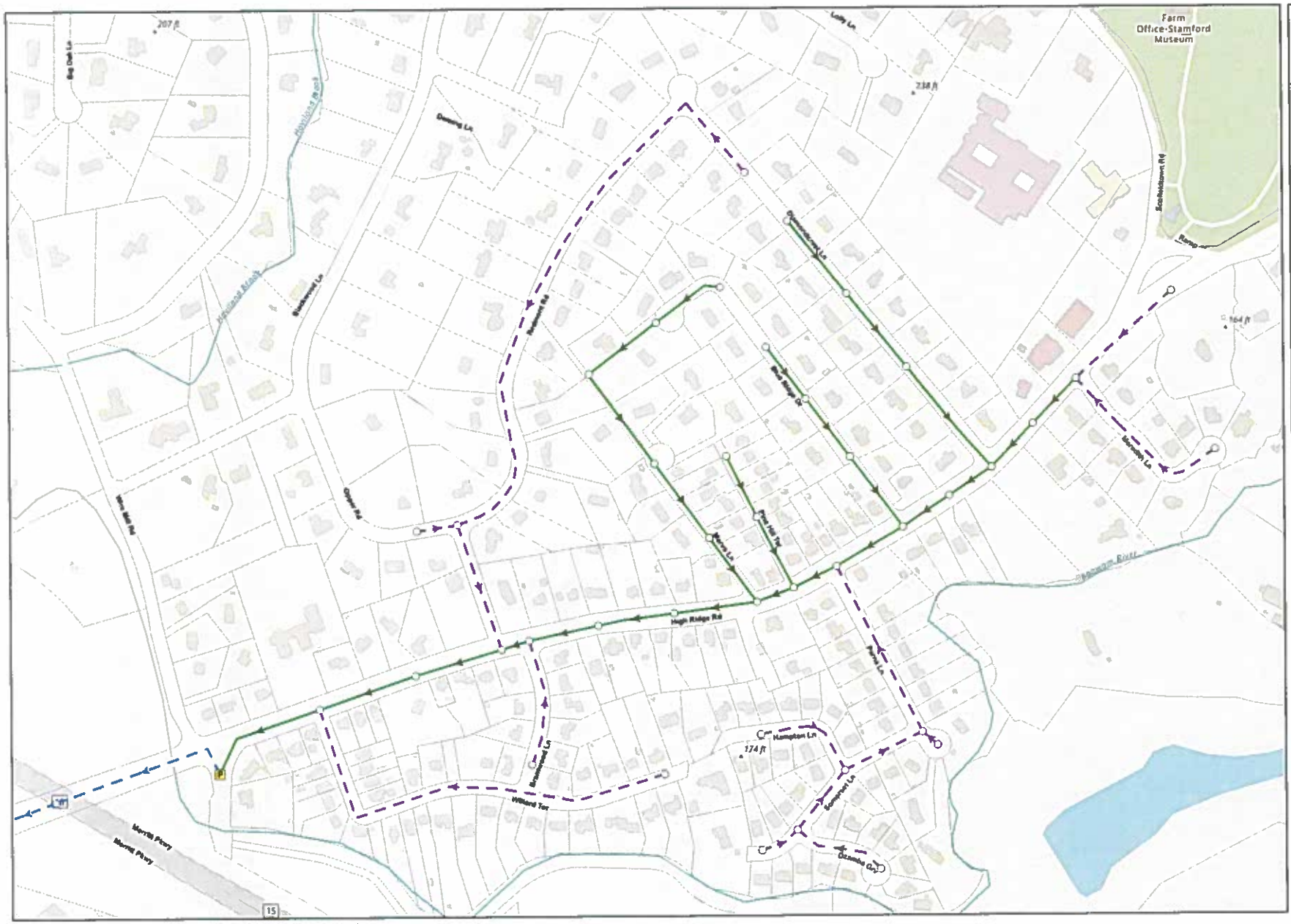

FIGURE 4-1
ALTERNATE #11

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)
- Low Pressure Sewer (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

Perna Lane Area
Sanitary Sewer
Alternatives Report

October 2019

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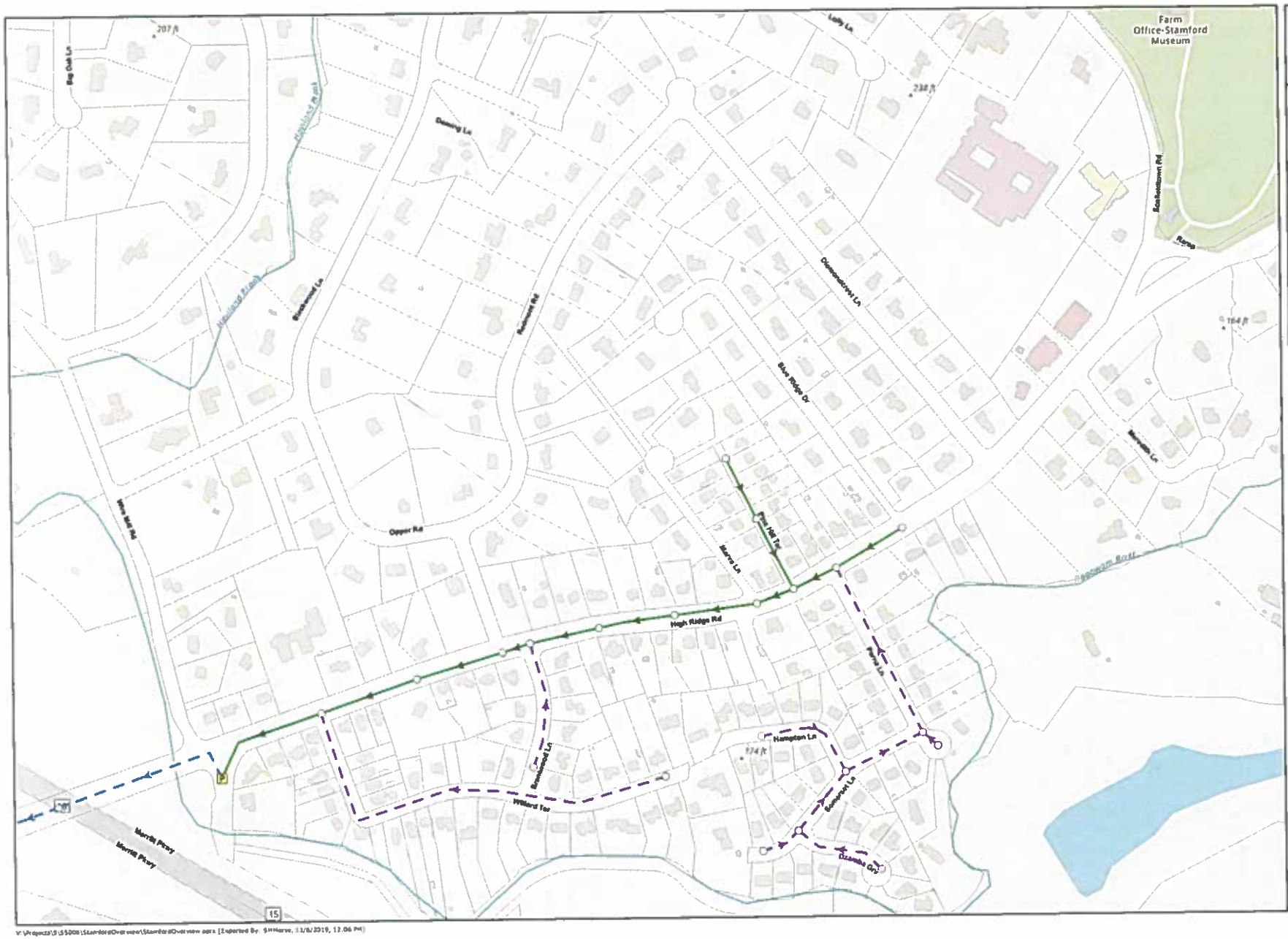

