Delaware County Regional Sewer District

Central Alum Creek Treatment Plant

Plant Location and Collections System Study

November 6, 2017

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Mason Janczak, P.E.

Introduction

The District is anticipating building a treatment plant in the vicinity of US36 on the West side of I71. This plant was conceived in the 2005 Master Plan and was recommended as a short term project in the 2017 Master Plan as a way to alleviate capacity concerns in the area and extend the current service areas. The following report provides an analysis on the preferred plant site and the subsequent layout of the collections system. While the bulk of the report is spent evaluating gravity sewer and pump station locations on the west and north sides of the reservoir the East side is somewhat constrained by existing developments and infrastructure. A synopsis of improvements for the East side is included in Section 4 for completeness.

1.0 Central Subarea

Plant Site

The site being considered for the new Central Alum Creek Treatment Plant (CAC) is located on the peninsula between forks of the Alum Creek Reservoir. The District anticipates there will be significant development in the area surrounding the 36/37 and I-71 interchange as well as the newly constructed Olentangy Berlin High School. Flows from these areas are currently tributary to the Alum Creek Water Reclamation Facility and will need to be intercepted to be conveyed and CAC plant site. Those projects to intercept flow would need to be coordinated with CAC startup.

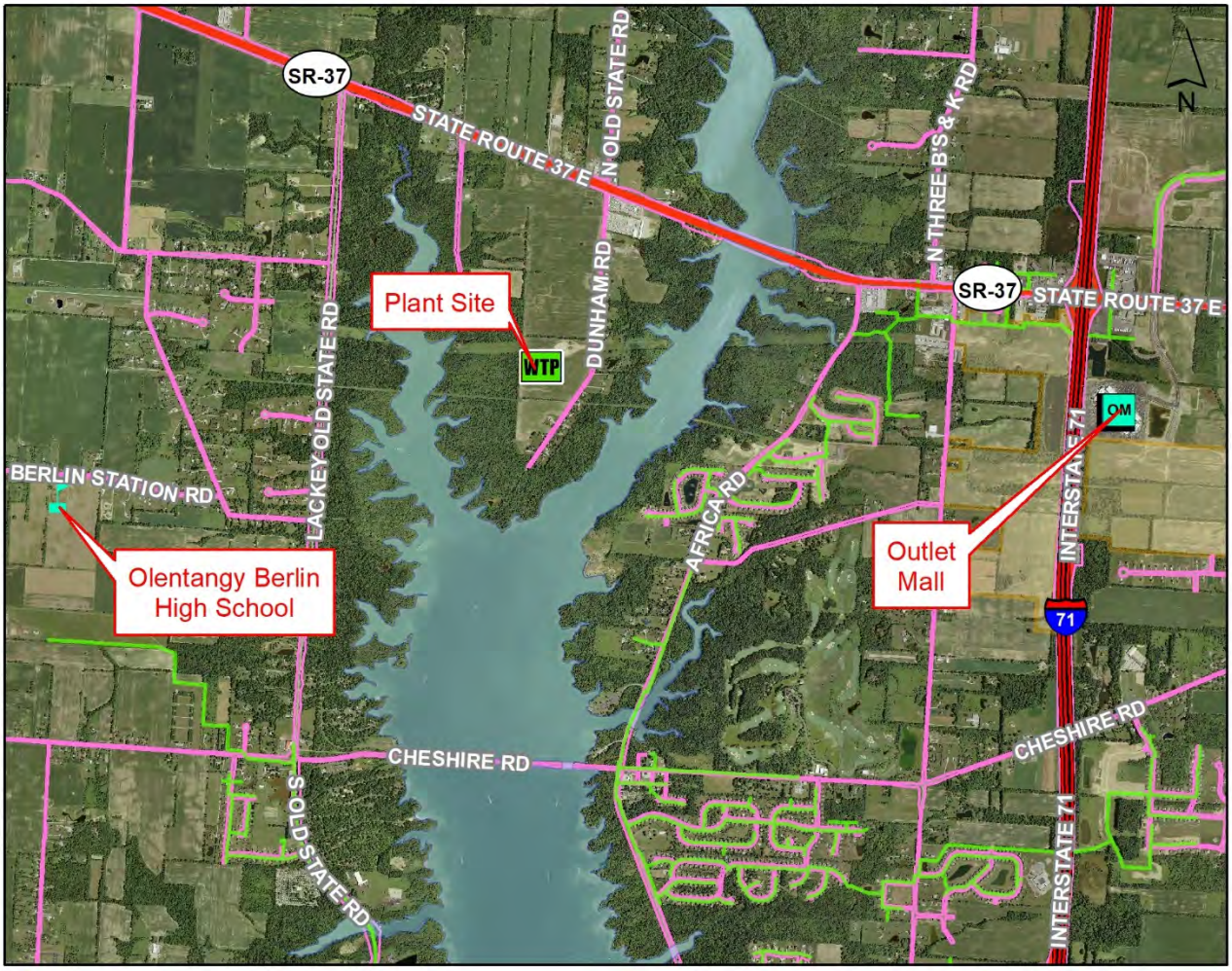

Figure 1.1 - Location Map of Central Alum Creek Plant Site.

The preferred site places the plant at the intersection of several major power lines. The power line easements could act as important corridors leading North, East, and West for which to run the trunk lines and force mains to the plant. The map in Figure 1.2 shows the location of these lines and a conceptual layout of the plant.

Figure 1.2 CAC Plant Site.

The District has obtained a contract option to purchase this site. As part of the terms for this contract the District must construct a gravity sewer trunk which will be discussed later in this section.

The plant site is near a ridge indicated in Figure 1.2 with the blue line. The site has an average elevation of approximately 925. In order to further evaluate routes for the trunk sewers it was assumed that the normal pool elevation of the reservoir is 888 and the maximum pool is 901. When establishing the sewer trunk depth near the plant an attempt was made to stay above the lake pool elevation as the ground water conditions would likely be more difficult to control during construction.

Information contained in available well logs were combined into an elevation model to provide an estimate of rock depth. The estimated rock elevations have been incorporated where possible into the profiles. There are only a few well logs available for this area so further subsurface investigation will be necessary.

In order to evaluate the capacity needs and sewer depths, the tributary area was divided into subareas. These subareas are illustrated in figure 1.3.

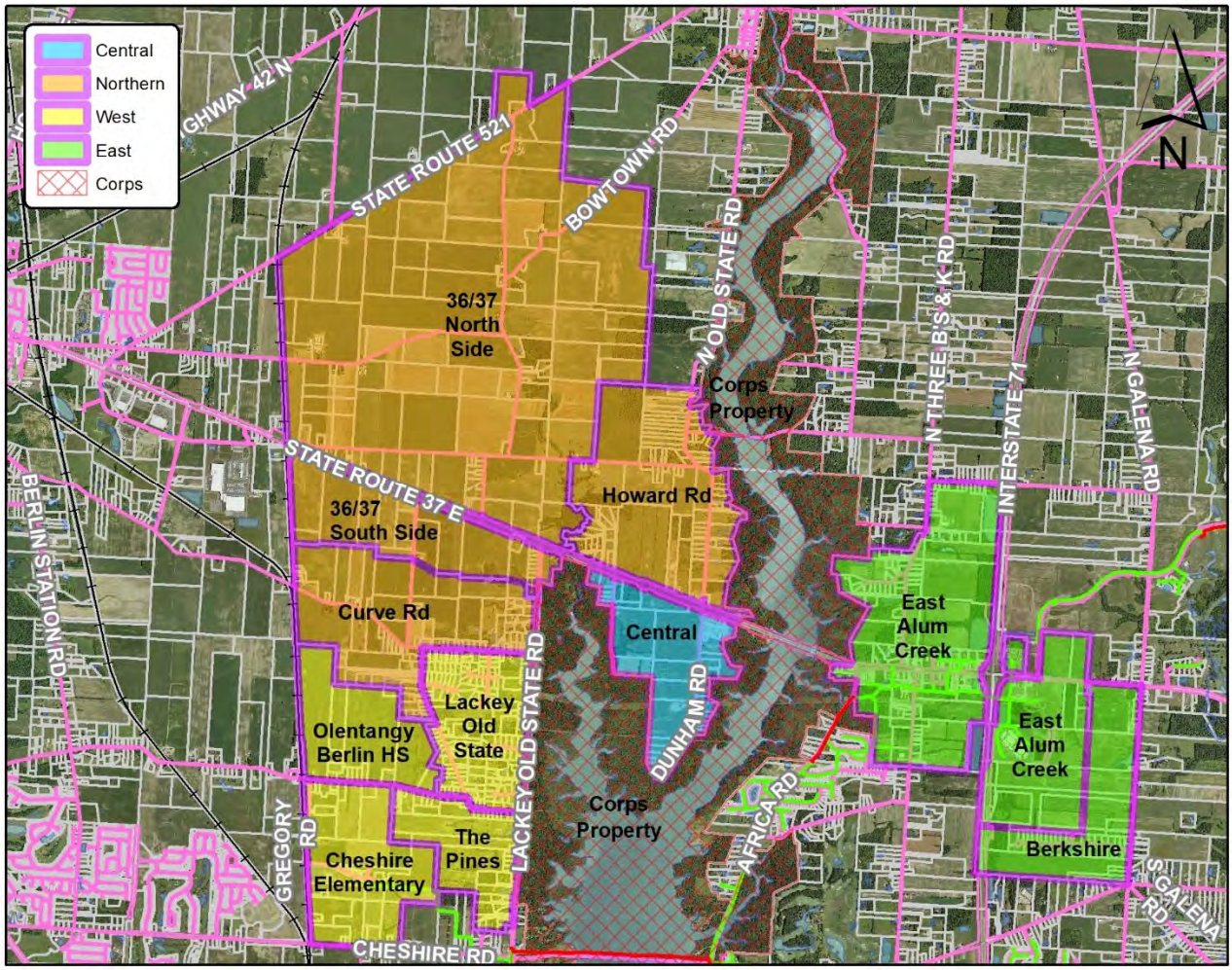

Figure 1.3 - CAC Subareas.

Effluent Line

A critical component of siting this plant is the location of the effluent outfall. A preliminary alignment of the effluent line is shown on the map in Figure 1.4. The following table describes the characteristics of this sewer and the profile is provided in Figure 1.5. It appears to be possible to have the effluent discharge entirely by gravity but acquisition of easements and plant layout may affect the feasibility of gravity flow. Prior discussions with the Army Corps have indicated that effluent line will need to terminate in an intermittent stream prior to flowing onto the Army Corps property.

