Tysons East Conveyance System Modifications

Fairfax County, VA

Contract Number: WW-000034-001
Fund Number: 690-C69310
Work Order No.: 18665-000

Preliminary Engineering Report

SEPTEMBER 2022

Quality Assurance / Quality Control Form

Project:	Tysons East Conveyance System Modifications Fairfax County, VA **Preliminary Engineering Report**
Contract Number:	WW-000034-001
Fund Number:	690-C69310
Work Order Number:	18665-000
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Table of Contents

List of Tables

List of Figures

List of Appendices

1 Introduction

1.1 Background

The Tysons East Conveyance System Modifications project includes a proposed 10 million gallon per day (MGD) sanitary sewer pump station, flow diversion structure and associated gravity and force main conveyance systems to convey flows from the Scotts Run Interceptor to a new Tysons West Pump Station (TWPS). This configuration gives the County operational flexibility to send flows to either the DC Water Blue Plains Wastewater Treatment Plant or the Noman Cole Pollution Control Plant as shown in **Figure 1.1** below. Tysons East Pump Station (TEPS) is part of a comprehensive system approach to manage flow into the Potomac Interceptor (PI). Under certain flow conditions flow will be diverted from the interceptors leading to the PI and diverted to the Noman Cole Pollution Control Plant.

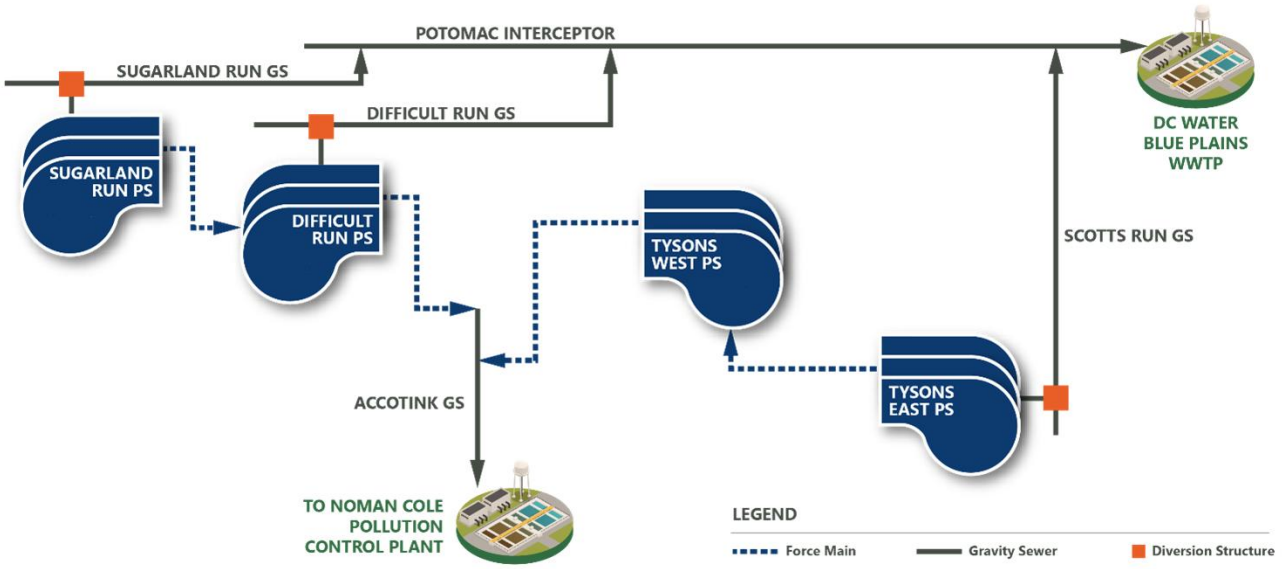


Figure 1.1: Sewershed System Schematic

1.2 Purpose

The purpose of this Preliminary Engineering Report (PER) is to determine a selected site area and force main alternative to aid the County with the site selection for the Tysons East Pump Station (TEPS). A recommended alternative will be selected based on criteria developed with the County for this project. This PER also establishes the preliminary design criteria for the proposed pump station, force main and gravity sewer design.

1.3 Report Organization

The following is a general outline of the sections provided within this report:

- **Section 2**: Discusses the notable site characteristics for the ten pump station site areas and force main alternatives selected for initial review, along with an initial screening to determine which site area sites and alignments to include for additional evaluation.
- **Section 3:** Describes the evaluation performed to determine the selected site area and force main alternative.

- **Section 4**: Outlines the proposed multi-disciplinary design criteria for the selected site area and force main alternative and provides a detailed description of the force main alignment.
- **Section 5**: Outlines the project permitting requirements.
- **Section 6**: Outlines the engineer's opinion of construction cost for the project

2 Pump Station Site Area and Force Main Alternatives

The Scotts Run Interceptor conveys flows from south to north, with flows increasing as the Interceptor proceeds to the north. The Tysons East Pump Station (TEPS) project will include an influent diversion structure connected to the Scotts Run Interceptor, influent gravity sewer, pump station facility, and force main to convey flows to the Tysons West Pump Station. The proposed site area will require improvements to accommodate a new pump station building, wet well, and stormwater management/best management facilities, as well as provide access to the new sanitary diversion structure. AASHTO SU-40 design vehicle turnaround access is required for all major facilities. The required acreage anticipated for the pump station is estimated to be a minimum of one (1) acre of land disturbance. The land disturbance of the site will vary based on its unique topography, distance to the Scotts Run Interceptor, environmental features, access to public roadway, and configuration of maintenance access to pump station facilities. Site requirements are described in more detail in **Section 4**.

After an initial screening for feasible locations, ten potential site area and force main alternatives were identified for evaluation. In reviewing potential locations for the TEPS, the Dulles Toll Road was identified as the southern boundary constraint for the geographical location of the TEPS. This constraint is to ensure adequate flow is available in the Scotts Run Interceptor to support the proposed capacity. The northern boundary constraint for the TEPS location was determined to be the Scotts Run Nature Preserve, which is located north of Georgetown Pike. This constraint was primarily identified based on the practicality of the location of the TEPS and to limit the length of the force main.

Figures 2.1 and 2.2 provide a location map of all ten site area alternatives relative to Scotts Run Interceptor. Also shown in **Figures 2.1 and 2.2** are the force main alignments associated with each pump station site area alternative. The following sections review the notable features for each pump station site area and force main alternative and discuss which of the identified alternatives can be eliminated from additional analysis.

After an initial review of the ten potential alternatives, five of the most suitable site area and force main alternatives were identified to be included in a detailed evaluation included in **Section 3**. The five pump station site area and force main selections are evaluated based on a variety of factors including Financial, Construction, Impact to Public/Environment, and Operation and Maintenance (O&M) Criteria.

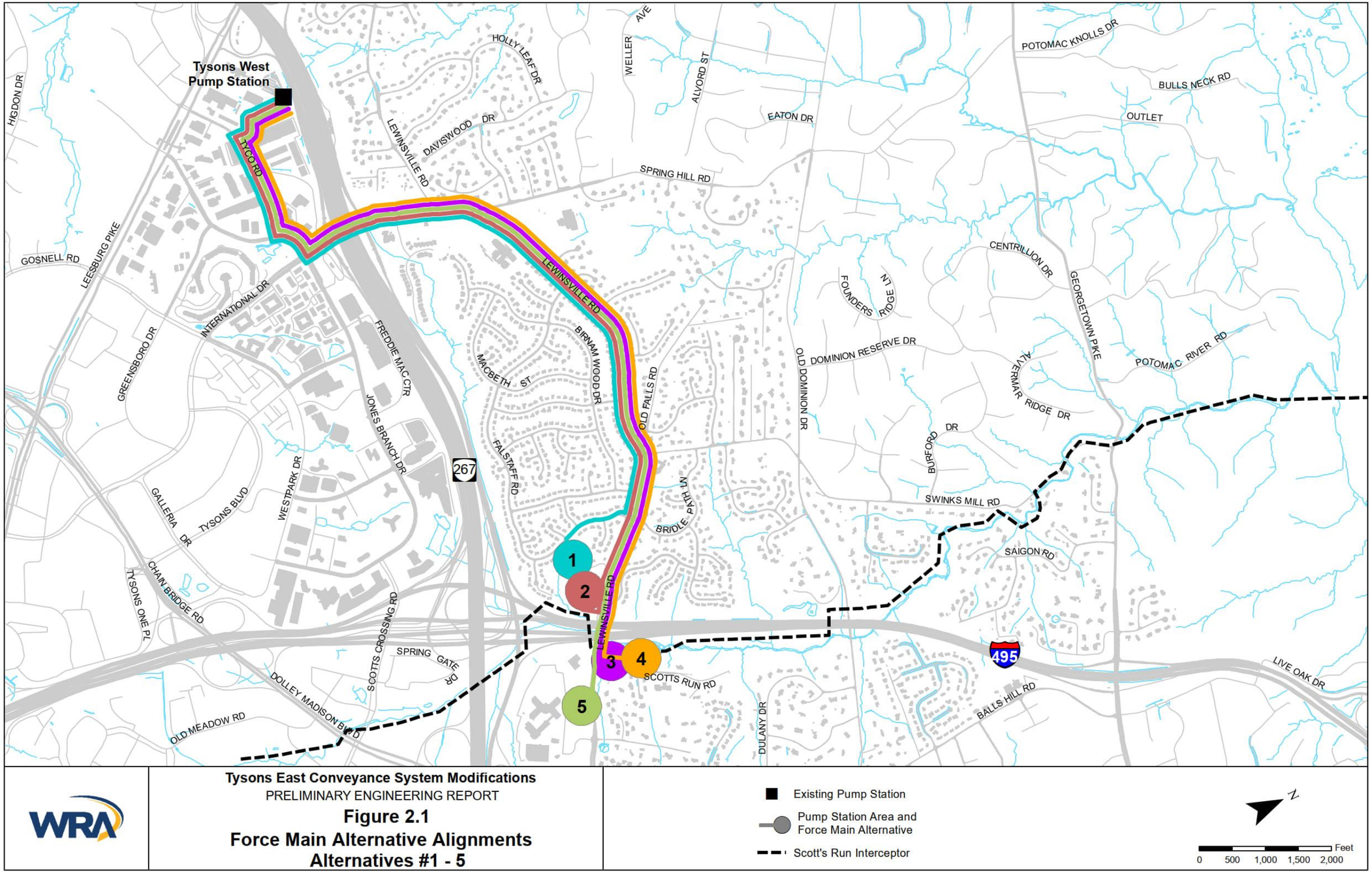


Figure 2.1: Map of Site Area and Force Main Alternatives #1-5

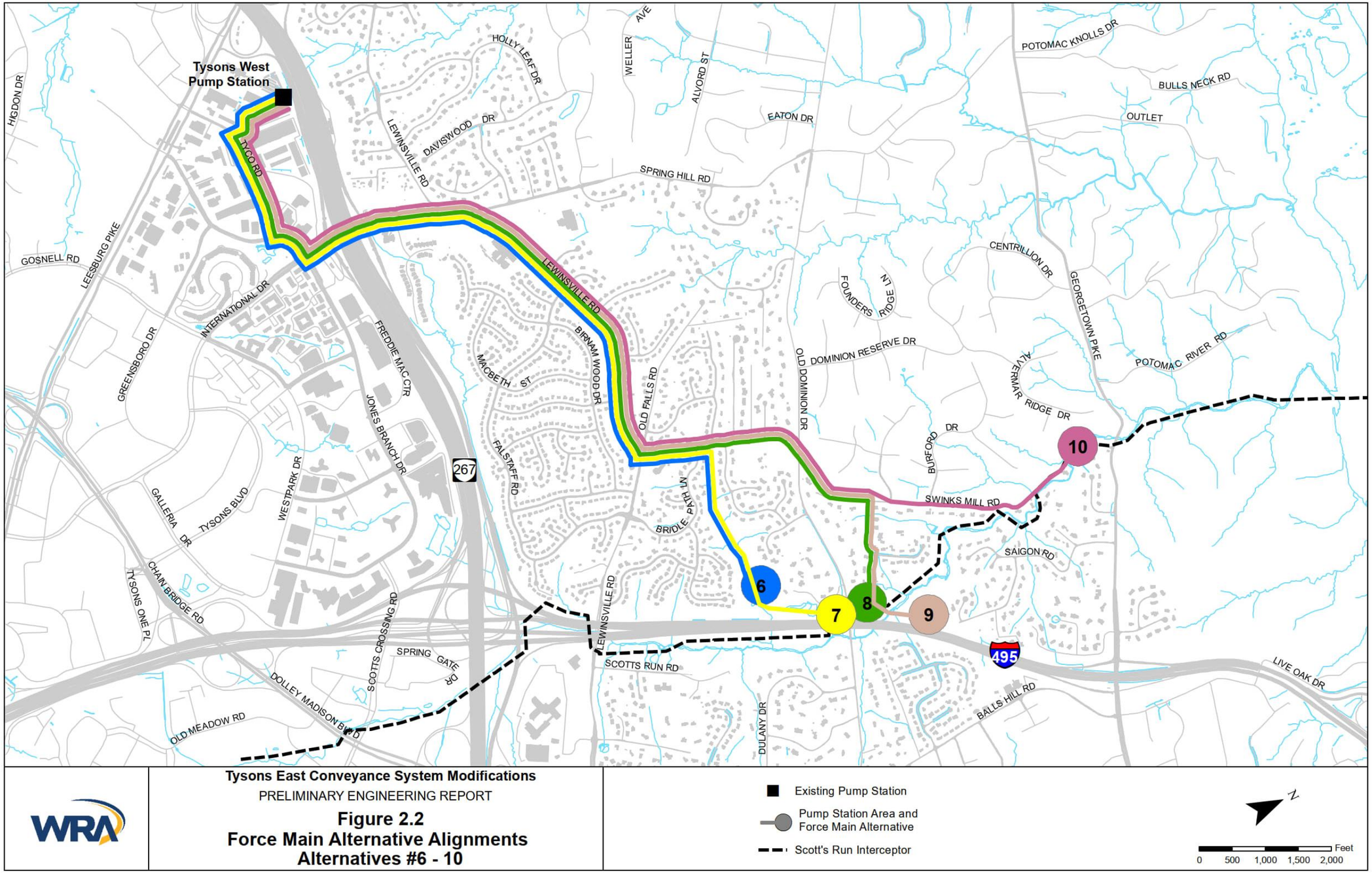


Figure 2.2: Map of Site Area and Force Main Alternatives #6-10

An on-going project within the region impacting the TEPS project is the I-495 Express Lanes Northern Extension Project (495 NEXT). As indicated in **Figure 2.3**, the 495 NEXT involves extending the 495 Express Lanes north from the Dulles Corridor to the George Washington Memorial Parkway interchanges near the American Legion Bridge.

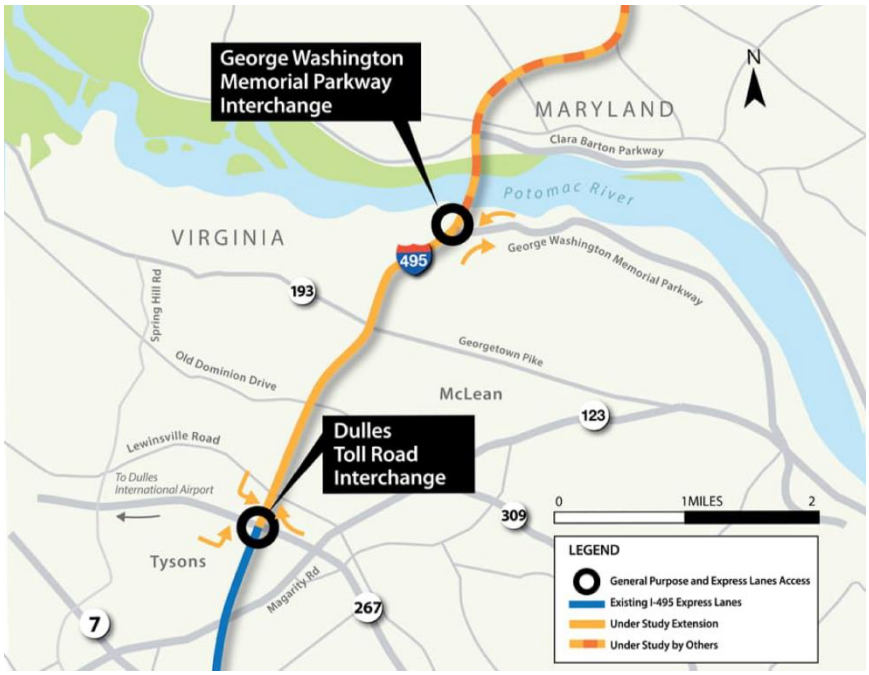


Figure 2.3: Limits of 495 NEXT Project (Ref: http://www.495northernextension.org)

2.1 Site Area and Force Main Alternative #1

As indicated in **Figure 2.1,** Site Area #1 is located in the vicinity of the County owned Falstaff Park, which is surrounded by a densely populated residential area. The notable site characteristics of Site Area and Force Main Alternative #1 include the following:

- Falstaff Park is a County owned site
- There is a significant (50') +/- elevation increase from Scotts Run Interceptor to the site area
- The site area resides farther away from the Scotts Run Interceptor compared to other alternatives, requiring a longer influent sewer to the pump station
- There will be a high impact to a popular publicly used space
- An I-495 crossing is not required for force main construction
- The pump station site area is located outside of the Resource Protection Area (RPA) and 100-year floodplain

Force Main Alternative #1 includes an alignment along a portion of Falstaff Road within the Hamlet Subdivision running north towards Lewinsville Road, and then west along Lewinsville Road towards Spring Hill Road. After this intersection, the alignment goes south along Spring Hill Road under Route 267 towards the existing Tysons West Pump Station. See **Figure 2.4** and **Figure 2.5** for representative photos of Lewinsville Road and the Spring Hill Road/Route 267 overpass.

