TECHNICAL MEMORANDUM November 6, 2024

To: Union County Board of County Commissioners
500 N. Main Street, Suite 932
Monroe, NC 28112

From: BGE, Inc., on behalf of D.R. Horton, Inc.
1111 Metropolitan Ave, Suite 250
Charlotte, NC 28204

RE: Project 20222058 – Sanctuary at Southgate Phase II Development Pump Station Alternatives Analysis

Dear Board of Commissioners,

BGE, Inc. (BGE), on behalf of D.R. Horton, Inc., completed the pump station alternatives analysis for the proposed Sanctuary at Southgate Phase II development to garner your approval for a new pump station. The proposed Sanctuary at Southgate Phase II development is located in Union County, North Carolina, at the intersection of Poplin Road and North Rocky River Road (See Appendix 1) and is comprised of 75 single-family residential homes, a future mixed use development with multi-family units, clubhouse and pool, a future commercial development with mixed use retail shops, fast food restaurant, medical office, grocery, coffee shop, fuel center, car wash, restaurant, and a future fire station. The proposed development is within Union County's Twelve Mile Creek Water Reclamation Facility's service area via the Poplin Road Pump Station.

D.R. Horton, Inc., in collaboration with Walton Global Holdings, LLC, has reviewed the Future Land Use Plans for Union County and Indian Trail and believe the proposed pump station is well-suited for the larger goals of the municipality and the county. The Town of Indian Trail 2041 Future Land Use Plan, adopted 7/12/2022, identifies this area as a Walkable Activity Center. A Walkable Activity Center is home to a broad range of uses including commercial, office, and residential with an emphasis on promoting economic development.

The Union County 2050 Comprehensive Plan shows this area located in proximity to Community and Employment Centers located off Unionville-Indian Trail Road and the Monroe Expressway. D.R. Horton, Inc. and Walton Global Holdings, LLC believe a regional pump station fits both the economic goals of Indian Trail and Union County based on the planning and plans.

Walton Global Holdings, LLC donated land to Indian Trail that has been identified for a future Fire Station. The funding for the Fire Station is discussed in the Union County Capital Improvement Plan and the proposed pump station would service the facility.

This Technical Memorandum outlines the proposed project, potential area to be served by the pump station, capacity analyses completed by Black & Veatch, and the pump station alternatives analysis with life cycle cost calculations. The pump station alternatives analysis compares Alternative 1, including a proposed new on-site pump station with force main connecting to the existing gravity sewer infrastructure of the Annandale Subdivision, and Alternative 2, including a proposed gravity

1111 Metropolitan Avenue, Suite 250 · Charlotte, North Carolina 28204 · 980-220-2322

sewer main connecting to the Porter Ridge Pump Station (See Appendix 7). For Alternative 2, Black & Veatch completed an analysis outlining required upgrades to the existing Porter Ridge and Fieldstone Pump Stations.

The life cycle costs analysis determined the proposed Alternative 1 is more cost effective than Alternative 2 (See Total Life Cycle Cost Alternative Summary Table).

Total Life Cycle Cost Alternative Summary Table - NPV	
Alternative 1 - On-Site Pump Station with Gravity Sewer Connection at Annandale Subdivision	$2,086,600.86
Alternative 2 - Off-Site Gravity Sewer Connection to Porter Ridge Pump Station	$3,585,319.06
DELTA	$1,498,718.20

Based on the life cycle cost analysis for both pump station alternatives, a new on-site pump station receiving wastewater flows from the proposed Sanctuary at Southgate Phase II development with connection to existing gravity sewer infrastructure of the Annandale subdivision, would be the best option for this project.

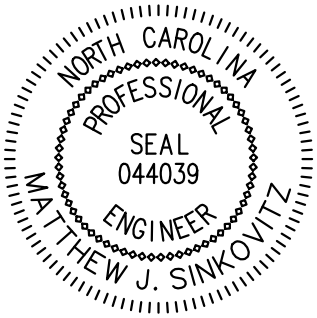
Please contact me (msinkovitz@bgeinc.com; 980.867.4497) with any questions or concerns.

Thank-you for your consideration.

Sincerely,

Matthew J. Sinkovitz

11/06/2024



Matthew J. Sinkovitz, P.E.
Senior Project Manager

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

D.R. Horton and Walton Global Holdings, LLC (Walton) are seeking Union County Board of County Commissioners approval for the Sanctuary at Southgate Phase II development. The project is located in Union County, North Carolina, at the intersection of Poplin Road and North Rocky River Road (See Appendix 1). The Phase II site includes a portion of parcel 07006001A, 07021015E, parcel 07009017, parcel 07006001B, and parcel 07009017A, totaling 61.2 acres (See Appendices 1 and 2). The Phase II development includes 75 single-family residential homes (by D.R. Horton), a future multi-family development including 240 multi-family units (by Walton), a future commercial development including a shopping center with food service (by others), with sanitary sewer infrastructure including gravity lines, on-site pump station, and force main. Walton has started preliminary design on the commercial components and is actively marketing the spaces to well-known retailers. BGE prepared this Pump Station Alternatives Analysis to meet the requirements of Union County Code, Section 34-336, Para b.1.b. The analysis includes the (1) area to be served by the proposed pump station, (2) volume of wastewater flow to be generated by the development, (3) capacity analysis with necessary improvements identified to handle flow from the development, and (4) a pump station alternative analysis comparing the lifecycle costs of gravity and pump station sanitary sewer solutions for the development.

BACKGROUND

The area to be served by the proposed pump station totals approximately 74 acres and includes 75 single-family residential homes (by D.R. Horton), a future multi-family development (by Walton), two future commercial developments (by others), and a future emergency response facility (by others) (See Appendix 2). The Utility Sketch Plan developed by BGE is included as Appendix 3.

BGE determined the total wastewater demand of the proposed Sanctuary at Southgate Phase II development and the future multi-family, commercial, and the future emergency response facility serviced by the proposed pump station to be **97,870 GPD** (See Appendix 4). BGE utilized the total wastewater demand and determined the total peak wet weather wastewater flow design condition for the proposed pump station to be **177.20 GPM**, by applying the minimum peaking factor of 2.5 as outlined in the *NCDENR Minimum Design Criteria for the Permitting of Pump Stations and Force Mains* to all design daily flows, except the single family detached lots (See Appendix 4). BGE applied a peaking factor of 3 to the single family detached lots design daily flow per Black & Veatch's assumptions outlined in its Sanctuary at Southgate Phase 2 Wastewater Collection System Analyses (See Appendices 5 & 6).

Black & Veatch analyzes wastewater flows and provides wastewater collection system hydraulic modeling services for Union County Water (UCW). Black & Veatch completed two (2) Sanctuary at Southgate Phase II wastewater collection system analyses to determine impacts of the new development on wastewater flows in the receiving wastewater collection system.

Black & Veatch's first analysis, dated 4/26/2023 (See Appendix 5), analyzed two alternatives.

- Alternative 1 – On-Site Pump Station with Gravity Sewer Connection at Phase I. Alternative 1 includes an on-site pump station for the Sanctuary at Southgate Phase II development with force main discharging into the gravity sewers installed during the Sanctuary at Southgate Phase I development. "After being discharged to the Phase 1 sewer, wastewater will flow downstream by gravity to an existing 12-inch sewer. The flow travels through 5,200 feet of 12-inch sewer, the Fieldstone Pump Station, and 4,500 feet of 6-inch force main and then discharges to 1,300 feet of 8-inch gravity sewer that flows to the Poplin Road Pump Station" (Black & Veatch, 4/26/2023).

- Alternative 2 – Off-Site Gravity Sewer Connection to Porter Ridge Pump Station. Alternative 2 assumes construction of 4,700 feet of adequately sized sewer to convey project flows to the Porter Ridge service area. Sanctuary at Southgate Phase II development wastewater flows "would connect to a 3,100 LF 8-inch gravity sewer leading to the Porter Ridge pump station, which discharges into the 12-inch

Fieldstone service area collection sewer, approximately 8,000 LF downstream of the connection point indicated on the development's site utility plan" (Black & Veatch, 4/26/2023).

The findings and recommendations outlined in Black & Veatch's report, dated 4/26/2023, include:

- Evaluation of both the 12-inch and 8-inch gravity sewers associated with the Sanctuary at Southgate Phase II Development flows determined neither are predicted to surcharge under a 1-year storm event.
- Alternative 2 "has little effect on the analysis in terms of capacity based on the modeling results but requires the construction of off-site gravity sewer conveying flows to the Porter Ridge Pump Station service area. The Porter Ridge Pump Station capacity needs to be evaluated if [Alternative 2] is further considered."
- The allocation and firm capacities of the Fieldstone Pump Station are exceeded with the addition of the Sanctuary at Southgate Phase II development wastewater flows. "It is not recommended that the 0.44 MGD firm capacity of the [Fieldstone Pump Station] be exceeded."
- The allocation and firm capacities of the Poplin Road Pump Station are exceeded with the addition of the Sanctuary at Southgate Phase II development wastewater flows. "Approval for this development is dependent on completion of the CIP improvement project that will install adequate flow equalization at the Poplin Road Pump Station. Once an equalization tank is installed, the storage volume will be sufficient to prevent backup in the gravity system upstream of the Poplin Pump Station." [Per email from Crystal Panico, dated 12/7/2023, the equalization tank was substantially completed and should be online in the next couple of months.]
- "The Twelve Mile Creek WRF has a rated capacity of 7.5 MGD."

At Union County Water's direction, Black & Veatch analyzed two additional alternatives and issued a Sanctuary at Southgate Phase 2 Revised Wastewater Collection System Analysis, dated 8/24/2023 (See Appendix 6).

- Alternative 3 - On-Site Pump Station with Gravity Sewer Connection at Sedgewick Road. Alternative 3 includes an on-site pump station for the Sanctuary at Southgate Phase II development with force main discharging to the northwest, across Poplin Road, into the gravity sewer along Sedgewick Road, and the gravity sewer conveying wastewater flow approximately 2,000 feet to the Poplin Road Pump Station.

- Alternative 4 - On-Site Pump Station with Gravity Sewer Connection at Potomac Road. Alternative 4 includes an on-site pump station for the Sanctuary at Southgate Phase II development with force main discharging to the northwest, across Poplin Road, into the gravity sewer along Potomac Road, and the gravity sewer conveying flow approximately 2,000 feet to the Poplin Road pump station.

The findings and recommendations outlined in Black & Veatch's report, dated 8/24/2023, include:

- Both Alternative 3 and Alternative 4 "are not predicted to surcharge under a 1-year storm event." Either sewer discharge location "is viable from a capacity standpoint."
- "The allocation and firm capacities of the Poplin Road Pump Station are exceeded with the addition of [the Sanctuary at Southgate Phase II development] proposed peak flows."
- "Approval for [the Sanctuary at Southgate Phase II development] is dependent on completion of the CIP improvement project that will provide flow equalization at the Poplin Road Pump Station. At that point, the storage volume will be sufficient to prevent backup in the gravity system upstream of the Poplin Road Pump Station…Until the Poplin Road Pump Station [Equalization] Basin project is completed, it is not recommended that the 3.64 MGD operational capacity of the station be exceeded." [Per email from Crystal Panico, dated 12/7/2023, the equalization tank was substantially completed and should be online in the next couple of months.]
- "The Twelve Mile Creek WRF has a rated capacity of 7.5 MGD."

Based on the analyses completed by Black & Veatch, topography, and direction provided by UCW [Per email from Crystal Panico, dated 9/29/2023), BGE defined two alternatives for the Pump Station Alternatives Analysis. Alternative 1 includes an on-site pump station with gravity sewer force main connecting to existing infrastructure at Potomac Road (Annadale Subdivision) and Alternative 2 includes gravity sewer line connecting to the Porter Ridge Pump Station with upgrades to the existing Porter Ridge Pump Station and the Fieldstone Pump Station (See Appendix 7). For Alternative 2, Black & Veatch outlined the required upgrades for the existing Porter Ridge Pump Station and the Fieldstone Pump Station in the Sanctuary at Southgate Gravity Alternative Calculations, dated 11/21/2023 (See Appendix 8). Black & Veatch recommended the following for Alternative 2:

- Minimum 8-inch pipe diameter for the 7,100 linear feet of gravity sewer.
- Replace the two (2) pumps at the Porter Ridge Pump Station pumps with 275 GPM pumps at 105 feet of head.
- Replace the two (2) pumps at the Fieldstone Pump Station with news pumps at design point of 490 GPM at approximately 102 feet of head.
- "The pump sizing at each station is increasing by [30% to 50%]. Wet well improvements may be required depending on size of [the] new pumps and [the] existing wet well." Wet wells should be assessed to ensure the pumps fit in the pump slots and the wet well provides adequate volume to limit the number of on/off cycles. "The sizing of the existing electrical systems and generator should also be assessed to determine whether they can support the larger pumps."

ALTERNATIVE 1 – ON-SITE PUMP STATION WITH GRAVITY SEWER CONNECTION AT ANNANDALE SUBDIVISION

Overview

Alternative 1 includes a new on-site pump station for the proposed Sanctuary at Southgate Phase II development and 5,460 linear feet of 6" PVC sanitary sewer force main connecting to existing sanitary sewer infrastructure at Potomac Road (See Appendix 7).

Assumptions

- BGE calculated a total sewer demand of 97,870 GPD (**design daily flow = 67.97 GPM**) and utilized a 2.5 peaking factor per *NCDENR Minimum Design Criteria for the Permitting of Pump Stations and Force Mains,* except for the single family detached lots. BGE applied a peaking factor of 3 to the single family detached lots design daily flow per Black & Veatch's assumptions outlined in its Sanctuary at Southgate Phase 2 Wastewater Collection System Analyses (See Appendices 5 & 6). This resulted in a peak wet weather wastewater flow of 255,175 GPD (**peak hourly flow = 177.20 GPM**) (See Appendix 4).
- New Sanctuary at Southgate Phase II pump station calculations are included as Appendix 9.
- BGE coordinated pump recommendations with Xylem Water Solutions USA, Inc. (Xylem). For the pump station condition of pump rate = 225 GPM, static head = 43 feet, and total head = 64 feet, Xylem recommended the Flygt NP 3127 HT 3~ Adaptive 488 pump (See Appendix 10).
- BGE coordinated pump station budget costs with CMH Solutions, LLC (CMH). CMH provided a lump sum budget cost of **$963,000** for the new on-site Sanctuary at Southgate Phase II pump station. Scope included:
    - 6-foot diameter, 21-foot deep wet well,
    - 4-inch discharge piping and 4-inch valve vault piping (force main will increase to 6-inch after the valve vault),
    - One (1) 8-inch gravity sewer into the wet well, and
    - 30-foot driveway.

Life Cycle Cost Analysis

BGE completed a life cycle cost analysis per the *Union County Water Documentation Requirements for the Consideration of Wastewater Pump Stations*. BGE determined the Net-Present-Value of Alternative 1 lifecycle costs is **$2,086,600.86** (See Appendix 11).

ALTERNATIVE 2 – OFF-SITE GRAVITY SEWER CONNECTION TO PORTER RIDGE PUMP STATION

Overview

Alternative 2 includes construction of 7,100 linear feet of 8" PVC gravity sewer line with upgrades to the existing Porter Ridge Pump Station and the Fieldstone Pump Station.

