TOWN OF PITTSBORO
NORTH CAROLINA

WASTEWATER TREATMENT PLANT

PRELIMINARY ENGINEERING REPORT
80% PER SUMMARY

JUNE 18, 2015

THE WOOTEN COMPANY

ENGINEERING ARCHITECTURE
PLANNING GEOMATICS

Wastewater Treatment Plant PER – 80% Summary

The following 80% PER summary highlights the key aspects of the Town of Pittsboro Wastewater Treatment Plant PER. The PER is being performed to address the Town's future wastewater treatment needs as significant future growth is anticipated in the area.

1. Overview

A. *Planning Period*
   1. Design Year is 2035 (20-year period)
   2. Planning area includes the Town of Pittsboro, ETJ, and Chatham Park Development.

B. *Future Permit Requirements*
   1. Two permit outfall locations: Robeson Creek and Haw River
      a. Robeson Creek allowable discharge = 1.249 million gallons per day (mgd)
      b. Haw River allowable discharge = 1.97mgd
      c. Total allowable permitted discharge = 3.22 mgd
   2. Existing WWTP discharges to Robeson Creek; capacity = 0.75 mgd. Need to increase capacity to 1.249 mgd.
   3. No discharge to the Haw currently.
   4. Permits require **additional** treatment:
      a. Total Nitrogen (Total N) mass limit.
      b. Total Phosphorus (Total P) mass limit.
      c. Limits apply to the sum of the Robeson Creek and Haw River discharges.
      d. Design for WWTP effluent Total N of 6 mg/L initially and then to 3 mg/L.

2. Influent Wastewater Characteristics at WWTP

A. *Proposed Influent Wastewater Characteristics*
   1. Influent wastewater characteristics were evaluated using 2011 through 2014 Daily Monitoring Reports (DMRs) and Process Data Bench Sheets.
   2. The following influent characteristics are suggested:
      a. BOD_5 = 325 mg/l **
      b. TSS = 300 mg/l
      c. TKN = 40 mg/l
      d. NH_3-N = 25 mg/l
      e. Total P = 8 mg/l
      f. Total Alkalinity as $CaCO_3$ = 120 mg/l
      g. BOD_5/TKN ration = 8.125
      h. BOD_5/TP ratio = 40.625
      ** Higher influent value used due to reported monthly average values and anticipated increase in BOD5 in new developments utilizing low water use fixtures and water conservation efforts as may be imposed by the Town.

3. Wastewater Influent Flow Analysis

A. *Influent Flow Determination*
   1. WWTP flow measurement and EQ flow diversion (Attachment 1).
   2. Wastewater flows to influent wet well not measured directly.
   3. To evaluate existing inflow/infiltration flows need to know what is directly flowing into influent wet well.
   4. Estimated flows to influent wet well as follows:
      a. Daily flow to influent wet well = Treated metered flow + EQ volume pumped to EQ tank – EQ volume returned to influent wet well.
      b. Used 2014 data as EQ pump and return volumes available for that year.

B. *Influent Flow Summary Statistics (2014)*
   1. 2014 Influent Flow Graph (Attachment 2)
   2. Flow Statistics (Table 1)

a. Annual Average Flow includes overall inflow and infiltration (I/I) volume
b. Dry Weather Base Flow (dry weather infiltration)
c. Sewer Billed Flow (totally leak proof sewers).

Table 1: 2014 Influent Wet Well Flow Summary Statistics	
Flow Type	**Flow (MGD)**
Annual Average Flow	513,000
Dry Weather Base Flow	350,000
Sewer Billed Flow	267,000
Peak Daily Flow	1,444,000
Peaking Sustained Flow (3-days)	1,189,000
Dry weather I/I Flow	83,000
Wet weather average I/I Flow	163,000
Estimated Peak Hour	Est. up to 2800 gpm

C. *Infiltration/Inflow Volume (2014)*
1. Evaluated rain vs flow data for 2014 and Jan – April 2015 (Attachments 2 & 3)
2. Evaluated 13 events with rainfall of 0.5 inches or greater (Table 2)
3. Estimated storm inflow ~ 0.55 MG/inch of rain. Duration of inflow varies significantly.