FIGURE 4-1A
REVISED
ALTERNATE #11A

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)
- Low Pressure Sewer (6" deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

Perna Lane Area
Sanitary Sewer
Alternatives Report

November 2019

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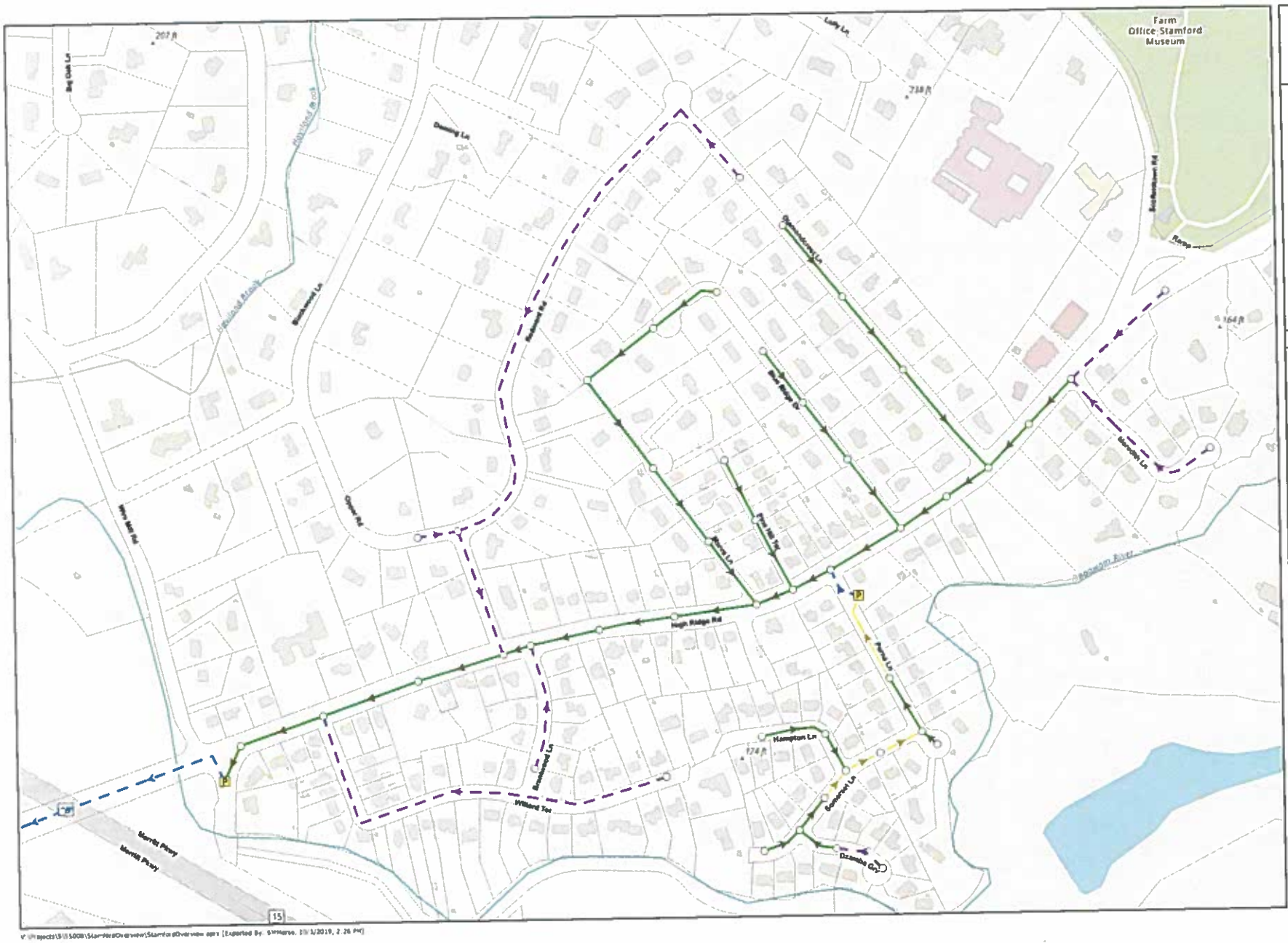

FIGURE 4-2
ALTERNATE #12

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6" deep)
- Low Pressure Sewer (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate

