PRELIMINARY ENGINEERING REPORT FOR

EDNEYVILLE SEWER SERVICE

HENDERSON COUNTY, NC

KCI
ASSOCIATES OF NC

PRELIMINARY ENGINEERING REPORT

FOR

EDNEYVILLE SEWER SERVICE

HENDERSON COUNTY, NORTH CAROLINA

Prepared for

Henderson County, North Carolina

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Prepared By

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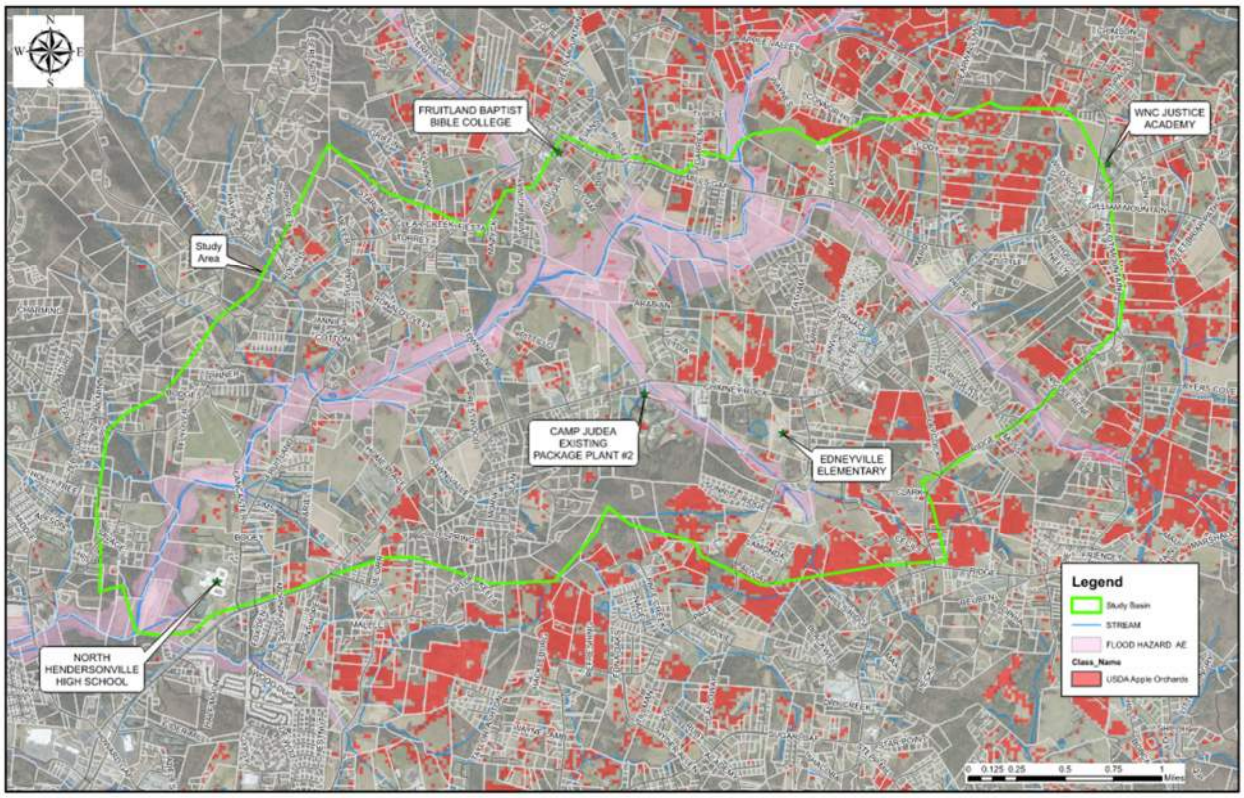
Preliminary Engineering Report
for
Edneyville Sewer Service
Prepared for
Henderson County, NC

EXECUTIVE SUMMARY

Edneyville, North Carolina is an unincorporated community in east-central Henderson County (HC). The area consists primarily of rural/agricultural areas and some suburban developments. On-site treatment is the primary method of handling wastewater in the area. Edneyville Elementary School serves approximately 600 students (700 student capacity) and is the only public school in Henderson County without connection to public sewer utilities. The nearest public sewer utility is owned and operated by the City of Hendersonville (COH) and is located to the south of North Hendersonville High School.

The study area for this report encompasses the service area surrounding the following facilities: Edneyville Elementary School, WNC Justice Academy, Camp Judaea and Fruitland Baptist Bible College. This study area also includes the COH sewer connection point near North Henderson High School. A map of this study area is shown in Figure 1-1 below.

Figure ES-1: Edneyville Sewer Study Area



Recently, there has been interest in providing public wastewater service to Edneyville Elementary School, WNC Justice Academy, Camp Judaea and Fruitland Baptist Bible College. These facilities are currently served by on-site treatment facilities (either package wastewater treatment plants or septic systems).

The goal of this study is to evaluate public sewer service alternatives to serve these facilities and surrounding service areas. Four (4) primary alternatives for the project were identified and investigated along with three (3) sub-alternatives. The alternatives evaluated were:

1. Construct a new pump station near Camp Judaea to collect wastewater from Edneyville Elementary and Camp Judaea. Convey wastewater via force main to COH. Decommission the existing the Camp Judaea wastewater treatment package plant.
    A. Construct a new pump station at Edneyville Elementary to collect wastewater from the school. Convey wastewater via force main to COH.
2. Construct a new WWTF near Camp Judaea to treat wastewater from Edneyville Elementary and Camp Judaea.
3. Construct a series of pump stations along Hwy 64 to collect and convey wastewater from Edneyville Elementary, Camp Judaea and surrounding service areas to COH.
    A. Incorporate WNC Justice Academy.
4. Construct a new WWTF near North Henderson High School to treat wastewater from a regional gravity sewer system.
    A. Incorporate WNC Justice Academy, Basin 3 and Fruitland Baptist Bible College into the regional sewer collection system.
    B. Incorporate WNC Justice Academy and Fruitland Baptist Bible College into the regional sewer collection system.
    C. Incorporate minor gravity sewer lines to connect trunk sewers to developments.

A detailed evaluation was performed for each alternative and included the following key components; environmental impacts; land requirements, potential construction issues, and opinions of probable cost. In addition, a present worth analysis was conducted for each alternative to capture the total 20-year life cycle cost. The life cycle cost included initial capital, salvage value and operation & maintenance costs. Detailed summaries of these evaluations are included in the main report.

Since the projects varied greatly in scale, metrics other than costs were also evaluated. Two main evaluations were used to provide a meaningful comparison including:

1. Capital Cost Effectiveness - uses the ratio of the capital cost vs. average daily flow to determine a cost per gallon treated or conveyed.

2. Alternatives Analysis Matrix – evaluates each alternative's impact to the environment, service area coverage, land requirements, ability to meet objectives, initial capital cost, capital cost effectiveness, and operating cost effectiveness.

CAPITAL COST EFFECTIVENESS

Table ES-1 below provides a summary of the capital cost effectiveness evaluation. Since some alternatives discharge to the COH system and others to new WWTFs owned by HC, this was noted in the summary table to assist with determining long-term operational impacts.

Table ES-1: Capital Cost Effectiveness

Alternative	Capital Cost [a] ($ Million)	ADF (MGD)	Cost / Gal [b]	Wastewater Treatment Entity
1. New PS @ Camp Judaea, Gravity from Edneyville, FM to COH	$3.58	0.020	$ 179.00	COH
1A. New PS @ Edneyville Elem., FM to COH	$2.20	0.009	$ 244.44	COH
2. New WWTF @ Camp Judaea, Gravity from Edneyville	$3.44	0.020	$ 172.00	**HC**
3. 3 PS Along Hwy 64, Gravity to COH	$8.57	0.35	$ 24.49	COH
3A. 3 PS Along Hwy 64, Gravity to COH, New PS @ WNC Justice Academy	$9.49	0.35	$ 27.11	COH
4. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School	$29.56	1.4	$ 21.11	**HC**
4A. Regional Gravity System from Edneyville, WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$47.32	2.1	$ 22.53	**HC**
4B. Regional Gravity System from Edneyville, New PS @ WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$33.19	1.4	$ 23.71	**HC**
4C. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School, including minor gravity sewer lines to serve developments	$61.85	1.4	$ 44.18	**HC**

[a] Costs do not include any required improvements to the COH system if current treatment capacity is insufficient to accept the additional flow from the project.
[b] Cost / Gallon is defined as the initial capital costs divided by the Average Daily Flow (ADF) of the total conveyance and/or treatment system.

It should be noted that for Alternative 3, the ADF assumes buildout of the 3 sub-basins. If the 3 pump stations are installed and only Edneyville and Camp Judea are served, the Cost / Gallon changes to $200 / gallon which is comparable to Alternatives 1 & 2. This analysis raises several additional key discussion points:

A. There are three general capital cost ranges:
    1. < $5 Million (Alternatives 1, 1A and 2)
    2. Approx. $10 Million (Alternative 3 and 3A)
    3. > $25 Million (Alternatives 4, 4A,4B and 4C)

B. Ownership of the treatment system will either be by Henderson County (Alternatives 1, 1A,3 and 3A) with the construction of a new WWTF, or by City of Hendersonville for treatment at the Hendersonville WWTF (Alternatives 2, 4, 4A,4B and 4C).

C. There is a distinct difference in the Cost per Gallon between alternatives 1, 1A and 2 and the remaining alternatives. The first three Alternatives only serve Edneyville Elementary and/or Camp Judea, resulting in very low service populations and therefore low average daily flows. The remaining four Alternatives all have larger service areas, therefore the ratio of capital cost to ADF (i.e. service population) is more favorable.

D. Alternatives 3 and 4 (including sub-alternatives) could be phased to create smaller initial capital projects with expansion in the future as growth occurs.

ALTERNATIVES ANALYSIS MATRIX

The alternatives were evaluated based on each alternative's impact to the environment, service area coverage, land requirements, ability to meet objectives, initial capital cost, capital cost effectiveness, and operating cost effectiveness. A brief description of each criterion follows:

1. Environmental Impact – considers effluent quality (if direct discharge) and the risk and nature of potential discharge violations. Also considers the impact on the use of decentralized treatment such as septic tanks within areas that have the potential to be served by the public sewer alternative;

2. Service Area Coverage – considers the capability to serve a large service area without need for future expansion;

3. Land Requirements – considers the number of private easements, total land area, and cost required;

4. Meets Objectives – considers goals of the project including; providing wastewater collection to desired service areas, funding feasibility,

5. Initial Capital Cost – considers the magnitude of the initial capital investment required to fund the project.

6. Capital Cost Effectiveness – considers the capital cost per gallon of capacity and the likelihood of obtaining sufficient project funding;

7. Operating Cost Effectiveness – considers operations cost per gallon treated.

Values of 1 to 10 were assigned to each alternative under each category. Higher scoring indicates more favorable characteristics of the category. Parameters were also assigned weights according to their respective importance. The alternative with the highest overall weighted score (maximum weighted value of 10) is the most favorable based on the criteria.

The scoring values were color coded to help note differences between the different alternatives. A green, yellow and red scale was used to differentiate highest scores (green) from lowest scores (red).

Table ES-2: Alternatives Analysis Matrix

Parameter		Alt. 1		Alt. 1A		Alt. 2		Alt. 3		Alt. 3A		Alt. 4		Alt. 4A		Alt. 4B		Alt. 4C	
	Weight	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV
Environment Impact	10%	7	0.7	9	0.9	7	0.7	8	0.8	8	0.8	4	0.4	3	0.3	4	0.4	4	0.4
Service Area Coverage	15%	2	0.3	1	0.15	2	0.3	5	0.75	5	0.75	8	1.2	10	1.5	9	1.4	9	1.35
Land Requirements	10%	7	0.7	9	0.9	7	0.7	7	0.7	6	0.6	4	0.4	2	0.2	4	0.4	4	0.4
Meets Objectives	20%	9	1.8	7	1.4	4	0.8	8	1.6	8	1.6	5	1	4	0.8	5	1	5	1
Initial Captital Cost	15%	8	1.2	10	1.5	8	1.2	6	0.9	5	0.75	3	0.45	1	0.2	2	0.3	1	0.15
Capital Cost Effectiveness	20%	1	0.2	1	0.2	1	0.2	7	1.4	7	1.4	8	1.6	8	1.6	9	1.8	9	1.8
Operating Cost Effectiveness	10%	3	0.3	2	0.2	2	0.2	8	0.8	8	0.8	9	0.9	9	0.9	9	0.9	9	0.9
Total:	**100%**		**5.2**		**5.25**		**4.1**		**6.95**		**6.7**		**5.95**		**5.5**		**6.2**		**6**
Rank:		**8**		**7**		**9**		**1**		**2**		**5**		**6**		**3**		**4**	

Value Color Scale: 1 — 10

As shown in Table ES-2, Alternative 3 had the highest overall score. The next highest score was Alternative 3A. The notable difference between these alternatives is the initial capital cost and land requirements. Other metrics were very similar between the two.

It should be noted that the scoring used above is based on KCI's experience with performing these assessments on previous projects. Scores of some of the qualitative metrics such as "Meets Objectives" may vary since there are multiple factors that define the objective.

Table ES-3 on the following page provides a summary of the recommended infrastructure sizing and estimated quantities for each alternative.

NEXT STEPS

KCI recommends that Henderson County Staff and Commissioners review the scoring and obtain agreement on the overall goals of the project, as well as validating the scoring values used in the alternatives analysis matrix before the results are used for decision-making discussions. Additional discussions regarding project funding, ownership, sewer rates, and ultimate treatment are needed before an alternative is recommended for implementation.

Table ES-3: Summary of Alternatives Project Infrastructure

Alternative	ADF (mgd)	Gravity Sewers		Pump Stations		Force Mains		New WWTF	
		Length (ft)	Diameter (in.)	#	Capacity (gpm)	Length (ft)	Diameter (in.)	#	Capacity (MGD)
1	0.02	4,800	8	1	100	15,100	4	-	-
1A	0.009	-	-	1	100	19,600	4	-	-
2	0.02	4,800	8	-	-	-	-	1	0.08
3	0.35	400	8	1	270	2,800	6	-	-
		7,710	10	2	400	700	6	-	-
		4,200	15	3	770	4,450	8	-	-
3A		400	8	1	320	2,800	6	-	-
		7,710	10	2	440	700	6	-	-
		4,200	15	3	810	4,450	8	-	-
		-	-	4	100	5,000	4	-	-
4	1.4	400	8	1	2,490	750	16	1	1.4
		8,500	10	-	-	-	-	-	-
		3,970	15	-	-	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4A	2.1	7,225	8	1	3,550	750	18	1	2.1
		9,520	10	-	-	-	-	-	-
		4,030	15						
		3,970	18	-	-	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4B	1.4	400	8	1	100	750	16	1	1.4
		8,500	10	2	100	-	-	-	-
		3,970	15	3	2,490	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4C	1.4	64,324	8	1	3,550	750	18	1	2.1
		8,500	10	-	-	-	-	-	-
		3,970	15						
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-

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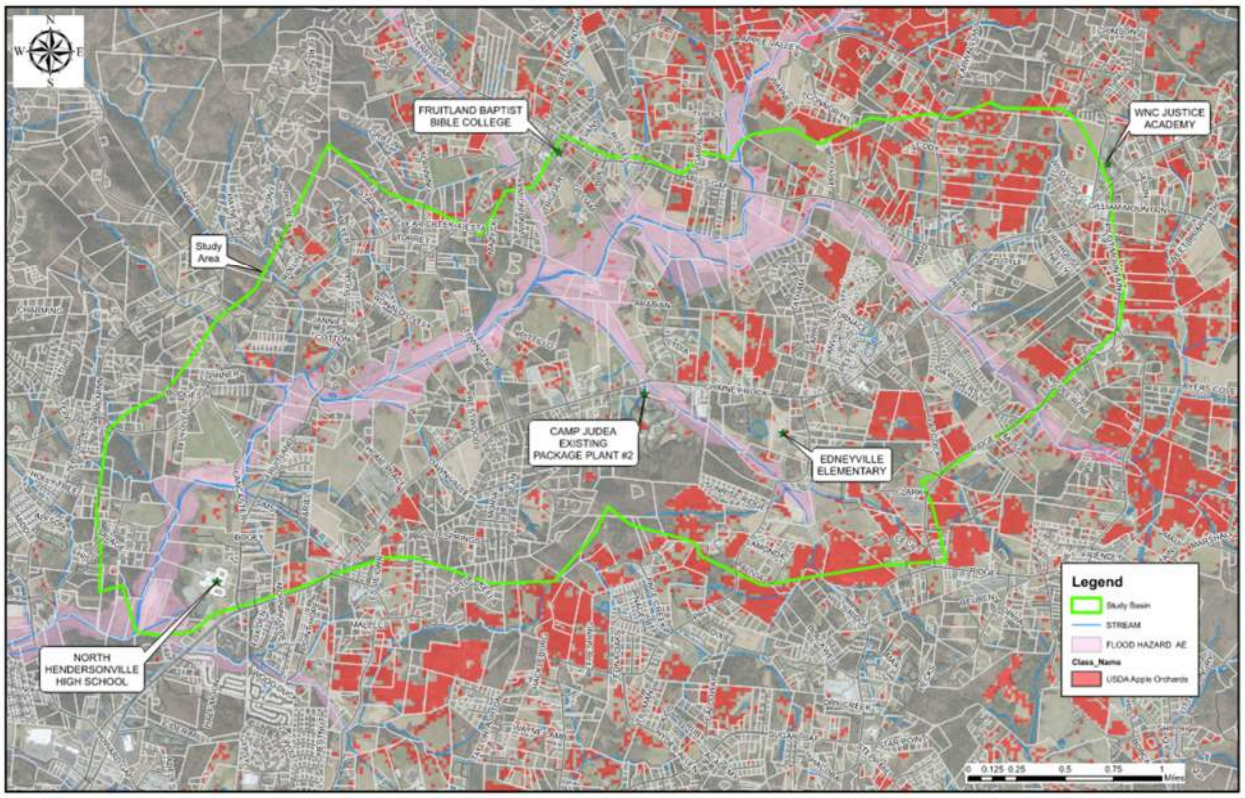
1.0 PROJECT PLANNING

1.1 LOCATION

Edneyville, North Carolina is an unincorporated community in east-central Henderson County. The area consists primarily of rural/agricultural areas and some suburban developments. On-site treatment is the primary method of handling wastewater in the area. Edneyville Elementary School serves approximately 600 students (700 student capacity) and is the only public school in Henderson County without connection to public sewer utilities. The nearest public sewer utility is owned and operated by the COH and is located to the south of North Hendersonville High

The study area for this report encompasses the service area surrounding the following facilities: Edneyville Elementary School, WNC Justice Academy, Camp Judaea and Fruitland Baptist Bible College. This study area also includes the City of Hendersonville sewer connection point near North Henderson High School. A map of this study area is shown in Figure 1-1 below.

Figure 1-1: Edneyville Sewer Study Area



1.2 ENVIRONMENTAL RESOURCES PRESENT

The study area is in the Blue Ridge Mountains of southwestern North Carolina. The Eastern Continental Divide passes through the County.

1.2.1 Topographical and geological features:

The topographical features range from an elevation 2,000 feet to 2,400 feet indicating sloping to hilly terrain with various inclines and declines. The location for the proposed pump stations and Wastewater Treatment Facilities (WWTFs) are relatively level clearings surrounded by wooded areas and developments.

Henderson County's mountainous terrain provides scenic character, attracting residents and visitors. However, the steep slopes, often 30% or greater, provide physical challenges to development. Restrictions are placed on steep slope development and Protected Ridges in the County.

The potential for flooding also presents challenges for development in the study area with 100-year floodplains along the US Highway 64 corridor and Clear Creek. The study area contains Zone AE and Zone X floodways.

1.2.2 Soils Characterization:

The primary soil types within the study area are HyC – Hayesville Loam, 7 to 15 percent slopes; HyB – Hayesville Loam, 2 to 7 percent slopes; Co – Codorous Loam (arkaqua); Ede - Edneyville Fine Sandy Loam, 15 to 25 percent slopes; and HyE – Hayesville Loam 15 to 25 percent slopes. The complete soil survey is available in Appendix A.

1.2.3 Land Use:

The study area consists of suburban, rural/suburban transition and rural/agricultural areas. Suburban developments occupy the Highway 64 and Interstate 26 corridors while agricultural land predominates the lower elevations. Apple orchards are a significant contributor to the local economy in Henderson County. According to the Clear Creek Growth Analysis[1] performed for the County in 2017 (CCGA), apple orchards occupy a significant portion of the mid-level elevations.

1.2.4 Forest Resources:

The study area consists of rural/suburban communities, forests, agricultural land and apple orchards. The Mountain region of North Carolina may contain the following common forest trees: Maple, Beech, Ash, Oak, Pine, Magnolia, Hemlock, Elm, Sycamore, Cedar, Cherry, etc. Forested lands are primarily found in the high-level elevations of the study area (CCGA).

[1] Benchmark Planning, *Clear Creek Growth Analysis* (2017)

1.2.5 Wildlife Habitat:

Wildlife within the study area may include various types of mammals, fish, birds, reptiles, amphibians, crustaceans, and mollusks. Federally protected wildlife in Henderson County include:

Vertebrate:
Bald eagle, Bog turtle, Carolina northern flying squirrel, Eastern small-footed bat, Gray bat, Green salamander, Hellbender, Northern long-eared bat.

Invertebrate:
Appalachian elk-toe, Rusty-patched bumblebee, Tennessee heel-splitter.

Should any of the proposed alternatives in this report be implemented, a detailed review by the State Clearinghouse need to be performed to evaluate the potential presence of these species within the project area.

1.2.6 Wetlands and streams:

Clear Creek is located within the study area. Several intermittent streams such as Laurel Branch and Henderson Creek that are tributaries of Clear Creek are also present within the study area. These water features are shown on the various alternative figures presented in Appendix B.

Due to steep topography, there are very few wetland areas identified on the National Wetlands Inventory Map (Appendix A). Most of the identified wetlands are associated with private ponds.

1.3 POPULATION TRENDS

1.3.1 Population

According to US Census data[2], the estimated population of Henderson County was 117,417 in 2019. The County experienced a 10% population increase between 2010 and 2019 and an approximate 1.31% increase in population between 2017 and 2018.

Between 2017 and 2018, the median household income grew from $50,545 to $52,815, a 4.68% increase. The three largest ethnic groups in the County are White (Non-Hispanic) (83.2%), White (Hispanic) (7.54%) and Black or African American (Non-Hispanic) (3.14%).

According to the Office of State Management and Budget, population growth projections for Henderson County are:

- 2020 – 2030: +13,500 (~12% increase)
- 2030 – 2040: +7,100 (~5% increase)

[2] https://www.census.gov/quickfacts/fact/dashboard/hendersoncountynorthcarolina,US/PST045219

1.4 COMMUNITY ENGAGEMENT

The Henderson County Board of Commissioners (HCBC) has engaged the community in regularly scheduled public meetings where alternatives for providing sewer service to Edneyville Elementary School and the Edneyville region have been presented. The public has participated in multiple iterations of engineering and planning studies in the past three years.

On October 19, 2017, an HCBC meeting was held to discuss sewage disposal needs and alternatives for Edneyville Elementary School. Several of the alternatives presented in that meeting have been re-evaluated in this report. One alternative evaluated in this report, the Alternative 3, was initially suggested by a member of the public.

Additionally, collaboration between Henderson County and the City of Hendersonville (COH) has provided a means of sharing information and evaluating the suitability of these alternatives. This collaboration enabled each entity to understand the potential demand certain alternatives would have on the COH wastewater collection system and treatment capacity.

2.0 EXISTING FACILTIES

2.1 EDNEYVILLE REGION

2.1.1 Location and History

Edneyville, North Carolina is an unincorporated community in east-central Henderson County. The area consists primarily of rural/agricultural areas and some suburban developments. On-site treatment is the primary method of handling wastewater in the area. Edneyville Elementary School serves approximately 600 students (700 student capacity) and is the only public school in Henderson County without connection to public sewer utilities. The nearest public sewer utility is owned and operated by the COH and is located South of North Hendersonville High School.

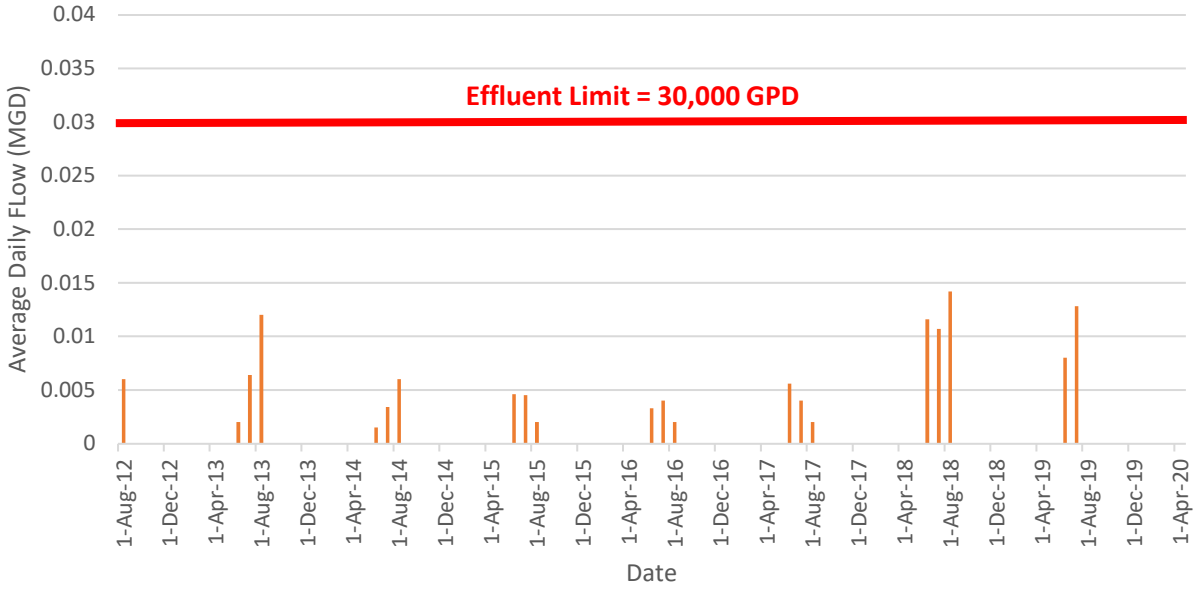
2.1.2 Condition of Existing Facilities

Edneyville Elementary School completed construction of a new 87,000 square-foot building in 2019 to replace the original school constructed in 1970. A new drip irrigation system was constructed to accommodate flow of 6,000 gallons per day (gpd). Due to site constraints and soil conditions, the drip irrigation system does not allow for any future expansion of the school. In addition, it requires frequent maintenance and will likely not be suitable as a long-term wastewater disposal solution.

Camp Judaea is a recreational summer camp facility located approximately 1.5 miles west of Edneyville Elementary School. Camp Judaea hosts approximately 600 campers per year during the summer months (June – August). The camp has a private WWTF with a National Pollutant Discharge Elimination System (NPDES) permit (NPDES ID - NC0033430) to discharge up to 30,000 gpd into Henderson Creek.

As shown in Figure 2-1 below, the camp only discharges wastewater when the camp is active during summer months; typically June, July and August. The maximum average daily flow is just below 15,000 gallons per day.

Figure 2-1: Camp Judaea WWTF DMR Effluent Flow Data



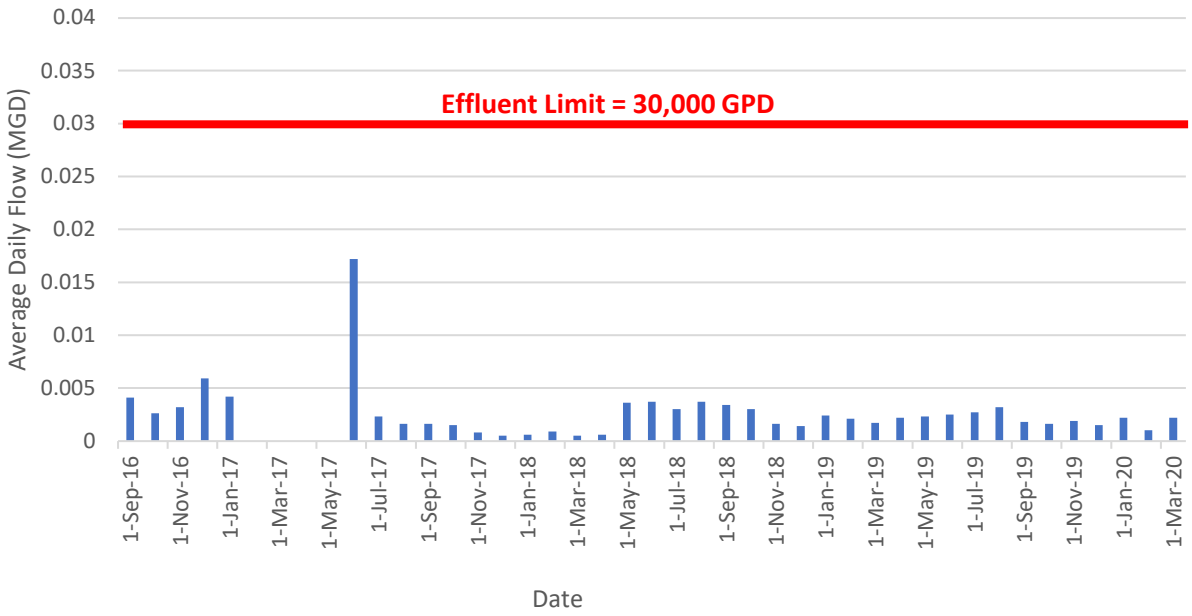
The Camp Judaea WWTF is in poor condition and has reached the end of its useful service life.

Western North Carolina Justice Academy (WNCJA) is located approximately two miles northeast of Edneyville Elementary School. The WNCJA has a private WWTF with a NPDES permit (NPDES ID - NC0086070) to discharge up to 30,000 gpd into Lewis Creek, a tributary of Clear Creek. As shown in Figure 2-2 on the next page, the school generally has an average daily flow below 5,000 GPD. There are two anomalies in the data:

1. Between February and May 2017, no data were recorded;
2. Between May and June 2017, the recorded flow was 17,200 GPD, which may have been a reporting error accounting for the non-reported months from February to May.

The WWTF is in reasonably good condition and could be improved with facility upgrades. WNCJA may be considered as a potential customer as wastewater collection systems expand in the region.

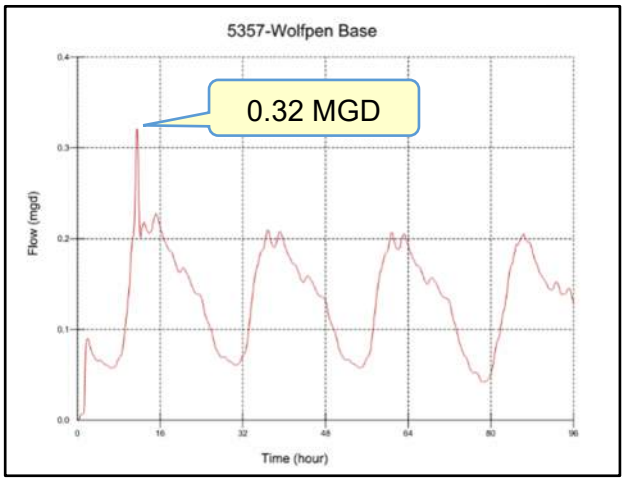
Figure 2-2: WNCJA WWTF DMR Effluent Flow Data



Fruitland Baptist Bible College (FBBC) is located approximately 2.5 miles northwest of Edneyville Elementary School. According to the Preliminary Engineering Report prepared by McGill and Associates in 2018 (MGPER), the FBBC has two dormitories and a cafeteria in addition to classroom facilities. FBBC is currently served by an on-site (septic) wastewater treatment system and may be considered as a potential customer as wastewater collection systems expand in the region.

The nearest connection point to the COH wastewater collection system is the 24-inch Wolfpen Interceptor which has approximately 3.8 MGD of total hydraulic capacity; however, the available capacity is limited by the downstream treatment facility capacity. Based on current modeling provided by COH, the approximate peak daily flow in the Wolfpen interceptor is 0.32 MGD as shown in Figure 2-3.

Figure 2-3: Wolfpen Interceptor Current Capacity



The Hendersonville Wastewater Treatment Plant (NPDES ID – NC0025534) has a design average daily flow capacity of 4.8 MGD with the potential to expand up to 12 MGD.

3.0 NEED FOR PROJECT

3.1 HEALTH, SANITATION, AND SECURITY

The County has not had any issues with health, sanitation or security in wastewater collection system or at on-site facilities. However, continued operation or expansion of on-site drip irrigation in proximity to students at Edneyville Elementary School is viewed as a potential health and sanitation concern. The alternatives evaluated in this report provide safer wastewater collection and treatment options for the school.

Regional alternatives 3 and 4 provide a means of incorporating additional customers into the sanitary sewer collection system. Aging on-site wastewater treatment systems present risks to public health and sanitation and should be eliminated when possible. These regional alternatives allow for the potential elimination of many existing and future on-site systems by providing communities with public sewer connections.

3.2 AGING INFRASTRUCTURE

The WWTF at Camp Judaea has reached the end of useful service life. Alternatives presented in this report propose to eliminate this WWTF and provide sewer service or a new package WWTF to the camp.

3.3 REASONABLE GROWTH

3.3.1 Flow Projections

The Alternatives presented in Section 4 below provide varying levels of sewer service within the study area. Some alternatives provide service only to Edneyville Elementary School and Camp Judaea, while others incorporate additional sub-basins within the study area. The following design assumptions were used to calculate estimated flows for each alternative:

1. All existing residential units are assumed to be 3-bedroom units. The associated residential unit contributory loading for a 3-bedroom unit is 300 gallons per day.
2. The estimated flow from existing commercial parcels is 1,200 gallons per day (gpd) per acre.
3. 50% of the “non-sewered” existing homes and/or commercial development will connect to the proposed gravity sewer.
    a. “Non-sewered” refers to any development that is not currently on sewer.
4. 80% of the developable area will be used for the development of new residential homes.
5. Gravity sewer piping and pump stations are designed to accommodate the peak daily flow projections, which is calculated by applying the peaking factor to the average daily flow. The peaking factor is calculated by using the following formula[3]:

[3] Recommended Standards for Wastewater Facilities – 2014 Edition. Figure 1: Ratio of Peak Hourly Flow to Design Average Flow.

$$Peaking\ Factor = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}, where\ P = population\ in\ thousands$$

WWTF's are sized to treat the maximum month average daily flow (ADF) while allowing the peak hourly flow to be hydraulically passed through the facility.

3.3.1.1 Edneyville Elementary & Camp Judaea

Edneyville Elementary was recently upgraded to replace the original facility. Due to the recent upgrade, significant future increases in flow are not anticipated.

Camp Judaea has undergone recent upgrades to several facilities. Over the last 3 years, there has been a slight increase in flow as shown in Figure 2-1. Due to property constraints, and recent upgrades, significant increases to current flows are not anticipated.

3.3.1.2 COH Wolfpen Interceptor

The City of Hendersonville recently completed a Sanitary Sewer Asset Inventory and Assessment (SSAIA) Master Plan[4]. This master plan utilizes 2010 Census Traffic Analysis Zone (TAZ) data, economic and historical data to calculate flow projections for years 2025 and 2040. In particular, the CCGA study referenced previously was incorporated into this master plan to project flows in the Edneyville Region which could be connected to the COH collections system via the Wolfpen Interceptor. Figure 3-1 and Figure 3-2 display peak flow projections at the Wolfpen Interceptor in years 2025 and 2040. [3]

Figure 3-1: Wolfpen Interceptor 2025 Flow Projection

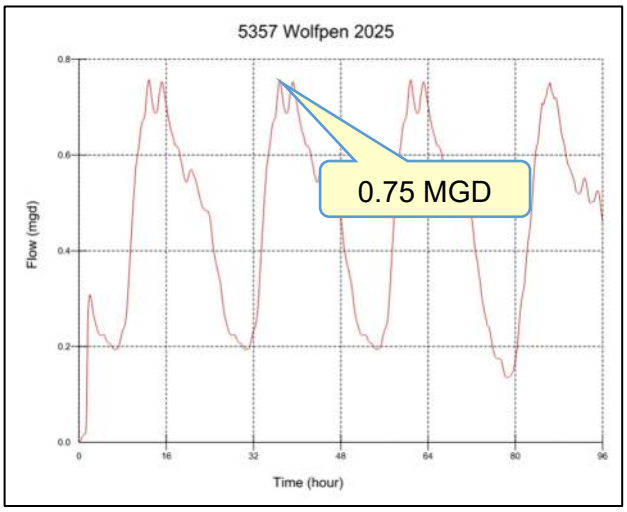
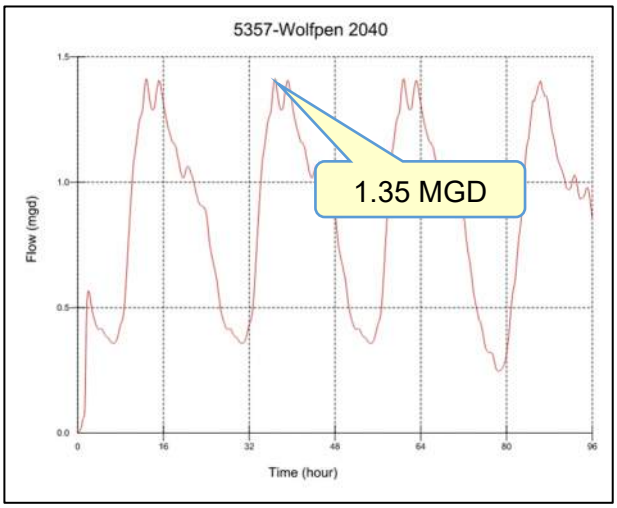


Figure 3-2: Wolfpen Interceptor 2040 Flow Projection



[4] Black & Veatch, *Sanitary Sewer Asset Inventory and Assessment Master Plan Report* (2019)

3.3.1.3 Growth within Study Area

For the purposes of this study, only two (2) regional sewer alternatives were evaluated; Alternatives 3 and 4 (including sub-alternatives). The remaining alternatives are intended only to serve specific facilities or small-scale service areas.

The 2017 CCGA study (referenced in Section 1.2.2) provided evaluation of an anticipated growth within the Clear Creek Basin. The theoretical maximum yields of the following segments (as described on pg. 22 and depicted in Figures 14 and 15 of the CCGA study) are as follows:

- ***Gravity Sewer Option: 16,907 Total Dwelling Units***
    - *School Line: 13,807 Total Dwelling Units*
        - *2,543 Single Family Dwelling Units*
        - *11,264 Multi-Family Dwelling Units*
    - *Justice Academy Line: 3,100 Total Dwelling Units*
        - *2,412 Single Family Dwelling Unit*
        - *688 Multi-Family Dwelling Units*
- ***Multiple Pump Station Option: 6,044 Total Dwelling Units***
    - *2,988 Single Family Dwelling Units*
    - *3,056 Multi-Family Dwelling Units*

For this study, KCI used the flow projection methodology presented in Section 3.3.1 to calculate the potential developable parcels and corresponding wastewater flows. Parcels meeting the following criteria were included in the flow projection calculations:

1. Total acreage greater than or equal to 5.0 acres
2. Not located within a Floodplain
3. No significant existing structures
4. Apple orchards are a significant economic and cultural resource of the Edneyville area, parcels containing existing orchards were also assumed to not be developable.

This methodology provides a reasonable assumption for potential buildout within the basin, excluding major water consuming industrial, commercial, or multi-family residential, which is not characteristic of the study area. The methodology resulted in the estimated number of dwelling units below the theoretical maximum yields presented in the CCGA study. The methodology did not factor in growth rates and only assumed build-out conditions in order to size the infrastructure to handle build-out capacity. In some instances, a phased implementation of the alternative could be used to reduce initial capital costs and defer future investment until growth necessitates additional infrastructure.

4.0 ALTERNATIVES CONSIDERED

4.1 ALTERNATIVES CONSIDERED

Four (4) primary alternatives for the project were identified and investigated along with three (3) sub-alternatives. The alternatives evaluated are:

1. Construct a new pump station near Camp Judaea to collect wastewater from Edneyville Elementary and Camp Judaea. Convey wastewater via force main to COH. Decommission the existing the Camp Judaea wastewater treatment package plant.
   A. Construct a new pump station at Edneyville Elementary to collect wastewater from the school. Convey wastewater via force main to COH.
2. Construct a new WWTF near Camp Judaea to treat wastewater from Edneyville Elementary and Camp Judaea.
3. Construct a series of pump stations along Hwy 64 to collect and convey wastewater from Edneyville Elementary, Camp Judaea and surrounding service areas to COH.
   A. Incorporate WNC Justice Academy
4. Construct a new WWTF near North Henderson High School to treat wastewater from a regional gravity sewer system.
   A. Incorporate WNC Justice Academy, Basin 3 and Fruitland Baptist Bible College into the regional sewer collection system.
   B. Incorporate WNC Justice Academy and Fruitland Baptist Bible College into the regional sewer collection system.
   C. Incorporate minor gravity sewer lines to connect trunk sewers to developments.