Assumptions

- For the Porter Ridge Pump Station, BGE estimated a total sewer demand of 151,570 GPD (**design daily flow = 105.26 GPM**) and utilized a 2.5 peaking factor per *NCDENR Minimum Design Criteria for the Permitting of Pump Stations and Force Mains,* except for the single family detached lots. BGE applied a peaking factor of 3 to the single family detached lots design daily flow per Black & Veatch's assumptions outlined in its Sanctuary at Southgate Phase 2 Wastewater Collection System Analyses (See Appendices 5 & 6). This resulted in a peak wet weather wastewater flow of 389,425 GPD (**peak hourly flow = 270.43 GPM**). Porter Ridge Pump Station calculations are included as Appendix 12.
- For the Fieldstone Pump Station, BGE estimated a total sewer demand of 310,050 GPD (**design daily flow = 215.31 GPM**) and utilized a 2.5 peaking factor per *NCDENR Minimum Design Criteria for the Permitting of Pump Stations and Force Mains,* except for the single family detached lots. BGE applied a peaking factor of 3 to the single family detached lots design daily flow per Black & Veatch's assumptions outlined in its Sanctuary at Southgate Phase 2 Wastewater Collection System Analyses (See Appendices 5 & 6). This resulted in a peak wet weather wastewater flow of 785,625 GPD (**peak hourly flow = 545.57 GPM**). Fieldstone Pump Station calculations are included as Appendix 13.
- BGE coordinated pump recommendations with Xylem for the Porter Ridge Pump Station. For the pump station condition of pump rate = 300 GPM, static head = 43 feet, and total head = 94 feet, Xylem recommended the Flygt NP 3153 HT 3~ 462 pump (See Appendix 14).
- BGE coordinated Porter Ridge Pump Station upgrade budget costs with CMH Solutions, LLC (CMH). CMH provided a lump sum budget cost of **$430,000** for the Porter Ridge Pump Station upgrades. Scope included:
    - Replace existing pumps with two (2) new Flygt NP 3153 HT 3~ 462 pumps,
    - Modifications to the existing pump control panel to include new 30Hp solid state reduced voltage starters, pump breakers, transformer breaker, power wiring, and ancillary controls as required,
    - Replace existing generator with a 60kW unit with 80kW alternator and 200A transfer switch, and
    - Upgrade existing electrical service to a 200A service.
    - The budget cost includes by-pass operations for the duration of the system upgrade.
    - The budget cost does not include modifications to the existing Radio Telemetry System.
- BGE coordinated pump recommendations with Xylem for the Fieldstone Pump Station. For the pump station condition of pump rate = 600 GPM, static head = 62 feet, and total head = 167 feet, Xylem recommended the Flygt NP 3202.185 HT pump (See Appendix 15).
- BGE coordinated Fieldstone Pump Station upgrade budget costs with CMH Solutions, LLC (CMH). CMH provided a lump sum budget cost of **$642,000** for the Fieldstone Pump Station upgrades. Scope included:
    - Replace existing pumps with two (2) new Flygt NP 3202.185 HT pumps,
    - Modifications to the existing pump control panel to include new 75Hp solid state reduced voltage starters, pump breakers, transformer breaker, power wiring, and ancillary controls as required,

    - Replace existing generator with a 175kW unit with 200kW alternator and 400A transfer switch, and
    - Upgrade existing electrical service to a 400A service.
    - The budget cost includes by-pass operations for the duration of the system upgrade.
    - The budget cost does not include modifications to the existing Radio Telemetry System.
- BGE assumed construction of a 7,100 linear foot 8" PVC gravity sanitary sewer line with manholes located every 425 feet (plus 20%, one at beginning, and one at end).
- BGE assumed 10 acres of clearing and grubbing would be required to construct the new gravity sanitary sewer line.
- BGE assumed 10 acres of temporary construction easement and five (5) acres of sanitary sewer easement would be acquired for the new gravity sanitary sewer line.

Life Cycle Cost Analysis

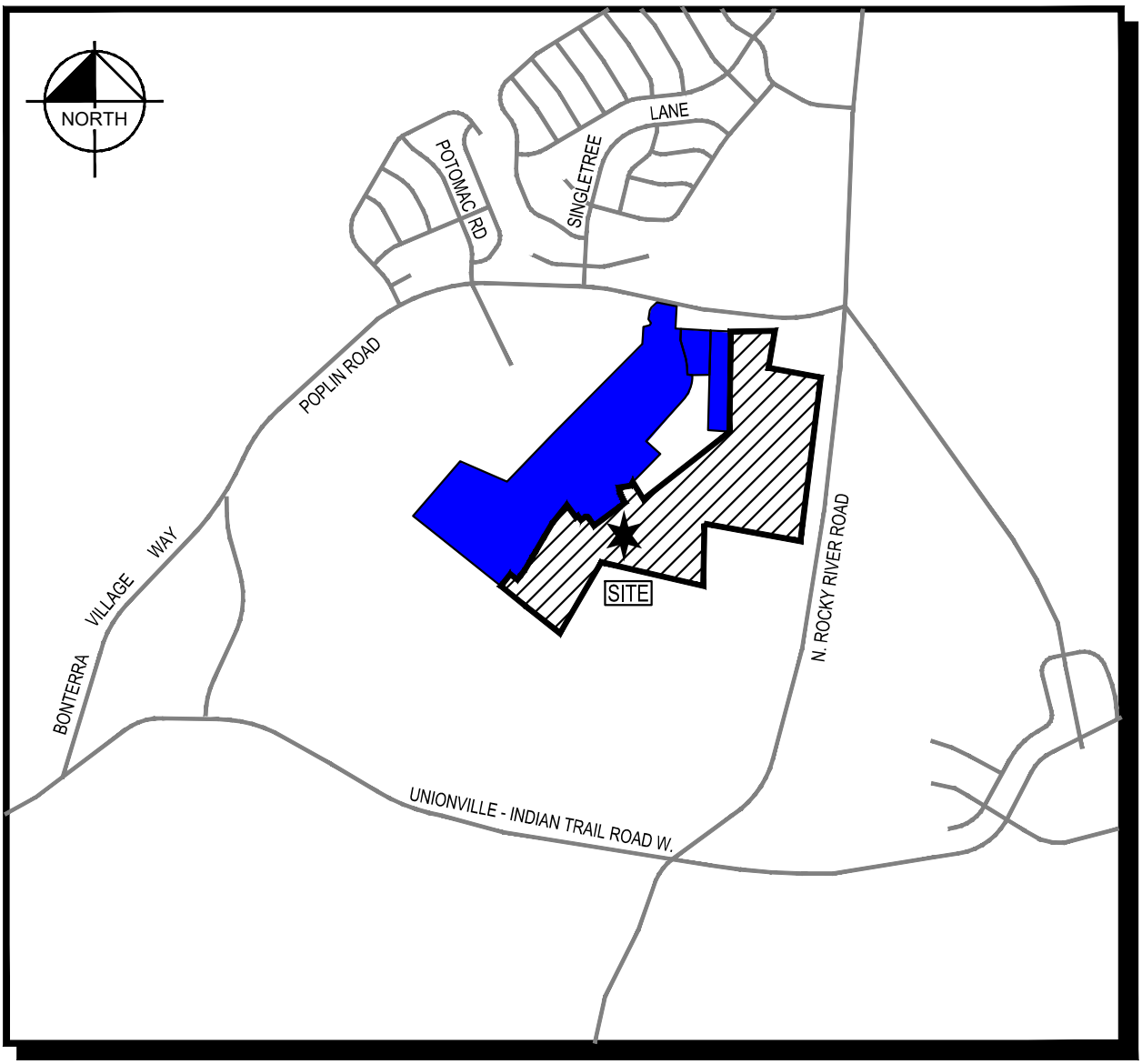
BGE completed a life cycle cost analysis per the *Union County Water Documentation Requirements for the Consideration of Wastewater Pump Stations*. BGE determined the Net-Present-Value of Alternative 2 lifecycle costs is **$3,585,319.06** (See Appendix 16).

CONCLUSION

The life cycle cost analysis determined Alternative 1 is more cost effective than Alternative 2.

Total Life Cycle Cost Alternative Summary Table - NPV	
Alternative 1 - On-Site Pump Station with Gravity Sewer Connection at Annandale Subdivision	**$2,086,600.86**
Alternative 2 - Off-Site Gravity Sewer Connection to Porter Ridge Pump Station	**$3,585,319.06**
New Gravity Sanitary Sewer Line	$1,669,354.47
Porter Ridge Pump Station Upgrades	$753,607.36
Fieldstone Pump Station Upgrades	$1,162,357.23
DELTA	**$1,498,718.20**