Table 2: Inflow and Rainfall Event Summary			
Storm Event Period	**Rainfall over event, in**	**Est. Inflow Volume over period, MG**	**Inflow/Inch of Rain, MG/in**
Jan 10 to Jan 13, 2014	2.5	1.8	0.72
Feb 3 to Feb 9, 2014	0.7	0.46	0.66
Mar 7 to Mar, 12 2014	3.6	1.99	0.55
June 15 to 18, 2014	5.5	1.78	0.32
Aug 9 to 14, 2014	3.6	1.86	0.52
Nov 23 to 27, 2014	2.9	1.46	0.51
Dec 20 to 28, 2014	3.1	1.98	0.63
Jan 12 to 17, 2015	1.55	1.28	0.83
Feb 9 to 12, 2015	0.95	0.48	0.50
Mar 5 to 8, 2015	1.3	0.58	0.48
Apr 9 to 13, 2015	4	2.14	0.42
Apr 14 to 17, 2015	1.4	0.58	0.41
Apr 19 to 24, 2015	3.1	1.98	0.65
Overall average			0.55

D. *Equalization Volume*
1. Existing Conditions
   a. Existing clarifiers peak capacity = 600 gpm (0.864 MGD) – Beyond this flow, solids wash-out tends to occur.
   b. Sustained 3-day peak flow = 1.3 MGD for 3 days in a row.
      1. Daily Storage = 1.3 – 0.86 = 0.44 MG per day
      2. EQ volume = 0.44 x 3 days = 1.32 MG
   c. Peak 2-day consecutive <u>inflow</u> (above plant capacity)
      1. Mar. 7 & 8, 2014 = 0.9 + 0.5 = 1.4 MG
      2. May 15 & 16, 2014 = 0.7 + 0.7 = 1.4 MG

2. Future Conditions
   a. Worst Case Peak Day Inflow
      1. 10-year, 24-hour storm event is 5.22 inch storm
      2. Storm inflow = 5.22 x 0.55 MG/in = 2.87 MG
   b. Additional future I/I Flow
      1. Without Chatham Park ~ 75,000 gpd
      2. With Chatham Park ~ 400,000 gpd
   c. Based upon future WWTP daily flow capacity of 2.5 mgd, a total equalization volume of 1.5 MG is necessary.
3. EQ Tanks Location
   a. On-site next to existing
      1. Tanks in floodplain and fill required
      2. Variance to Town ordinance needed and Army Corp floodplain permit
   b. Off-site at Town land to the northwest of the WWTP
      1. Need additional force main along Small Street
      2. No floodplain issue, but closer to residents

4. 20-Yr Wastewater Flow Projections (Design Year 2035) – Attachment 4

A. *Wastewater Flow Projection Summary*

Pittsboro and ETJ Areas. gpd	1,749,000
Chatham Park Wastewater Flow, gpd	2,700,000
Total Projected 2035 Wastewater Flow, gpd	**4,449,000**

B. *Wastewater Discharge Summary*

Pittsboro and ETJ Areas, gpd*	1,689,000
Chatham Park Wastewater Discharge, gpd **	1,200,000
Total Net 2035 Wastewater Discharge, gpd	**2,889,000**

** Includes 60,000 gpd reclaimed flow to 3M*
*** Includes 1.5 mgd reclaimed water demand at CP*

C. *Chatham Park Build-Out*

Wastewater Demand, gpd	4,900,000
Water Demand, gpd	6,500,000
Reclaimed Water Demand, gpd	2,800,000

D. *Wastewater Flow Projection Graph*
1. Phase 1: Expansion of existing WWTP to 1.249 mgd will provide the Town's capacity up to ~ Year 2025 to 2027 based on flow projections.
2. Phase 2: For future additional need of 0.5 mgd, the Town will need to work cooperatively with Chatham Park or Sanford to accommodate this need.

5. Wastewater Treatment Plant Expansion Alternatives (Attachment 5)

A. *Alternative 1 – Conventional BNR*
1. Use standard tank sizes and buy additional land (~ 3.3 acres)
2. Biological nitrogen treatment (anoxic and aerobic)
3. Final Clarifiers (settling)
4. Final Filters
5. UV disinfection
6. Convert existing package plants to aerobic digesters.

B. *Alternative 2 – Membrane Bioreactor (MBR)*
1. Use membrane barrier to allow smaller biological treatment volume.
2. Add separate membrane tank

3. Retrofit existing package plants
4. Eliminate clarifiers and final filters
5. UV disinfection
6. Add new sludge digestion tanks

C. *Alternative 3 – Integrated Fixed-Film Activated Sludge (IFAS)*
1. Add plastic media (for bacteria attachment) to allow smaller biological treatment volume sizes and buy additional land (~ 1.5 acres)
2. Retrofit existing package plants and partition into IFAS and other tank sections
3. Final Clarifiers (settling)
4. Final Filters
5. UV disinfection
6. Add new sludge digestion tanks

D. *Alternative Comparison (see Table 3)*

E. *Alternative Preliminary Capital Cost (see Table 4)*

6. Pump to Sanford Alternative

A. *Big Buffalo Wastewater Treatment Facility*

1.	Permitted Flow	12 mgd
2.	Est. Obligated flow, not yet tributary	0.482 mgd
3.	Current Average Daily Flow	4.0 mgd
4.	Available Capacity	7.52 mgd

B. *Wholesale Fees (To be included in O&M Cost Analysis)*
1. Cost of Transmission: *$0* – Flow transmitted directly to the Big Buffalo WWTP as Sanford desires.
2. Cost of Treatment: *$1.25 per 1000 gallons treated* – Calculated from previous year's budget applicable to treatment and dividing by the total volume treated for that budget year.
3. Capacity Fee: *$1,000,000 per year* – Calculated as a percentage of the City's annual debt service payment of $6,000,000. Therefore, 17% of the total plant capacity (2 mgd/12 mgd x 100) yields a capacity fee equal to 17% of the annual debt service.