The following sections provide detailed descriptions of each alternative including:

- Map of Alternative (Full-size versions provided in Appendix B)
- Design Criteria: *This section includes descriptions of pertinent design criteria including; service area flow calculations, pump station sizing (if required), gravity/force main sizing, and other relevant items critical to preliminary design.*
- Environmental Impacts: *This section provides descriptions of any temporary or long-term environmental impacts resulting from implementation of the proposed alternative. Impacts may include; water quality, animal habitat, erosion / sedimentation, groundwater, and other pertinent impacts.*
- Land Requirements: *The land required for both facilities (i.e. pump stations) and linear features (i.e. gravity sewer and/or force main) is documented in this section. In addition, lists of impacted private properties are documented.*

- Potential Construction Problems*: There are numerous risks associated with any construction project. This section identifies potential major issues that could impact the implementation of the selected alternative. Additional risks may be identified during detailed design once detailed survey, geotechnical investigations, and SUE are performed.*
- Sustainability: *This section is used to assist potential funding agencies with any sustainable components of the project. Components may include sustainable materials, energy efficiency, use of nature-based solutions, etc.*
- Opinions of Probable Cost (OPC): *An OPC was prepared for each Alternative to estimate the range of anticipated construction costs. As with any pricing estimate, inflation, market conditions, availability of contractors / labor, materials pricing, equipment utilization, and other factors can cause variability in the actual cost to construct. In addition, until detailed design is performed, certain unit prices and existing conditions cannot be accurately captured. For this level of budgetary estimate, KCI recommends using a construction cost estimate with a range of -30% and +50%.*

4.1.1 ***Alternative 1 – Gravity Sewer from Edneyville Elementary to New Pump Station at Camp Judaea, Force Main to COH***

Alternative 1 involves the construction of a new wastewater pump station at Camp Judaea, near the intersection of Chimney Rock Road and Camp Judaea Drive. Wastewater will be conveyed to the pump station via 4,800 LF of gravity sewer. This pump station and associated gravity sewer will collect wastewater from two sources: Edneyville Elementary and Camp Judaea. Wastewater from the pump station will be conveyed via 15,100 LF of force main along Hwy 64 to the COH connection point (Wolfpen Interceptor). A location map of this Alternative is shown in Figure 4-1 on the next page.

4.1.1.1 Design Criteria

The new pump station and gravity sewer will be sized to accommodate the estimated peak flow generated from the Edneyville Elementary and Camp Judaea. The estimated peak flow is calculated, which is done by applying the peaking factor provided in the Ten State Standards to the average daily flow. The peaking factor is calculated by using the formula below:

$$Peaking\ Factor = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}, where\ P = population\ in\ thousands$$

Figure 4-1: Alternative 1 Location Map

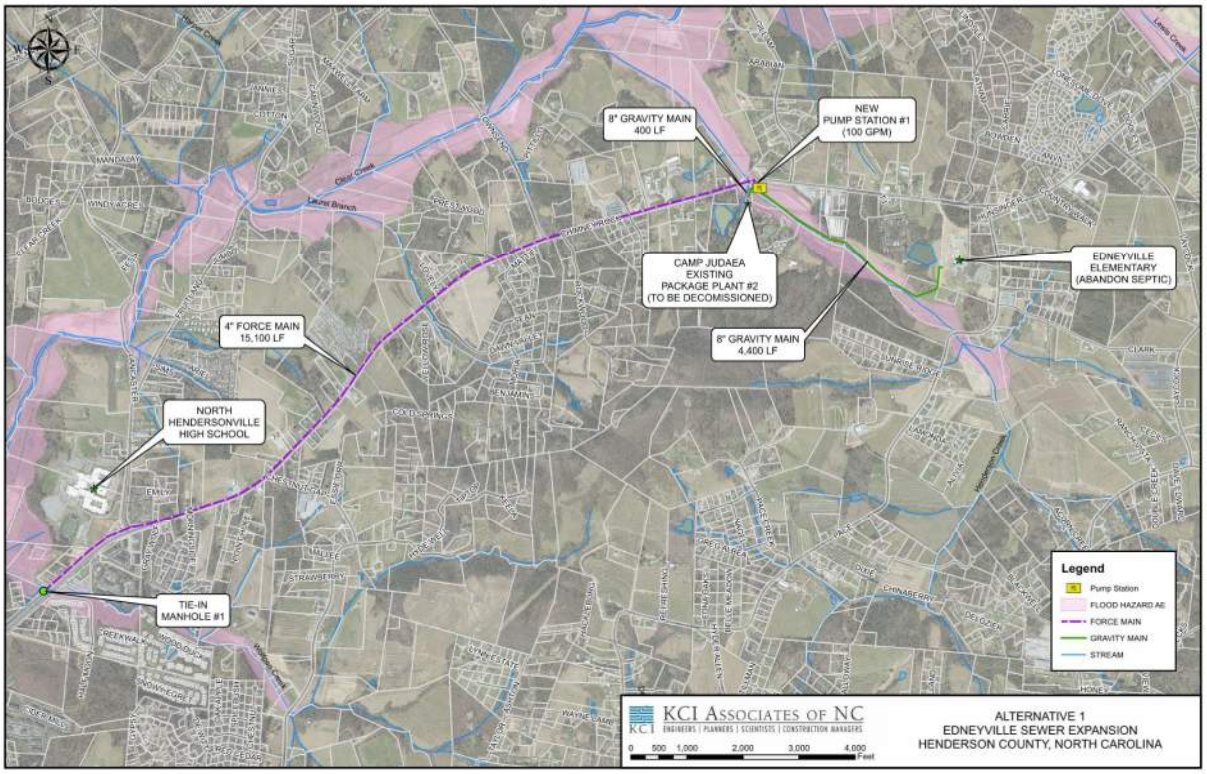


Table 4-1 details how the peak flow is calculated for Alternative 1.

Table 4-1: Alternative 1 Peak Daily Flow Calculation

Flow Contributors	Average Daily Flow (gpd) [1]	Population (persons)	Peaking Factor	Peak Daily Flow (gpd) [2]
Edneyville Elementary School	9,000	600	--	--
Camp Judaea	11,640	600	--	--
TOTAL	**20,400**	**1,200**	**3.75**	**76,700** [3]

The estimated peak daily flow from the two sources is 76,700 gallons per day, or 53 gpm. In order to meet state guidelines for wastewater pump stations, a minimum of 2 feet per second must be achieved within the force main at the design flow rate to prevent deposition of solids. While a minimum of 2 fps can be achieved at the estimated peak flow using a 3-inch force main, this option is not considered preferable as the head loss through a smaller diameter pipe will be significant. In an effort to minimize the head loss across the estimated 15,100 feet of force main, the pump station design flow rate will be 100 gpm, and a 4-inch PVC force main will be used to convey wastewater to the tie-in manhole (see Alternative 1 figure in Appendix B).

As mentioned above, the new gravity sewer is sized to accommodate the estimated peak daily flow. It is assumed that an 8-inch sewer can effectively convey this flow without concerns of surcharging. Table 4-2 shows flow calculations at the minimum slope for an 8-inch gravity sewer.

Table 4-2: Alternative 1 Proposed Gravity Trunk Sewer Sizing

PIPE SIZE & MATERIAL (inches)	SLOPE (%)[1]	PEAK DAILY FLOW (MGD) [2]	% FULL (d/D)	AVAILABLE CAPACITY REMAINING IN PIPE (MGD) [2]
8" SDR 35 PVC	0.40%	0.08	0.27	0.41

[1] Minimum slope for an 8-inch pipe.
[2] Available Remaining Pipe Capacity = Qfull – Peak Daily Flow, where Qfull is equal to the maximum flow that can be conveyed through the pipe.

4.1.1.2 Environmental Impacts

Environmental impacts associated with this alternative are from temporary impacts associated with construction. Installation of the gravity sewer and force main will result in creek/stream crossings and require clearing of wooded areas. Best Management Practices (BMPs) will be utilized to minimize stormwater impacts due to construction. Stormwater BMPs will be used to minimize temporary environmental impacts from construction.

This Alternative also results in decommissioning of the existing Camp Judaea WWTF which would result in the elimination of the NPDES direct discharge to Henderson Creek. This would provide water quality benefits in this portion of the watershed.

4.1.1.3 Land Requirements

Approximately 0.5 acres of land would need to be acquired for the construction of the new pump station under this alternative. A portion of the gravity sewer would be installed on the Edneyville Elementary property, which is owned by Henderson County. Temporary and permanent easements would be required for installation of the gravity sewer on private property. The following parcels would likely be impacted by construction of the gravity sewer:

Table 4-3: Alternative 1 Impacted Parcels

No.	PIN	Deed/Page	Acreage	Owner	Project Use
1	9690186629	1411/148	30.05	CJ PROPERTY INC	Gravity Sewer
2	9690294135	1410/490	14.5	LYDA, SONNA; LYDA, JEFFREY	Pump Station /Gravity Sewer
3	9690289645	1410/490	1.58	LYDA, SONNA; LYDA, JEFFREY	Gravity Sewer
4	9690382633	1589/148	4.7	COOKE, MATTHEW T; COOKE, KELLY C	Gravity Sewer
5	9690385539	1068/241	9.01	MESSER, JAMES R; MESSER, PATSY A	Gravity Sewer

No.	PIN	Deed/Page	Acreage	Owner	Project Use
6	9690484480	1370/334	39.81	HANNEN, JAMES E; HANNEN, TAMMY M	Gravity Sewer
7	9690573008	295/314	25.91	CONNER, EMMA D	Gravity Sewer
8	9690583114	3232/583	25.35	HENDERSON, COUNTY OF	Gravity Sewer

The force main would generally be located within the public road right-of-way. Temporary construction easements may be required on private property for bore pits at road crossings.

4.1.1.4 Potential Construction Problems

Construction of the gravity sewer requires a minimum constant grade in order to achieve the design flow rate. While general topography has been evaluated in this study, detailed design will be required to verify existing conditions and confirm the final pipe alignments.

Steep slopes may be encountered during the laying of the force main. A thorough geotechnical investigation will be conducted along the force main route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and make recommendations for dewatering and stabilization during installation of piping and the pump station wet well.

Sub-surface Utility Engineering (SUE) will also need to be performed, particularly in the public right-of-way, to locate and avoid utility conflicts during construction.

The force main will primarily be constructed in within the public right-of-way. Temporary traffic control will be required in accordance with NCDOT requirements. Several jack-and-bores will be required for roadway crossings. There are also several commercial and residential driveways that will be temporarily impacted during construction.

Other typical construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.1.5 Sustainability

The proposed gravity sewer, pump station and force main will be made with construction materials in accordance with NCDEQ and Industry Standards. The pump station and force main will be designed for optimal pumping efficiency based on the design system conditions.

Elimination of the drip irrigation system at Edneyville Elementary School and replacement with a pump station will provide long-term reliable wastewater disposal. As noted previously, there are limitations to the long-term sustainability of operating the drip irrigation system.

Replacing the decommissioned Camp Judaea WWTF with a pump station and force main to the COH gravity sewer system will reduce long-term operation and maintenance efforts.

4.1.1.6 Opinion of Probable Cost (OPC)

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

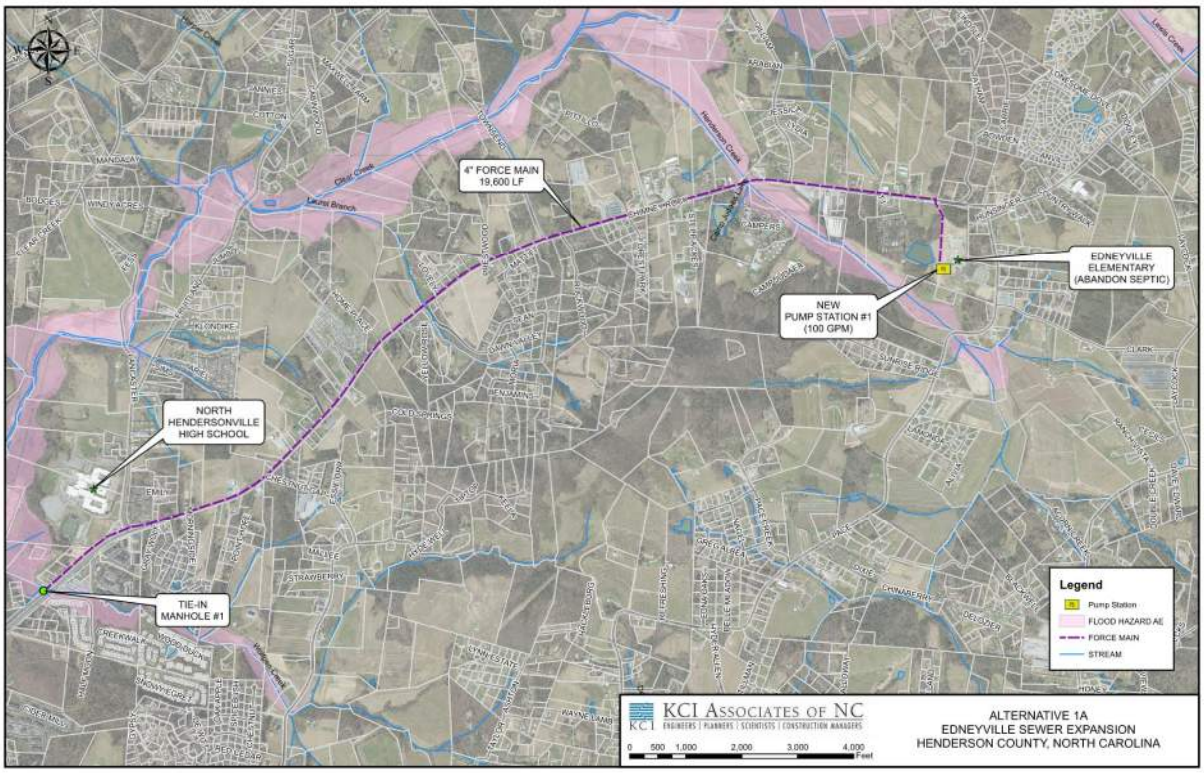
- Estimated Construction Cost: **$3,580,000**
- Low Range (-30%): $2,506,000
- High Range (+50%) $5,370,000

A detailed OPC is included in Appendix D.

4.1.2 Alternative 1A – New Pump Station at Edneyville Elementary, Force Main to COH

Under this sub-alternative, a new pump station will be constructed at Edneyville Elementary and serve only the school. Wastewater will be conveyed via force main along Pace Road to Hwy 64 and along Hwy 64 to the COH connection point. Wastewater will be conveyed to the pump station via 4,400 LF of gravity sewer. This sub-alternative provides a means of comparing cost distribution between Edneyville Elementary and Camp Judaea.

Figure 4-2: Alternative 1A Location Map



4.1.2.1 Design Criteria

The design criteria for Alternative 1A focus on the estimated peak flow for the new pump station and the required size for its force main. Similar to Alternative 1, the peak daily flow will be calculated by applying a peaking factor to the average daily flow from the Edneyville Elementary School. Table 4-4 details how the peak daily flow is determined.

Table 4-4: Alternative 1A Peak Daily Flow Calculation

Flow Contributors	Average Daily Flow (gpd) [1]	Population (persons)	Peaking Factor	Peak Daily Flow (gpd) [2]
Edneyville Elementary School	9,000	600	3.93	35,400

The estimated peak daily flow from the Edneyville Elementary School is 35,400 gpd, or 25 gpm. As with Alternative 1, a design flow rate of 25 gpm would require a force main smaller than 2-inch to meet the minimum flow velocity requirement and using a 2-inch force main over the proposed 19,600-foot force main route would significantly increase the total dynamic head that the pump would have to overcome. There are several maintenance advantages for using a pipe size greater than 2 or 3 inch such as allowing for minimum 3-inch solids to be conveyed through the force main more easily and reduce potential clogging. Therefore, a 100 gpm pump station is recommended with a 4-inch force main.

4.1.2.2 Environmental Impacts

Environmental impacts associated with this option are from temporary impacts associated with construction. Installation of the force main will result in creek/stream crossings and require clearing of wooded areas. Best Management Practices (BMPs) will be utilized to minimize stormwater impacts due to construction. Stormwater BMPs will be used to minimize temporary environmental impacts from construction.

4.1.2.3 Land Requirements

Approximately 0.5 acres of land would need to be acquired for the construction of the new pump station under this alternative. The force main would generally be located within the public road right-of-way.

4.1.2.4 Potential Construction Problems

Steep slopes may be encountered during the laying of the force main. A thorough geotechnical investigation will be conducted along the force main route to anticipate, budget for, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and make recommendations for dewatering and stabilization during installation of piping and the pump station wet well.

Sub-surface Utility Engineering (SUE) will also need to be performed, particularly in the public right-of-way, to locate and avoid utility conflicts during construction.

The force main will primarily be constructed in within the public right-of-way. Temporary traffic control will be required in accordance with NCDOT requirements. Several jack-and-bores will be required for roadway crossings. There are also several commercial and residential driveways that will be temporarily impacted during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.2.5 Sustainability

The proposed gravity sewer, pump station and force main will be made with construction materials in accordance with NCDEQ and Industry Standards. The pump station and force main will be designed for optimal pumping efficiency based on the design system conditions.

Elimination of the drip irrigation system at Edneyville Elementary School and replacement with a pump station will provide long-term reliable wastewater disposal. As noted previously, there are limitations to the long-term sustainability of operating the drip irrigation system.

4.1.2.6 Opinion of Probable Cost

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

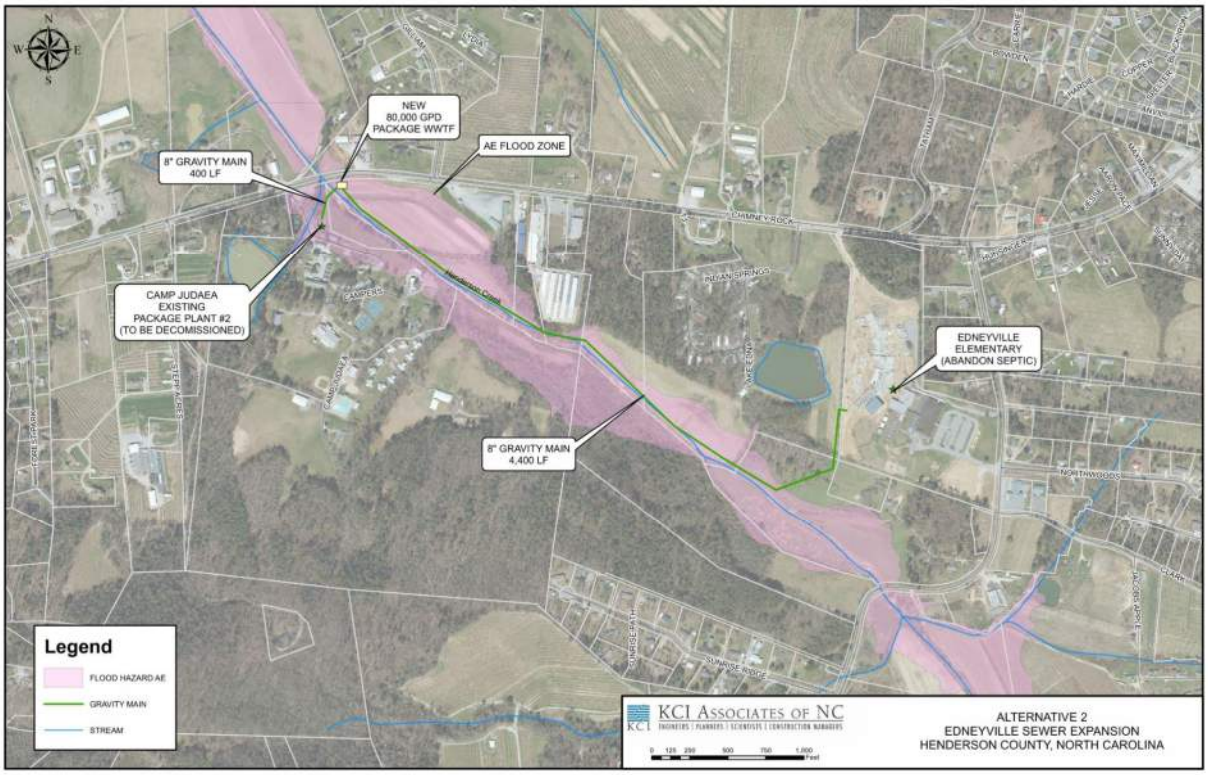
- Estimated Construction Cost: **$2,200,000**
- Low Range (-30%): $1,540,000
- High Range (+50%) $3,300,000

A detailed OPC is included in Appendix D.

*4.1.3 **Alternative 2 - Gravity Sewer to New WWTF at Camp Judaea***

Alternative 2 involves the construction of a new WWTF at Camp Judaea, near the intersection of Chimney Rock Road and Camp Judaea Drive. This WWTF will treat wastewater from two sources: Edneyville Elementary and Camp Judaea. Wastewater will be conveyed via 4,800 LF of gravity sewer. A map of this alternative is included in Figure 4-3.

Figure 4-3: Alternative 2 Location Map



4.1.3.1 Design Criteria

The new gravity sewer will only accept flow from the Edneyville Elementary School and the Camp Judaea Existing Package Plant #2 that will be decommissioned under this Alternative. The flows generated in this Alternative are the same as Alternative #1 as the two (2) flow contributors are the same. The new gravity sewer shall be sized to accommodate the peak flow, while the new package treatment plant will be designed for the average daily flow generated by the Edneyville Elementary School and the drainage basin for the new gravity sewer. Refer to Table 4-1 and Table 4-2 for the peak daily flow and gravity sewer sizing determination calculations. Refer to Appendix C for detailed calculations associated with this alternative.

4.1.3.2 Environmental Impacts

Minor standard construction impacts will come from constructing a new WWTF. Replacing the antiquated Camp Judaea WWTF with a new WWTF should result in an improvement to water quality in Henderson Creek as treatment technologies have improved in the last several decades.

Installation of gravity sewer will result in creek/stream crossings and require clearing of wooded areas. Stormwater BMPs will be used to minimized temporary environmental impacts from construction.

4.1.3.3 Land Requirements

Approximately 2.0 acres of land would need to be acquired for the construction of the package treatment plant under this alternative. A portion of the gravity sewer would be installed on the Edneyville Elementary property, which is owned by Henderson County. Temporary and permanent easements would be required for installation of the gravity sewer on private property. The following parcels would likely be impacted by construction of the gravity sewer:

Table 4-5: Alternative 2 Impacted Parcels

No.	PIN	Deed/Page	Acreage	Owner	Project Use
1	9690186629	1411/148	30.05	CJ PROPERTY INC	Gravity Sewer
2	9690294135	1410/490	14.5	LYDA, SONNA; LYDA, JEFFREY	WWTF / Gravity Sewer
3	9690289645	1410/490	1.58	LYDA, SONNA; LYDA, JEFFREY	Gravity Sewer
4	9690382633	1589/148	4.7	COOKE, MATTHEW T; COOKE, KELLY C	Gravity Sewer
5	9690385539	1068/241	9.01	MESSER, JAMES R; MESSER, PATSY A	Gravity Sewer
6	9690484480	1370/334	39.81	HANNEN, JAMES E; HANNEN, TAMMY M	Gravity Sewer
7	9690573008	295/314	25.91	CONNER, EMMA D	Gravity Sewer
8	9690583114	3232/583	25.35	HENDERSON, COUNTY OF	Gravity Sewer

4.1.3.4 Construction Problems

A thorough geotechnical investigation will be conducted along the gravity sewer route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and recommendations for dewatering and stabilization during installation of piping and the pump station wet well.

Sub-surface Utility Engineering (SUE) will also need to be performed to locate and avoid utility conflicts during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.3.5 Sustainability

The proposed gravity sewer will be made with construction materials in accordance with NCDEQ and Industry Standards.

Elimination of the drip irrigation system at Edneyville Elementary School and replacement with a gravity sewer will provide long-term reliable wastewater disposal. As noted previously, there are limitations to the long-term sustainability of operating the drip irrigation system.

4.1.3.6 Opinion of Probable Cost

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

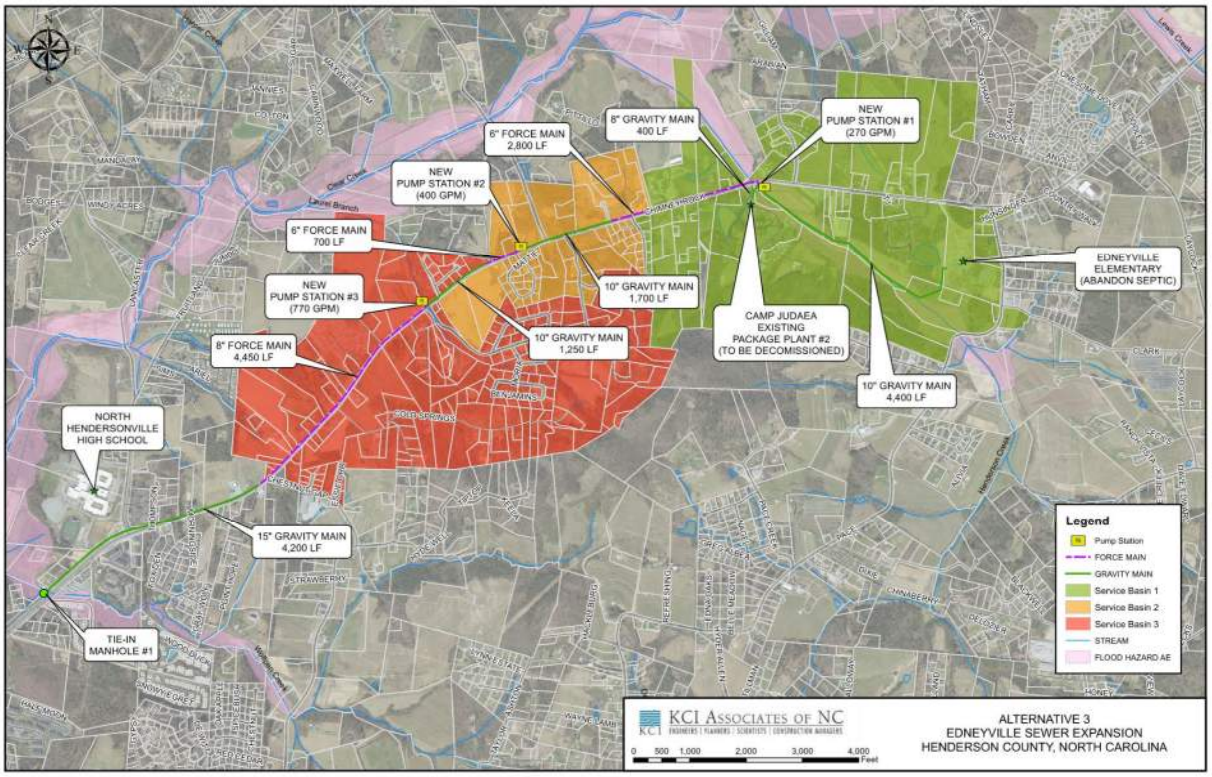
- Estimated Construction Cost: **$3,440,000**
- Low Range (-30%): $2,408,000
- High Range (+50%) $5,160,000

A detailed OPC is included in Appendix D.

4.1.4 Alternative 3 - Gravity Sewer to Series of Pump Stations/Force Main to COH

Alternative 3 will involve the construction of three new pump stations along Hwy 64 to collect and convey wastewater to the COH connection point via a total of 11,950 of gravity sewer and 5,550 LF of force main. This alternative allows for future customers to connect to the sewer system within three potential service areas.

Figure 4-4: Alternative 3 Location Map



4.1.4.1 Design Criteria

Alternative #3 includes a combination of gravity sewer and pumping. The New Pump Stations #1, #2 and #3 receive flow from Service Basins 3, 2 and 1, respectively. The following tables detail the estimated peak flow from each basin.

Table 4-6: Alternative 3 Peak Daily Flow Calculation for New Pump Station #1

Flow Contributors	Area (acres)	Average Daily Flow (gpd)	Population (persons)	Peaking Factor	Peak Daily Flow (gpd)
Service Basin 1	146	106,200	1,416	3.70	392,676

Table 4-7: Alternative 3 Peak Daily Flow Calculation for New Pump Station #2

Flow Contributors	Area (acres)	Average Daily Flow (gpd)	Population (persons)	Peaking Factor	Peak Daily Flow (gpd)
Service Basin 1	146	106,200	1,416	--	--
Service Basin 2	135	103,488	1,380	--	--
TOTAL	288	215,288	2,872	3.46	744,908

Table 4-8: Alternative 3 Peak Daily Flow Calculation for New Pump Station #3

Flow Contributors	Area (acres)	Average Daily Flow (gpd)	Population (persons)	Peaking Factor	Peak Daily Flow (gpd)
Service Basin 1	146	106,200	1,416	--	--
Service Basin 2	135	103,488	1,380	--	--
Service Basin 3	255	187,200	2,496	--	--
TOTAL	460	341,388	4,552	3.28	1,120,622

The following pump station and associated force main sizes are recommended:

Pump Station #1: 270 gpm, 2,800 LF of 6-inch PVC force main;
Pump Station #2: 400 gpm, 700 LF of 6-inch PVC force main;
Pump Station #3: 770 gpm, 4,450 LF of 8-inch PVC force main.

Sizing for the gravity sewer segments connecting each pump station and force main are summarized in Table 4-9:

Table 4-9: Alternative 3 Proposed Gravity Trunk Sewer Sizing

GRAVITY SEWER SEGMENT	PIPE SIZE & MATERIAL (inches)	SLOPE (%) [1]	PEAK DAILY FLOW (MGD)	% FULL (d/D)	AVAILABLE CAPACITY REMAINING IN PIPE (MGD) [2]
Edneyville Elem. to PS#1	10" SDR 35 PVC	0.28%	0.39	0.52	0.34
PS#1 FM to PS#2	10" SDR 35 PVC	0.28%	0.56	0.65	0.17
PS#2 FM to PS#3	10" SDR 35 PVC	0.28%	0.56	0.65	0.17
PS#3 FM to COH Gravity	15" SDR 35 PVC	0.15%	1.10	0.65	0.36

[1] Minimum slope based on pipe size from Ten States Standards.[5]
[2] Available Remaining Pipe Capacity = Qfull – Peak Daily Flow, where Qfull is equal to the maximum flow that can be conveyed through the pipe.

4.1.4.2 Environmental Impacts

Environmental impacts associated with this option are from temporary impacts associated with construction. Installation of the gravity sewer and force main will result in creek/stream crossings and require clearing of wooded areas. Best Management Practices (BMPs) will be utilized to minimize stormwater impacts due to construction. Stormwater BMPs will be used to minimize temporary environmental impacts from construction.

4.1.4.3 Land Requirements

Approximately 0.5 acres of land would need to be acquired for the construction of each new pump station under this alternative. A portion of the gravity sewer would be installed on the Edneyville Elementary property, which is owned by Henderson County. Temporary and permanent easements would be required for installation of the gravity sewer on private property. The following parcels would be likely impacted by construction of the gravity sewer:

Table 4-10: Alternative 3 Impacted Parcels

No.	PIN	Deed/Page	Acreage	Owner	Project Use
1	9690186629	1411/148	30.05	CJ PROPERTY INC	Gravity Sewer
2	9690294135	1410/490	14.5	LYDA, SONNA; LYDA, JEFFREY	Pump Station #1 & Gravity Sewer
3	9690289645	1410/490	1.58	LYDA, SONNA; LYDA, JEFFREY	Gravity Sewer
4	9690382633	1589/148	4.7	COOKE, MATTHEW T; COOKE, KELLY C	Gravity Sewer
5	9690385539	1068/241	9.01	MESSER, JAMES R; MESSER, PATSY A	Gravity Sewer
6	9690484480	1370/334	39.81	HANNEN, JAMES E; HANNEN, TAMMY M	Gravity Sewer
7	9690573008	295/314	25.91	CONNER, EMMA D	Gravity Sewer
8	9690583114	3232/583	25.35	HENDERSON, COUNTY OF	Gravity Sewer

[5] Recommended Standards for Wastewater Facilities – 2014 Edition. 33.41 – Recommended Minimum Slopes.

No.	PIN	Deed/Page	Acreage	Owner	Project Use
9	9680786755	2008E/715	7.11	STEPP, JAYNE	Pump Station #2
10	9680575886	1604/151	10.89	APPLE COUNTRY LODGE LLC	Pump Station #3

The force mains would generally be located within the public road right-of-way. Temporary construction easements may be required on private property for bore pits at road crossings.

4.1.4.4 Construction Problems

Construction of the gravity sewer requires a minimum constant grade in order to achieve the design flow rate. While general topography has been evaluated in this study, detailed design will be required to verify existing conditions and confirm final pipe alignments.

Steep slopes may be encountered during the laying of the force main. A thorough geotechnical investigation will be conducted along the force main route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and recommendations for dewatering and stabilization during installation of piping and the pump station wet well.

Sub-surface Utility Engineering (SUE) will also need to be performed, particularly in the public right-of-way, to locate and avoid utility conflicts during construction.

The force main will primarily be constructed in within the public right-of-way. Temporary traffic control will be required in accordance with NCDOT requirements. Several jack-and-bores will be required for roadway crossings. There are also several commercial and residential driveways that will be temporarily impacted during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.4.5 Sustainability

The proposed gravity sewer, pump stations and force mains will be made with construction materials in accordance with NCDEQ and Industry Standards. The pump stations and force mains will be designed for optimal pumping efficiency based on the design system conditions.

Compared to Alternatives 1 and 1A, this option is less sustainable due to the installation of three (3) pump stations rather than one (1). While the additional pump stations could open additional service area, which would provide more sustainable wastewater treatment compared to on-site (septic) systems, there are additional operations and maintenance costs and effort associated with additional pump stations.

4.1.4.6 Opinion of Probable Cost

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative:

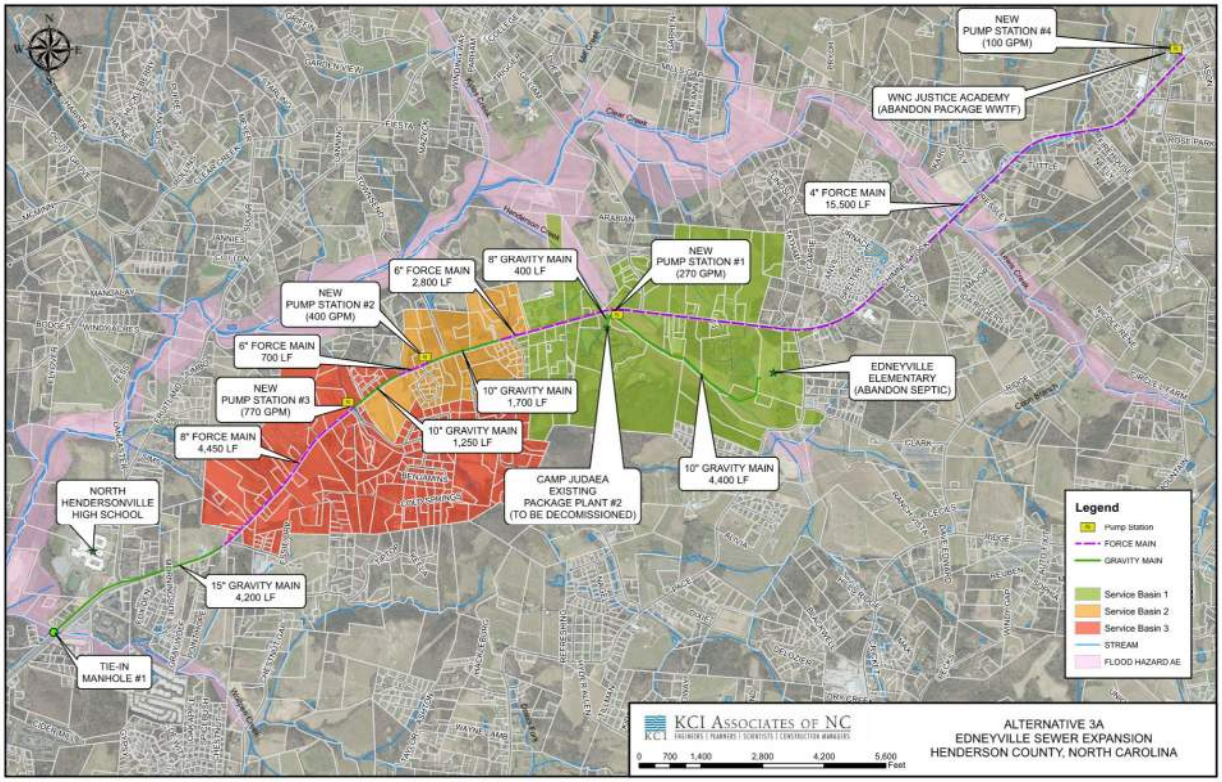
- Estimated Construction Cost: **$8,570,000**
- Low Range (-30%): $6,000,000
- High Range (+50%) $12,860,000

A detailed OPC is included in Appendix D.

4.1.5 Alternative 3A – Gravity Sewer to Series of Pump Stations/Force Main to COH, Add Justice Academy

Alternative 3A will be similar to Alternative 3, which involves the construction of three new pump stations along Hwy 64 to collect and convey wastewater to the COH connection point via a total of 11,950 of gravity sewer and 5,550 LF of force main. This alternative will also include another pump station that receives flow from the WNC Justice Academy and convey its flow to the new Pump Station #1.

Figure 4-5: Alternative 3A Location Map



4.1.5.1 Design Criteria

The following pump station and associated force main sizes are recommended:

Pump Station #1: 320 gpm, 2,800 LF of 6-inch PVC force main;
Pump Station #2: 440 gpm, 700 LF of 6-inch PVC force main;
Pump Station #3: 810 gpm, 4,450 LF of 8-inch PVC force main.
New Pump Station #4 (near WNCJA): 100 gpm, 15,500 LF of 4-inch PVC force main;

Sizing for the gravity sewer segments connecting each pump station and force main are summarized in Table 4-11:

Table 4-11: Alternative 3A Proposed Gravity Trunk Sewer Sizing

GRAVITY SEWER SEGMENT	PIPE SIZE & MATERIAL (inches)	SLOPE (%) [1]	PEAK DAILY FLOW (MGD)	% FULL (d/D)	AVAILABLE CAPACITY REMAINING IN PIPE (MGD) [2]
Edneyville Elem. to PS#1	10" SDR 35 PVC	0.28%	0.46	0.58	0.34
PS#1 FM to PS#2	10" SDR 35 PVC	0.28%	0.63	0.72	0.27
PS#2 FM to PS#3	10" SDR 35 PVC	0.28%	0.63	0. 72	0.10
PS#3 FM to COH Gravity	15" SDR 35 PVC	0.15%	1.17	0.67	0.30

[1] Minimum slope based on pipe size from Ten States Standards.[6]
[2] Available Remaining Pipe Capacity = Qfull – Peak Daily Flow, where Qfull is equal to the maximum flow that can be conveyed through the pipe.

4.1.5.2 Opinion of Probable Cost

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

- Estimated Construction Cost: **$9,490,000**
- Low Range (-30%): $6,640,000
- High Range (+50%) $14,240,000

A detailed OPC is included in Appendix D.

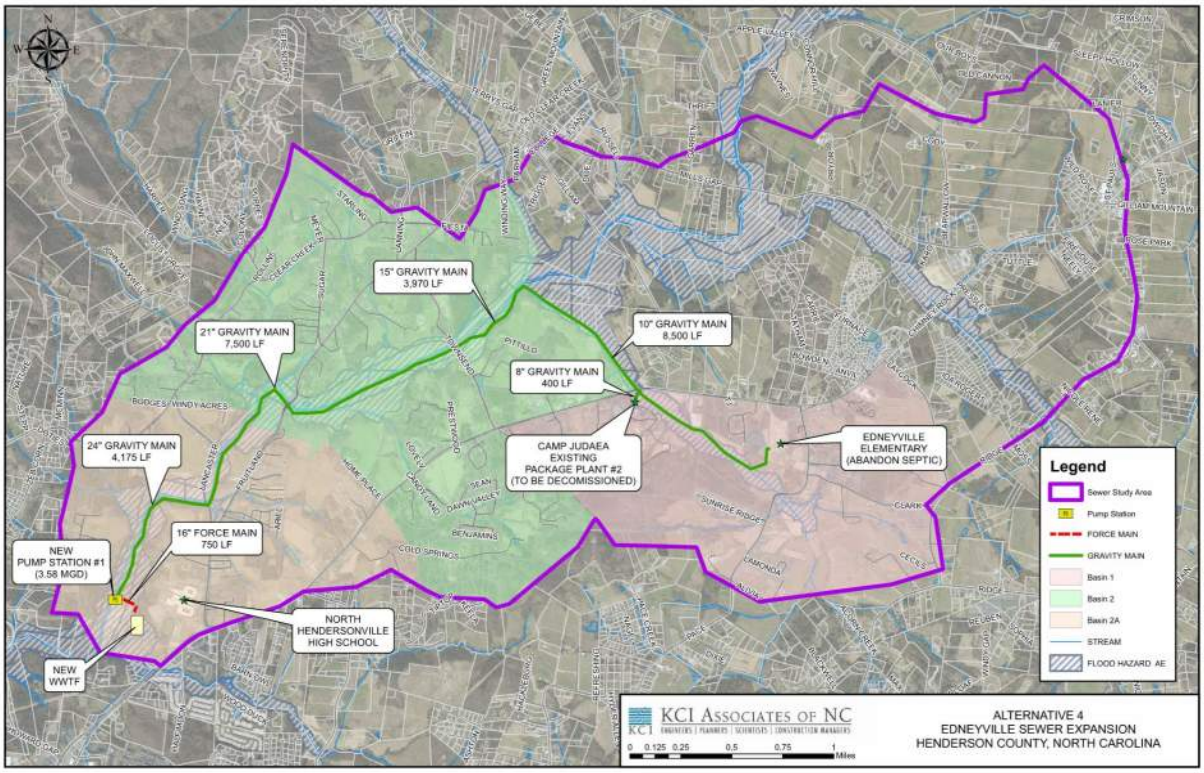
4.1.6 Alternative 4 – Regional Gravity Sewer System to New WWTF near North Henderson High School

Alternative 4 involves the construction of a new WWTF near North Henderson High School on a parcel between Apple Orchard Road and Clear Creek. A new influent pump station will be constructed adjacent to Clear Creek to collect wastewater from 15,650 LF of gravity sewer from the surrounding service area. 20,900 LF of gravity sewer will be installed to send wastewater to

[6] Recommended Standards for Wastewater Facilities – 2014 Edition. 33.41 – Recommended Minimum Slopes.

the new influent pump station. From there, flow will be conveyed to the new package treatment plant via 750 LF of 16-inch force main.