Figure 2.4: Lewinsville Road (West)

Figure 2.5: Route 267 Overpass over Spring Hill Road

Based on a preliminary review of Site Area and Force Main Alternative #1, there are significant issues that impact the feasibility of this alternative. Most notable is the constructability of a pump station associated with Site Area #1. A pump station constructed in Site Area #1 would require an extremely deep station wet well (in excess of 70' +/-). A station of this depth would create significant Operation and Maintenance issues and would result in very high construction costs. In addition to depth issues, there would be very significant public impacts due to the construction of the station within an existing park in the middle of a dense residential area. For these reasons, it was determined that Site Area and Force Main Alternative #1 is not a viable alternative. Therefore, Site Area and Force Main Alternative #1 will not be considered further.

2.2 Site Area and Force Main Alternative #2

As indicated in **Figure 2.1,** Site Area #2 is located to the east of Site Area #1 closer to the Scotts Run Interceptor and I-495. The notable site characteristics of Site Area and Force Main Alternative #2 include the following:

- There is significant overhead electric transmission within the site area, impacting the available constructable land
- Site access would be difficult due to the density of existing residences within and around the site area
- Limited space is available for the pump station structure within the site area
- An I-495 crossing is not required for the force main construction
- The pump station site area is located outside of the RPA and 100-year floodplain

Force Main Alternative #2 is very similar to the force main alignment associated with Alternative #1. The most significant difference is that in lieu of residential impacts, there is an impact on a two-lane stretch of Lewinsville Road in the direct vicinity of Site Area #2 (See **Figure 2.6**).

Figure 2.6: Restricted (2-lane) portion of Lewinsville Road

Based on a preliminary review of Site Area and Force Main Alternative #2, there are significant issues that impact the feasibility of this alternative. This area is dominated by existing residential homes, electrical transmission lines with very limited space accessible for actual construction of a significant facility. Site Area #2 is in a densely populated residential area, which would present a challenge to provide operational access, as well as presents significant impacts on multiple residences during construction. For these reasons, it was determined that Site Area and Force Main Alternative #2 is not a viable alternative. Therefore, Site Area and Force Main Alternative #2 will not be considered further.

2.3 Site Area and Force Main Alternative #3

As indicated in **Figure 2.1**, Site Area #3 is located off Scotts Run Road to the east of I-495. The notable site characteristics for Site Area and Force Main Alternative #3 are as follows:

- The area is less densely populated with residences
- Existing streams are located within the site area
- An I-495 crossing is required for force main construction
- Coordination is required with the on-going I-495 NEXT project
- A small portion of the pump station site area is located within both the RPA and the 100-year floodplain
- Access is available to the site area from Scotts Run Road and Lewinsville Road

Force Main Alternative #3 is similar to Force Main Alternative #2, except that a trenchless crossing of Route 495 will be required. The available information regarding a potential tunneling location is discussed in more detail in **Section 4.**

Site Area and Force Main Alternative #3 has significant advantages over Alternative #1 and #2. Not only will fewer existing residences be impacted within Site Area #3, but also the existing site access from Scotts Run Road and Lewinsville Road will be beneficial for construction as well as for long-term access to the pump station for O&M purposes. Additionally, most of the site area is outside of the 100-year floodplain, which likely reduces permitting efforts. Therefore, it is recommended to maintain Site Area and Force Main Alternative #3 for additional consideration.

2.4 Site Area and Force Main Alternative #4

As indicated in **Figure 2.1**, Site Area #4 is located just to the north of Site Area #3 along Scotts Run Road. The notable site characteristics for Site Area and Force Main Alternative #4 are as follows:

- The area is less densely populated with residences
- An I-495 crossing is required for force main construction
- Coordination is required with the on-going I-495 NEXT project
- Most of the pump station site area resides within the RPA and 100-year floodplain
- There are existing wetlands within the site area
- Access is available to the site area from Scotts Run Road

Force Main Alternative #4 is similar to Force Main Alternative #3 with slightly greater impact to Scotts Run Road. Scotts Run Road is a two-lane dead-end road (See **Figure 2.7**). Due to the relative low traffic volume in Scotts Run Road, significant impacts are not anticipated within Scotts Run Road that cannot be mitigated through the design process.

Figure 2.7: Scotts Run Road (East)

Based on this information, the most significant characteristic of Site Area #4 is the environmental resource impacts that would need to be permitted for the construction of the station. These issues are not impossible to overcome, but they present significant challenges from both a public perception and project permitting standpoint. In addition, since most of Site Area #4 resides in the 100-year floodplain, maintaining access during a significant storm event will need to be reviewed. The existing site access from Scotts Run Road is a significant advantage for this site area, similar to Site Area #3, and due to its elevation the wet well depth is anticipated to be shallow. It is recommended to maintain Site Area and Force Main Alternative #4 for additional evaluation.

2.5 Site Area and Force Main Alternative #5

As indicated in **Figure 2.1**, Site Area #5 is located east of I-495 along Lewinsville Road. The notable site characteristics for Site Area and Force Main Alternative #5 are as follows:

- The area is less densely populated with residences
- The site area resides farther away from the Scotts Run Interceptor, requiring a longer influent sewer to the pump station
- Access is available to the site area from Lewinsville Road
- An I-495 crossing is required for force main construction
- The station depth will be significant (75’ +/-)
- The pump station site area is located outside of the RPA and the 100-year floodplain

Based on a preliminary review of Site Area and Force Main Alternative #5, there are significant issues that impact the feasibility of this alternative. Most notable is the constructability of a pump station associated with Site Area #5. Similar to Site Area #1, Site Area #5 would require an extremely deep station wet well (in excess of 75' +/-), with the same O&M and cost issues. In addition to depth issues, the access to the Scotts Run Interceptor is very limited. For these reasons, it was determined that Site Area and Force Main Alternative #5 is not a viable alternative. Therefore, Site Area and Force Main Alternative #5 will not be considered further.

2.6 Site Area and Force Main Alternative #6

As indicated in **Figure 2.2**, Site Area #6 is located in the vicinity of County owned Timberly Park, to the west of the existing Timberly residential subdivision. The notable site characteristics for Site Area and Force Main Alternative #6 are as follows:

- Longer access would likely be required to pump station (1,500' +/-) because there are few existing roads within the site area
- The site would significantly impact a public park (Timberly Park)
- I-495 crossing is required for the new gravity sewer to connect to Scotts Run Interceptor
- Operator access of two facilities (station and diversion structure) is required on opposite sides of I-495
- A portion of the site area is located within the RPA and the 100-year floodplain
- Significant coordination is required with the on-going I-495 NEXT project
- Overhead electric transmission is within the site area, impacting the available constructable land

Force Main Alternative #6 includes an alignment west through Timberly Park and towards Swinks Mill Road, south along Swinks Mill Road, and then west along Lewinsville Road towards the existing Tysons West Pump Station (See **Figure 2.8** and **Figure 2.9** respectively for the Timberly Park and Swinks Mill Road areas).

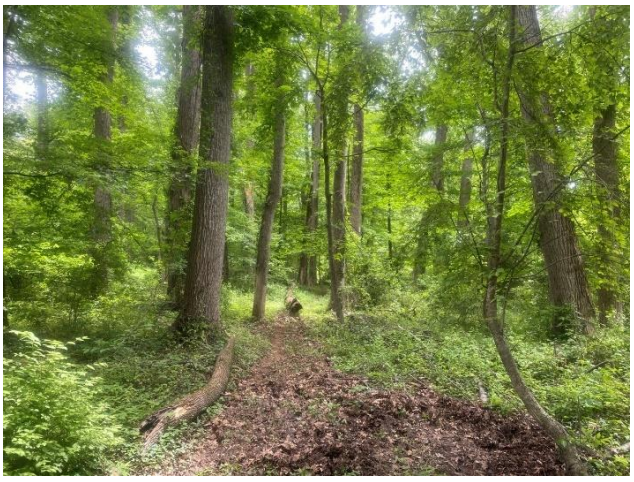


Figure 2.8: Timberly Park Force Main Impacts

Figure 2.9: Swinks Mill Road

Based on a preliminary review of Site Area and Force Main Alternative #6, there are significant issues that impact the feasibility of this alternative. Due to its location on the other side of I-495 from the Scotts Run Interceptor, access would be required to two separate facilities (Diversion Structure and Pump Station) on both sides of I-495. In addition, access to the Site Area is very limited and would require an extensive access road to be constructed through long stretches of Timberly Park in likely environmentally sensitive areas. While these issues are technically feasible to construct, they result in an alternative that is highly undesirable from an environmental, public relations and access perspective. For these reasons, it was determined that Site Area and Force Main Alternative #6 is not a reasonably viable alternative. Therefore, Site Area and Force Main Alternative #6 will not be considered further.

2.7 Site Area and Force Main Alternative #7

As indicated in **Figure 2.2**, Site Area #7 is located just south of Old Dominion Drive (VA 738) on the west side of I-495. The notable site characteristics for Site Area and Force Main Alternative #7 are as follows:

- Site access would be difficult due to the density of existing residences within and around the site area
- Significant coordination is required with the on-going I-495 NEXT project
- Overhead electric transmission is within the site area, impacting the available constructable land
- I-495 crossing is not required for force main construction
- The pump station site area is located outside of existing wetlands, the RPA, and the 100-year floodplain

Force Main Alternative #7 is similar to Force Main Alternative #6, except the alignment would extend through a larger portion of Timberly Park compared to Force Main Alternative #6, with the remainder of the alignment coinciding with Force Main Alternative #6 towards the existing Tysons West Pump Station.

The most notable disadvantages of Site Area and Force Main Alternative #7 are the construction of a longer force main, the area being more densely populated with residential homes, and the large impact to Timberly Park. However, Site Area #7 does not have as many significant access disadvantages as compared to Site Area #6. Since the Scotts Run Interceptor is located close to Site Area #7 west of I-495, the diversion structure would be located closer to the station with an associated shorter gravity connection. It is recommended to maintain Site Area and Force Main Alternative #7 for further evaluation.

2.8 Site Area and Force Main Alternative #8

As indicated in **Figure 2.2**, Site Area #8 is located just north of Old Dominion Drive (VA 738) on the west side of I-495. The notable site characteristics for Site Area and Force Main Alternative #8 are as follows:

- Most of the pump station site area resides within the RPA and the 100-year floodplain
- Overhead electric transmission is within the site area, impacting the available constructable land
- Site access is difficult due to the density of existing residences within and around the site area
- I-495 crossing is not required for force main construction
- Force main installation is required within sub-division streets/Swinks Mill Road or Old Dominion Drive, both of which are two lane roads with limited access

Force Main Alternative #8 would include an alignment through a residential area along Gelston Circle (See **Figure 2.10**), south along a longer portion of Swinks Mill Road, and then west along Lewinsville Road towards the existing Tysons West Pump Station.

Figure 2.10: Gelston Circle

The items noted above such as the environmental implications and the impact to the force main alignment are significant challenges that need to be further quantified and reviewed; however, as compared to other alternatives that have been eliminated, there is adequate space to feasibly construct and access a pump station facility although with potential significant impacts. Due to the relative feasibility of construction, it is recommended to maintain Site Area and Force Main Alternative #8 for further evaluation.

2.9 Site Area and Force Main Alternative #9

As indicated in **Figure 2.2**, Site Area #9 is located just north of Site Area #8, across the Scotts Run Interceptor. The notable site characteristics for Site Area and Force Main Alternative #9 are as follows:

- I-495 crossing is not required for force main construction
- The area is in the vicinity of existing utility (Dominion Substation)
- Overhead electric transmission is within the site area, impacting the available constructable land
- The site area resides farther away from the Scotts Run Interceptor, requiring a longer influent sewer to the pump station
- Significant coordination is required with the on-going I-495 NEXT project
- Force main installation is required within sub-division Streets/Swinks Mill Road
- A portion of the pump station site area is located within both the RPA and the 100-year floodplain

Force Main Alternative #9 would include an alignment along the east side of I-495 south towards Old Dominion Drive and then along the same path as Force Main Alternative #8 towards the existing Tysons West Pump Station.

The notable site characteristics such as the long influent sewer and the impact of the force main alignment are significant challenges that need to be further quantified and reviewed; however, environmental Impacts would appear to be minimized and overall constructability of Alternative #9 appears viable. It is recommended to maintain Site Area and Force Main Alternative #9 for further evaluation.

2.10 Site Area and Force Main Alternative #10

As indicated in **Figure 2.2**, Site Area #10 is located north along Swinks Mill Road near the intersection of Georgetown Pike. The notable site characteristics for Site Area and Force Main Alternative #10 are as follows:

- I-495 crossing is not required for force main construction
- Most of the pump station site area resides within the RPA and the 100-year floodplain
- A longer force main is required compared to the other alternatives, primarily within the roadway (Swinks Mill Road) with space constraints
- The site area resides close to the Scotts Run Interceptor, so the influent gravity sewer will be shorter than other alternatives
- Difficult site access since there are many existing residences within and around the site area

Force Main Alternative #10 would include alignment along a long portion of Swinks Mill Road south towards Lewinsville Road, and west along Lewinsville Road towards the existing Tysons West Pump Station. This section of Swinks Mill Road is inclusive of a crossing of a tributary of Scotts Run, likely requiring a section of trenchless installation (See **Figure 2.11**).

Figure 2.11: Swinks Mill Road Stream Crossing

Based on a preliminary review of Site Area and Force Main Alternative #10, there are significant issues that impact the feasibility of this alternative. Due to its location to the extreme northern end of the project area, the required force main length to pump back to the TEPS would be considerably higher (30-40% longer) than several other alternatives being considered. Environmental features (RPA and floodplain impact) and site availability are also significant concerns. Based on these factors, Site Area and Force Main Alternative #10 will not be considered further.

3 Site Area and Force Main Alternative Evaluation

Of the ten site area and force main alternatives examined in the initial assessment, five are recommended for further evaluation, which include Alternatives #3, #4, #7, #8, and #9. This section includes a detailed evaluation of these five alternatives to determine the recommended site area and force main alternative.

3.1 Site Area and Force Main Alternative Qualitative Evaluation

Table 3.1 highlights the most relevant features of the five site area and force main alternatives. The site area and force main alternatives will be further evaluated based on quantitative evaluation criteria in the sections below.

Table 3.1: Site Area and Force Main Alternatives Evaluation					
	Alternative #3	**Alternative #4**	**Alternative #7**	**Alternative #8**	**Alternative #9**
Approx. Force Main Length (LF)	10,800	11,100	12,000	12,600	13,500
Approx. Gravity Sewer Length (LF) / Distance from Scotts Run Interceptor	240	280	150	70	750
Approx. Wet Well Depth (FT)	44	33	36	25	43
Relative Grading Requirements	High	Low	Low	Low	High
Approx. Total Force Main Head Loss (FT)	268	274	300	307	321
Relative Pump Horsepower Requirements	Low	Low	High	High	High
Relative O&M Costs	$$	$$	$$$	$$$$	$$$$
Site Access	• Direct access available from a state-maintained highway (Scotts Run Road)	• Direct access available from a state-maintained highway (Scotts Run Road)	• Limited access • Structural and geometric (i.e. increased width) improvements to the existing roads will likely be required to provide adequate access both during construction and for long-term (O&M vehicle) usage	• Limited access • Structural and geometric (i.e. increased width) improvements to the existing roads will likely be required to provide adequate access both during construction and for long-term (O&M vehicle) usage	• Limited access • Structural and geometric (i.e. increased width) improvements to the existing roads will likely be required to provide adequate access both during construction and for long-term (O&M vehicle) usage
Relative Site Area Population Density	Low	Low	High	High	Low
Environmental Concerns	• Approximately 25% of the site area is within the 100-year floodplain • Approximately 25% of the site area is within the RPA • There are existing wetlands within the site area • Existing streams within the site area will be impacted • Less permitting requirements are anticipated	• Approximately 85% of the site area is within the 100-year floodplain • Approximately 90% of the site area is within the RPA • There are existing wetlands within the site area • Extensive permitting efforts are anticipated before construction	• Approximately 5% of the site area is within the 100-year floodplain • Approximately 5% of the site area is within the RPA • There are no wetlands within the site area • Less permitting requirements are anticipated	• Approximately 60% of the site area is within the 100-year floodplain • Approximately 75% of the site area is within the RPA • There are no wetlands within the site area • Extensive permitting efforts are anticipated before construction	• Approximately 30% of the site area is within the 100-year floodplain • Approximately 25% of the site area is within the RPA • There are existing wetlands between the site area and the Scotts Run Interceptor (wetlands near the proposed gravity sewer) • Less permitting requirements are anticipated
Crossing of Scotts Run Required	Yes	Yes	No	No	Yes
Utilities	• Site area is close to existing utilities (water and electrical power)	• Site area is close to existing utilities (water and electrical power)	• Site area could be largely impacted by the existing overhead electrical transmission lines • Site area is far from existing electrical distribution power sources	• Site area could be largely impacted by the existing overhead electrical transmission lines	• Site area is far from existing water sources • Site area could be largely impacted by the existing overhead electrical transmission lines

3.2 Site Area and Force Main Alternative Quantitative Evaluation Criteria

The following criteria categories have been defined and weighted based on feedback from Fairfax County. Each category includes criteria to be used as an evaluation tool to review each of the five general pump station areas and associated force main alignments. Only general locations are currently being reviewed, with the intent to identify a general area a pump station could be sited rather than a specific parcel. The following are the identified criteria categories:

- Commercial/residential property owners' impacts
- Traffic impacts
- Environmental impacts
- Permitting
- Constructability
- Access/operation and maintenance (O&M)
- Hydraulic considerations
- Utility conflicts
- Easements
- Construction cost

The site alternative evaluation criteria have been categorized and defined as described below. These criteria will be used to evaluate the site area and force main alternatives.