Perna Lane Area Sanitary Sewer Alternatives Report

October 2019

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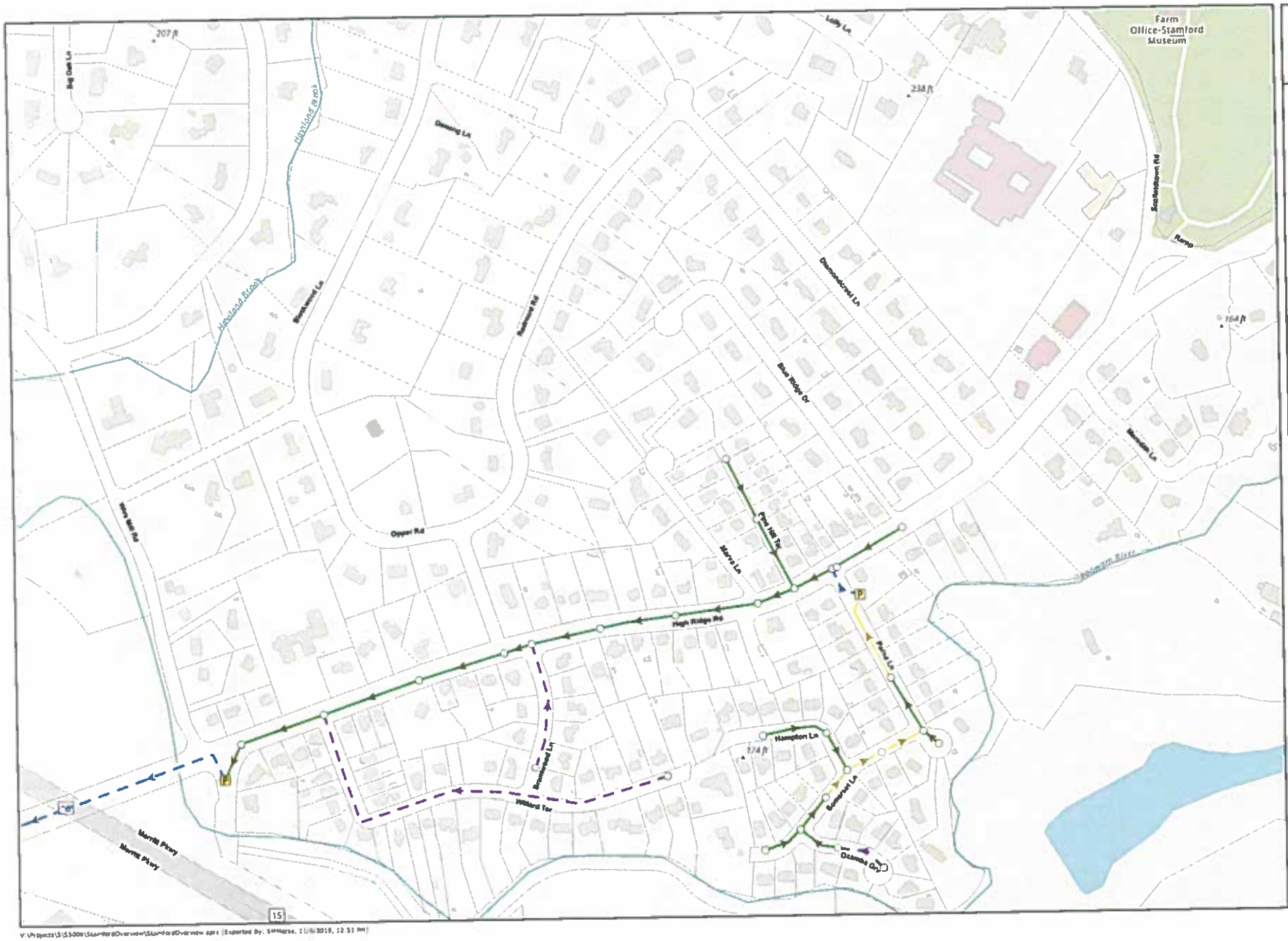

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FIGURE 4-2A
REVISED
ALTERNATE #12A

LEGEND

- Pump Station
- Sewer Manhole
- Force Main (6' deep)
- Low Pressure Sewer (6' deep)

Gravity Sewer/Main Depth

- Less than 10'
- 10' - 15'
- 15' - 20'
- 20' - 30'
- 30'+
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel Boundaries downloaded from CTDEEP and are approximate.

Perna Lane Area
Sanitary Sewer
Alternatives Report

November 2019

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5-1

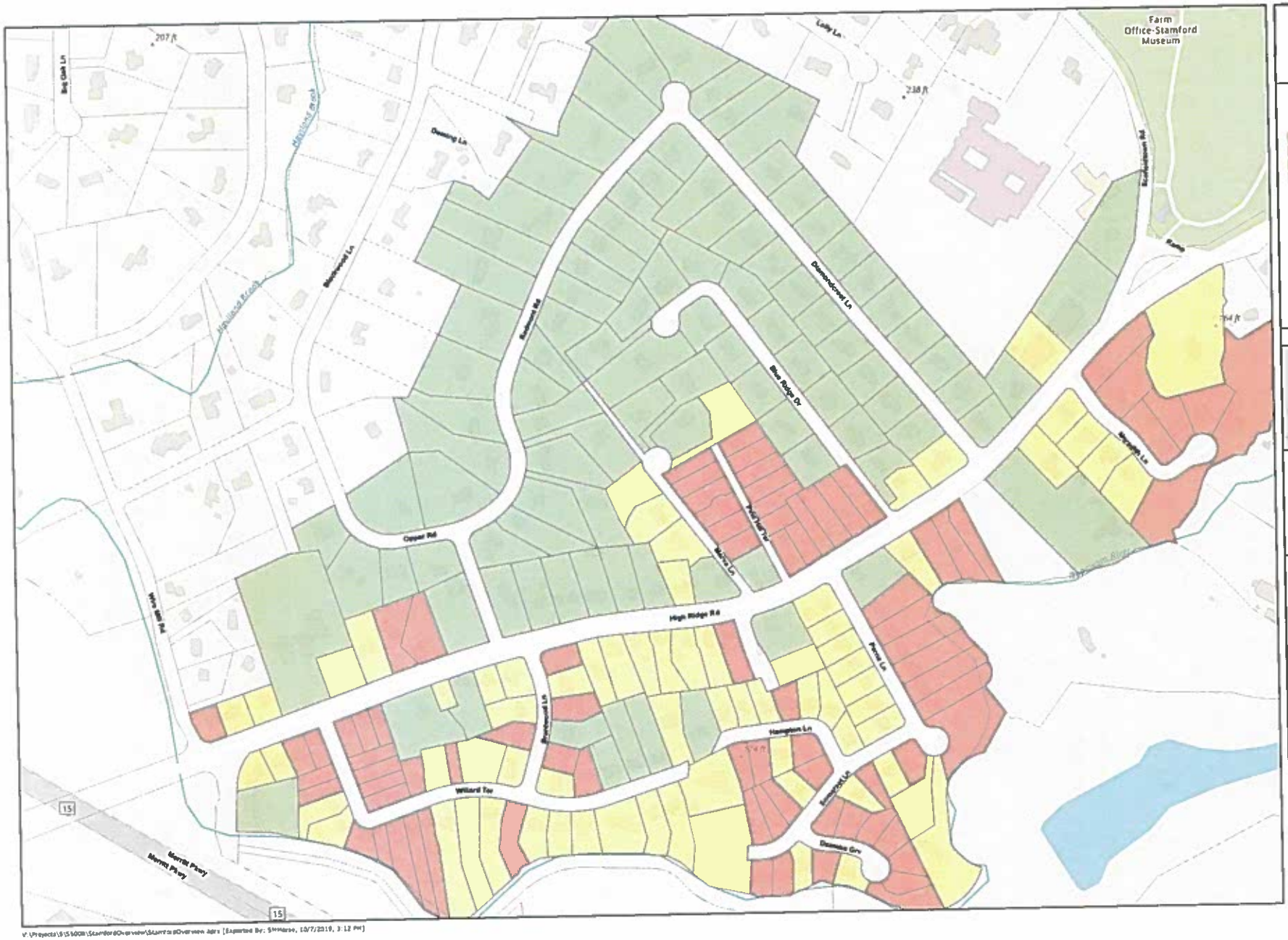

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FIGURE 6-1
SEPTIC SYSTEM FEASIBILITY