Figure 4-6: Alternative 4 Location Map

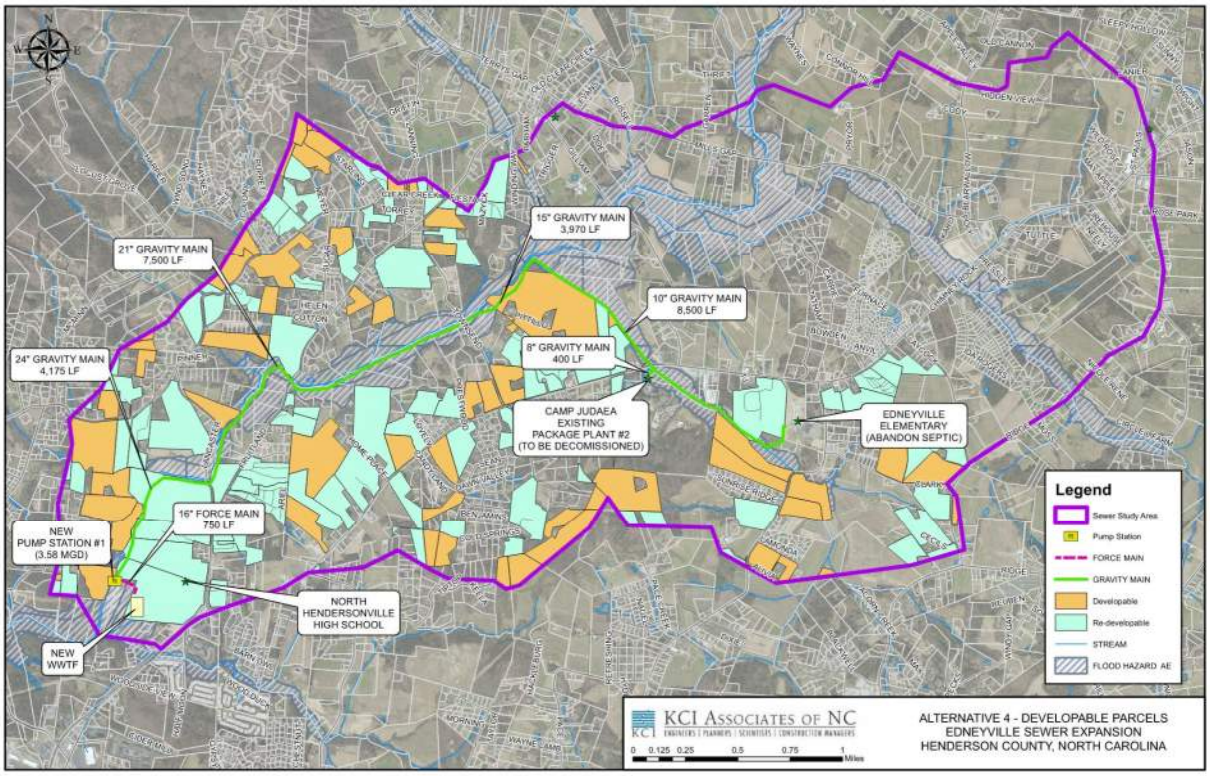


4.1.6.1 Design Criteria

In addition to the base flows from Edneyville Elementary and Camp Judaea, the surrounding potential service area that could be served by the new gravity sewer was analyzed. Parcels were categorized based on potential developability and potential for re-development and/or conversion from on-site (septic) disposal to connection to the new gravity sewer. Parcels that were significantly within the 100-year floodplain, substantially developed, or existing apple orchards were excluded.

Figure 4-7 depicts the potential parcels identified for contributory flows to the new gravity sewer line.

Figure 4-7: Alternative 4 Developable Parcels



The following tables detail the Peak flow and gravity sewer sizing calculations for the three Service Basins.

Table 4-12: Alternative 4 Peak Daily Flow Calculation

Flow Contributors	Area (acres)	Average Daily Flow (gpd)	Population (persons)	Peaking Factor	Peak Daily Flow (gpd)
Basin 1	484	228,238	3,043	3.44	784,482
Basin 2	1,458	815,988	10,880	2.92	2,381,227
Basin 2A	657	337,632	4,502	3.29	1,109,774

Table 4-13: Alternative 4 Proposed Gravity Trunk Sewer Sizing

Basins	PIPE SIZE & MATERIAL (inches)	SLOPE (%)[1]	PEAK DAILY FLOW (MGD)	% FULL (d/D)	AVAILABLE CAPACITY REMAINING IN PIPE (MGD)[2]
Basin #1	10" SDR 35 PVC	0.66%	0.78	0.62	0.34
Basin #2	21" SDR 35 PVC	0.15%	2.83	0.64	1.03
Basin #2A	24" SDR 35 PVC	0.15%	3.58	0.60	1.71

[1] Estimates for slope based on topography along the line.
[2] Available Remaining Pipe Capacity = Qfull – Peak Daily Flow, where Qfull is equal to the maximum flow that can be conveyed through the pipe.

The following influent pump station capacity and associated force main size are recommended:

New Pump Station (near new WWTF): 3.58 MGD, 750 LF of 16-inch PVC force main.

4.1.6.2 Environmental Impacts

Environmental impacts associated with this option are from temporary impacts associated with construction. Installation of the gravity sewer and force main will result in creek/stream crossings and require clearing of wooded areas. Best Management Practices (BMPs) will be utilized to minimize stormwater impacts due to construction. Stormwater BMPs will be used to minimize temporary environmental impacts from construction.

4.1.6.3 Land Requirements

Over 30 parcels could potentially be impacted by construction of this alternative. Due to the variability in the final design alignment, a list of affected parcels is not provided for this alternative. Detailed survey, wetlands delineation and geotechnical investigations are recommended during detailed design to verify existing conditions prior to selecting a final design alignment.

4.1.6.4 Construction Problems

A thorough geotechnical investigation will be conducted along the gravity sewer route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and recommendations for dewatering and stabilization during installation of piping and the pump station wet well.

Sub-surface Utility Engineering (SUE) will also need to be performed to locate and avoid utility conflicts during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.6.5 Sustainability

The proposed gravity sewer will be made with construction materials in accordance with NCDEQ and Industry Standards.

Elimination of the Camp Judaea NPDES direct discharge to Henderson Creek and the drip irrigation system at Edneyville Elementary School will provide long-term reliable wastewater disposal via public sewer conveyance and treatment. This option provides a more sustainable solution than Alternatives 1, 1A, and 3, due to the use of gravity sewer and minimization of pumping long distances. It also provides opportunities for additional developable areas to be served by public sewer rather than on-site (septic) disposal.

4.1.6.6 Opinion of Probable Cost

A construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

- Estimated Construction Cost: **$29,560,000**
- Low Range (-30%): $20,690,000
- High Range (+50%) $44,340,000

A detailed OPC is included in Appendix D.

4.1.7 Alternative 4A – Regional Gravity Sewer System to New WWTF near North Henderson High School – Incorporate WNC Justice Academy and Fruitland Baptist Bible College

This sub-alternative involves the construction of a new WWTF near North Henderson High School on a parcel between Apple Orchard Road and Clear Creek. A new influent pump station in the same location at Alternative 4 and will collect wastewater via more than 24,000 LF gravity sewer from the sub-basins in the surrounding service area. Wastewater will be conveyed from the influent pump station to the WWTF via 750 LF of 18-inch force main. An additional 20,900 LF of gravity sewer will be installed to connect WNC Justice Academy to the regional sewer system. To connect Fruitland Baptist Bible College to the system, a new pump station will be constructed near the college and 5,000 LF of force main will be installed. Figure on the next page depicts this alternative.

4.1.7.1 Design Criteria

In addition to the base flows from Edneyville Elementary and Camp Judaea, the surrounding potential service area that could be served by the new gravity sewer was analyzed. Parcels were categorized based on potential developability and potential for re-development and/or conversion from on-site (septic) disposal to connection to the new gravity sewer. Parcels that were significantly within the 100-year floodplain, substantially developed, or existing large apple orchards were excluded.

Figure 4-8 on the next page depicts the potential parcels evaluated for contributory flows to the new gravity sewer line.

This sub-alternative involves the construction of a new WWTF near North Henderson High School on a parcel between Apple Orchard Road and Clear Creek. A new influent pump station will be constructed adjacent to Clear Creek to collect wastewater from 15,650 LF of gravity sewer from the surrounding service area. Wastewater will be conveyed from the influent pump station to the WWTF via 750 LF of force main. An additional 20,900 LF of gravity sewer will be installed to connect WNC Justice Academy to the regional sewer system. To connect Fruitland Baptist Bible College to the system, a new pump station will be constructed near the college and 5,000 LF of force main will be installed.

Figure 4-8: Alternative 4A Location Map

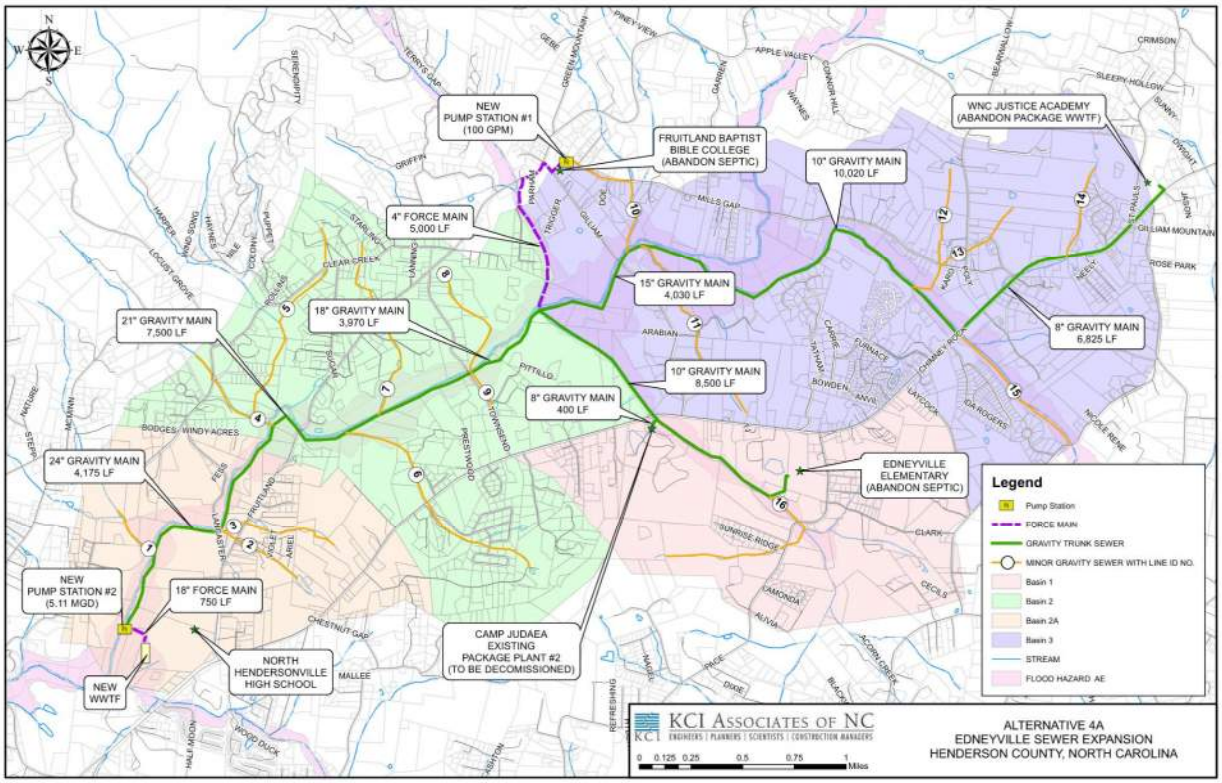
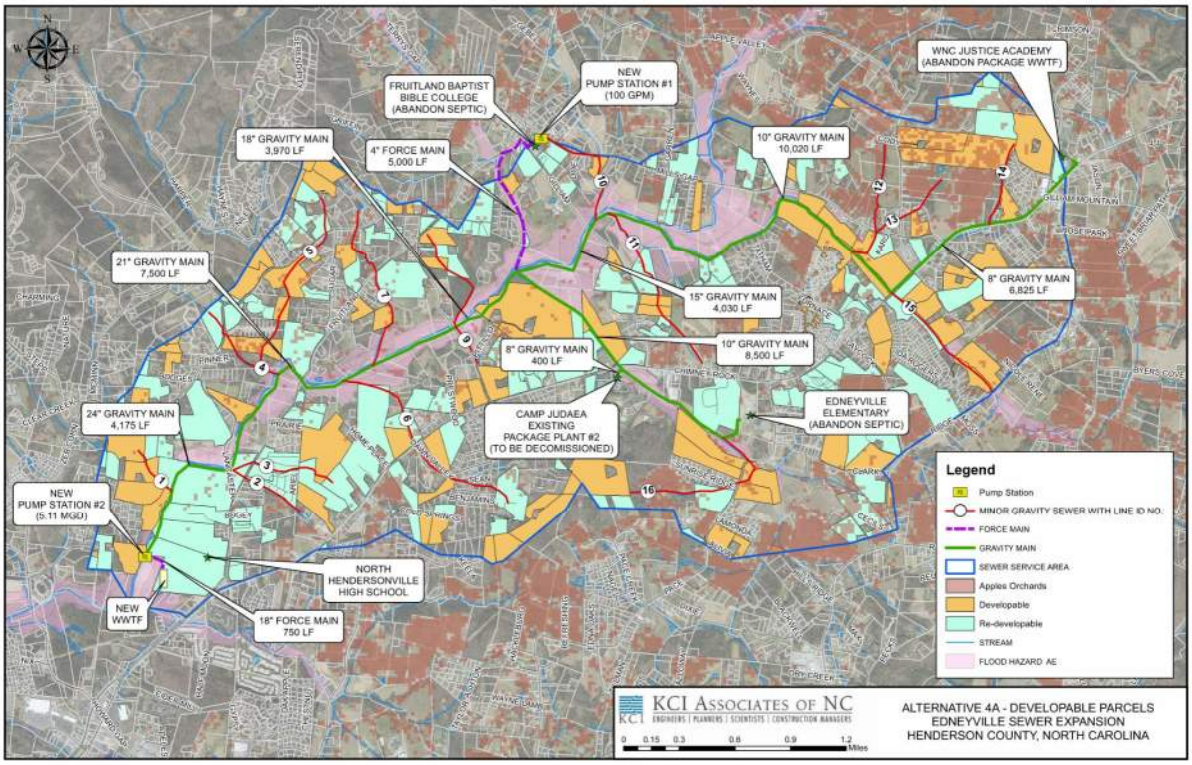


Figure 4-9: Alternative 4A Developable Parcels



Refer to Table 4-14 for Peak Daily Flow calculations presented below for the sizing of the gravity trunk sewers. It is assumed that all minor gravity sewer line will be 8-inch.

Table 4-14: Alternative 4A Proposed Gravity Trunk Sewer Sizing

Basins	PIPE SIZE & MATERIAL (inches)	SLOPE (%)[1]	PEAK DAILY FLOW (MGD)	% FULL (d/D)	AVAILABLE CAPACITY REMAINING IN PIPE (MGD) [2]
Basin 1	10" SDR 35 PVC	0.66%	0.78	0.62	0.34
Basin 3	15" SDR 35 PVC	0.40%	2.13	0.74	0.26
Basins 1 + 3	18" SDR 35 PVC	0.25%	2.67	0.69	0.55
Basin 2	24" SDR 35 PVC	0.15%	4.43	0.70	0.86
Basin 2A	24" SDR 35 PVC	0.15%	5.11	0.79	0.18

[1] Estimates for slope based on topography along the line.
[2] Available Remaining Pipe Capacity = Qfull – Peak Daily Flow, where Qfull is equal to the maximum flow that can be conveyed through the pipe.

The following new pump station capacity and associated force main size are recommended:

New Pump Station #1 (near Fruitland BBC): 100 gpm, 5,000 LF of 4-inch PVC force main;
New Pump Station #2 (near new WWTF): 5.11 MGD, 750 LF of 18-inch PVC force main.

4.1.7.2 Environmental Impacts

Minor standard construction impacts will come from constructing a new gravity sewer to replace the Camp Judaea WWTF and the Edneyville Elementary drip irrigation system. Replacing these systems should result in an improvement to water quality in Henderson Creek.

Installation of gravity sewer will result in creek/stream crossings and require clearing of wooded areas. Stormwater BMPs will be used to minimized temporary environmental impacts from construction.

4.1.7.3 Land Requirements

Over 45 parcels could potentially be impacted by construction of this alternative. Due to the variability in the final design alignment, a list of affected parcels is not provided for this alternative. Detailed survey, wetlands delineation and geotechnical investigations are recommended during detailed design to verify existing conditions prior to selecting a final design alignment.
The gravity sewer serving the Justice Academy along Hwy 64 would generally be located within the public road right-of-way. Temporary construction easements may be required on private property for bore pits at road crossings.

4.1.7.4 Construction Problems

Construction of the gravity sewer requires minimum constant grade in order to achieve the design flow rate. While general topography has been evaluated in this study, detailed design is required to verify existing conditions. A thorough geotechnical investigation will be conducted along the

gravity sewer route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and recommendations for dewatering and stabilization during installation of piping.

Sub-surface Utility Engineering (SUE) will also need to be performed, particularly in the public right-of-way, to locate and avoid utility conflicts during construction.

A portion of the gravity sewer will be constructed in within the public right-of-way. Temporary traffic control will be required in accordance with NCDOT requirements. Several jack-and-bores will be required for roadway crossings. There are also several commercial and residential driveways that will be temporarily impacted during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.7.5 Sustainability

The proposed gravity sewer will be made with construction materials in accordance with NCDEQ and Industry Standards.

Elimination of the drip irrigation system at Edneyville Elementary School and replacement with a gravity sewer will provide long-term reliable wastewater disposal. As noted previously, there are limitations to the long-term sustainability of operating the drip irrigation system. In addition, Elimination of the WWTF's at Camp Judea and Fruitland Baptist church will result in decreased operation and maintenance costs of decentralized treatment systems. Furthermore, combining multiple discharges into one larger discharge reduces compliance and environmental risks. Construction of the new WWTF will utilize modern treatment technology which will result in high quality treated effluent.

Replacing the antiquated Camp Judaea WWTF with a new WWTF should result in an improvement to water quality in Henderson Creek as treatment technologies have improved in the last several decades. Two sets of opinions of probable costs are provided below.

4.1.7.6 Opinion of Probable Cost

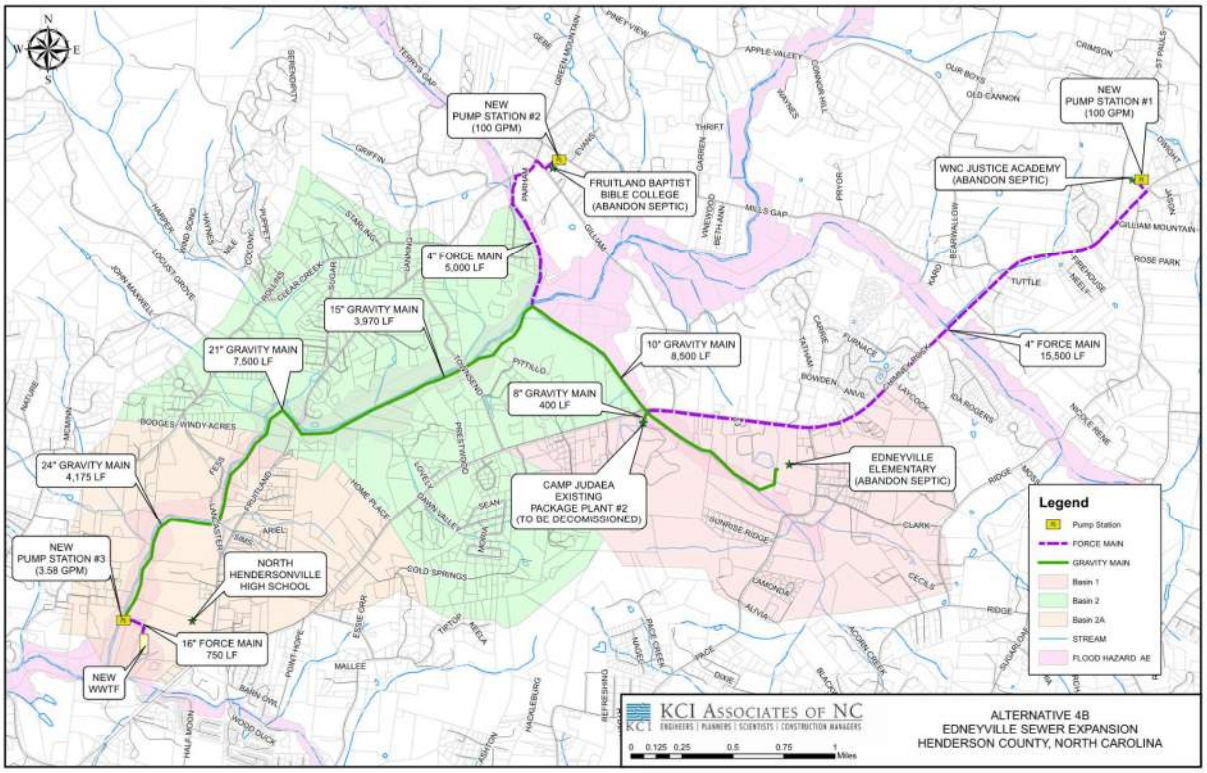
- Estimated Construction Cost: **$47,320,000**
- Low Range (-30%): $33,124,000
- High Range (+50%) $70,980,000

A detailed OPC is included in Appendix D.

4.1.8 ***Alternative 4B – Regional Gravity Sewer System to New WWTF near North Henderson High School – Incorporate WNC Justice Academy and Fruitland Baptist Bible College***

This sub-alternative is similar to Alternative 4A as it involves conveying flow from the WNC Justice Academy (See Figure 4-7 for illustration of the proposed improvements). This sub-alternative does not include the installation of gravity sewer within Basin 3 to collect the flow generated in this sub-basin. This sub-alternative involves the construction of a new WWTF near North Henderson High School on a parcel between Apple Orchard Road and Clear Creek. A new influent pump station will be constructed adjacent to Clear Creek to collect wastewater from 15,650 LF of gravity sewer from the surrounding service area. Wastewater will be conveyed from the influent pump station to the WWTF via 750 LF of force main. In order to connect Fruitland Baptist Bible College to the system, a new pump station will be constructed near the college and 5,000 LF of force main will be installed.

Figure 4-10: Alternative 4B Location Map



4.1.8.1 Design Criteria

In addition to the base flows from Edneyville Elementary and Camp Judaea, the potential flow generated in the surrounding potential service area (i.e. Basins 1, 2 and 2A) was analyzed. Parcels were categorized based on their parcel type, potential developability & potential for re-development and/or conversion from on-site (septic) disposal to connection to the new gravity

sewer. Parcels that were significantly within the 100-year floodplain, substantially developed, or existing large apple orchards were excluded. Refer to Table 4-12 for Peak Daily Flow calculations presented below for the sizing of the gravity trunk sewers shown in Table 4-13.

The new pump station capacity and associated force main size are recommended:

New Pump Station #1 (near Fruitland BBC): 100 gpm, 5,000 LF of 4-inch PVC force main;
New Pump Station #1 (near WNCJA): 100 gpm, 15,500 LF of 4-inch PVC force main;
New Pump Station (near new WWTF): 3.58 MGD, 750 LF of 18-inch PVC force main.

4.1.8.2 Environmental Impacts

Minor standard construction impacts will come from constructing a new gravity sewer to replace the Camp Judaea WWTF and the Edneyville Elementary drip irrigation system. Replacing these systems should result in an improvement to water quality in Henderson Creek.

Installation of gravity sewer will result in creek/stream crossings and require clearing of wooded areas. Stormwater BMPs will be used to minimized temporary environmental impacts from construction.

4.1.8.3 Land Requirements

Over 45 parcels could potentially be impacted by construction of this alternative. Due to the variability in the final design alignment, a list of affected parcels is not provided for this alternative. Detailed survey, wetlands delineation and geotechnical investigations are recommended during detailed design to verify existing conditions prior to selecting a final design alignment.

The force main serving the Justice Academy along Hwy 64 would generally be located within the public road right-of-way. Temporary construction easements may be required on private property for bore pits at road crossings.

4.1.8.4 Construction Problems

Construction of the gravity sewer requires minimum constant grade in order to achieve the design flow rate. While general topography has been evaluated in this study, detailed design is required to verify existing conditions. A thorough geotechnical investigation will be conducted along the gravity sewer route to anticipate, budget, and avoid subsurface rock where possible. The geotechnical investigation will also identify the depth to the water table and recommendations for dewatering and stabilization during installation of piping.

Sub-surface Utility Engineering (SUE) will also need to be performed, particularly in the public right-of-way, to locate and avoid utility conflicts during construction.

A small portion of the gravity sewer will be constructed in within the public right-of-way. Temporary traffic control will be required in accordance with NCDOT requirements. Several jack-and-bores will be required for roadway crossings. There are also several commercial and residential driveways that will be temporarily impacted during construction.

Other construction issues can be mitigated through detailed planning and phasing of construction activities.

4.1.8.5 Sustainability

The proposed gravity sewer will be made with construction materials in accordance with NCDEQ and Industry Standards.

Elimination of the drip irrigation system at Edneyville Elementary School and replacement with a gravity sewer will provide long-term reliable wastewater disposal. As noted previously, there are limitations to the long-term sustainability of operating the drip irrigation system. In addition, Elimination of the WWTF's at Camp Judaea and Fruitland Baptist church will result in decreased operation and maintenance costs of decentralized treatment systems.

Replacing the antiquated Camp Judaea WWTF with a new WWTF should result in an improvement to water quality in Henderson Creek.

4.1.8.6 Opinion of Probable Cost

- Estimated Construction Cost: **$33,190,000**
- Low Range (-30%): $23,233,000
- High Range (+50%) $49,785,000

A detailed OPC is included in Appendix D.

4.1.9 Alternative 4C – Regional Gravity Sewer System to New WWTF near North Henderson High School – Incorporate WNC Justice Academy and Fruitland Baptist Bible College

In addition to the main gravity sewer Trunk Lines in the primary Alternative 4, Henderson County requested KCI to capture the costs of the sewer collection lines that will drain into the larger trunk gravity mains shown in Alternative 4B. Alternative 4C mirrors Alternative 4A, with the only exception being the sewer collection lines are factored in the cost estimate. Design Criteria, Construction problems and Sustainability are similar to Alternative 4B. Land requirements will increase due to the installation of the minor gravity lines. Since this is a high-level concept of minor lines to be installed, a detailed analysis of land impacts was not performed.

The service area and the sizing of the gravity trunk sewer and other new sewer infrastructure shall remain unchanged. Thus, no additional calculations will be provided for this alternative. The costs of the collection lines will be incurred by the developers in these areas, not Henderson County. All smaller piping within each sub-basin is assumed to be 8-inch.

4.1.9.1 Opinion of Probable Cost (for Gravity Trunk Sewer & Minor Gravity Lines)

Table 4-15 below details the length of each pipe segment in Alternative 4C and the associated installed cost.

Table 4-15: Alternative 4C Proposed Gravity Sewer Sizing & Cost

Line ID No.	Basin	Length **(ft)**	Pipe Diameter (in.)	Unit Cost ($)	Total Cost ($)
1	Basin 2A	1,540	8	$100.00	$154,000
2		2,320	8	$100.00	$232,000
3		3,120	8	$100.00	$312,000
4	Basin 2	2,840	8	$100.00	$284,000
5		5,650	8	$100.00	$565,000
6		6,390	8	$100.00	$639,000
7		5,130	8	$100.00	$513,000
8		3,380	8	$100.00	$338,000
9		1,200	8	$100.00	$120,000
10	Basin 3	3,610	8	$100.00	$361,000
11		5,290	8	$100.00	$529,000
12		3,660	8	$100.00	$366,000
13		2,460	8	$100.00	$246,000
14		2,410	8	$100.00	$241,000
15		4,030	8	$100.00	$403,000
16	Basin 1	5,070	8	$100.00	$507,000
TOTALS		58,100	--	--	$5,810,000

An overall construction cost estimate was prepared to determine the anticipated costs for installation of this alternative. The following is the budget range anticipated for this alternative.

- Estimated Construction Cost: **$61,850,000**
- Low Range (-30%): $43,295,000
- High Range (+50%) $92,775,000
-

A detailed OPC is included in Appendix D.

5.0 ALTERNATIVES ANALYSIS

5.1.1 Life Cycle Cost Analysis

5.1.1.1 Capital Cost Evaluation

Table 5-1 depicts a summary of the probable capital cost of each Major Alternative summarized below. Detailed plans have not been created for any of the proposed projects, only conceptual designs for the purposes of estimation. Detailed opinions of cost are included in Appendix D.

Table 5-1: Capital Cost of Alternatives

Alternative	Estimated Capital Cost[a]
1. New PS @ Camp Judaea, Gravity from Edneyville, FM to COH	$3.6 Million
1A. New PS @ Edneyville Elem., FM to COH	$2.2 Million
2. New WWTF @ Camp Judaea, Gravity from Edneyville	$3.4 Million
3. 3 PS Along Hwy 64, Gravity to COH	$8.6 Million
3A. 3 PS Along Hwy 64, Gravity to COH, New PS @ WNC Justice Academy	$9.5 Million
4. Regional Gravity System from Edneyville to New WWTF @ N. Henderson High School	$29.6 Million
4A. Regional Gravity System from Edneyville, WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$47.3 Million
4B. Regional Gravity System from Edneyville, New PS @ WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$33.2 Million
4C. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School, including minor gravity sewer lines to serve developments	$61.9 Million

[a] Capital Cost includes construction, engineering, contingency, and all other up-front project costs, rounded to the nearest $100,000. Note that budgetary ranges were provided in Section 4 to show variability in actual construction costs at the PER level of analysis.

5.1.1.2 Calculation of Total Present Worth

Table 5-2 depicts the present worth life cycle costs of each alternative. The life cycle costs are based on the capital costs presented above, O&M costs and the usage of a Federal discount rate of 0.3% throughout the 20-year life cycle period. This discount rate was obtained from the current Appendix C of OMB Circular A-94 (November 2019).

The salvage value associated with each alternative is meant to represent the remaining value of the asset beyond the 20-year life cycle period. The term “salvage value” does not represent the ability to re-sell a used asset for profit, but is a way to quantify the remaining useful life of an asset. Gravity mains and manholes are estimated to have a useful life of 50 years, so 30 years’ worth of remaining value that extends beyond the lifecycle period is represented as salvage value to determine the total lifecycle present worth cost during the 20 year study period. Conceptual-level construction cost estimates are included in Appendix D. Present worth analyses for each alternative are included in Appendix E of this report.

Table 5-2: 20-Year Life Cycle Cost of Alternatives

Alternative	Capital Cost PW	O&M PW	Salvage Value PW	Estimated Life Cycle Cost PW
Alternative 1	$3.6 Million	$0.3 Million	($0.4 Million)	$3.5 Million
Alternative 1A	$2.2 Million	$0.3 Million	--	$2.5 Million
Alternative 2	$3.4 Million	$0.8 Million	($0.4 Million)	$3.9 Million
Alternative 3	$8.6 Million	$0.9 Million	($1.2 Million)	$8.3 Million
Alternative 3A	$9.5 Million	$0.9 Million	($1.2 Million)	$9.2 Million
Alternative 4	$29.6 Million	$1.0 Million	($3.1 Million)	$27.5 Million
Alternative 4A	$47.3Million	$1.7 Million	($4.8 Million)	$44.3 Million
Alternative 4B	$33.2 Million	$1.3 Million	($3.1 Million)	$31.5 Million
Alternative 4C	$61.9 Million	$1.7 Million	($4.8 Million)	$58.8 Million

5.1.2 Capital and Operational Cost Effectiveness

Capital cost effectiveness is a metric used to evaluate projects of substantially different size / scope. This metric uses the ratio of the capital cost vs. average daily flow to determine a cost per gallon treated or conveyed. The following table summarizes the capital cost effectiveness.

Table 5-3: Capital Cost Effectiveness

Alternative	Capital Cost [a] ($ Million)	ADF (MGD)	Cost / Gal [b]	Wastewater Treatment Entity
1. New PS @ Camp Judaea, Gravity from Edneyville, FM to COH	$3.58	0.020	$ 179.00	COH
1A. New PS @ Edneyville Elem., FM to COH	$2.20	0.009	$ 244.44	COH
2. New WWTF @ Camp Judaea, Gravity from Edneyville	$3.44	0.020	$ 172.00	**HC**
3. 3 PS Along Hwy 64, Gravity to COH	$8.57	0.35	$ 24.49	COH
3A. 3 PS Along Hwy 64, Gravity to COH, New PS @ WNC Justice Academy	$9.49	0.37	$ 27.11	COH
4. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School	$29.56	1.4	$ 21.11	**HC**
4A. Regional Gravity System from Edneyville, WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$47.32	2.1	$ 22.53	**HC**
4B. Regional Gravity System from Edneyville, New PS @ WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$33.19	1.4	$ 23.71	**HC**
4C. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School, including minor gravity sewer lines to serve developments	$61.85	1.4	$ 44.18	**HC**

[a] Costs do not include any required improvements to the COH system if current treatment capacity is insufficient to accept the additional flow from the project.

[b] Cost / Gallon is defined as the initial capital costs divided by the Average Daily Flow (ADF) of the total conveyance and/or treatment system.

It should be noted that for Alternative 3, the ADF assumes buildout of the 3 sub-basins. If the 3 pump stations are installed and only Edneyville and Camp Judea are served, the Cost / Gallon changes to $200 / gallon which is comparable to Alternatives 1 & 2. This analysis raises several additional key discussion points:

A. There are three general capital cost ranges:
    1. < $5 Million (Alternatives 1, 1A and 2)
    2. Approx. $10 Million (Alternatives 3 and 3A)
    3. > $25 Million (Alternatives 4, 4A,4B and 4C)

B. Ownership of the treatment system will either be by Henderson County (Alternatives 1, 1A, 3 and 3A) with the construction of a new WWTF, or by City of Hendersonville for treatment at the Hendersonville WWTF (Alternatives 2, 4, 4A,4B and 4C).

C. There is a distinct difference in the Cost per Gallon between alternatives 1, 1A and 2 and the remaining alternatives. The first three Alternatives only serve Edneyville Elementary and/or Camp Judea, resulting in very low service populations and therefore low average daily flows. The remaining four Alternatives all have larger service areas, therefore the ratio of capital cost to ADF (i.e. service population) is more favorable.

D. Alternatives 3 and 4 (including sub-alternatives) could be phased to create smaller initial capital projects with expansion in the future as growth occurs.

Operational cost effectiveness can also be used to compare O&M costs of projects with substantially different size / scope. This metric uses the ratio of the present worth O&M costs vs. average daily flow to determine a cost per gallon treated or conveyed. The following table summarizes the operational cost effectiveness.

Table 5-4: Operational Cost Effectiveness

Alternative	O&M PW ($ Million)	ADF (MGD)	Cost / Gal [a]
1. New PS @ Camp Judaea, Gravity from Edneyville, FM to COH	$0.30	0.020	$15.00
1A. New PS @ Edneyville Elem., FM to COH	$0.30	0.009	$33.33
2. New WWTF @ Camp Judaea, Gravity from Edneyville	$0.80	0.020	$40.00
3. 3 PS Along Hwy 64, Gravity to COH	$0.90	0.35	$2.57
3A. 3 PS Along Hwy 64, Gravity to COH, New PS @ WNC Justice Academy	$0.90	0.37	$2.43
4. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School	$1.00	1.400	$0.71
4A. Regional Gravity System from Edneyville, WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$1.70	2.100	$0.81

Alternative	O&M PW ($ Million)	ADF (MGD)	Cost / Gal [a]
4B. Regional Gravity System from Edneyville, New PS @ WNC Justice Academy & Fruitland Baptist to New WWTF @ N. Henderson High School.	$1.30	1.400	$0.93
4C. Regional Gravity System from Edneyville to New WWTF@ N. Henderson High School, including minor gravity sewer lines to serve developments	$1.70	2.100	$0.81

5.1.3 Non-Monetary Factors.

In addition to the capital costs presented previously, there are several non-monetary factors that contribute to the selection of a preferred alternative. Examples may include; goals of the County, socio-economic benefits, environmental benefits, sustainability, consolidation of resources, etc. Several of these factors are quantified in the scoring matrix presented in the next section. While these items are subjective, the use of a quantitative scoring weight provides a basis for considering non-monetary factors in decision-making.

5.1.4 Evaluation of Alternatives

The alternatives were evaluated based on each alternative's impact to the environment, service area coverage, land requirements, how well it accomplishes the County's objectives, initial capital cost, capital cost effectiveness, and operating cost effectiveness. A brief description of each criterion follows:

- Environmental Impact – considers effluent quality (if direct discharge) and the risk and nature of potential discharge violations. Also considers the impact on the use of decentralized treatment such as septic tanks within areas that have the potential to be served by the public sewer alternative;
- Service Area Coverage – considers the capability to serve a large service area without need for future expansion;
- Land Requirements – considers the number of private easements, total land area, and cost required;
- Meets Objectives – considers goals of the project including: providing wastewater collection to desired service areas, funding feasibility, regulatory compliance, etc.
- Initial Capital Cost – considers the magnitude of the initial capital investment required to fund the project.
- Capital Cost Effectiveness – considers the capital cost per gallon of capacity and the likelihood of obtaining sufficient project funding;
- Operating Cost Effectiveness – considers operations cost per gallon treated.

Values of 1 to 10 were assigned to each alternative under each category. Higher scoring indicates more favorable characteristics of the category. Parameters were also assigned weights according to their respective importance. The alternative with the highest overall weighted score (maximum weighted value of 10) is the most favorable based on the criteria.

The scoring values were color coded to help note differences between the different alternatives. A green, yellow and red scale was used to differentiate highest scores (green) from lowest scores (red).

Table 5-5: Alternatives Analysis Matrix

Parameter		Alt. 1		Alt. 1A		Alt. 2		Alt. 3		Alt. 3A		Alt. 4		Alt. 4A		Alt. 4B		Alt. 4C	
	Weight	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV	Value	WV
Environment Impact	10%	7	0.7	9	0.9	7	0.7	8	0.8	8	0.8	4	0.4	3	0.3	4	0.4	4	0.4
Service Area Coverage	15%	2	0.3	1	0.15	2	0.3	5	0.75	5	0.75	8	1.2	10	1.5	9	1.4	9	1.35
Land Requirements	10%	7	0.7	9	0.9	7	0.7	7	0.7	6	0.6	4	0.4	2	0.2	4	0.4	4	0.4
Meets Objectives	20%	9	1.8	7	1.4	4	0.8	8	1.6	8	1.6	5	1	4	0.8	5	1	5	1
Initial Captital Cost	15%	8	1.2	10	1.5	8	1.2	6	0.9	5	0.75	3	0.45	1	0.2	2	0.3	1	0.15
Capital Cost Effectiveness	20%	1	0.2	1	0.2	1	0.2	7	1.4	7	1.4	8	1.6	8	1.6	9	1.8	9	1.8
Operating Cost Effectiveness	10%	3	0.3	2	0.2	2	0.2	8	0.8	8	0.8	9	0.9	9	0.9	9	0.9	9	0.9
Total:	**100%**		**5.2**		**5.25**		**4.1**		**6.95**		**6.7**		**5.95**		**5.5**		**6.2**		**6**
Rank:		**8**		**7**		**9**		**1**		**2**		**5**		**6**		**3**		**4**	

Value Color Scale: 1 — 10

As shown in the above Alternatives Analysis Matrix, Alternative 3 had the highest overall score. The next highest score was Alternative 3A. The notable difference between these alternatives is the initial capital cost and land requirements. Other metrics were very similar between the two.

It should be noted that the scoring used above is based on KCI's experience with performing these assessments on previous projects. Some of the qualitative metrics such as "Meets Objectives" may vary depending on individual goals.

6.0 CONCLUSION & RECOMENDATIONS

A detailed evaluation was performed for each alternative and included the following key components; environmental impacts; land requirements, potential construction issues, and opinions of probable costs. In addition, a present worth analysis was conducted for each alternative to capture the total 20-year life cycle cost. The life cycle cost included initial capital, salvage value and operation & maintenance costs. Detailed summaries of these evaluations are included in the main report.

Since the projects varied greatly in scale, metrics other than costs were also evaluated. Two main evaluations were used to provide a meaningful comparison including:

1. Capital Cost Effectiveness - uses the ratio of the capital cost vs. average daily flow to determine a cost per gallon treated or conveyed.

2. Alternatives Analysis Matrix – evaluates each alternative's impact to the environment, service area coverage, land requirements, ability to meet objectives, initial capital cost, capital cost effectiveness, and operating cost effectiveness.