CAC Effluent				
Size	**Start Elev.**	**Min Depth**	**Max Depth**	**Length**
36"	910.00	0.00	19.23	3212

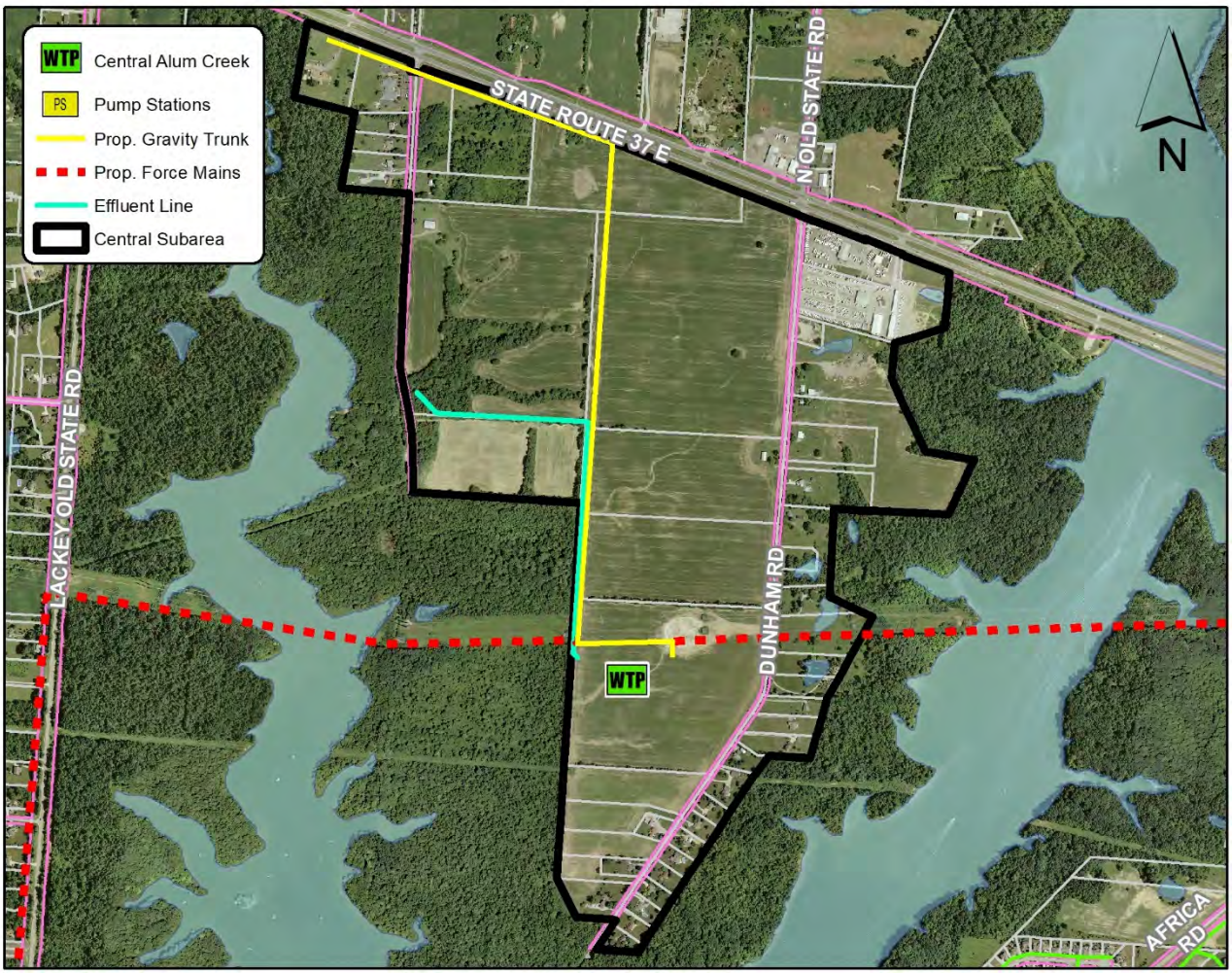

Figure 1.4 – Central Subarea.

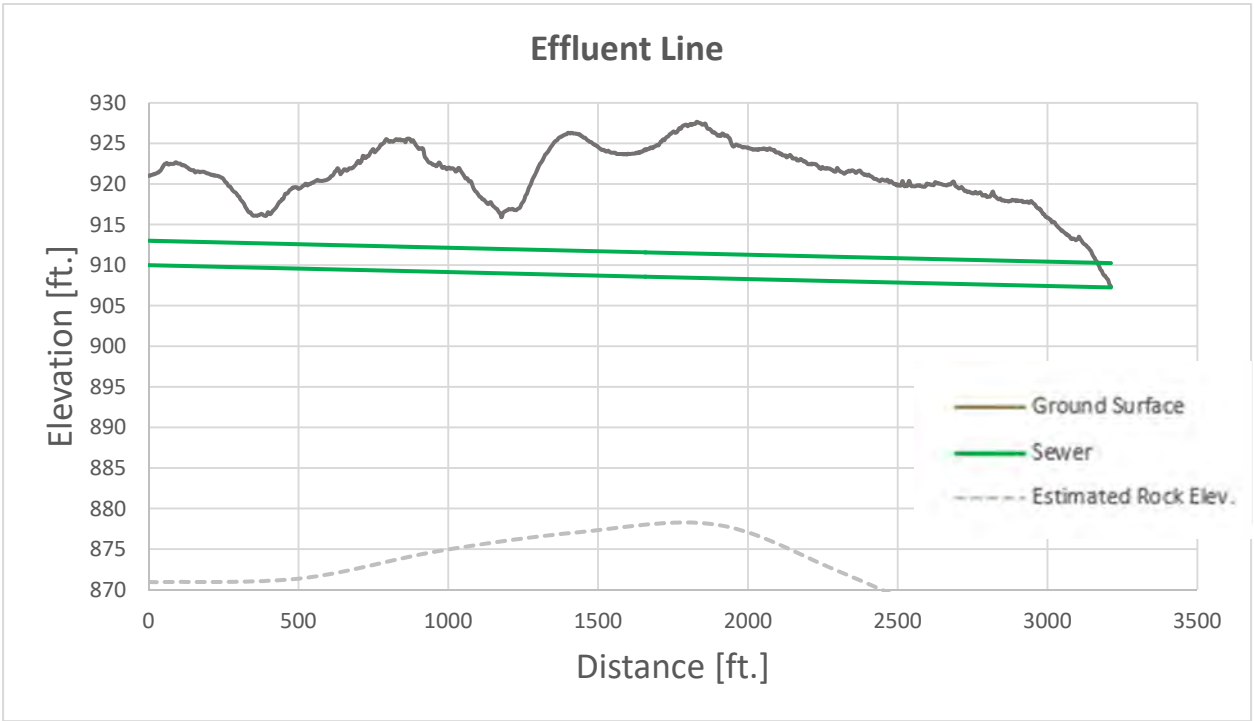

Figure 1.5 CAC Preliminary Effluent Line Profile.

Central

The Central Subarea is anticpated to develop as a planned residential district with some commerial along the US 36 cooridor. The table below summarizes the anticipated development characteristics of this subarea.

Central Subarea			
	Area [Ac.]	ERU	Density [ERU/Ac.]
Total	411.1	822.2	2.00

Since this subarea is isolated from the rest of the subareas by Alum Creek Resevoir and US 36, the primary purpose of CAC Trunk is to convey the flows from the several force main outlets to the plant. The exact location of the force main outlets will be dictated by the availibty of easements and permits to cross the resevoir; thefore, the preliminary trunk was assumed to be 36 inches in diameter through out its length. The preliminary alignment of the CAC Trunk Sewer is shown in Figure 1.4. This alignment was preferred because the trunk would follow the electric lines north to US 36 and then head west following the US 36 right-of-way. It is important to note, there is limited space along US 36 due to a Del-co water line in this general location. The following table describes the characteristics of this sewer alignment.

CAC Trunk				
Size	Start Elev.	Min Depth	Max Depth	Length
36"	904.00	6.14	27.82	7226

Since the flow is pumped from the adjacent subareas the depth of this trunk would mainly be dicated by the slopes and minimum cover needed to serve the extremities of this sub area. The preliminary profile was generated using the above alignment and is provided in Figure 1.6.

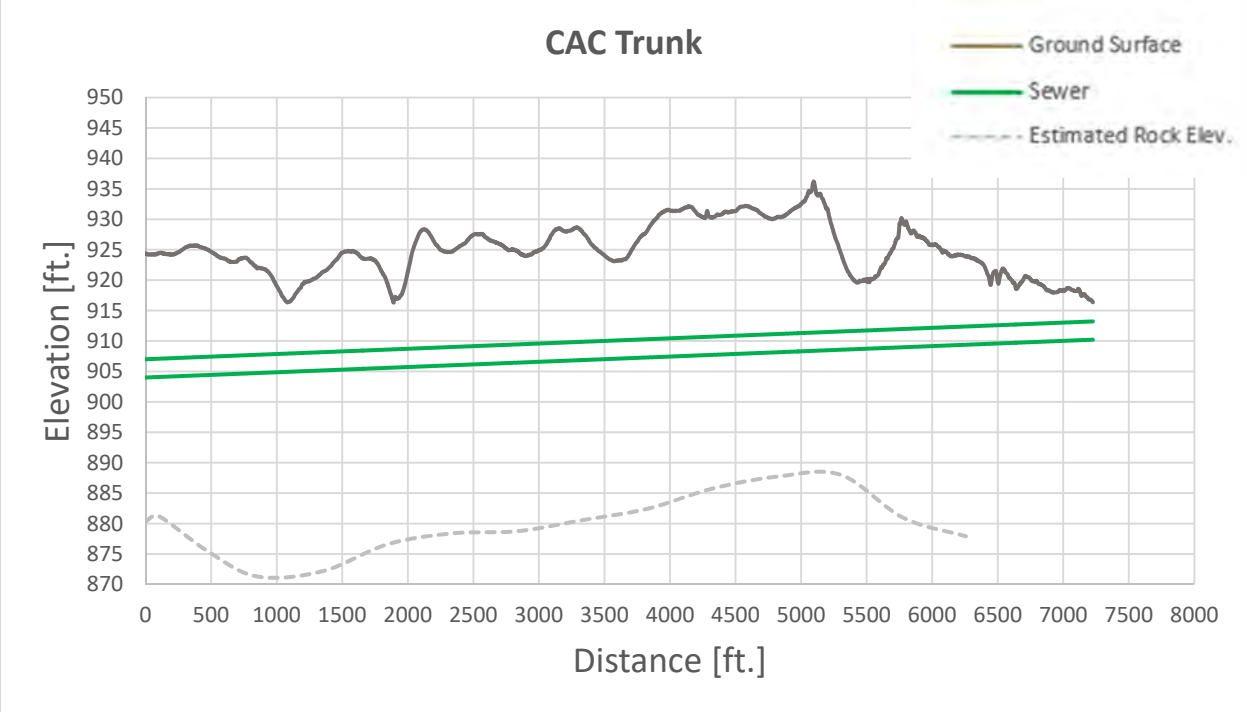

Figure 1.6 – CAC Trunk Profile.

Further evaluation of the trunk depth indicates that the majority of the subarea can be served from various connection points on the trunk with 10" sewer extensions run at minimum slope. The map in Figure 1.7 illustrates this serviceability analysis. Areas in green are considered deep enough to provide basement service, yellow areas can achieve minimum cover but are not deep enough for basement service, and red areas cannot be served without pumping.

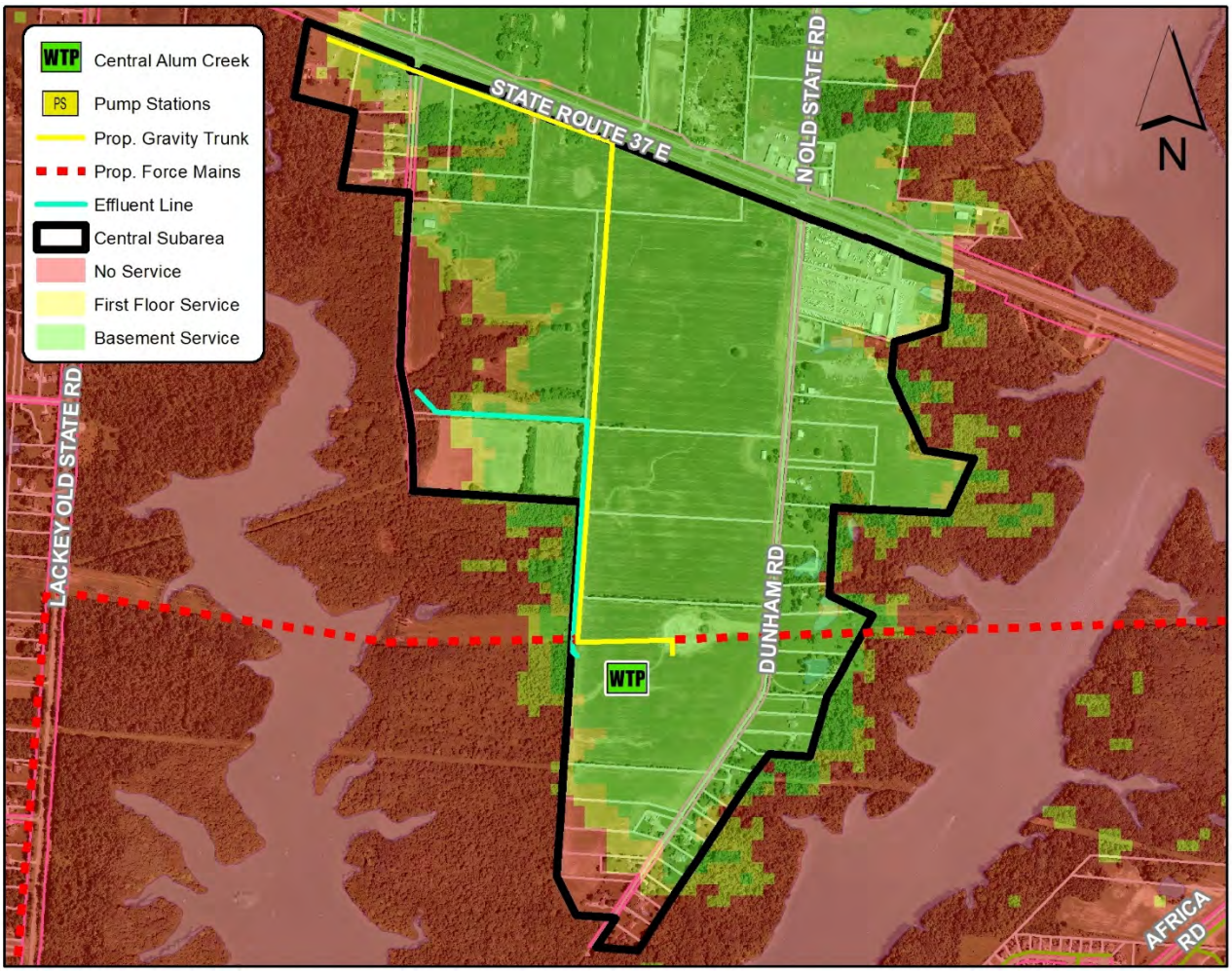

Figure 1.7 – CAC Trunk serviceability analysis map.