3.2.1 Commercial/Residential Property Owners' Impacts

Site area and force main alternatives were developed with the goal of minimizing impacts at the site area and along the force main alignment as much as practical. Impacts can be temporary, such as removal and restoration of lawns, gardens, fences, sidewalks, and/or driveways associated with trenching. Impacts can also be long-term or permanent, such as removal of large trees or utility relocations along the force main alternative. The full impacts will not be known until field investigations, topographic surveys, and utility location surveys of the entire alignment are completed. Pipeline routes will be adjusted during detail design, where possible, to reduce both temporary and permanent impacts.

Large portions of the force main alignments will follow either existing utility easements or public/private road rights-of-way; however, sections of the force main will require easements from private or public/park properties. Additional temporary construction easements will be required for construction activities. Due to the potential impacts construction could have on the commercial and residential property owners and, as a result, on project schedule and cost, this criterion was assigned a weighting factor of 15%.

3.2.2 Traffic Impacts

Construction of a new pump station and force main along heavily congested streets will impact traffic flow. Traffic Management Plans (TMPs) will be required for any construction in the Virginia Department of Transportation (VDOT) or County road rights-of-way. Because of this, traffic impacts need to be considered when the alternatives are evaluated. The new pump station and force main should be constructed so that access to roadways from side streets always remains open to local traffic and emergency vehicles to the extent practicable. Based on the impacts traffic could have on the project schedule and cost, this criterion was assigned a weighting factor of 10%.

3.2.3 Environmental Impacts

Environmental impacts considered included wetland impacts, Resource Protection Area (RPA) impact, 100-year floodplain impact, stream crossings, and tree removal, which can increase design and construction schedule and cost. Environmental impacts can also extend the time required to obtain permits and increase the number of

permits necessary. Due to the potential effects environmental impacts could have on the project permitting, schedule, and cost, this criterion was assigned a weighting factor of 10%.

3.2.4 Permitting

The ability and ease to acquire the necessary permits is a critical factor to the success of this project. The site area and force main alignment will be subject to review by regulatory agencies, depending on the pipe installation methodology (e.g., open-cut versus trenchless), and the location of road or easement crossings, which may mitigate potential impacts.

All VDOT road crossings will require permits from VDOT and the development of TMPs. Obtaining United States Army Corps of Engineers (USACE) Nationwide Permits will likely be required for alternatives with potential impacts on the RPA, wetlands, and streams. Mitigation may be required by USACE for unavoidable RPA, wetland, or stream impacts. Approvals will also be needed for the crossing of any right-of-way or easement owned by Dominion Energy and Washington Gas. Due to the potential impact permitting could have on the project schedule and cost, this criterion was assigned a weighting factor of 10%.

3.2.5 Constructability

The ease and speed with which the project can be constructed greatly impacts the overall project cost and surrounding property impacts. Constructability issues, where considered during the route evaluation process, include contractor access to the site, ability to store materials, access to potential project staging areas, speed of construction, and construction safety. Due to the impact constructability could have on the project schedule and cost, this criterion was assigned a weighting factor of 10%.

3.2.6 Access/Operation and Maintenance (O&M)

The new pump station and force main must be accessible for O&M considerations once the station is in service. Future O&M and construction access issues were evaluated as part of the analysis. Due to the potential impact that the construction access and future O&M could have on the project schedule and cost, this criterion was assigned a weighting factor of 10%.

3.2.7 Hydraulic Considerations

Hydraulic considerations include the physical features and the resulting pump performance requirements that contribute to both construction and operation costs. Physical features such as force main length, elevation change, number of bends, and high/low points contribute to construction costs associated with the costs of pumping. Elevation change is the difference in elevation between the pump station and the highest point along the route. The larger the elevation change, the larger the pump horsepower will be. Number of bends is a measure of fitting costs and minor hydraulic losses, which also increase the pump power. High and low points tend to increase the operation and maintenance of the facility and can increase the likelihood of odors venting along the alignment.

Brake horsepower is a measure of the power necessary to overcome the total head and convey the design discharge, and it was used as the metric for comparison. This criterion will be evaluated in more detail as the design progresses. Due to the potential impact that hydraulic considerations could have on the project cost and long-term O&M costs, this criterion was assigned a weighting factor of 10%.

3.2.8 Utility Conflicts

The entire region includes congested rights-of-way. Potential conflicts with existing utilities cannot be eliminated. The design will have to address these conflicts. For this reason, alternatives were evaluated to minimize conflicts between utilities, particularly large utilities that are not easily moved, such as overhead electrical lines. The full impacts of existing utilities will not be known until utility location surveys of the entire alignment is completed. The depth and exact alignment of the proposed force main will be adjusted as necessary during final design to avoid conflicts with utilities. This criterion also considers the site area proximity to existing sources of water, power, and telecom, which will be necessary for the pump station construction. Due to the potential impact the utility conflicts could have on the project schedule and cost, this criterion was assigned a weighting factor of 10%.

3.2.9 Easements

Easements will be required for all alternatives; however, the quantity of easements required varies for each alternative. Easements will include both permanent and temporary construction easements. Due to the potential impact that easement acquisition could have on the project schedule and cost, this criterion was assigned a weighting factor of 5%.

3.2.10 Construction Cost

Preliminary construction costs were developed for each alternative. The cost evaluations for each site area and force main alternative included the cost to construct the pump station, force main, diversion structure and gravity sewer connection. Cost comparisons did not include rock excavation. Depth to rock is unknown for the alternatives and it is not expected to be a significant discriminator among the alternatives, so it was not considered in the evaluation. Due to cost being one of the critical factors in selecting the new site area and force main alternative, this criterion was assigned a weighting factor of 10%.

3.3 Evaluation Criteria Weighting

Each of the evaluation criteria noted above have been weighted to reflect their relative importance to the construction and operation of the new pump station and force main. **Table 3.2** lists the relative weights for each of the evaluated criteria. The weighting factors were discussed with the County staff and represent the consensus opinion. The weights used for each criterion reflect the relative importance of project cost, as well as an increased focus on the project's impacts to property and commercial/business interests for each site area and force main alternative.

Table 3.2: Evaluation Criteria Weights	
Evaluation Criteria	**Weight (percentage)**
Commercial/residential property owners' impacts	15
Traffic impacts	10
Environmental impacts	10
Permitting	10
Constructability	10
Access/O&M	10
Hydraulic considerations	10
Utility conflicts	10
Easements	5
Construction cost	10

3.4 Site Area and Force Main Alternative Evaluation

Each site area and force main alternative was assigned a score based on a scale of 1 to 5, with 1 being the lowest or least desirable and 5 being the highest or most desirable for a given criterion.

The total score for each category was then determined by multiplying the individual criteria scores by the assigned weight presented in **Table 3.2**, and then summing up the weighted scores. **Table 3.3** presents the final criteria ranking tabulation.

Appendix A contains conceptual force main profiles for each site area and force main alternative. Information on the profiles includes the number of required air release valves (ARV's) at major intermediate high points along each alignment and stationing along each alignment to estimate force main lengths associated with each alternative. **Appendix B** contains environmental mapping associated with each site area and force main alternative. Mapping is included for items such as wetlands, floodplains, RPA mapping, and soils information (asbestos containing soils, radon levels, and hydric/wetland soils). This information was used to evaluate relevant environmental categories for each site area and force main alternative.

Table 3.3: Site Area and Force Main Alternatives Quantitative Evaluation and Ranking

Weight %	15		10		10		10		10		10		10		10		5		10		100	
	Commercial/Residential Property Owners' Impacts		Traffic Impacts		Environmental Impacts		Permitting		Constructability		Access/Operation and Maintenance (O&M)		Hydraulic Considerations		Utility Conflicts		Easements		Construction Cost		Total Score	Rank
	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments		
Alternative #3	4	Moderate impact on residential and low impact on commercial properties	4	Relatively low traffic impact, require significant traffic management plans in residential neighborhoods	4	Relatively low impact since there are few wetlands within the site area; existing streams will be impacted. Low percentage of 100-year floodplain and RPA are within the site area.	4	Relatively low impact since there are few wetlands within the site area	3	Moderately challenging (significant grading requirements/wet well depth)	4	Minimally difficult to access (Access available via Scotts Run Road)	5	Low number of high points/ARVs; shortest force main; lowest head loss	4	Site area is close to existing water and electrical power	4	Relatively low quantity of estimated easements required	4	$58.9M	4.00	1
Alternative #4	4	Moderate impact on residential and low impact on commercial properties	4	Relatively low traffic impact, require significant traffic management plans in residential neighborhoods	2	High impact since there are existing wetlands within the site area. High percentage of 100-year floodplain and RPA are within the site area.	2	High impact since there are existing wetlands and RPA within site area	2	Challenging (Significant permitting requirements)	4	Minimally difficult to access (Access available via Scotts Run Road)	4	Low number of high points/ARVs; relatively short force main; moderately low head loss	4	Site area is close to existing water and electrical power	4	Relatively low quantity of estimated easements required	5	$58.1M	3.50	2
Alternative #7	2	High impact on residential and low impact on commercial properties	2	Large traffic impact, require significant traffic management plans in residential neighborhoods	5	Low impact since there are no wetlands within the site area. Low percentage of 100-year floodplain and RPA are within the site area.	5	Low impact since there are no wetlands or RPA within the site area	2	Challenging (Moderately long force main, relatively high radon levels in soil, difficult access to site area)	2	Difficult access (Limited access through residential areas; will likely require modifications to existing roads)	3	Low number of high points/ARVs; moderate length force main; moderate head loss	2	Site area is far from existing electrical distribution power sources; site area could be largely impacted by existing overhead electrical transmission lines	2	Relatively high quantity of estimated easements required	2	$61.9M	2.70	3
Alternative #8	2	High impact on residential and low impact on commercial properties	2	Large traffic impact, require significant traffic management plans in residential neighborhoods	2	High impact since there is a high percentage of 100-year floodplain and RPA within the site area. There are no existing wetlands within the site area.	2	High impact since there are existing wetlands and RPA within site area	2	Challenging (Relatively long force main, relatively high radon levels in soil, difficult access to site area)	2	Difficult access (Limited access through residential areas; will likely require modifications to existing roads)	2	High number of high points/ARVs; higher length force main; moderately high head loss	3	Site area could be largely impacted by existing overhead electrical transmission lines	4	Relatively low quantity of estimated easements required	3	$60.2M	2.30	4
Alternative #9	3	Relatively high impact on residential and low impact on commercial properties	3	Moderate traffic impact, require significant traffic management plans in residential neighborhoods	3	Moderate impact since there are some wetlands within site area. Relatively low percentage of 100-year floodplain and RPA are within the site area.	3	Moderate impact since there are some wetlands and RPA within site area	1	Highly challenging (Long gravity sewer required, longest force main, significant grading requirements/wet well depth, relatively high radon levels in soil)	3	Moderately difficult access (Limited access through residential areas; may require modifications to existing roads)	1	Highest number of high points/ARVs; longest force main; highest head loss	2	Site area is far from existing water sources; site area could be largely impacted by existing overhead electrical transmission lines	3	Relatively moderate quantity of estimated easements required	1	$63.8M	2.30	4

3.5 Recommended Alternative

Based on the results of the evaluation, of the five site area and force main alternatives evaluated, Alternative #3 received the highest score based on the criteria listed in this section. As a result of the evaluation, Site Area and Force Main Alternative #3 is recommended for the Tysons East Pump Station. This alternative will be further developed during detailed design.

4 Pump Station and Force Main Design

The pump station description in the following sections is based on the proposed Site Area and Force Main Alternative #3. The proposed pump station layout and criteria is based on the Fairfax County Department of Public Works and Environmental Services Wastewater Guidelines for Architects and Engineers – Volume 2 – Facility Design Criteria dated July 7, 2021, and Design Manual and Virginia Sewage Collection and Treatment (SCAT) Regulations. The pump station will also need to conform to the Fairfax County Zoning Ordinance (FCZO) and Public Facilities Manuals regulations.

4.1 Site Layout

Figure 4.1 provides a typical site layout for the pump station. The site improvement footprint will accommodate the required new pump station building, wet well, stormwater management/best management facilities and will provide access to the new sanitary diversion structure. AASHTO SU-40 design vehicle turnaround access is provided to all major facilities. The required acreage anticipated for the pump station is estimated to be a minimum of 1 acre of land disturbance. The land disturbance of the site will vary based on its unique topography, distance to the Scotts Run Interceptor, environmental features, access to public roadway, and configuration of maintenance access to pump station facilities.

Per the FCZO, the pump station use will be designated as a light utility facility. This use will require a 50-foot-wide Type III Transitional Screening and D, E, or F Barrier if constructed adjacent to the Single Family Detached uses present along the Scotts Run Interceptor. This barrier typically consists of a 42-inch to 48-inch tall chain link fence, 6-ft tall wall of brick or architectural block, or solid wood or otherwise architecturally solid fence, respectively.

4.2 Diversion Structure

A diversion structure will be located on the Scotts Run Interceptor to divert flow into the pump station. The proposed layout of the diversion structure is depicted in **Figure 4.2**. An adjustable weir in the diversion structure will determine the flow rate diverted into the pump station. Operators will be able to adjust the weir remotely via a motor operated actuator to determine when the station receives flow. Additionally, stop logs can be installed to isolate the influent sewer from the Scotts Run Interceptor if needed.

4.3 Pump Station Layout Description

The proposed pump station layout is shown in **Figures 4.3** through **4.5**. The proposed pump station configuration will consist of an influent manhole, grinder vault, wet well, dry well and grade level structure. Influent sewage flows from the diversion structure on the Scotts Run Interceptor will be conveyed via a gravity sewer to the influent manhole on the pump station site. The entrance of the grinder vault will have a slide gate that can be used to isolate the station completely from the gravity sewer. The grinder vault will consist of a primary channel and a bypass channel. The primary channel will contain one channel grinder and a manually cleaned bar screen downstream of the channel grinder. Stop logs are provided upstream of the channel grinder and downstream of the bar screen to allow isolation of the primary channel for maintenance. The bypass channel contains only a manually cleaned bar screen. Stop logs are also provided upstream and downstream of the bar screen to allow isolation of the bypass channel. A debris bin will be located between the channels for debris collected on the bar screens. The grinder vault will be accessed via a hatch with stairway. Additional hatches will be provided for the removal of the channel grinder and the debris bin when necessary.