C. *FM Routing/Potential Tie-In Locations*
1. Force main routed primarily along US 15-501 and Little Buffalo PS force main to plant. (Attachment 6)
2. Per NCDOT/Chatham Co., US 15-501 from SR 2219 (Old Sanford Rd) to county line is considered controlled access. District Engineer indicated that the proposed force main would need to be located outside of the right-of-way for this stretch (roughly 33,800 ft). However, the reclaimed water line to 3M was constructed in Hwy 15/501 R/W in area deemed controlled access by DOT. Thus, a final determination on this issue by DOT is needed.
3. Section of US 15-501 from county line to where FM would turn toward plant is partially controlled access as confirmed with NCDOT/Lee Co.
4. If screening and grit removal is provided prior to pumping, then Sanford desires tie-in to their existing equalization basin.
5. If no screening and grit removal is provided prior to pumping, then Sanford desires tie-in to the junction box ahead of the headworks.

7. Clean Water State Revolving Fund (CWSRF) Funding Considerations

A. *Phasing*

1. Phased approach to the 20-yr planning window is acceptable where funding can be pursued for Phase 1 activities initially followed by funding of future phase(s) at a later date. Allows for uncertainty of development growth and how future flows materialize.
2. Do not necessarily need signed MOUs or local agreements in place for second phase.
3. Present worth analysis in ER can be provided for first phase work only.
4. Plan to meet with DENR to verify phasing and discuss funding aspects.

B. *Funding*

1. $80 mil for CWSRF funding available for Fall 2015 round.
2. Process is competitive; however, last 2 rounds of CWSRF applications had more loan money available than the cost of the projects submitted. Thus, all eligible applications were granted their funding request.