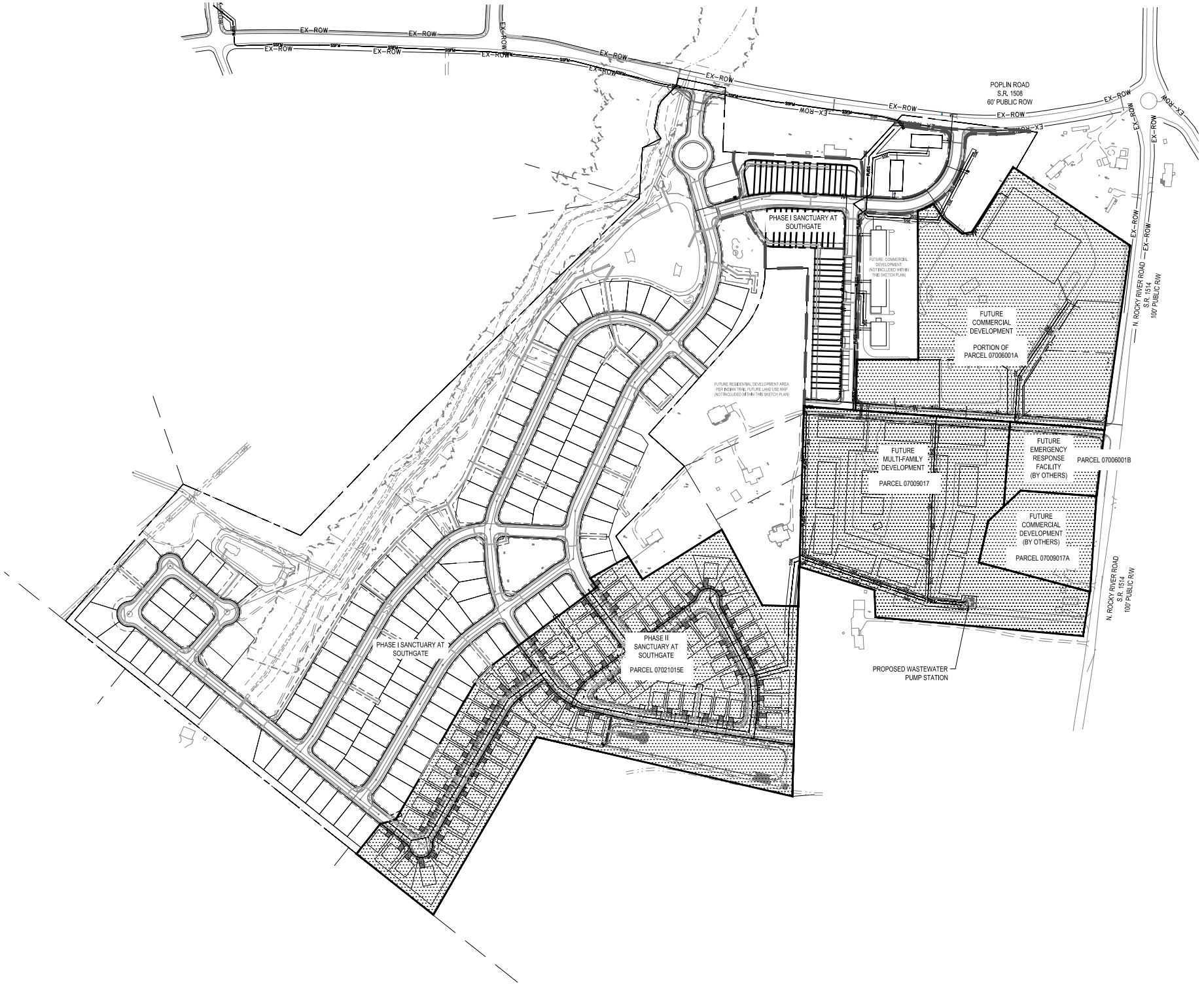
APPENDIX 1 - SITE LOCATION MAP

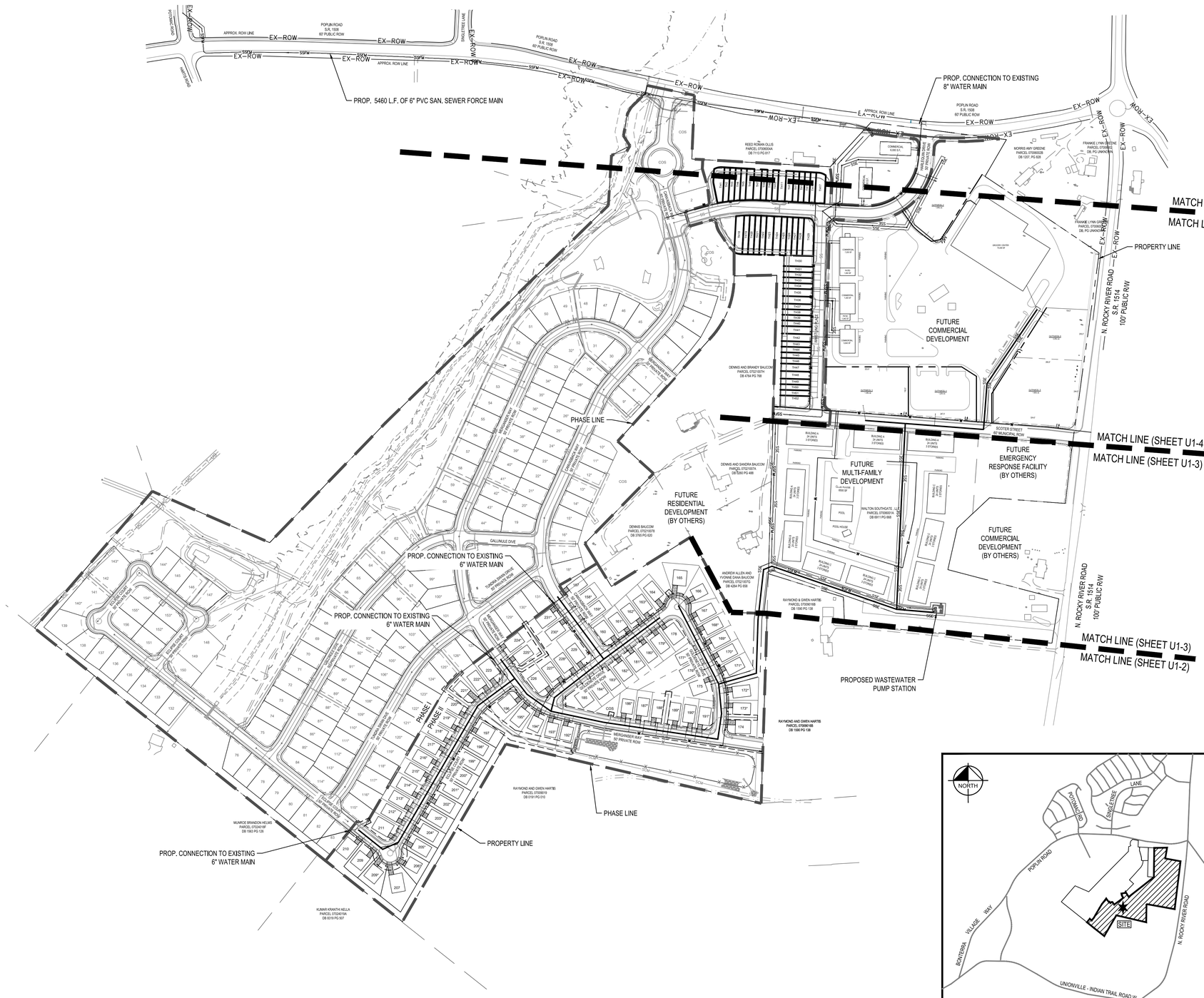


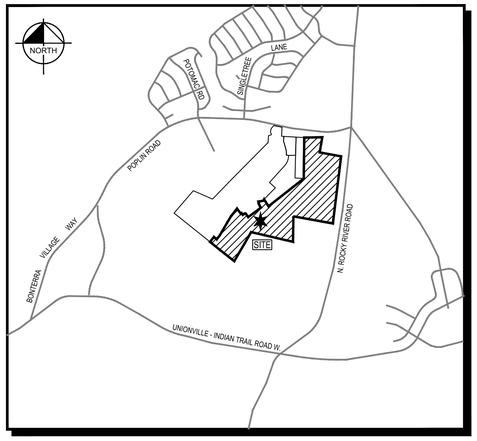
SITE LOCATION MAP
NOT TO SCALE

Phase I
Phase II

APPENDIX 2 - PROPOSED PUMP STATION SERVICE AREA MAP







SITE LOCATION MAP
NOT TO SCALE

SITE DEVELOPMENT DATA

JURISDICTION: TOWN OF INDIAN TRAIL, NC
TOTAL PROJECT AREA: 90.355 ACRES

DEVELOPER: D.R. HORTON
8025 ARROWRIDGE BLVD
CHARLOTTE, NC 28273
TAKARSKI@DRHORTON.COM
704-574-4579
CONTACT: TROY KARSKI

TAX PARCEL #: 07006001A
ADDRESS: 4823 N ROCKY RIVER ROAD
INDIAN TRAIL, NC 28079
CURRENT OWNER: WALTON SOUTHGATE, LLC
MAILING ADDRESS: 8800 N GAINEY CENTER DRIVE, STE 345
SCOTTSDALE, AZ 85258
CONTACT: BRAD MARTIN
BMARTIN@WALTON.COM

TAX PARCEL #: 07009017
ADDRESS: 4709 N ROCKY RIVER ROAD
INDIAN TRAIL, NC 28079
CURRENT OWNER: WALTON SOUTHGATE, LLC
MAILING ADDRESS: 8800 N GAINEY CENTER DRIVE, STE 345
SCOTTSDALE, AZ 85258
CONTACT: BRAD MARTIN
BMARTIN@WALTON.COM

TAX PARCEL #: 07021015E
ADDRESS: 0 POPLIN ROAD
INDIAN TRAIL, NC 28079
CURRENT OWNER: WALTON NORTH CAROLINA, LLC, ET AL
MAILING ADDRESS: 8800 N GAINEY CENTER DRIVE, STE 345
SCOTTSDALE, AZ 85258
CONTACT: BRAD MARTIN
BMARTIN@WALTON.COM

SUBMITTINTG ENGINEER /
LANDSCAPE ARCHITECT: MATT SINKOVITZ, P.E.
BGE, INC.
1111 METROPOLITAIN AVE, STE 250
CHARLOTTE, NC 28204
MSINKOVITZ@BGEINC.COM
980.666.0326

PHASE II SANCTUARY AT SOUTHGATE:
PARCEL(S): 07021015E
SINGLE FAMILY RESIDENTIAL UNITS: 75

FUTURE MULTI-FAMILY DEVELOPMENT:
PARCEL(S): 07009017
UNITS: 240
CLUBHOUSE: 6,500 SF
POOL: 2,500 SF

FUTURE COMMERCIAL DEVELOPMENT:
PARCEL(S): 07006001A, 07006001B, 07009017A
GROCERY CENTER: 75,000 SF
RETAIL SHOPS: 20,000 SF
COFFEE SHOP WITH DRIVE THROUGH: 10,000 SF
FAST FOOD RESTAURANT WITH DRIVE THROUGH: 6,000 SF
MEDICAL OFFICES: 12,000 SF
FUEL CENTER: 9,500 SF
BRANCH BANK WITH DRIVE THROUGH: 6,000 SF
CAR WASH: 5,000 SF
RESTAURANT (BY OTHERS): 6,000 SF
EMERGENCY RESPONSE CENTER (BY OTHERS): 14,000 SF

NUMBER AND SIZE OF DOMESTIC AND IRRIGATION WATER METERS:
SINGLE FAMILY RESIDENTIAL UNITS: 75 METERS
3/4" DOMESTIC AND IRRIGATION
FUTURE MULTI-FAMILY DEVELOPMENT: 3/4" FIRE DETECTOR, 2" DOMESTIC

NUMBER AND SIZE OF COMMERCIAL WATER METERS:
FUTURE COMMERCIAL DEVELOPMENT: 20 METERS
GROCERY CENTER: 3/4" FIRE DETECTOR, 1" DOMESTIC
MIXED USE RETAIL SHOPS: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
COFFEE SHOP: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
FAST FOOD RESTAURANT: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
MEDICAL OFFICES: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
FUEL CENTER: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
BRANCH BANK: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
CAR WASH: 3/4" FIRE DETECTOR, 3/4" DOMESTIC
RESTAURANT (BY OTHERS): 3/4" FIRE DETECTOR, 1" DOMESTIC
FUTURE EMERGENCY RESPONSE FACILITY (BY OTHERS): 3/4" FIRE DETECTOR, 3/4" DOMESTIC

UNION COUNTY PUBLIC WORKS UTILITY NOTES:
1. WATER MAIN TO BE LOCATED IN R.O.W. OR WITHIN A 15-FOOT EXCLUSIVE WATER EASEMENT.
2. SEWER MAIN IS TO BE LOCATED IN R.O.W. OR WITHIN A 20-FOOT EXCLUSIVE SEWER EASEMENT.
3. WATER AND SEWER SERVICE SHALL NOT CROSS PROPERTY BOUNDARY.

RECEIVING WATER TREATMENT FACILITY: TWELVE MILE CREEK WASTEWATER TREATMENT PLANT

QUALITY OF WASTEWATER SERVICE: DOMESTIC AND COMMERCIAL
PHASE II AND FUTURE RESIDENTIAL, MULTI-FAMILY, AND COMMERCIAL DEVELOPMENTS REQUIRE CONSTRUCTION OF NEW WASTEWATER PUMP STATION. THE PROPOSED WASTEWATER PUMP STATION WILL SERVICE A +/- 74 ACRE AREA.
SEE SHEET U1-1 FOR CALCULATIONS AND THE PROPOSED PUMP STATION SERVICE AREA.

NOTE:
ANY WELLS AND/OR ON-SITE WATERWATER DISPOSAL SYSTEMS DISCOVERED DURING THE SITE DEVELOPMENT PROCESS WILL BE ABANDONED IN ACCORDANCE WITH APPLICABLE NORTH CAROLINA LAWS AND RULES.

0 100' 200' 400'
SCALE: 1" = 200'

811 Know what's below. Call before you dig.

REV	DATE	DESCRIPTION
1	10/10/2024	REVISED PER UCW COMMENTS
2	06/25/2024	REVISED PER UCW COMMENTS
3	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY: APS
DRAWN BY: APS
REVIEWED BY: MJS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

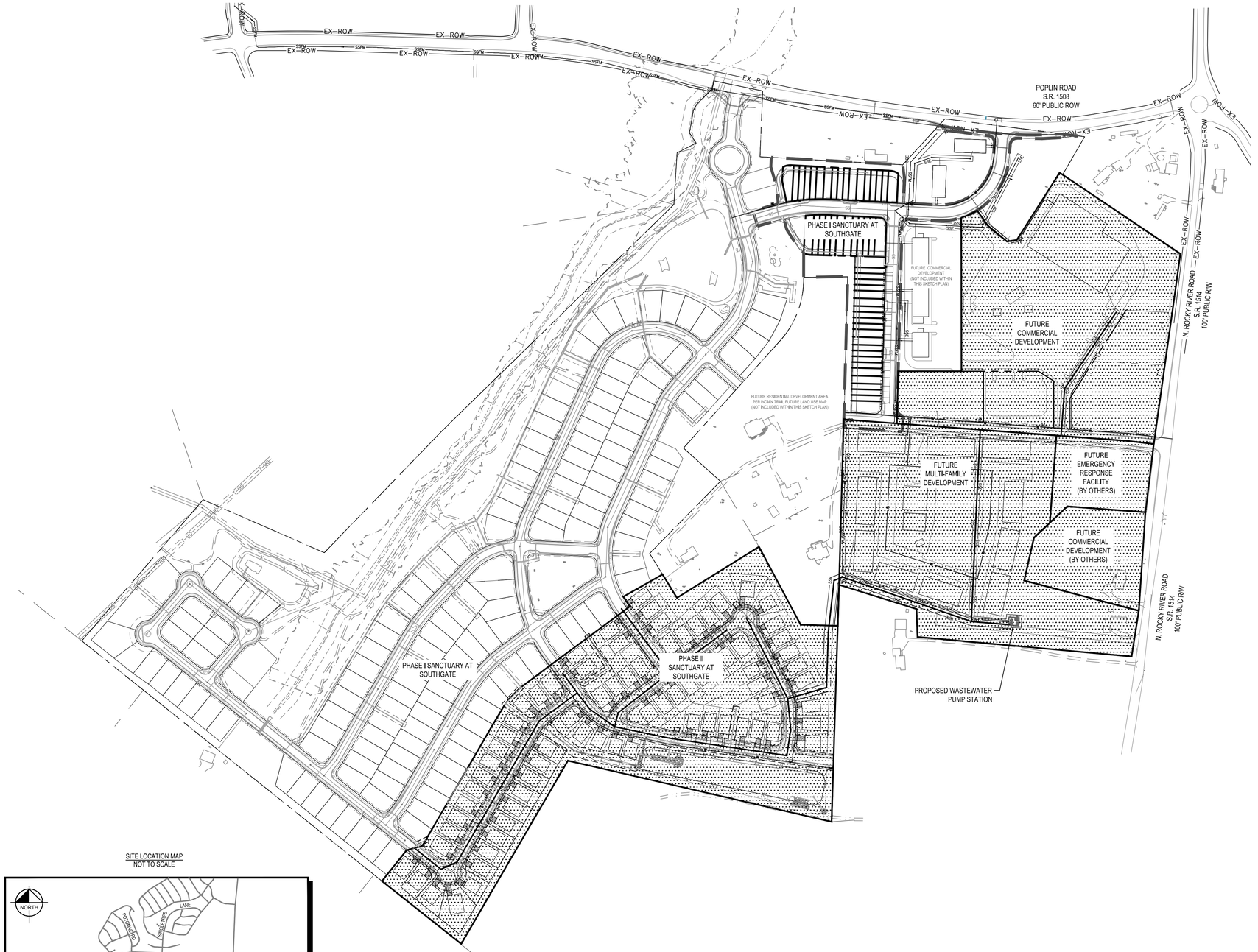
D·R·HORTON
America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

SANCTUARY AT SOUTHGATE PHASE II
INDIAN TRAIL, NC 28613

OVERALL UTILITY SKETCH PLAN

FILE NUMBER: 7734-16
DATE: 07/07/2022
U1-0

G:\NCAD\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-0



PUMP STATION SERVICE AREA (+/- 61.2 ACRES)

PARCELS: 07006001A
07006001B
07009017
07009017A
07021007A
07021007J
07021015E

CALCULATIONS:

IRRIGATION WATER USAGE:

SINGLE FAMILY RESIDENTIAL UNITS
75 RESIDENTIAL UNITS X 200 GPD/LOT = 15,000 GPD

OPEN SPACE - MULTI-FAMILY / AMENITY AREA
6,250 CU. FT X 7.48052 GAL/CU. FT = 46,754 GAL/WK = 6,679 GPD
ASSUMES 1/2" WATERING WEEKLY ON APPROX. 150,000 SF OF LANDSCAPED AREAS.
1/2" = 0.041667 FT

TOTAL IRRIGATION WATER DEMAND = 21,679 GPD

DOMESTIC WATER USAGE:

SINGLE FAMILY RESIDENTIAL UNITS
75 RESIDENTIAL UNITS X 400 GPD = 30,000 GPD

FUTURE MULTI-FAMILY DEVELOPMENT
UNITS (240 UNITS, ASSUME 3 BEDROOMS PER UNIT):
720 BEDROOMS X 125 GPD/BEDROOM = 90,000 GPD
CLUBHOUSE:10 FIXTURES X 250 GPD/FIXTURE = 2,500 GPD
POOL: 2,500 SF / 15 POOL SURFACE AREA SF/SWIMMER = 167 SWIMMERS
10 GPD/SWIMMER X 167 SWIMMERS = 1,670 GPD

REQUESTED DOMESTIC WATER DEMAND = 124,170 GPD
PEAK DOMESTIC WATER DEMAND = 215.6 GPM

DOMESTIC WASTEWATER DEMAND FLOW:

SINGLE FAMILY RESIDENTIAL UNITS
75 RESIDENTIAL UNITS X 280 GPD = 21,000 GPD

FUTURE MULTI-FAMILY DEVELOPMENT
UNITS (240 UNITS, ASSUME 3 BEDROOMS PER UNIT):
720 BEDROOMS X 70 GPD/BEDROOM = 50,400 GPD
CLUBHOUSE: 10 FIXTURES X 250 GPD/FIXTURE = 2,500 GPD
POOL: 2,500 SF / 15 POOL SURFACE AREA SF/SWIMMER = 167 SWIMMERS
10 GPD/SWIMMER X 167 SWIMMERS = 1,670 GPD

TOTAL DOMESTIC WASTEWATER DEMAND = 75,570 GPD

COMMERCIAL WATER USAGE AND WASTEWATER DEMAND FLOW:
(PEAK FLOWS CALCULATED USING 2.5 PEAKING FACTOR)

FUTURE EMERGENCY RESPONSE BUILDING (BY OTHERS)
10 FIXTURES X 250 GPD/FIXTURE = 2,500 GPD
PEAK = 4.34 GPM

FUTURE COMMERCIAL DEVELOPMENT
GROCERY CENTER (75,000 SF)
DELI = 1,000 SF X 40 GPD/100 SF = 400 GPD
MEAT/FISH DEPARTMENT = 2,000 SF X 75 GPD/100 SF = 1,500 GPD
16 FIXTURES X 250 GPD/FIXTURE = 4,000 GPD
TOTAL = 5,900 GPD
PEAK = 10.24 GPM

COFFEE SHOP WITH DRIVE THROUGH (10,000 SF)
10,000 SF X 50 GPD/100 SF = 5,000 GPD
PEAK = 8.68 GPM
FUEL CENTER (9,500 SF)
2 FIXTURES X 250 GPD/FIXTURE = 500 GPD
PEAK = 0.87 GPM
CAR WASH (5,000 SF)
1,200 GPD/BAY X 2 BAYS = 2,400 GPD
PEAK = 4.17 GPM
RESTAURANT (150 SEATS) (BY OTHERS)
40 GAL/SEAT X 200 SEATS = 6,000 GPD
PEAK = 10.42 GPM

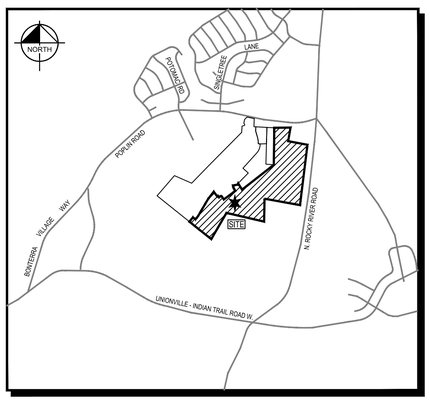
TOTAL COMMERCIAL WASTEWATER DEMAND = 22,300 GPD
TOTAL COMMERCIAL WATER DEMAND = 22,300 GPD
PEAK COMMERCIAL WATER DEMAND = 38.7 GPM

CALCULATIONS SUMMARY

WATER DEMAND SUMMARY (PS SERVICE AREA)		
DEMAND TYPE	FLOW	UNIT
IRRIGATION	21,679	GPD
DOMESTIC	124,170	GPD
COMMERCIAL	22,300	GPD
TOTAL	168,149	GPD
PEAK DOMESTIC	216	GPM
PEAK COMMERCIAL	38.7	GPM
TOTAL	254	GPM

WASTEWATER DEMAND SUMMARY (PS SERVICE AREA)		
DEMAND TYPE	FLOW	UNIT
DOMESTIC	75,570	GPD
COMMERCIAL	22,300	GPD
TOTAL	97,870	GPD

SITE LOCATION MAP
NOT TO SCALE



0 100' 200' 400'
SCALE: 1" = 200'

Know what's below. Call before you dig.