This analysis raises several key discussion points:

A. There are three general capital cost ranges:
    1. < $5 Million (Alternatives 1, 1A and 2)
    2. Approx. $10 Million (Alternatives 3 and 3A)
    3. > $25 Million (Alternatives 4, 4A,4B and 4C)

B. Ownership of the treatment system will either be by Henderson County (Alternatives 1, 1A, 3 and 3A) with the construction of a new WWTF, or by City of Hendersonville for treatment at the Hendersonville WWTF (Alternatives 2, 4, 4A,4B and 4C).

C. There is a distinct difference in the Cost per Gallon between alternatives 1, 1A and 2 and the remaining alternatives. The first three Alternatives only serve Edneyville Elementary and/or Camp Judea, resulting in very low service populations and therefore low average daily flows. The remaining four Alternatives all have larger service areas, therefore the ratio of capital cost to ADF (i.e. service population) is more favorable.

D. Alternatives 3 and 4 (including sub-alternatives) could be phased to create smaller initial capital projects with expansion in the future as growth occurs.

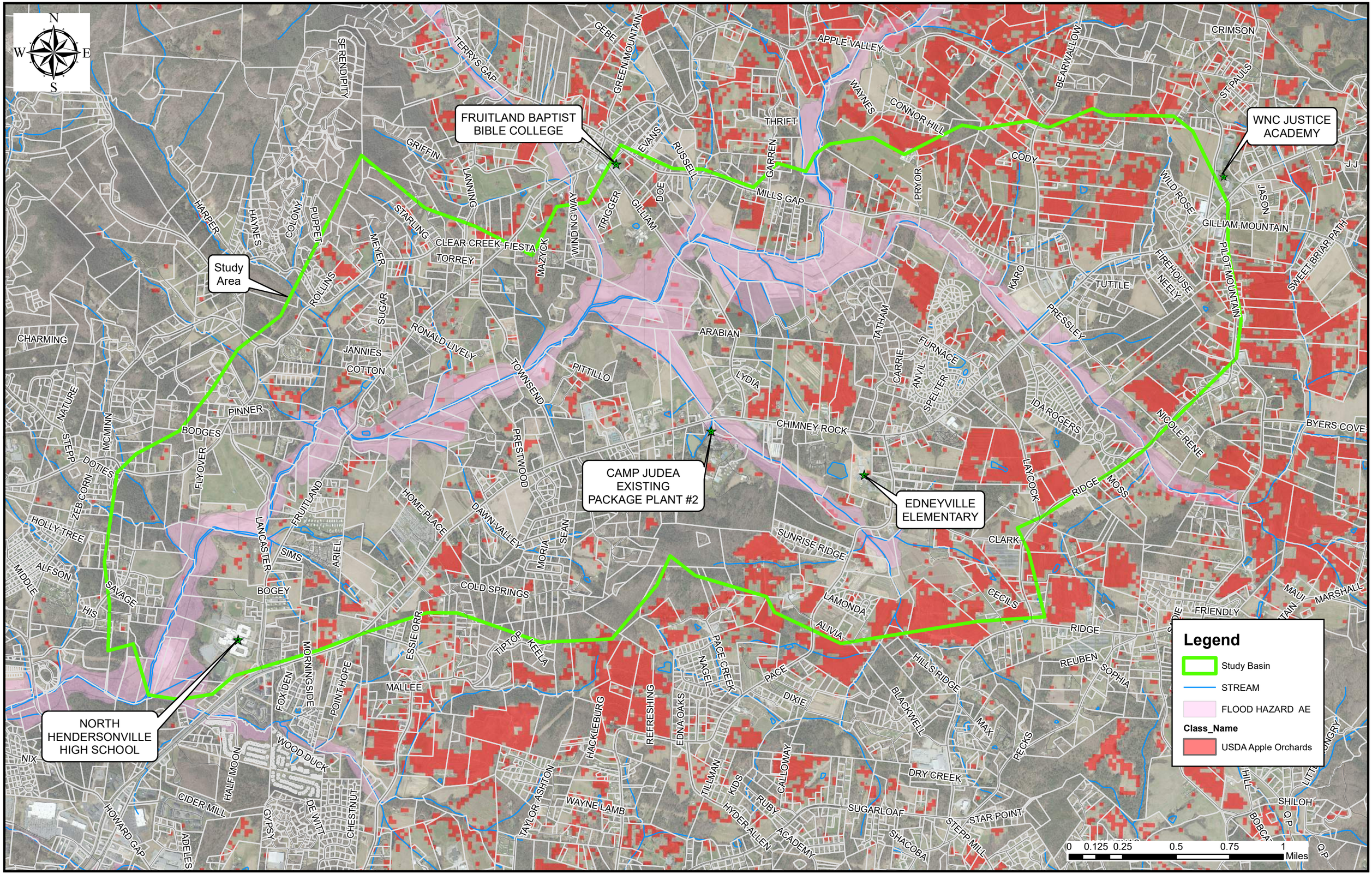
The following table provides a summary of the recommended infrastructure sizing and estimated quantities for each alternative.

Table 6-1: Summary of Alternatives Project Infrastructure

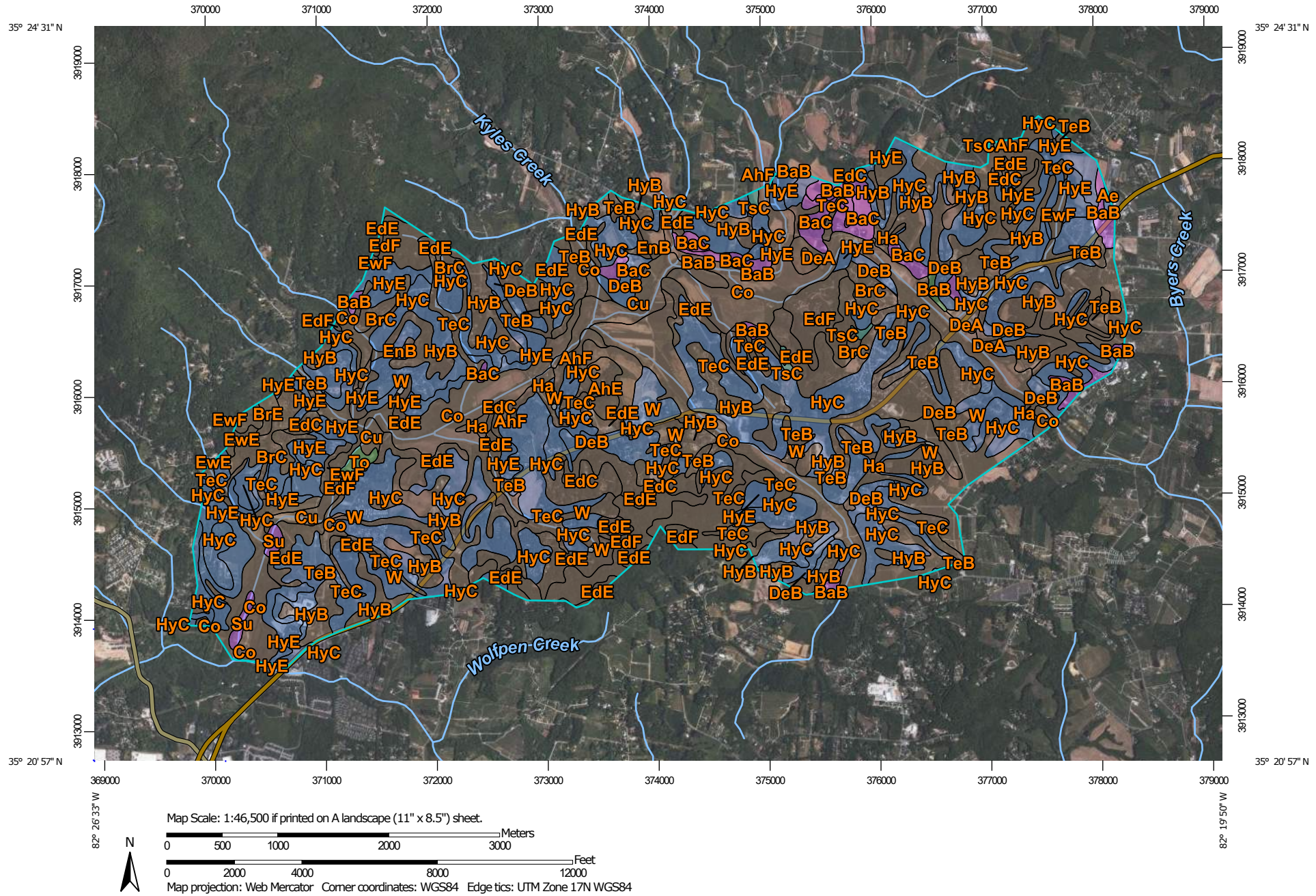
Alternative	ADF (mgd)	Gravity Sewers		Pump Stations		Force Mains		New WWTF	
		Length (ft)	Diameter (in.)	#	Capacity (gpm)	Length (ft)	Diameter (in.)	#	Capacity (MGD)
1	0.02	4,800	8	1	100	15,100	4	-	-
1A	0.009	-	-	1	100	19,600	4	-	-
2	0.02	4,800	8	-	-	-	-	1	0.02
3	0.35	400	8	1	270	2,800	6	-	-
		7,710	10	2	400	700	6	-	-
		4,200	15	3	770	4,450	8	-	-
3A	0.37	400	8	1	320	2,800	6	-	-
		7,710	10	2	440	700	6	-	-
		4,200	15	3	810	4,450	8	-	-
		-	-	4	100	5,000	4	-	-
4	1.4	400	8	1	2,490	750	16	1	1.4
		8,500	10	-	-	-	-	-	-
		3,970	15	-	-	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4A	2.1	7,225	8	1	3,550	750	18	1	2.1
		9,520	10	-	-	-	-	-	-
		4,030	15						
		3,970	18	-	-	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4B	1.4	400	8	1	100	750	16	1	1.4
		8,500	10	2	100	-	-	-	-
		3,970	15	3	2,490	-	-	-	-
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-
4C	1.4	64,324	8	1	3,550	750	18	1	2.1
		8,500	10	-	-	-	-	-	-
		3,970	15						
		7,500	21	-	-	-	-	-	-
		4,175	24	-	-	-	-	-	-

KCI recommends that Henderson County Staff and Commissioners review the scoring and obtain agreement on the overall goals of the project, as well as validating the scoring values used in the alternatives analysis matrix before the results are used for decision-making discussions. Additional discussions regarding project funding, ownership, sewer rates, and ultimate treatment are needed before an alternative is recommended for implementation.

APPENDIX A


N
W
E
S
FRUITLAND BAPTIST BIBLE COLLEGE
WNC JUSTICE ACADEMY
Study Area
CAMP JUDEA EXISTING PACKAGE PLANT #2
EDNEYVILLE ELEMENTARY
NORTH HENDERSONVILLE HIGH SCHOOL
SERENDIPITY
TERRYS GAP
GEBE
GREEN MOUNTAIN
APPLE VALLEY
BEARWALLOW
CRIMSON
ST PAULS
WAYNES
CONNOR HILL
THRIFT
GRIFFIN
EVANS
RUSSELL
GARREN
CODY
JJ
JASON
WILD ROSE
GILLIAM MOUNTAIN
SWEET BRIAR PATH
PILOT MOUNTAIN
FIREHOUSE
NEELY
TUTTLE
KARO
PRESSLEY
HARPER
HAYNES
COLONY
PUPPET
ROLLINS
MEYER
STARLING
CLEAR CREEK
FIESTA
TORREY
MAZYCK
WINDING WAY
TRIGGER
GILLIAM
DOE
MILLS GAP
PRYOR
LANNING
CHARMING
NATURE
STEPP
MCMINN
DOTIES
ZEB CORN
BODGES
PINNER
FLYOVER
SUGAR
RONALD LIVELY
JANNIES
COTTON
TOWNSEND
PITTILLO
ARABIAN
LYDIA
TATHAM
CARRIE
ANVIL
FURNACE
SPELTER
IDA ROGERS
CHIMNEY ROCK
BYERS COVE
NICOLE RENE
LAYCOCK
RIDGE
MOSS
HOLLY TREE
ALFSON
MIDDLE
SAVAGE
HIS
BOGEY
LANCASTER
SIMS
ARIEL
FRUITLAND
HOME PLACE
DAWN VALLEY
PRESTWOOD
MORIA
SEAN
SUNRISE RIDGE
CLARK
CECILS
LAMONDA
ALIVIA
COLD SPRINGS
TIPTOP KEELA
ESSIE ORR
MORNINGSIDE
FOX DEN
POINT HOPE
MALLEE
PACE CREEK
NAGEL
PACE
DIXIE
HILLS RIDGE
REUBEN
SOPHIA
FRIENDLY
MAUI
MARSHALL
HACKLEBURG
REFRESHING
EDNA OAKS
BLACKWELL
MAX
PECKS
NIX
HALF MOON
WOOD DUCK
CIDER MILL
HOWARD GAP
ADELES
GYPSY
DE WITT
CHESTNUT
TAYLOR ASHTON
WAYNE LAMB
TILLMAN
KIDS
RUBY
HYDERALLEN
ACADEMY
CALLOWAY
DRY CREEK
SUGARLOAF
SHACOBA
STEPP MILL
STAR POINT
SHILOH
BOBCAT
Legend
Study Basin
STREAM
FLOOD HAZARD AE
Class_Name
USDA Apple Orchards
0 0.125 0.25 0.5 0.75 1
Miles

AASHTO Group Classification (Surface)—Henderson County, North Carolina
(Edneyville Sewer PER)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Soil Rating Lines

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Soil Rating Points

- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

Soil Survey Area: Henderson County, North Carolina
Survey Area Data: Version 20, Jun 4, 2020

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

Date(s) aerial images were photographed: May 3, 2020—May 7, 2020

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

AASHTO Group Classification (Surface)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ae	Arents, loamy	A-6	3.5	0.1%
AhE	Ashe stony sandy loam, 15 to 25 percent slopes	A-4	28.2	0.5%
AhF	Ashe stony sandy loam, 25 to 45 percent slopes	A-4	33.0	0.5%
BaB	Bradson gravelly loam, 2 to 7 percent slopes	A-2-4	91.8	1.5%
BaC	Bradson gravelly loam, 7 to 15 percent slopes	A-2-4	85.9	1.4%
BrC	Brevard loam, 7 to 15 percent slopes	A-4	96.2	1.5%
BrE	Brevard loam, 15 to 25 percent slopes	A-4	10.5	0.2%
Co	Codorus loam (arkaqua)	A-4	812.6	13.0%
Cu	Comus (colvard) fine sandy loam	A-4	112.8	1.8%
DeA	Delanco (dillard) loam, 0 to 2 percent slopes	A-4	29.4	0.5%
DeB	Delanco (dillard) loam, 2 to 7 percent slopes	A-6	151.0	2.4%
EdC	Edneyville (edneytown) fine sandy loam, 7 to 15 percent slopes	A-4	94.8	1.5%
EdE	Edneyville (edneytown) fine sandy loam, 15 to 25 percent slopes	A-4	581.8	9.3%
EdF	Edneyville (edneytown) fine sandy loam, 25 to 45 percent slopes	A-4	238.7	3.8%
EnB	Elsinboro loam, 0 to 3 percent slopes	A-4	19.8	0.3%
EwE	Evard soils, 15 to 25 percent slopes	A-4	19.8	0.3%
EwF	Evard soils, 25 to 45 percent slopes	A-4	39.4	0.6%
Ha	Hatboro loam	A-4	134.7	2.2%
HyB	Hayesville loam, 2 to 7 percent slopes	A-4	925.4	14.8%
HyC	Hayesville loam, 7 to 15 percent slopes	A-6	1,873.1	30.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HyE	Hayesville loam, 15 to 25 percent slopes	A-6	317.3	5.1%
Ko	Kinkora loam	A-4	2.8	0.0%
Su	Suncook loamy sand (biltmore)	A-2-4	18.6	0.3%
TeB	Tate fine sandy loam, 2 to 7 percent slopes	A-4	227.6	3.6%
TeC	Tate fine sandy loam, 7 to 15 percent slopes	A-4	259.5	4.2%
To	Toxaway silt loam	A-7-5	17.7	0.3%
TsC	Tusquitee loam, 7 to 15 percent slopes	A-5	10.8	0.2%
W	Water		11.0	0.2%
Totals for Area of Interest			**6,247.8**	**100.0%**

Description

AASHTO group classification is a system that classifies soils specifically for geotechnical engineering purposes that are related to highway and airfield construction. It is based on particle-size distribution and Atterberg limits, such as liquid limit and plasticity index. This classification system is covered in AASHTO Standard No. M 145-82. The classification is based on that portion of the soil that is smaller than 3 inches in diameter.

The AASHTO classification system has two general classifications: (i) granular materials having 35 percent or less, by weight, particles smaller than 0.074 mm in diameter and (ii) silt-clay materials having more than 35 percent, by weight, particles smaller than 0.074 mm in diameter. These two divisions are further subdivided into seven main group classifications, plus eight subgroups, for a total of fifteen for mineral soils. Another class for organic soils is used.

For each soil horizon in the database one or more AASHTO Group Classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

U.S. Fish and Wildlife Service

National Wetlands Inventory

Edneyville Sewer Study Area

November 25, 2020

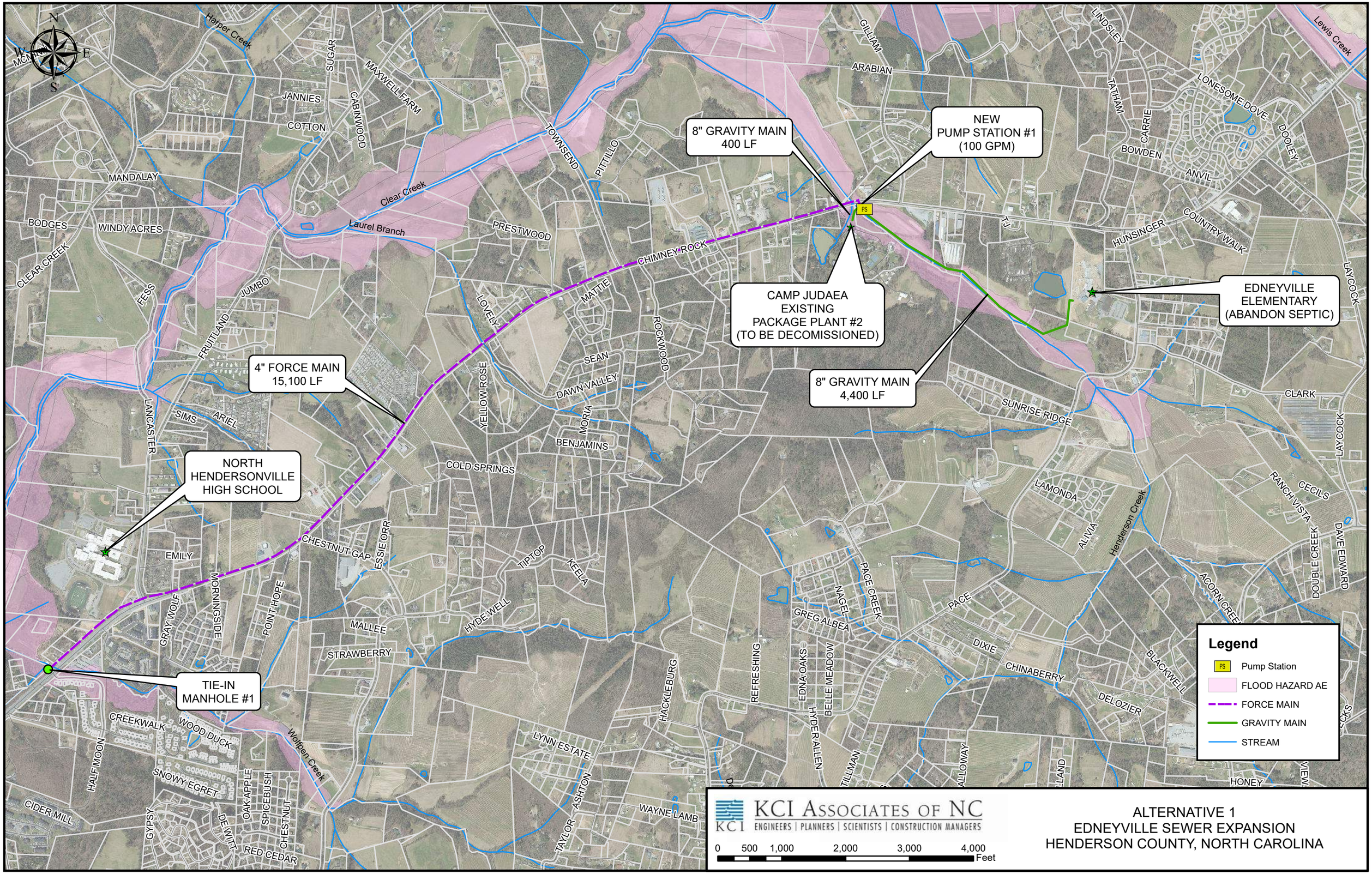
Wetlands

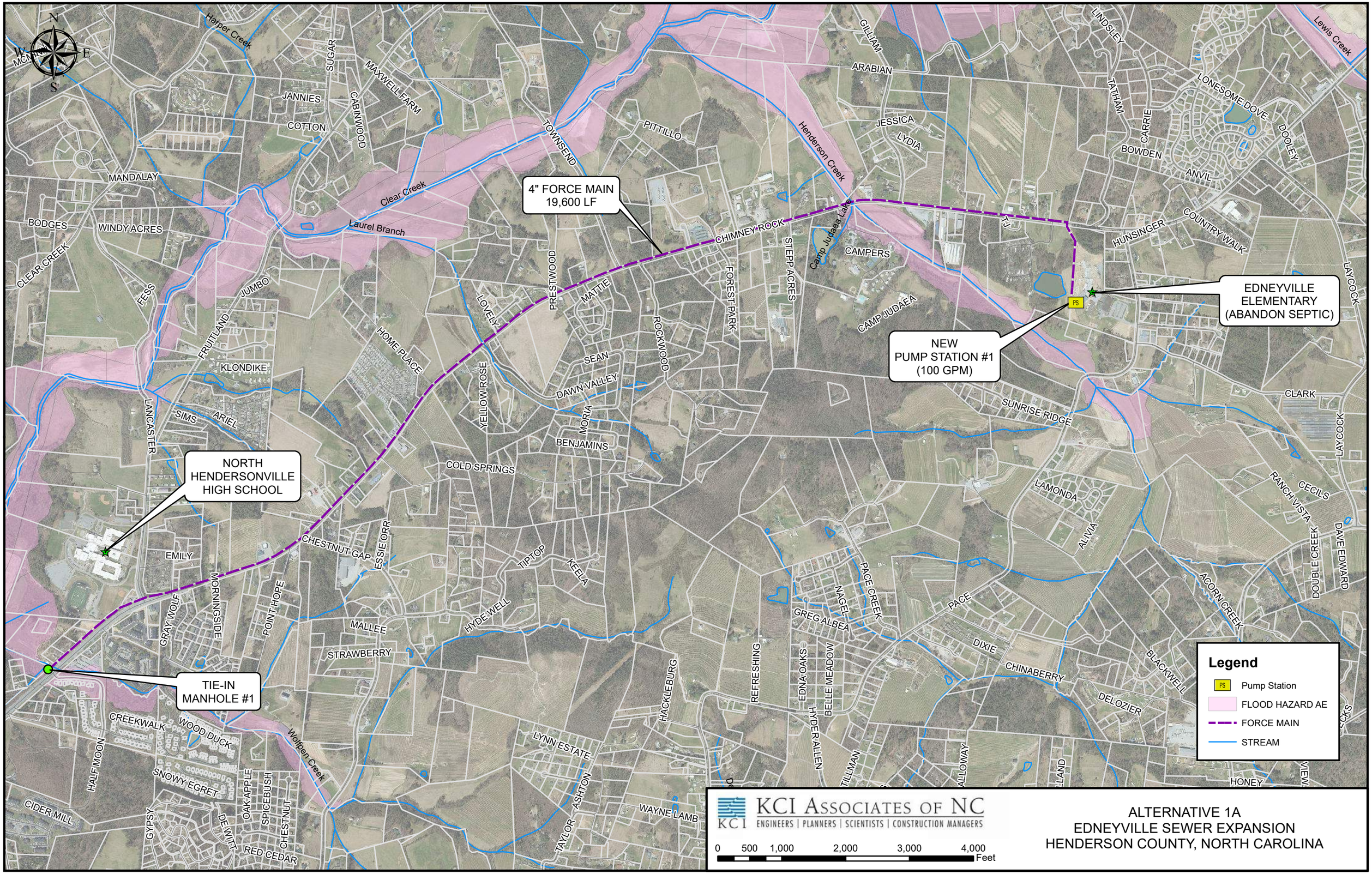
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

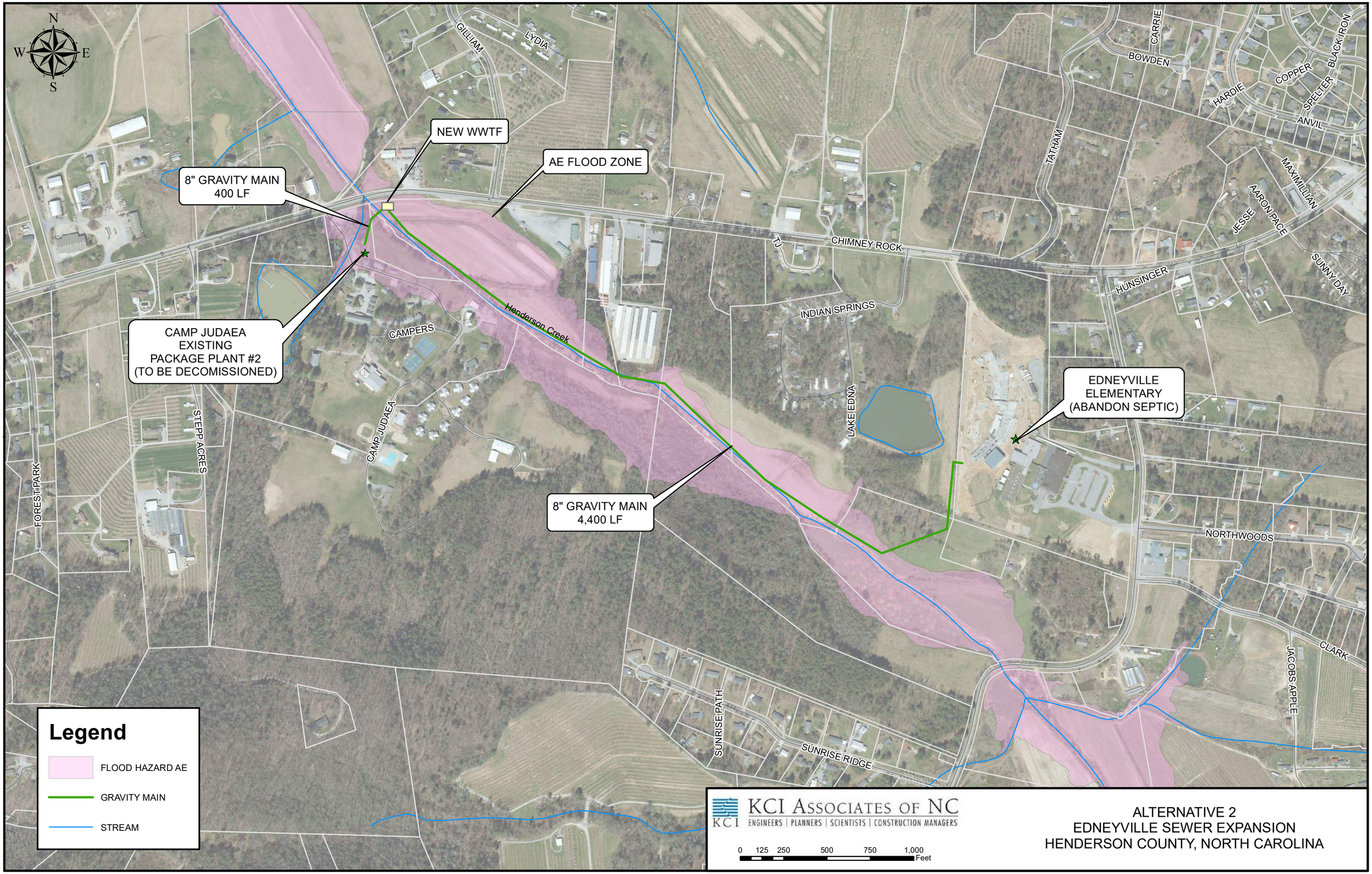
This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

APPENDIX B


8" GRAVITY MAIN
400 LF
NEW
PUMP STATION #1
(100 GPM)
CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
8" GRAVITY MAIN
4,400 LF
4" FORCE MAIN
15,100 LF
NORTH
HENDERSONVILLE
HIGH SCHOOL
TIE-IN
MANHOLE #1
PS
Harper Creek
Clear Creek
Laurel Branch
Lewis Creek
Henderson Creek
Wolfpen Creek
CHIMNEY ROCK
TOWNSEND
PITTILLO
GILLIAM
ARABIAN
LINDSLEY
TATHAM
CARRIE
LONESOME DOVE
DOOLEY
BOWDEN
ANVIL
HUNSINGER
COUNTRY WALK
LAYCOCK
CLARK
SUNRISE RIDGE
PRESTWOOD
MANDALAY
BODGES
WINDY ACRES
CLEAR CREEK
FESS
JUMBO
FRUITLAND
LANCASTER
SIMS
ARIEL
SUGAR
CABINWOOD
MAXWELL FARM
JANNIES
COTTON
LOVELY
MATTIE
ROCKWOOD
SEAN
DAWN VALLEY
MORIA
BENJAMINS
YELLOW ROSE
COLD SPRINGS
EMILY
CHESTNUT GAP
ESSIE ORR
TIPTOP
KEELA
MORNINGSIDE
POINT HOPE
GRAY WOLF
MALLEE
HYDE WELL
STRAWBERRY
CREEKWALK
WOOD DUCK
HALF MOON
SNOWY EGRET
CIDER MILL
GYPSY
DEWITT
OAK APPLE
SPICEBUSH
CHESTNUT
RED CEDAR
LYNN ESTATE
TAYLOR ASHTON
WAYNE LAMB
HACKLEBURG
REFRESHING
EDNA OAKS
BELLE MEADOW
HYDER ALLEN
TILLMAN
ALLOWAY
GREG ALBEA
NAGEL
PACE CREEK
PACE
DIXIE
CHINABERRY
DELOZIER
BLACKWELL
HONEY
LAMONDA
ALIVIA
RANCH VISTA
CECILS
DAVE EDWARD
DOUBLE CREEK
ACORN CREEK
Legend
Pump Station
FLOOD HAZARD AE
FORCE MAIN
GRAVITY MAIN
STREAM
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 500 1,000 2,000 3,000 4,000
Feet
ALTERNATIVE 1
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA


4" FORCE MAIN
19,600 LF
NEW
PUMP STATION #1
(100 GPM)
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
NORTH
HENDERSONVILLE
HIGH SCHOOL
TIE-IN
MANHOLE #1
PS
CHIMNEY ROCK
Harper Creek
Clear Creek
Laurel Branch
Henderson Creek
Lewis Creek
Camp Judaea Lake
Wolfpen Creek
MANDALAY
BODGES
WINDY ACRES
CLEAR CREEK
FESS
JUMBO
FRUITLAND
KLONDIKE
LANCASTER
SIMS
ARIEL
HOME PLACE
LOVELY
PRESTWOOD
MATTIE
ROCKWOOD
FOREST PARK
STEPP ACRES
SEAN
DAWN VALLEY
MORIA
BENJAMINS
COLD SPRINGS
YELLOW ROSE
JANNIES
COTTON
SUGAR
CABINWOOD
MAXWELL FARM
TOWNSEND
PITTILLO
GILLIAM
ARABIAN
JESSICA
LYDIA
CAMPERS
CAMP JUDAEA
TATHAM
LINDSLEY
CARRIE
LONESOME DOVE
DOOLEY
BOWDEN
ANVIL
HUNSINGER
COUNTRY WALK
LAYCOCK
CLARK
SUNRISE RIDGE
LAMONDA
ALIVIA
RANCH VISTA
CECILS
DAVE EDWARD
DOUBLE CREEK
ACORN CREEK
PACE
PACE CREEK
NAGEL
GREG ALBEA
DIXIE
CHINABERRY
BLACKWELL
DELOZIER
HONEY
EMILY
CHESTNUT GAP
ESSIE ORR
TIPTOP
KEELA
MORNINGSIDE
POINT HOPE
GRAY WOLF
MALLEE
HYDE WELL
STRAWBERRY
HACKLEBURG
REFRESHING
EDNA OAKS
BELLE MEADOW
HYDER ALLEN
TILLMAN
ALLOWAY
LYNN ESTATE
ASHTON
TAYLOR
WAYNE LAMB
CREEKWALK
WOOD DUCK
HALF MOON
SNOWY EGRET
CIDER MILL
GYPSY
DEWITT
OAK APPLE
SPICEBUSH
CHESTNUT
RED CEDAR
Legend
Pump Station
FLOOD HAZARD AE
FORCE MAIN
STREAM
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 500 1,000 2,000 3,000 4,000
Feet
ALTERNATIVE 1A
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA


N
W
E
S
NEW WWTF
AE FLOOD ZONE
8" GRAVITY MAIN
400 LF
CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)
8" GRAVITY MAIN
4,400 LF
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
GILLIAM
LYDIA
CHIMNEY ROCK
TJ
TATHAM
CARRIE
BOWDEN
HARDIE
COPPER
SPELTER
BLACKIRON
ANVIL
MAXIMILLIAN
AARON PACE
JESSE
SUNNY DAY
HUNSINGER
INDIAN SPRINGS
LAKE EDNA
Henderson Creek
CAMPERS
CAMP JUDAEA
STEPP ACRES
FOREST PARK
NORTHWOODS
CLARK
JACOBS APPLE
SUNRISE PATH
SUNRISE RIDGE
Legend
FLOOD HAZARD AE
GRAVITY MAIN
STREAM
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 125 250 500 750 1,000
Feet
ALTERNATIVE 2
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

N
W
E
S

Harper Creek
SUGAR
MAXWELL FARM
JANNIES
CABINWOOD
COTTON
MANDALAY
Clear Creek
Laurel Branch
BODGES
WINDY ACRES
CLEAR CREEK
LANCASTER
JUMBO
FRUITLAND
SIMS
ARIEL
PITTILLO
GILLIAM
ARABIAN
LINDSLEY
TATHAM
CARRIE
LONESOME DOVE
DOOLEY
BOWDEN
ANVIL
Lewis Creek
HUNSINGER
COUNTRY WALK
LAYCOCK
CLARK
MATTIE
MORIA
BENJAMINS
COLD SPRINGS
CHESTNUT GAP
ESSIE ORR
TIPTOP
KEELA
HYDE WELL
STRAWBERRY
THOMPSON
MORNINGSIDE
FOX DEN
GRAY WOLF
POINT HOPE
WOOD DUCK
Wolfpen Creek
SNOWY EGRET
HALF MOON
GYPSY
DEWITT
OAK APPLE
SPICEBUSH
CHESTNUT
RED CEDAR
LYNN ESTATE
ASHTON
TAYLOR
WAYNE LAMB
HACKLEBURG
REFRESHING
EDNA OAKS
BELLE MEADOW
HYDERALLEN
TILLMAN
GREG ALBEA
NAGEL
PACE CREEK
PACE
DIXIE
CHINABERRY
BLACKWELL
DELOZIER
ALLOWAY
HONEY
RANCH VISTA
CECILS
DAVE EDWARD
ALIVIA
Henderson Creek
CHIMNEY ROCK
PS

NEW
PUMP STATION #2
(400 GPM)

6" FORCE MAIN
2,800 LF

8" GRAVITY MAIN
400 LF

NEW
PUMP STATION #1
(270 GPM)

6" FORCE MAIN
700 LF

NEW
PUMP STATION #3
(770 GPM)

10" GRAVITY MAIN
1,700 LF

10" GRAVITY MAIN
1,250 LF

8" FORCE MAIN
4,450 LF

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

10" GRAVITY MAIN
4,400 LF

NORTH
HENDERSONVILLE
HIGH SCHOOL

15" GRAVITY MAIN
4,200 LF

TIE-IN
MANHOLE #1

Legend

- Pump Station
- FORCE MAIN
- GRAVITY MAIN
- Service Basin 1
- Service Basin 2
- Service Basin 3
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 500 1,000 2,000 3,000 4,000 Feet

ALTERNATIVE 3
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

N
W
E
S

Harper Creek
SUGAR
MAXWELL FARM
JANNIES
CABINWOOD
COTTON
MANDALAY
Clear Creek
Laurel Branch
BODGES
WINDY ACRES
CLEAR CREEK
LANCASTER
JUMBO
FRUITLAND
SIMS
ARIEL
PITTILLO
GILLIAM
ARABIAN
LINDSLEY
TATHAM
CARRIE
LONESOME DOVE
DOOLEY
BOWDEN
ANVIL
Lewis Creek
LAYCOCK
CLARK
CECILS
RANCH VISTA
DAVE EDWARD
ALIVIA
Henderson Creek
HONEY

8" GRAVITY MAIN
400 LF

NEW
PUMP STATION #1
(270 GPM)

6" FORCE MAIN
2,800 LF

NEW
PUMP STATION #2
(400 GPM)

CHIMNEY ROCK

PS

74

HUNSINGER
COUNTRY WALK

6" FORCE MAIN
700 LF

MATTIE

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

10" GRAVITY MAIN
1,700 LF

NEW
PUMP STATION #3
(770 GPM)

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

10" GRAVITY MAIN
1,250 LF

8" FORCE MAIN
4,450 LF

MORIA
BENJAMINS
COLD SPRINGS

10" GRAVITY MAIN
4,400 LF

NORTH
HENDERSONVILLE
HIGH SCHOOL

CHESTNUT GAP
ESSIE ORR
TIPTOP
KEELA
THOMPSON
MORNINGSIDE
FOX DEN
GRAY WOLF
POINT HOPE
HYDE WELL
STRAWBERRY

15" GRAVITY MAIN
4,200 LF

TIE-IN
MANHOLE #1

WOOD DUCK
Wolfpen Creek
SNOWY EGRET
HALF MOON
GYPSY
DEWITT
OAK APPLE
SPICEBUSH
CHESTNUT
RED CEDAR
LYNN ESTATE
TAYLOR ASHTON
WAYNE LAMB
HACKLEBURG
REFRESHING
EDNA OAKS
BELLE MEADOW
HYDER ALLEN
TILLMAN
GREG ALBEA
NAGEL
PACE CREEK
PACE
DIXIE
CHINABERRY
DELOZIER
BLACKWELL
ALLOWAY

Legend

- PS — Pump Station
- FORCE MAIN
- GRAVITY MAIN
- Developable
- Re-developable
- Service Basin 1
- Service Basin 2
- Service Basin 3
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 500 1,000 2,000 3,000 4,000 Feet

ALTERNATIVE 3 - DEVELOPABLE PARCELS
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

NEW
PUMP STATION #4
(100 GPM)

WNC JUSTICE ACADEMY
(ABANDON PACKAGE WWTF)

4" FORCE MAIN
15,500 LF

NEW
PUMP STATION #1
(270 GPM)

8" GRAVITY MAIN
400 LF

6" FORCE MAIN
2,800 LF

NEW
PUMP STATION #2
(400 GPM)

6" FORCE MAIN
700 LF

NEW
PUMP STATION #3
(770 GPM)

10" GRAVITY MAIN
1,700 LF

10" GRAVITY MAIN
1,250 LF

8" FORCE MAIN
4,450 LF

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

10" GRAVITY MAIN
4,400 LF

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

NORTH
HENDERSONVILLE
HIGH SCHOOL

15" GRAVITY MAIN
4,200 LF

TIE-IN
MANHOLE #1

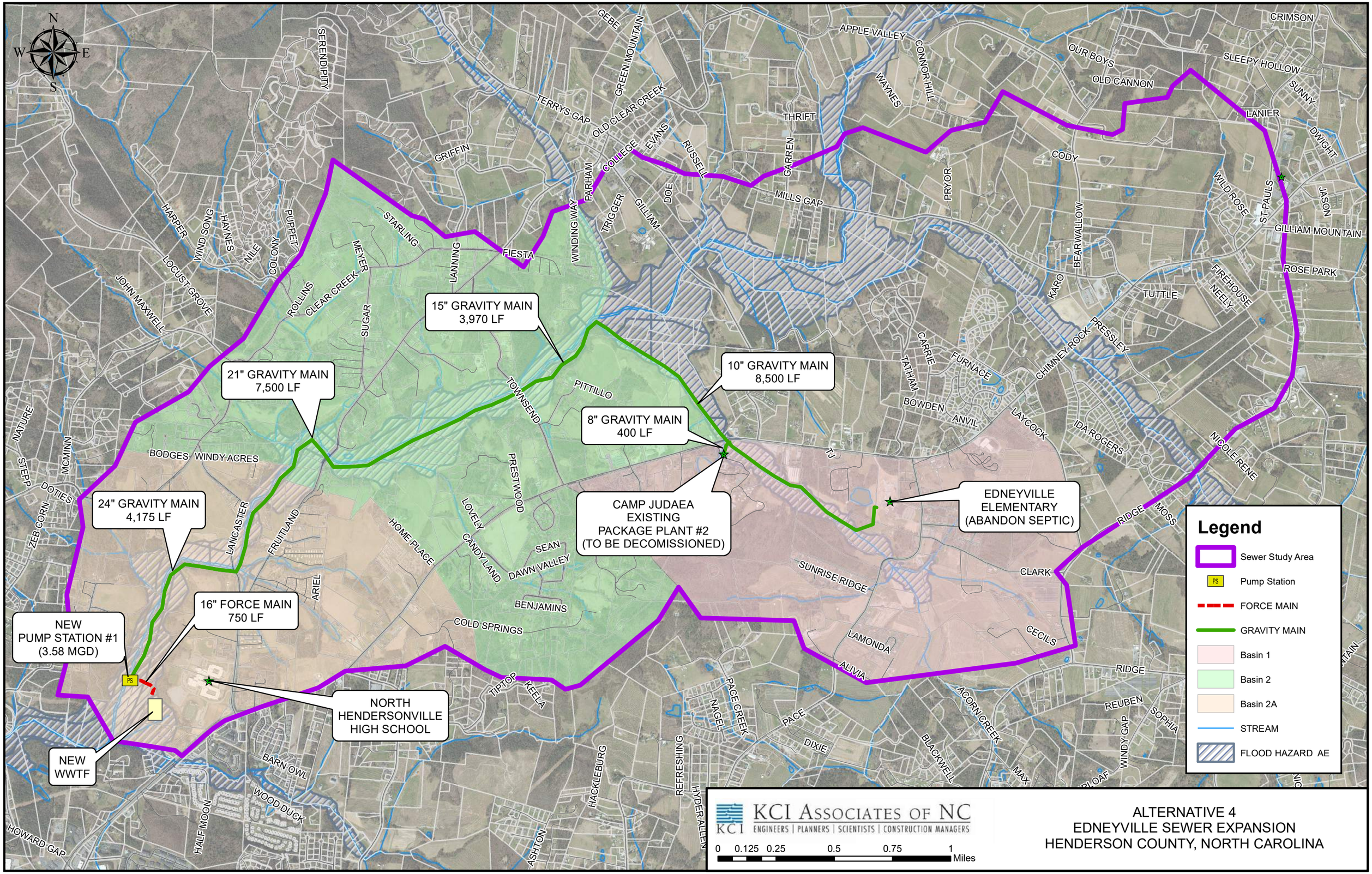
Legend

- Pump Station
- FORCE MAIN
- GRAVITY MAIN
- Service Basin 1
- Service Basin 2
- Service Basin 3
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 700 1,400 2,800 4,200 5,600 Feet