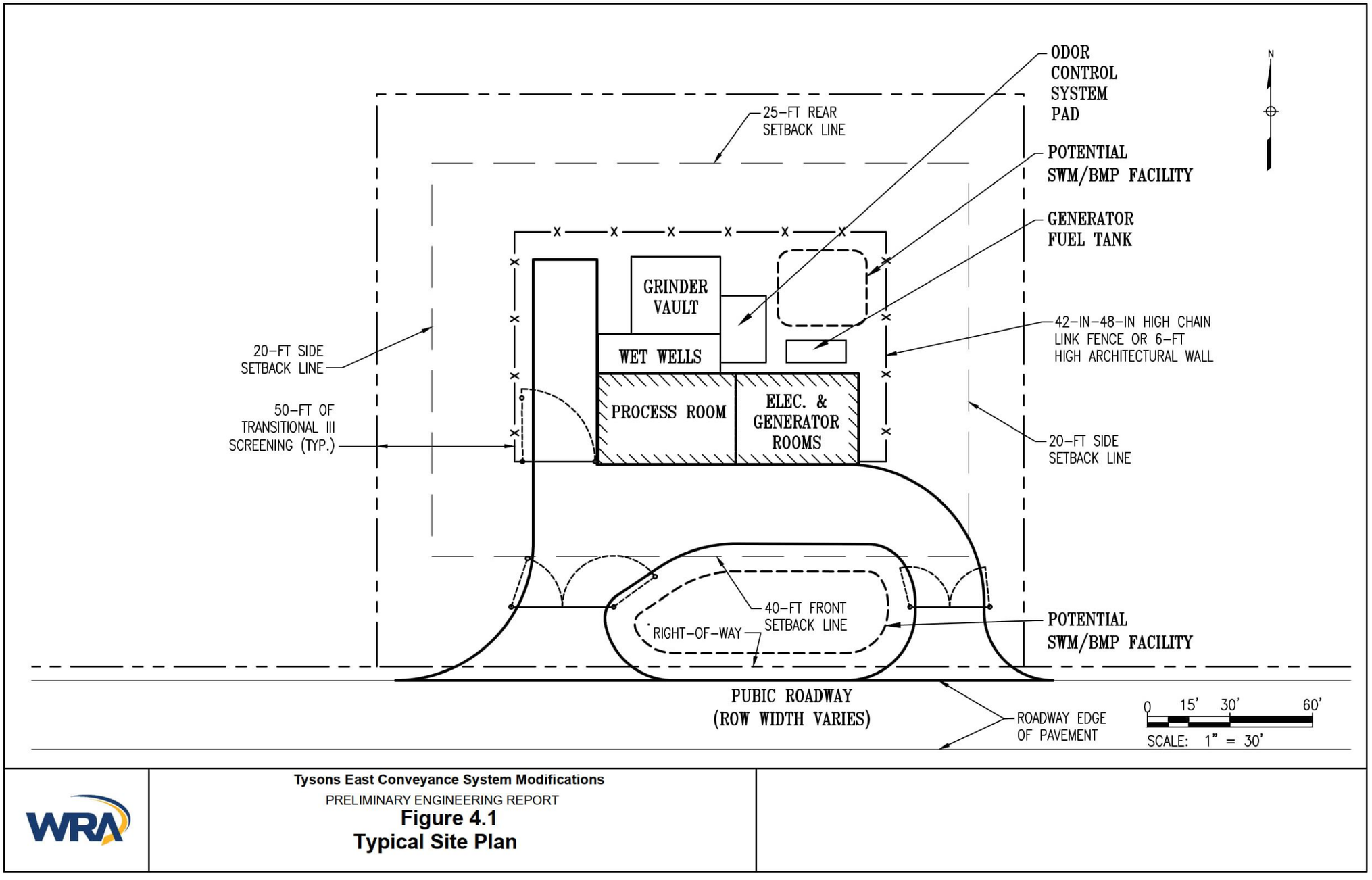
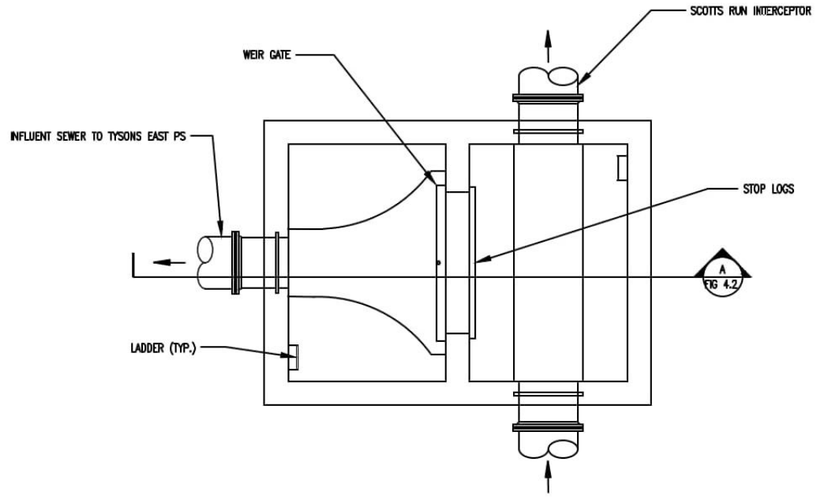
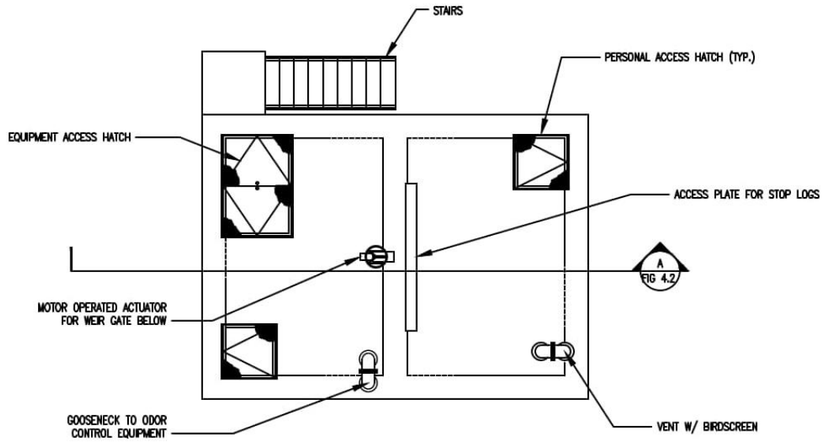


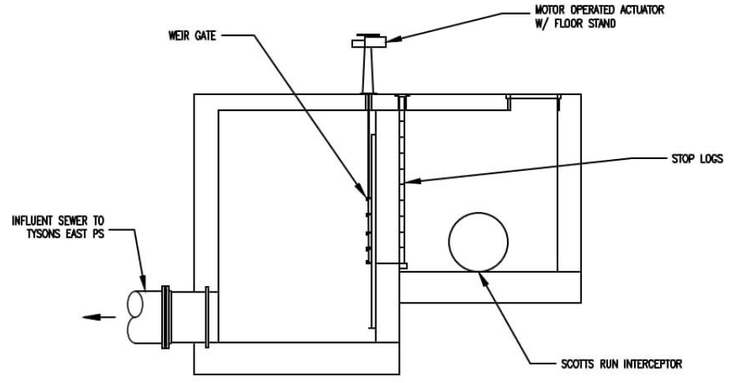
Figure 4.1: Site Layout



1 FIG. 4.2 LOWER LEVEL PLAN



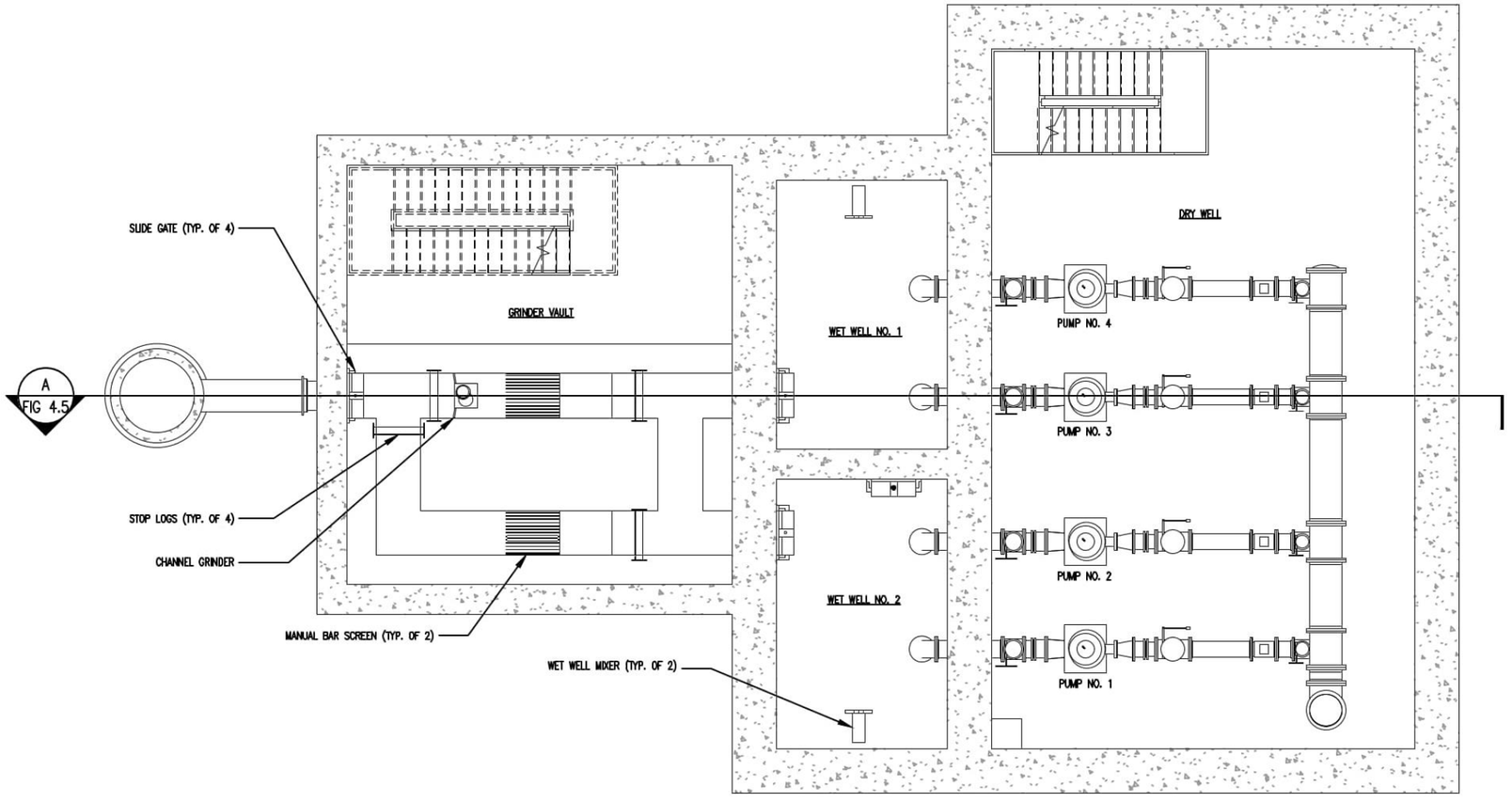
2 FIG. 4.2 TOP SLAB PLAN



A FIG. 4.2 SECTION

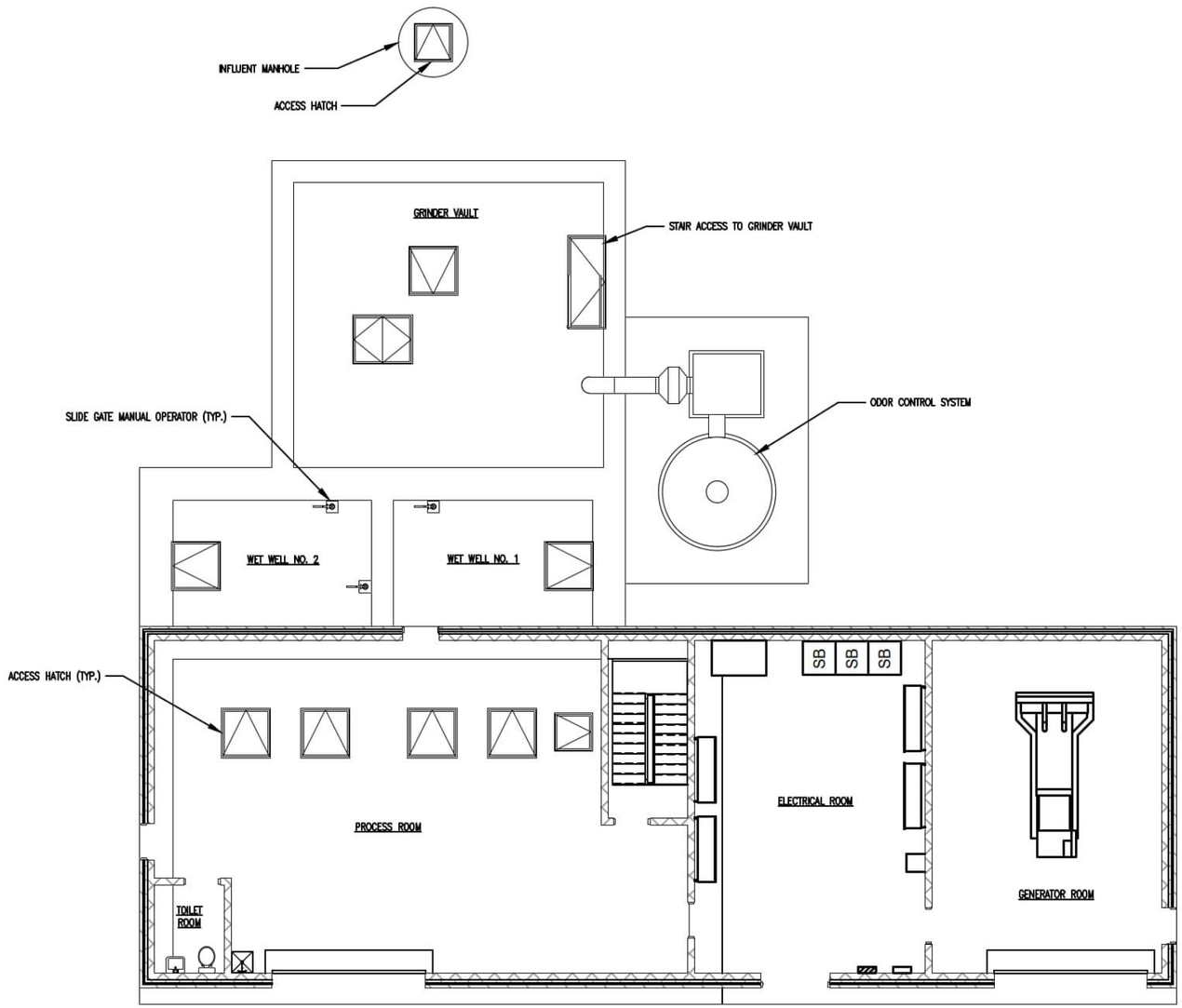
Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT
Figure 4.2
Diversion Structure Plans and Section

Figure 4.2: Diversion Structure Plans and Section



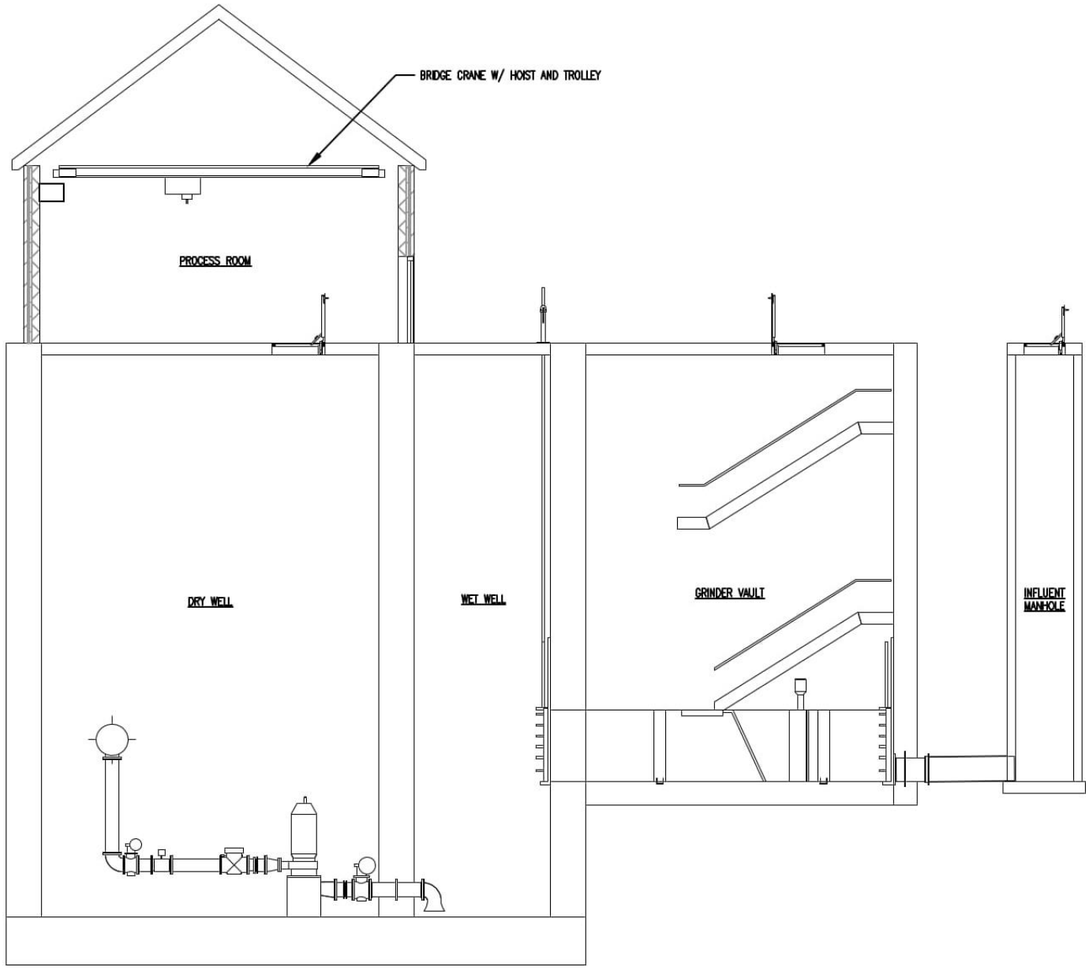
Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT
Figure 4.3
Pump Station Lower Level Plan

Figure 4.3: Pump Station Lower Level Plan



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT
Figure 4.4
Pump Station Grade Level Plan

Figure 4.4: Pump Station Grade Level Plan



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT
Figure 4.5
Pump Station Section

Figure 4.5: Pump Station Section

Downstream of the grinder vault, flow enters the wet well area. The wet well will be a split configuration, with an interconnecting slide gate to allow the flexibility for both sections to function as a single well. Two pumps will be dedicated to the wet well no. 1 and two pumps will be dedicated to the wet well no. 2. A wet well mixer to suspend solids will be in each wet well section.