REV	DATE	DESCRIPTION
1	10/10/2024	REVISED PER UCW COMMENTS
2	06/25/2024	REVISED PER UCW COMMENTS
3	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY: APS
DRAWN BY: APS
REVIEWED BY: MJS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

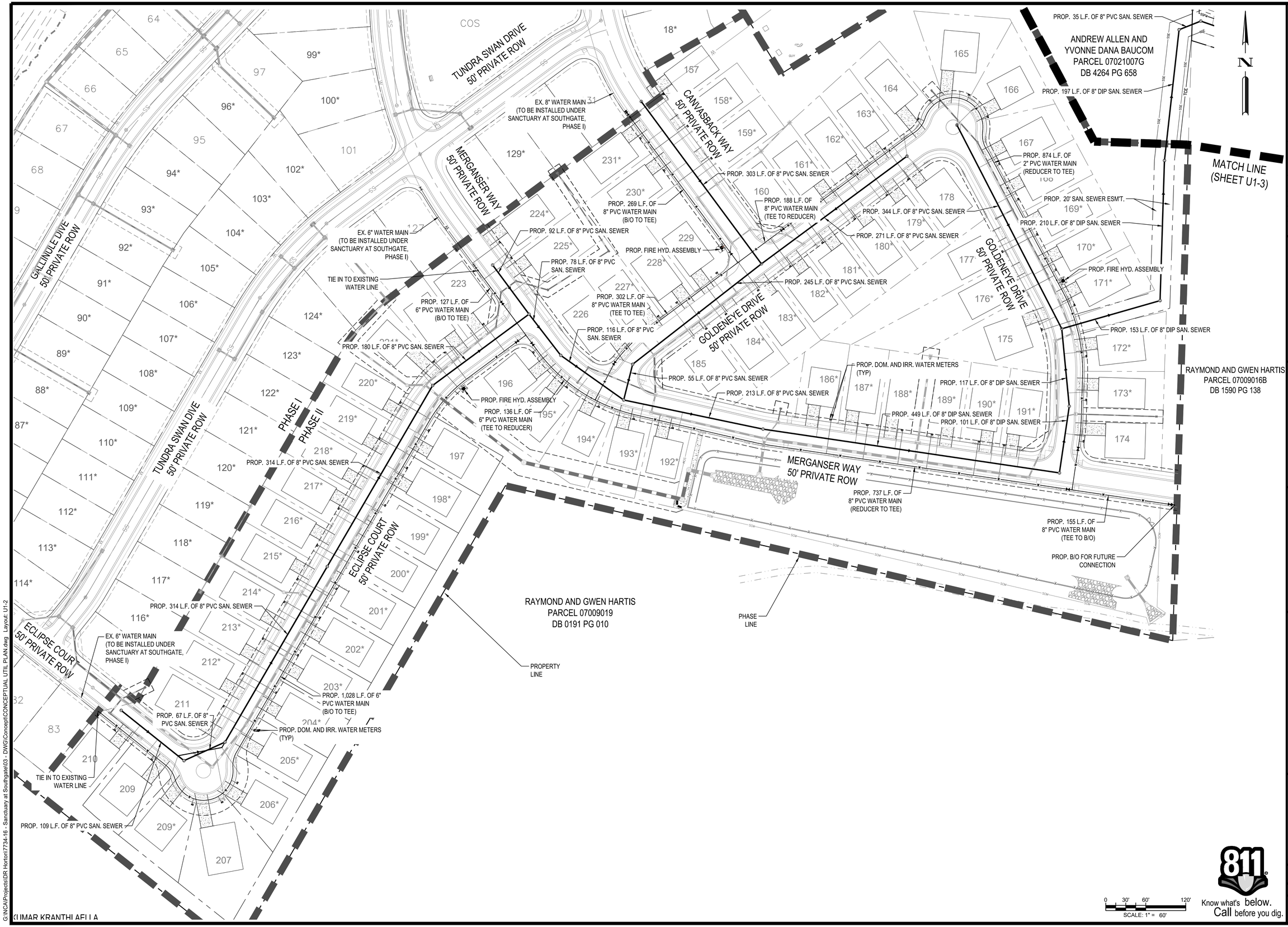
D·R·HORTON
America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

SANCTUARY AT SOUTHGATE
PHASE II
INDIAN TRAIL, NC 28613

PROPOSED PUMP STATION SERVICE AREA MAP

FILE NUMBER: 7734-16
DATE: 07/07/2022
U1-1

G:\NCA\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-1



REV	DATE	DESCRIPTION
7	10/10/2024	REVISED PER UCW COMMENTS
6	06/25/2024	REVISED PER UCW COMMENTS
5	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY: AEM
DRAWN BY: AEM
REVIEWED BY: MSS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

D·R·HORTON
America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

SANCTUARY AT SOUTHGATE
PHASE II
INDIAN TRAIL, NC 28613

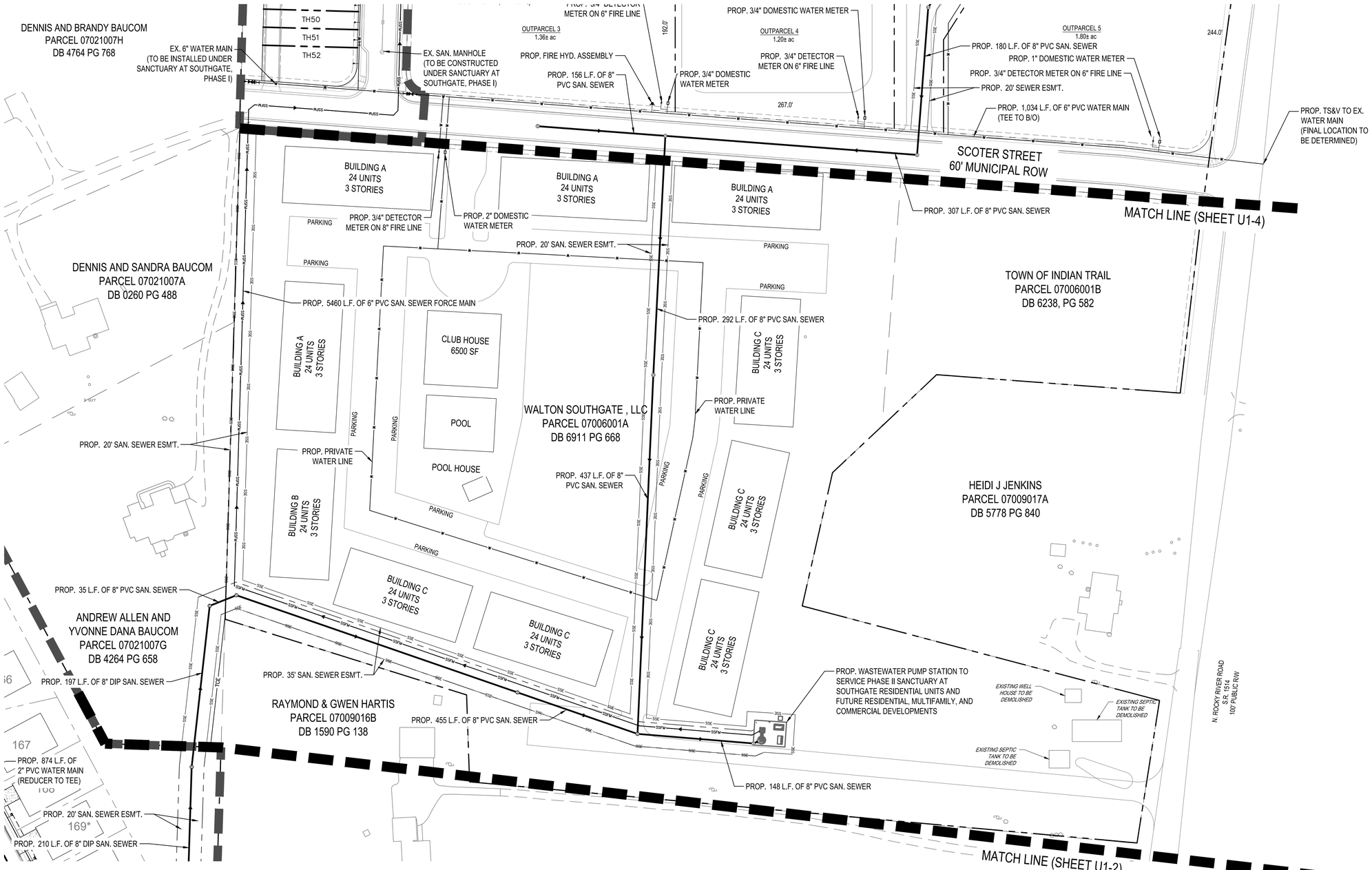
UTILITY SKETCH PLAN
(1 OF 4)

FILE NUMBER: 7734-16
DATE: 07/07/2022
U1-2

811 Know what's below. Call before you dig.

G:\NCA\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-2

KUMAR KRANTHI AELLA



REV	DATE	DESCRIPTION
1	10/10/2024	REVISED PER UCW COMMENTS
2	06/25/2024	REVISED PER UCW COMMENTS
3	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY:	APS
DRAWN BY:	APS
REVIEWED BY:	MJS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

D·R·HORTON
America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

SANCTUARY AT SOUTHGATE PHASE II
INDIAN TRAIL, NC 28613

UTILITY SKETCH PLAN
(2 OF 4)

FILE NUMBER: 7734-16

DATE: 07/07/2022

U1-3

811 Know what's below. Call before you dig.

G:\NCA\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-3

APPROX. ROW LINE

S.R. 1508
60' PUBLIC ROW

PROP. CONNECTION TO EXISTING 8" WATER MAIN

REED ROMAN OLLIS
PARCEL 07006004A
DB 7113 PG 817

PROP. 146 L.F. OF PVT. 8" PVC SAN. SEWER

PROP. 69 L.F. OF PVT. 8" PVC SAN. SEWER

PROP. 143 L.F. OF PVT. 8" PVC SAN. SEWER

PROP. 3/4" DOMESTIC WATER METER
COMMERCIAL
6,000 S.F.

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

HARLEQUIN DRIVE
50' PRIVATE ROW

MORRIS AMY GREENE
PARCEL 07006002B
DB 1207, PG 828

FRANKIE LYNN GREENE
PARCEL 07006002
DB, PG UNKNOWN

MATCH LINE (SHEET U1-5)

EX. 6" WATER MAIN
(TO BE INSTALLED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

PROP. 3/4" DOMESTIC WATER METER

PROP. 298 L.F. OF PVT. 8" PVC SAN. SEWER

PROP. 40' SEWER ESM'T.

EX. 8" SAN. SEWER
(TO BE CONSTRUCTED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

PROP. 77 L.F. OF 8" PVC SAN. SEWER

PROP. 74 L.F. OF 8" PVC SAN. SEWER

PROP. 3/4" DOMESTIC WATER METER

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

OUTPARCEL 2
1.84± ac

PROP. 20' SEWER ESM'T.

PROP. 3/4" DETECTOR METER ON 8" FIRE LINE

PROP. 1" DOMESTIC WATER METER

PROP. SAN. SEWER LATERAL TO SERVE COMMERCIAL BLDG. (TYP)

PROP. 3/4" DETECTOR METER ON 8" FIRE LINE

PROP. 3/4" DOMESTIC WATER METER

PROP. 274 L.F. OF PVT. 8" PVC SAN. SEWER

GROCERY CENTER
75,000 SF

FRANKIE LYNN GREENE
PARCEL 07006002A
DB, PG UNKNOWN

COMMERCIAL
7,200 SF

PARKING

PROP. 5460 L.F. OF 6" PVC SAN. SEWER FORCE MAIN

PATIO
1,800 SF

EX. 6" WATER MAIN
(TO BE INSTALLED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

PHASE I

PHASE II

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

PROP. 3/4" DOMESTIC WATER METER

EX. FIRE HYD.
(SEE SANCTUARY AT SOUTHGATE, PHASE I)

PROP. 32 L.F. OF 8" PVC SAN. SEWER

PROP. 19 L.F. OF PVT. 8" PVC SAN. SEWER

PATIO
1,040 SF

PROP. 20' SEWER ESM'T.

PROP. 115 L.F. OF PVT. 8" PVC SAN. SEWER

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

COMMERCIAL
5,640 SF

PROP. 3/4" DOMESTIC WATER METER

WHISTLING PLACE

EXISTING BUILDING TO BE DEMOLISHED

EXISTING SEPTIC TANK TO BE DEMOLISHED

EXISTING SEPTIC TANK TO BE DEMOLISHED

WALTON SOUTHGATE , LLC
PARCEL 07006001A
DB 6911 PG 668

PROP. SAN. SEWER LATERAL TO SERVE GROCERY BLDG. (TYP)

N. ROCKY RIVER ROAD
S.R. 1514
100' PUBLIC R/W

154.0'

200.0'

OUTPARCEL 6
0.95± ac

PROP. 350 L.F. OF 8" PVC SAN. SEWER

PROP. 20' SEWER ESM'T.