LEGEND

- Alternative Technology
- Compliant System Not Possible
- Traditional Leaching Trenches
- Approximate Parcel Boundary

LOCUS MAP

0 150 300
Feet
1:3,600

NOTES

1. Based on ESRI World Topographic Vector Map Service.
2. Parcel boundaries downloaded from CTDEEP and are approximate.

Perna Lane Area Sanitary Sewer Alternatives Report

October 2019

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APPENDIX A

City of Stamford, Connecticut
High Ridge Road Sanitary Sewer Extension
Engineer's Opinion of Probable Construction Cost

10/4/2019

This is an engineer's Opinion of probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of the Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost

Tighe&Bond
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		Alternative 7 - Phase 1				**Alternative 7 - Phase 2**				**Alternative 7 - Phase 3**				**Total**			
Bid Item No.	Bid Item Description	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total
1	Rock Excavation	800	CY	$300.00	$240,000.00	1500	CY	$300.00	$450,000.00	1300	CY	$300.00	$390,000.00	3600	CY	$300.00	$1,080,000.00
2A	Gravity Sewer Main < 10'	6702	LF	$130.00	$871,260.00	5792	LF	$130.00	$752,960.00	900	LF	$130.00	$117,000.00	13394	LF	$130.00	$1,741,220.00
2B	Gravity Sewer Main 10 - 15'		LF	$150.00	$0.00		LF	$150.00	$0.00	900	LF	$150.00	$135,000.00	900	LF	$150.00	$135,000.00
2C	Gravity Sewer Main > 15'		LF	$200.00	$0.00		LF	$200.00	$0.00	900	LF	$200.00	$180,000.00	900	LF	$200.00	$180,000.00
3	Low Pressure Sewer Main - single		LF	$85.00	$0.00		LF	$85.00	$0.00		LF	$85.00	$0.00		LF	$85.00	$0.00
4	Low Pressure Sewer Main - double		LF	$120.00	$0.00		LF	$120.00	$0.00		LF	$120.00	$0.00		LF	$120.00	$0.00
5	Gravity Sewer Manholes	56	Each	$6,500.00	$364,000.00	40	Each	$6,500.00	$260,000.00	16	Each	$6,500.00	$104,000.00	112	Each	$6,500.00	$728,000.00
6	Air Release Valves	1	Each	$2,000.00	$2,000.00		Each	$2,000.00	$0.00		Each	$2,000.00	$0.00	1	Each	$2,000.00	$2,000.00
7	Junction Manhole (LPS)		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00
8	Terminal Manhole (LPS)		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00
9	Low Pressure Sewer Laterals	1640	LF	$85.00	$139,400.00	2050	LF	$85.00	$174,250.00	110	LF	$85.00	$9,350.00	3800	LF	$85.00	$323,000.00
10	Gravity Sewer Laterals	4300	LF	$110.00	$473,000.00	2200	LF	$110.00	$242,000.00	1260	LF	$110.00	$138,600.00	7760	LF	$110.00	$853,600.00
11	Sewer Grinder Pumps	15	Each	$10,000.00	$150,000.00	14	Each	$10,000.00	$140,000.00	1	Each	$10,000.00	$10,000.00	30	Each	$10,000.00	$300,000.00
12A	Submersible Pump Station - Large	1	Each	$575,000.00	$575,000.00		Each	$575,000.00	$0.00		Each	$575,000.00	$0.00	1	Each	$575,000.00	$575,000.00
12B	Submersible Pump Station - Small	1	Each	$250,000.00	$250,000.00	1	Each	$250,000.00	$250,000.00		Each	$250,000.00	$0.00	2	Each	$250,000.00	$500,000.00
13	Pump Station Force Main	2500	LF	$125.00	$312,500.00		LF	$125.00	$0.00		LF	$125.00	$0.00	2500	LF	$125.00	$312,500.00
14	Storm Drainage	1	LS	$180,000.00	$180,000.00	1	LS	$160,000.00	$160,000.00	1	LS	$220,000.00	$220,000.00	1	LS	$560,000.00	$560,000.00
15	Topsoil + Seeding	4800	SY	$5.00	$24,000.00	1300	SY	$5.00	$6,500.00	950	SY	$5.00	$4,750.00	7050	SY	$5.00	$35,250.00
16	Water Handling	1	LS	$40,000.00	$40,000.00		LS	$40,000.00	$0.00		LS	$40,000.00	$0.00	1	LS	$40,000.00	$40,000.00
17	Sediment and Erosion Control	1	LS	$27,000.00	$27,000.00	1	LS	$20,000.00	$20,000.00	1	LS	$12,500.00	$12,500.00	1	LS	$59,500.00	$59,500.00
18	EPB Landscaping	1	LS	$30,000.00	$30,000.00	1	LS	$5,000.00	$5,000.00	1	LS		$0.00	1	LS	$35,000.00	$35,000.00
19	Pavement	1	LS	$1,535,000.00	$1,535,000.00	1	LS	$1,050,000.00	$1,050,000.00	1	LS	$150,000.00	$150,000.00	1	LS	$2,735,000.00	$2,735,000.00
20	Mobilization/Demobilization (6%)	1	LS	$312,789.60	$312,789.60	1	LS	$210,642.60	$210,642.60	1	LS	$88,272.00	$88,272.00	1	LS	$611,704.20	$611,704.20
21	Maintenance + Protection of Traffic (4%)	1	LS	$208,526.40	$208,526.40	1	LS	$140,428.40	$140,428.40	1	LS	$58,848.00	$58,848.00	1	LS	$407,802.80	$407,802.80
22	Trafficmen	1607	hrs	$70.00	$112,494.67	1158	hrs	$70.00	$81,088.00	270	hrs	$70.00	$18,900.00	3035	hrs	$70.00	$212,482.67
23	Clear + Grub (2%)	1	LS	$104,263.20	$104,263.20	1	LS	$70,214.20	$70,214.20	1	LS	$29,424.00	$29,424.00	1	LS	$203,901.40	$203,901.40
				Total:	$5,951,233.87			Total:	$4,013,083.20			Total:	$1,666,644.00			Total:	$11,630,961.07
				15% Project Contingency:	$892,685.08			15% Project Contingency:	$601,962.48			15% Project Contingency:	$249,996.60			15% Project Contingency:	$1,744,644.16
				Subtotal:	$6,843,918.95			Subtotal:	$4,615,045.68			Subtotal:	$1,916,640.60			Subtotal:	$13,375,605.23