ALTERNATIVE 3A
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA


15" GRAVITY MAIN
3,970 LF
21" GRAVITY MAIN
7,500 LF
10" GRAVITY MAIN
8,500 LF
8" GRAVITY MAIN
400 LF
24" GRAVITY MAIN
4,175 LF
16" FORCE MAIN
750 LF
NEW
PUMP STATION #1
(3.58 MGD)
NEW
WWTF
NORTH
HENDERSONVILLE
HIGH SCHOOL
CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
Legend
Sewer Study Area
Pump Station
FORCE MAIN
GRAVITY MAIN
Basin 1
Basin 2
Basin 2A
STREAM
FLOOD HAZARD AE
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 0.125 0.25 0.5 0.75 1 Miles
ALTERNATIVE 4
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

21" GRAVITY MAIN
7,500 LF

15" GRAVITY MAIN
3,970 LF

10" GRAVITY MAIN
8,500 LF

8" GRAVITY MAIN
400 LF

24" GRAVITY MAIN
4,175 LF

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

16" FORCE MAIN
750 LF

NEW
PUMP STATION #1
(3.58 MGD)

NORTH
HENDERSONVILLE
HIGH SCHOOL

NEW
WWTF

TERRYS GAP
OLD CLEAR CREEK
GRIFFIN
LANNING
EVANS
RUSSELL
THRIFT
WAYNES
CONNOR HILL
APPLE VALLEY
OLD CANNON
SLEEPY HOLLOW
SUNNY
LANIER
DWIGHT
HIDDEN VIEW
CODY
JASON
WILD ROSE
MAY APPLE
ST PAULS
ROSE PARK
FIREHOUSE
NEELY
TUTTLE
KARO
FOLLY BEARWALLOW
PRESSLEY
CHIMNEY ROCK
CARRIE
FURNACE
TATHAM
BOWDEN
ANVIL
LAYCOCK
IDA ROGERS
NICOLE RENE
CIRCLE L FARM
RIDGE MOSS
REUBEN
WINDY GAP
MAX
BLACKWELL
ACORN CREEK
DIXIE
RIDGE
CLARK
CECILS
LAMONDA
ALIVIA
SUNRISE RIDGE
PRYOR
MILLS GAP
GARREN
DOE
GILLIAM
TRIGGER
PARHAM
WINDING WAY
MAZYCK
FIESTA
CLEAR CREEK
TORREY
STARLING
MEYER
SUGAR
HELEN
COTTON
MCMINN
PINNER
TOWNSEND
PITTILLO
PRESTWOOD
LOVELY
CANDYLAND
SEAN
DAWN VALLEY
BENJAMINS
COLD SPRINGS
HOME PLACE
FRUITLAND
LANCASTER
ARIEL
TIPTOP
KEELA
PACE CREEK
NAGEL
REFRESHING
HACKLEBURG
MORNING
TAYLOR
WAYNE LAMB
PAGE
BARN OWL
WOOD DUCK
WOODSIDE VIEW
HALF MOON
CIDER MILL
CHESTNUT
HARPER
WIND SONG
HAYNES
YALE
COLONY
PUPPET
LOCUST GROVE
TJ

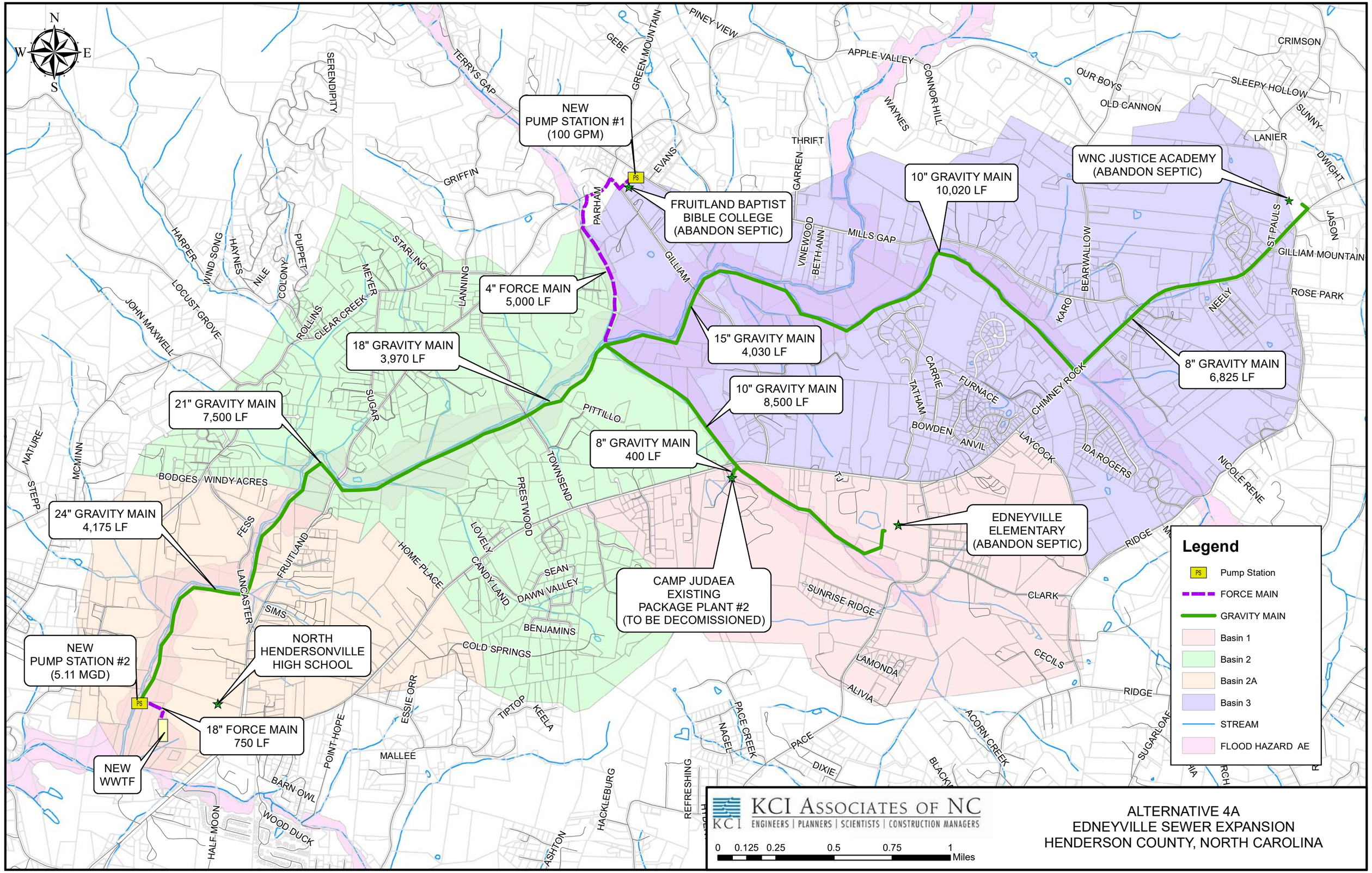
Legend

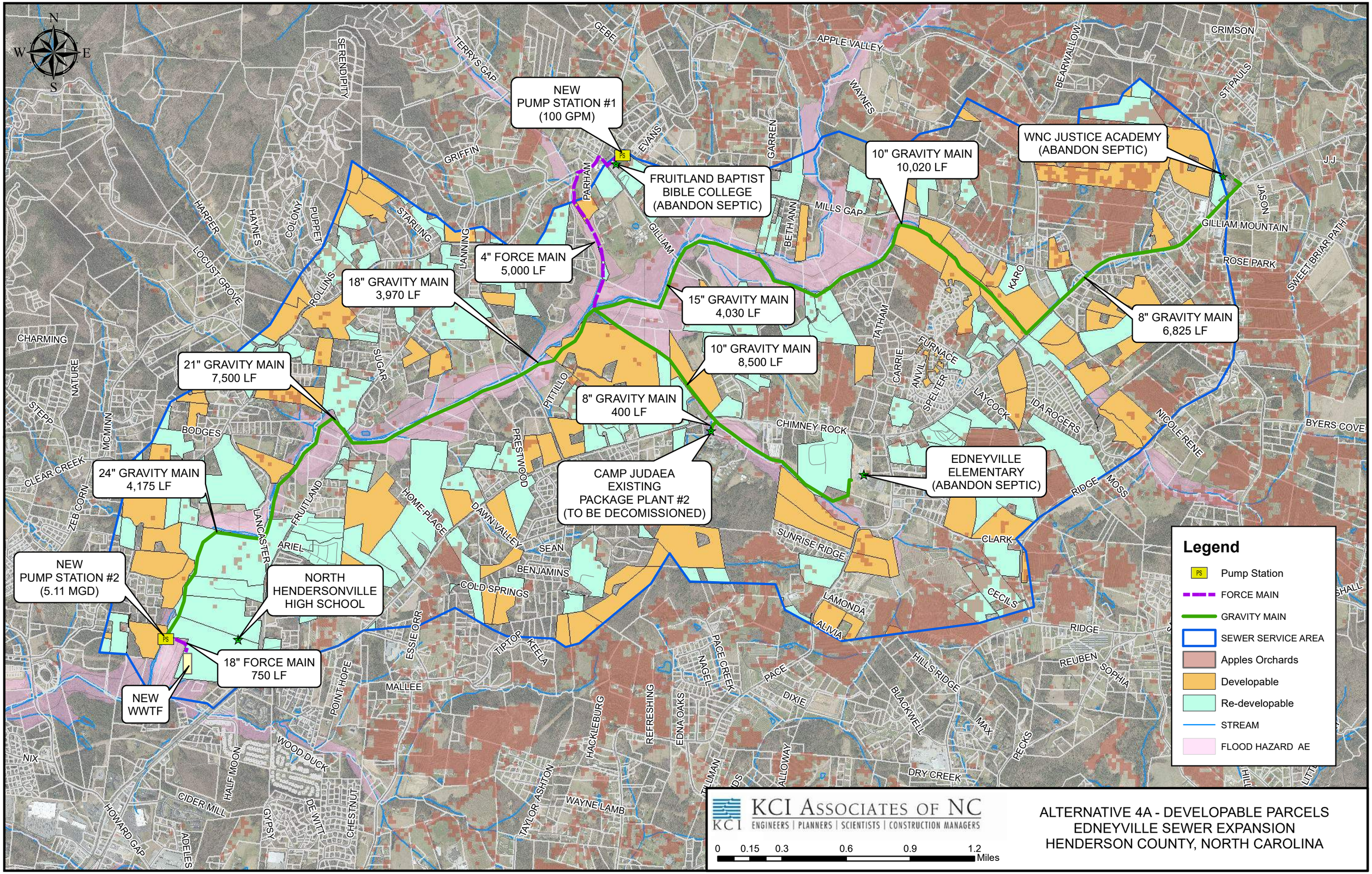
- Sewer Study Area
- Pump Station
- FORCE MAIN
- GRAVITY MAIN
- Developable
- Re-developable
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 0.125 0.25 0.5 0.75 1 Miles

ALTERNATIVE 4 - DEVELOPABLE PARCELS
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA


N
W
E
S
NEW
PUMP STATION #1
(100 GPM)
PS
FRUITLAND BAPTIST
BIBLE COLLEGE
(ABANDON SEPTIC)
WNC JUSTICE ACADEMY
(ABANDON SEPTIC)
10" GRAVITY MAIN
10,020 LF
4" FORCE MAIN
5,000 LF
15" GRAVITY MAIN
4,030 LF
8" GRAVITY MAIN
6,825 LF
18" GRAVITY MAIN
3,970 LF
21" GRAVITY MAIN
7,500 LF
10" GRAVITY MAIN
8,500 LF
8" GRAVITY MAIN
400 LF
24" GRAVITY MAIN
4,175 LF
CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
NEW
PUMP STATION #2
(5.11 MGD)
NORTH
HENDERSONVILLE
HIGH SCHOOL
18" FORCE MAIN
750 LF
NEW
WWTF
SERENDIPITY
TERRYS GAP
GEBE
GREEN MOUNTAIN
PINEY VIEW
APPLE VALLEY
CONNOR HILL
WAYNES
OUR BOYS
OLD CANNON
CRIMSON
SLEEPY HOLLOW
SUNNY
LANIER
DWIGHT
JASON
GILLIAM MOUNTAIN
ROSE PARK
NEELY
ST PAULS
BEARWALLOW
KARO
CHIMNEY ROCK
CARRIE
FURNACE
TATHAM
BOWDEN
ANVIL
LAYCOCK
IDA ROGERS
NICOLE RENE
RIDGE
CLARK
SUNRISE RIDGE
CECILS
LAMONDA
ALIVIA
ACORN CREEK
SUGARLOAF
PACE
PACE CREEK
NAGEL
DIXIE
REFRESHING
HACKLEBURG
ASHTON
MALLEE
POINT HOPE
ESSIE ORR
TIPTOP
KEELA
COLD SPRINGS
BENJAMINS
SEAN
DAWN VALLEY
CANDY LAND
LOVELY
PRESTWOOD
TOWNSEND
HOME PLACE
FRUITLAND
FESS
LANCASTER
SIMS
BODGES
WINDY ACRES
NATURE
STEPP
MCMINN
HALF MOON
WOOD DUCK
BARN OWL
JOHN MAXWELL
LOCUST GROVE
HARPER
WIND SONG
HAYNES
NILE
COLONY
PUPPET
ROLLINS
CLEAR CREEK
MEYER
STARLING
LANNING
SUGAR
PITTILLO
GRIFFIN
PARHAM
EVANS
GILLIAM
VINEWOOD
BETH ANN
GARREN
THRIFT
MILLS GAP
TJ
Legend
Pump Station
FORCE MAIN
GRAVITY MAIN
Basin 1
Basin 2
Basin 2A
Basin 3
STREAM
FLOOD HAZARD AE
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 0.125 0.25 0.5 0.75 1
Miles
ALTERNATIVE 4A
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA


NEW
PUMP STATION #1
(100 GPM)
FRUITLAND BAPTIST
BIBLE COLLEGE
(ABANDON SEPTIC)
4" FORCE MAIN
5,000 LF
18" GRAVITY MAIN
3,970 LF
15" GRAVITY MAIN
4,030 LF
10" GRAVITY MAIN
10,020 LF
WNC JUSTICE ACADEMY
(ABANDON SEPTIC)
8" GRAVITY MAIN
6,825 LF
10" GRAVITY MAIN
8,500 LF
8" GRAVITY MAIN
400 LF
21" GRAVITY MAIN
7,500 LF
24" GRAVITY MAIN
4,175 LF
CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)
EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)
NEW
PUMP STATION #2
(5.11 MGD)
NORTH
HENDERSONVILLE
HIGH SCHOOL
18" FORCE MAIN
750 LF
NEW
WWTF
PS
N
S
E
W
SERENDIPITY
TERRYS GAP
GEBE
APPLE VALLEY
WAYNES
BEARWALLOW
CRIMSON
ST PAULS
J J
JASON
GILLIAM MOUNTAIN
ROSE PARK
SWEET BRIAR PATH
GRIFFIN
EVANS
PARHAM
GILLIAM
GARREN
BETHANN
MILLS GAP
HARPER
LOCUST GROVE
HAYNES
COLONY
PUPPET
STARLING
LANNING
ROLLINS
KARO
TATHAM
CARRIE
ANVIL
FURNACE
SPELTER
LAYCOCK
IDA ROGERS
NICOLE RENE
BYERS COVE
CHARMING
NATURE
STEPP
MCMINN
SUGAR
PITTILLO
BODGES
CHIMNEY ROCK
PRESTWOOD
CLEAR CREEK
ZEB CORN
LANCASTER
FRUITLAND
HOME PLACE
DAWN VALLEY
SEAN
BENJAMINS
ARIEL
COLD SPRINGS
SUNRISE RIDGE
CLARK
RIDGE
MOSS
LAMONDA
CECILS
ALIVIA
ESSIE ORR
TIPTOP
KEELA
POINT HOPE
MALLEE
PACE CREEK
NAGEL
PACE
DIXIE
HILLS RIDGE
BLACKWELL
REUBEN
SOPHIA
MAX
PECKS
DRY CREEK
HACKLEBURG
REFRESHING
EDNA OAKS
TAYLOR ASHTON
WAYNE LAMB
NIX
HALF MOON
WOOD DUCK
CIDER MILL
HOWARD GAP
GYPSY
DE WITT
CHESTNUT
ADELIES
Legend
Pump Station
FORCE MAIN
GRAVITY MAIN
SEWER SERVICE AREA
Apples Orchards
Developable
Re-developable
STREAM
FLOOD HAZARD AE
KCI ASSOCIATES OF NC
ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS
0 0.15 0.3 0.6 0.9 1.2
Miles
ALTERNATIVE 4A - DEVELOPABLE PARCELS
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

N
W
E
S

NEW
PUMP STATION #2
(100 GPM)

FRUITLAND BAPTIST
BIBLE COLLEGE
(ABANDON SEPTIC)

4" FORCE MAIN
5,000 LF

15" GRAVITY MAIN
3,970 LF

21" GRAVITY MAIN
7,500 LF

10" GRAVITY MAIN
8,500 LF

8" GRAVITY MAIN
400 LF

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

NEW
PUMP STATION #1
(100 GPM)

WNC JUSTICE ACADEMY
(ABANDON SEPTIC)

4" FORCE MAIN
15,500 LF

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

24" GRAVITY MAIN
4,175 LF

NEW
PUMP STATION #3
(3.58 GPM)

NORTH
HENDERSONVILLE
HIGH SCHOOL

16" FORCE MAIN
750 LF

NEW
WWTF

SERENDIPITY
TERRYS GAP
GEBE
GREEN MOUNTAIN
PINEY VIEW
APPLE VALLEY
CONNOR HILL
WAYNES
OUR BOYS
OLD CANNON
CRIMSON
ST PAULS
DWIGHT
JASON
GILLIAM MOUNTAIN
ROSE PARK
FIREHOUSE
NEELY
TUTTLE
KARO
BEARWALLOW
PRYOR
MILLS GAP
THRIFT
GARREN
VINEWOOD
BETH ANN
GILLIAM
PARHAM
EVANS
GRIFFIN
HARPER
WIND SONG
HAYNES
NILE
COLONY
PUPPET
LOCUST GROVE
JOHN MAXWELL
STARLING
LANNING
ROLLINS
CLEAR CREEK
SUGAR
NATURE
MCMINN
BODGES
WINDY ACRES
FESS
LANCASTER
FRUITLAND
ARIEL
SIMS
HOME PLACE
PRESTWOOD
LOVELY
DAWN VALLEY
SEAN
MORIA
COLD SPRINGS
ESSIE ORR
POINT HOPE
TIPTOP
KEELA
MALLEE
BARN OWL
WOOD DUCK
HALF MOON
HACKLEBURG
ASHTON
REFRESHING
PACE CREEK
NAGEL
PACE
DIXIE
ACORN CREEK
SUNRISE RIDGE
LAMONDA
ALIVIA
CECILS
CLARK
RIDGE
MOSS
NICOLE RENE
IDA ROGERS
LAYCOCK
ANVIL
BOWDEN
TATHAM
CARRIE
FURNACE
CHIMNEY ROCK
PITTILLO
TOWNSEND

Legend

- Pump Station
- FORCE MAIN
- GRAVITY MAIN
- Basin 1
- Basin 2
- Basin 2A
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
KCI ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 0.125 0.25 0.5 0.75 1 Miles

ALTERNATIVE 4B
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

NEW
PUMP STATION #1
(100 GPM)

FRUITLAND BAPTIST
BIBLE COLLEGE
(ABANDON SEPTIC)

WNC JUSTICE ACADEMY
(ABANDON PACKAGE WWTF)

10" GRAVITY MAIN
10,020 LF

4" FORCE MAIN
5,000 LF

15" GRAVITY MAIN
4,030 LF

21" GRAVITY MAIN
7,500 LF

18" GRAVITY MAIN
3,970 LF

10" GRAVITY MAIN
8,500 LF

8" GRAVITY MAIN
6,825 LF

8" GRAVITY MAIN
400 LF

24" GRAVITY MAIN
4,175 LF

EDNEYVILLE
ELEMENTARY
(ABANDON SEPTIC)

NEW
PUMP STATION #2
(5.11 MGD)

18" FORCE MAIN
750 LF

NEW
WWTF

NORTH
HENDERSONVILLE
HIGH SCHOOL

CAMP JUDAEA
EXISTING
PACKAGE PLANT #2
(TO BE DECOMISSIONED)

SERENDIPITY
TERRYS GAP
GEBE
GREEN MOUNTAIN
PINEY VIEW
GARREN
APPLE VALLEY
WAYNES
CONNOR HILL
BEARWALLOW
CRIMSON
SLEEPY HOLLOW
SUNNY
DWIGHT
JASON
GILLIAM MOUNTAIN
ROSE PARK
NEELY
ST PAULS
GRIFFIN
PARHAM
TRIGGER
DOE
GILLIAM
MILLS GAP
HARPER
WIND SONG
HAYNES
NILE
COLONY
PUPPET
LOCUST GROVE
STARLING
CLEAR CREEK
LANNING
ROLLINS
SUGAR
PITTILLO
TOWNSEND
PRESTWOOD
ARABIAN
CARRIE
FURNACE
TATHAM
BOWDEN
ANVIL
LAYCOCK
IDA ROGERS
CHIMNEY ROCK
KARO
POLY
NICOLE RENE
NATURE
STEPP
MCMINN
BODGES
WINDY ACRES
FESS
LANCASTER
FRUITLAND
VIOLET
ARIEL
TJ
SUNRISE RIDGE
CLARK
CECILS
LAMONDA
ALIVIA
ACORN CREEK
CHESTNUT GAP
MALLEE
NAGEL
PACE
DIXIE
REFRESHING
HALF MOON
WOOD DUCK
ASHTON

Legend

- Pump Station
- FORCE MAIN
- GRAVITY TRUNK SEWER
- MINOR GRAVITY SEWER WITH LINE ID NO.
- Basin 1
- Basin 2
- Basin 2A
- Basin 3
- STREAM
- FLOOD HAZARD AE

KCI ASSOCIATES OF NC
KCI ENGINEERS | PLANNERS | SCIENTISTS | CONSTRUCTION MANAGERS

0 0.125 0.25 0.5 0.75 1 Miles

ALTERNATIVE 4C
EDNEYVILLE SEWER EXPANSION
HENDERSON COUNTY, NORTH CAROLINA

APPENDIX C

Development or PIN	Parcel Type	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 1 Flow Calculations													
Edneyville School				0	0	0	0	0	0	0	9,000	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
Camp Judaea				0	0	0	0	0	0	0	11,460	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
	Alternative 1 Totals		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20,460**	**1,200**	

Residential Flow per Unit	300	gpd	
Commercial Flow per Acre	1200	gpd	
Residential Unit Density per Acre	3	units/acre	
Persons per Residential Unit	4	persons/unit	
Persons per Commercial Unit	20	persons/unit	
% Available Area for Development	80%		
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%		
Flow per person	60	gpd/person	

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:
Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 1A Flow Calculations													
Edneyville School				0	0	0	0	0	0	0	9,000	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
	Alternative 1A Totals		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9,000**	**600**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household

2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

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Commercial = 1
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Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 2 Flow Calculations													
Edneyville School				0	0	0	0	0	0	0	9,000	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
Camp Judaea				0	0	0	0	0	0	0	11,460	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
Total			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20,460**	**1,200**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:
Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 3 (Basin 1)														
Edneyville School					0	0	0	0	0	0	0	9,000	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
1014456	MANU HOME PARK		2	39.81	0	32	96	0	0	28,800	0	28,800	480	
201795	VACANT LAND		2	21.94	0	18	53	0	0	15,900	0	15,900	265	
1014081	VACANT LAND		2	18.93	0	15	46	0	0	13,800	0	13,800	230	
1013215	RES-MULTI RE		2	5.25	0	4	13	0	0	3,900	0	3,900	65	
200258	RES-SINGLE FAMILY		2	10.77	0	9	26	0	0	7,800	0	7,800	130	
9932509	AUX IMPROVEMEN		2	26.73	0	21	65	0	0	19,500	0	19,500	325	
1011897	AUX IMPROVEMEN		2	14.19	0	11	35	0	0	10,500	0	10,500	175	
	Basin 1 Total			**138**	**0**	**110**	**334**	**0**	**0**	**100,200**	**0**	**109,200**	**2,270**	
Pump Station #1				**138**	**0**	**110**	**334**	**0**	**0**	**100,200**	**0**	**109,200**	**2,270**	

Alternative 3 (Basin 2)														
1018628	RES-SINGLE FAMILY		2	9.84	0	8	24	0	0	7,200	0	7,200	120	
10004959	COMMERCIAL		1	7.74	0	0	0	8	0	0	9,288	9,288	155	
10005820	RES-SINGLE FAMILY		2	13.05	0	10	32	0	0	9,600	0	9,600	160	
10004939	RES-SINGLE FAMILY		2	7.18	0	6	18	0	0	5,400	0	5,400	90	
1003258	RES-SINGLE FAMILY		2	7.11	0	6	18	0	0	5,400	0	5,400	90	
9929420	VACANT LAND		2	7.27	0	6	18	0	0	5,400	0	5,400	90	
301288	RES-SINGLE FAMILY		2	7.98	0	6	20	0	0	6,000	0	6,000	100	
9929318	RES-SINGLE FAMILY		2	7.56	0	6	19	0	0	5,700	0	5,700	95	
	Basin 2 Totals			**68**	**0**	**48**	**149**	**8**	**0**	**44,700**	**9,288**	**53,988**	**900**	
	Pump Station #2			**205**	**0**	**158**	**483**	**8**	**0**	**144,900**	**9,288**	**163,188**	**3,170**	

Alternative 3 (Basin 3)														
9949667	AUX IMPROVEMEN		2	16.43	0	13	40	0	0	12,000	0	12,000	200	
201292	RES-SINGLE FAMILY		2	6.32	0	5	16	0	0	4,800	0	4,800	80	
10000709	RES-SINGLE FAMILY		2	14.23	0	11	35	0	0	10,500	0	10,500	175	
301041	RV PARK		2	23.97	0	19	58	0	0	17,400	0	17,400	290	
9949665	VACANT LAND		2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9975801	AUX IMPROVEMEN		2	6.64	0	5	16	0	0	4,800	0	4,800	80	
9929478	AUX IMPROVEMEN		2	37.06	0	30	89	0	0	26,700	0	26,700	445	
9929318	RES-SINGLE FAMILY		2	7.56	0	6	19	0	0	5,700	0	5,700	95	
300971	MANU HOME PARK		2	13.83	0	11	34	0	0	10,200	0	10,200	170	
300281	REAL PROP MANF HOME		2	10.53	0	8	26	0	0	7,800	0	7,800	130	
301288	RES-SINGLE FAMILY		2	7.98	0	6	20	0	0	6,000	0	6,000	100	
10000326	RES-SINGLE FAMILY		2	7.50	0	6	18	0	0	5,400	0	5,400	90	
1008392	RES-SINGLE FAMILY		2	4.92	0	4	12	0	0	3,600	0	3,600	60	
1015966	RES-SINGLE FAMILY		2	5.05	0	4	13	0	0	3,900	0	3,900	65	
9969099	RES-SINGLE FAMILY		2	5.58	0	4	14	0	0	4,200	0	4,200	70	
201375	RES-SINGLE FAMILY		2	6.73	0	5	17	0	0	5,100	0	5,100	85	
1017776	RES-SINGLE FAMILY		2	10.91	0	9	27	0	0	8,100	0	8,100	135	
1013094	RES-SINGLE FAMILY		2	22.52	0	18	55	0	0	16,500	0	16,500	275	
200619	VACANT LAND		2	6.11	0	5	15	0	0	4,500	0	4,500	75	
200076	VACANT LAND		2	6.44	0	5	16	0	0	4,800	0	4,800	80	
300376	VACANT LAND		2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9929480	VACANT LAND		2	10.48	0	8	26	0	0	7,800	0	7,800	130	
	Basin 3 Totals			**255**	**0**	**204**	**624**	**0**	**0**	**187,200**	**0**	**187,200**	**3,120**	
	Pump Station #3			**460**	**0**	**362**	**1,107**	**8**	**0**	**332,100**	**9,288**	**350,388**	**6,290**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person
Septic Residential Density per Acre	2	units/acre

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:

Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 3A (Basin 1)														
New Pump Station #4					0	0	0	0	0	0	0	24,000	600	
Edneyville School					0	0	0	0	0	0	0	9,000	600	Population based on camper/students only. Support staff are excluded from wastewater flow calculations per NCDEQ 2T regulations.
1014456	MANU HOME PARK		2	39.81	0	32	96	0	0	28,800	0	28,800	480	
201795	VACANT LAND		2	21.94	0	18	53	0	0	15,900	0	15,900	265	
1014081	VACANT LAND		2	18.93	0	15	46	0	0	13,800	0	13,800	230	
1013215	RES-MULTI RE		2	5.25	0	4	13	0	0	3,900	0	3,900	65	
200258	RES-SINGLE FAMILY		2	10.77	0	9	26	0	0	7,800	0	7,800	130	
9932509	AUX IMPROVEMEN		2	26.73	0	21	65	0	0	19,500	0	19,500	325	
1011897	AUX IMPROVEMEN		2	14.19	0	11	35	0	0	10,500	0	10,500	175	
	Basin 1 Total			**138**	**0**	**110**	**334**	**0**	**0**	**100,200**	**0**	**133,200**	**2,870**	
	Pump Station #1			**138**	**0**	**110**	**334**	**0**	**0**	**100,200**	**0**	**133,200**	**2,870**	

Alternative 3A (Basin 2)														
1018628	RES-SINGLE FAMILY		2	9.84	0	8	24	0	0	7,200	0	7,200	120	
10004959	COMMERCIAL		1	7.74	0	0	0	8	0	0	9,288	9,288	155	
10005820	RES-SINGLE FAMILY		2	13.05	0	10	32	0	0	9,600	0	9,600	160	
10004939	RES-SINGLE FAMILY		2	7.18	0	6	18	0	0	5,400	0	5,400	90	
1003258	RES-SINGLE FAMILY		2	7.11	0	6	18	0	0	5,400	0	5,400	90	
9929420	VACANT LAND		2	7.27	0	6	18	0	0	5,400	0	5,400	90	
301288	RES-SINGLE FAMILY		2	7.98	0	6	20	0	0	6,000	0	6,000	100	
9929318	RES-SINGLE FAMILY		2	7.56	0	6	19	0	0	5,700	0	5,700	95	
	Basin 2 Totals			**68**	**0**	**48**	**149**	**8**	**0**	**44,700**	**9,288**	**53,988**	**900**	
	Pump Station #2			**205**	**0**	**158**	**483**	**8**	**0**	**144,900**	**9,288**	**187,188**	**3,770**	

Alternative 3A (Basin 3)														
9949667	AUX IMPROVEMEN		2	16.43	0	13	40	0	0	12,000	0	12,000	200	
201292	RES-SINGLE FAMILY		2	6.32	0	5	16	0	0	4,800	0	4,800	80	
10000709	RES-SINGLE FAMILY		2	14.23	0	11	35	0	0	10,500	0	10,500	175	
301041	RV PARK		2	23.97	0	19	58	0	0	17,400	0	17,400	290	
9949665	VACANT LAND		2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9975801	AUX IMPROVEMEN		2	6.64	0	5	16	0	0	4,800	0	4,800	80	
9929478	AUX IMPROVEMEN		2	37.06	0	30	89	0	0	26,700	0	26,700	445	
9929318	RES-SINGLE FAMILY		2	7.56	0	6	19	0	0	5,700	0	5,700	95	
300971	MANU HOME PARK		2	13.83	0	11	34	0	0	10,200	0	10,200	170	
300281	REAL PROP MANF HOME		2	10.53	0	8	26	0	0	7,800	0	7,800	130	
301288	RES-SINGLE FAMILY		2	7.98	0	6	20	0	0	6,000	0	6,000	100	
10000326	RES-SINGLE FAMILY		2	7.50	0	6	18	0	0	5,400	0	5,400	90	
1008392	RES-SINGLE FAMILY		2	4.92	0	4	12	0	0	3,600	0	3,600	60	
1015966	RES-SINGLE FAMILY		2	5.05	0	4	13	0	0	3,900	0	3,900	65	
9969099	RES-SINGLE FAMILY		2	5.58	0	4	14	0	0	4,200	0	4,200	70	
201375	RES-SINGLE FAMILY		2	6.73	0	5	17	0	0	5,100	0	5,100	85	
1017776	RES-SINGLE FAMILY		2	10.91	0	9	27	0	0	8,100	0	8,100	135	
1013094	RES-SINGLE FAMILY		2	22.52	0	18	55	0	0	16,500	0	16,500	275	
200619	VACANT LAND		2	6.11	0	5	15	0	0	4,500	0	4,500	75	
200076	VACANT LAND		2	6.44	0	5	16	0	0	4,800	0	4,800	80	
300376	VACANT LAND		2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9929480	VACANT LAND		2	10.48	0	8	26	0	0	7,800	0	7,800	130	
	Basin 3 Totals			**255**	**0**	**204**	**624**	**0**	**0**	**187,200**	**0**	**187,200**	**3,120**	
	Pump Station #3			**460**	**0**	**362**	**1,107**	**8**	**0**	**332,100**	**9,288**	**374,388**	**6,890**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person
Septic Residential Density per Acre	2	units/acre

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:

Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 4 (Basin 1)														
9690781514	AUX IMPROVEMEN	Basin 1	2	16.30	0	13	40	0	0	12,000	0	12,000	200	
9690385539	COMM VACANT LAND	Basin 1	2.5	9.01	0	0	0	0	7	0	8,650	8,650	144	
9690796343	COMMERCIAL	Basin 1	1	7.09	0	0	0	7	0	0	8,508	8,508	142	
9690940589	COMMERCIAL	Basin 1	1	8.39	0	0	0	8	0	0	10,068	10,068	168	
9690294135	COMMERCIAL	Basin 1	1	14.50	0	0	0	15	0	0	17,400	17,400	290	
9690878432	MANU HOME PARK	Basin 1	3	24.24	0	0	0	0	0	0	0	0	0	
9690484480	MANU HOME PARK	Basin 1	3	39.81	0	0	0	0	0	0	0	0	0	
9690634921	PERSONAL PROPERTY MH	Basin 1	2	8.36	0	7	21	0	0	6,300	0	6,300	105	
9690957779	PERSONAL PROPERTY MH	Basin 1	2	17.67	0	14	43	0	0	12,900	0	12,900	215	
9690856410	RES-LEASEHOLD	Basin 1	1	16.51	0	0	0	17	0	0	19,812	19,812	330	
9690777293	RES-SINGLE FAMILY	Basin 1	2	18.66	0	15	45	0	0	13,500	0	13,500	225	
9690682621	RES-SINGLE FAMILY	Basin 1	3	5.62	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 1	3	7.56	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 1	3	7.98	1	0	0	0	0	150	0	150	3	
9690891479	RES-SINGLE FAMILY	Basin 1	3	8.86	1	0	0	0	0	150	0	150	3	
9690158325	RES-SINGLE FAMILY	Basin 1	3	11.29	0	0	0	0	0	0	0	0	0	
9690968456	RES-SINGLE FAMILY	Basin 1	3	13.08	0	0	0	0	0	0	0	0	0	
9690843711	RES-SINGLE FAMILY	Basin 1	3	13.23	0	0	0	0	0	0	0	0	0	
9690453629	RES-SINGLE FAMILY	Basin 1	3	15.25	0	0	0	0	0	0	0	0	0	
9690573008	RES-SINGLE FAMILY	Basin 1	3	25.70	0	0	0	0	0	0	0	0	0	
9690345208	RES-SINGLE FAMILY	Basin 1	3	31.92	0	0	0	0	0	0	0	0	0	
9690445652	VACANT LAND	Basin 1	2	8.97	0	7	22	0	0	6,600	0	6,600	110	
9690555901	VACANT LAND	Basin 1	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9690566266	VACANT LAND	Basin 1	2	14.61	0	12	36	0	0	10,800	0	10,800	180	
9690868883	VACANT LAND	Basin 1	2	16.92	0	14	41	0	0	12,300	0	12,300	205	
9690460923	VACANT LAND	Basin 1	2	18.93	0	15	46	0	0	13,800	0	13,800	230	
9690471211	VACANT LAND	Basin 1	2	21.94	0	18	53	0	0	15,900	0	15,900	265	
9690437633	VACANT LAND	Basin 1	2	30.68	0	25	74	0	0	22,200	0	22,200	370	
9690160421	VACANT LAND	Basin 1	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
	Basin 1 Totals			**484**	**4**	**179**	**544**	**46**	**7**	**163,800**	**64,438**	**228,238**	**3,804**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person
Septic Residential Density per Acre	2	units/acre