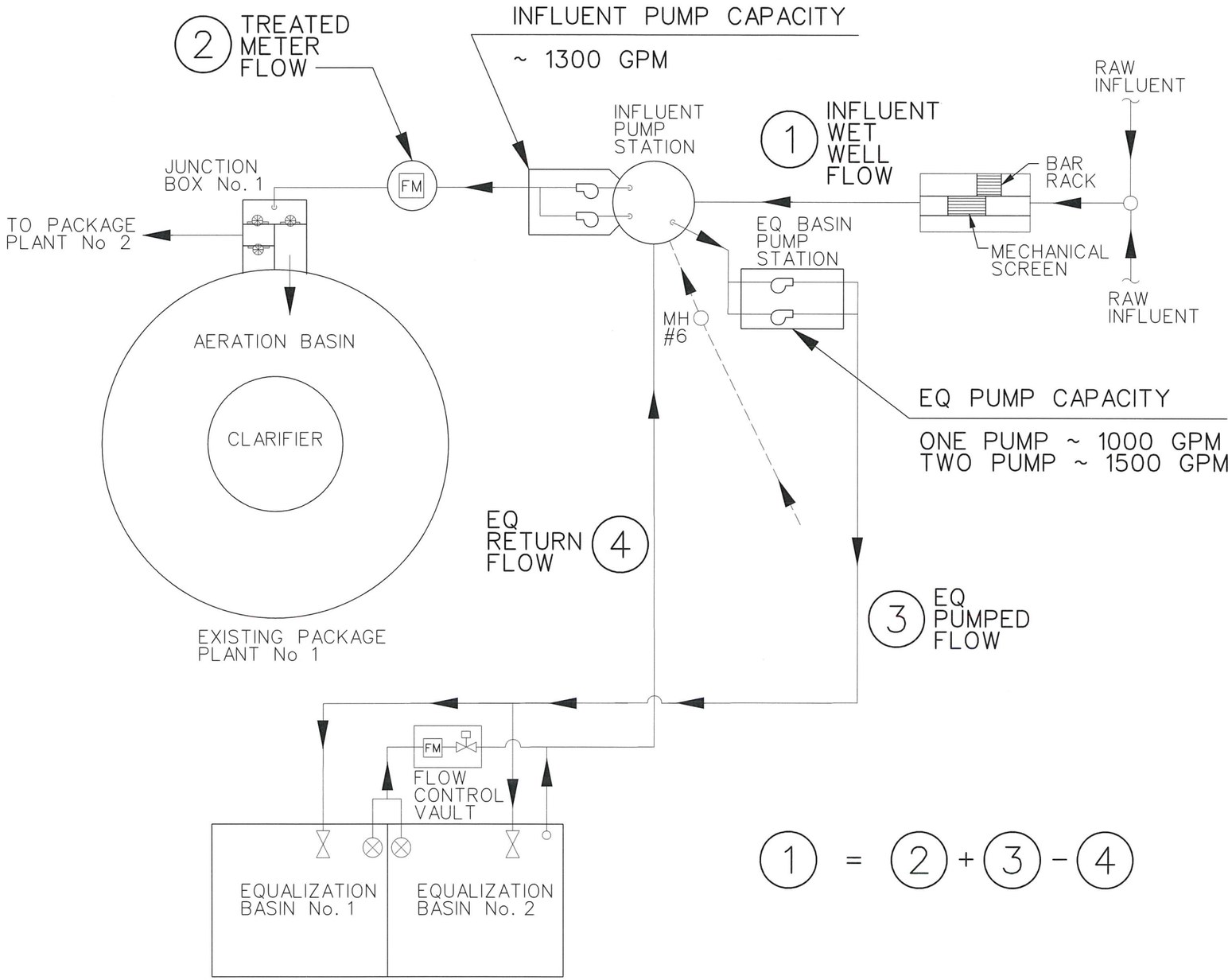
C. *Scoring*

1. The CWSRF Integrated Priority Rating System was evaluated to determine what, if any, measures the Town could implement that might increase priority points during the application review. It appears that preparation of an Asset Management Plan may be the most effective step to gain additional points.

Table 3: Alternative Comparison Table		
Alternative	**Advantages**	**Disadvantages**
Conventional Biological Nutrient Removal (BNR)	• Well proven technology • Operators more familiar with operation • Lower power requirements • Low automation • Standard equipment	• Requires land purchase (~ 3.5 acres) • Bigger tank volumes needed • More rock excavation (bedrock at ~ 6 feet) • Final filtration needed • Sensitive to solids settling in clarifiers • UV disinfection must be operated
Membrane Bioreactor (MBR)	• Established Technology • Smallest footprint • Highest level of treatment possible. • Reuse existing package plants. • Not sensitive to solids settling. • Eliminate final filters • May not need to run UV units • Easier to meet reclaim water standards	• Need fine screening • Operators less familiar with operation. • No by-passing possible • High level of automation. • Higher power requirements • Sludge tanks do not meet set-back (recommend 1 acre land purchase) • Construction will require significant electrical changes
Integrated Fixed Film Activated Sludge (IFAS)	• Moderate footprint • Reuse existing package plants. • Not as sensitive as conventional BNR to solids washout due to media • Relatively low power requirements • Low automation	• Requires land purchase (~ 1.6 acres) • Operators less familiar with operation. • Clarifier construction in floodplain close to floodway • Final filtration needed • UV disinfection must be run • Higher air requirement to suspend media • Harder to perform routine maintenance on IFAS tanks. • Operation of the WWTP during construction will require shut-down of half the treatment capacity.
On-site Equalization Tanks	• Adjacent to existing EQ tanks and on WWTP site – closer operation • Less piping and smaller EQ pumps	• Tank need to be constructed in floodplain. • Will need to permit floodplain construction. • More difficult construction
Off-site Equalization Tanks	• No floodplain issue • Could add future volume • Can use existing EQ tanks for sludge digesters • Various tank configurations possible	• Need force main along Small Street. • Need manhole on existing sewer line • Farther from WWTP for the operators • Tanks closer to residences.