2.0 Northern Subareas

Howard Rd

The Howard Rd Subarea is located north of Route 36/37 as shown on Figure 2.1. The majority of this subarea is expected to develop at a density of 1.25 ERU/Acre if centralized sewer is provided. Properties close to the 36/37 corridor are expected to develop with commercial uses. The following table summarizes this development potential.

Howard Rd			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Total	784.18	980.23	1.25

Service can be provided to this subarea using a 15" gravity sewer extending north from the CAC Trunk. A 15" gravity sewer would be capable of providing more sewer capacity than would be required by 1.25

ERU/Acre but the additional capacity would accommodate the commercial uses where a higher density is typical. The alignment of the sewer within this subarea should be coordinated with road improvements as ODOT has indicated they will require backage roads along Route 36/37. Figure 2.1 illustrates extent of this subarea that can be service via gravity sewer.

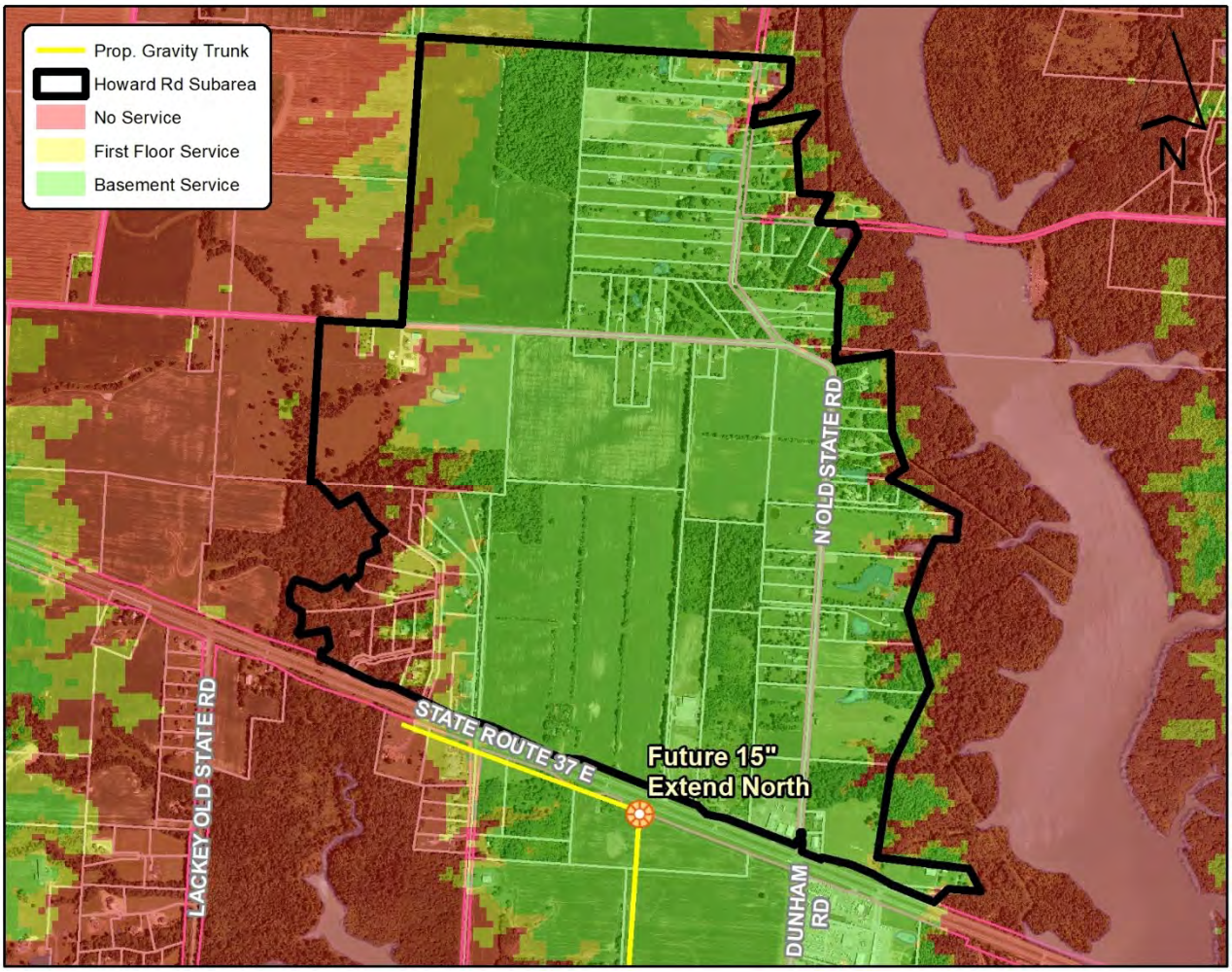

Figure 2.1 – Howard Rd serviceability analysis map.

Route 36/37 South Side

The Route 36/37 corridor that is west of Lackey Old State Rd is divided into North and South subareas because crossing Route 36/37 multiple times was determined to be not very economical. The subarea is anticipated to develop with mostly commercial and industrial uses. The following table summarizes the expected uses.

Route 36/37 South Side			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Total	464.51	1602.56	3.45

For the majority of the distance, an 18” sewer is sufficient to convey the flows expected in this area. A preliminary alignment is shown in Figure 2.2.

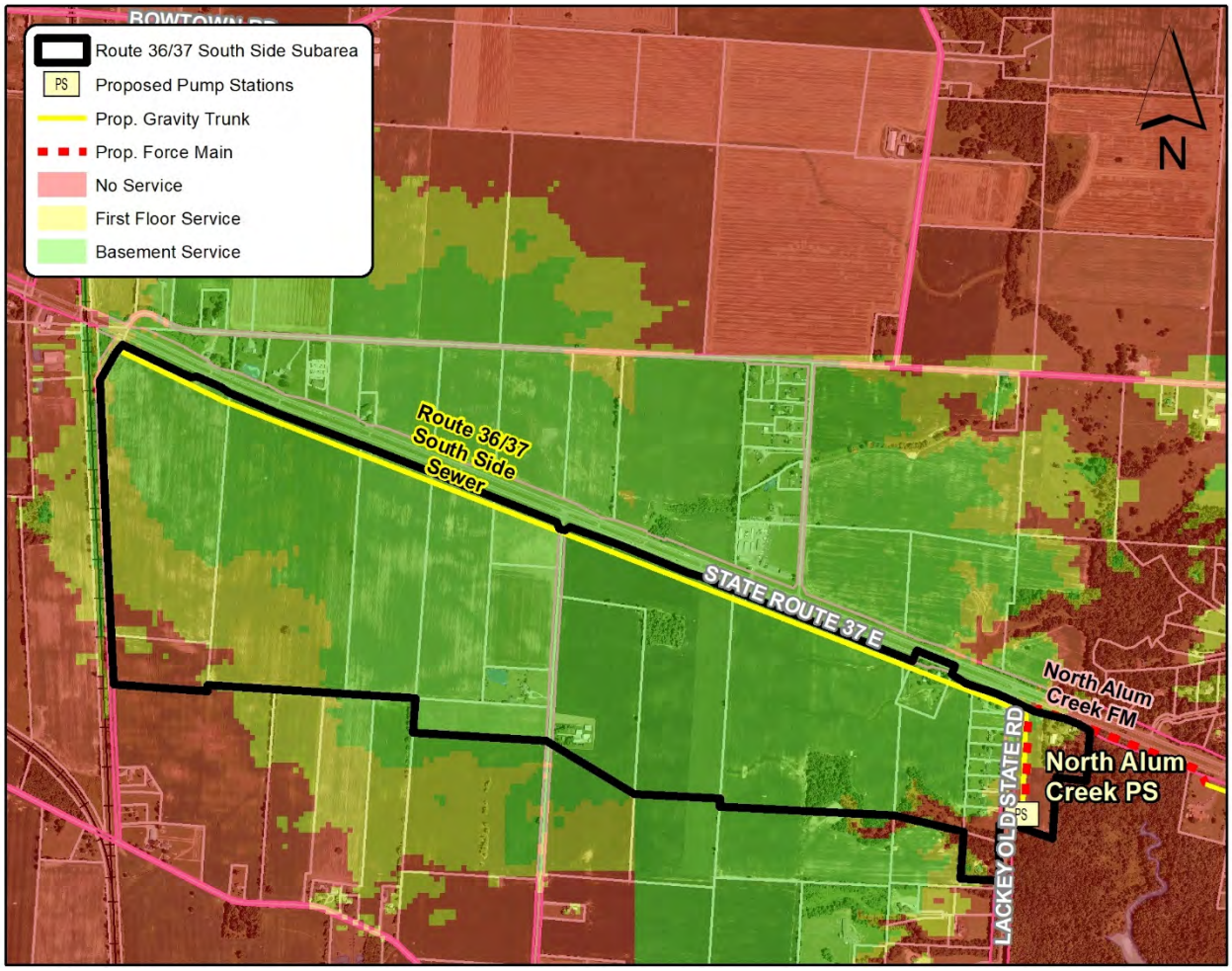

Figure 2.2 – Route 36/37 South Side Sewer preliminary alignment and serviceability analysis map.

The following table summarizes the characteristics of this sewer.

Route 36/37 South Side Sewer				
Size	**Start Elev.**	**Min Depth**	**Max Depth**	**Length**
18"	896.00	7.30	22.39	10301

The profile in Figure2.3 illustrates the significant amount of fall in the sewer line. The drops in this line will need to be adjusted to accommodate where sewers from the Curve Rd and Route 36/37 North Side sewers converge.