Alternative 4 (Basin 2)														
9680955626	AUX IMPROVEMEN	Basin 2	2	6.64	0	5	16	0	0	4,800	0	4,800	80	
9680596567	AUX IMPROVEMEN	Basin 2	2	10.06	0	8	25	0	0	7,500	0	7,500	125	
9681444605	AUX IMPROVEMEN	Basin 2	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9681627718	AUX IMPROVEMEN	Basin 2	2	11.00	0	9	27	0	0	8,100	0	8,100	135	
9690061935	AUX IMPROVEMEN	Basin 2	2	14.19	0	11	35	0	0	10,500	0	10,500	175	
9680389475	AUX IMPROVEMEN	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9690092520	AUX IMPROVEMEN	Basin 2	2	26.73	0	21	65	0	0	19,500	0	19,500	325	
9681505556	AUX IMPROVEMEN	Basin 2	2	34.87	0	28	84	0	0	25,200	0	25,200	420	
9680486221	AUX IMPROVEMEN	Basin 2	2	37.06	0	30	89	0	0	26,700	0	26,700	445	
9681746588	AUX IMPROVEMEN	Basin 2	2	37.50	0	30	90	0	0	27,000	0	27,000	450	
9680899335	COMMERCIAL	Basin 2	1	7.74	0	0	0	8	0	0	9,288	9,288	155	
9681531308	MANU HOME PARK	Basin 2	3	5.01	5	0	0	0	0	750	0	750	13	
9681235013	MANU HOME PARK	Basin 2	3	6.93	5	0	0	0	0	750	0	750	13	
9681114111	MANU HOME PARK	Basin 2	3	8.06	5	0	0	0	0	750	0	750	13	
9681734432	MANU HOME PARK	Basin 2	3	10.57	5	0	0	0	0	750	0	750	13	
9680679401	MANU HOME PARK	Basin 2	3	13.83	5	0	0	0	0	750	0	750	13	
9680191712	MANU HOME PARK	Basin 2	3	14.46	5	0	0	0	0	750	0	750	13	
9681845915	PERSONAL PROPERTY MH	Basin 2	2	9.98	0	8	24	0	0	7,200	0	7,200	120	
9680786755	RES-SINGLE FAMILY	Basin 2	2	7.11	0	6	18	0	0	5,400	0	5,400	90	
9680645815	RES-SINGLE FAMILY	Basin 2	2	7.50	0	6	18	0	0	5,400	0	5,400	90	
9681328673	RES-SINGLE FAMILY	Basin 2	2	7.63	0	6	19	0	0	5,700	0	5,700	95	
9681635234	RES-SINGLE FAMILY	Basin 2	2	8.67	0	7	21	0	0	6,300	0	6,300	105	
9680891017	RES-SINGLE FAMILY	Basin 2	2	13.05	0	10	32	0	0	9,600	0	9,600	160	
9680491819	RES-SINGLE FAMILY	Basin 2	2	27.14	0	22	66	0	0	19,800	0	19,800	330	
9680990706	RES-SINGLE FAMILY	Basin 2	3	5.05	1	0	0	0	0	150	0	150	3	
9670890594	RES-SINGLE FAMILY	Basin 2	3	5.23	1	0	0	0	0	150	0	150	3	
9681549360	RES-SINGLE FAMILY	Basin 2	3	5.40	1	0	0	0	0	150	0	150	3	
9680656373	RES-SINGLE FAMILY	Basin 2	3	5.58	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9690199774	RES-SINGLE FAMILY	Basin 2	3	6.73	1	0	0	0	0	150	0	150	3	
9681642351	RES-SINGLE FAMILY	Basin 2	3	6.82	1	0	0	0	0	150	0	150	3	
9680897034	RES-SINGLE FAMILY	Basin 2	3	7.18	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 2	3	7.56	1	0	0	0	0	150	0	150	3	
9681410936	RES-SINGLE FAMILY	Basin 2	3	7.79	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 2	3	7.98	1	0	0	0	0	150	0	150	3	
9681231410	RES-SINGLE FAMILY	Basin 2	3	8.51	1	0	0	0	0	150	0	150	3	
9680680504	RES-SINGLE FAMILY	Basin 2	3	8.70	1	0	0	0	0	150	0	150	3	
9680194141	RES-SINGLE FAMILY	Basin 2	3	9.01	1	0	0	0	0	150	0	150	3	
9680685596	RES-SINGLE FAMILY	Basin 2	3	9.12	1	0	0	0	0	150	0	150	3	
9680695987	RES-SINGLE FAMILY	Basin 2	3	9.33	1	0	0	0	0	150	0	150	3	
9680993553	RES-SINGLE FAMILY	Basin 2	3	9.84	1	0	0	0	0	150	0	150	3	
9681358208	RES-SINGLE FAMILY	Basin 2	3	10.21	1	0	0	0	0	150	0	150	3	
9680892805	RES-SINGLE FAMILY	Basin 2	3	10.30	1	0	0	0	0	150	0	150	3	
9681605727	RES-SINGLE FAMILY	Basin 2	3	10.37	1	0	0	0	0	150	0	150	3	
9690097798	RES-SINGLE FAMILY	Basin 2	3	10.77	1	0	0	0	0	150	0	150	3	
9680575886	RES-SINGLE FAMILY	Basin 2	3	10.91	1	0	0	0	0	150	0	150	3	
9680591357	RES-SINGLE FAMILY	Basin 2	3	11.07	1	0	0	0	0	150	0	150	3	
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9681239259	RES-SINGLE FAMILY	Basin 2	3	12.44	1	0	0	0	0	150	0	150	3	
9680693416	RES-SINGLE FAMILY	Basin 2	3	17.55	1	0	0	0	0	150	0	150	3	
9680856813	RES-SINGLE FAMILY	Basin 2	3	22.52	1	0	0	0	0	150	0	150	3	
9681205088	RES-SINGLE FAMILY	Basin 2	3	25.70	1	0	0	0	0	150	0	150	3	
9681514941	RES-SINGLE FAMILY	Basin 2	2	30.53	0	24	74	0	0	22,200	0	22,200	370	
9681938508	RES-SINGLE FAMILY	Basin 2	2	69.55	0	56	167	0	0	50,100	0	50,100	835	
9671809399	VACANT LAND	Basin 2	2	5.12	0	4	13	0	0	3,900	0	3,900	65	
9670899631	VACANT LAND	Basin 2	2	5.13	0	4	13	0	0	3,900	0	3,900	65	
9681546374	VACANT LAND	Basin 2	2	5.30	0	4	13	0	0	3,900	0	3,900	65	
9681623461	VACANT LAND	Basin 2	2	5.52	0	4	14	0	0	4,200	0	4,200	70	
9681412083	VACANT LAND	Basin 2	2	5.65	0	5	14	0	0	4,200	0	4,200	70	
9680654831	VACANT LAND	Basin 2	2	6.11	0	5	15	0	0	4,500	0	4,500	75	
9671808092	VACANT LAND	Basin 2	2	6.20	0	5	15	0	0	4,500	0	4,500	75	
9681210141	VACANT LAND	Basin 2	2	6.41	0	5	16	0	0	4,800	0	4,800	80	
9680640897	VACANT LAND	Basin 2	2	6.44	0	5	16	0	0	4,800	0	4,800	80	
9680292375	VACANT LAND	Basin 2	2	6.60	0	5	16	0	0	4,800	0	4,800	80	
9680383718	VACANT LAND	Basin 2	2	6.87	0	5	17	0	0	5,100	0	5,100	85	
9681408870	VACANT LAND	Basin 2	2	6.93	0	6	17	0	0	5,100	0	5,100	85	
9680780589	VACANT LAND	Basin 2	2	7.27	0	6	18	0	0	5,400	0	5,400	90	
9681354034	VACANT LAND	Basin 2	2	7.85	0	6	19	0	0	5,700	0	5,700	95	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9680573377	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9680674049	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9681242854	VACANT LAND	Basin 2	2	10.91	0	9	27	0	0	8,100	0	8,100	135	
9680393127	VACANT LAND	Basin 2	2	11.69	0	9	29	0	0	8,700	0	8,700	145	
9680496161	VACANT LAND	Basin 2	2	13.83	0	11	34	0	0	10,200	0	10,200	170	
9681257605	VACANT LAND	Basin 2	2	14.23	0	11	35	0	0	10,500	0	10,500	175	
9681540770	VACANT LAND	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9680739621	VACANT LAND	Basin 2	2	17.20	0	14	42	0	0	12,600	0	12,600	210	
9681103053	VACANT LAND	Basin 2	2	18.17	0	15	44	0	0	13,200	0	13,200	220	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681222062	VACANT LAND	Basin 2	2	21.84	0	17	53	0	0	15,900	0	15,900	265	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9681027736	VACANT LAND	Basin 2	2	25.07	0	20	61	0	0	18,300	0	18,300	305	
9681018906	VACANT LAND	Basin 2	2	27.30	0	22	66	0	0	19,800	0	19,800	330	
9680944861	VACANT LAND	Basin 2	2	29.36	0	23	71	0	0	21,300	0	21,300	355	
9681365007	VACANT LAND	Basin 2	2	33.42	0	27	81	0	0	24,300	0	24,300	405	
9690160421	VACANT LAND	Basin 2	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
9680836638	VACANT LAND	Basin 2	2	43.25	0	35	104	0	0	31,200	0	31,200	520	
9681902973	VACANT LAND	Basin 2	2	84.56	0	68	203	0	0	60,900	0	60,900	1,015	
9681820262	VACANT LAND	Basin 2	2	92.12	0	74	222	0	0	66,600	0	66,600	1,110	
	Basin 2 Totals			**1,458**	**60**	**875**	**2,659**	**8**	**0**	**806,700**	**9,288**	**815,988**	**13,600**	

Alternative 4 (Basin 2A)														
9670776307	AUX IMPROVEMEN	Basin 2A	2	33.14	0	27	80	0	0	24,000	0	24,000	400	
9670783704	AUX IMPROVEMEN	Basin 2A	2	5.07	0	4	13	0	0	3,900	0	3,900	65	
9680175718	AUX IMPROVEMEN	Basin 2A	2	13.68	0	11	33	0	0	9,900	0	9,900	165	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680351940	AUX IMPROVEMEN	Basin 2A	2	16.43	0	13	40	0	0	12,000	0	12,000	200	
9670978919	AUX IMPROVEMEN	Basin 2A	2	38.41	0	31	93	0	0	27,900	0	27,900	465	
9680059120	MANU HOME PARK	Basin 2A	3	7.69	1	0	0	0	0	150	0	150	3	
9680169881	MANU HOME PARK	Basin 2A	3	15.23	1	0	0	0	0	150	0	150	3	
9680260125	MANU HOME PARK	Basin 2A	3	16.36	1	0	0	0	0	150	0	150	3	
9670878616	PERSONAL PROPERTY MH	Basin 2A	3	14.01	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9680373201	RES-SINGLE FAMILY	Basin 2A	1	37.36	0	0	0	37	0	0	44,832	44,832	747	
9680170872	RES-SINGLE FAMILY	Basin 2A	3	5.29	1	0	0	0	0	150	0	150	3	
9670761693	RES-SINGLE FAMILY	Basin 2A	3	5.85	1	0	0	0	0	150	0	150	3	
9680548806	RES-SINGLE FAMILY	Basin 2A	3	6.32	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670873530	RES-SINGLE FAMILY	Basin 2A	3	10.45	1	0	0	0	0	150	0	150	3	
9680160607	RES-SINGLE FAMILY	Basin 2A	3	10.93	1	0	0	0	0	150	0	150	3	
9670883970	RES-SINGLE FAMILY	Basin 2A	3	11.20	1	0	0	0	0	150	0	150	3	
9670634662	RES-SINGLE FAMILY	Basin 2A	3	12.52	1	0	0	0	0	150	0	150	3	
9680367160	RES-SINGLE FAMILY	Basin 2A	3	14.23	1	0	0	0	0	150	0	150	3	
9680332551	RES-SINGLE FAMILY	Basin 2A	3	14.75	1	0	0	0	0	150	0	150	3	
9670954255	RES-SINGLE FAMILY	Basin 2A	3	21.63	1	0	0	0	0	150	0	150	3	
9670967079	RES-SINGLE FAMILY	Basin 2A	2	52.81	0	42	127	0	0	38,100	0	38,100	635	
9680184773	VACANT LAND	Basin 2A	2	5.60	0	4	14	0	0	4,200	0	4,200	70	
9670788592	VACANT LAND	Basin 2A	2	7.44	0	6	18	0	0	5,400	0	5,400	90	
9680447173	VACANT LAND	Basin 2A	2	10.44	0	8	26	0	0	7,800	0	7,800	130	
9680087219	VACANT LAND	Basin 2A	2	10.96	0	9	27	0	0	8,100	0	8,100	135	
9670853236	VACANT LAND	Basin 2A	2	11.18	0	9	27	0	0	8,100	0	8,100	135	
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	
9670732043	VACANT LAND	Basin 2A	2	12.11	0	10	30	0	0	9,000	0	9,000	150	
9670860566	VACANT LAND	Basin 2A	2	12.41	0	10	30	0	0	9,000	0	9,000	150	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9680259600	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	
9670758886	VACANT LAND	Basin 2A	2	17.62	0	14	43	0	0	12,900	0	12,900	215	
9670967933	VACANT LAND	Basin 2A	2	22.46	0	18	54	0	0	16,200	0	16,200	270	
Basin 2A Totals				**657**	**18**	**318**	**967**	**37**	**0**	**292,800**	**44,832**	**337,632**	**5,627**	
Alternative 4 Totals				**2,598**	**82**	**1,373**	**4,170**	**92**	**7**	**1,263,300**	**118,558**	**1,381,858**	**23,031**	

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:

Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 4A (Basin 1)														
9690781514	AUX IMPROVEMEN	Basin 1	2	16.30	0	13	40	0	0	12,000	0	12,000	200	
9690385539	COMM VACANT LAND	Basin 1	2.5	9.01	0	0	0	0	7	0	8,650	8,650	144	
9690796343	COMMERCIAL	Basin 1	1	7.09	0	0	0	7	0	0	8,508	8,508	142	
9690940589	COMMERCIAL	Basin 1	1	8.39	0	0	0	8	0	0	10,068	10,068	168	
9690294135	COMMERCIAL	Basin 1	1	14.50	0	0	0	15	0	0	17,400	17,400	290	
9690878432	MANU HOME PARK	Basin 1	3	24.24	0	0	0	0	0	0	0	0	0	
9690484480	MANU HOME PARK	Basin 1	3	39.81	0	0	0	0	0	0	0	0	0	
9690634921	PERSONAL PROPERTY MH	Basin 1	2	8.36	0	7	21	0	0	6,300	0	6,300	105	
9690957779	PERSONAL PROPERTY MH	Basin 1	2	17.67	0	14	43	0	0	12,900	0	12,900	215	
9690856410	RES-LEASEHOLD	Basin 1	1	16.51	0	0	0	17	0	0	19,812	19,812	330	
9690777293	RES-SINGLE FAMILY	Basin 1	2	18.66	0	15	45	0	0	13,500	0	13,500	225	
9690682621	RES-SINGLE FAMILY	Basin 1	3	5.62	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 1	3	7.56	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 1	3	7.98	1	0	0	0	0	150	0	150	3	
9690891479	RES-SINGLE FAMILY	Basin 1	3	8.86	1	0	0	0	0	150	0	150	3	
9690158325	RES-SINGLE FAMILY	Basin 1	3	11.29	0	0	0	0	0	0	0	0	0	
9690968456	RES-SINGLE FAMILY	Basin 1	3	13.08	0	0	0	0	0	0	0	0	0	
9690843711	RES-SINGLE FAMILY	Basin 1	3	13.23	0	0	0	0	0	0	0	0	0	
9690453629	RES-SINGLE FAMILY	Basin 1	3	15.25	0	0	0	0	0	0	0	0	0	
9690573008	RES-SINGLE FAMILY	Basin 1	3	25.70	0	0	0	0	0	0	0	0	0	
9690345208	RES-SINGLE FAMILY	Basin 1	3	31.92	0	0	0	0	0	0	0	0	0	
9690445652	VACANT LAND	Basin 1	2	8.97	0	7	22	0	0	6,600	0	6,600	110	
9690555901	VACANT LAND	Basin 1	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9690566266	VACANT LAND	Basin 1	2	14.61	0	12	36	0	0	10,800	0	10,800	180	
9690868883	VACANT LAND	Basin 1	2	16.92	0	14	41	0	0	12,300	0	12,300	205	
9690460923	VACANT LAND	Basin 1	2	18.93	0	15	46	0	0	13,800	0	13,800	230	
9690471211	VACANT LAND	Basin 1	2	21.94	0	18	53	0	0	15,900	0	15,900	265	
9690437633	VACANT LAND	Basin 1	2	30.68	0	25	74	0	0	22,200	0	22,200	370	
9690160421	VACANT LAND	Basin 1	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
Basin 1 Totals				**484**	**4**	**179**	**544**	**46**	**7**	**163,800**	**64,438**	**228,238**	**3,804**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person
Septic Residential Density per Acre	2	units/acre

Alternative 4A (Basin 3)														
9691028693	AUX IMPROVEMEN	Basin 3	2	14.75	0	12	36	0	0	10,800	0	10,800	180	
9691918703	AUX IMPROVEMEN	Basin 3	2	5.44	0	4	14	0	0	4,200	0	4,200	70	
9690092520	AUX IMPROVEMEN	Basin 3	2	26.73	0	21	65	0	0	19,500	0	19,500	325	
601021775	COMMERCIAL	Basin 3	1	5.14	0	0	0	5	0	0	6,168	6,168	103	
9691815752	COMMERCIAL	Basin 3	1	11.93	0	0	0	12	0	0	14,316	14,316	239	
9691053097	MANU HOME PARK	Basin 3	2	8.84	0	7	22	0	0	6,600	0	6,600	110	
9691813231	MANU HOME PARK	Basin 3	3	5.02	1	0	0	0	0	150	0	150	3	
9691206472	MANU HOME PARK	Basin 3	3	7.24	1	0	0	0	0	150	0	150	3	
9691206472	MANU HOME PARK	Basin 3	3	7.24	1	0	0	0	0	150	0	150	3	
600396597	MANU HOME PARK	Basin 3	3	8.12	1	0	0	0	0	150	0	150	3	
9691920893	MANU HOME PARK	Basin 3	3	8.64	1	0	0	0	0	150	0	150	3	
600380895	MANU HOME PARK	Basin 3	3	10.54	0	0	0	0	0	0	0	0	0	
601112940	PERSONAL PROPERTY MH	Basin 3	2	6.15	0	5	15	0	0	4,500	0	4,500	75	
9681845915	PERSONAL PROPERTY MH	Basin 3	2	9.98	0	8	24	0	0	7,200	0	7,200	120	
9691228223	PERSONAL PROPERTY MH	Basin 3	2	14.82	0	12	36	0	0	10,800	0	10,800	180	
9681858624	RELIGIOUS	Basin 3	3	13.89	0	0	0	0	0	0	0	0	0	
9681858624	RELIGIOUS	Basin 3	3	13.89	0	0	0	0	0	0	0	0	0	
601513560	RES-LEASEHOLD	Basin 3	3	10.14	1	0	0	0	0	150	0	150	3	
9691355343	RES-LEASEHOLD	Basin 3	3	15.82	1	0	0	0	0	150	0	150	3	
601522789	RES-LEASEHOLD	Basin 3	3	21.43	1	0	0	0	0	150	0	150	3	
601522789	RES-LEASEHOLD	Basin 3	3	21.43	1	0	0	0	0	150	0	150	3	
9691719829	RES-SINGLE FAMILY	Basin 3	2	5.00	0	4	12	0	0	3,600	0	3,600	60	
600491990	RES-SINGLE FAMILY	Basin 3	2	6.14	0	5	15	0	0	4,500	0	4,500	75	
9691143520	RES-SINGLE FAMILY	Basin 3	2	10.75	0	9	26	0	0	7,800	0	7,800	130	
9691642243	RES-SINGLE FAMILY	Basin 3	2	10.86	0	9	27	0	0	8,100	0	8,100	135	
9691809664	RES-SINGLE FAMILY	Basin 3	2	11.99	0	10	29	0	0	8,700	0	8,700	145	
601214640	RES-SINGLE FAMILY	Basin 3	2	16.16	0	13	39	0	0	11,700	0	11,700	195	
601066090	RES-SINGLE FAMILY	Basin 3	2	21.42	0	17	52	0	0	15,600	0	15,600	260	
601066090	RES-SINGLE FAMILY	Basin 3	2	21.42	0	17	52	0	0	15,600	0	15,600	260	
601250560	RES-SINGLE FAMILY	Basin 3	2	45.63	0	37	110	0	0	33,000	0	33,000	550	
9691549930	RES-SINGLE FAMILY	Basin 3	3	5.12	1	0	0	0	0	150	0	150	3	
9691041613	RES-SINGLE FAMILY	Basin 3	3	5.18	1	0	0	0	0	150	0	150	3	
9691341081	RES-SINGLE FAMILY	Basin 3	3	5.25	1	0	0	0	0	150	0	150	3	
9681957640	RES-SINGLE FAMILY	Basin 3	3	5.77	1	0	0	0	0	150	0	150	3	
9691758098	RES-SINGLE FAMILY	Basin 3	3	5.88	1	0	0	0	0	150	0	150	3	
9690199774	RES-SINGLE FAMILY	Basin 3	3	6.73	1	0	0	0	0	150	0	150	3	
9691255559	RES-SINGLE FAMILY	Basin 3	3	7.44	1	0	0	0	0	150	0	150	3	
9691317558	RES-SINGLE FAMILY	Basin 3	3	7.46	1	0	0	0	0	150	0	150	3	
9690693636	RES-SINGLE FAMILY	Basin 3	3	7.91	1	0	0	0	0	150	0	150	3	
9691425120	RES-SINGLE FAMILY	Basin 3	3	8.07	1	0	0	0	0	150	0	150	3	
601439301	RES-SINGLE FAMILY	Basin 3	3	8.55	1	0	0	0	0	150	0	150	3	
601439301	RES-SINGLE FAMILY	Basin 3	3	8.55	1	0	0	0	0	150	0	150	3	
9691118330	RES-SINGLE FAMILY	Basin 3	3	9.41	1	0	0	0	0	150	0	150	3	
9691442099	RES-SINGLE FAMILY	Basin 3	3	9.80	1	0	0	0	0	150	0	150	3	
9691045170	RES-SINGLE FAMILY	Basin 3	3	10.34	1	0	0	0	0	150	0	150	3	
9691658167	RES-SINGLE FAMILY	Basin 3	3	10.51	1	0	0	0	0	150	0	150	3	
9691552232	RES-SINGLE FAMILY	Basin 3	3	10.60	1	0	0	0	0	150	0	150	3	
9691451019	RES-SINGLE FAMILY	Basin 3	3	10.62	1	0	0	0	0	150	0	150	3	
9691115910	RES-SINGLE FAMILY	Basin 3	3	13.69	1	0	0	0	0	150	0	150	3	
9691223105	RES-SINGLE FAMILY	Basin 3	3	16.08	1	0	0	0	0	150	0	150	3	
9691456356	RES-SINGLE FAMILY	Basin 3	3	17.17	1	0	0	0	0	150	0	150	3	
601263328	RES-SINGLE FAMILY	Basin 3	3	18.66	1	0	0	0	0	150	0	150	3	
9691415810	RES-SINGLE FAMILY	Basin 3	3	19.32	1	0	0	0	0	150	0	150	3	
601115501	RES-SINGLE FAMILY	Basin 3	3	20.62	1	0	0	0	0	150	0	150	3	
600076062	RES-SINGLE FAMILY	Basin 3	3	26.68	1	0	0	0	0	150	0	150	3	
601514044	RES-SINGLE FAMILY	Basin 3	3	28.01	1	0	0	0	0	150	0	150	3	
600086484	RES-SINGLE FAMILY	Basin 3	3	34.31	1	0	0	0	0	150	0	150	3	
601172198	RES-SINGLE FAMILY	Basin 3	3	37.12	1	0	0	0	0	150	0	150	3	
9681938508	RES-SINGLE FAMILY	Basin 3	2	69.55	0	56	167	0	0	50,100	0	50,100	835	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9691826922	VACANT LAND	Basin 3	2	5.07	0	4	13	0	0	3,900	0	3,900	65	
9691150176	VACANT LAND	Basin 3	2	5.19	0	4	13	0	0	3,900	0	3,900	65	
9691049750	VACANT LAND	Basin 3	2	5.63	0	5	14	0	0	4,200	0	4,200	70	
9691653046	VACANT LAND	Basin 3	2	5.63	0	5	14	0	0	4,200	0	4,200	70	
601124251	VACANT LAND	Basin 3	2	5.74	0	5	14	0	0	4,200	0	4,200	70	
601176645	VACANT LAND	Basin 3	2	5.77	0	5	14	0	0	4,200	0	4,200	70	
9691216354	VACANT LAND	Basin 3	2	5.95	0	5	15	0	0	4,500	0	4,500	75	
601436905	VACANT LAND	Basin 3	2	6.05	0	5	15	0	0	4,500	0	4,500	75	
9691740183	VACANT LAND	Basin 3	2	6.10	0	5	15	0	0	4,500	0	4,500	75	
9691216088	VACANT LAND	Basin 3	2	6.40	0	5	16	0	0	4,800	0	4,800	80	
601031416	VACANT LAND	Basin 3	2	6.53	0	5	16	0	0	4,800	0	4,800	80	
601011523	VACANT LAND	Basin 3	2	6.99	0	6	17	0	0	5,100	0	5,100	85	
9691348024	VACANT LAND	Basin 3	2	7.44	0	6	18	0	0	5,400	0	5,400	90	
601236849	VACANT LAND	Basin 3	2	7.96	0	6	20	0	0	6,000	0	6,000	100	
9691540157	VACANT LAND	Basin 3	2	8.19	0	7	20	0	0	6,000	0	6,000	100	
9690991881	VACANT LAND	Basin 3	2	8.37	0	7	21	0	0	6,300	0	6,300	105	
9691503894	VACANT LAND	Basin 3	2	8.59	0	7	21	0	0	6,300	0	6,300	105	
9691421909	VACANT LAND	Basin 3	2	8.68	0	7	21	0	0	6,300	0	6,300	105	
601014103	VACANT LAND	Basin 3	2	8.97	0	7	22	0	0	6,600	0	6,600	110	
9681928191	VACANT LAND	Basin 3	2	9.10	0	7	22	0	0	6,600	0	6,600	110	
9691130386	VACANT LAND	Basin 3	2	9.44	0	8	23	0	0	6,900	0	6,900	115	
9691828124	VACANT LAND	Basin 3	2	9.63	0	8	24	0	0	7,200	0	7,200	120	
9691015889	VACANT LAND	Basin 3	2	10.35	0	8	25	0	0	7,500	0	7,500	125	
601009560	VACANT LAND	Basin 3	2	10.39	0	8	25	0	0	7,500	0	7,500	125	
9691738327	VACANT LAND	Basin 3	2	10.44	0	8	26	0	0	7,800	0	7,800	130	
9691138562	VACANT LAND	Basin 3	2	11.18	0	9	27	0	0	8,100	0	8,100	135	
9691728905	VACANT LAND	Basin 3	2	12.39	0	10	30	0	0	9,000	0	9,000	150	
9691323332	VACANT LAND	Basin 3	2	12.80	0	10	31	0	0	9,300	0	9,300	155	
9691127942	VACANT LAND	Basin 3	2	15.83	0	13	38	0	0	11,400	0	11,400	190	
601222405	VACANT LAND	Basin 3	2	16.10	0	13	39	0	0	11,700	0	11,700	195	
9691923239	VACANT LAND	Basin 3	2	19.27	0	15	47	0	0	14,100	0	14,100	235	
9691637729	VACANT LAND	Basin 3	2	19.77	0	16	48	0	0	14,400	0	14,400	240	
9691148489	VACANT LAND	Basin 3	2	20.08	0	16	49	0	0	14,700	0	14,700	245	
9691148489	VACANT LAND	Basin 3	2	20.08	0	16	49	0	0	14,700	0	14,700	245	
9691102369	VACANT LAND	Basin 3	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9691102369	VACANT LAND	Basin 3	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9691437446	VACANT LAND	Basin 3	2	25.74	0	21	62	0	0	18,600	0	18,600	310	
9691460863	VACANT LAND	Basin 3	2	26.62	0	21	64	0	0	19,200	0	19,200	320	
9691331119	VACANT LAND	Basin 3	2	30.49	0	24	74	0	0	22,200	0	22,200	370	
601352907	VACANT LAND	Basin 3	2	36.51	0	29	88	0	0	26,400	0	26,400	440	
9681902973	VACANT LAND	Basin 3	2	84.56	0	68	203	0	0	60,900	0	60,900	1,015	
9681820262	VACANT LAND	Basin 3	2	92.12	0	74	222	0	0	66,600	0	66,600	1,110	
Basin 3 Totals				**1,520**	**37**	**788**	**2,390**	**17**	**0**	**722,550**	**20,484**	**743,034**	**12,384**	

Alternative 4A (Basin 2)														
9680955626	AUX IMPROVEMEN	Basin 2	2	6.64	0	5	16	0	0	4,800	0	4,800	80	
9680596567	AUX IMPROVEMEN	Basin 2	2	10.06	0	8	25	0	0	7,500	0	7,500	125	
9681444605	AUX IMPROVEMEN	Basin 2	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9681627718	AUX IMPROVEMEN	Basin 2	2	11.00	0	9	27	0	0	8,100	0	8,100	135	
9690061935	AUX IMPROVEMEN	Basin 2	2	14.19	0	11	35	0	0	10,500	0	10,500	175	
9680389475	AUX IMPROVEMEN	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9690092520	AUX IMPROVEMEN	Basin 2	2	26.73	0	21	65	0	0	19,500	0	19,500	325	
9681505556	AUX IMPROVEMEN	Basin 2	2	34.87	0	28	84	0	0	25,200	0	25,200	420	
9680486221	AUX IMPROVEMEN	Basin 2	2	37.06	0	30	89	0	0	26,700	0	26,700	445	
9681746588	AUX IMPROVEMEN	Basin 2	2	37.50	0	30	90	0	0	27,000	0	27,000	450	
9680899335	COMMERCIAL	Basin 2	1	7.74	0	0	0	8	0	0	9,288	9,288	155	
9681531308	MANU HOME PARK	Basin 2	3	5.01	5	0	0	0	0	750	0	750	13	
9681235013	MANU HOME PARK	Basin 2	3	6.93	5	0	0	0	0	750	0	750	13	
9681114111	MANU HOME PARK	Basin 2	3	8.06	5	0	0	0	0	750	0	750	13	
9681734432	MANU HOME PARK	Basin 2	3	10.57	5	0	0	0	0	750	0	750	13	
9680679401	MANU HOME PARK	Basin 2	3	13.83	5	0	0	0	0	750	0	750	13	
9680191712	MANU HOME PARK	Basin 2	3	14.46	5	0	0	0	0	750	0	750	13	
9681845915	PERSONAL PROPERTY MH	Basin 2	2	9.98	0	8	24	0	0	7,200	0	7,200	120	
9680786755	RES-SINGLE FAMILY	Basin 2	2	7.11	0	6	18	0	0	5,400	0	5,400	90	
9680645815	RES-SINGLE FAMILY	Basin 2	2	7.50	0	6	18	0	0	5,400	0	5,400	90	
9681328673	RES-SINGLE FAMILY	Basin 2	2	7.63	0	6	19	0	0	5,700	0	5,700	95	
9681635234	RES-SINGLE FAMILY	Basin 2	2	8.67	0	7	21	0	0	6,300	0	6,300	105	
9680891017	RES-SINGLE FAMILY	Basin 2	2	13.05	0	10	32	0	0	9,600	0	9,600	160	
9680491819	RES-SINGLE FAMILY	Basin 2	2	27.14	0	22	66	0	0	19,800	0	19,800	330	
9680990706	RES-SINGLE FAMILY	Basin 2	3	5.05	1	0	0	0	0	150	0	150	3	
9670890594	RES-SINGLE FAMILY	Basin 2	3	5.23	1	0	0	0	0	150	0	150	3	
9681549360	RES-SINGLE FAMILY	Basin 2	3	5.40	1	0	0	0	0	150	0	150	3	
9680656373	RES-SINGLE FAMILY	Basin 2	3	5.58	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9690199774	RES-SINGLE FAMILY	Basin 2	3	6.73	1	0	0	0	0	150	0	150	3	
9681642351	RES-SINGLE FAMILY	Basin 2	3	6.82	1	0	0	0	0	150	0	150	3	
9680897034	RES-SINGLE FAMILY	Basin 2	3	7.18	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 2	3	7.56	1	0	0	0	0	150	0	150	3	
9681410936	RES-SINGLE FAMILY	Basin 2	3	7.79	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 2	3	7.98	1	0	0	0	0	150	0	150	3	
9681231410	RES-SINGLE FAMILY	Basin 2	3	8.51	1	0	0	0	0	150	0	150	3	
9680680504	RES-SINGLE FAMILY	Basin 2	3	8.70	1	0	0	0	0	150	0	150	3	
9680194141	RES-SINGLE FAMILY	Basin 2	3	9.01	1	0	0	0	0	150	0	150	3	
9680685596	RES-SINGLE FAMILY	Basin 2	3	9.12	1	0	0	0	0	150	0	150	3	
9680695987	RES-SINGLE FAMILY	Basin 2	3	9.33	1	0	0	0	0	150	0	150	3	
9680993553	RES-SINGLE FAMILY	Basin 2	3	9.84	1	0	0	0	0	150	0	150	3	
9681358208	RES-SINGLE FAMILY	Basin 2	3	10.21	1	0	0	0	0	150	0	150	3	
9680892805	RES-SINGLE FAMILY	Basin 2	3	10.30	1	0	0	0	0	150	0	150	3	
9681605727	RES-SINGLE FAMILY	Basin 2	3	10.37	1	0	0	0	0	150	0	150	3	
9690097798	RES-SINGLE FAMILY	Basin 2	3	10.77	1	0	0	0	0	150	0	150	3	
9680575886	RES-SINGLE FAMILY	Basin 2	3	10.91	1	0	0	0	0	150	0	150	3	
9680591357	RES-SINGLE FAMILY	Basin 2	3	11.07	1	0	0	0	0	150	0	150	3	
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	
9681239259	RES-SINGLE FAMILY	Basin 2	3	12.44	1	0	0	0	0	150	0	150	3	
9680693416	RES-SINGLE FAMILY	Basin 2	3	17.55	1	0	0	0	0	150	0	150	3	
9680856813	RES-SINGLE FAMILY	Basin 2	3	22.52	1	0	0	0	0	150	0	150	3	
9681205088	RES-SINGLE FAMILY	Basin 2	3	25.70	1	0	0	0	0	150	0	150	3	
9681514941	RES-SINGLE FAMILY	Basin 2	2	30.53	0	24	74	0	0	22,200	0	22,200	370	
9681938508	RES-SINGLE FAMILY	Basin 2	2	69.55	0	56	167	0	0	50,100	0	50,100	835	
9671809399	VACANT LAND	Basin 2	2	5.12	0	4	13	0	0	3,900	0	3,900	65	
9670899631	VACANT LAND	Basin 2	2	5.13	0	4	13	0	0	3,900	0	3,900	65	
9681546374	VACANT LAND	Basin 2	2	5.30	0	4	13	0	0	3,900	0	3,900	65	
9681623461	VACANT LAND	Basin 2	2	5.52	0	4	14	0	0	4,200	0	4,200	70	
9681412083	VACANT LAND	Basin 2	2	5.65	0	5	14	0	0	4,200	0	4,200	70	
9680654831	VACANT LAND	Basin 2	2	6.11	0	5	15	0	0	4,500	0	4,500	75	
9671808092	VACANT LAND	Basin 2	2	6.20	0	5	15	0	0	4,500	0	4,500	75	
9681210141	VACANT LAND	Basin 2	2	6.41	0	5	16	0	0	4,800	0	4,800	80	
9680640897	VACANT LAND	Basin 2	2	6.44	0	5	16	0	0	4,800	0	4,800	80	
9680292375	VACANT LAND	Basin 2	2	6.60	0	5	16	0	0	4,800	0	4,800	80	
9680383718	VACANT LAND	Basin 2	2	6.87	0	5	17	0	0	5,100	0	5,100	85	
9681408870	VACANT LAND	Basin 2	2	6.93	0	6	17	0	0	5,100	0	5,100	85	
9680780589	VACANT LAND	Basin 2	2	7.27	0	6	18	0	0	5,400	0	5,400	90	
9681354034	VACANT LAND	Basin 2	2	7.85	0	6	19	0	0	5,700	0	5,700	95	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9680573377	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9680674049	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9681242854	VACANT LAND	Basin 2	2	10.91	0	9	27	0	0	8,100	0	8,100	135	
9680393127	VACANT LAND	Basin 2	2	11.69	0	9	29	0	0	8,700	0	8,700	145	
9680496161	VACANT LAND	Basin 2	2	13.83	0	11	34	0	0	10,200	0	10,200	170	
9681257605	VACANT LAND	Basin 2	2	14.23	0	11	35	0	0	10,500	0	10,500	175	
9681540770	VACANT LAND	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9680739621	VACANT LAND	Basin 2	2	17.20	0	14	42	0	0	12,600	0	12,600	210	
9681103053	VACANT LAND	Basin 2	2	18.17	0	15	44	0	0	13,200	0	13,200	220	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681222062	VACANT LAND	Basin 2	2	21.84	0	17	53	0	0	15,900	0	15,900	265	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9681027736	VACANT LAND	Basin 2	2	25.07	0	20	61	0	0	18,300	0	18,300	305	
9681018906	VACANT LAND	Basin 2	2	27.30	0	22	66	0	0	19,800	0	19,800	330	
9680944861	VACANT LAND	Basin 2	2	29.36	0	23	71	0	0	21,300	0	21,300	355	
9681365007	VACANT LAND	Basin 2	2	33.42	0	27	81	0	0	24,300	0	24,300	405	
9690160421	VACANT LAND	Basin 2	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
9680836638	VACANT LAND	Basin 2	2	43.25	0	35	104	0	0	31,200	0	31,200	520	
9681902973	VACANT LAND	Basin 2	2	84.56	0	68	203	0	0	60,900	0	60,900	1,015	
9681820262	VACANT LAND	Basin 2	2	92.12	0	74	222	0	0	66,600	0	66,600	1,110	
Basin 2 Totals				**1,458**	**60**	**875**	**2,659**	**8**	**0**	**806,700**	**9,288**	**815,988**	**13,600**	

Alternative 4A (Basin 2A)														
9670776307	AUX IMPROVEMEN	Basin 2A	2	33.14	0	27	80	0	0	24,000	0	24,000	400	
9670783704	AUX IMPROVEMEN	Basin 2A	2	5.07	0	4	13	0	0	3,900	0	3,900	65	
9680175718	AUX IMPROVEMEN	Basin 2A	2	13.68	0	11	33	0	0	9,900	0	9,900	165	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680351940	AUX IMPROVEMEN	Basin 2A	2	16.43	0	13	40	0	0	12,000	0	12,000	200	
9670978919	AUX IMPROVEMEN	Basin 2A	2	38.41	0	31	93	0	0	27,900	0	27,900	465	
9680059120	MANU HOME PARK	Basin 2A	3	7.69	1	0	0	0	0	150	0	150	3	
9680169881	MANU HOME PARK	Basin 2A	3	15.23	1	0	0	0	0	150	0	150	3	
9680260125	MANU HOME PARK	Basin 2A	3	16.36	1	0	0	0	0	150	0	150	3	
9670878616	PERSONAL PROPERTY MH	Basin 2A	3	14.01	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9680373201	RES-SINGLE FAMILY	Basin 2A	1	37.36	0	0	0	37	0	0	44,832	44,832	747	
9680170872	RES-SINGLE FAMILY	Basin 2A	3	5.29	1	0	0	0	0	150	0	150	3	
9670761693	RES-SINGLE FAMILY	Basin 2A	3	5.85	1	0	0	0	0	150	0	150	3	
9680548806	RES-SINGLE FAMILY	Basin 2A	3	6.32	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670873530	RES-SINGLE FAMILY	Basin 2A	3	10.45	1	0	0	0	0	150	0	150	3	
9680160607	RES-SINGLE FAMILY	Basin 2A	3	10.93	1	0	0	0	0	150	0	150	3	
9670883970	RES-SINGLE FAMILY	Basin 2A	3	11.20	1	0	0	0	0	150	0	150	3	
9670634662	RES-SINGLE FAMILY	Basin 2A	3	12.52	1	0	0	0	0	150	0	150	3	
9680367160	RES-SINGLE FAMILY	Basin 2A	3	14.23	1	0	0	0	0	150	0	150	3	
9680332551	RES-SINGLE FAMILY	Basin 2A	3	14.75	1	0	0	0	0	150	0	150	3	
9670954255	RES-SINGLE FAMILY	Basin 2A	3	21.63	1	0	0	0	0	150	0	150	3	
9670967079	RES-SINGLE FAMILY	Basin 2A	2	52.81	0	42	127	0	0	38,100	0	38,100	635	
9680184773	VACANT LAND	Basin 2A	2	5.60	0	4	14	0	0	4,200	0	4,200	70	
9670788592	VACANT LAND	Basin 2A	2	7.44	0	6	18	0	0	5,400	0	5,400	90	
9680447173	VACANT LAND	Basin 2A	2	10.44	0	8	26	0	0	7,800	0	7,800	130	
9680087219	VACANT LAND	Basin 2A	2	10.96	0	9	27	0	0	8,100	0	8,100	135	
9670853236	VACANT LAND	Basin 2A	2	11.18	0	9	27	0	0	8,100	0	8,100	135	
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	
9670732043	VACANT LAND	Basin 2A	2	12.11	0	10	30	0	0	9,000	0	9,000	150	
9670860566	VACANT LAND	Basin 2A	2	12.41	0	10	30	0	0	9,000	0	9,000	150	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9680259600	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	
9670758886	VACANT LAND	Basin 2A	2	17.62	0	14	43	0	0	12,900	0	12,900	215	
9670967933	VACANT LAND	Basin 2A	2	22.46	0	18	54	0	0	16,200	0	16,200	270	
Basin 2A Totals				**657**	**18**	**318**	**967**	**37**	**0**	**292,800**	**44,832**	**337,632**	**5,627**	
Alternative 4A Total				**4,118**	**119**	**2,160**	**6,560**	**109**	**7**	**1,985,850**	**139,042**	**2,124,892**	**35,415**	

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:

Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
Alternative 4 (Basin 1)														
9690781514	AUX IMPROVEMEN	Basin 1	2	16.30	0	13	40	0	0	12,000	0	12,000	200	
9690385539	COMM VACANT LAND	Basin 1	2.5	9.01	0	0	0	0	7	0	8,650	8,650	144	
9690796343	COMMERCIAL	Basin 1	1	7.09	0	0	0	7	0	0	8,508	8,508	142	
9690940589	COMMERCIAL	Basin 1	1	8.39	0	0	0	8	0	0	10,068	10,068	168	
9690294135	COMMERCIAL	Basin 1	1	14.50	0	0	0	15	0	0	17,400	17,400	290	
9690878432	MANU HOME PARK	Basin 1	3	24.24	0	0	0	0	0	0	0	0	0	
9690484480	MANU HOME PARK	Basin 1	3	39.81	0	0	0	0	0	0	0	0	0	
9690634921	PERSONAL PROPERTY MH	Basin 1	2	8.36	0	7	21	0	0	6,300	0	6,300	105	
9690957779	PERSONAL PROPERTY MH	Basin 1	2	17.67	0	14	43	0	0	12,900	0	12,900	215	
9690856410	RES-LEASEHOLD	Basin 1	1	16.51	0	0	0	17	0	0	19,812	19,812	330	
9690777293	RES-SINGLE FAMILY	Basin 1	2	18.66	0	15	45	0	0	13,500	0	13,500	225	
9690682621	RES-SINGLE FAMILY	Basin 1	3	5.62	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 1	3	7.56	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 1	3	7.98	1	0	0	0	0	150	0	150	3	
9690891479	RES-SINGLE FAMILY	Basin 1	3	8.86	1	0	0	0	0	150	0	150	3	
9690158325	RES-SINGLE FAMILY	Basin 1	3	11.29	0	0	0	0	0	0	0	0	0	
9690968456	RES-SINGLE FAMILY	Basin 1	3	13.08	0	0	0	0	0	0	0	0	0	
9690843711	RES-SINGLE FAMILY	Basin 1	3	13.23	0	0	0	0	0	0	0	0	0	
9690453629	RES-SINGLE FAMILY	Basin 1	3	15.25	0	0	0	0	0	0	0	0	0	
9690573008	RES-SINGLE FAMILY	Basin 1	3	25.70	0	0	0	0	0	0	0	0	0	
9690345208	RES-SINGLE FAMILY	Basin 1	3	31.92	0	0	0	0	0	0	0	0	0	
9690445652	VACANT LAND	Basin 1	2	8.97	0	7	22	0	0	6,600	0	6,600	110	
9690555901	VACANT LAND	Basin 1	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9690566266	VACANT LAND	Basin 1	2	14.61	0	12	36	0	0	10,800	0	10,800	180	
9690868883	VACANT LAND	Basin 1	2	16.92	0	14	41	0	0	12,300	0	12,300	205	
9690460923	VACANT LAND	Basin 1	2	18.93	0	15	46	0	0	13,800	0	13,800	230	
9690471211	VACANT LAND	Basin 1	2	21.94	0	18	53	0	0	15,900	0	15,900	265	
9690437633	VACANT LAND	Basin 1	2	30.68	0	25	74	0	0	22,200	0	22,200	370	
9690160421	VACANT LAND	Basin 1	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
	Basin 1 Totals			**484**	**4**	**179**	**544**	**46**	**7**	**163,800**	**64,438**	**228,238**	**3,804**	