260.0'

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

PROP. 3/4" DOMESTIC WATER METER

DENNIS AND BRANDY BAUCOM
PARCEL 07021007H
DB 4764 PG 768

323.0'

EX. 8" SAN. SEWER
(TO BE CONSTRUCTED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

192.0'

PROP. 3/4" DOMESTIC WATER METER

OUTPARCEL 3
1.36± ac

OUTPARCEL 4
1.20± ac

OUTPARCEL 5
1.80± ac

244.0'

PROP. 180 L.F. OF 8" PVC SAN. SEWER

PROP. 1" DOMESTIC WATER METER

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

PROP. 20' SEWER ESM'T.

EX. 6" WATER MAIN
(TO BE INSTALLED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

EX. SAN. MANHOLE
(TO BE CONSTRUCTED UNDER SANCTUARY AT SOUTHGATE, PHASE I)

PROP. FIRE HYD. ASSEMBLY

PROP. 156 L.F. OF 8" PVC SAN. SEWER

PROP. 3/4" DOMESTIC WATER METER

PROP. 3/4" DETECTOR METER ON 6" FIRE LINE

267.0'

PROP. 1,034 L.F. OF 6" PVC WATER MAIN (TEE TO B/O)

PROP. TS&V TO EX. WATER MAIN (FINAL LOCATION TO BE DETERMINED)

SCOTER STREET
60' MUNICIPAL ROW

BUILDING A
24 UNITS
3 STORIES

BUILDING A
24 UNITS
3 STORIES

BUILDING A
24 UNITS
3 STORIES

PROP. 3/4" DETECTOR METER ON 8" FIRE LINE

PROP. 2" DOMESTIC WATER METER

PROP. 307 L.F. OF 8" PVC SAN. SEWER

MATCH LINE (SHEET U1-3)

TH2 TH3 TH4 TH5 TH6 TH7 TH8 TH9 TH10 TH11 TH12 TH13 TH14 TH15 TH16 TH17

TH18 TH19 TH20 TH21 TH22 TH23 TH24 TH25 TH26 TH27 TH28 TH29

TH30 TH31 TH32 TH33 TH34 TH35 TH36 TH37 TH38 TH39 TH40 TH41 TH42 TH43 TH44 TH45 TH46 TH47 TH48 TH49 TH50 TH51 TH52

N

0 30' 60' 120'
SCALE: 1" = 60'

Know what's below. Call before you dig.

REV	DATE	DESCRIPTION
1	10/10/2024	REVISED PER UCW COMMENTS
2	06/25/2024	REVISED PER UCW COMMENTS
3	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY: APS
DRAWN BY: APS
REVIEWED BY: MJS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

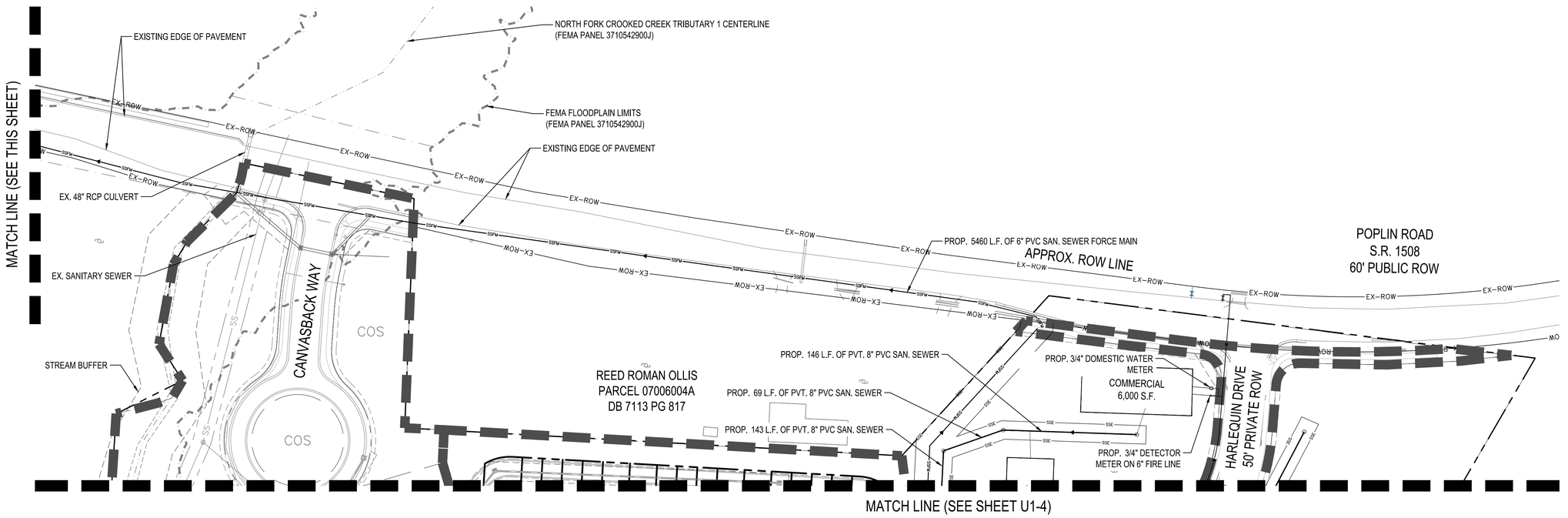
D·R·HORTON
America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

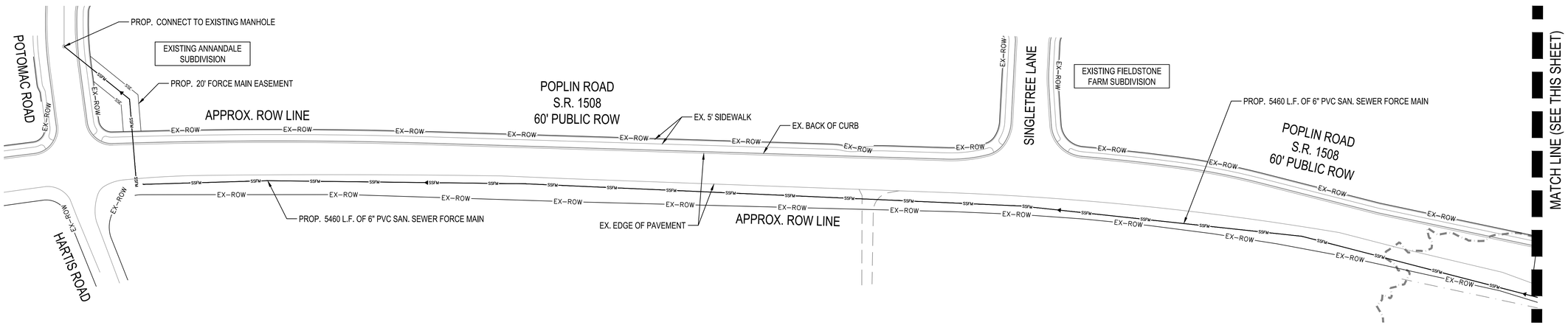
SANCTUARY AT SOUTHGATE
PHASE II
INDIAN TRAIL, NC 28613

UTILITY SKETCH PLAN
(3 OF 4)

FILE NUMBER: 7734-16
DATE: 07/07/2022
U1-4

G:\NCA\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-4





0 30 60 120
SCALE: 1" = 60

811 Know what's below. Call before you dig.

REV	DATE	DESCRIPTION
1	10/10/2024	REVISED PER UCW COMMENTS
2	06/25/2024	REVISED PER UCW COMMENTS
3	02/15/2024	REVISED PER UCW COMMENTS
4	02/13/2023	REVISED PER UCW COMMENTS

DESIGNED BY: APS
DRAWN BY: APS
REVIEWED BY: MJS

BGE
1111 METROPOLITAN AVE, SUITE 250
CHARLOTTE, NC 28204
www.bgeinc.com
NC LICENSE #C-4397

D·R·HORTON America's Builder
8025 ARROWRIDGE BOULEVARD
CHARLOTTE / NC / 28273

SANCTUARY AT SOUTHGATE
PHASE II
INDIAN TRAIL, NC 28613

UTILITY SKETCH PLAN
(4 OF 4)

FILE NUMBER: 7734-16
DATE: 07/07/2022
U1-5

G:\NCA\Projects\DR Horton\7734-16 - Sanctuary at Southgate\03 - DWG\Concept\CONCEPTUAL UTIL PLAN.dwg Layout: U1-5

APPENDIX 4 - BGE PROPOSED PUMP STATION PEAK WET WEATHER SEWER FLOW

ESTIMATED DOMESTIC SEWER DEMAND			
SANCTUARY AT SOUTHGATE PHASE II SINGLE FAMILY DETACHED LOTS			
TOTAL (LOTS)	GPD/LOT	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
75	280	21000	63000
FUTURE MULTI-FAMILY UNITS (240) (BY OTHERS)			
TOTAL (BEDROOMS)	GPD/ BEDROOM	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
720	70	50400	126000
FUTURE CLUBHOUSE (BY OTHERS)			
TOTAL (FIXTURES)	GPD/ FIXTURE	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
10	250	2500	6250
FUTURE POOL (BY OTHERS)			
TOTAL (SF)	SWIMMERS	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
2500	167	1670	4175
TOTAL DOMESTIC SEWER		**75570**	**199425**

NOTES:

1) WASTEWATER DESIGN FLOW RATES USED FROM 15A NCAC 02T .0114.

2A) 2500 SF / 15 POOL SURFACE AREA SF/SWIMMER = 167 SWIMMERS

2B) 10 GALLONS/DAY/SWIMMER

3) BGE UTILIZED MINIMUM PEAKING FACTOR OF 2.5 TO CALCULATE PEAK WASTEWATER FLOWS FOR ANY PUMP STATION. PER NCDENR MINIMUM DESIGN CRITERIA FOR THE PERMITTING OF PUMP STATIONS AND FORCE MAINS, IN ALL INSTANCES, EXCEPT FOR THE SINGLE FAMILY DETACHED LOTS. BGE UTILIZED A PEAKING FACTOR OF 3 TO CALCULATE PEAK WASTEWATER FLOWS FOR THE SINGLE FAMILY DETACHED LOTS.

ESTIMATED COMMERCIAL SEWER DEMAND			
EMERGENCY RESPONSE BUILDING (BY OTHERS)			
TOTAL (FIXTURES)	GPD/ FIXTURE	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
10	250	2500	6250
FUTURE GROCERY (75,000 SF) (BY OTHERS)			
SPACE	GPD	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
DELI	400	5900	14750
MEAT/FISH DEPARTMENT	1500		
FIXTURES	4000		
FUTURE COFFEE SHOP (10,000 SF) (BY OTHERS)			
GPD/100 SF	100 SF	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
50	100	5000	12500
FUTURE FUEL CENTER (9,500 SF) (BY OTHERS)			
TOTAL (FIXTURES)	GPD/ FIXTURE	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
2	250	500	1250
FUTURE CAR WASH (5,000 SF) (BY OTHERS)			
GAL/BAY	BAYS	AVE DAILY FLOW (GPD)	PEAK WET WEATHER FLOW (GPD)
1200	2	2400	6000
FUTURE RESTAURANT (150 SEATS) (BY OTHERS)			
GAL/SEAT	SEATS	TOTAL (GPD)	PEAK WET WEATHER FLOW (GPD)
40	150	6000	15000
TOTAL COMMERCIAL SEWER (GPD)		**22300**	**55750**

NOTES:

1) DESIGN FLOW RATES FROM NCAC 02T .0114.

2) ASSUMES 1,000 SF DELI, 2,000 SF MEAT/FISH DEPARTMENT, AND 16 BATHROOM FIXTURES FOR GROCERY.

3) ASSUMES 200 SF PER EMPLOYEE FOR MIXED USE RETAIL SHOPS AND ONE SHIFT.

4) ASSUMES 1 MEDICAL PRACTITIONER PER 1,000 SF OF MEDICAL OFFICE SPACE AND ONE SHIFT.

5) BGE UTILIZED MINIMUM PEAKING FACTOR OF 2.5 TO CALCULATE PEAK WASTEWATER FLOWS FOR ANY PUMP STATION. PER NCDENR MINIMUM DESIGN CRITERIA FOR THE PERMITTING OF PUMP STATIONS AND FORCE MAINS, IN ALL INSTANCES, EXCEPT FOR THE SINGLE FAMILY DETACHED LOTS. BGE UTILIZED A PEAKING FACTOR OF 3 TO CALCULATE PEAK WASTEWATER FLOWS FOR THE SINGLE FAMILY DETACHED LOTS.

TOTAL SEWER DEMAND (GPD)	**97870**	**255175**
TOTAL PEAK WET WEATHER FLOW (GPM)		**177.20**

Black & Veatch International Company
10925 David Taylor Drive, Suite 280, Charlotte, NC, 28262
P +1 704-510-8455 E ThompsonSL@BV.com

26 April 2023

Union County Water
500 N. Main Street, Suite 500
Monroe, NC 28112

Wastewater Collection System Analysis
Sanctuary at Southgate Phase 2
Black & Veatch Project
175886.8058

Attention: Crystal Outlaw Panico, PE

BACKGROUND

Union County Water (UCW) has requested that Black & Veatch perform hydraulic analyses for the proposed Sanctuary at Southgate development utilizing UCW's collection system hydraulic model. The analyses are intended to evaluate the impacts of the new development on wastewater flows in the receiving collection system. The proposed Sanctuary at Southgate Phase 2 development would be tributary to the Poplin Road pump station, which pumps receiving flows into the Twelve Mile Creek Basin.

Additionally, UCW has requested that a capacity analysis be performed for the collection system from the development to the Poplin Road Pump Station, including gravity sewer and the Fieldstone PS. Several developments that are permitted to discharge to the same gravity sewer as Sanctuary at Southgate Phase 2 but do not yet have a sewer connection are incorporated into this analysis. This analysis is intended to evaluate the impacts of the new development on the wastewater flows in the receiving collection system

DEVELOPMENT OVERVIEW

Based on the Utility Sketch Plan document prepared by BGE, Inc, dated July 7, 2022 the site will consist of 75 single family homes, 240 three-bedroom multi-family units, one clubhouse and pool, 24,500 SF of commercial development, a 200 seat restaurant, and an emergency response building. The development is located south of the intersection of Poplin Road and North Rocky River Road. The site is ±72 acres and Figure 1 shows a plan view of the proposed development.