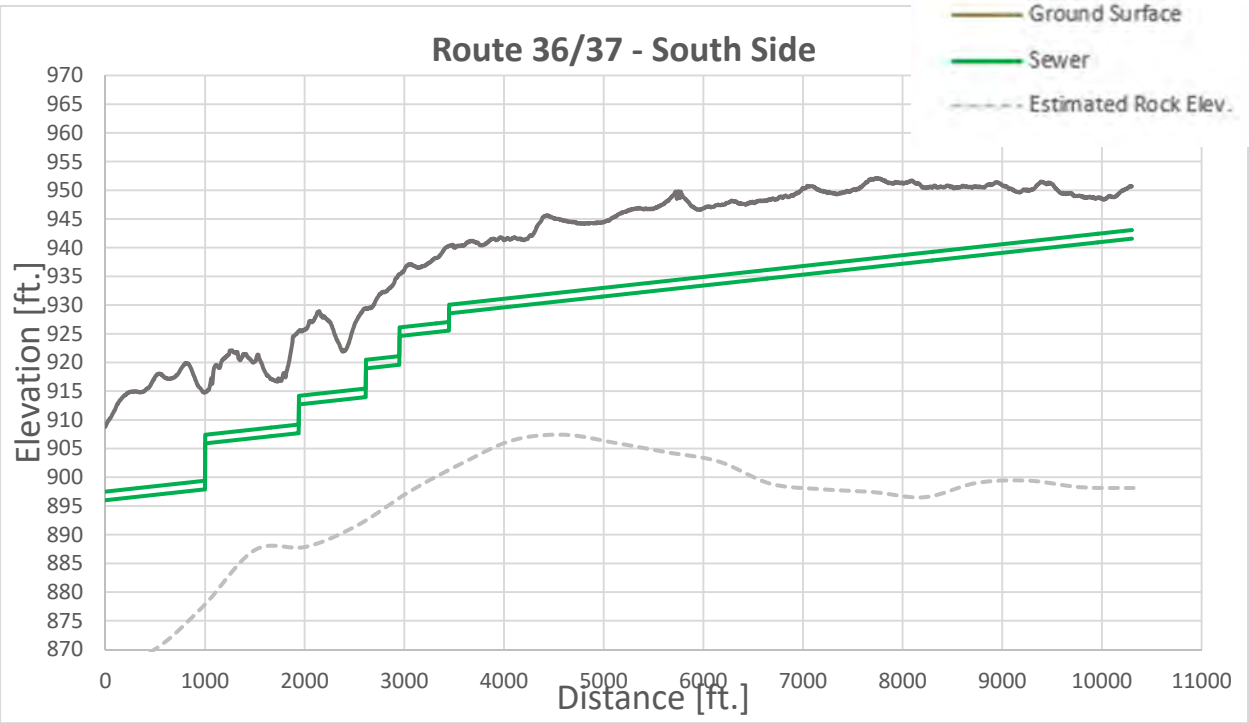

Figure 2.3 Route 36/37 South Side Sewer preliminary profile.

Route 36/37 North Side

This subarea includes the commercial corridor along the north side of Route 36/37 however, the majority of the land is located in the low density agricultural district of Brown Township. These low density areas are not likely to receive sewer anytime soon as the density does not make it economical to serve. The lay of the land does indicate that this is the most likely way that sewer would be extended to the area. Figure 2.4 shows the serviceability analysis map which assumes the sewer will continue north from the east most manhole along Baker Rd to provide service into Brown Township. The development characteristics for this subarea are summarized in the following table.

Route 36/37 North Side			
	Area [Ac.]	ERU	Density [ERU/Ac.]
Total	3158	1579.00	0.50

A preliminary alignment to serve the commercial corridor is shown in Figure 2.4. The following table summarizes the characteristics of this sewer and the preliminary profile is provided in Figure 2.5.

Route 36/37 North Side Sewer				
Size	Start Elev.	Min Depth	Max Depth	Length
18"	896.00	4.20	26.15	12044

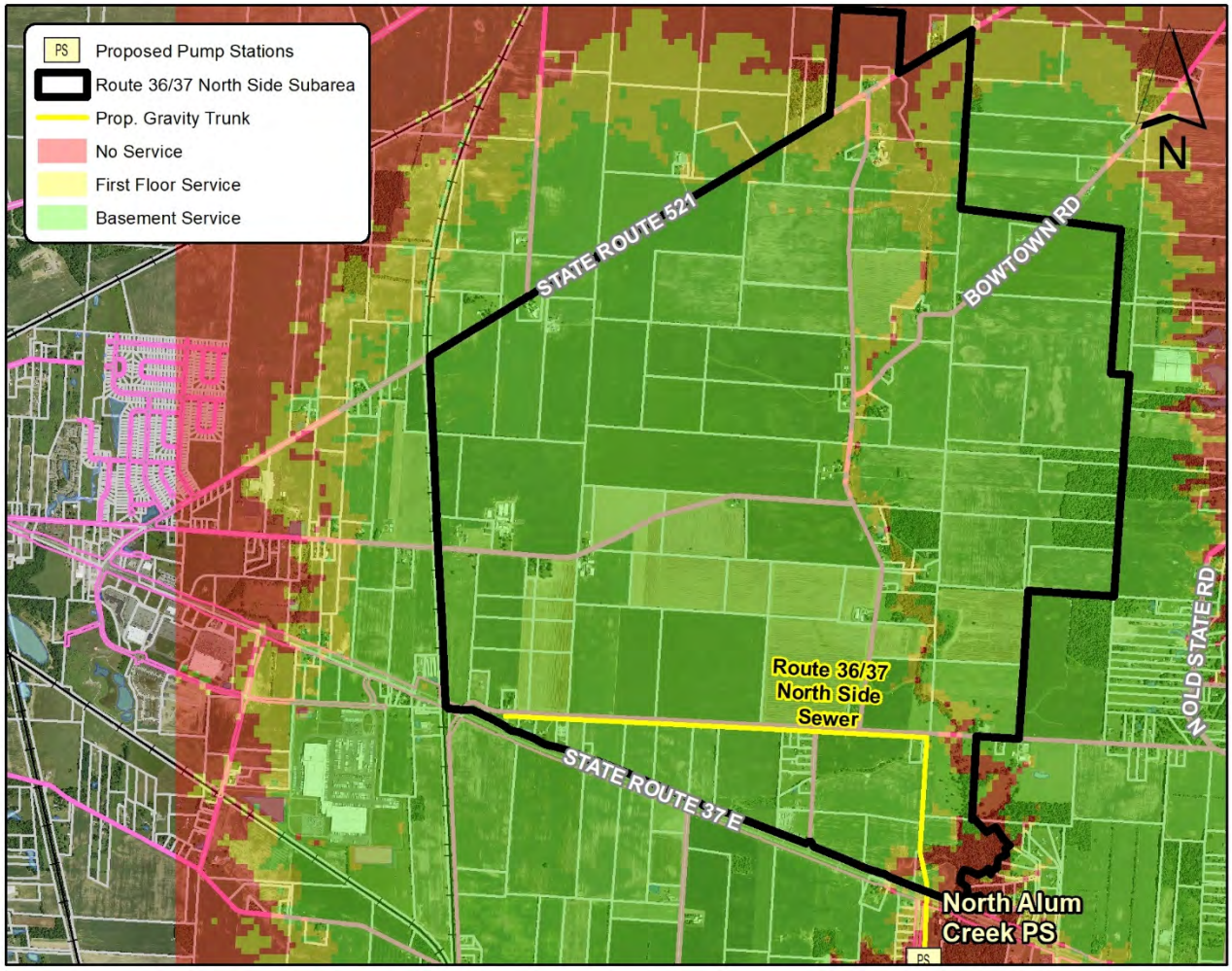

Figure 2.4 - Route 36/37 North Side preliminary alignment and serviceability analysis map.

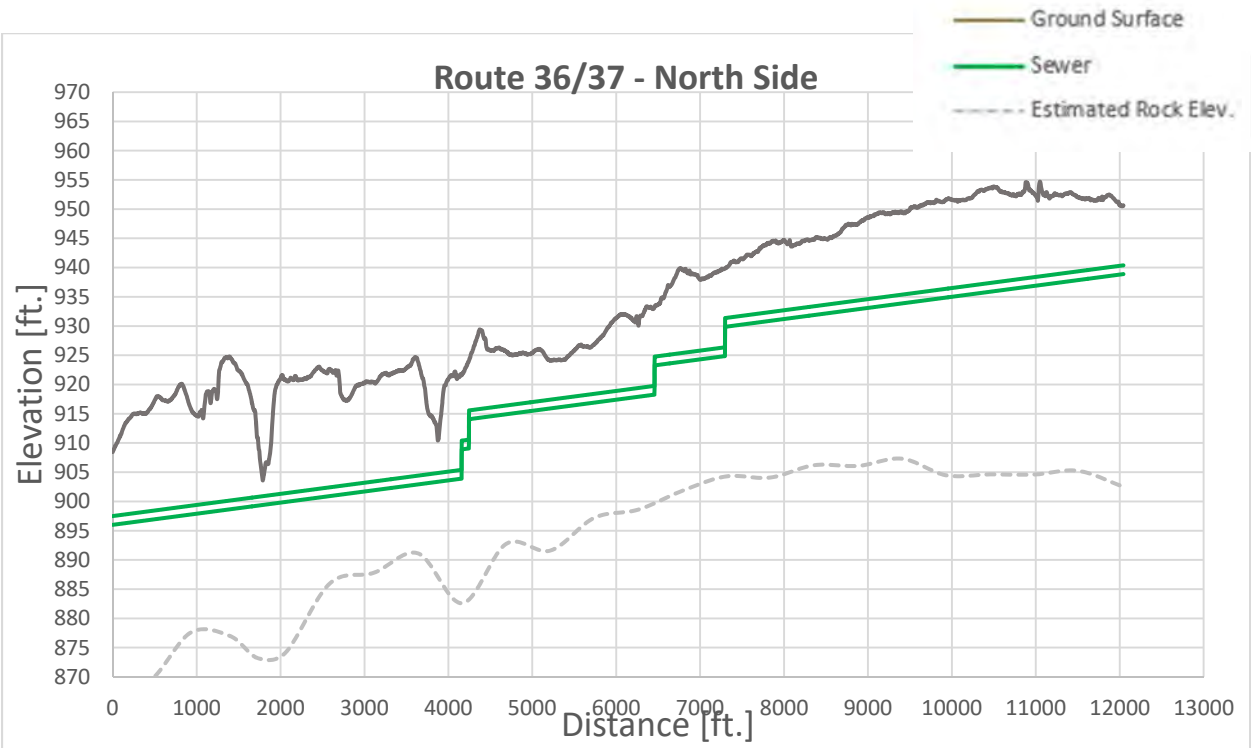

Figure 2.5 – Route 36/37 North Side Sewer preliminary profile.

Curve Road

This subarea is anticipated to be mostly residential land uses. Figure 2.4 shows the proposed alignment for a trunk sewer to serve this subarea. Olentangy Schools owns the parcel at the end of this alignment and may be a significant driver for the need to serve this subarea. The table below summarizes the anticipated development characteristics of this subarea.

	Curve Rd		
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Total	685.08	1027.62	1.50