The dry well of the pump station will be comprised of multiple levels. The lower level of the dry well will house the pumps, piping and valves. The mezzanine level will provide access to the surge relief valve and piping. The process room (first floor of the dry well) will house the station bridge crane. In addition to the process room, the pumping station grade level will have a toilet room, a generator room, and an electrical room. Design details will be further developed during the design phase of the project.

4.4 Influent Manhole

The influent manhole will be located at the pump station site and will collect all incoming pump station flows. The influent manhole will be approximately 5-feet in diameter and have an access hatch and manhole steps. Pump station bypass suction piping will be provided at the manhole to fully bypass the pump station. A gravity sewer will be installed to connect the diversion chamber to the influent manhole and then from the influent manhole to the grinder vault.

4.5 Architectural Design

The objective of the exterior building design is to develop exterior finish scheme that will be contextually acceptable for the location selected. Pump stations are found throughout the built environment. Several examples of pump stations using context sensitive design are included in **Figures 4.6** through **4.8.** These examples are not intended to depict what the station will look like but rather show how a pump station can be integrated into site specific context. The variables include general proportions of the building, exterior wall materials, roof material and slope, inclusion of intersecting gables and dormers, and proportion of the walls and roof to form an attractive building. Detail of wall openings such as doors, windows, and louvers will be integrated into the building design.

Figure 4.6: Falling Creek Pump Station – Park and residential setting, Richmond, Virginia

Figure 4.7: Dukes Avenue Pump Station – Residential neighborhood (Town Home and single family detached homes) Ocean City, Maryland

Figure 4.8: Sunnybrook Pump Station – Residential Neighborhood located in Richmond, Virginia.

4.5.1 Applicable Building Codes

The pump station will be designed to meet the following codes:

- Virginia Uniform State Building Code, 2018
- Virginia Existing Building Code, 2018
- Virginia Energy Conservation Code, 2018
- Virginia Mechanical Code, 2018
- Virginia Plumbing Code, 2018
- National Fire Protection Association – Life Safety Code, 2015
- National Electrical Code, 2020
- ADA
- OSHA

4.6 Structural Design

The structural design will accommodate architectural requirements, access requirements, electrical, process and mechanical equipment in the pump station. The pump station will be a reinforced concrete structure with CMU infill walls and an architectural facade. The reinforced concrete structure will be designed to meeting all applicable structural building code requirements. Soil pressure, hydrostatic loading, equipment loads, live loads, wind loads, and seismic loads will all be analyzed to provide structures of adequate strength and durability.

4.6.1 Geotechnical Considerations

Foundations for the pump station will be recommended by a Geotechnical Investigation and Report. To date, geotechnical investigations have not been performed at any potential pump station site.

4.7 Force Main Criteria

The sizing of the force main is primarily a function of the allowable minimum and maximum design velocities and the resulting head loss over the life of the system. The Virginia Sewage Collection and Treatment (SCAT) Regulations allow operating velocity ranges from 2 to 8 feet/second (ft/s). The following **Table 4.1** indicates the design capacity based on this recommended velocity ranges for a 20-inch and 24-inch force main.

Table 4.1: Force Main Velocity Criteria

Force Main Velocity (ft/s)	Capacity - 20” FM (MGD)	Capacity - 24” FM (MGD)
2 ft/s (minimum velocity)	2.8	4.0
6 ft/s	8.5	12.2
8 ft/s (maximum velocity)	11.3	16.2

Thus, based on a design flow of 10 MGD for the TEPS, the force main size could be either 20-inches or 24-inches in diameter at a design velocity of 7.1 ft/s and 4.9 ft/s, respectively. If it determined that flows closer to 10 MGD will be normal, with minimum flows anticipated above 4 MGD, then a 24-inch FM may be beneficial in minimizing system head losses. However, if it is anticipated that minimum flows will be closer to 3 MGD, then the use of a 20-inch force main may be warranted to minimize force main deposition at lower flows.

Currently, it is anticipated that the sizing of the force main will be finalized during the final design stages of the project. For the purposes of all analysis performed for this report, a 20-inch force main was assumed. Since this reports analysis is primarily comparative in nature, refining the force main size at this time will not significantly impact the analysis.

4.8 Recommended Force Main Alignment

The following section provides a detailed description of the force main alignment associated with the selected Alternative #3, as indicted on **Figure 4.9**. A schematic profile associated with Site Area and Force Main Alternative #3 is provided in **Figure 4.10.** The following section identifies the primary challenges within this corridor and outlines why the Lewinsville/Spring Hill corridor was identified as the recommended corridor for installation of the force main.

4.8.1 Interstate 495 Trenchless Crossing

The trenchless crossing of I-495 will be a significant challenge. This proposed utility tunnel will require an approximate 42-inch tunnel to convey the 20-inch carrier pipe and will be approximately 650 feet in length. Based in available geologic information, the trenchless installation will be located at the intersection of two units of the

Mather Gorge Formation. The portion of the formation at the eastern end of the alignment consists primarily of schist rock with interbedded metagraywacke and mafic rock debris. The portion of the formation at the central and western ends of the alignment consist primarily of metagraywacke with interbedded quartzose schist. Based on nearby borings performed for Bridge B642 which carries Lewinsville Road over I-495, the soil profile of the proposed site appears to be silt and sand mixtures (USCS: ML & SM) extending from the ground surface to elevations ranging from 279 feet above mean sea level (MSL) to 232 feet above msl. Underlying these soils is rock. Based on the available boring information, this rock consists of schist at varying degrees of weathering and was encountered to the depth of termination to an elevation of approximately 199.0 feet above MSL in the lowest boring performed.

Based on the conditions encountered in the available boring information, the length of the proposed trenchless installation, as well as the need to maintain an accurate grade over the course of the line, it is expected that microtunneling will be the most effective method for the trenchless installation. A complete geotechnical evaluation including site specific borings will be completed during the final design phase of the project.

4.8.2 Description of Force Main Alignment Corridor

A general description of the Force Main associated with Alternative #3 was previously given in **Section 2.3**. As discussed previously, the corridor generally follows Lewinsville Road west to the intersection of Spring Hill Road, ultimately terminating south of the Spring Hill Road/Route 267 overpass.

The primary challenges within Lewinsville Road are the temporary impacts to the public that will result during construction. Based on available limited utility information, it is highly likely that a main travel lane will be impacted during construction. These impacts will need to be mitigated through traffic control measures and requirements for limiting work hours to off peak construction. Additional considerations that will need to be mitigated will include coordination with public facilities within the corridor. Access to both the Spring Hill Elementary School and Spring Hill Recreation Center are from Lewinsville Road and will be temporarily impacted.

Additional challenges in this alignment corridor will occur at the intersection of Lewinsville Road/Spring Hill Road and the required crossing under the Dulles Toll Road (Route 267).

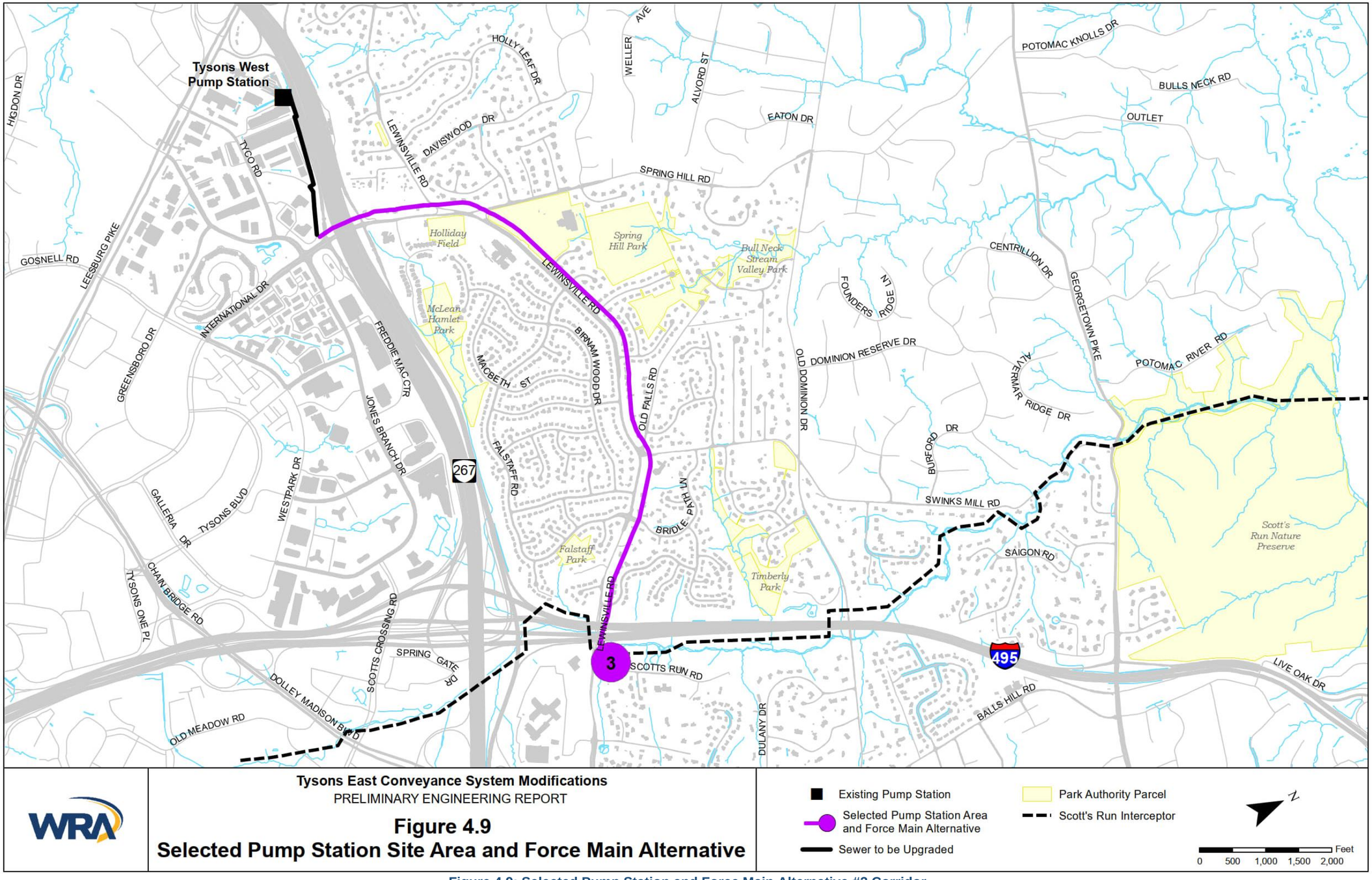


Figure 4.9: Selected Pump Station and Force Main Alternative #3 Corridor

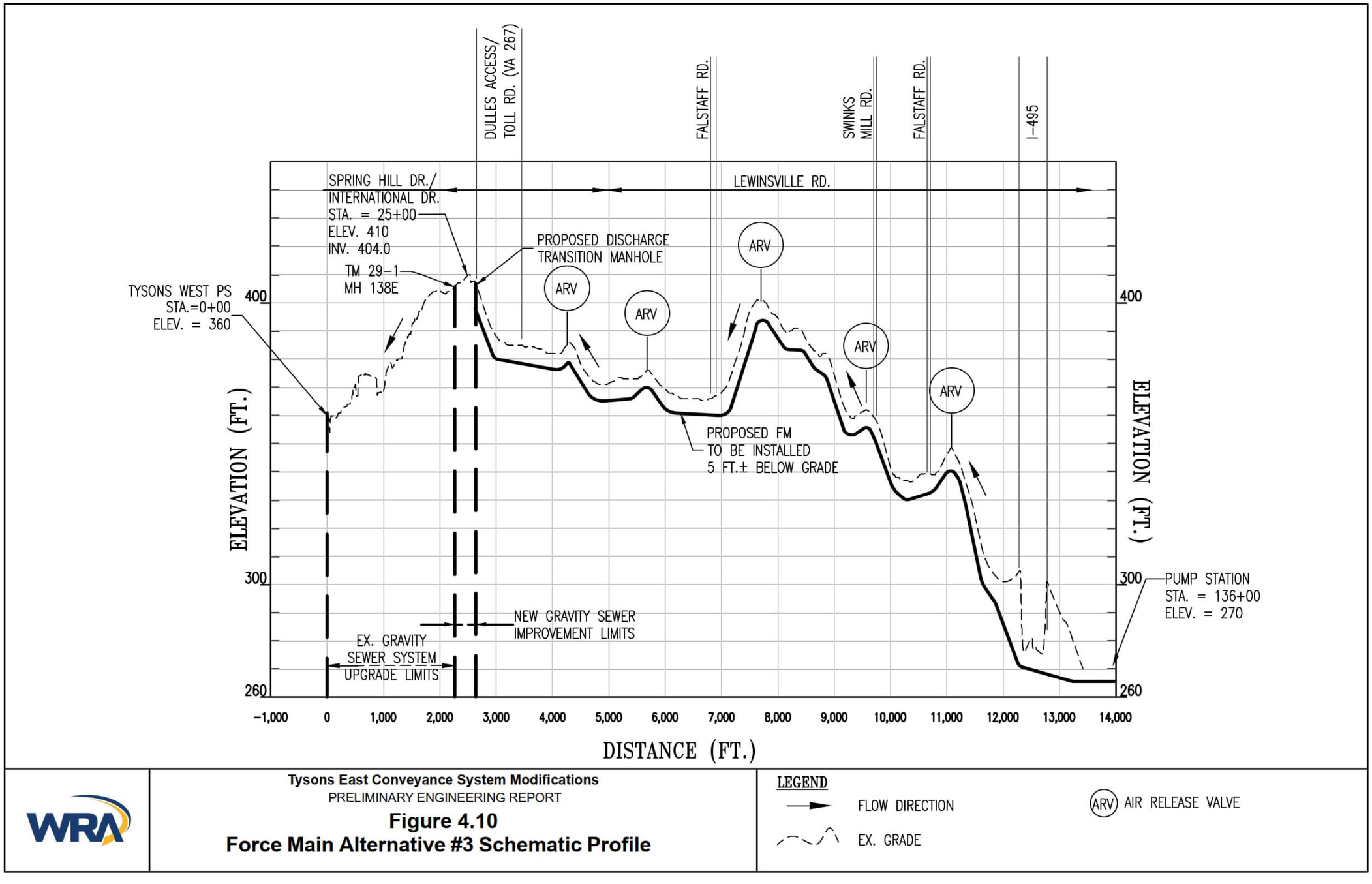


Figure 4.10: Site Area and Force Main Alternative #3 Schematic Force Main Profile

The Fairfax County Department of Transportation (FCDOT) has started planning efforts for a potential capital project to improve the Lewinsville Road/Spring Hill Road Intersection (See **Figure 4.11**). Based on previous FCDOT coordination meetings, this intersection project is in the beginning planning stages, but has gone through several public participation meetings. Any utility improvements through this area will need to be coordinated with and if possible integrated into the intersection project to minimize public impacts in this area.

Figure 4.11: Lewinsville Road/Spring Hill Road Intersection

Regarding the crossing of Route 267, Route 267 has an overpass over Spring Hill Road (See **Figure 4.12**). It is currently proposed that the force main will be open-cut in Spring Hill Road underneath the overpass. However, as the planning and design for the force man progresses, there are significant items that still need to be reviewed. These items include coordination with the Metropolitan Washington Airports Authority (MWAA) for the permitting of the crossing under Route 267. Additionally, an extensive subsurface utility review will be required to insure constructability of the large diameter force main in this area. Regardless, the existing Spring Hill Road/Route 267 underpass provides a location for the potential installation of the force main by open cut rather than significantly more costly tunneling methods.

Figure 4.12: Route 267 Overpass over Spring Hill Road

5 Project Permitting Requirements

The proposed Tysons East Pump Station and Force Main will require state and local regulatory review and approval to ensure compliance with Federal, State and Local regulations. The following paragraphs outline state and local requirements based on anticipated construction activities for the project. Certain permits such as the Joint Permit Application (JPA) are dependent on the results of environmental field reviews that will need to be performed during final design.

5.1 Federal and State Regulatory Review and Approval

The permitting requirements and permit timelines are driven by the nature of the proposed construction activities within the waters of the U.S. and/or Commonwealth of Virginia. The permit process will be initiated early in the design phase after field surveys and the site plan location is formalized.