Residential Flow per Unit	300	gpd
Commercial Flow per Acre	1200	gpd
Residential Unit Density per Acre	3	units/acre
Persons per Residential Unit	4	persons/unit
Persons per Commercial Unit	20	persons/unit
% Available Area for Development	80%	
% Available Flow from Existing Residents to be sent to Proposed Sewer	50%	
Flow per person	60	gpd/person
Septic Residential Density per Acre	2	units/acre

Alternative 4 (Basin 2)														
9680955626	AUX IMPROVEMEN	Basin 2	2	6.64	0	5	16	0	0	4,800	0	4,800	80	
9680596567	AUX IMPROVEMEN	Basin 2	2	10.06	0	8	25	0	0	7,500	0	7,500	125	
9681444605	AUX IMPROVEMEN	Basin 2	2	10.42	0	8	26	0	0	7,800	0	7,800	130	
9681627718	AUX IMPROVEMEN	Basin 2	2	11.00	0	9	27	0	0	8,100	0	8,100	135	
9690061935	AUX IMPROVEMEN	Basin 2	2	14.19	0	11	35	0	0	10,500	0	10,500	175	
9680389475	AUX IMPROVEMEN	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9690092520	AUX IMPROVEMEN	Basin 2	2	26.73	0	21	65	0	0	19,500	0	19,500	325	
9681505556	AUX IMPROVEMEN	Basin 2	2	34.87	0	28	84	0	0	25,200	0	25,200	420	
9680486221	AUX IMPROVEMEN	Basin 2	2	37.06	0	30	89	0	0	26,700	0	26,700	445	
9681746588	AUX IMPROVEMEN	Basin 2	2	37.50	0	30	90	0	0	27,000	0	27,000	450	
9680899335	COMMERCIAL	Basin 2	1	7.74	0	0	0	8	0	0	9,288	9,288	155	
9681531308	MANU HOME PARK	Basin 2	3	5.01	5	0	0	0	0	750	0	750	13	
9681235013	MANU HOME PARK	Basin 2	3	6.93	5	0	0	0	0	750	0	750	13	
9681114111	MANU HOME PARK	Basin 2	3	8.06	5	0	0	0	0	750	0	750	13	
9681734432	MANU HOME PARK	Basin 2	3	10.57	5	0	0	0	0	750	0	750	13	
9680679401	MANU HOME PARK	Basin 2	3	13.83	5	0	0	0	0	750	0	750	13	
9680191712	MANU HOME PARK	Basin 2	3	14.46	5	0	0	0	0	750	0	750	13	
9681845915	PERSONAL PROPERTY MH	Basin 2	2	9.98	0	8	24	0	0	7,200	0	7,200	120	
9680786755	RES-SINGLE FAMILY	Basin 2	2	7.11	0	6	18	0	0	5,400	0	5,400	90	
9680645815	RES-SINGLE FAMILY	Basin 2	2	7.50	0	6	18	0	0	5,400	0	5,400	90	
9681328673	RES-SINGLE FAMILY	Basin 2	2	7.63	0	6	19	0	0	5,700	0	5,700	95	
9681635234	RES-SINGLE FAMILY	Basin 2	2	8.67	0	7	21	0	0	6,300	0	6,300	105	
9680891017	RES-SINGLE FAMILY	Basin 2	2	13.05	0	10	32	0	0	9,600	0	9,600	160	
9680491819	RES-SINGLE FAMILY	Basin 2	2	27.14	0	22	66	0	0	19,800	0	19,800	330	
9680990706	RES-SINGLE FAMILY	Basin 2	3	5.05	1	0	0	0	0	150	0	150	3	
9670890594	RES-SINGLE FAMILY	Basin 2	3	5.23	1	0	0	0	0	150	0	150	3	
9681549360	RES-SINGLE FAMILY	Basin 2	3	5.40	1	0	0	0	0	150	0	150	3	
9680656373	RES-SINGLE FAMILY	Basin 2	3	5.58	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9681632654	RES-SINGLE FAMILY	Basin 2	3	5.98	1	0	0	0	0	150	0	150	3	
9690199774	RES-SINGLE FAMILY	Basin 2	3	6.73	1	0	0	0	0	150	0	150	3	
9681642351	RES-SINGLE FAMILY	Basin 2	3	6.82	1	0	0	0	0	150	0	150	3	
9680897034	RES-SINGLE FAMILY	Basin 2	3	7.18	1	0	0	0	0	150	0	150	3	
9680889078	RES-SINGLE FAMILY	Basin 2	3	7.56	1	0	0	0	0	150	0	150	3	
9681410936	RES-SINGLE FAMILY	Basin 2	3	7.79	1	0	0	0	0	150	0	150	3	
9680871981	RES-SINGLE FAMILY	Basin 2	3	7.98	1	0	0	0	0	150	0	150	3	
9681231410	RES-SINGLE FAMILY	Basin 2	3	8.51	1	0	0	0	0	150	0	150	3	
9680680504	RES-SINGLE FAMILY	Basin 2	3	8.70	1	0	0	0	0	150	0	150	3	
9680194141	RES-SINGLE FAMILY	Basin 2	3	9.01	1	0	0	0	0	150	0	150	3	
9680685596	RES-SINGLE FAMILY	Basin 2	3	9.12	1	0	0	0	0	150	0	150	3	
9680695987	RES-SINGLE FAMILY	Basin 2	3	9.33	1	0	0	0	0	150	0	150	3	
9680993553	RES-SINGLE FAMILY	Basin 2	3	9.84	1	0	0	0	0	150	0	150	3	
9681358208	RES-SINGLE FAMILY	Basin 2	3	10.21	1	0	0	0	0	150	0	150	3	
9680892805	RES-SINGLE FAMILY	Basin 2	3	10.30	1	0	0	0	0	150	0	150	3	
9681605727	RES-SINGLE FAMILY	Basin 2	3	10.37	1	0	0	0	0	150	0	150	3	
9690097798	RES-SINGLE FAMILY	Basin 2	3	10.77	1	0	0	0	0	150	0	150	3	
9680575886	RES-SINGLE FAMILY	Basin 2	3	10.91	1	0	0	0	0	150	0	150	3	
9680591357	RES-SINGLE FAMILY	Basin 2	3	11.07	1	0	0	0	0	150	0	150	3	
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	
9680280623	RES-SINGLE FAMILY	Basin 2	3	11.62	1	0	0	0	0	150	0	150	3	
9681239259	RES-SINGLE FAMILY	Basin 2	3	12.44	1	0	0	0	0	150	0	150	3	
9680693416	RES-SINGLE FAMILY	Basin 2	3	17.55	1	0	0	0	0	150	0	150	3	
9680856813	RES-SINGLE FAMILY	Basin 2	3	22.52	1	0	0	0	0	150	0	150	3	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes
9681205088	RES-SINGLE FAMILY	Basin 2	3	25.70	1	0	0	0	0	150	0	150	3	
9681514941	RES-SINGLE FAMILY	Basin 2	2	30.53	0	24	74	0	0	22,200	0	22,200	370	
9681938508	RES-SINGLE FAMILY	Basin 2	2	69.55	0	56	167	0	0	50,100	0	50,100	835	
9671809399	VACANT LAND	Basin 2	2	5.12	0	4	13	0	0	3,900	0	3,900	65	
9670899631	VACANT LAND	Basin 2	2	5.13	0	4	13	0	0	3,900	0	3,900	65	
9681546374	VACANT LAND	Basin 2	2	5.30	0	4	13	0	0	3,900	0	3,900	65	
9681623461	VACANT LAND	Basin 2	2	5.52	0	4	14	0	0	4,200	0	4,200	70	
9681412083	VACANT LAND	Basin 2	2	5.65	0	5	14	0	0	4,200	0	4,200	70	
9680654831	VACANT LAND	Basin 2	2	6.11	0	5	15	0	0	4,500	0	4,500	75	
9671808092	VACANT LAND	Basin 2	2	6.20	0	5	15	0	0	4,500	0	4,500	75	
9681210141	VACANT LAND	Basin 2	2	6.41	0	5	16	0	0	4,800	0	4,800	80	
9680640897	VACANT LAND	Basin 2	2	6.44	0	5	16	0	0	4,800	0	4,800	80	
9680292375	VACANT LAND	Basin 2	2	6.60	0	5	16	0	0	4,800	0	4,800	80	
9680383718	VACANT LAND	Basin 2	2	6.87	0	5	17	0	0	5,100	0	5,100	85	
9681408870	VACANT LAND	Basin 2	2	6.93	0	6	17	0	0	5,100	0	5,100	85	
9680780589	VACANT LAND	Basin 2	2	7.27	0	6	18	0	0	5,400	0	5,400	90	
9681354034	VACANT LAND	Basin 2	2	7.85	0	6	19	0	0	5,700	0	5,700	95	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9681341753	VACANT LAND	Basin 2	2	9.32	0	7	23	0	0	6,900	0	6,900	115	
9680573377	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9680674049	VACANT LAND	Basin 2	2	10.48	0	8	26	0	0	7,800	0	7,800	130	
9681242854	VACANT LAND	Basin 2	2	10.91	0	9	27	0	0	8,100	0	8,100	135	
9680393127	VACANT LAND	Basin 2	2	11.69	0	9	29	0	0	8,700	0	8,700	145	
9680496161	VACANT LAND	Basin 2	2	13.83	0	11	34	0	0	10,200	0	10,200	170	
9681257605	VACANT LAND	Basin 2	2	14.23	0	11	35	0	0	10,500	0	10,500	175	
9681540770	VACANT LAND	Basin 2	2	15.04	0	12	37	0	0	11,100	0	11,100	185	
9680739621	VACANT LAND	Basin 2	2	17.20	0	14	42	0	0	12,600	0	12,600	210	
9681103053	VACANT LAND	Basin 2	2	18.17	0	15	44	0	0	13,200	0	13,200	220	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681705406	VACANT LAND	Basin 2	2	18.83	0	15	46	0	0	13,800	0	13,800	230	
9681222062	VACANT LAND	Basin 2	2	21.84	0	17	53	0	0	15,900	0	15,900	265	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9691102369	VACANT LAND	Basin 2	2	23.42	0	19	57	0	0	17,100	0	17,100	285	
9681027736	VACANT LAND	Basin 2	2	25.07	0	20	61	0	0	18,300	0	18,300	305	
9681018906	VACANT LAND	Basin 2	2	27.30	0	22	66	0	0	19,800	0	19,800	330	
9680944861	VACANT LAND	Basin 2	2	29.36	0	23	71	0	0	21,300	0	21,300	355	
9681365007	VACANT LAND	Basin 2	2	33.42	0	27	81	0	0	24,300	0	24,300	405	
9690160421	VACANT LAND	Basin 2	2	40.14	0	32	97	0	0	29,100	0	29,100	485	
9680836638	VACANT LAND	Basin 2	2	43.25	0	35	104	0	0	31,200	0	31,200	520	
9681902973	VACANT LAND	Basin 2	2	84.56	0	68	203	0	0	60,900	0	60,900	1,015	
9681820262	VACANT LAND	Basin 2	2	92.12	0	74	222	0	0	66,600	0	66,600	1,110	
Basin 2 Totals				**1,458**	**60**	**875**	**2,659**	**8**	**0**	**806,700**	**9,288**	**815,988**	**13,600**	
Alternative 4 (Basin 2A)														
9670776307	AUX IMPROVEMEN	Basin 2A	2	33.14	0	27	80	0	0	24,000	0	24,000	400	
9670783704	AUX IMPROVEMEN	Basin 2A	2	5.07	0	4	13	0	0	3,900	0	3,900	65	
9680175718	AUX IMPROVEMEN	Basin 2A	2	13.68	0	11	33	0	0	9,900	0	9,900	165	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680284172	AUX IMPROVEMEN	Basin 2A	2	15.22	0	12	37	0	0	11,100	0	11,100	185	
9680351940	AUX IMPROVEMEN	Basin 2A	2	16.43	0	13	40	0	0	12,000	0	12,000	200	
9670978919	AUX IMPROVEMEN	Basin 2A	2	38.41	0	31	93	0	0	27,900	0	27,900	465	
9680059120	MANU HOME PARK	Basin 2A	3	7.69	1	0	0	0	0	150	0	150	3	
9680169881	MANU HOME PARK	Basin 2A	3	15.23	1	0	0	0	0	150	0	150	3	
9680260125	MANU HOME PARK	Basin 2A	3	16.36	1	0	0	0	0	150	0	150	3	
9670878616	PERSONAL PROPERTY MH	Basin 2A	3	14.01	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9670639740	PERSONAL PROPERTY MH	Basin 2A	3	17.70	1	0	0	0	0	150	0	150	3	
9680373201	RES-SINGLE FAMILY	Basin 2A	1	37.36	0	0	0	37	0	0	44,832	44,832	747	
9680170872	RES-SINGLE FAMILY	Basin 2A	3	5.29	1	0	0	0	0	150	0	150	3	
9670761693	RES-SINGLE FAMILY	Basin 2A	3	5.85	1	0	0	0	0	150	0	150	3	
9680548806	RES-SINGLE FAMILY	Basin 2A	3	6.32	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670829712	RES-SINGLE FAMILY	Basin 2A	3	9.88	1	0	0	0	0	150	0	150	3	
9670873530	RES-SINGLE FAMILY	Basin 2A	3	10.45	1	0	0	0	0	150	0	150	3	
9680160607	RES-SINGLE FAMILY	Basin 2A	3	10.93	1	0	0	0	0	150	0	150	3	
9670883970	RES-SINGLE FAMILY	Basin 2A	3	11.20	1	0	0	0	0	150	0	150	3	
9670634662	RES-SINGLE FAMILY	Basin 2A	3	12.52	1	0	0	0	0	150	0	150	3	
9680367160	RES-SINGLE FAMILY	Basin 2A	3	14.23	1	0	0	0	0	150	0	150	3	
9680332551	RES-SINGLE FAMILY	Basin 2A	3	14.75	1	0	0	0	0	150	0	150	3	
9670954255	RES-SINGLE FAMILY	Basin 2A	3	21.63	1	0	0	0	0	150	0	150	3	
9670967079	RES-SINGLE FAMILY	Basin 2A	2	52.81	0	42	127	0	0	38,100	0	38,100	635	
9680184773	VACANT LAND	Basin 2A	2	5.60	0	4	14	0	0	4,200	0	4,200	70	
9670788592	VACANT LAND	Basin 2A	2	7.44	0	6	18	0	0	5,400	0	5,400	90	
9680447173	VACANT LAND	Basin 2A	2	10.44	0	8	26	0	0	7,800	0	7,800	130	
9680087219	VACANT LAND	Basin 2A	2	10.96	0	9	27	0	0	8,100	0	8,100	135	
9670853236	VACANT LAND	Basin 2A	2	11.18	0	9	27	0	0	8,100	0	8,100	135	
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	
9670738262	VACANT LAND	Basin 2A	2	11.81	0	9	29	0	0	8,700	0	8,700	145	
9670732043	VACANT LAND	Basin 2A	2	12.11	0	10	30	0	0	9,000	0	9,000	150	
9670860566	VACANT LAND	Basin 2A	2	12.41	0	10	30	0	0	9,000	0	9,000	150	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670747009	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9680259600	VACANT LAND	Basin 2A	2	13.28	0	11	32	0	0	9,600	0	9,600	160	
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	
9670833237	VACANT LAND	Basin 2A	2	17.17	0	14	42	0	0	12,600	0	12,600	210	
9670758886	VACANT LAND	Basin 2A	2	17.62	0	14	43	0	0	12,900	0	12,900	215	
9670967933	VACANT LAND	Basin 2A	2	22.46	0	18	54	0	0	16,200	0	16,200	270	
Basin 2A Totals				**657**	**18**	**318**	**967**	**37**	**0**	**292,800**	**44,832**	**337,632**	**5,627**	
Alternative 4 Totals				**2,598**	**82**	**1,373**	**4,170**	**92**	**7**	**1,263,300**	**118,558**	**1,381,858**	**23,031**	

Development or PIN	Parcel Type	Basin No.	Parcel Type Designation	Total Acres	Existing Residential Septic (Units) (1 unit for parcels under 5 acres)	Future Developable Residential Acres	Future Residential Units	Existing Commercial Acres	Future Developable Commercial Acres	Existing and Future Residential Flow (GPD)	Existing and Future Commercial Flow (GPD)	ADF (GPD)	Population	Notes

Assumptions:

1) Existing & Future Residential units flow assumed to be 300 gpd/unit; assume 75 gpd per person; 4 persons per household
2) Future Developable residential acres flow assumed to be 80% build-out, 3 units per acre, 300 gpd/unit
3) Existing and Future Developable commercial acres flow assumed to be 80% build-out and 1,200 gpd/acre
4) For parcels greater than 5 acres with one home, it was assumed that the acreage amount in excess of the 5 acres is developable
5) For Existing Residential Units, all parcels under 10 acres assumed to have only 1 unit. Manually count number of units on parcels greater than 10 acres.

Parcels Type Designation Numbers:

Commercial = 1
Residential (Developable) = 2
Commercial (Developable) = 2.5
Residential (Existing) = 3
Industrial = 4

EDNEYVILLE SEWER SERVICE
HENDERSON COUNTY, NORTH CAROLINA
PEAK DAILY FLOW CALCULATIONS
MAY 2021

Alternatives / Sub-Basins		Acreage	ADF (GPD)	Equivalent Population	Peaking Factor	Peak Flow (GPD)	Peak Flow (GPM)
Alt 1		--	20,460	1,200	3.75	76,675	53
Alt 1A		--	9,000	600	3.93	35,390	25
Alt 2		--	20,460	1,200	3.75	76,675	53
Alt 3	**Pump Station #1**	138	109,200	2,270	3.54	386,828	269
	Pump Station #2	205	163,188	3,170	3.42	558,426	388
	Pump Station #3	460	350,388	6,290	3.15	1,104,148	767
Alt 3A	**Pump Station #1**	138	133,200	2,870	3.46	460,696	320
	Pump Station #2	205	187,188	3,770	3.36	628,253	436
	Pump Station #3	460	374,388	6,890	3.11	1,165,566	809
	Pump Station #4	--	24,000	600	3.93	94,372	66
Alt 4	**Basin 1**	484	228,238	3,804	3.35	765,233	531
	Basin 2	1,458	815,988	13,600	2.82	2,301,959	1,599
	Basins 1 + 2	1,941	1,044,226	17,404	2.71	2,833,206	1,968
	Basin 2A	657	337,632	5,627	3.20	1,079,427	750
	All Basins	2,598	1,381,858	23,031	2.59	3,580,503	2,486
Alt 4A	**Basin 1**	484	228,238	3,804	3.35	765,233	531
	Basin 3	1,520	743,034	12,384	2.86	2,126,512	1,477
	Basins 1 + 3	2,004	971,272	16,188	2.74	2,666,037	1,851
	Basin 2	1,458	815,988	13,600	2.82	2,301,959	1,599
	Basin 1, 2 & Basin 3	3,461	1,787,260	29,788	2.48	4,432,866	3,078
	Basin 2A	657	337,632	5,627	3.20	1,079,427	750
	All Basins	4,118	2,124,892	35,415	2.41	5,114,377	3,552
Alt 4B	**Basin 1**	484	228,238	3,804	3.35	765,233	531
	Basin 2	1,458	815,988	13,600	2.82	2,301,959	1,599
	Basins 1 + 2	1,941	1,044,226	17,404	2.71	2,833,206	1,968
	Basin 2A	657	337,632	5,627	3.20	1,079,427	750
	All Basins	2,598	1,381,858	23,031	2.59	3,580,503	2,486

Assumptions:

1) Peaking factor calculated using the formula in Ten State Standards and equating ADF to an equivalent population based 300 gpd/unit and 4 residents/unit for residential flow and 1,200 gpd/acre for commercial flow.

$$Peaking\ Factor = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}, where\ P = population\ in\ thousands$$

Alternative 1

Full-Pipe Flow based on Manning's equation

n	0.013		8" SDR 35 PVC
S	0.40%		
D (ID)	7.92	in	**Target Flow 53 gpm**
	0.66	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.18	ft/s	
Qfull	**335**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.08	0.37	0.0321	0.012	0.73	4
0.1	0.15	0.53	0.0619	0.033	1.13	17
0.15	0.23	0.66	0.0891	0.058	1.45	38
0.18	0.27	0.73	0.1042	0.076	1.61	54
0.2	0.30	0.77	0.1138	0.088	1.70	67
0.25	0.38	0.88	0.1357	0.119	1.91	102
0.3	0.45	0.98	0.1549	0.151	2.09	142
0.33	0.50	1.04	0.1650	0.171	2.18	167
0.35	0.53	1.08	0.1711	0.184	2.23	185
0.4	0.61	1.18	0.1842	0.217	2.35	228
0.45	0.68	1.28	0.1938	0.248	2.43	271
0.5	0.76	1.39	0.1995	0.278	2.47	309
0.55	0.83	1.52	0.2006	0.305	2.48	340
0.6	0.91	1.67	0.1957	0.327	2.44	358
0.66	1.00	2.07	0.1650	0.342	2.18	335

Capacity Remaining in Pipe to 100% full (mgd) **0.41**

Alternative 1A

Full-Pipe Flow based on Manning's equation

n	0.013		8" SDR 35 PVC
S	0.40%		
D (ID)	7.92	in	**Target Flow 25 gpm**
	0.66	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.18	ft/s	
Qfull	**335**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.08	0.37	0.0321	0.012	0.73	4
0.1	0.15	0.53	0.0619	0.033	1.13	17
0.12	0.18	0.58	0.0731	0.042	1.27	24
0.15	0.23	0.66	0.0891	0.058	1.45	38
0.2	0.30	0.77	0.1138	0.088	1.70	67
0.25	0.38	0.88	0.1357	0.119	1.91	102
0.3	0.45	0.98	0.1549	0.151	2.09	142
0.33	0.50	1.04	0.1650	0.171	2.18	167
0.35	0.53	1.08	0.1711	0.184	2.23	185
0.4	0.61	1.18	0.1842	0.217	2.35	228
0.45	0.68	1.28	0.1938	0.248	2.43	271
0.5	0.76	1.39	0.1995	0.278	2.47	309
0.55	0.83	1.52	0.2006	0.305	2.48	340
0.6	0.91	1.67	0.1957	0.327	2.44	358
0.66	1.00	2.07	0.1650	0.342	2.18	335

Capacity Remaining in Pipe to 100% full (mgd) **0.45**

Ten States Standards

Nominal Sewer Size	Minimum Slope in Feet Per 100 Feet (m/100 m)
8 inch (200 mm)	0.40
10 inch (250 mm)	0.28
12 inch (300 mm)	0.22
15 inch (375 mm)	0.15
18 inch (450 mm)	0.12
21 inch (525 mm)	0.10
24 inch (600 mm)	0.08
27 inch (675 mm)	0.067
30 inch (750 mm)	0.058
33 inch (825 mm)	0.052
36 inch (900 mm)	0.046
39 inch (975 mm)	0.041
42 inch (1050 mm)	0.037

Alternative 2

Full-Pipe Flow based on Manning's equation

n	0.013		8" SDR 35 PVC
S	0.40%		
D (ID)	7.92	in	**Target Flow 53 gpm**
	0.66	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.18	ft/s	
Qfull	**335**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.08	0.37	0.0321	0.012	0.73	4
0.1	0.15	0.53	0.0619	0.033	1.13	17
0.15	0.23	0.66	0.0891	0.058	1.45	38
0.18	0.27	0.73	0.1042	0.076	1.61	54
0.2	0.30	0.77	0.1138	0.088	1.70	67
0.25	0.38	0.88	0.1357	0.119	1.91	102
0.3	0.45	0.98	0.1549	0.151	2.09	142
0.33	0.50	1.04	0.1650	0.171	2.18	167
0.35	0.53	1.08	0.1711	0.184	2.23	185
0.4	0.61	1.18	0.1842	0.217	2.35	228
0.45	0.68	1.28	0.1938	0.248	2.43	271
0.5	0.76	1.39	0.1995	0.278	2.47	309
0.55	0.83	1.52	0.2006	0.305	2.48	340
0.6	0.91	1.67	0.1957	0.327	2.44	358
0.65	0.98	1.91	0.1785	0.341	2.30	352
0.66	1.00	2.07	0.1650	0.342	2.18	335

Capacity Remaining in Pipe to 100% full (mgd) **0.41**

Alternative 3 (Pump Station #1 Flow to Pump Station #2)

Full-Pipe Flow based on Manning's equation

n	0.013		10" SDR 35 PVC
S	0.28%		
D (ID)	9.9	in	**Target Flow 269 gpm**
	0.83	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.12	ft/s	
Qfull	**508**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.06	0.41	0.0324	0.013	0.62	4
0.1	0.12	0.59	0.0628	0.037	0.96	16
0.15	0.18	0.73	0.0913	0.066	1.23	37
0.18	0.22	0.80	0.1075	0.086	1.37	53
0.2	0.24	0.85	0.1178	0.100	1.46	65
0.25	0.30	0.96	0.1422	0.137	1.65	101
0.3	0.36	1.07	0.1644	0.176	1.82	143
0.33	0.40	1.13	0.1767	0.200	1.91	171
0.35	0.42	1.17	0.1845	0.216	1.97	190
0.4	0.48	1.27	0.2022	0.257	2.09	241
0.427	0.52	1.32	0.2108	0.279	2.15	269
0.45	0.55	1.37	0.2175	0.298	2.19	294
0.5	0.61	1.47	0.2302	0.339	2.28	347
0.55	0.67	1.58	0.2402	0.379	2.34	398
0.6	0.73	1.69	0.2471	0.416	2.39	446
0.65	0.79	1.80	0.2507	0.452	2.41	489
0.7	0.85	1.93	0.2503	0.484	2.41	523
0.75	0.91	2.09	0.2446	0.510	2.37	543
0.8	0.97	2.30	0.2300	0.530	2.28	541
0.825	1.00	2.59	0.2063	0.535	2.12	508

Capacity Remaining in Pipe to 100% full (mgd) **0.34**

Alternative 3 (Pump Station #2 Flow to Pump Station #3)
Full-Pipe Flow based on Manning's equation

n	0.013		10" SDR 35 PVC
S	0.28%		
D (ID)	9.9	in	**Target Flow 388 gpm**
	0.83	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.12	ft/s	
Qfull	**508**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.12	0.59	0.0628	0.037	0.96	16
0.2	0.24	0.85	0.1178	0.100	1.46	65
0.3	0.36	1.07	0.1644	0.176	1.82	143
0.4	0.48	1.27	0.2022	0.257	2.09	241
0.5	0.61	1.47	0.2302	0.339	2.28	347
0.54	0.65	1.56	0.2384	0.371	2.33	388
0.6	0.73	1.69	0.2471	0.416	2.39	446
0.7	0.85	1.93	0.2503	0.484	2.41	523
0.8	0.97	2.30	0.2300	0.530	2.28	541
0.825	1.00	2.59	0.2063	0.535	2.12	508

Capacity Remaining in Pipe to 100% full (mgd) **0.17**

Alternative 3 (Pump Station #3 Flow to Tie-In Manhole #1)
Full-Pipe Flow based on Manning's equation

n	0.013		15" SDR 35 PVC
S	0.15%		
D (ID)	14.426	in	**Target Flow 767 gpm**
	1.20	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	1.99	ft/s	
Qfull	**1015**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.08	0.70	0.0641	0.045	0.71	14
0.2	0.17	1.01	0.1228	0.124	1.10	61
0.3	0.25	1.26	0.1760	0.221	1.39	138
0.4	0.33	1.48	0.2235	0.330	1.63	242
0.5	0.42	1.69	0.2650	0.447	1.83	367
0.6	0.50	1.89	0.3002	0.566	1.99	506
0.7	0.58	2.09	0.3286	0.686	2.11	651
0.782	0.65	2.26	0.3465	0.782	2.19	768
0.8	0.67	2.29	0.3497	0.802	2.20	793
0.9	0.75	2.51	0.3625	0.911	2.26	923
1	0.83	2.76	0.3655	1.009	2.27	1028
1.1	0.92	3.07	0.3551	1.089	2.23	1087
1.2	1.00	3.67	0.3089	1.135	2.03	1033

Capacity Remaining in Pipe to 100% full (mgd) **0.36**

Alternative 3A (Pump Station #1 Flow to Pump Station #2)
Full-Pipe Flow based on Manning's equation

n	0.013		10" SDR 35 PVC
S	0.28%		
D (ID)	9.9	in	**Target Flow 320 gpm**
	0.83	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.12	ft/s	
Qfull	**508**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.06	0.41	0.0324	0.013	0.62	4
0.1	0.12	0.59	0.0628	0.037	0.96	16
0.15	0.18	0.73	0.0913	0.066	1.23	37
0.18	0.22	0.80	0.1075	0.086	1.37	53
0.2	0.24	0.85	0.1178	0.100	1.46	65
0.25	0.30	0.96	0.1422	0.137	1.65	101
0.3	0.36	1.07	0.1644	0.176	1.82	143
0.33	0.40	1.13	0.1767	0.200	1.91	171
0.35	0.42	1.17	0.1845	0.216	1.97	190
0.4	0.48	1.27	0.2022	0.257	2.09	241
0.45	0.55	1.37	0.2175	0.298	2.19	294
0.475	0.58	1.42	0.2242	0.319	2.24	320
0.5	0.61	1.47	0.2302	0.339	2.28	347
0.55	0.67	1.58	0.2402	0.379	2.34	398
0.6	0.73	1.69	0.2471	0.416	2.39	446
0.65	0.79	1.80	0.2507	0.452	2.41	489
0.7	0.85	1.93	0.2503	0.484	2.41	523
0.75	0.91	2.09	0.2446	0.510	2.37	543
0.8	0.97	2.30	0.2300	0.530	2.28	541
0.825	1.00	2.59	0.2063	0.535	2.12	508

Capacity Remaining in Pipe to 100% full (mgd) **0.27**

Alternative 3A (Pump Station #2 Flow to Pump Station #3)
Full-Pipe Flow based on Manning's equation

n	0.013		10" SDR 35 PVC
S	0.28%		
D (ID)	9.9	in	**Target Flow 436 gpm**
	0.83	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.12	ft/s	
Qfull	**508**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.12	0.59	0.0628	0.037	0.96	16
0.2	0.24	0.85	0.1178	0.100	1.46	65
0.3	0.36	1.07	0.1644	0.176	1.82	143
0.4	0.48	1.27	0.2022	0.257	2.09	241
0.5	0.61	1.47	0.2302	0.339	2.28	347
0.59	0.72	1.66	0.2460	0.409	2.38	437
0.6	0.73	1.69	0.2471	0.416	2.39	446
0.7	0.85	1.93	0.2503	0.484	2.41	523
0.8	0.97	2.30	0.2300	0.530	2.28	541
0.825	1.00	2.59	0.2063	0.535	2.12	508

Capacity Remaining in Pipe to 100% full (mgd) **0.10**

Alternative 3A (Pump Station #3 Flow to Tie-In Manhole)
Full-Pipe Flow based on Manning's equation

n	0.013		15" SDR 35 PVC
S	0.15%		
D (ID)	14.426	in	**Target Flow 809 gpm**
	1.20	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	1.99	ft/s	
Qfull	**1015**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.08	0.70	0.0641	0.045	0.71	14
0.2	0.17	1.01	0.1228	0.124	1.10	61
0.3	0.25	1.26	0.1760	0.221	1.39	138
0.4	0.33	1.48	0.2235	0.330	1.63	242
0.5	0.42	1.69	0.2650	0.447	1.83	367
0.6	0.50	1.89	0.3002	0.566	1.99	506
0.7	0.58	2.09	0.3286	0.686	2.11	651
0.8	0.67	2.29	0.3497	0.802	2.20	793
0.81	0.67	2.32	0.3514	0.814	2.21	807
0.9	0.75	2.51	0.3625	0.911	2.26	923
1	0.83	2.76	0.3655	1.009	2.27	1028
1.1	0.92	3.07	0.3551	1.089	2.23	1087
1.2	1.00	3.67	0.3089	1.135	2.03	1033

Capacity Remaining in Pipe to 100% full (mgd) **0.30**

Alternatives 4, 4A & 4B (Basin 1 Only)
Full-Pipe Flow based on Manning's equation

n	0.013		10" SDR 35 PVC
S	0.66%		
D (ID)	9.9	in	**Target Flow 531 gpm**
	0.83	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	3.25	ft/s	
Qfull	**780**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.05	0.06	0.41	0.0324	0.013	0.95	6
0.1	0.12	0.59	0.0628	0.037	1.47	24
0.15	0.18	0.73	0.0913	0.066	1.89	56
0.2	0.24	0.85	0.1178	0.100	2.24	100
0.25	0.30	0.96	0.1422	0.137	2.54	156
0.3	0.36	1.07	0.1644	0.176	2.79	220
0.35	0.42	1.17	0.1845	0.216	3.02	292
0.4	0.48	1.27	0.2022	0.257	3.21	370
0.45	0.55	1.37	0.2175	0.298	3.37	451
0.5	0.61	1.47	0.2302	0.339	3.50	532
0.55	0.67	1.58	0.2402	0.379	3.60	611
0.6	0.73	1.69	0.2471	0.416	3.67	685
0.65	0.79	1.80	0.2507	0.452	3.70	751
0.7	0.85	1.93	0.2503	0.484	3.70	802
0.75	0.91	2.09	0.2446	0.510	3.64	834
0.8	0.97	2.30	0.2300	0.530	3.50	831
0.825	1.00	2.59	0.2063	0.535	3.25	780

Capacity Remaining in Pipe to 100% full (mgd) **0.36**

Alternative 4 & 4B (Basins 1 + 2 Only)

Full-Pipe Flow based on Manning's equation

n	0.013		21" SDR 35 PVC
S	0.15%		
D (ID)	20.783	in	**Target Flow 1,968 gpm**
	1.73	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.54	ft/s	
Qfull	**2686**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.06	0.84	0.0649	0.055	0.72	18
0.2	0.12	1.20	0.1261	0.151	1.12	76
0.3	0.17	1.49	0.1835	0.273	1.43	176
0.4	0.23	1.74	0.2371	0.412	1.70	314
0.5	0.29	1.96	0.2868	0.564	1.93	488
0.6	0.35	2.18	0.3324	0.725	2.13	693
0.7	0.40	2.39	0.3739	0.892	2.30	923
0.8	0.46	2.59	0.4110	1.064	2.45	1172
0.9	0.52	2.79	0.4435	1.237	2.58	1433
1	0.58	2.99	0.4713	1.409	2.69	1700
1.1	0.64	3.19	0.4941	1.578	2.77	1965
1.2	0.69	3.41	0.5113	1.742	2.84	2219
1.3	0.75	3.63	0.5226	1.897	2.88	2452
1.4	0.81	3.87	0.5270	2.040	2.90	2652
1.5	0.87	4.14	0.5232	2.168	2.88	2804
1.6	0.92	4.47	0.5084	2.274	2.83	2885
1.7	0.98	4.97	0.4721	2.346	2.69	2833
1.73	1.00	5.33	0.4423	2.356	2.58	2724

Capacity Remaining in Pipe to 100% full (mgd) **1.03**

Alternative 4 & 4B (All Basins)

Full-Pipe Flow based on Manning's equation

n	0.013		24" SDR 35 PVC
S	0.15%		
D (ID)	23.381	in	**Target Flow 2,486 gpm**
	1.95	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.75	ft/s	
Qfull	**3677**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.05	0.89	0.0651	0.058	0.72	19
0.2	0.10	1.27	0.1269	0.161	1.12	81
0.3	0.15	1.57	0.1854	0.291	1.44	189
0.4	0.21	1.83	0.2405	0.441	1.72	340
0.5	0.26	2.07	0.2922	0.605	1.95	530
0.6	0.31	2.29	0.3403	0.780	2.16	757
0.7	0.36	2.50	0.3848	0.964	2.35	1016
0.8	0.41	2.71	0.4255	1.153	2.51	1300
0.9	0.46	2.91	0.4623	1.346	2.65	1604
1	0.51	3.11	0.4952	1.541	2.78	1922
1.1	0.56	3.31	0.5238	1.735	2.88	2246
1.175	0.60	3.47	0.5423	1.879	2.95	2490
1.2	0.62	3.52	0.5480	1.927	2.97	2570
1.3	0.67	3.72	0.5674	2.114	3.04	2886
1.4	0.72	3.94	0.5818	2.293	3.09	3184
1.5	0.77	4.17	0.5905	2.463	3.12	3454
1.6	0.82	4.42	0.5928	2.620	3.13	3684
1.7	0.87	4.70	0.5875	2.760	3.11	3857
1.8	0.92	5.03	0.5719	2.878	3.06	3950
1.9	0.98	5.50	0.5381	2.962	2.94	3904
1.94	1.00	5.86	0.5081	2.980	2.83	3781

Capacity Remaining in Pipe to 100% full (mgd) **1.71**

Alternative 4A (Basin 3)

Full-Pipe Flow based on Manning's equation

n	0.013		15" SDR 35 PVC
S	0.40%		
D (ID)	14.426	in	**Target Flow 1,477 gpm**
	1.20	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	3.25	ft/s	
Qfull	**1657**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.08	0.70	0.0641	0.045	1.16	23
0.2	0.17	1.01	0.1228	0.124	1.79	100
0.3	0.25	1.26	0.1760	0.221	2.28	226
0.4	0.33	1.48	0.2235	0.330	2.67	396
0.5	0.42	1.69	0.2650	0.447	2.99	599
0.6	0.50	1.89	0.3002	0.566	3.25	826
0.7	0.58	2.09	0.3286	0.686	3.45	1063
0.8	0.67	2.29	0.3497	0.802	3.60	1296
0.885	0.74	2.48	0.3612	0.896	3.68	1478
0.9	0.75	2.51	0.3625	0.911	3.69	1508
1	0.83	2.76	0.3655	1.009	3.71	1678
1.1	0.92	3.07	0.3551	1.089	3.64	1776
1.2	1.00	3.67	0.3089	1.135	3.31	1687

Capacity Remaining in Pipe to 100% full (mgd) **0.26**

Alternative 4A (Basins 1 + 3)

Full-Pipe Flow based on Manning's equation

n	0.013		18" SDR 35 PVC
S	0.25%		
D (ID)	17.629	in	**Target Flow 1,851 gpm**
	1.47	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.94	ft/s	
Qfull	**2236**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.07	0.78	0.0645	0.050	0.92	21
0.2	0.14	1.11	0.1247	0.138	1.43	89
0.3	0.20	1.38	0.1805	0.249	1.83	204
0.4	0.27	1.61	0.2316	0.374	2.16	362
0.5	0.34	1.83	0.2781	0.509	2.44	558
0.6	0.41	2.04	0.3196	0.651	2.68	783
0.7	0.48	2.24	0.3559	0.797	2.88	1029
0.8	0.54	2.44	0.3869	0.944	3.04	1289
0.9	0.61	2.64	0.4121	1.089	3.17	1550
1	0.68	2.85	0.4310	1.229	3.27	1803
1.02	0.69	2.89	0.4340	1.256	3.29	1852
1.1	0.75	3.07	0.4431	1.361	3.33	2035
1.2	0.82	3.32	0.4470	1.482	3.35	2229
1.3	0.88	3.60	0.4409	1.587	3.32	2364
1.4	0.95	3.97	0.4194	1.666	3.21	2401
1.465	1.00	4.46	0.3799	1.695	3.01	2286

Capacity Remaining in Pipe to 100% full (mgd) **0.55**

Alternative 4A (Basins 1, 2 & Basin 3)

Full-Pipe Flow based on Manning's equation

n	0.013		24" SDR 35 PVC
S	0.15%		
D (ID)	23.381	in	**Target Flow 3,078 gpm**
	1.95	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.75	ft/s	
Qfull	**3677**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.05	0.89	0.0651	0.058	0.72	19
0.2	0.10	1.27	0.1269	0.161	1.12	81
0.3	0.15	1.57	0.1854	0.291	1.44	189
0.4	0.21	1.83	0.2405	0.441	1.72	340
0.5	0.26	2.07	0.2922	0.605	1.95	530
0.6	0.31	2.29	0.3403	0.780	2.16	757
0.7	0.36	2.50	0.3848	0.964	2.35	1016
0.8	0.41	2.71	0.4255	1.153	2.51	1300
0.9	0.46	2.91	0.4623	1.346	2.65	1604
1	0.51	3.11	0.4952	1.541	2.78	1922
1.1	0.56	3.31	0.5238	1.735	2.88	2246
1.2	0.62	3.52	0.5480	1.927	2.97	2570
1.3	0.67	3.72	0.5674	2.114	3.04	2886
1.364	0.70	3.86	0.5772	2.230	3.08	3079
1.4	0.72	3.94	0.5818	2.293	3.09	3184
1.5	0.77	4.17	0.5905	2.463	3.12	3454
1.6	0.82	4.42	0.5928	2.620	3.13	3684
1.7	0.87	4.70	0.5875	2.760	3.11	3857
1.8	0.92	5.03	0.5719	2.878	3.06	3950
1.9	0.98	5.50	0.5381	2.962	2.94	3904
1.94	1.00	5.86	0.5081	2.980	2.83	3781

Capacity Remaining in Pipe to 100% full (mgd) **0.86**

Alternative 4A (All Basins)

Full-Pipe Flow based on Manning's equation

n	0.013		24" SDR 35 PVC
S	0.15%		
D (ID)	23.381	in	**Target Flow 3,552 gpm**
	1.95	ft	Note: If Target Flow exceeds Qfull, upstream surcharging will result
Vfull	2.75	ft/s	
Qfull	**3677**	**gpm**	

Partial-Pipe Flow based on Manning's equation

					Constant n	
d	d/D (% full)	P	rH	A	v	Q
ft		ft	ft	ft^2	ft/s	gpm
0.1	0.05	0.89	0.0651	0.058	0.72	19
0.2	0.10	1.27	0.1269	0.161	1.12	81
0.3	0.15	1.57	0.1854	0.291	1.44	189
0.4	0.21	1.83	0.2405	0.441	1.72	340
0.5	0.26	2.07	0.2922	0.605	1.95	530
0.6	0.31	2.29	0.3403	0.780	2.16	757
0.7	0.36	2.50	0.3848	0.964	2.35	1016
0.8	0.41	2.71	0.4255	1.153	2.51	1300
0.9	0.46	2.91	0.4623	1.346	2.65	1604
1	0.51	3.11	0.4952	1.541	2.78	1922
1.1	0.56	3.31	0.5238	1.735	2.88	2246
1.2	0.62	3.52	0.5480	1.927	2.97	2570
1.3	0.67	3.72	0.5674	2.114	3.04	2886
1.4	0.72	3.94	0.5818	2.293	3.09	3184
1.5	0.77	4.17	0.5905	2.463	3.12	3454
1.54	0.79	4.27	0.5922	2.528	3.13	3551
1.6	0.82	4.42	0.5928	2.620	3.13	3684
1.7	0.87	4.70	0.5875	2.760	3.11	3857
1.8	0.92	5.03	0.5719	2.878	3.06	3950
1.9	0.98	5.50	0.5381	2.962	2.94	3904
1.94	1.00	5.86	0.5081	2.980	2.83	3781

Capacity Remaining in Pipe to 100% full (mgd) **0.18**

APPENDIX D

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 1 - GRAVITY SEWER TO NEW PUMP STATION AT CAMP JUDAEA, FORCE MAIN TO COH
DATE: 5/13/2021

ISO 9001:2015 CERTIFIED
KCI ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0890

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$125,000.00	$125,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$175,000.00	$175,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,740	$100.00	$474,000
4	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$450.00	$27,000
5	MANHOLES [2]	EA	14	$7,000.00	$98,000
6	4" PVC FORCEMAIN, OPEN CUT	LF	14,920	$45.00	$671,400
7	4" DIP IN 14" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$250.00	$45,000
8	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	1	$500,000.00	$500,000
9	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
10	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
11	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
12	TRAFFIC CONTROL	DAYS	60	$1,000.00	$60,000
13	STREAM CROSSINGS	EA	3	$20,000.00	$60,000
14	DEWATERING	LF	4,800	$62.00	$297,600
15	ROCK EXCAVATION CONTINGENCY [3]	CY	1,000	$150.00	$150,000
SUBTOTAL FOR ITEMS 1 THROUGH 15 INCLUSIVE, IN THE AMOUNT OF [4]					**$2,723,000**
	Construction Contingency (15%) [5]				**$408,450**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$3,132,000**
	Engineering Design, Permitting & Construction Administration (10%)				$313,200
	Easement Acquisition				$125,000
TOTAL ESTIMATED PROJECT COST [4]					**$3,580,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 4 FT. IN DIAMETER AND 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 1A - NEW PUMP STATION AT EDNEYVILLE ELEMENTARY, FORCE MAIN TO COH
DATE: 5/13/2021

ISO 9001:2015 CERTIFIED
KCI ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0890

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$90,000.00	$90,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$75,000.00	$75,000
3	4" PVC FORCEMAIN, OPEN CUT	LF	19,420	$45.00	$873,900
4	4" DIP IN 14" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$250.00	$45,000
5	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	1	$500,000.00	$500,000
6	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
7	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
8	TRAFFIC CONTROL	LS	70	$1,000.00	$70,000
9	STREAM CROSSINGS	EA	3	$20,000.00	$60,000
SUBTOTAL FOR ITEMS 1 THROUGH 9 INCLUSIVE, IN THE AMOUNT OF [2]					**$1,734,000**
	Construction Contingency (15%) [4]				**$260,100**
TOTAL ESTIMATED CONSTRUCTION COST [2]					**$1,995,000**
	Engineering Design, Permitting & Construction Administration (10%)				$199,500
	Easement Acquisition [3]				$0
TOTAL ESTIMATED PROJECT COST [2]					**$2,200,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] COST IS ROUNDED UP TO NEAREST THOUSAND.