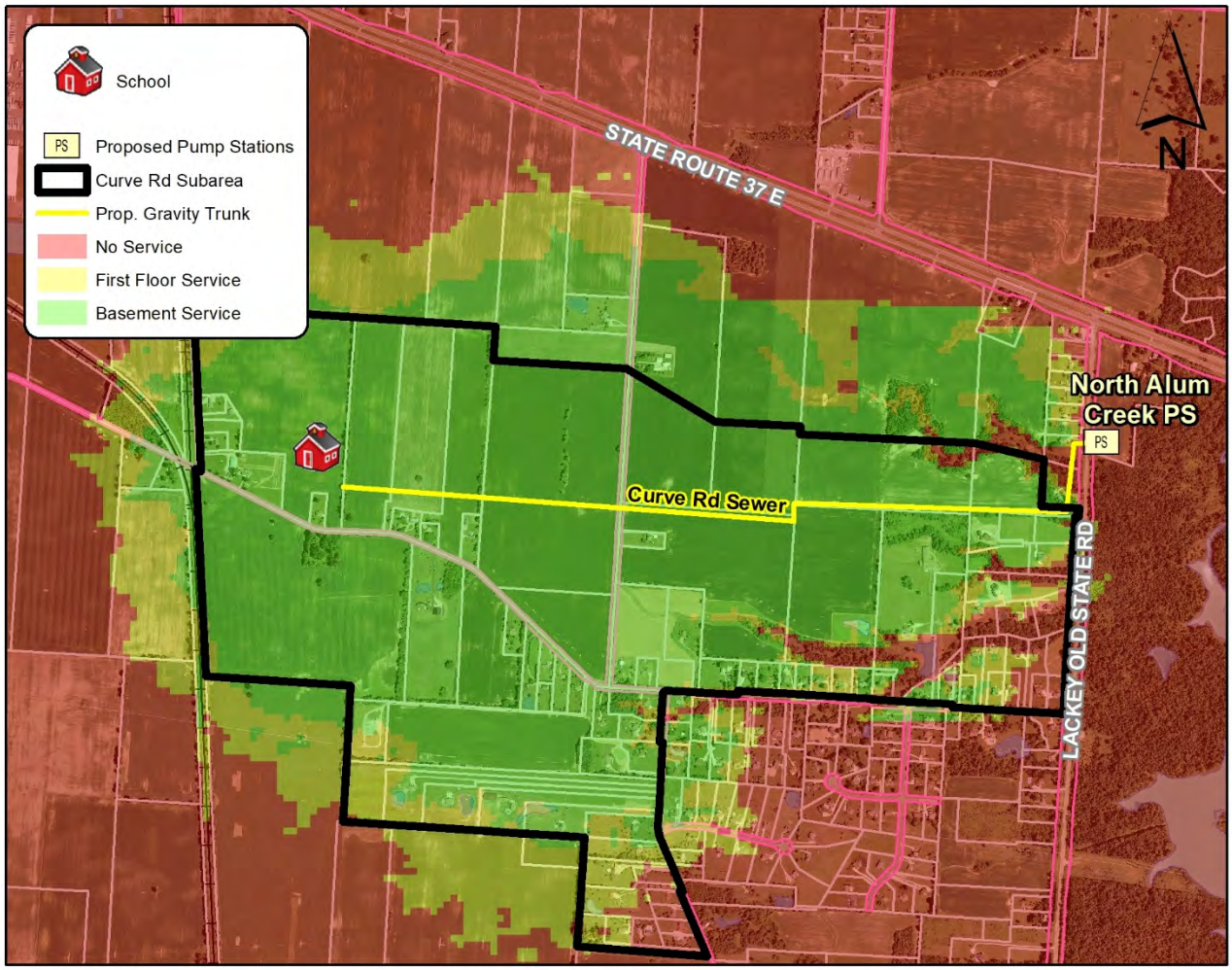

Figure 2.6 – Curve Rd Sewer preliminary alignment and serviceability analysis map

The table below summarizes the Characteristics of the proposed sewer. This sewer would terminate at a future pump station since it is not possible to cross the stream on the west leg of the reservoir by gravity sewer without making the Central Trunk Sewer significantly deeper. The preliminary profile of this sewer alignment is provided in Figure 2.7.

Curve Rd Sewer				
Size	**Start Elev.**	**Min Depth**	**Max Depth**	**Length**
15"	895.00	5.00	25.87	8056

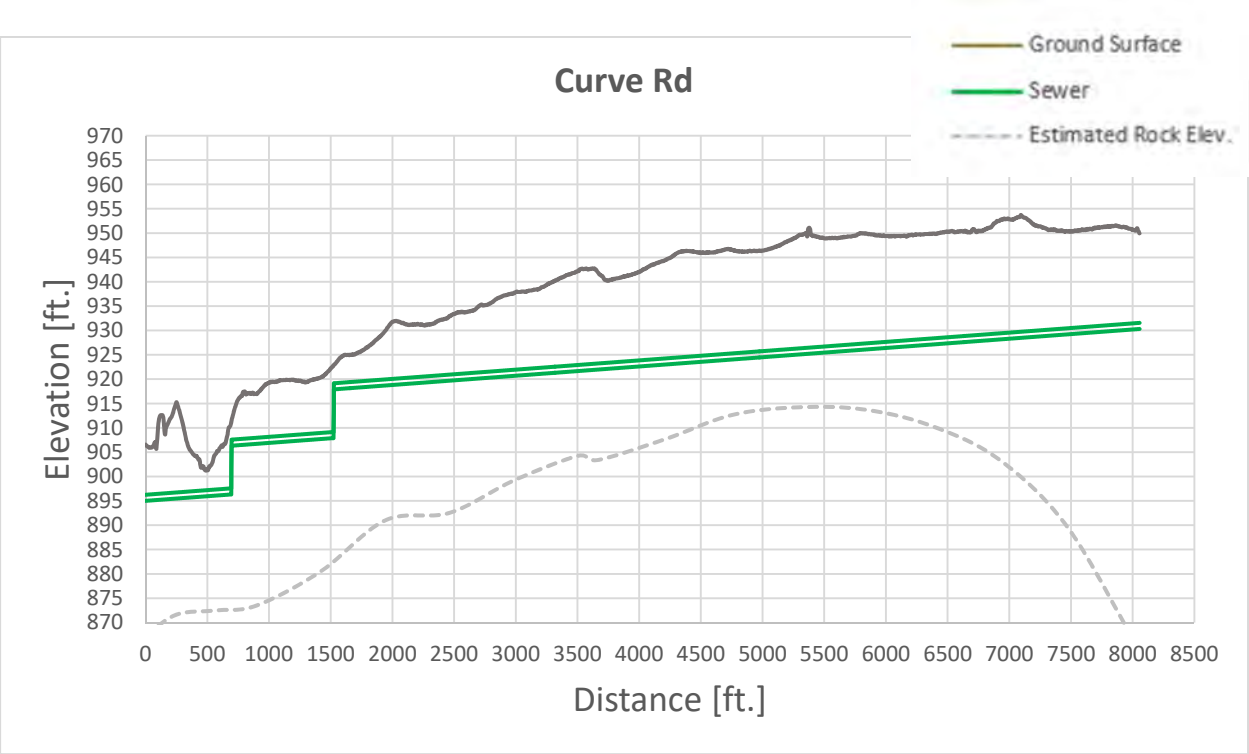

Figure 2.7 – Curve Rd Sewer preliminary profile.

North Alum Creek Pump Station

This pump station would need to be located near the intersection of Lackey Old State Rd and Route 36/37. The pump station would provide service to Curve Rd, Route 36/37 South Side, and Route 36/37 North Side subareas. Figure 2.2 shows the preferred location of this pump station and the short force main that would connect to the Central Alum Creek Trunk The table below summarizes the expected build-out flows from these areas.

North Alum Creek PS		
Area	**Total ERU**	**GPM**
Route 36/37 North Side	1579.00	953.98
Route 36/37 South Side	1602.56	968.21
Curve Rd	1267.40	765.72
Total	**4448.96**	**2687.91**

Where any two or more subarea converge prior to entering the pump the sewer will need to be upsized. At complete build-out the ultimate size of the pump station is expected to be 2,690 gpm firm capacity.

3.0 West Side Subareas

The Pines

The Pines development, also known as the Roh Tract, will initially be tributary to Alum Creek Water Reclamation Facility. At 57% of the total area, this development will be the most significant development in this subarea. The District is currently working on an agreement with the Developer to provide additional sewer capacity and depth so that surrounding subareas can be served by CAC. The specifics of each subarea are described later in this section. EMH&T is in the preliminary stages of

designing this development and the required infrastructure. The subarea and development are shown in figure 3.1.

The Pines development will initially be served by a pump station which will direct flow to the existing sewer at the south end of the development. Once CAC is ready to accept flow, the pump station will be upgraded and redirected to CAC. The table below summarizes the anticipated development characteristics within this subarea.

	The Pines		
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Proposed	174.44	340.00	1.95
Remaining	130.84	242.05	1.85
Total	**305.28**	**582.05**	**1.91**

The additional flows from adjacent subareas detailed later in this section would require the pump station to be upgrade to ultimate built-out size of 1,500 gpm.

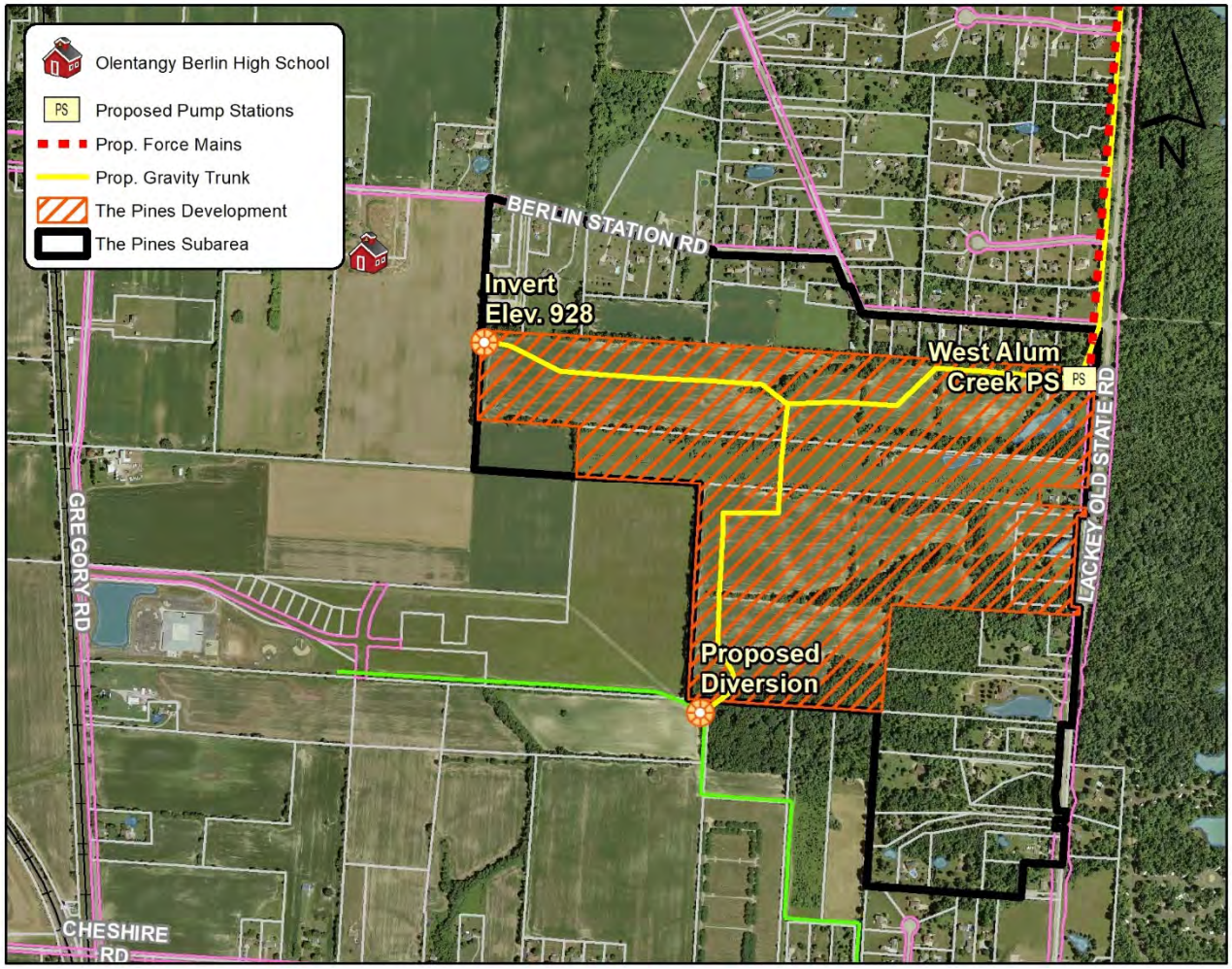

Figure 3.1 - The Pines Subarea and Development

Olentangy Berlin High School Extension

As part of The Pines development a 12" sewer will be extended to the east side of the Olentangy Berlin High School with an invert elevation no higher than 928. This extension is intended to serve the area

immediately north of the High School. The table below summarizes the anticipated development characteristics of this subarea.

4th High School Extension			
	Area [Ac.]	ERU	Density [ERU/Ac.]
Total	375.54	694.75	1.85

A serviceability analysis was conducted on the subarea and the resulting map is shown in figure 3.2. The analysis indicates that the sewer serving this area will need to be a 12" sewer run at minimum slope in order to serve the entire subarea.