A Joint Permit Application (JPA) is a permit application process to apply for water protection permits from both state and federal agencies. A JPA will likely be required and submitted for the combined pump station and force main projects to initiate the Federal and State permitting process. The Habitat Management Division of the Virginia Marine Resources Commission (VMRC), United States Army Corps of Engineers (USACE), and Virginia Department of Environmental Quality (DEQ) will receive a complete application for proposed disturbance or alteration of environmental resources found within the project area. This project will likely require review and approval from the following federal and state agencies.

5.1.1 Virginia Marine Resource Commission (VMRC)

VMRC is the clearing house that distributes copies of the JPA to the regulatory agencies involved in the permitting process. This includes the USACE and DEQ. These agencies will conduct a separate review of the JPA. Each agency will then issue its own permit, or a No Permit Required (NPR) for the work to be performed.

VMRC regulates Subaqueous Lands of the Commonwealth, tidal wetlands, sand dunes, and beaches. These lands include non-tidal waterways with perennial flow supporting a drainage area greater than 5 square miles or with a mean annual instream flow greater than 5 cubic feet per second. If impacts to tidal waters or wetlands are anticipated, coordination with the local wetlands board, in addition to a VMRC permit, would be required.

5.1.2 Virginia Department of Environmental Quality (DEQ) – Virginia Water Protection (VWP) Permit

The Virginia Water Protection (VWP) Compliance Program within DEQ is designed to protect wetlands, streams or other state waters from being filled, excavated, drained, or dredged. In concurrence with a Nationwide permit (NWP) 58, a Virginia Water Protection General Permit, an individual Section 401 Water Quality Certification, or waiver from the Department of Environmental Quality (DEQ) will be required.

5.1.3 U.S. Army Corps of Engineers

As previously stated, the USACE is a recipient of the JPA. The USACE regulates activities in waters of the United States, including wetlands and streams impacts. If impacts from the project exceed the threshold for a USACE Nationwide Permit 58 (1/2 acre permanent wetland impacts), the project will require an Individual Permit from the USACE for wetland and stream impacts.

When a pre-construction notification (PCN) is required, a compensatory mitigation plan is also required if certain permanent or temporary wetlands loss limits are exceeded. These limits are dependent on the classification of the wetland as well if the impact is temporary or permanent.

The USACE Section 404 authorization also requires compliance with Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act as part of the JPA process. In June 2022, WRA queried threatened and endangered species databases to determine if any listed species have been documented that could be affected by the project. The databases queried include the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) system, the Virginia Department of Wildlife Resources (VDWR) Virginia Fish and Wildlife Information Service (VAFWIS), and the Virginia Department of Conservation and Recreation Division of Natural Heritage (DCR-DNH).

The results of the database queries are included in **Figure 5.1**. Species that were identified near the project area are identified in **Table 5.1**. These results were the same for all Site Area and Force Main Alternatives reviewed.

Table 5.1: Summary of Documented Federally- and State-Listed Species

Common Name	Scientific Name	Legal Status	IPaC	VAFWIS Confirmed Observation within a 2-Mile Buffer	DCR-DNH (12-Digit HUC)
Northern long-eared bat	*Myotis septentrionalis*	FTST	X	---	---
Rusty-patched Bumblebee	*Bombus affinis*	FE	---	---	X
Wood Turtle	*Glyptemys insculpta*	ST	---	Confirmed	X
Appalachian Springsnail	*Fontigens bottimeri*	SE	---	---	X
Peregrine Falcon	Falco peregrinus	SE	---	---	X

FE = Federally Endangered, FT = Federally Threatened, ST = State Threatened, SE = State Endangered

A more detailed review with state and federal agencies will be required during final design once final alignments and sites are determined. Any impacts will be mitigated through necessary, buffer requirements, time of year construction requirements, etc. or other permitting requirements as required by the permitting agencies.

5.1.4 Virginia Department of Environmental Quality (DEQ) – Stormwater

Fairfax County's Site Development and Inspections Division (SDID) is responsible for the enforcement of Federal, State, and local laws related to residential and commercial development projects. As the acting Virginia Stormwater Management Program (VSMP) Authority, the County's SDID will review the force main plans to confirm compliance with the Chesapeake Bay Preservation Act (CBPA), Erosion and Sediment (E&S) Control Regulations and other floodplain management programs.

The SDID considers the entire county to be in the CBPA and appropriate E&S measures will be addressed during the design phase of this project for force main plans.

For the force main plans, no stormwater management is required based on the Department of Environmental Quality (DEQ) Guidance Memo No. 15-2003 where linear utility projects are exempt from water quality and quantity compliance. The force main will be constructed such that no more 500 linear feet of trench may be open at one time.

Similarly, the County's SDID, will review and approve the pump station plans once submitted through the County's Site Development process. The County's SDID will confirm compliance with VSMP land disturbance activities, the Chesapeake Bay Preservation Act (CBPA), and Erosion and Sediment (E&S) Control Regulations and other floodplain management programs.

The land disturbance activities for the pump station project are anticipated to be greater than 2,500 square feet and likely over one acre. Therefore, in addition to CBPA compliance, a General Permit from DEQ is anticipated for stormwater management compliance. Because the General Permit is needed, a Stormwater Pollution Prevention Plan (SWPPP) will also be required as part of the permit conditions. The stormwater management compliance for this project will be based on the new DEQ Stormwater Regulation.

Water Quality

This project will adhere to the VSMP Part IIB water quality design criteria which sets the post-development required phosphorous reduction and includes a 20% improvement factor compared to the pre-development phosphorous loads. The appropriate Virginia Runoff Reduction Method (VRRM) Compliance spreadsheet (New Development or potentially Re-Development) will be used to determine the total pollutant load removal. Pollutant reduction load is anticipated to be slightly over 1 lb/yr. Nutrient credits will likely be purchased to comply with water quality reduction requirements, based upon project location and credit availability.

Water Quantity

Following the VSMP Part IIB channel and flood protection requirements, the design documents will include capacity calculations for the increase in drainage area from pre- to post-construction conditions for the pump station site. The sites considered for the placement of the pump station are nested between residential communities. Site topography and drainage conditions vary from site to site. However, all sites drain and are near to the Scotts Run floodplain. The selected site will be graded to promote sheet flow where possible. The inclusion of a stormwater management facility, such as a basin, may be used to capture the increase in runoff created by the pump station improvements. The design documents will show that the increase pre- to post-construction will not cause erosion, sedimentation, or flooding downstream of the improvement and on adjacent properties.

5.1.5 Virginia Department of Environmental Quality (DEQ) – Wastewater

Regarding the wastewater aspect of this project, the Wastewater Engineering Program within DEQ administers the SCAT Regulations. The SCAT Regulations require that a Certificate to Construct (CTC) and Certificate to Operate (CTO) be obtained for all new or expanded pump stations and force mains that discharge to gravity sewers having an average day design flow of greater than 2,000 GPD. Based on the required and proposed capacity upgrades for the TEPS, a CTC permit will be required for this project and upon construction completion the facility owner will need to request a CTO.

5.1.6 Virginia Department of Transportation

The Virginia Department of Transportation (VDOT) requires a Land Use Permit Application (LUP-A) be submitted and approved prior to the start of any construction work within a VDOT roadway or right of way. A permit fee and surety are also required at the time a LUP-A is submitted. For the TEPS project, Land Use Permits will be obtained by the construction contractor using the project plans previously approved by VDOT.

The TEPS engineering plans will be submitted to VDOT for approval prior to submittal of the LUP-A. For the trenchless crossing of I-495, a geotechnical report will also be submitted including information regarding the construction method for the trenchless crossing.

During the project final design phase, subconsultants such as geotechnical firms and underground utility locating firms are also required to submit LUP-A, permit fees and surety prior to conducting work within VDOT roadways or the VDOT ROW.

Surety submitted with LUP-A packages can consist of bonds, irrevocable letters of credit or cash. The surety is used by VDOT to pay for any repairs, replacements or restoration of VDOT assets if the construction contractor fails to complete the project per the approved plans. Fairfax County has an agreement with VDOT that includes a commitment to pay cash in the event a contractor fails to complete a project allowing VDOT to waive the surety. Since a surety is not necessary for the TEPS project, all responsibility for obtaining the Land Use Permit should be the responsibility of the construction contractor.

After the construction contractor for the TEPS project has been given Notice to Proceed, they can bring the LUP-A and permit fees to the VDOT Northern Virginia Residency. The Land Use Permit is issued upon receipt of the documents and fees.

5.2 Local Regulatory Review and Approval

5.2.1 Fairfax County Development Review Process

A pump station is classified as a light utility facility use by the Fairfax County Zoning Ordinance (FCZO). This use is permitted within the R-1 or R-2 zoning districts overlaying the potential pump station study area. However, a Special Exception and Virginia Code 15-2-2232 review will be required as part Fairfax County's Planning and Zoning Application and Development Review including a Board of Supervisors public hearing.

5.2.2 Fairfax County Plan Review Process

A major site plan application including plans will need to be submitted to the Fairfax County Land Development Services Department for the pump station since land disturbance will exceed 2,500 square feet (SF). All applications will be made in accordance with Fairfax County codes and standards including the Public Facilities Manual and VDOT requirements. Approval of the site-related plan will be necessary to obtain both the Land Disturbance Permit and Building Permit.

5.2.3 Tree Conservation Ordinance

Fairfax County Code 64-08-122 established a Tree Conservation Ordinance when tree removal is required. The Ordinance establishes Tree Canopy Requirements and Tree Preservation Requirements.

5.2.4 Land Disturbance Permit

A Land Disturbance Permit (LDP) will be issued by the Fairfax County Land Development Services Department once the following approvals have been received.

- Fairfax County grading plan approval
- All necessary rights of way or easements have been acquired and recorded.
- Copies of all Federal and State permits

5.2.5 Park Authority Permit

There are several parks within the project area that are controlled by either the Fairfax County Park Authority (FCPA) or Northern Virginia Park Authority (NOVA Parks), Impacts to these entities are not currently defined.

However, if impacts were to occur, permits and easements will need to be obtained from these independent authorities.

5.2.6 Fairfax County Building Permit

A Building Permit will be required through the Fairfax County Land Development Service Department prior to commencing work on the building construction. All applications will be made in accordance with the 2018 Uniform Statewide Building Code and the Statewide Fire Prevention Code and County Codes.

5.2.7 Dulles Toll Road Crossing

Coordination with and associated permitting required for the crossing under Route 267 (Dulles Toll Road) will needed with the Metropolitan Washington Airports Authority (MWAA).

5.3 Summary of Anticipated Federal, State and Local Permits

A summary of anticipated Federal, State and Local Permits are as follows:

- VMRC – General Permit
- USACE – Individual Permit
- DEQ – Certificate to Construct (CTC) and VSMP General Permit
- Fairfax County Land Disturbance Permit
- Fairfax County Building Inspection – Building Permit
- DOT permits from VDOT and MWAA

6 Project Cost

This section includes a breakdown of the estimated construction cost for the recommended at Site Area and Force Main Alternative #3.

The cost estimates were developed using preliminary quantity take-offs and equipment supplier quotations based on the design concepts described in this preliminary engineering report. WRA referred to Fairfax County standards for trench details and public facilities to make proper estimates on material quantities. VDOT's open-cut pavement restoration requirements were also consulted.

All pump station sites, and alternative alignments were analyzed for project cost, but this section will focus on the recommended Site Are and Force Main Alternative #3. The cost estimates for each of the pump station and force main alternatives is provided in **Appendix C**.

Contingency cost, an allowance that reflects the uncertainty associated with a construction cost opinion based on a "predesign" study of the indicated facilities, is included in the estimates. Contingency costs include items that are recognized as unquantified within the estimate. Since this contingency is based solely on the facilities and improvements listed in **Section 4,** it should not be viewed as a potential budget for other facilities and improvements that are not described in this section.

The cost estimates for each of the proposed pump stations and alignment alternatives were developed using the expertise and experience of the WRA engineers. The cost estimates presented represent WRA's best engineering judgement and assumes that competitive bids are received. However, the unpredictability of the current market should be taken into consideration when the project goes to bid. The estimates were prepared in accordance with AACE Class 4 Budgetary (planning-level) construction cost requirements. All costs are presented in 2022 dollars and will need to be indexed using the annual inflation rate. The cost estimates carry the following markups in the total shown.

- Design and Services During Construction – 12%
- Contractor General Conditions – 10%
- Permits and Insurances – 4%
- Overhead and Profit – 15%
- Contingency – 35%
- Escalation – 10%

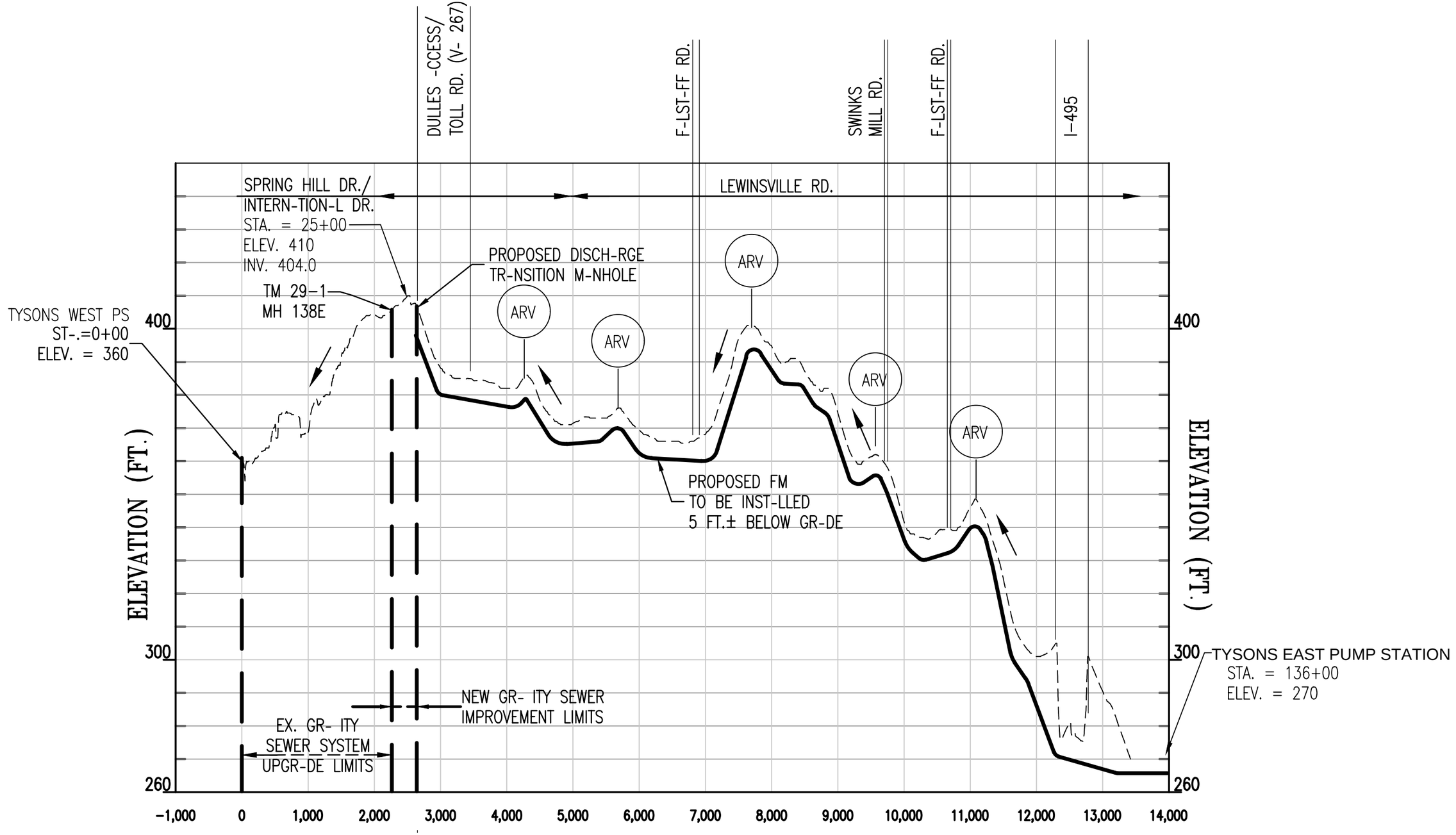
6.1 Site Area and Force Main Alternative Cost Estimate Summary

The estimated total construction cost for the pump station and force main is summarized in **Table 6.1**.