City of Stamford, Connecticut
High Ridge Road Sanitary Sewer Extension
Engineer's Opinion of Probable Construction Cost

10/4/2019

This is an engineer's Opinion of probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of the Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost

Tighe&Bond
Engineers | Environmental Specialists

		Alternative #8 - Phase 1				**Alternative #8 - Phase 2**				**Alternative #8 - Phase 3**				**Total**			
Bid Item No.	Bid Item Description	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total
1	Rock Excavation	800	CY	$300.00	$240,000.00	1500	CY	$300.00	$450,000.00	1000	CY	$300.00	$300,000.00	3300	CY	$300.00	$990,000.00
2A	Gravity Sewer Main < 10'	6702	LF	$130.00	$871,260.00	5792	LF	$130.00	$752,960.00	2700	LF	$130.00	$351,000.00	15194	LF	$130.00	$1,975,220.00
2B	Gravity Sewer Main 10 - 15'		LF	$150.00	$0.00		LF	$150.00	$0.00		LF	$150.00	$0.00	0	LF	$150.00	$0.00
2C	Gravity Sewer Main > 15'		LF	$200.00	$0.00		LF	$200.00	$0.00		LF	$200.00	$0.00	0	LF	$200.00	$0.00
3	Low Pressure Sewer Main - single		LF	$85.00	$0.00		LF	$85.00	$0.00		LF	$85.00	$0.00		LF	$85.00	$0.00
4	Low Pressure Sewer Main - double		LF	$120.00	$0.00		LF	$120.00	$0.00		LF	$120.00	$0.00		LF	$120.00	$0.00
5	Gravity Sewer Manholes	56	Each	$6,500.00	$364,000.00	40	Each	$6,500.00	$260,000.00	16	Each	$6,500.00	$104,000.00	112	Each	$6,500.00	$728,000.00
6	Air Release Valves	1	Each	$2,000.00	$2,000.00		Each	$2,000.00	$0.00		Each	$2,000.00	$0.00	1	Each	$2,000.00	$2,000.00
7	Junction Manhole (LPS)		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00		Each	$7,500.00	$0.00
8	Terminal Manhole (LPS)		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00		Each	$6,750.00	$0.00
9	Low Pressure Sewer Laterals	1640	LF	$85.00	$139,400.00	2050	LF	$85.00	$174,250.00	400	LF	$85.00	$34,000.00	4090	LF	$85.00	$347,650.00
10	Gravity Sewer Laterals	4300	LF	$110.00	$473,000.00	2200	LF	$110.00	$242,000.00	1260	LF	$110.00	$138,600.00	7760	LF	$110.00	$853,600.00
11	Sewer Grinder Pumps	15	Each	$10,000.00	$150,000.00	14	Each	$10,000.00	$140,000.00	4	Each	$10,000.00	$40,000.00	33	Each	$10,000.00	$330,000.00
12A	Submersible Pump Station - Large	1	Each	$575,000.00	$575,000.00		Each	$575,000.00	$0.00		Each	$575,000.00	$0.00	1	Each	$575,000.00	$575,000.00
12B	Submersible Pump Station - Small	1	Each	$250,000.00	$250,000.00	1	Each	$250,000.00	$250,000.00	1	Each	$250,000.00	$250,000.00	3	Each	$250,000.00	$750,000.00
13	Pump Station Force Main	2500	LF	$125.00	$312,500.00		LF	$125.00	$0.00		LF	$125.00	$0.00	2500	LF	$125.00	$312,500.00
14	Storm Drainage	1	LS	$180,000.00	$180,000.00	1	LS	$160,000.00	$160,000.00	1	LS	$220,000.00	$220,000.00	1	LS	$560,000.00	$560,000.00
15	Topsoil + Seeding	4800	SY	$5.00	$24,000.00	1300	SY	$5.00	$6,500.00	950	SY	$5.00	$4,750.00	7050	SY	$5.00	$35,250.00
16	Water Handling	1	LS	$40,000.00	$40,000.00		LS	$40,000.00	$0.00		LS	$40,000.00	$0.00	1	LS	$40,000.00	$40,000.00
17	Sediment and Erosion Control	1	LS	$27,000.00	$27,000.00	1	LS	$20,000.00	$20,000.00	1	LS	$12,500.00	$12,500.00	1	LS	$59,500.00	$59,500.00
18	EPB Landscaping	1	LS	$30,000.00	$30,000.00	1	LS	$5,000.00	$5,000.00	1	LS		$0.00	1	LS	$35,000.00	$35,000.00
19	Pavement	1	LS	$1,535,000.00	$1,535,000.00	1	LS	$1,050,000.00	$1,050,000.00	1	LS	$150,000.00	$150,000.00	1	LS	$2,735,000.00	$2,735,000.00
20	Mobilization/Demobilization (6%)	1	LS	$312,789.60	$312,789.60	1	LS	$210,642.60	$210,642.60	1	LS	$96,291.00	$96,291.00	1	LS	$619,723.20	$619,723.20
21	Maintenance + Protection of Traffic (4%)	1	LS	$208,526.40	$208,526.40	1	LS	$140,428.40	$140,428.40	1	LS	$64,194.00	$64,194.00	1	LS	$413,148.80	$413,148.80
22	Trafficmen	1607	hrs	$70.00	$112,490.00	1158	hrs	$70.00	$81,060.00	270	hrs	$70.00	$18,900.00	3035	hrs	$70.00	$212,450.00
23	Clear + Grub (2%)	1	LS	$104,263.20	$104,263.20	1	LS	$70,214.20	$70,214.20	1	LS	$32,097.00	$32,097.00	1	LS	$206,574.40	$206,574.40
				Total:	$5,951,229.20			Total:	$4,013,055.20			Total:	$1,816,332.00			Total:	$11,780,616.40
				15% Project Contingency:	$892,684.38			15% Project Contingency:	$601,958.28			15% Project Contingency:	$272,449.80			15% Project Contingency:	$1,767,092.46
				Subtotal:	$6,843,913.58			Subtotal:	$4,615,013.48			Subtotal:	$2,088,781.80			Subtotal:	$13,547,708.86

City of Stamford, Connecticut
High Ridge Road Sanitary Sewer Extension
Engineer's Opinion of Probable Construction Cost