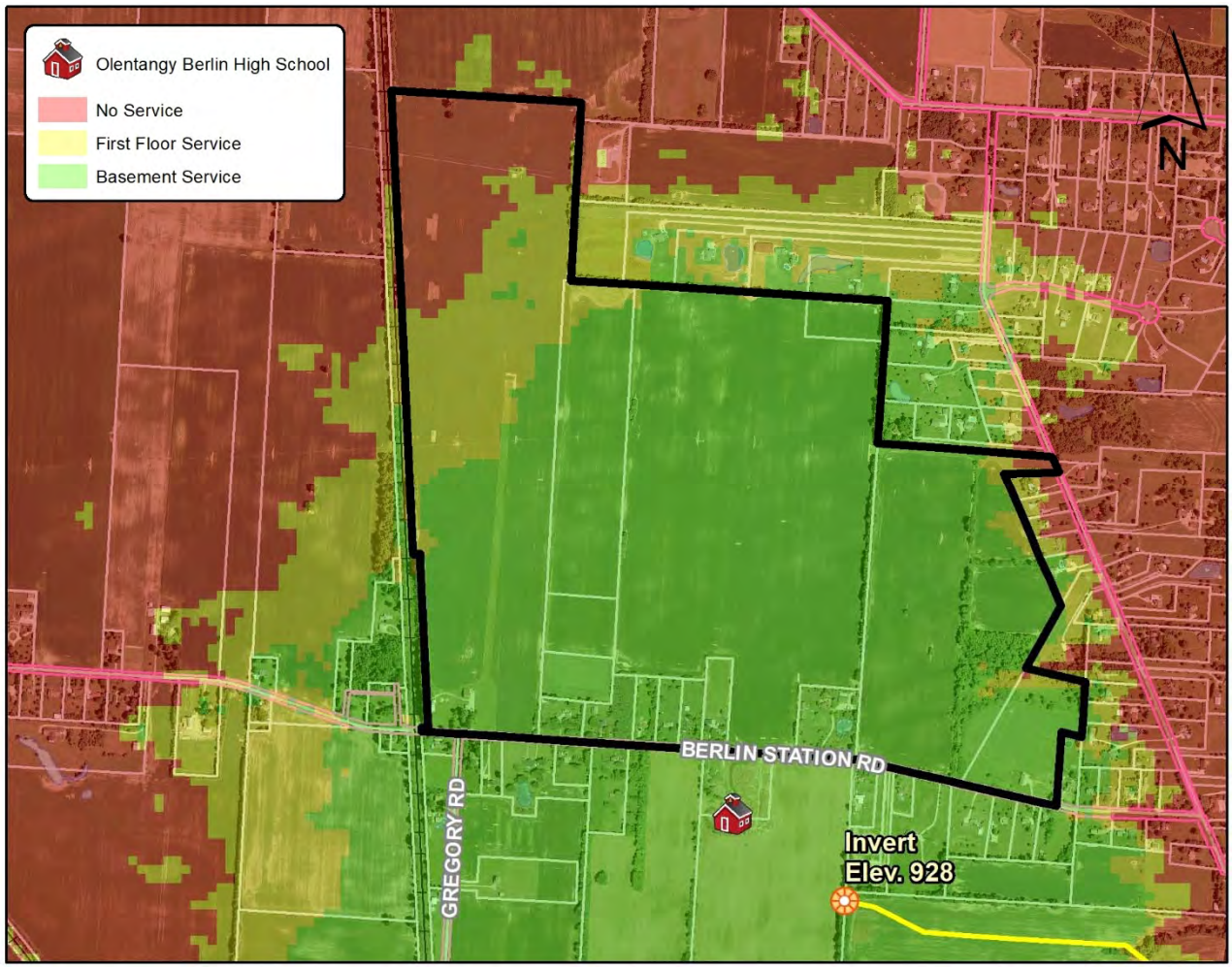

Figure 3.2 – Olentangy Berlin High School Subarea serviceability analysis map

Cheshire Elementary

The Cheshire Elementary subarea has existing sewer service from Alum Creek Water Reclamation Facility. At some future date, the improvements installed with The Pines development will be used to redirect flow from this subarea. This redirection was recommended in the 2017 Master Plan Update as way to alleviate capacity concerns in the Peachblow Pump Station tributary area.

The map in figure 3.3 shows the existing and proposed sewer users at the time of this report. The table below summarizes the densities for these areas and the projected build-out for the subarea. A 15"

equivalent sewer will be needed in the pines development in order to divert the flows from the existing sewer.

Cheshire Elementary			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Existing	21.49	11.70	0.54
Proposed	292.53	363.79	1.24
Remaining	161.62	299.00	1.85
Total	**475.64**	**674.49**	**1.42**

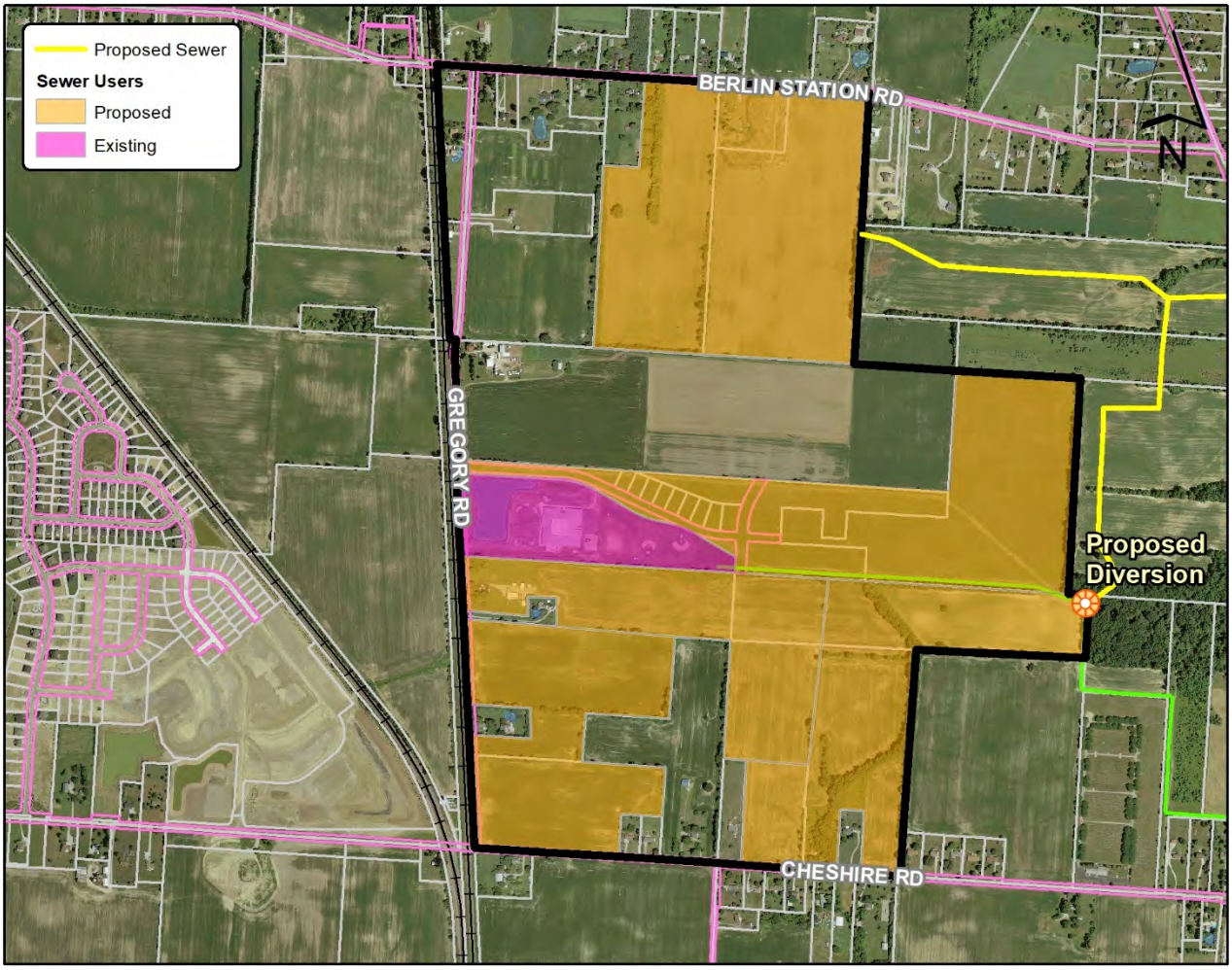

Figure 3.3 – Cheshire Elementary Subarea

Lackey Old State

The Lackey Old State subarea is mainly comprised of small residential farm lots on septic. For the purpose of this report it was assumed that this area will continue to be split to form residential lots with an average minimum size of 2 acres and that redevelopment of existing lots in not likely. The table below summarizes these development characteristics.

Lackey Old State			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Total	412.81	206.41	0.50

In order to serve the subarea a sewer will need to be constructed along Lackey Old State Rd. The District does not anticipate installing this sewer until such a time that there is a significant need to address failing septic systems within the subarea. The District at that time may explore the option of a sewer assessment project. The proposed alignment for the sewer trunk is shown in figure 3.4.

While the anticipated flow does not require a large diameter sewer the various streams which run east into the reservoir require this sewer to be installed deeper. In order to help mitigate the depth a 15" sewer was evaluated. The table below summarizes this sewer design. The sewer profile is provided in figure 3.5.

Lackey Old State Sewer				
Size	**Start Elev.**	**Min Depth**	**Max Depth**	**Length**
15"	880.00	4.91	38.81	5626