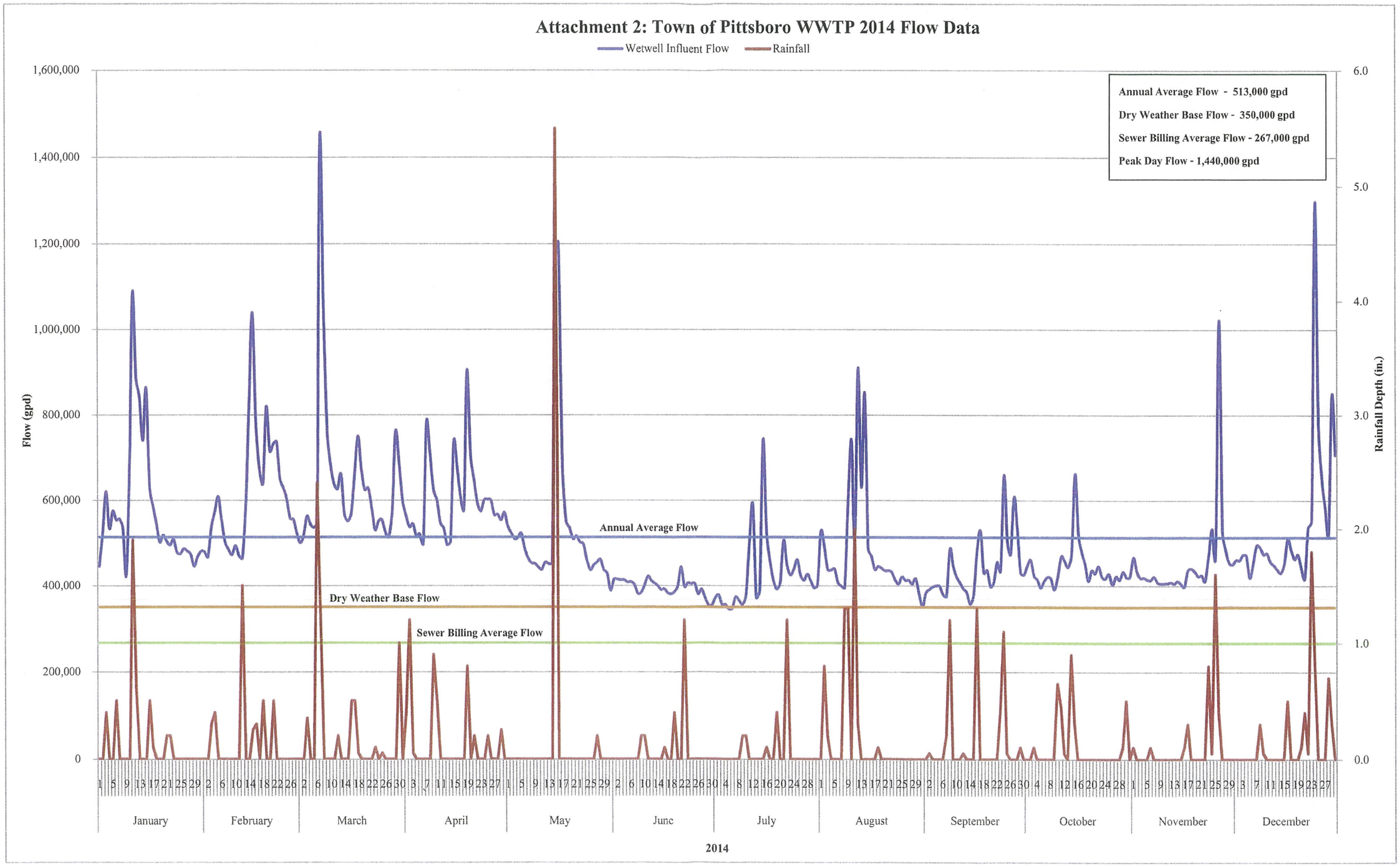
Table 4: Alternative Preliminary Capital Cost Table	
Alternative	**Capital Cost Range (million dollars)**
Alternative 1: Conventional Biological Nutrient Removal (BNR)	$15,500,000 to $16,700,000
Alternative 2: Membrane Bioreactor (MBR)	$15,000,000 to $16,100,000
Alternative 3: Integrated Fixed Film Activated Sludge (IFAS)	$15,800,000 to $16,800,000
Alternative 4: Pump to Sanford	$14,750,000 to $16,000,000

(1) Alternative 1 to 3 preliminary cost estimates assume on-site EQ tanks location.