10/4/2019

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Tighe&Bond
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		Alternative No. 9: All Low Pressure Sewer - Single Pipe				**Alternative No. 10: Low Pressure - Double Pipe**				**Alternative No.11: Combination 1**				**Alternative No. 12: Combination 2**			
Bid Item No.	Bid Item Description	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total
5	Rock Excavation	100	CY	$300.00	$30,000.00	100	CY	$300.00	$30,000.00	100	CY	$300.00	$30,000.00	100	CY	$300.00	$30,000.00
6A	Gravity Sewer Main < 10'	0	LF	$130.00	$0.00	0	LF	$130.00	$0.00	7010	LF	$130.00	$911,300.00	9003	LF	$130.00	$1,170,390.00
6B	Gravity Sewer Main 10 - 15'	0	LF	$150.00	$0.00	0	LF	$150.00	$0.00	0	LF	$150.00	$0.00	0	LF	$150.00	$0.00
6C	Gravity Sewer Main > 15'	0	LF	$200.00	$0.00	0	LF	$200.00	$0.00	0	LF	$200.00	$0.00	0	LF	$200.00	$0.00
7	Low Pressure Sewer Main - single	17307	LF	$85.00	$1,471,095.00	17307	LF	$85.00	$1,471,095.00	7986	LF	$85.00	$678,810.00	5993	LF	$85.00	$509,405.00
8	Low Pressure Sewer Main - double	0	LF	$120.00	$0.00	5940	LF	$120.00	$712,800.00	0	LF	$120.00	$0.00	0	LF	$120.00	$0.00
9	Gravity Sewer Manholes	0	Each	$6,500.00	$0.00	0	Each	$6,500.00	$0.00	38	Each	$6,500.00	$247,000.00	52	Each	$6,500.00	$338,000.00
10	Air Release Valves	8	Each	$2,000.00	$16,000.00	9	Each	$2,000.00	$18,000.00	4	Each	$2,000.00	$8,000.00	4	Each	$2,000.00	$8,000.00
11	Junction Manhole (LPS)	15	Each	$7,500.00	$112,500.00	16	Each	$7,500.00	$120,000.00	8	Each	$7,500.00	$60,000.00	8	Each	$7,500.00	$60,000.00
12	Terminal Manhole (LPS)	14	Each	$6,750.00	$94,500.00	15	Each	$6,750.00	$101,250.00	7	Each	$6,750.00	$47,250.00	7	Each	$6,750.00	$47,250.00
13	Low Pressure Sewer Laterals	251	Each	$2,150.00	$539,650.00	251	Each	$2,150.00	$539,650.00	147	Each	$2,150.00	$316,050.00	105	Each	$2,150.00	$225,750.00
14	Gravity Sewer Laterals	0	Each	$110.00	$0.00	0	Each	$110.00	$0.00	104	Each	$2,300.00	$239,200.00	146	Each	$2,300.00	$335,800.00
15	Sewer Grinder Pumps	251	Each	$6,000.00	$1,506,000.00	251	Each	$6,000.00	$1,506,000.00	147	Each	$6,000.00	$882,000.00	105	Each	$6,000.00	$630,000.00
16A	Submersible Pump Station - Large	0	Each	$575,000.00	$0.00	0	Each	$575,000.00	$0.00	1	Each	$575,000.00	$575,000.00	1	Each	$575,000.00	$575,000.00
16B	Submersible Pump Station - Small	0	Each	$250,000.00	$0.00	0	Each	$250,000.00	$0.00	0	Each	$250,000.00	$0.00	1	Each	$250,000.00	$250,000.00
17	Pump Station Force Main	0	LF	$125.00	$0.00	0	LF	$125.00	$0.00	2400	LF	$125.00	$300,000.00	2550	LF	$125.00	$318,750.00
18	Storm Drainage	1	LS	$560,000.00	$560,000.00	1	LS	$560,000.00	$560,000.00	1	LS	$560,000.00	$560,000.00	1	LS	$560,000.00	$560,000.00
19	Topsoil + Seeding	7050	SY	$5.00	$35,250.00	7050	SY	$5.00	$35,250.00	7050	SY	$5.00	$35,250.00	7050	SY	$5.00	$35,250.00
20	Water Handling - Rippowam River	1	LS	$40,000.00	$40,000.00	1	LS	$40,000.00	$40,000.00	1	LS	$40,000.00	$40,000.00	1	LS	$40,000.00	$40,000.00
21	Sediment and Erosion Control	1	LS	$59,500.00	$59,500.00	1	LS	$59,500.00	$59,500.00	1	LS	$59,500.00	$59,500.00	1	LS	$59,500.00	$59,500.00
22	EPB Landscaping	1	LS	$35,000.00	$35,000.00	1	LS	$35,000.00	$35,000.00	1	LS	$35,000.00	$35,000.00	1	LS	$35,000.00	$35,000.00
23	Pavement	1	LS	$2,735,000.00	$2,735,000.00	1	LS	$2,735,000.00	$2,735,000.00	1	LS	$2,735,000.00	$2,735,000.00	1	LS	$2,735,000.00	$2,735,000.00
1	Mobilization/Demobilization (6%)	1	LS	$257,197.50	$257,197.50	1	LS	$257,197.50	$257,197.50	1	LS	$257,328.90	$257,328.90	1	LS	$257,328.90	$257,328.90
2	Maintenance + Potection of Traffic (4%)	1	LS	$171,465.00	$171,465.00	1	LS	$171,465.00	$171,465.00	1	LS	$171,552.60	$171,552.60	1	LS	$171,552.60	$171,552.60
3	Trafficmen	1530	hrs	$70.00	$107,100.00	1850	hrs	$70.00	$129,500.00	1960	hrs	$70.00	$137,200.00	2170	hrs	$70.00	$151,900.00
4	Clearing + Grubbing (2%)	1	LS	$85,732.50	$85,732.50	1	LS	$85,732.50	$85,732.50	1	LS	$85,776.30	$85,776.30	1	LS	$85,776.30	$85,776.30
				Total:	$7,855,990.00			Total:	$8,607,440.00			Total:	$8,411,217.80			Total:	$8,629,652.80
				15% Project Contingency:	$1,178,398.50			15% Project Contingency:	$1,291,116.00			15% Project Contingency:	$1,261,682.67			15% Project Contingency:	$1,294,447.92
				Subtotal:	$9,034,388.50			Subtotal:	$9,898,556.00			Subtotal:	$9,672,900.47			Subtotal:	$9,924,100.72

Notes:

- nominal rock quantity of 100 cy
- gravity lateral cost 20 LF x $115/LF
- LPS lateral cost 20 LF x $90/LF plus $350 valve kit