Table 6.1: Site Area and Force Main Alternative #3 Cost Estimate	
Pump Station[1]	$30,600,000
Force Main (10,800 LF)	$28,300,000
Total Cost Estimate	**$58,900,000**

[1] Pump station cost estimate includes installation of four (4) dry pit submersible pumps, channel grinder, 1000 kW generator, 7,500 gallon above grade fuel tank, odor control system, diversion structure, and influent gravity sewer.
[2] Force main cost includes I-495 Tunnel

Appendix A
Site Area and Force Main Alignment Schematic Force Main Profiles



Tysons East Conveyance System Modifications

PRELIMINARY ENGINEERING REPORT

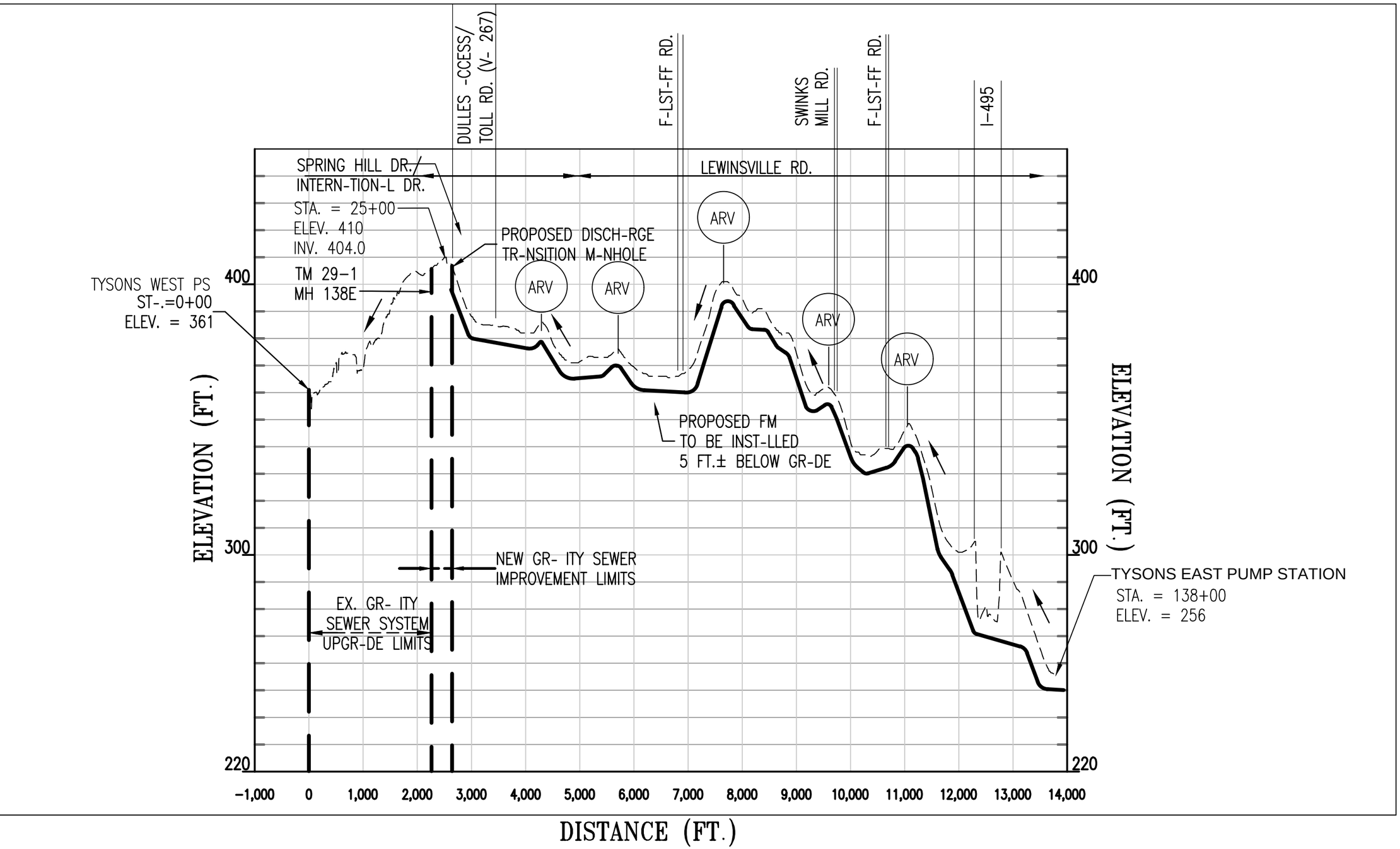
Figure A-1
Site Area and Force Main Alternative #3

LEGEND

FLOW DIRECTION

EX. GRADE

ARV AIR RELEASE VALVE



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

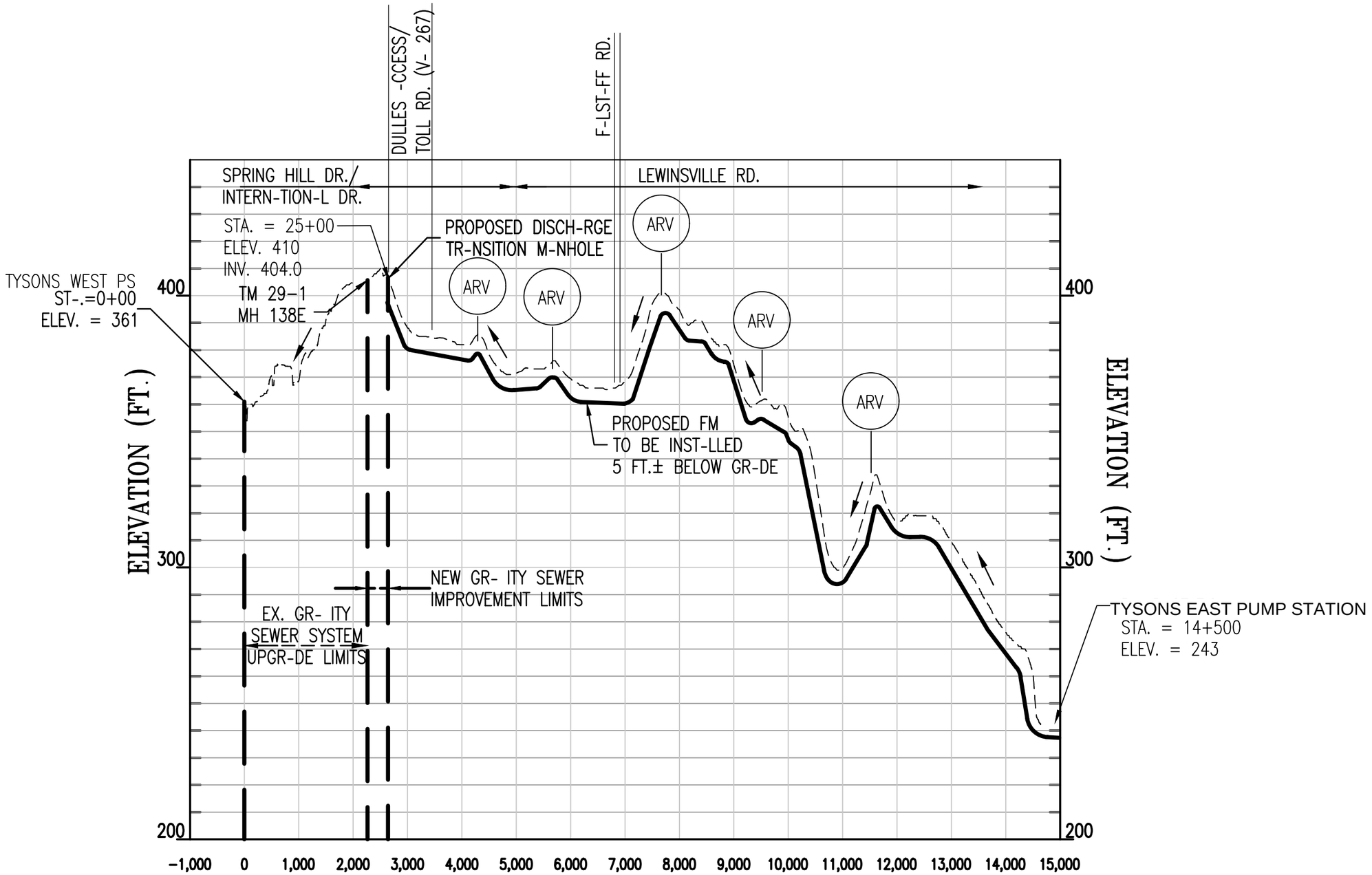
Figure A-2
Site Area and Force Main Alternative #4

LEGEND

FLOW DIRECTION

EX. GRADE

ARV AIR RELEASE VALVE



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

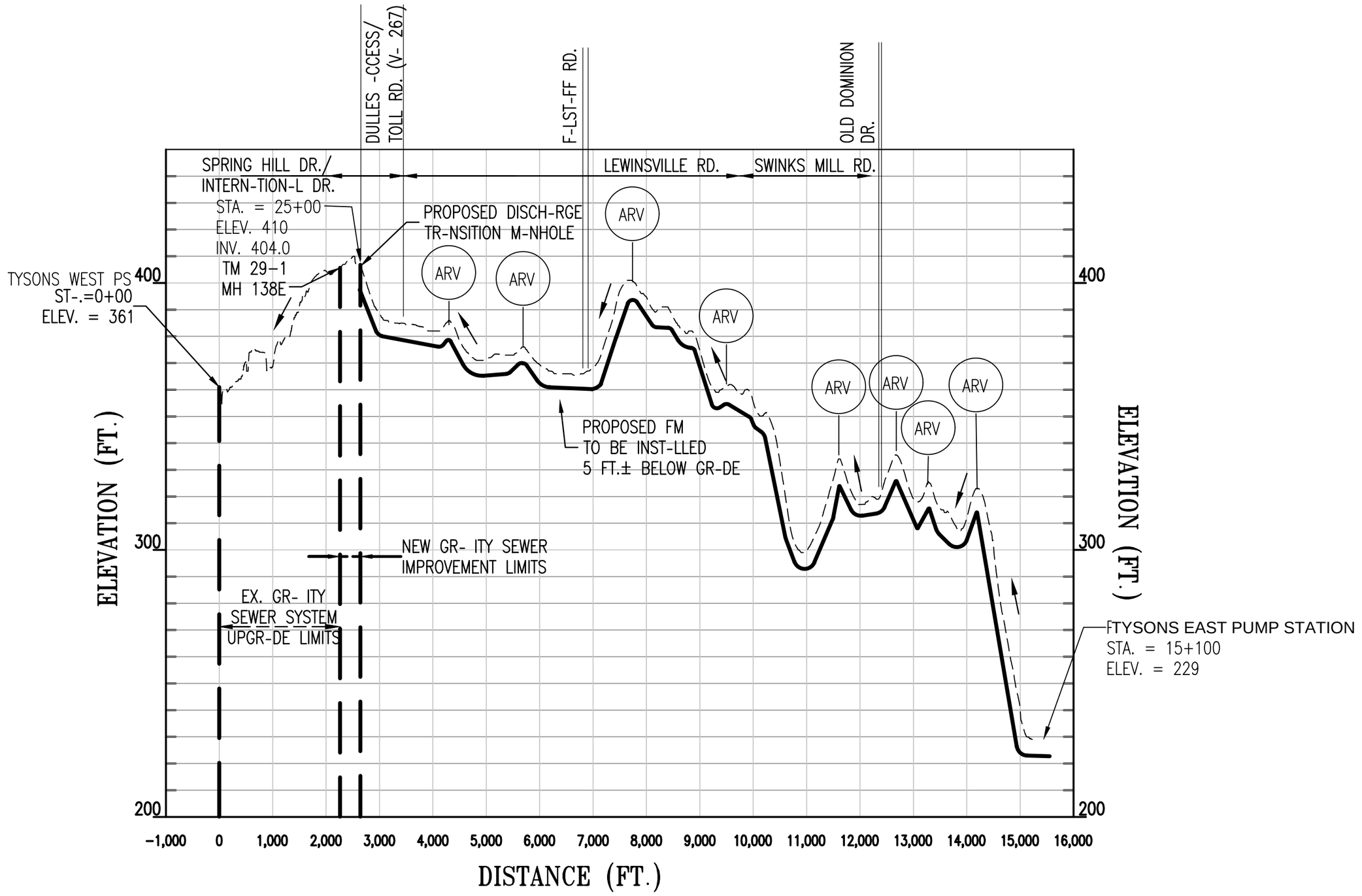
Figure A-3
Site Area and Force Main Alternative #7

LEGEND

FLOW DIRECTION

EX. GRADE

ARV AIR RELEASE VALVE

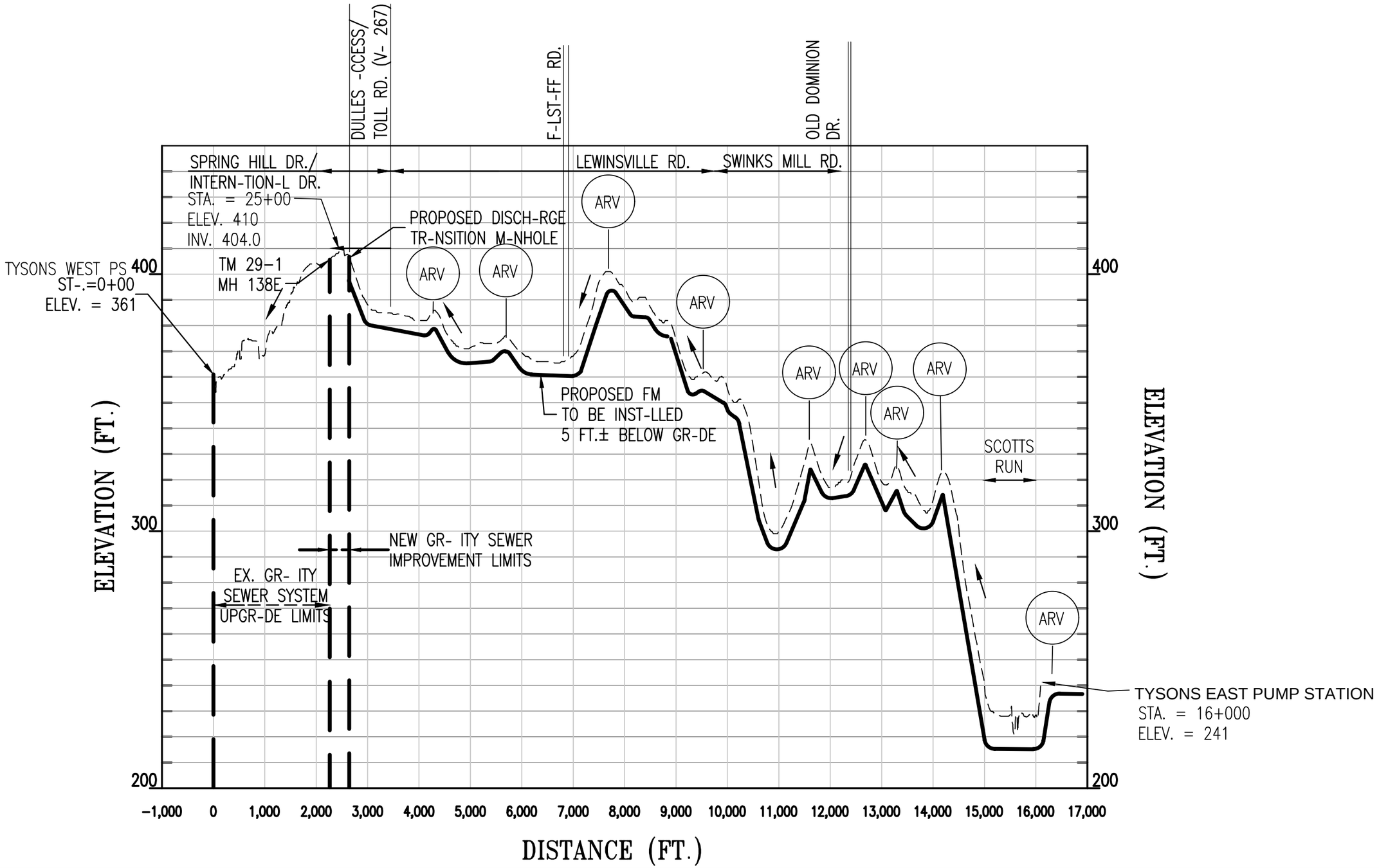


Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure A-4
Site Area and Force Main Alternative #8

LEGEND

- FLOW DIRECTION
- EX. GRADE
- (ARV) AIR RELEASE VALVE



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure A-5
Site Area and Force Main Alternative #9

LEGEND

FLOW DIRECTION

EX. GRADE

ARV AIR RELEASE VALVE

Appendix B
Site Area and Force Main Alignment Environmental Mapping

Old Courthouse Spring Branch
Rocky Run
Tysons West Pump Station
LEWINSVILLE RD
Potomac River
Bullneck Run
Potomac River
267
Bradley Branch
LEWINSVILLE RD
3
4
7
8
9
495
Scott Run
Scott Run