[3] IT IS ASSUMED THAT THE ENTIRE FORCE MAIN ROUTE WILL BE LOCATED IN EITHER THE ROAD RIGHT-OF-WAY OR PROPERTY OWNED BY HENDERSON COUNTY.

[4] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 2 - GRAVITY SEWER TO NEW WWTF AT CAMP JUDAEA
DATE: 5/13/2021

ISO 9001:2015 CERTIFIED
KCI ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0890

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$150,000.00	$150,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$125,000.00	$125,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,740	$100.00	$474,000
4	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$450.00	$27,000
5	MANHOLES [2]	EA	14	$7,000.00	$98,000
6	20,000 GPD PACKAGE TREATMENT PLANT	LS	1	$1,250,000.00	$1,250,000
7	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
8	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
9	STREAM CROSSINGS	EA	1	$20,000.00	$20,000
10	DEWATERING	LF	4,800	$62.00	$297,600
11	ROCK EXCAVATION CONTINGENCY [3]	CY	800	$150.00	$120,000
SUBTOTAL FOR ITEMS 1 THROUGH 11 INCLUSIVE, IN THE AMOUNT OF [4]					**$2,592,000**
	Construction Contingency (15%) [5]				**$388,800**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$2,981,000**
	Engineering Design, Permitting & Construction Administration (10%)				$298,100
	Easement Acquisition				$152,000
TOTAL ESTIMATED PROJECT COST [4]					**$3,440,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 4 FT. IN DIAMETER AND 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 3 - GRAVITY SEWER TO SERIES OF PUMP STATIONS ALONG HWY 64
DATE: 5/13/2021

ISO 9001:2015 CERTIFIED
KCI ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0890

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$400,000.00	$400,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$300,000.00	$300,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	400	$100.00	$40,000
4	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,170	$120.00	$860,400
5	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$400.00	$72,000
6	15" PVC GRAVITY SEWER, OPEN CUT	LF	4,140	$160.00	$662,400
7	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$500.00	$30,000
8	MANHOLES [2]	EA	35	$7,000.00	$245,000
9	6" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	3,380	$50.00	$169,000
10	6" DIP IN 14" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$250.00	$30,000
11	8" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	4,390	$75.00	$329,250
12	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$300.00	$18,000
13	270 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$750,000.00	$750,000
14	400 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$900,000.00	$900,000
15	770 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$1,200,000.00	$1,200,000
16	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
17	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
18	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
19	TRAFFIC CONTROL	DAYS	40	$1,000.00	$40,000
20	STREAM CROSSINGS	EA	3	$20,000.00	$60,000
21	DEWATERING	LF	5,000	$62.00	$310,000
22	ROCK EXCAVATION CONTINGENCY [3]	CY	1,500	$150.00	$225,000
SUBTOTAL FOR ITEMS 1 THROUGH 22 INCLUSIVE, IN THE AMOUNT OF [4]					**$6,682,000**
	Construction Contingency (15%) [6]				**$1,002,300**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$7,685,000**
	Engineering Design, Permitting & Construction Administration (10%)				$768,500
	Easement Acquisition [5]				$116,000
TOTAL ESTIMATED PROJECT COST [4]					**$8,570,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 4 FT. IN DIAMETER AND 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] THE COST OF EASEMENT ACQUISITION SHALL MATCH THE COST REQUIRED IN ALTERNATIVE #1 . IT IS ASSUMED THAT THE ENTIRE FORCE MAIN ROUTE & REMAINING GRAVITY SEWER WILL BE LOCATED IN EITHER THE ROAD RIGHT-OF-WAY OR PROPERTY OWNED BY HENDERSON COUNTY.

[6] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 3A - GRAVITY SEWER TO SERIES OF PUMP STATIONS
ALONG HWY 64, ADD JUSTICE ACADEMY
DATE: 5/13/2021

ISO 9001:2015 CERTIFIED
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ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$400,000.00	$400,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$300,000.00	$300,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	400	$100.00	$40,000
4	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,170	$120.00	$860,400
5	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$400.00	$72,000
6	15" PVC GRAVITY SEWER, OPEN CUT	LF	4,140	$160.00	$662,400
7	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$500.00	$30,000
8	MANHOLES [2]	EA	35	$7,000.00	$245,000
9	4" PVC FORCEMAIN, OPEN CUT	LF	5,000	$45.00	$225,000
10	6" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	3,380	$50.00	$169,000
11	6" DIP IN 14" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$250.00	$30,000
12	8" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	4,390	$75.00	$329,250
13	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$300.00	$18,000
14	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	1	$500,000.00	$500,000
15	270 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$750,000.00	$750,000
16	400 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$900,000.00	$900,000
17	770 GPM ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$1,200,000.00	$1,200,000
18	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
19	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
20	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
21	TRAFFIC CONTROL	DAYS	40	$1,000.00	$40,000
22	STREAM CROSSINGS	EA	3	$20,000.00	$60,000
23	DEWATERING	LF	5,000	$62.00	$310,000
24	ROCK EXCAVATION CONTINGENCY [3]	CY	1,500	$150.00	$225,000
SUBTOTAL FOR ITEMS 1 THROUGH 24 INCLUSIVE, IN THE AMOUNT OF [4]					**$7,407,000**
	Construction Contingency (15%) [6]				**$1,111,050**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$8,519,000**
	Engineering Design, Permitting & Construction Administration (10%)				$851,900
	Easement Acquisition [5]				$116,000
TOTAL ESTIMATED PROJECT COST [4]					**$9,490,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 4 FT. IN DIAMETER AND 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] THE COST OF EASEMENT ACQUISITION SHALL MATCH THE COST REQUIRED IN ALTERNATIVE #1 . IT IS ASSUMED THAT THE ENTIRE FORCE MAIN ROUTE & REMAINING GRAVITY SEWER WILL BE LOCATED IN EITHER THE ROAD RIGHT-OF-WAY OR PROPERTY OWNED BY HENDERSON COUNTY.

[6] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA

PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT

ALTERNATIVE 4 - REGIONAL GRAVITY SEWER SYSTEM TO NEW WWTF NEAR NORTH HENDERSON HIGH SCHOOL, FRUITLAND BBC CONVEYED VIA PUMP STATION

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106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0800

DATE: 5/13/2021

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$400,000.00	$400,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$250,000.00	$250,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	400	$100.00	$40,000
4	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	8,320	$120.00	$998,400
5	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$400.00	$72,000
6	15" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$160.00	$625,600
7	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$500.00	$30,000
8	21" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,440	$220.00	$1,636,800
9	20" DIP IN 32" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$600.00	$36,000
10	24" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,055	$240.00	$973,200
11	24" DIP IN 36" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$650.00	$78,000
12	4' MANHOLES [2]	EA	37	$7,000.00	$259,000
13	5' MANHOLES [2]	EA	34	$10,000.00	$340,000
14	15" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	750	$120.00	$90,000
15	3.58 MGD ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$2,000,000.00	$2,000,000
16	1.38 MGD PACKAGE TREATMENT PLANT	LS	1	$14,000,000.00	$14,000,000
17	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
18	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
19	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
20	STREAM CROSSINGS	EA	5	$20,000.00	$100,000
21	DEWATERING	LF	9,250	$62.00	$573,500
22	ROCK EXCAVATION CONTINGENCY [3]	CY	4,000	$150.00	$600,000
SUBTOTAL FOR ITEMS 1 THROUGH 22 INCLUSIVE, IN THE AMOUNT OF [4]					**$23,143,000**
	Construction Contingency (15%) [5]				**$3,471,450**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$26,615,000**
	Engineering Design, Permitting & Construction Administration (10%)				$2,661,500
	Easement Acquisition				$279,000
TOTAL ESTIMATED PROJECT COST [4]					**$29,560,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA
PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 4A - REGIONAL GRAVITY SEWER SYSTEM,
ADD JUSTICE ACADEMY AND FRUITLAND BAPTIST BIBLE COLLEGE
(DOES NOT INCLUDE MINOR GRAVITY SEWER LINES)

ISO 9001:2015 CERTIFIED
KCI ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0800

DATE: 5/13/2021

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$500,000.00	$500,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$500,000.00	$500,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,225	$100.00	$722,500
4	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$400.00	$72,000
5	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	18,340	$120.00	$2,200,800
6	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$450.00	$81,000
7	15" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$160.00	$625,600
8	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$400.00	$48,000
9	18" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$180.00	$703,800
10	18" DIP IN 30" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$475.00	$28,500
11	21" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,380	$220.00	$1,623,600
12	20" DIP IN 32" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$550.00	$66,000
13	24" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,115	$240.00	$987,600
14	24" DIP IN 36" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$650.00	$39,000
15	4' MANHOLES [2]	EA	86	$7,000.00	$602,000
16	5' MANHOLES [2]	EA	22	$8,000.00	$176,000
17	4" PVC FORCEMAIN, OPEN CUT	LF	5,000	$45.00	$225,000
18	18" PVC FORCEMAIN, OPEN CUT	LF	750	$130.00	$97,500
19	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	1	$500,000.00	$500,000
20	5.11 MGD ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$2,500,000.00	$2,500,000
21	2.12 MGD PACKAGE TREATMENT PLANT	LS	1	$21,000,000.00	$21,000,000
22	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
23	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
24	ABANDONMENT OF JUSTICE ACADEMY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
25	ABANDONMENT OF FRUITLAND BAPTIST BIBLE COLLEGE SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
26	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
27	STREAM CROSSINGS	EA	5	$20,000.00	$100,000
28	DEWATERING	LF	45,600	$62.00	$2,827,200
29	ROCK EXCAVATION CONTINGENCY [3]	CY	4,000	$150.00	$600,000
SUBTOTAL FOR ITEMS 1 THROUGH 29 INCLUSIVE, IN THE AMOUNT OF [4]					**$36,887,000**
	Construction Contingency (15%) [5]				**$5,533,050**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$42,421,000**
	Engineering Design, Permitting & Construction Administration (10%)				$4,242,100
	Easement Acquisition				$649,000
TOTAL ESTIMATED PROJECT COST [4]					**$47,320,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA

PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT

ALTERNATIVE 4B - REGIONAL GRAVITY SEWER SYSTEM TO NEW WWTF NEAR NORTH HENDERSON HIGH SCHOOL, WNC JUSTICE ACADEMY & FRUITLAND BBC CONVEYED VIA PUMP STATION

ISO 9001:2015 CERTIFIED
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106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0800

DATE: 5/13/2021

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$400,000.00	$400,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$250,000.00	$250,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	400	$100.00	$40,000
4	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	8,320	$120.00	$998,400
5	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$400.00	$72,000
6	16" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$160.00	$625,600
7	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$500.00	$30,000
8	21" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,440	$220.00	$1,636,800
9	20" DIP IN 32" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$600.00	$36,000
10	24" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,055	$240.00	$973,200
11	24" DIP IN 36" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$650.00	$78,000
12	4' MANHOLES [2]	EA	37	$7,000.00	$259,000
13	5' MANHOLES [2]	EA	34	$10,000.00	$340,000
14	4" PVC FORCEMAIN, OPEN CUT	LF	20,500	$45.00	$922,500
15	16" PVC FORCEMAIN, 0 - 4' DEPTH, OPEN CUT	LF	750	$120.00	$90,000
16	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	2	$500,000.00	$1,000,000
17	3.58 MGD ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$2,000,000.00	$2,000,000
18	1.38 MGD PACKAGE TREATMENT PLANT	LS	1	$14,000,000.00	$14,000,000
19	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
20	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
21	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
22	STREAM CROSSINGS	EA	5	$20,000.00	$100,000
23	DEWATERING	LF	24,545	$62.00	$1,521,790
24	ROCK EXCAVATION CONTINGENCY [3]	CY	4,000	$150.00	$600,000
SUBTOTAL FOR ITEMS 1 THROUGH 24 INCLUSIVE, IN THE AMOUNT OF [4]					**$26,014,000**
	Construction Contingency (15%) [5]				**$3,902,100**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$29,917,000**
	Engineering Design, Permitting & Construction Administration (10%)				$2,991,700
	Easement Acquisition				$279,000
TOTAL ESTIMATED PROJECT COST [4]					**$33,190,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] EACH MANHOLE IS ASSUMED TO BE 10 FT. DEEP. MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

PREPARED FOR: HENDERSON COUNTY, NORTH CAROLINA

PROJECT: EDNEYVILLE SEWER PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 4C - REGIONAL GRAVITY SEWER SYSTEM,
ADD JUSTICE ACADEMY, FRUITLAND BAPTIST BIBLE COLLEGE AND MINOR GRAVITY SEWER LINES

ISO 9001:2015 CERTIFIED
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106 Clair Drive • Piedmont, SC 29673 • Phone 864-269-0900

DATE: 5/14/2021

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL AMT. (Budget)
1	MOBILIZATION	LS	1	$500,000.00	$500,000
2	EROSION CONTROL & MAINTENANCE	LS	1	$500,000.00	$500,000
3	8" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	63,604	$100.00	$6,360,400
4	8" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	720	$400.00	$288,000
5	10" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	18,340	$120.00	$2,200,800
6	10" DIP IN 18" STEEL ENCASEMENT, JACKED & BORED [1]	LF	180	$450.00	$81,000
7	15" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$160.00	$625,600
8	16" DIP IN 24" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$400.00	$48,000
9	18" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	3,910	$180.00	$703,800
10	18" DIP IN 30" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$475.00	$28,500
11	21" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	7,380	$220.00	$1,623,600
12	20" DIP IN 32" STEEL ENCASEMENT, JACKED & BORED [1]	LF	120	$550.00	$66,000
13	24" PVC GRAVITY SEWER, 8 - 12' DEPTH, OPEN CUT	LF	4,115	$240.00	$987,600
14	24" DIP IN 36" STEEL ENCASEMENT, JACKED & BORED [1]	LF	60	$650.00	$39,000
15	4' MANHOLES [2]	EA	249	$7,000.00	$1,743,000
16	5' MANHOLES [2]	EA	22	$8,000.00	$176,000
17	4" PVC FORCEMAIN, OPEN CUT	LF	5,000	$45.00	$225,000
18	18" PVC FORCEMAIN, OPEN CUT	LF	750	$130.00	$97,500
19	100 GPM PUMP STATION, WET WELL & CONTROLS	LS	1	$500,000.00	$500,000
20	5.11 MGD ABOVEGROUND LIFT STATION, WET WELL & CONTROLS	LS	1	$2,500,000.00	$2,500,000
21	2.12 MGD PACKAGE TREATMENT PLANT	LS	1	$21,000,000.00	$21,000,000
22	CAMP JUDAEA EXISTING PACKAGE PLANT #2 DECOMMISSIONING	LS	1	$20,000.00	$20,000
23	ABANDONMENT OF EDNEYVILLE ELEMENTARY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
24	ABANDONMENT OF JUSTICE ACADEMY SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
25	ABANDONMENT OF FRUITLAND BAPTIST BIBLE COLLEGE SEPTIC SYSTEM	LS	1	$10,000.00	$10,000
26	CONNECTION TO EXISTING SEWER	LS	1	$10,000.00	$10,000
27	STREAM CROSSINGS	EA	5	$20,000.00	$100,000
28	DEWATERING	LF	102,519	$62.00	$6,356,178
29	ROCK EXCAVATION CONTINGENCY [3]	CY	4,000	$150.00	$600,000
SUBTOTAL FOR ITEMS 1 THROUGH 29 INCLUSIVE, IN THE AMOUNT OF [4]					**$47,410,000**
	Construction Contingency (15%) [5]				**$7,111,500**
TOTAL ESTIMATED CONSTRUCTION COST [4]					**$54,522,000**
	Engineering Design, Permitting & Construction Administration (10%)				$5,452,200
	Easement Acquisition				$1,872,000
TOTAL ESTIMATED PROJECT COST [4]					**$61,850,000**

[1] IT IS ASSUMED THAT ROAD CROSSINGS WILL PERFORMED VIA JACK AND BORE INSTALLATION METHOD. EACH CROSSING WILL REQUIRE 60 FT. OF CARRIER & CASING PIPE.

[2] MANHOLE SPACING WILL BE NO MORE THAN 350 FT.

[3] IT IS ASSUMED THAT ROCK WILL BE ENCOUNTERED ON 15% OF TOTAL GRAVITY SEWER.

[4] COST IS ROUNDED UP TO NEAREST THOUSAND.

[5] TYPICAL CONTINGENCY FOR PLANNING LEVEL COST ESTIMATES IS 30%. THIS WAS REVISED TO 15% AT THE REQUEST OF HENDERSON COUNTY.

APPENDIX E

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 1

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 1: Gravity Sewer to Pump Station at Camp Judaea, Force Main to COH

	Capital [1]	Total Annual Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost [2]
Year 0	$3,580,000				
Year 1		$12,520	$1,500.00	$520.00	$10,500
Year 2		$12,802	$1,533.79	$531.71	$10,737
Year 3		$13,090	$1,568.34	$543.69	$10,978
Year 4		$13,385	$1,603.67	$555.94	$11,226
Year 5		$13,687	$1,639.80	$568.46	$11,479
Year 6		$13,995	$1,676.74	$581.27	$11,737
Year 7		$14,310	$1,714.51	$594.36	$12,002
Year 8		$14,633	$1,753.14	$607.75	$12,272
Year 9		$14,962	$1,792.63	$621.44	$12,548
Year 10		$15,300	$1,833.01	$635.44	$12,831
Year 11		$15,644	$1,874.31	$649.76	$13,120
Year 12		$15,997	$1,916.53	$664.40	$13,416
Year 13		$16,357	$1,959.70	$679.36	$13,718
Year 14		$16,725	$2,003.85	$694.67	$14,027
Year 15		$17,102	$2,048.99	$710.32	$14,343
Year 16		$17,488	$2,095.15	$726.32	$14,666
Year 17		$17,881	$2,142.35	$742.68	$14,996
Year 18		$18,284	$2,190.61	$759.41	$15,334
Year 19		$18,696	$2,239.96	$776.52	$15,680
Year 20		$19,117	$2,290.42	$794.01	$16,033
PW Capital Cost	$3,580,000				
PW O&M Cost	$301,694				
PW Total	**$3,882,000**				
PW Salvage Value [3]	**($359,400)**				
20-Year PW Total	**$3,523,000**				

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 1A

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 1A: New Pump Station to Edneyville Elementary, Force Main to COH

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost
Year 0	$2,200,000				
Year 1		$12,262	$1,242.00	$520.00	$10,500
Year 2		$12,538	$1,269.98	$531.71	$10,737
Year 3		$12,821	$1,298.59	$543.69	$10,978
Year 4		$13,109	$1,327.84	$555.94	$11,226
Year 5		$13,405	$1,357.76	$568.46	$11,479
Year 6		$13,707	$1,388.34	$581.27	$11,737
Year 7		$14,016	$1,419.62	$594.36	$12,002
Year 8		$14,331	$1,451.60	$607.75	$12,272
Year 9		$14,654	$1,484.30	$621.44	$12,548
Year 10		$14,984	$1,517.74	$635.44	$12,831
Year 11		$15,322	$1,551.93	$649.76	$13,120
Year 12		$15,667	$1,586.89	$664.40	$13,416
Year 13		$16,020	$1,622.64	$679.36	$13,718
Year 14		$16,381	$1,659.19	$694.67	$14,027
Year 15		$16,750	$1,696.57	$710.32	$14,343
Year 16		$17,127	$1,734.79	$726.32	$14,666
Year 17		$17,513	$1,773.87	$742.68	$14,996
Year 18		$17,907	$1,813.83	$759.41	$15,334
Year 19		$18,311	$1,854.69	$776.52	$15,680
Year 20		$18,723	$1,896.47	$794.01	$16,033
PW Capital Cost	$2,200,000				
PW O&M Cost	$295,477				
PW Total	**$2,495,000**				
PW Salvage Value [3]	**$0**				
20-Year PW Total	**$2,495,000**				

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE THIS ALTERNATIVE HAS NO GRAVITY SEWER INFRASTRUCTURE & IT IS ASSUMED THAT THE INFRASTRUCTURE INSTALLED HAS A 20-YEAR LIFESPAN, THE SALVAGE VALUE IS EQUAL TO ZERO.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 2

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 2 - Gravity Sewer to New WWTF at Camp Judaea

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost [2]	Annual Package Plant Operation Cost [3]
Year 0	$3,440,000			
Year 1		$35,000	$5,000.00	$30,000
Year 2		$35,788	$5,112.64	$30,676
Year 3		$36,595	$5,227.81	$31,367
Year 4		$37,419	$5,345.58	$32,073
Year 5		$38,262	$5,466.00	$32,796
Year 6		$39,124	$5,589.13	$33,535
Year 7		$40,005	$5,715.04	$34,290
Year 8		$40,907	$5,843.79	$35,063
Year 9		$41,828	$5,975.43	$35,853
Year 10		$42,770	$6,110.04	$36,660
Year 11		$43,734	$6,247.68	$37,486
Year 12		$44,719	$6,388.43	$38,331
Year 13		$45,726	$6,532.34	$39,194
Year 14		$46,756	$6,679.50	$40,077
Year 15		$47,810	$6,829.97	$40,980
Year 16		$48,887	$6,983.83	$41,903
Year 17		$49,988	$7,141.16	$42,847
Year 18		$51,114	$7,302.03	$43,812
Year 19		$52,266	$7,466.52	$44,799
Year 20		$53,443	$7,634.72	$45,808
PW Capital Cost	$3,440,000			
PW O&M Cost	$843,395			
PW Total	**$4,283,000**			
PW Salvage Cost [4]	**($359,400)**			
20-Year PW Total	**$3,924,000**			

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] IT IS EXPECTED THAT THE NEW PACKAGE TREATMENT PLANT WILL REQUIRE AT LEAST ONE SIGNIFCANT REPLACEMENT AND REPAIRS OF EQUIPMENT. THE ESTIMATED COST FOR THESE REPAIRS AND REPLACEMENT IS APPROXIMATELY $100,000. THIS COST WAS DISTURBED OVER THE 20-YEAR LIFECYCLE ANALYSIS PERIOD, FACTORING IN INFLATION AND THE CURRENT FEDERAL DISCOUNT RATE.

[3] THE ANNUAL COST AT YEAR 1 WAS PROVIDED BY THE MANUFACTURER. THIS COST INCLUDES ENERGY, REPAIR, AND OPERATION & MAINTENANCE.

[4] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 3

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 3 - Gravity Sewer to Series of Pump Stations Along Hwy. 64 to COH

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost
Year 0	$8,570,000				
Year 1		$36,784	$3,726.01	$1,557.64	$31,500
Year 2		$37,612	$3,809.94	$1,592.73	$32,210
Year 3		$38,460	$3,895.77	$1,628.61	$32,935
Year 4		$39,326	$3,983.53	$1,665.29	$33,677
Year 5		$40,212	$4,073.27	$1,702.81	$34,436
Year 6		$41,118	$4,165.03	$1,741.17	$35,212
Year 7		$42,044	$4,258.86	$1,780.39	$36,005
Year 8		$42,991	$4,354.80	$1,820.50	$36,816
Year 9		$43,960	$4,452.90	$1,861.51	$37,645
Year 10		$44,950	$4,553.21	$1,903.45	$38,493
Year 11		$45,963	$4,655.78	$1,946.33	$39,360
Year 12		$46,998	$4,760.67	$1,990.17	$40,247
Year 13		$48,057	$4,867.91	$2,035.00	$41,154
Year 14		$49,139	$4,977.57	$2,080.85	$42,081
Year 15		$50,246	$5,089.70	$2,127.72	$43,029
Year 16		$51,378	$5,204.36	$2,175.65	$43,998
Year 17		$52,536	$5,321.60	$2,224.67	$44,989
Year 18		$53,719	$5,441.48	$2,274.78	$46,003
Year 19		$54,929	$5,564.06	$2,326.03	$47,039
Year 20		$56,167	$5,689.41	$2,378.43	$48,099
PW Capital Cost	$8,570,000				
PW O&M Cost	$886,375				
PW Total	**$9,456,000**				
PW Salvage Cost [3]	**($1,183,440)**				
20-Year PW Total	**$8,273,000**				

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON EACH OF THREE (3) PROPOSED PUMP STATIONS, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 3A

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 3A - Gravity Sewer to Series of Pump Stations Along Hwy. 64 to COH (Incorporate WNC Justice Academy)

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost
Year 0	$9,490,000				
Year 1		$37,303	$3,726.01	$2,076.85	$31,500
Year 2		$38,143	$3,809.94	$2,123.64	$32,210
Year 3		$39,002	$3,895.77	$2,171.48	$32,935
Year 4		$39,881	$3,983.53	$2,220.39	$33,677
Year 5		$40,779	$4,073.27	$2,270.41	$34,436
Year 6		$41,698	$4,165.03	$2,321.56	$35,212
Year 7		$42,637	$4,258.86	$2,373.86	$36,005
Year 8		$43,598	$4,354.80	$2,427.33	$36,816
Year 9		$44,580	$4,452.90	$2,482.01	$37,645
Year 10		$45,584	$4,553.21	$2,537.93	$38,493
Year 11		$46,611	$4,655.78	$2,595.10	$39,360
Year 12		$47,661	$4,760.67	$2,653.56	$40,247
Year 13		$48,735	$4,867.91	$2,713.34	$41,154
Year 14		$49,833	$4,977.57	$2,774.46	$42,081
Year 15		$50,955	$5,089.70	$2,836.96	$43,029
Year 16		$52,103	$5,204.36	$2,900.87	$43,998
Year 17		$53,277	$5,321.60	$2,966.22	$44,989
Year 18		$54,477	$5,441.48	$3,033.04	$46,003
Year 19		$55,705	$5,564.06	$3,101.37	$47,039
Year 20		$56,959	$5,689.41	$3,171.23	$48,099
PW Capital Cost	$9,490,000				
PW O&M Cost	$898,887				
PW Total	**$10,389,000**				
PW Salvage Cost [3]	**($1,183,440)**				
20-Year PW Total	**$9,206,000**				

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON EACH OF THREE (3) PROPOSED PUMP STATIONS, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 4

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 4 – Regional Gravity Sewer System to New WWTF near North Henderson High School

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost [2]	Annual Package Plant Operation Cost [3]
Year 0	$29,560,000					
Year 1		$42,520	$1,500	$520	$10,500	$30,000
Year 2		$43,478	$1,534	$532	$10,737	$30,676
Year 3		$44,457	$1,568	$544	$10,978	$31,367
Year 4		$45,459	$1,604	$556	$11,226	$32,073
Year 5		$46,483	$1,640	$568	$11,479	$32,796
Year 6		$47,530	$1,677	$581	$11,737	$33,535
Year 7		$48,601	$1,715	$594	$12,002	$34,290
Year 8		$49,696	$1,753	$608	$12,272	$35,063
Year 9		$50,815	$1,793	$621	$12,548	$35,853
Year 10		$51,960	$1,833	$635	$12,831	$36,660
Year 11		$53,130	$1,874	$650	$13,120	$37,486
Year 12		$54,327	$1,917	$664	$13,416	$38,331
Year 13		$55,551	$1,960	$679	$13,718	$39,194
Year 14		$56,802	$2,004	$695	$14,027	$40,077
Year 15		$58,082	$2,049	$710	$14,343	$40,980
Year 16		$59,390	$2,095	$726	$14,666	$41,903
Year 17		$60,728	$2,142	$743	$14,996	$42,847
Year 18		$62,096	$2,191	$759	$15,334	$43,812
Year 19		$63,495	$2,240	$777	$15,680	$44,799
Year 20		$64,926	$2,290	$794	$16,033	$45,808
PW Capital Cost	$29,560,000					
PW O&M Cost	$1,024,604					
PW Total	**$30,585,000**					
PW Salvage Cost [4]	**($3,053,400)**					
20-Year PW Total	**$27,532,000**					

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] THE ANNUAL COST AT YEAR 1 WAS PROVIDED BY THE MANUFACTURER. THIS COST INCLUDES ENERGY, REPAIR, AND OPERATION & MAINTENANCE.

[4] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 4A

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 4A – Regional Gravity Sewer System (Incorporate WNC Justice Academy, Basin 3 & Fruitland BBC)

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost [2]	Annual Package Plant Operation Cost [3]
Year 0	$47,320,000					
Year 1		$71,520	$5,000	$15,520	$21,000	$30,000
Year 2		$73,131	$5,113	$15,870	$21,473	$30,676
Year 3		$74,779	$5,228	$16,227	$21,957	$31,367
Year 4		$76,463	$5,346	$16,593	$22,451	$32,073
Year 5		$78,186	$5,466	$16,966	$22,957	$32,796
Year 6		$79,947	$5,589	$17,349	$23,474	$33,535
Year 7		$81,748	$5,715	$17,739	$24,003	$34,290
Year 8		$83,590	$5,844	$18,139	$24,544	$35,063
Year 9		$85,473	$5,975	$18,548	$25,097	$35,853
Year 10		$87,398	$6,110	$18,966	$25,662	$36,660
Year 11		$89,367	$6,248	$19,393	$26,240	$37,486
Year 12		$91,380	$6,388	$19,830	$26,831	$38,331
Year 13		$93,439	$6,532	$20,276	$27,436	$39,194
Year 14		$95,544	$6,679	$20,733	$28,054	$40,077
Year 15		$97,696	$6,830	$21,200	$28,686	$40,980
Year 16		$99,897	$6,984	$21,678	$29,332	$41,903
Year 17		$102,147	$7,141	$22,166	$29,993	$42,847
Year 18		$104,448	$7,302	$22,665	$30,669	$43,812
Year 19		$106,801	$7,467	$23,176	$31,359	$44,799
Year 20		$109,207	$7,635	$23,698	$32,066	$45,808
PW Capital Cost	$47,320,000					
PW O&M Cost	$1,723,417					
PW Total	**$49,043,000**					
PW Salvage Cost [4]	**($4,785,840)**					
20-Year PW Total	**$44,258,000**					

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] THE ANNUAL COST AT YEAR 1 WAS PROVIDED BY THE MANUFACTURER. THIS COST INCLUDES ENERGY, REPAIR, AND OPERATION & MAINTENANCE.

[4] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 4B

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 4B – Regional Gravity Sewer System to New WWTF near North Henderson High School (Incorporate WNC Justice Academy & Fruitland BBC)

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost [2]	Annual Package Plant Operation Cost [3]
Year 0	$33,190,000					
Year 1		$55,040	$3,000	$1,040	$21,000	$30,000
Year 2		$56,280	$3,068	$1,063	$21,473	$30,676
Year 3		$57,548	$3,137	$1,087	$21,957	$31,367
Year 4		$58,844	$3,207	$1,112	$22,451	$32,073
Year 5		$60,170	$3,280	$1,137	$22,957	$32,796
Year 6		$61,525	$3,353	$1,163	$23,474	$33,535
Year 7		$62,911	$3,429	$1,189	$24,003	$34,290
Year 8		$64,328	$3,506	$1,216	$24,544	$35,063
Year 9		$65,778	$3,585	$1,243	$25,097	$35,853
Year 10		$67,259	$3,666	$1,271	$25,662	$36,660
Year 11		$68,775	$3,749	$1,300	$26,240	$37,486
Year 12		$70,324	$3,833	$1,329	$26,831	$38,331
Year 13		$71,908	$3,919	$1,359	$27,436	$39,194
Year 14		$73,528	$4,008	$1,389	$28,054	$40,077
Year 15		$75,184	$4,098	$1,421	$28,686	$40,980
Year 16		$76,878	$4,190	$1,453	$29,332	$41,903
Year 17		$78,610	$4,285	$1,485	$29,993	$42,847
Year 18		$80,381	$4,381	$1,519	$30,669	$43,812
Year 19		$82,191	$4,480	$1,553	$31,359	$44,799
Year 20		$84,043	$4,581	$1,588	$32,066	$45,808
PW Capital Cost	$33,190,000					
PW O&M Cost	$1,326,299					
PW Total	**$34,516,000**					
PW Salvage Cost [4]	**($3,053,400)**					
20-Year PW Total	**$31,463,000**					

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.

[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] THE ANNUAL COST AT YEAR 1 WAS PROVIDED BY THE MANUFACTURER. THIS COST INCLUDES ENERGY, REPAIR, AND OPERATION & MAINTENANCE.

[4] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

Net Present Value Analysis
Preliminary Engineering Report for
Edneyville Sewer Service
Alternative 4C

Fed Discount Rate	0.3%	(per Appx. C of OMB Circular No. A-94, 11/2019)
Inflation	2.3%	(average annual inflation, 10/2000-9/2020)

Alternative 4C – Regional Gravity Sewer System (Incorporate WNC Justice Academy, Basin 3, Fruitland BBC & Minor Gravity Sewer Lines)

	Capital	Total Annual O&M Costs	Annual Equipment Repairs & Replacement Cost	Annual Energy Cost	Annual Operator Cost [2]	Annual Package Plant Operation Cost [3]
Year 0	$61,850,000					
Year 1		$71,520	$5,000	$15,520	$21,000	$30,000
Year 2		$73,131	$5,113	$15,870	$21,473	$30,676
Year 3		$74,779	$5,228	$16,227	$21,957	$31,367
Year 4		$76,463	$5,346	$16,593	$22,451	$32,073
Year 5		$78,186	$5,466	$16,966	$22,957	$32,796
Year 6		$79,947	$5,589	$17,349	$23,474	$33,535
Year 7		$81,748	$5,715	$17,739	$24,003	$34,290
Year 8		$83,590	$5,844	$18,139	$24,544	$35,063
Year 9		$85,473	$5,975	$18,548	$25,097	$35,853
Year 10		$87,398	$6,110	$18,966	$25,662	$36,660
Year 11		$89,367	$6,248	$19,393	$26,240	$37,486
Year 12		$91,380	$6,388	$19,830	$26,831	$38,331
Year 13		$93,439	$6,532	$20,276	$27,436	$39,194
Year 14		$95,544	$6,679	$20,733	$28,054	$40,077
Year 15		$97,696	$6,830	$21,200	$28,686	$40,980
Year 16		$99,897	$6,984	$21,678	$29,332	$41,903
Year 17		$102,147	$7,141	$22,166	$29,993	$42,847
Year 18		$104,448	$7,302	$22,665	$30,669	$43,812
Year 19		$106,801	$7,467	$23,176	$31,359	$44,799
Year 20		$109,207	$7,635	$23,698	$32,066	$45,808
PW Capital Cost	$61,850,000					
PW O&M Cost	$1,723,417					
PW Total	**$63,573,000**					
PW Salvage Cost [4]	**($4,785,840)**					
20-Year PW Total	**$58,788,000**					

[1] THE CAPITAL COST AT YEAR 0 IS EQUAL TO THE TOTAL ESTIMATED PROJECT COST FOR THE RESPECTIVE ALTERNATIVE.
[2] THE ANNUAL OPERATOR COST ASSUMES THAT TWO (2) OPERATORS WILL WORK ON THE PROPOSED PUMP STATION, ONE (1) HOUR EACH, 5 DAYS A WEEK, 52 WEEKS A YEAR, AT AN HOURLY WAGE OF $20/HR.

[3] THE ANNUAL COST AT YEAR 1 WAS PROVIDED BY THE MANUFACTURER. THIS COST INCLUDES ENERGY, REPAIR, AND OPERATION & MAINTENANCE.

[4] A SALVAGE VALUE REPRESENTS THE PORTION OF THE CAPITAL COST THAT THE OWNER HAS NOT RECEIVED VALUE BY THE END OF THE 20-YEAR WINDOW OF THE LIFECYCLE ANALYSIS. GRAVITY MAINS & MANHOLES HAVE A USEFUL LIFE OF 50 YEARS. SINCE ONLY 40% OF THE USEFUL LIFE OF THIS INFRASTRCUTRE HAS BEEN USED WITHIN THE 20-YEAR WINDOW, THE TOTAL CAPITAL COST ASSOCIATED WITH GRAVITY MAIN & MANHOLE INSTALLATION IS MULTIPLIED TO 60% TO REPRESENT THE VALUE OF THE CAPITAL COST THAT THE OWNER HAS REMAINED ON THE INFRASTRUCTURE INSTALLED AT YEAR 0.

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RISE TO THE **CHALLENGE**