City of Stamford, Connecticut
High Ridge Road Sanitary Sewer Extension
Engineer's Opinion of Probable Construction Cost

9/12/2019

This is an engineer's Opinion of probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of the Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost

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		Trench Type System				**Alternative Type System - Geomatrix GST3724**			
Bid Item No.	Bid Item Description	Quantity	Unit	Estimated Unit Cost	Extended Total	Quantity	Unit	Estimated Unit Cost	Extended Total
1	Construction Staking	1	LS	$2,000.00	$2,000.00	1	LS	$2,000.00	$2,000.00
2	Soil + Erosion Control	1	LS	$500.00	$500.00	1	LS	$500.00	$500.00
3	Clearing & Grubbing	1	LS	$1,000.00	$1,000.00	1	LS	$1,000.00	$1,000.00
4	Pump Existing Tank	1	LS	$500.00	$500.00	1	LS	$500.00	$500.00
5	New Septic Tank	1	Each	$1,000.00	$1,000.00	1	Each	$1,000.00	$1,000.00
6	House Service	15	LF	$30.00	$450.00	15	LF	$30.00	$450.00
7A	Excavate 280 LF Leaching Trenches	62	CY	$10.00	$622.22		CY	$10.00	$0.00
7B	Excavate 80 LF for Geomatrix System		CY	$10.00	$0.00	22	CY	$20.00	$444.44
8A	Stone 280 LF Leaching Trenches	62	LF	$40.00	$2,480.00		LF	$40.00	$0.00
8B	Leaching Trench Pipe	280	LF	$15.00	$4,200.00		LF	$15.00	$0.00
9	Geoamatrix GST 3724 w/ Stone		LF	$180.00	$0.00	80	LF	$220.00	$17,600.00
10	Topsoil & Seed	267	SY	$4.00	$1,066.67	160	SY	$4.00	$640.00
11	Fill	62	CY	$40.00	$2,480.00	30	CY	$40.00	$1,200.00
12	Distribution Boxes	6	Each	$175.00	$1,050.00	2	Each	$175.00	$350.00
				Total:	$17,348.89			Total:	$25,684.44
				15% Project Contingency:	$2,602.33			15% Project Contingency:	$3,852.67
				Subtotal:	$19,951.22			Subtotal:	$29,537.11

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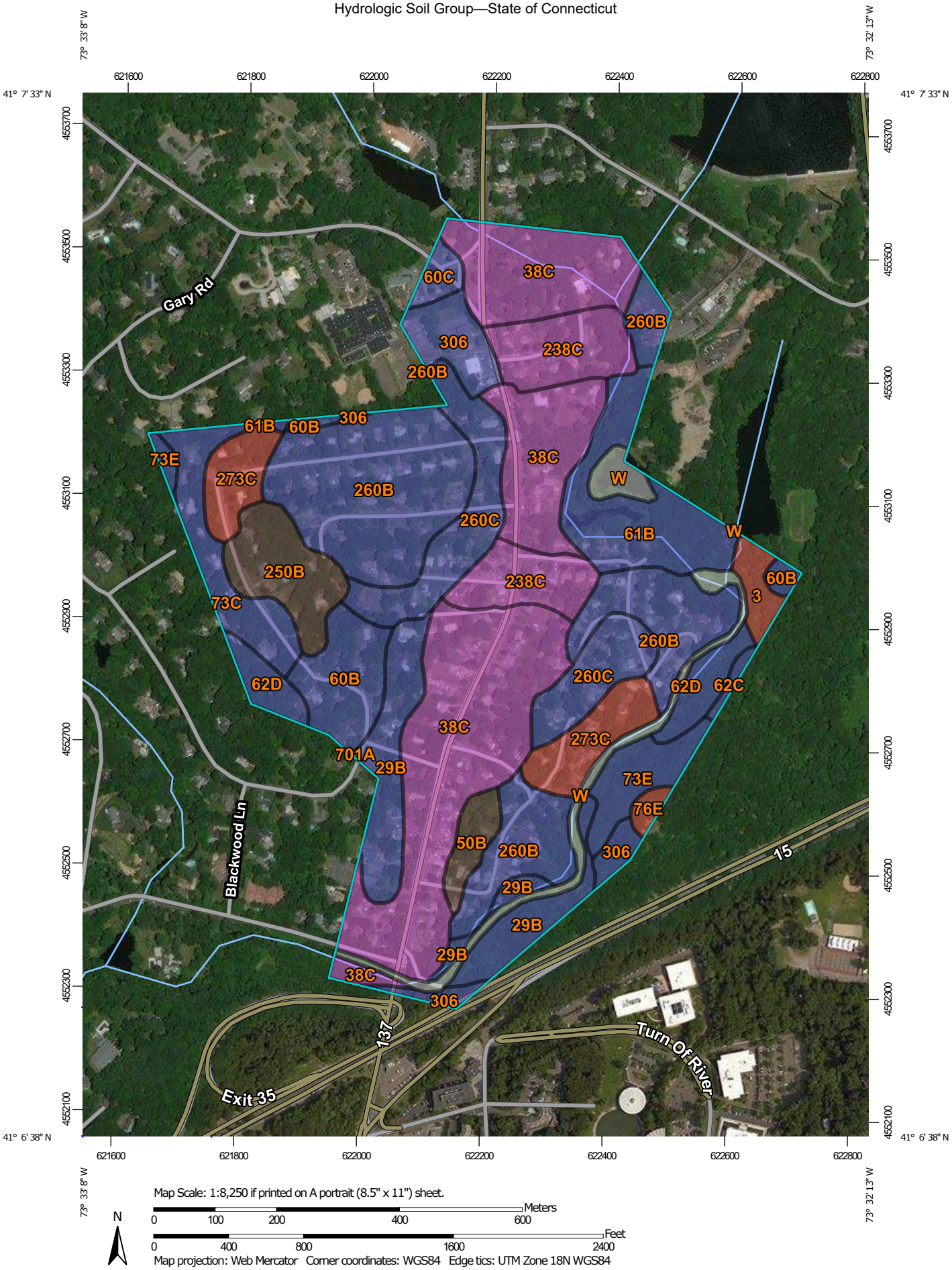
APPENDIX B