Tysons East Conveyance System Modifications

PRELIMINARY ENGINEERING REPORT

Figure B-1
Wetlands, Resource Protection and Forested Areas

Sewer to be Upgraded

Pump Station Area and Force Main Alternative

Scott's Run Interceptor

Existing Pump Station

Fairfax County Mapped Resource Protection Area

Wetlands

PUB

PEM

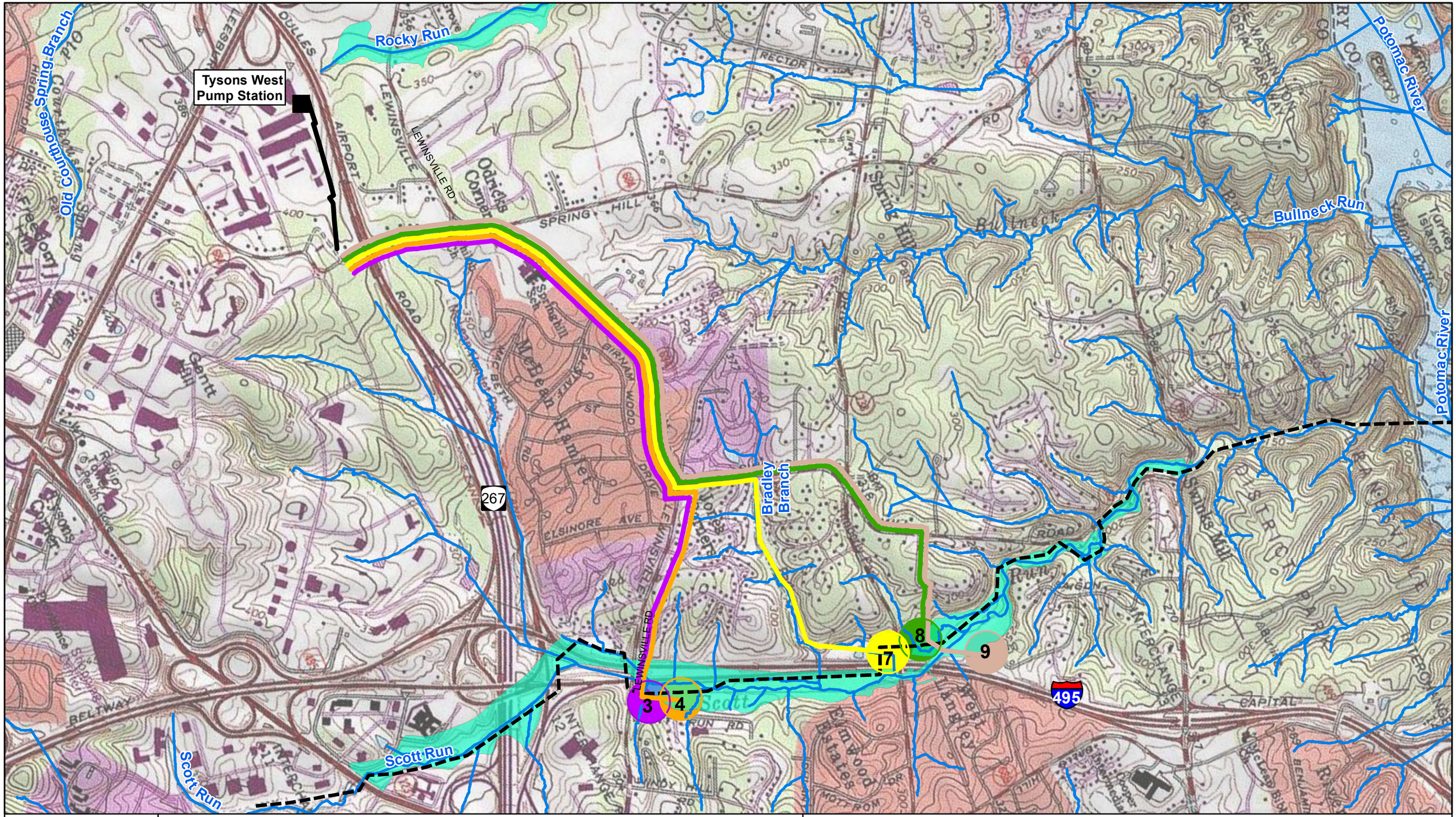
PFO

NHD Stream

Forest

N

0 500 1,000 1,500 2,000 Feet



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure B-2
Streams and 100-year Floodplain

Sewer to be Upgraded
Pump Station Area and Force Main Alternative
Scott's Run Interceptor
Existing Pump Station
NHD Stream
100-Year Floodplain

N

0 500 1,000 1,500 2,000 Feet

Tysons West
Pump Station

LEWINSVILLE RD

1

4

5

4

1

267

LEWINSVILLE RD

3

4

7

8

9

495

Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure B-3
Radon Potentials

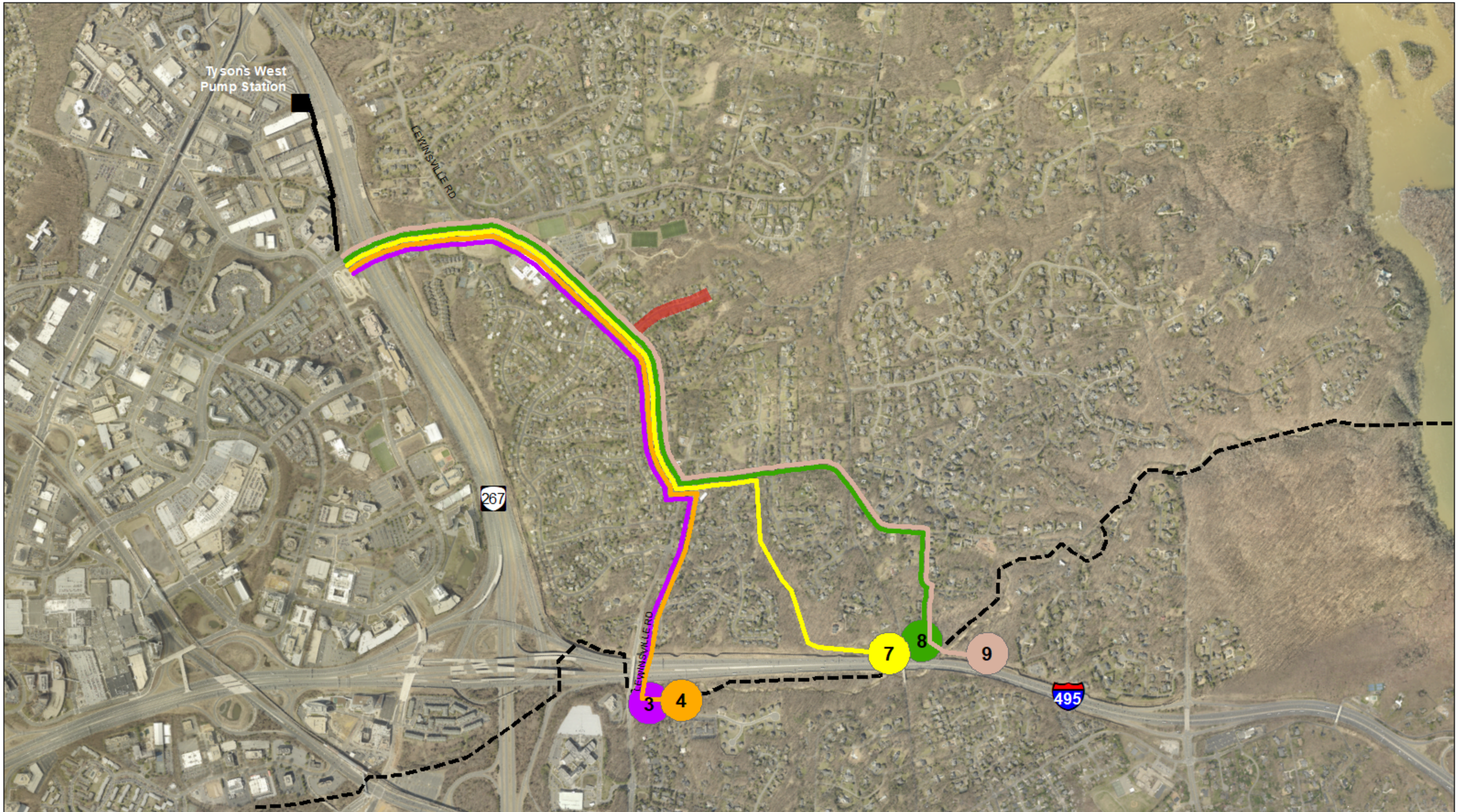
Sewer to be Upgraded
Pump Station Area and Force Main Alternative
Scott's Run Interceptor
Existing Pump Station

Radon Potential Areas (labeled by category)
1 (Low)
2
3
4
5 (High)

Source: Fairfax County Division of Environmental Health

N

0 500 1,000 1,500 2,000 Feet



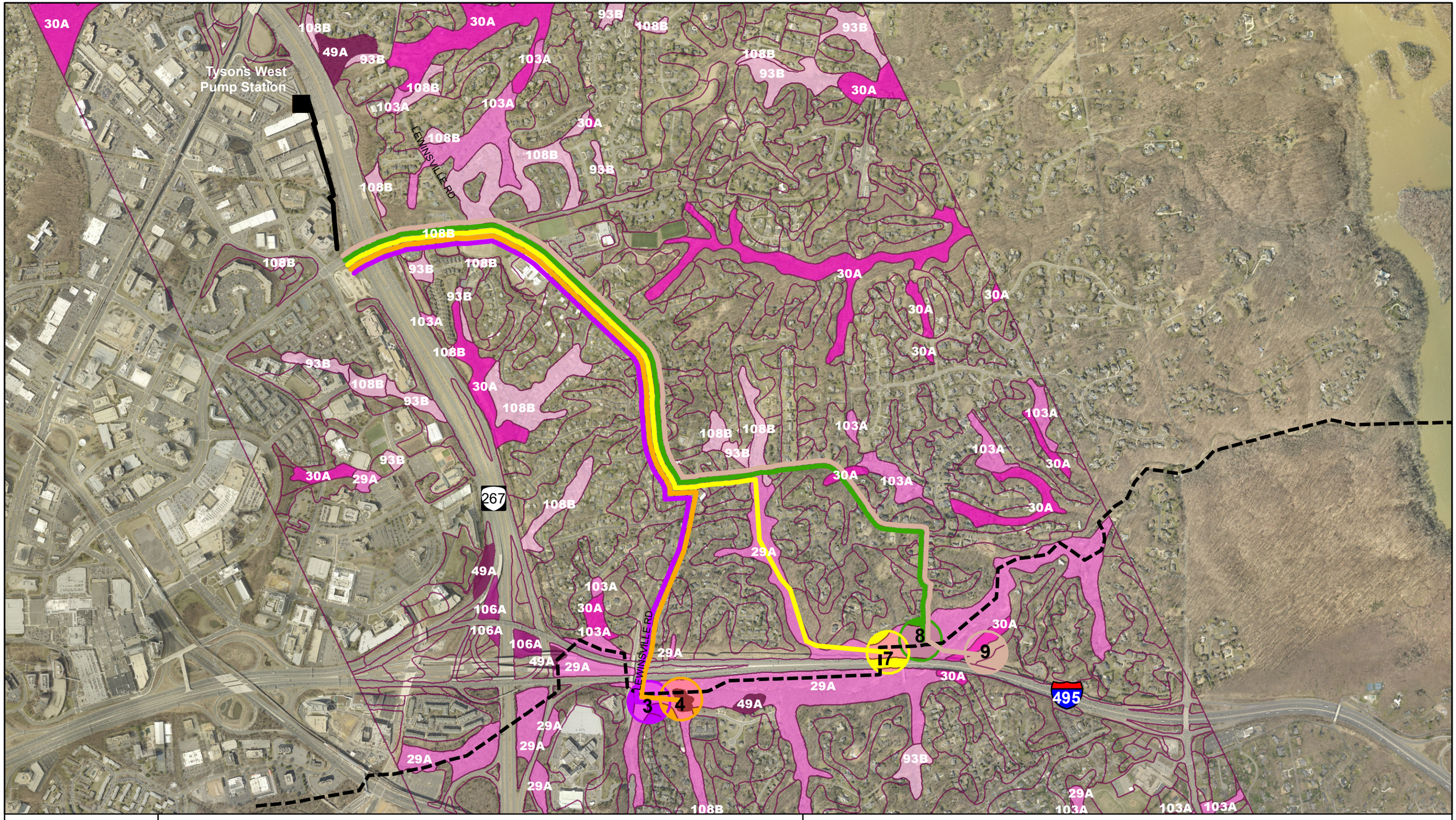
Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure B-4
Potential Asbestos Containing Soils

Sewer to be Upgraded
Pump Station Area and Force Main Alternative
Scott's Run Interceptor
Existing Pump Station
Potential Asbestos Containing Soils

N

Feet
0 500 1,000 1,500 2,000



Tysons East Conveyance System Modifications
PRELIMINARY ENGINEERING REPORT

Figure B-5
Hydric Soils Map

Sewer to be Upgraded
Pump Station Area and Force Main Alternative
Scott's Run Interceptor
Existing Pump Station

Percent Hydric Soil

0%	35%
2%	40%
5%	85%

N

0 500 1,000 1,500 2,000 Feet

Appendix C
Cost Estimates of Site Area and Force Main Alternatives

Site Area and Force Main Alternative #3		
Estimated Construction Costs		
Category	**Estimated Cost**	
Pump Station		
Civil / Site Development	$	3,230,000
Process Mechanical	$	7,360,000
Building Mechanical	$	470,000
Electrical	$	3,920,000
Structural	$	2,940,000
Instrumentation and Controls	$	1,170,000
Architectural	$	1,530,000
Pump Station Subtotal	**$**	**20,620,000**
35% Contingency	$	7,220,000
10% Escalation	$	2,780,000
Estimated Total Construction Cost of Pump Station	**$**	**30,620,000**
Force Main Estimate (10,800 LF - 650 LF)	$	16,750,000
I-495 Tunnel (650 LF)	$	2,300,000
Force Main Subtotal	**$**	**19,050,000**
35% Contingency	$	6,670,000
10% Escalation	$	2,570,000
Estimated Total Construction Cost of Force Main	**$**	**28,290,000**
Estimated Total Construction Cost of Pump Station and Force Main	**$**	**58,910,000**

Site Area and Force Main Alternative #4		
Estimated Construction Costs		
Category	**Estimated Cost**	
Pump Station		
Civil / Site Development	$	3,230,000
Process Mechanical	$	7,360,000
Building Mechanical	$	470,000
Electrical	$	3,920,000
Structural	$	2,500,000
Instrumentation and Controls	$	1,170,000
Architectural	$	1,530,000
Pump Station Subtotal	**$**	**20,180,000**
35% Contingency	$	7,060,000
10% Escalation	$	2,720,000
Estimated Total Construction Cost	**$**	**29,960,000**
Force Main Estimate (11,100 LF - 650 LF)	$	17,240,000
I-495 Tunnel (650 LF)	$	2,300,000
Force Main Subtotal	**$**	**19,540,000**
35% Contingency	$	6,030,000
10% Escalation	$	2,560,000
Estimated Total Construction Cost of Force Main	**$**	**28,130,000**
Estimated Total Construction Cost of Pump Station and Force Main	**$**	**58,090,000**

Site Area and Force Main Alternative #7		
Estimated Construction Costs		
Category	**Estimated Cost**	
Pump Station		
Civil / Site Development	$	3,230,000
Process Mechanical	$	8,160,000
Building Mechanical	$	560,000
Electrical	$	4,420,000
Structural	$	2,350,000
Instrumentation and Controls	$	1,170,000
Architectural	$	1,960,000
Pump Station and Force Main Subtotal	**$**	**21,850,000**
35% Contingency	$	7,650,000
10% Escalation	$	2,950,000
Estimated Total Construction Cost	**$**	**32,450,000**
Force Main Estimate (12,000 LF)	$	19,800,000
35% Contingency	$	6,930,000
10% Escalation	$	2,670,000
Estimated Total Construction Cost of Force Main	**$**	**29,400,000**
Estimated Total Construction Cost of Pump Station and Force Main	**$**	**61,850,000**

Site Area and Force Main Alternative #8		
Estimated Construction Costs		
Category	**Estimated Cost**	
Pump Station		
Civil / Site Development	$	3,230,000
Process Mechanical	$	8,160,000
Building Mechanical	$	560,000
Electrical	$	4,420,000
Structural	$	2,200,000
Instrumentation and Controls	$	1,170,000
Architectural	$	1,960,000
Pump Station and Force Main Subtotal	**$**	**21,700,000**
35% Contingency	$	7,600,000
10% Escalation	$	2,930,000
Estimated Total Construction Cost	**$**	**29,300,000**
Force Main Estimate (12,600 LF)	$	20,790,000
35% Contingency	$	7,280,000
10% Escalation	$	2,810,000
Estimated Total Construction Cost of Force Main	**$**	**30,880,000**
Estimated Total Construction Cost of Pump Station and Force Main	**$**	**60,180,000**

Site Area and Force Main Alternative #9		
Estimated Construction Costs		
Category	**Estimated Cost**	
Pump Station		
Civil / Site Development	$	3,520,000
Process Mechanical	$	8,160,000
Building Mechanical	$	560,000
Electrical	$	4,420,000
Structural	$	2,940,000
Instrumentation and Controls	$	1,170,000
Architectural	$	1,960,000
Pump Station and Force Main Subtotal	**$**	**22,730,000**
35% Contingency	$	7,960,000
10% Escalation	$	3,070,000
Estimated Total Construction Cost	**$**	**30,690,000**
Force Main Estimate (13,500 LF)	$	22,280,000
35% Contingency	$	7,800,000
10% Escalation	$	3,010,000
Estimated Total Construction Cost of Force Main	**$**	**33,090,000**
Estimated Total Construction Cost of Pump Station and Force Main	**$**	**63,780,000**