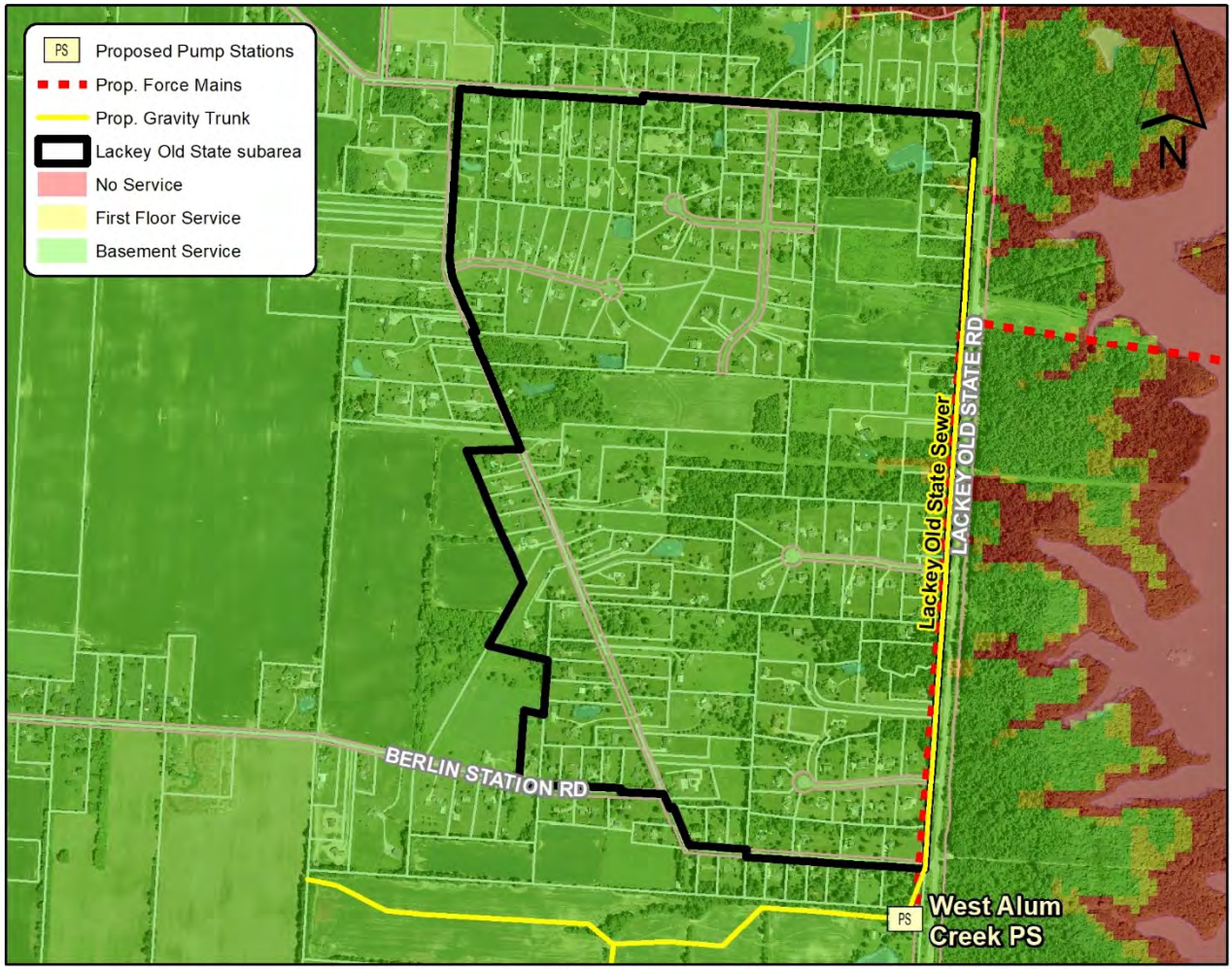

Figure 3.4 – Lackey Old State Subarea and Gravity Trunk alignment

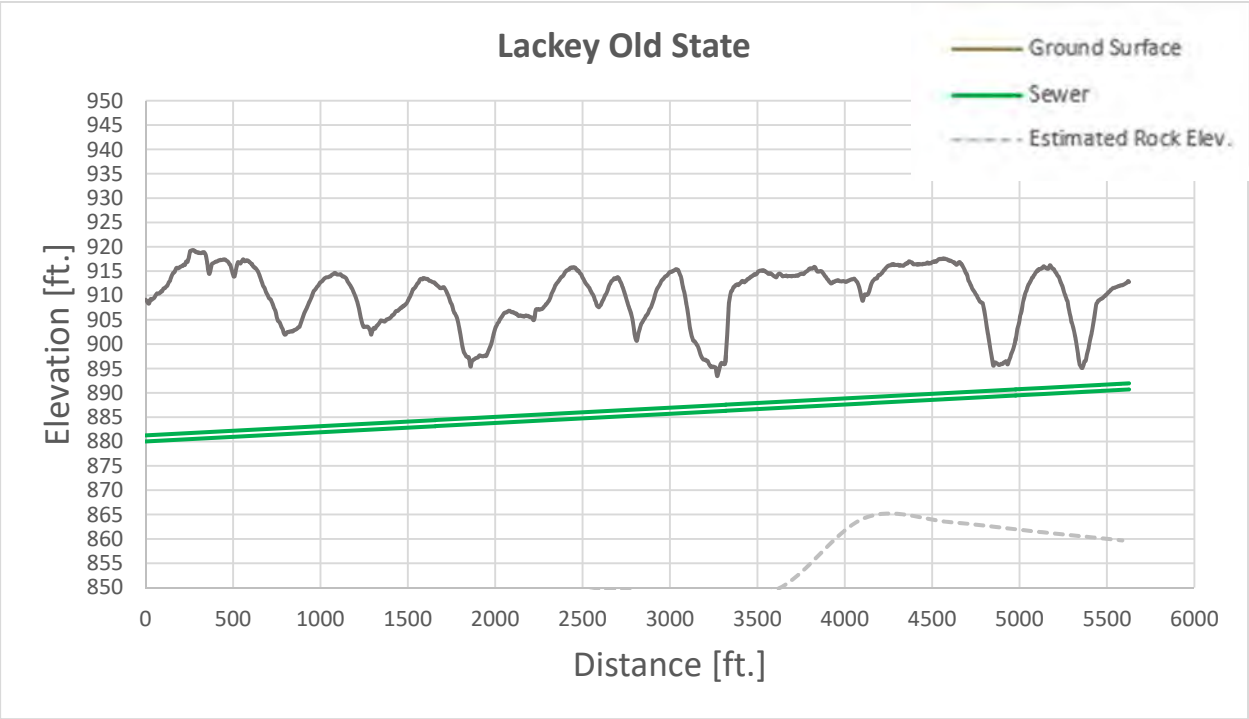

Figure 3.5 - Lackey Old State Sewer Profile

4.0 East Side Subareas

Berkshire

The Berkshire subarea shown in figure 4.1 is intended to be served by a new pump station. Prime AE has been retained to model and design this pump station. The 2017 Master Plan indicates that this pump station would outlet into the existing 15" sewer at Wilson Road for the near term. At such a time that the 15" reaches capacity, the force main would need to be extended to the 18" sewer further downstream and West of I-71. Both outlets are tributary to East Alum Creek Pump Station in this scenario.

Since the completion of the Master Plan another alternative has been explored. When the existing 15" sewer is determined to have reached capacity the District would like to consider redirecting the flow to an 18" sewer which currently terminates in the Brookview Manor subdivision on the west side of the I-71. This alternative would require the 18" sewer to be extended to the east site of I-71. If this alternative is chosen the flow would be directed to the Cheshire Pump Station and would therefore bypass the capacity restrictions caused by East Alum Creek Pump Station or its tributary sewers.

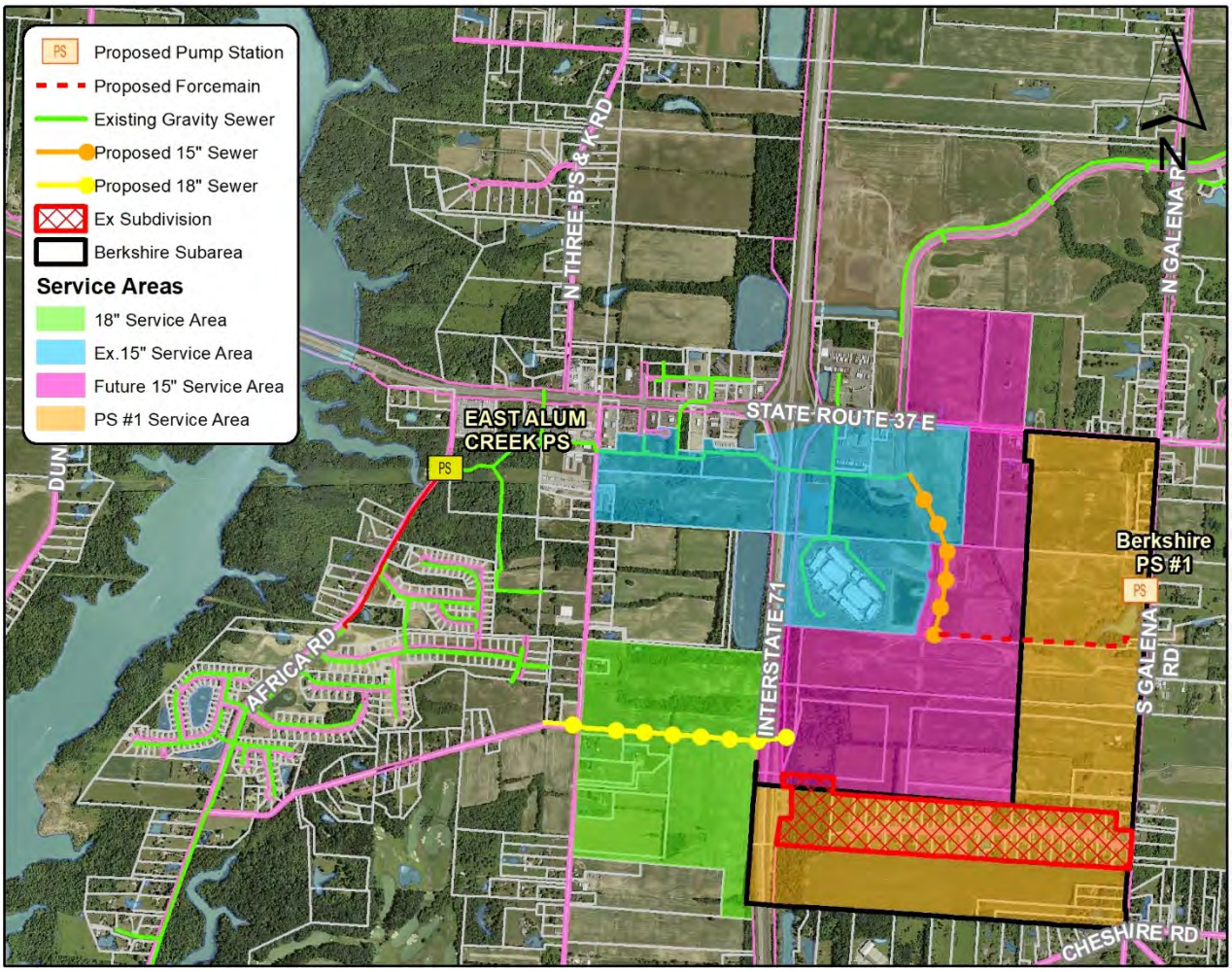

Figure 3.1 Berkshire Subarea and proposed improvements.

The following table summarizes the anticipated density for the Berkshire subarea. The existing subdivision, Estates at Cheshire, was assumed be to be connected to sewer but not redeveloped. At this density the area would require a gravity sewer of a 15" equivalent size to convey flows to the pump station. When this area is built-out the pump station would need to have a 700 gpm firm capacity.

Berkshire Subarea			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Total	411.95	1152.63	2.80

East Alum Creek

This subarea is served by the East Alum Creek Pump Station which is currently tributary to Cheshire Pump Station. The 2017 Master Plan predicts an ultimate condition that will exceed the current pumping capacity of East Alum Creek Pump Station. The eventual upgrade of the pump station will require additional capacity to be available at Cheshire Pump Station. Strand Associates has been retained to perform the design of the upgrades to Cheshire Pump Station. Capacity limitations farther downstream will limit the ultimate capacity of the upgrade to Cheshire Pump Station; therefore, the redirection of the East Alum Creek Pump Station to CAC is considered the ultimate solution for this subarea. The map below shows the preferred alignment of the force main to CAC.