73° 33' 8" W
73° 32' 13" W
621600
621800
622000
622200
622400
622600
622800
41° 7' 33" N
41° 6' 38" N
4553700
4553500
4553300
4553100
4552900
4552700
4552500
4552300
4552100
Gary Rd
Blackwood Ln
137
Exit 35
Turn Of River
15
60C
38C
260B
306
238C
61B
60B
73E
273C
W
260C
250B
3
62D
62C
50B
29B
701A
76E
Map Scale: 1:8,250 if printed on A portrait (8.5" x 11") sheet.
Meters
0 100 200 400 600
Feet
0 400 800 1600 2400
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 18, Dec 6, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 5, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	1.9	1.1%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	B	11.6	6.5%
38C	Hinckley loamy sand, 3 to 15 percent slopes	A	44.0	24.6%
50B	Sutton fine sandy loam, 3 to 8 percent slopes	B/D	2.3	1.3%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	B	7.1	4.0%
60C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes	B	1.4	0.8%
61B	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony	B	10.2	5.7%
62C	Canton and Charlton fine sandy loams, 3 to 15 percent slopes, extremely stony	B	0.5	0.3%
62D	Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony	B	4.7	2.6%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	6.5	3.6%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	B	4.7	2.6%
76E	Rock outcrop-Hollis complex, 3 to 45 percent slopes	D	0.8	0.4%
238C	Hinckley-Urban land complex, 3 to 15 percent slopes	A	11.1	6.2%
250B	Sutton-Urban land complex, 0 to 8 percent slopes	B/D	6.6	3.7%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
260B	Charlton-Urban land complex, 3 to 8 percent slopes	B	32.8	18.3%
260C	Charlton-Urban land complex, 8 to 15 percent slopes	B	13.2	7.4%
273C	Urban land-Charlton-Chatfield complex, rocky, 3 to 15 percent slopes	D	8.2	4.6%
306	Udorthents-Urban land complex	B	5.9	3.3%
701A	Ninigret fine sandy loam, 0 to 3 percent slopes	C	0.0	0.0%
W	Water		5.4	3.0%
Totals for Area of Interest			**178.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX C

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LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

81 WILLARD TERRACE

4 Bedroom

HSG B Soil, assume 1 inch in 20 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 787.5 SF

Borings W-4 to W-6 indicate boulders, bedrock around 11' deep.

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

787.5 SF / 3.0 SF/LF = 262.5 LF required

Maximum width available 44 LF

Use 6 rows of 44 LF trenches providing 264 LF

Depth required: 6 rows x 8' O.C. + 3' = 51'

Depth provided: 12'

► NO GOOD

Trail 2: Use Geomatrix GST 6236 @ 13' O.C., 62" W x 36" H, 26.2 SF ELA/LF

787.5 SF / 26.2 SF/LF = 30.05 LF

Use a single row, 30 LF

O.C. spacing exceeds available depth, therefore no room for reserve.

► NO GOOD, COMPLIANT SYSTEM NOT POSSIBLE

LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

15 HAMPTON LANE

4 Bedroom

HSG B Soil, assume 1 inch in 20 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 787.5 SF

Boring H2 indicates bedrock about 7' deep

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

787.5 SF / 3.0 SF/LF = 262.5 LF required

Maximum width available 43 LF

Use 7 rows of 40 LF trenches providing 280 LF

Depth required: 7 rows x 8' O.C. + 3' = 59'

Depth provided: 45' – 56'

► NO GOOD

Trail 2: Use Geomatrix GST 3724 @ 12' O.C., 37" W x 24" H, 10.5 SF ELA/LF

787.5 SF / 10.5 SF/LF = 75 LF

Use 2 rows of 40' = 80' OK

Check reserve

Reserve space exists

► COMPLIANT SYSTEM POSSIBLE

LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

11 PERNA LANE

4 Bedroom

HSG A Soil, assume 1 inch in 10 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 577.5 SF

Boring P1 indicates bedrock about 21' deep, groundwater at 10.5' deep

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

577.5 SF / 3.0 SF/LF = 192.5 LF required

Maximum width available 43 LF

Use 5 rows of 40 LF trenches providing 200 LF

Depth required: 5 rows x 8' O.C. + 3' = 43'

Depth provided: 24'

► NO GOOD

Trail 2: Use Geomatrix GST 6236 @ 13' O.C., 62" W x 36" H, 26.2 SF ELA/LF

577.5 SF / 26.2 SF/LF = 22.04 LF

Use rows of 30' OK

Check reserve

Reserve space exists

► COMPLIANT SYSTEM POSSIBLE

LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

22 BRANTWOOD LANE

3 Bedroom

HSG D Soil, assume 1 inch in 45 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 900 SF

Boring BR2 indicates bedrock about 13' deep, groundwater at 10.0' deep

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

900 SF / 3.0 SF/LF = 300 LF required

Maximum width available 54 LF

Use 6 rows of 50 LF trenches providing 300 LF

Depth required: 6 rows x 8' O.C. + 3' = 51'

Depth provided: 80'+ OK

Check Reserve

Not enough room for traditional trenches
Use Geomatrix GST 3724 @ 12' O.C., 37" W x 24" H, 10.5 SF ELA/LF

900 SF / 10.5 SF/LF = 85.7 LF

Use 2 rows of 45 LF, OK

► COMPLIANT SYSTEM POSSIBLE

LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

33 SOMERSET LANE

4 Bedroom

HSG B Soil, assume 1 inch in 20 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 787.5 SF

Boring S2 & S3 indicates bedrock about 7.5' deep

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

787.5 SF / 3.0 SF/LF = 262.5 LF required

Maximum width available 38 LF

Use 7 rows of 38 LF trenches providing 266 LF

Depth required: 7 rows x 8' O.C. + 3' = 59'

Depth provided: 17' – 33'

► NO GOOD

Trail 2: Use Geomatrix GST 6224 @ 13' O.C., 62" W x 24" H, 18.1 SF ELA/LF

787.5 SF / 18.1 SF/LF = 43.50 LF

Use 2 rows of 25'= 50 LF provided, OK

Check reserve

No remaining area for reserve space

► COMPLIANT SYSTEM NOT POSSIBLE

LEACHING FIELD SIZING COMPUTATIONS
September 24, 2019

19 MEREDITH LANE

5 Bedroom

HSG A Soil, assume 1 inch in 10 minutes

Technical Standards, Table 6, Effective Leaching Area Required: 660 SF

Boring M1 & M2 indicates bedrock about 22' deep, groundwater at 8' deep

Trial 1: Use 36" W x 18" D trenches @ 8' O.C., 3.0 SF ELA/LF

660 SF / 3.0 SF/LF = 220 LF required

Maximum width available 60 LF

Use 4 rows of 60 LF trenches providing 240 LF

Depth required: 4 rows x 8' O.C. + 3' = 35'

Depth provided: 10'

► NO GOOD

Trail 2: Use Geomatrix GST 6236 @ 13' O.C., 62" W x 36" H, 26.2 SF ELA/LF

660 SF / 26.2 SF/LF = 25.19 LF

Use 1 rows of 26', OK

Check reserve

No remaining area for reserve space

► COMPLIANT SYSTEM NOT POSSIBLE

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