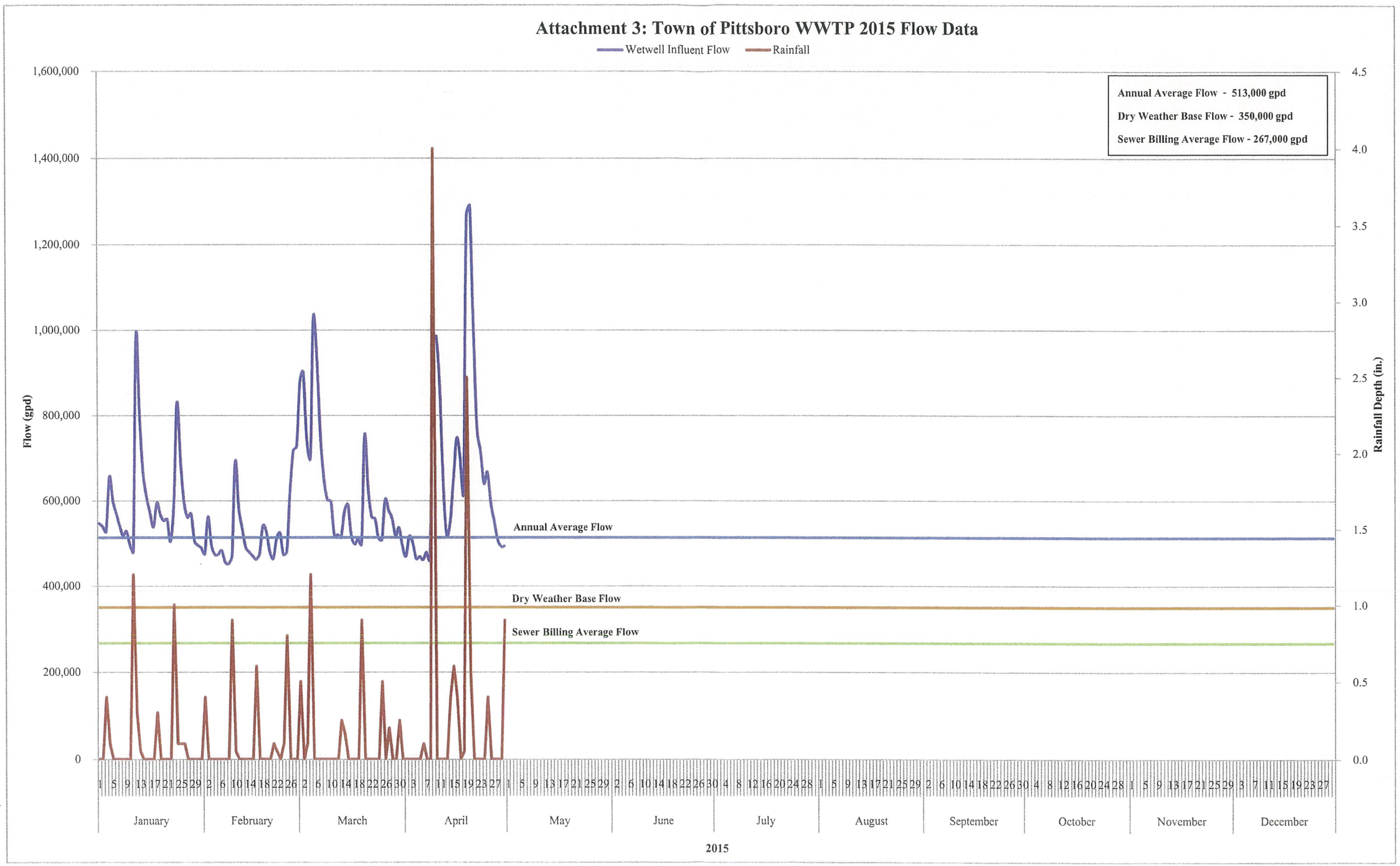


ATTACHMENT 1: PITTSBORO WWTP INFLUENT FLOW SCHEMATIC

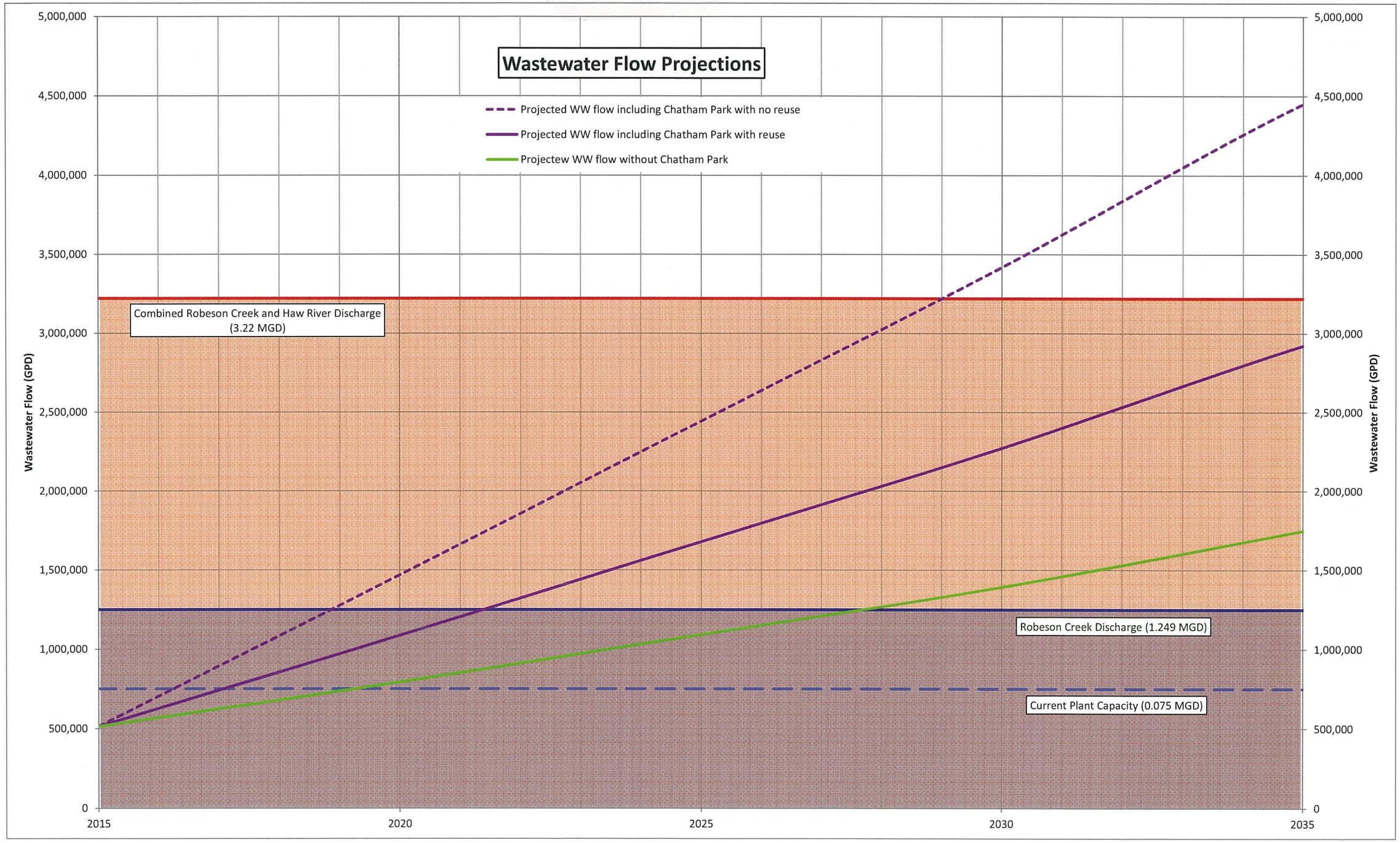
Attachment 2: Town of Pittsboro WWTP 2014 Flow Data