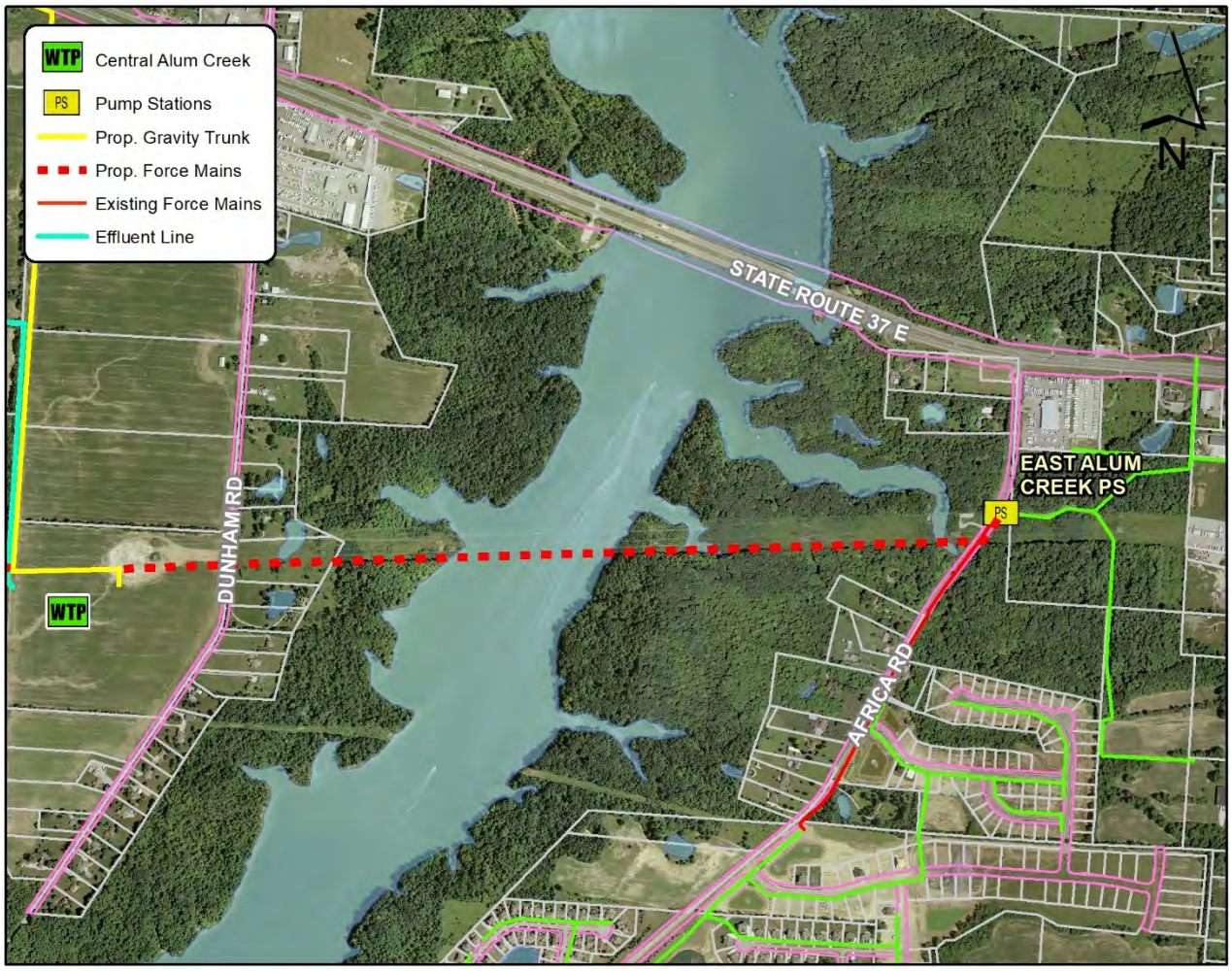

Figure 4.2 – Redirection of East Alum Creek Force Main

The intent of this alignment is to extend a new force main following the existing power lines and crossing under Alum Creek Reservoir. Permits, easements and agreements will be needed and would likely involve the Army Corps, County Engineer, Power Company, and private property owners in order to make this a viable route. The design and construction of the force main will need to cope with the steep terrain found on the banks of the reservoir. The design will also need to evaluate the existing force main to determine if the pipe size is appropriate.

The map in Figure 4.3 shows the existing and proposed sewer users at the time of this report. This map was used to calculate the undeveloped areas and a density of 3.45 ERU/Acre was used to estimate future flows. At this density the area would require a gravity sewer of a 24" equivalent size to convey flows to the pump station. When this area is built-out the pump station would need to have a 2,520 gpm firm capacity assuming that the Berkshire subarea has been redirected to Cheshire Pump Station. The table below summarizes the anticipated development characteristics within this subarea.

East Alum Creek Subarea			
	Area [Ac.]	**ERU**	**Density [ERU/Ac.]**
Existing	190.09	328.77	1.73
Proposed	252.86	395.26	1.56
Remaining	996.83	3439.06	3.45
Total	**1439.78**	**4163.09**	**2.89**

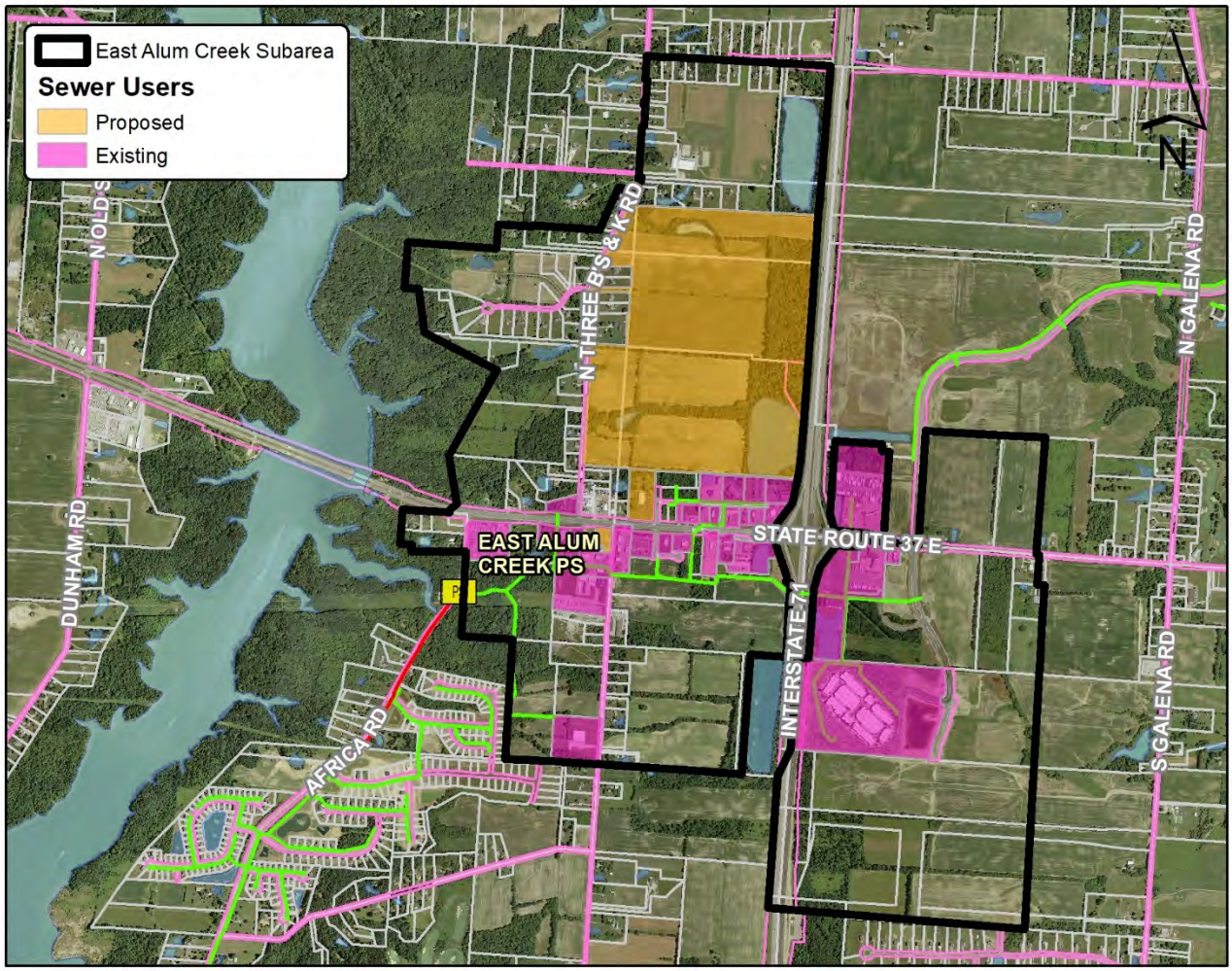

Figure 4.3 – East Alum Creek Subarea

5.0 Conclusions

The District currently has an agreement with the City of Columbus allowing for the CAC plant to treat 800,000 gal/day average daily flow. Startup flows for the plant are expected to come from the East Alum Creek, The Pines, and Cheshire Elementary sub areas. The table below tabulates the expected flows from these areas.

CAC Expected Startup Flows			
Area	**Total**	**Avg Flow**	**Peak Flow**
	ERU	**[MGD]**	**[MGD]**
East Alum Creek	724.03	0.21	0.63
The Pines	340.00	0.10	0.30
Cheshire Elementary	375.49	0.11	0.33
Total	**1439.52**	**0.42**	**1.25**

This means that both the East Alum Creek PS and West Alum Creek PS redirection projects would need to be coordinated with the plant construction. Also the diversion of the Cheshire sewer will need to follow soon behind the PS redirection. Conceptual alignments for these project are shown in figure 5.1.

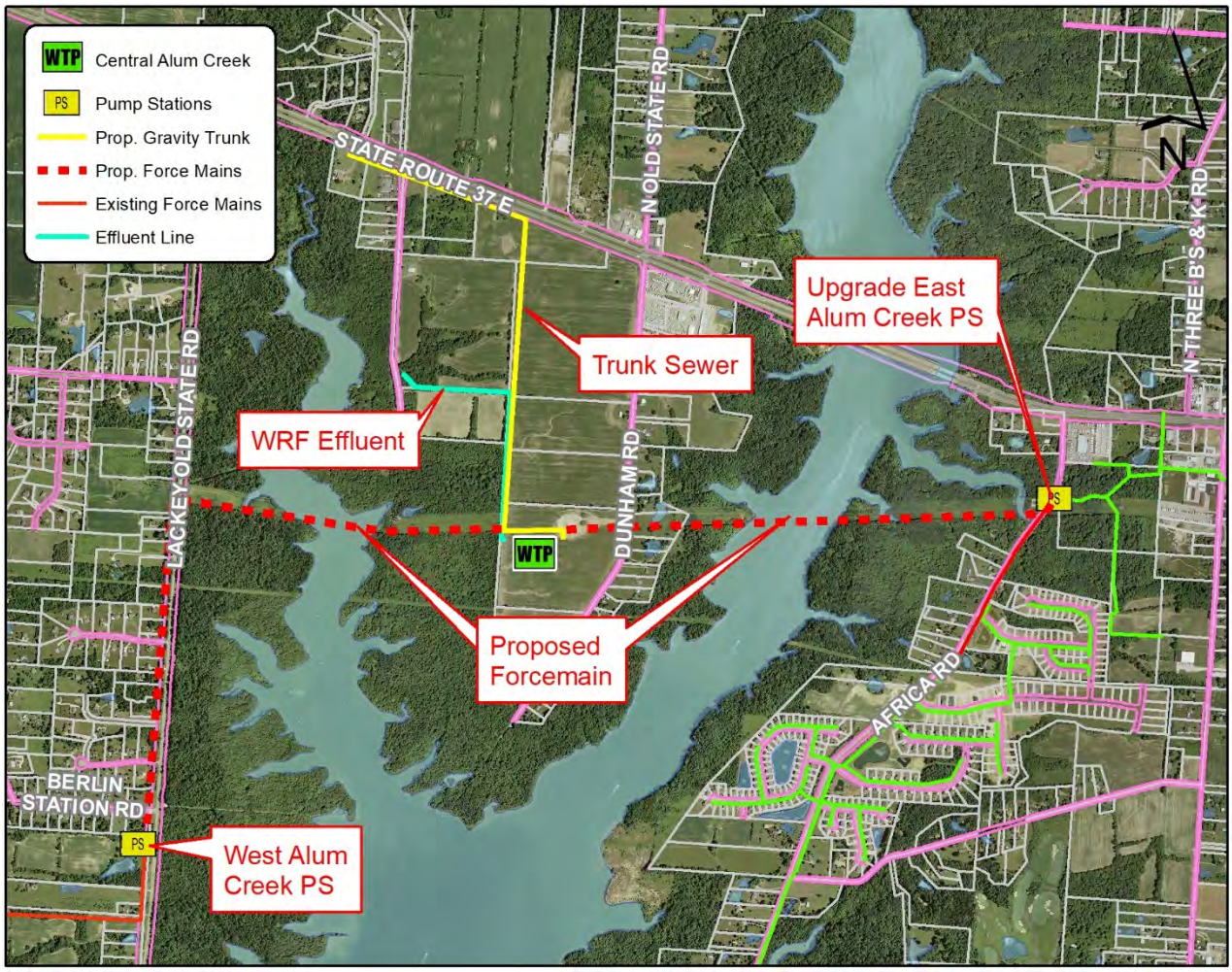

Figure 5.1 – Projects to startup CAC Plant.

The Plant layout will need to consider how the Plant may be expanded in the future to accommodate the additional flows from the complete build-out of all the tributary area. Those Flow summarized in the following table.

CAC Expected Ultimate Flows (Berkshire Flows to Cheshire PS)			
Area	**Total**	**Avg Flow**	**Peak Flow**
	ERU	**[MGD]**	**[MGD]**
East Alum Creek	4163.09	1.21	3.62
Berlin Olentangy HS	694.75	0.20	0.60
Central	822.20	0.24	0.72
Cheshire Elementary	674.49	0.20	0.59
Curve Rd	1267.40	0.37	1.10
Howard Rd	980.23	0.28	0.85
Lackey Old State	206.41	0.06	0.18
Route 36/37 North Side	1579.00	0.46	1.37
Route 36/37 South Side	1602.56	0.46	1.39
The Pines	582.05	0.17	0.51
Total	**12572.17**	**3.65**	**10.94**