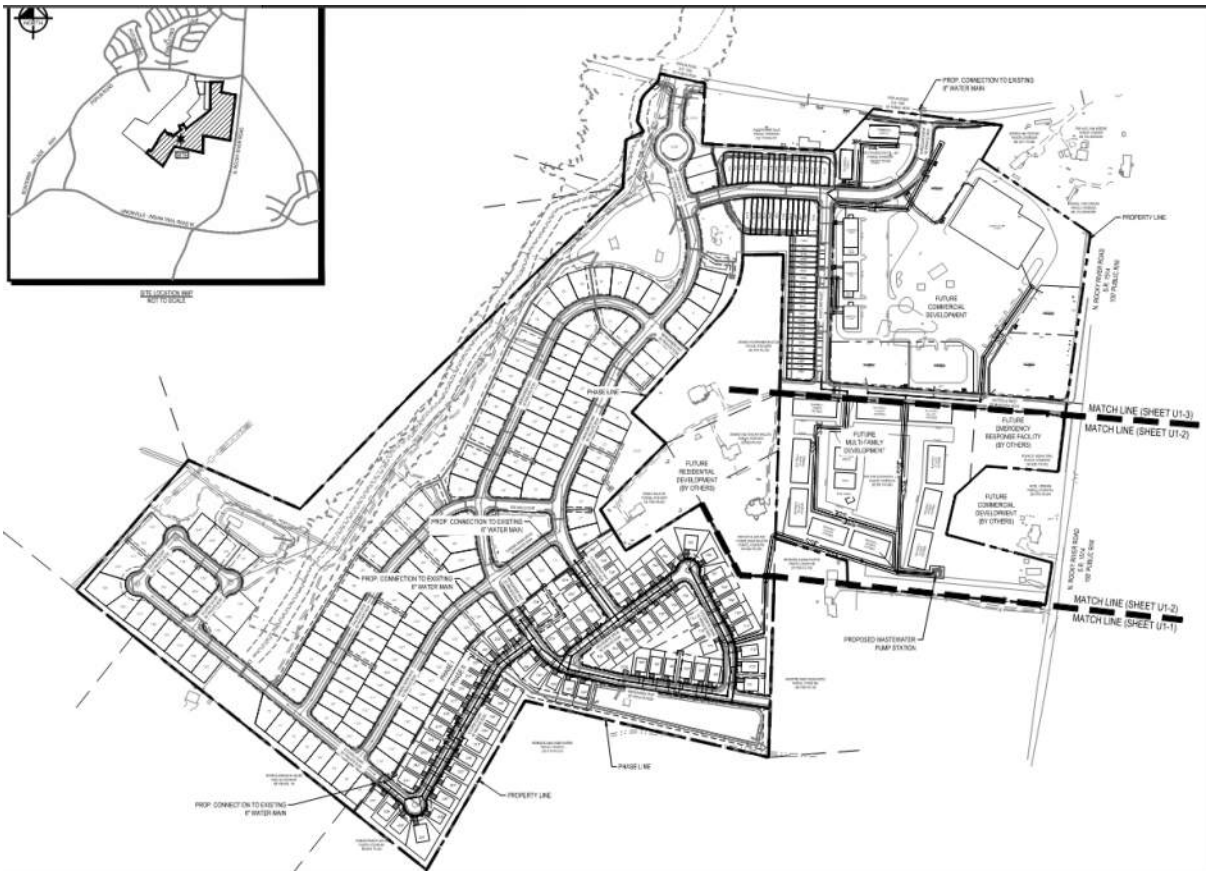


Figure 1 Development Overview

ESTIMATED DEVELOPMENT WASTEWATER FLOWS

The developer's sketch included an estimate of total average daily flow of 97,870 gpd for the development. Table 1 summarizes the development's wastewater flows. In addition to the average daily flow estimates provided by the developer, the peak wet weather flows were estimated using a peaking factor of 3 for single family homes and a peaking factor of 2.5 for multi-family homes and commercial. The peak flows incorporate an infiltration and inflow (I/I) flow component for the proposed development and is in line with the peaking factors observed in the UCW 2011 Comprehensive Master Plan I/I estimates for new developments.

Table 1 Sanctuary at Southgate Phase 2 Development Wastewater Flows Summary

Flow Source	Number of Units/Size	Unit	Unit Rates	Average Daily Flow (gpd)	Peak Wet Weather Flow (gpd)
Single Family Residential Units	75	Units	280	21,000	63,000
Multi-Family Units	720	Bedrooms	70	50,400	126,000
Pool	1	Unit	1,670	1,670	4,175
Clubhouse	10	Fixtures	250	2,500	6,250
Commercial / Retail	--	–	–	22,300*	55,750
Total				**97,870**	**255,175**

***Total commercial / retail calcs on project utility plans page U1-0 (total of 22,300 gpd) do not match page U1-1 calculations (total of 24,300 gpd).**

DEVELOPMENT ANALYSIS

Figure 2 is a map of the project location and contains a red-dashed line indicating the wastewater flow path for the development. The development contains an on-site pump station on the southeast portion of the site, according to site utility plans. The pump station would pump flows from Phase 2 of the development and discharge to the north into the Sanctuary at Southgate Phase 1 gravity sewers. After being discharged to the Phase 1 sewer, wastewater will flow downstream by gravity to an existing 12-inch sewer. The flow travels through 5,200 feet of 12-inch sewer, the Fieldstone Pump Station, and 4,500 feet of 6-inch force main and then discharges to 1,300 feet of 8-inch gravity sewer that flows to the Poplin Road Pump Station.

Additionally, a separate flow path was analyzed for the Sanctuary at Southgate Phase 2 development, indicated in Figure 2 with a blue-dashed line. This alternate flow path does not require an on-site pump station, but instead assumes the construction of approximately 4,700 LF of adequately sized sewer to convey project flows to the Porter Ridge service area. In this alternative, development flows would connect to a 3,100 LF 8-inch gravity sewer leading to the Porter Ridge pump station, which discharges into the 12-inch Fieldstone service area collection sewer, approximately 8,000 LF downstream of the connection point indicated on the development's site utility plan.

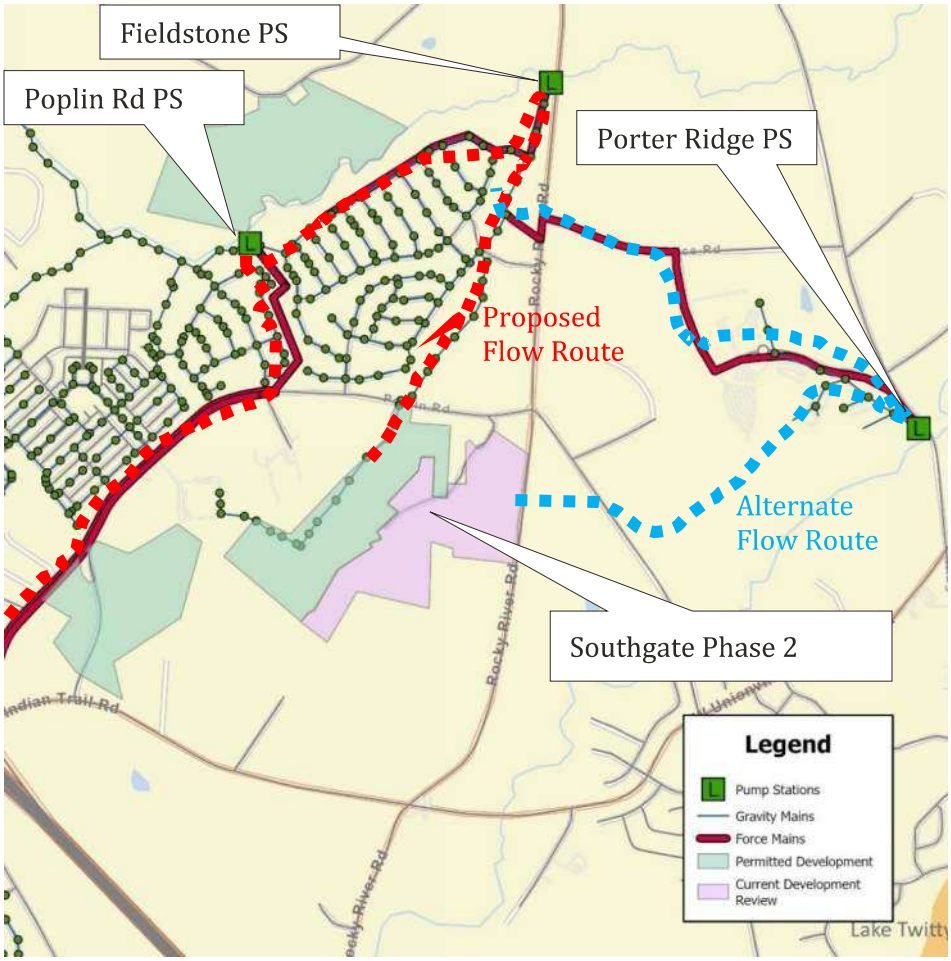


Figure 2 Development Location and Flow Paths

An initial model run was performed to simulate existing 2015 conditions within the Twelve Mile Creek model network under the 2011 Comprehensive Master Plan design storm event, a 1- year SCS Type III storm with a 24-hour duration. The 2015 model run was then adjusted to include the new Sanctuary at Southgate Phase 2 development. The impact to the collection system was compared to the predevelopment conditions including the receiving gravity sewer and the downstream system. Permitted development flows, totaling 122,180 gpd, were included in the model tributary to the Fieldstone PS. Estimated flows for the proposed new development, totaling 97,870 gpd were added on top these permitted flows in the 2015 model flows.

DEVELOPMENT RESULTS

The Sanctuary at Southgate Phase 2 pump station would pump flows from the project site to the north into the Phase 1 gravity sewers. After being discharged to the Phase 1 sewer, wastewater will flow downstream by gravity to the existing 12-inch sewer. The 2015 model was updated to show the new development flows going to the indicated connection point. Model

flows were compared against the UCW criteria for improvements in the wastewater collection system. The criteria that would trigger an improvement in the UCW gravity sewers is 50% of the MH depth surcharged above the crown of the pipe during a 1-year design storm.

The model predicts there will be no surcharge in pipes downstream of the development, and the addition of the Sanctuary at Southgate Phase 2 development flow does not increase the peak flows significantly. The peak flow to the Fieldstone pump station is approximately 0.70 MGD, and the peak velocity in the force main is 5.38 ft/s. The peak flows from proposed and permitted developments exceed the station's firm capacity of 0.44 MGD. The peak flow to the Poplin Road pump station is 4.07 mgd; however, the firm pumping capacity of the Poplin Road pump station is limited to 3.64 mgd because of the allowable pressures in the force main. Therefore, the peak flows exceeded the flow capacity at the Poplin Road pump station.

There is available capacity for the Sanctuary at Southgate Phase 2 development to connect to the 12-inch sewer. No SSOs were predicted in the 12-inch or 8-inch downstream gravity systems. However, the current firm pumping capacity of the Fieldstone and Poplin Road pump stations are inadequate to handle the additional wet weather flows from the new development.

GRAVITY SEWERS

The graphs in Figure 3 and Figure 4 below show the flow and depth in the sewer downstream of the new connection where the 12-inch sewer receives flow from this project and other tributary permitted project flows tributary to the Fieldstone pump station. The total flow at MH-14726 includes the obligated flows, as well as flows from the Sanctuary at Southgate Phase 2 development flows. Depth was not observed in the model to exceed the crown of pipe at this point in the collection system. Flow at this point prior to the development flows being added to

the model was 0.379 mgd. This increased to 0.624 mgd after Sanctuary at Southgate Phase 2 flows were added.

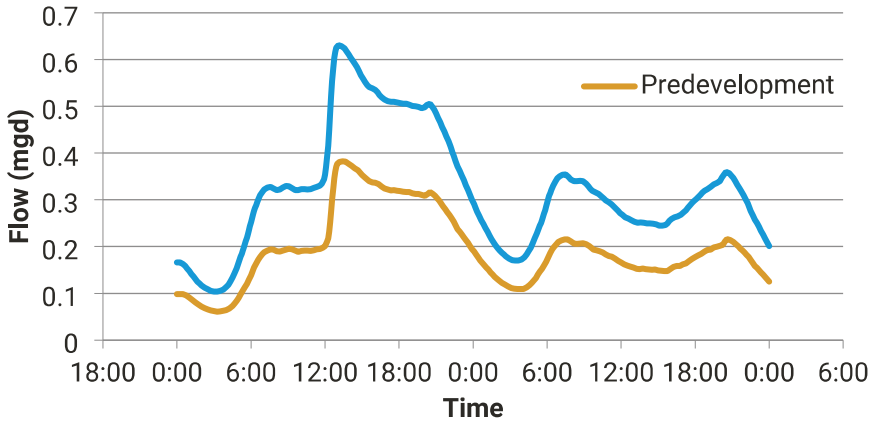


Figure 3 Peak Flow at MH-14726

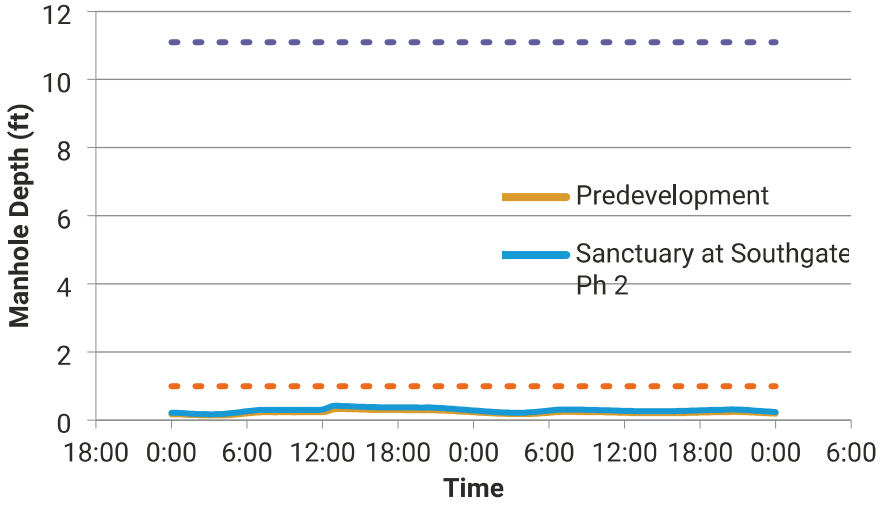


Figure 4 Peak Depth at MH-14726

The graphs in Figure 5 and Figure 6 below show the flow and depth in the sewer downstream of the new connection where the 8-inch sewer receives discharge from the Fieldstone pump station. The total flow at MH-6336 includes flows from Fieldstone, and the developments previously indicated within that service area. Depth was not observed in the model to exceed the crown of pipe at this point in the collection system. The peak flow in the pipe at this point before the Sanctuary at Southgate Phase 2 development was added was 0.44 mgd. With the development online, the peak flow increased to 0.69 mgd.