Attachment 3: Town of Pittsboro WWTP 2015 Flow Data



Attachment 4



Attachment 5

Wastewater Treatment Plant

Preliminary Alternative Layouts


PITTSBORO WWTP
CONVENTIONAL BNR
S SMALL ST
GRIT REMOVAL SYSTEM
ANOXIC
ANAEROBIC
AERATION
BNR SYSTEM TRAIN 1
BNR SYSTEM TRAIN 2
POST ANOXIC
RE-AERATION
FUTURE METHANOL STORAGE AREA
CLARIFIER
CLARIFIER
RAS/WAS BLOWER BLDG
50' Setback
100 Year Flood Zone
Floodway
10" SS
50' Setback
50' Setback
500 Year Flood Zone
NEW INFLUENT SCREEN AND CHANNEL
NEW INFLUENT AND EQ PUMP STATION
10" SS
EX AEROBIC DIGESTERS
DYNASAND FILTER EXPANSION
100 Year Flood Zone
RE-BUILD PRIOR UV CHANNEL
CASCADE AERATOR STRUCTURE
50' Setback
Floodway
Sanitary Sewer
15" SS
Floodway
CONVERT TO AEROBIC DIGESTER No 3
EQ TANK
EQ TANK
100 Year Flood Zone
Floodway
50' Setback
RE-PUPOSE EXISTING BLOWERS FOR DIGESTION
500 Year Flood Zone
EQ TANK No. 3
500 Year Flood Zone
CONVERT TO AEROBIC DIGESTER No 4
EQ TANK No 4
10" SS
500 Year Flood Zone
50' Setback
100 Year Flood Zone
100 Year Flood Zone
500 Year Flood Zone
0 20 40 80
Feet

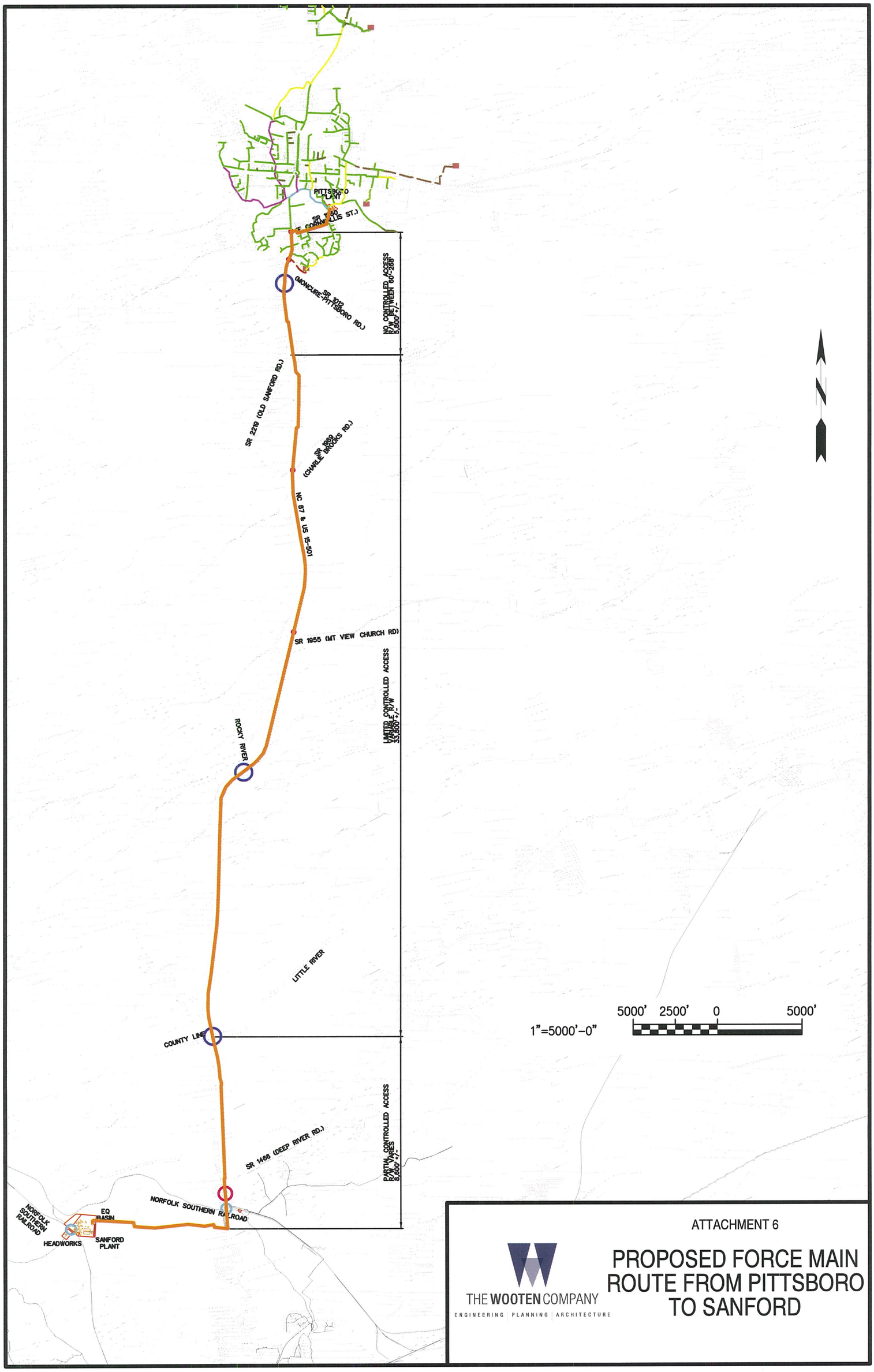
PITTSBORO WWTP
MBR SYSTEM

50' Setback
100 Year Flood Zone
Floodway
100 Year Flood Zone
Floodway
50' Setback
S SMALL ST
AEROBIC DIGESTER No 1
AEROBIC DIGESTER No 2
BLOWERS
10" SS
50' Setback
10" SS
50' Setback
NEW ADMIN BUILDING
500 Year Flood Zone
NEW INFLUENT /EQ P.S.
Stallings Sewer
15" SS
16" SS
COURSE SCREEN
GRIT REMOVAL
FINE SCREENS
FUTURE METHANOL STORAGE AND FEED SYSTEM
100 Year Flood Zone
RE-BUILD PRIOR UV CHANNEL
Floodway
50' Setback
MBR
I.R.
I.R.
MBR TANKS
EQ TANK
EQ TANK
CASCADE AERATOR STRUCTURE
EQ TANK No. 3
100 Year Flood Zone
500 Year Flood Zone
I.R.
I.R.
MBR
500 Year Flood Zone
EQ TANK No.4
500 Year Flood Zone
10" SS
Floodway
100 Year Flood Zone
50' Setback
0 20 40 80
Feet

PITTSBORO WWTP
IFAS SYSTEM

50' Setback
100 Year Flood Zone
Floodway
100 Year Flood Zone
Floodway
50' Setback
Sanitary Sewer
15" SS
8" SS
NEW LIFT P.S.
NEW INFLUENT SCREEN AND CHANNEL
NEW INFLUENT AND EQ P.S.
FUTURE METHANOL AREA
IFAS
50' Setback
500 Year Flood Zone
10" SS
100 Year Flood Zone
Floodway
50' Setback
BLOWERS
AEROBIC DIGESTER No 1
AEROBIC DIGESTER No 2
CLARIFIER
RAS/WAS P.S.
CLARIFIER
10" SS
50' Setback
GRIT REMOVAL SYSTEM
EQ TANK
EQ TANK
EQ TANK No. 3
IFAS
500 Year Flood Zone
EQ TANK No.4
RE-BUILD PRIOR UV CHANNEL
50' Setback
CASCADE AERATOR STRUCTURE
500 Year Flood Zone
100 Year Flood Zone
Floodway
100 Year Flood Zone
500 Year Flood Zone
50' Setback
10" SS

0 20 40 80
Feet



ATTACHMENT 6

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PROPOSED FORCE MAIN ROUTE FROM PITTSBORO TO SANFORD