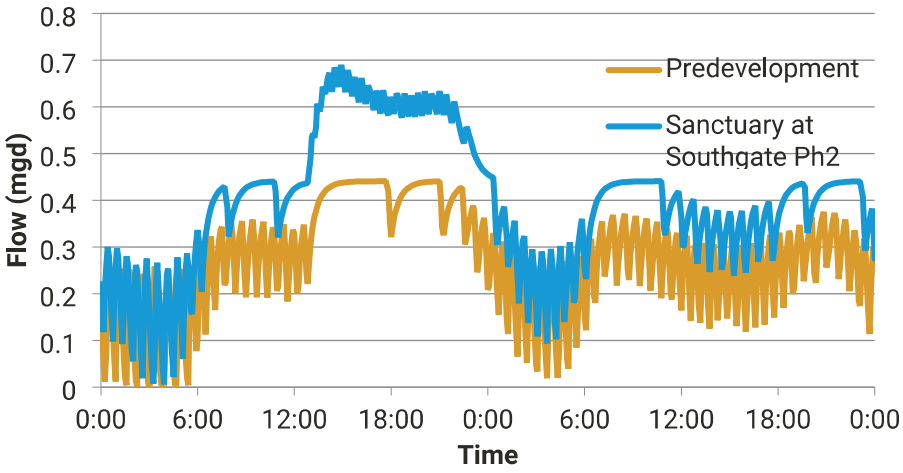


Figure 5 Peak Wet Weather Flow at MH-6336

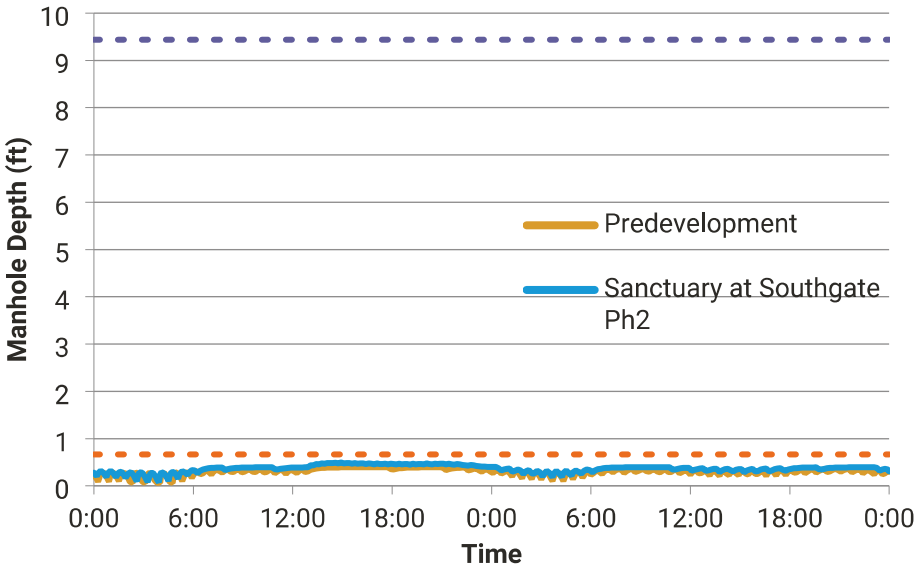


Figure 6 Peak Depth at MH-6336

Sewer capacity evaluations for the alternative flow route, sending project flows to the Porter Ridge pump station service area, were very similar to the results of the evaluation for the original connection point. The effect of moving the development's proposed flows to a more downstream point essentially return flows to predevelopment conditions upstream of the Porter Ridge pump station discharge manhole. There were no capacity limitations in the modeled 12-inch sewer in the original flow route, or in in the alternative flow route. This alternate flow route has no effect on the model results obtained at the Fieldstone or Poplin Road pump stations downstream. The capacity of the Porter Ridge pump station was not evaluated in this analysis, but it is recommended that the station's average flow, obligated flows, and firm capacity be evaluated in order to further assess the impact of this development on that station.

FIELDSTONE PUMP STATION AND FORCE MAIN

Table 2 summarizes the dry weather flows at the Fieldstone pump station. The station was evaluated for capacity based on the most recent drawdown test data shown in Table 3 and the existing flows in the model. The criteria that would trigger an improvement for a pump station is the pump station not having firm capacity to pump the flows during a 1-year design storm. The firm capacity of the Fieldstone Pump Stations is 0.44 mgd. The average flows to the pump station are approximately 0.21 mgd; therefore, there is approximately 0.23 mgd of available capacity at the pump station. This project's peak flows would exceed the allocation capacity of the station. The modeled peak flow to the Fieldstone pump station after the Sanctuary at Southgate development's flows come online exceed the station's firm capacity of 0.44 mgd. For these two reasons, there is not enough available capacity for the new development's flows.

Table 2 Fieldstone Pump Station Dry Weather Flows

Average Flow (MGD)	Obligated Flow (MGD)	Total Flow (MGD)
0.09	0.12	0.21

Table 3 Fieldstone Pump Station Capacity

Fieldstone Pump Station			
Drawdown Test Date	Pump 1 Drawdown (MGD)	Pump 2 Drawdown (MGD)	Firm Capacity (MGD)
4/9/2020	0.44	0.45	0.44

POPLIN ROAD PUMP STATION AND FORCE MAIN

UCW provided draw down tests that approximated the Poplin Road Pump Station firm capacity at 4.0 mgd, however, as noted in the *Poplin Road Pump Station Alternatives Analysis* technical memo, the force main flow is limited because the allowable pressures of the force main are below the pressures caused by the firm capacity. Therefore, the flows were limited to 3.64 mgd. Table 4 summarizes the dry weather flows to the Poplin Road pump station. The model was run with the force main capacity limitation. and the existing flows into the Poplin Road Pump Station were estimated to be 4.07 mgd, which exceeds the wet weather capacity at the pump station. It should be noted that there is a planned CIP project to provide wet weather storage for the Poplin Road Pump Station by building a 3.0 mgd equalization basin for the wet weather flows. Once this project is implemented the capacity at the Poplin Road Pump Station can be reevaluated. This project is scheduled to be completed in the third quarter of 2023.

Table 4 Poplin Road Pump Station Dry Weather Flows

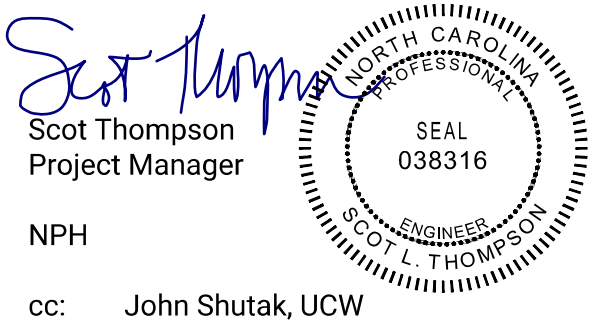
Average Flow (MGD)	Obligated Flow (MGD)	Total Flow (MGD)
1.04	0.32	1.36

RECOMMENDATION

Both the 12-inch and 8-inch gravity sewers associated with the development flows evaluated in this analysis are not predicted to surcharge under a 1-year storm event. The alternate flow path for this development has little effect on the analysis in terms of capacity based on the modeling results but requires the construction of off-site gravity sewer conveying flows to the Porter Ridge pump station service area. The Porter Ridge pump station capacity needs to be evaluated if the alternate route is further considered. The allocation and firm capacities of the Fieldstone pump station are exceeded with the addition of this project's proposed peak flows. It is not recommended that the 0.44 mgd firm capacity of the station be exceeded. Approval of the development flows connecting to the UCW collection system cannot be granted for this reason. Furthermore, the allocation and firm capacities of the Poplin Road pump station are exceeded with the addition of this project's proposed peak flows. Approval for this development is dependent on completion of the CIP improvement project that will install adequate flow equalization at the Poplin Road Pump Station. Once an equalization tank is installed, the storage volume will be sufficient to prevent backup in the gravity system upstream of the Poplin Rd Pump Station. It should be noted that the Poplin Road Pump Station is pumping at full capacity for extended periods of time to empty the wet weather equalization tank and the 24-inch gravity sewer downstream of the force main discharge location is at full capacity. The 3.0 mgd Poplin Road equalization basin project is expected to be completed in the third quarter of 2023. Until this project is completed, it is not recommended that the 3.64 mgd operational capacity of the station be exceeded.

The Twelve Mile Creek WRF has a rated capacity of 7.5 MGD. North Carolina law 15A NCAC 02T.0118, often referred to as the 80/90 rule, states that prior to exceeding 80% of the wastewater treatment system's permitted hydraulic capacity based on average flow of the last calendar year, an evaluation on meeting future wastewater needs must be submitted to the State. Additionally, at 90% plant capacity, final plans and specifications for expansion must be submitted and approved. Based on the 80/90 Rule, UC should be ready to submit an evaluation of their future treatment needs and outline plans going forward by the time the average annual flow exceeds 80% of the permitted treatment capacity (6 MGD). Current flows are approaching the 80% mark and UC should be prepared to submit an evaluation in the near future.

Very truly yours,
BLACK & VEATCH INTERNATIONAL COMPANY



Scot Thompson
Project Manager

NPH

cc: John Shutak, UCW
Jeff Coggins, BV
Katy Weidner BV

Black & Veatch International Company
10925 David Taylor Drive, Suite 280, Charlotte, NC, 28262
P +1 704-510-8455 E ThompsonSL@BV.com

24 August 2023

Union County Water
500 N. Main Street, Suite 500
Monroe, NC 28112

Wastewater Collection System Analysis
Sanctuary at Southgate Phase 2 Revised
Black & Veatch Project
175886.8063

Attention: Crystal Outlaw Panico, PE

BACKGROUND

Union County Water (UCW) has requested that Black & Veatch update hydraulic analyses for the proposed Sanctuary at Southgate development utilizing UCW's collection system hydraulic model. Previous hydraulic analyses, reported in the recent April 2023 technical memo contain model results for project wastewater flows conveyed through the Fieldstone and Porter Ridge pump stations. This analysis is intended to evaluate the impacts along two alternative sewer routes: Sedgewick Rd sewer and Potomac Rd sewer. The proposed Sanctuary at Southgate Phase 2 development would be tributary to the Poplin Road pump station, which pumps receiving flows into the Twelve Mile Creek Basin.

DEVELOPMENT OVERVIEW

Based on the Utility Sketch Plan document prepared by BGE, Inc, dated July 7, 2022 the site will consist of 75 single family homes, 240 three-bedroom multi-family units, one clubhouse and pool, 24,500 SF of commercial development, a 200 seat restaurant, and an emergency response building. The development is located south of the intersection of Poplin Road and North Rocky River Road. The site is ±72 acres and Figure 1 shows a plan view of the proposed development.

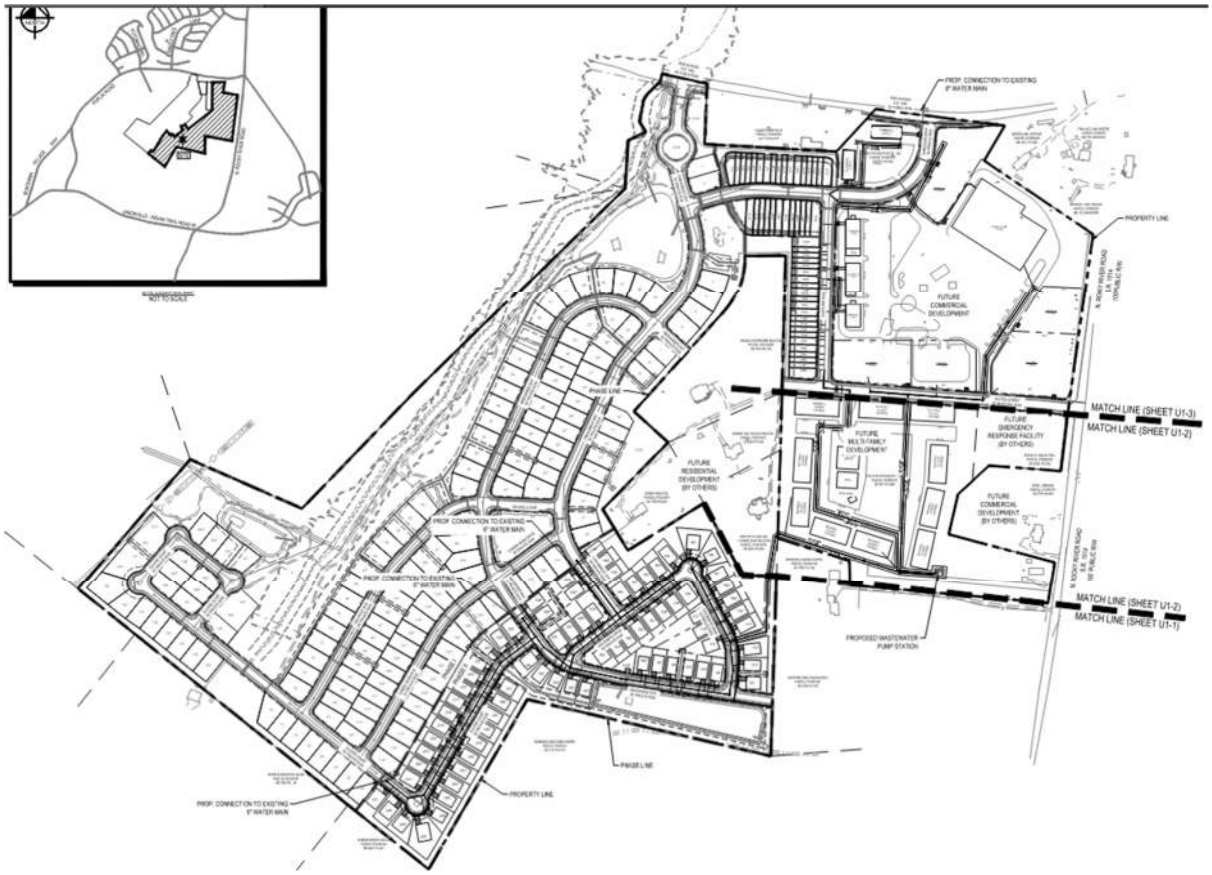


Figure 1 Development Overview

ESTIMATED DEVELOPMENT WASTEWATER FLOWS

The developer's sketch included an estimate of total average daily flow of 97,870 gpd for the development. Table 1 summarizes the development's wastewater flows. In addition to the average daily flow estimates provided by the developer, the peak wet weather flows were estimated using a peaking factor of 3 for single family homes and a peaking factor of 2.5 for multi-family homes and commercial. The peak flows incorporate an infiltration and inflow (I/I) flow component for the proposed development and is in line with the peaking factors observed in the UCW 2011 Comprehensive Master Plan I/I estimates for new developments.

Table 1 Sanctuary at Southgate Phase 2 Development Wastewater Flows Summary

Flow Source	Number of Units/Size	Unit	Unit Rates	Average Daily Flow (gpd)	Peak Wet Weather Flow (gpd)
Single Family Residential Units	75	Units	280	21,000	63,000
Multi-Family Units	720	Bedrooms	70	50,400	126,000
Pool	1	Unit	1,670	1,670	4,175
Clubhouse	10	Fixtures	250	2,500	6,250
Commercial / Retail	--	–	–	22,300*	55,750
Total				**97,870**	**255,175**

***Total commercial / retail calcs on project utility plans page U1-0 (total of 22,300 gpd) do not match page U1-1 calculations (total of 24,300 gpd).**

DEVELOPMENT ANALYSIS

Figure 2 is a map of the project location and contains a red and blue dashed lines indicating the potential wastewater flow paths for the development. The development contains an on-site pump station on the southeast portion of the site, according to site utility plans. The pump station would pump flows from Phase 2 of the development and discharge to the northwest across Poplin Rd into one of two possible gravity sewers along either Sedgewick Rd or Potomac Rd. From either discharge location, these gravity sewers convey flow approximately 2,000 feet to the Poplin Road Pump Station.

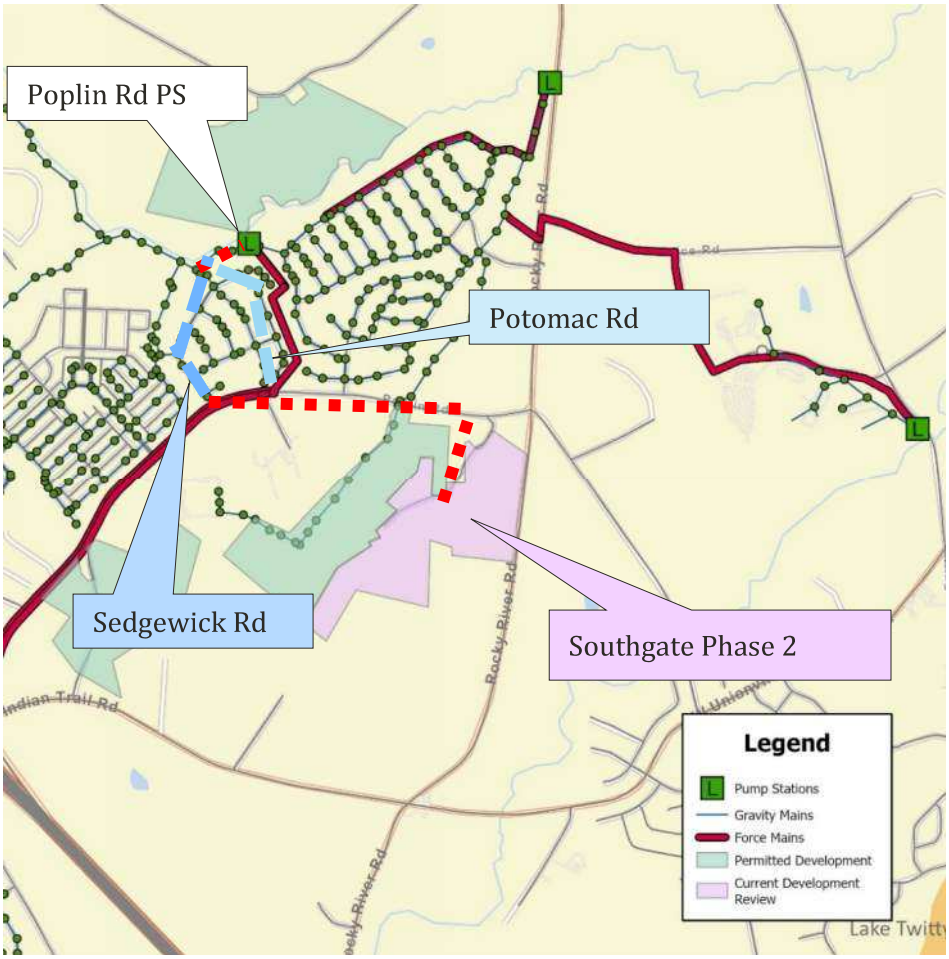


Figure 2 Development Location and Flow Paths

An initial model run was performed to simulate existing 2022 conditions within the Twelve Mile Creek model network under the 2022 Comprehensive Master Plan design storm event, a 1- year SCS Type II storm with a 24-hour duration. The 2022 model run was then adjusted to include the new Sanctuary at Southgate Phase 2 development. The impact to the collection system was compared to the predevelopment conditions including the receiving gravity sewer and the downstream system.

DEVELOPMENT RESULTS

The Sanctuary at Southgate Phase 2 pump station would pump flows from the project site to the northwest across Poplin Rd into either 8-inch sewer along Sedgewick Rd, or into 8-inch sewer along Potomac Rd. After being discharged to one of these 8-inch sewers, wastewater will flow downstream by gravity to the existing 36-inch sewer leading into the Poplin Rd pump station. The 2022 model was updated to show the new development flows going to the indicated connection point. Model flows were compared against the UCW criteria for

improvements in the wastewater collection system. The criteria that would trigger an improvement in the UCW gravity sewers is 50% of the MH depth surcharged above the crown of the pipe during a 1-year design storm.

The model predicts there will be no surcharge in pipes downstream of the development, and the addition of the Sanctuary at Southgate Phase 2 development flow does not increase the peak flows significantly. The peak flow to the Poplin Road pump station is 4.07 mgd; however, the firm pumping capacity of the Poplin Road pump station is limited to 3.64 mgd because of the allowable pressures in the force main. Therefore, the peak flows exceeded the flow capacity at the Poplin Road pump station.

There is available capacity for the Sanctuary at Southgate Phase 2 development to connect to the 8-inch sewers on both Sedgewick Rd and Potomac Rd. Surcharging in these sewers did not exceed the crown of the pipe and no SSOs were predicted in the downstream gravity systems. However, the current firm pumping capacity of the Poplin Road pump station is inadequate to handle the additional wet weather flows from the new development.

GRAVITY SEWERS

The graphs in Figures 3 through Figure 6 below show the flow and depth in the sewer downstream of the new connection at locations on both Sedgewick Rd and Potomac Rd where manhole depth is the least, meaning surcharging due to wet weather flow would be of most concern. The total flow at MH-6276 (Sedgewick route) and MH-6281 (Potomac route) includes the obligated flows, as well as flows from the Sanctuary at Southgate Phase 2 development flows. Depth was not observed in the model to exceed the crown of pipe at these points in the collection system. Flow at these points prior to the development flows being added to the model were 0.0141 mgd and 0.0013 mgd, and increased to 0.313 mgd and 0.304 mgd, respectively, after Sanctuary at Southgate Phase 2 flows were added.

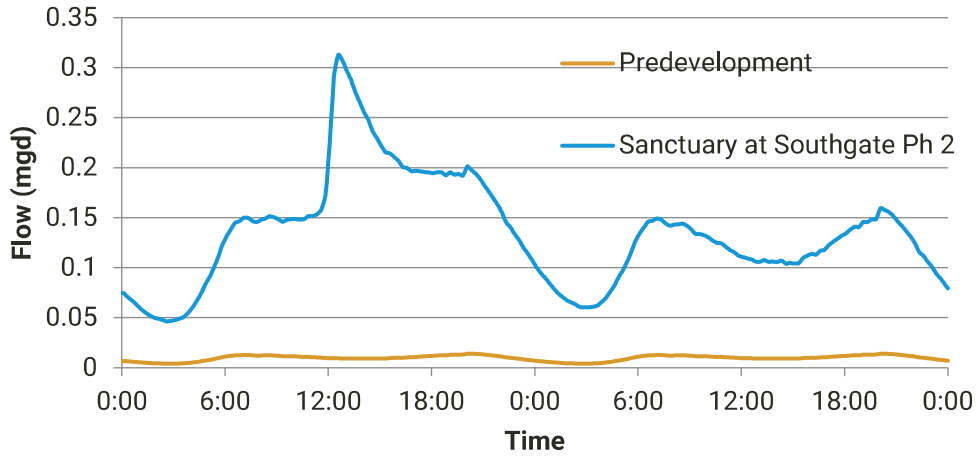


Figure 3 Peak Flow at MH-6276 (Sedgewick Route)

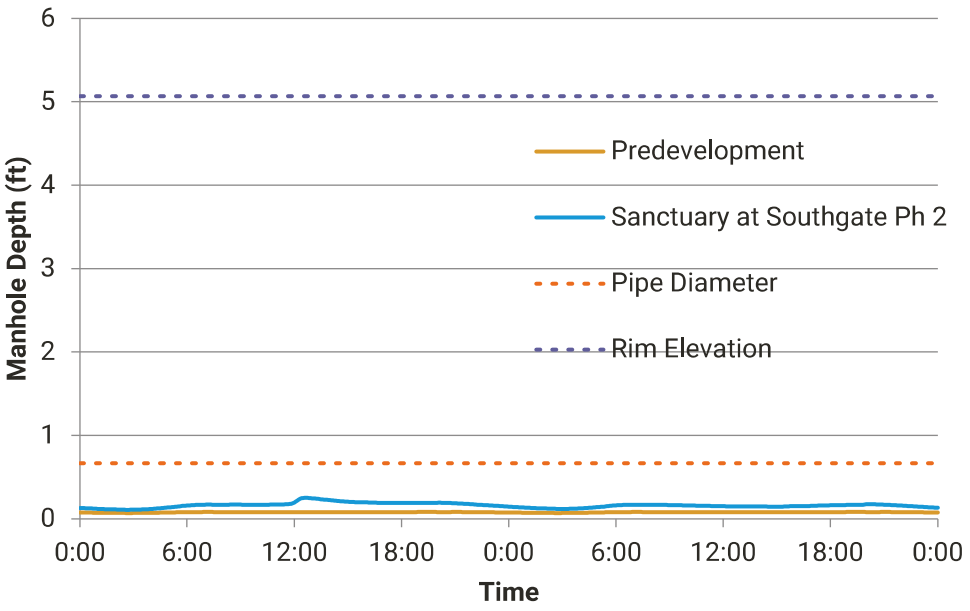


Figure 4 Peak Depth at MH-6276 (Sedgewick Route)

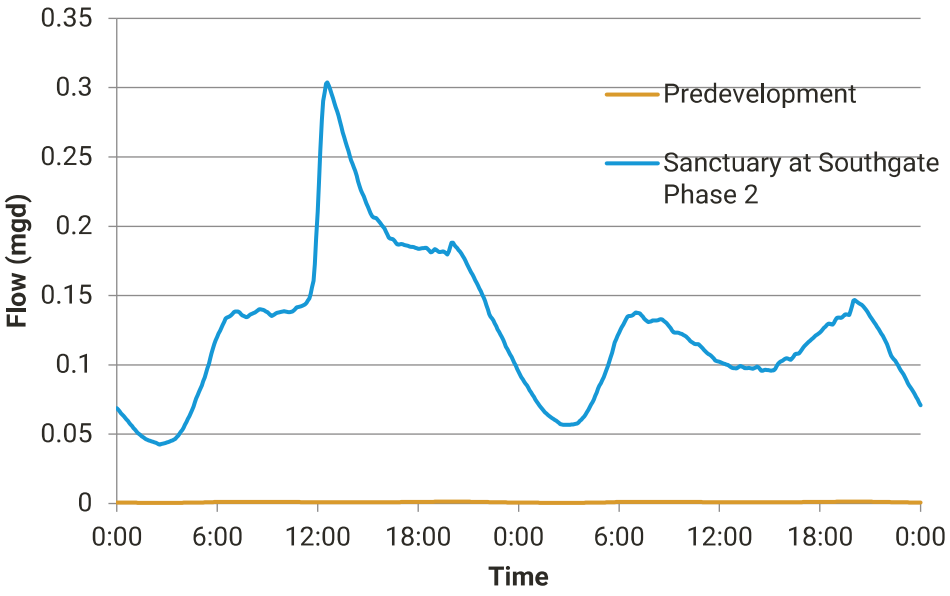


Figure 5 Peak Wet Weather Flow at MH-6281 (Potomac Route)

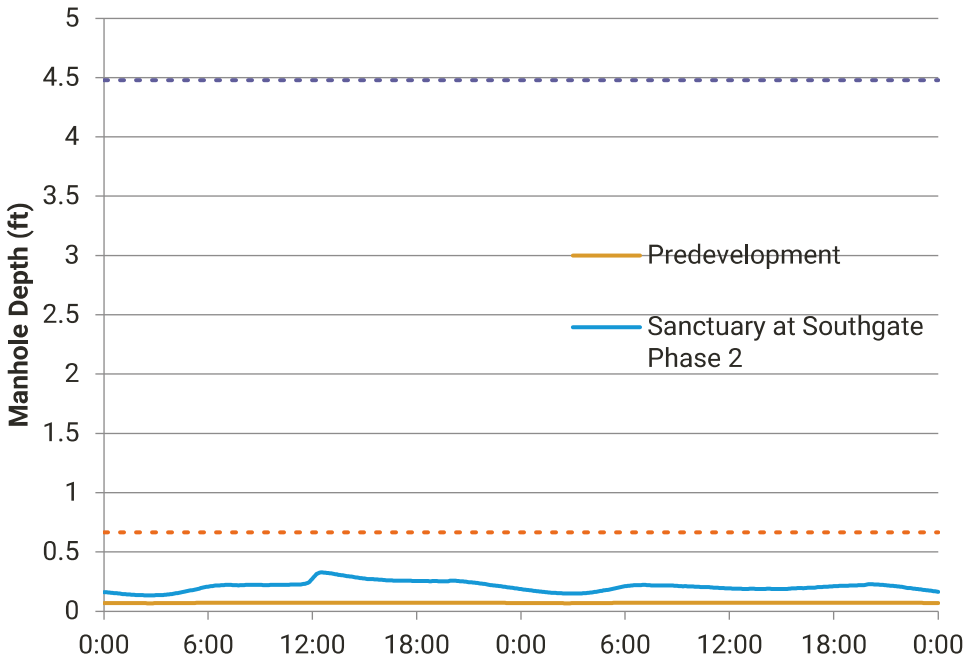


Figure 6 Peak Depth at MH-6281 (Potomac Route)

POPLIN ROAD PUMP STATION AND FORCE MAIN

UCW provided draw down tests that approximated the Poplin Road Pump Station firm capacity at 4.0 mgd, however, as noted in the *Poplin Road Pump Station Alternatives Analysis* technical memo, the force main flow is limited because the allowable pressures of the force main are below the pressures caused by the firm capacity. Therefore, the flows were limited to 3.64 mgd. Table 2 summarizes the dry weather flows to the Poplin Road pump station. The model was run with the force main capacity limitation. and the existing flows into the Poplin Road Pump Station were estimated to be 4.07 mgd, which exceeds the wet weather capacity at the pump station. It should be noted that there is an ongoing CIP project to provide wet weather storage for the Poplin Road Pump Station by building a 4.0 MG equalization basin for wet weather flows. Once this project is implemented the capacity at the Poplin Road Pump Station can be reevaluated. This project is scheduled to be completed in the third quarter of 2023.

Table 2 Poplin Road Pump Station Dry Weather Flows

Average Flow (MGD)	Obligated Flow (MGD)	Total Flow (MGD)
1.04	0.32	1.36

RECOMMENDATION

Both 8-inch gravity sewer discharge alternatives evaluated in this analysis are not predicted to surcharge under a 1-year storm event. Either location is viable from a capacity standpoint. The allocation and firm capacities of the Poplin Road pump station are exceeded with the addition

of this project's proposed peak flows. Approval for this development is dependent on completion of the CIP improvement project that will provide flow equalization at the Poplin Road Pump Station. At that point, the storage volume will be sufficient to prevent backup in the gravity system upstream of the Poplin Road Pump Station. It should be noted that the model runs project the Poplin Road Pump Station to be pumping at full capacity for extended periods of time to empty the equalization basin; meanwhile, the 24-inch gravity sewer downstream of the force main discharge location is at full capacity. Until the Poplin Road Pump Station EQ Basin project is completed, it is not recommended that the 3.64 mgd operational capacity of the station be exceeded.

The Twelve Mile Creek WRF has a rated capacity of 7.5 MGD. North Carolina law 15A NCAC 02T.0118, often referred to as the 80/90 rule, states that prior to exceeding 80% of the wastewater treatment system's permitted hydraulic capacity based on average flow of the last calendar year, an evaluation on meeting future wastewater needs must be submitted to the State. Additionally, at 90% plant capacity, final plans and specifications for expansion must be submitted and approved. Based on the 80/90 Rule, UC should be ready to submit an evaluation of their future treatment needs and outline plans going forward by the time the average annual flow exceeds 80% of the permitted treatment capacity (6 MGD). Current flows are approaching the 80% mark and UC should be prepared to submit an evaluation in the near future.

Very truly yours,
BLACK & VEATCH INTERNATIONAL COMPANY

Scot Thompson
Project Manager

NPH

cc: John Shutak, UCW
Jeff Coggins, BV
Katy Weidner BV
Nathan Hampton BV

APPENDIX 7 - PUMP STATION ALTERNATIVES

ALTERNATIVE 1

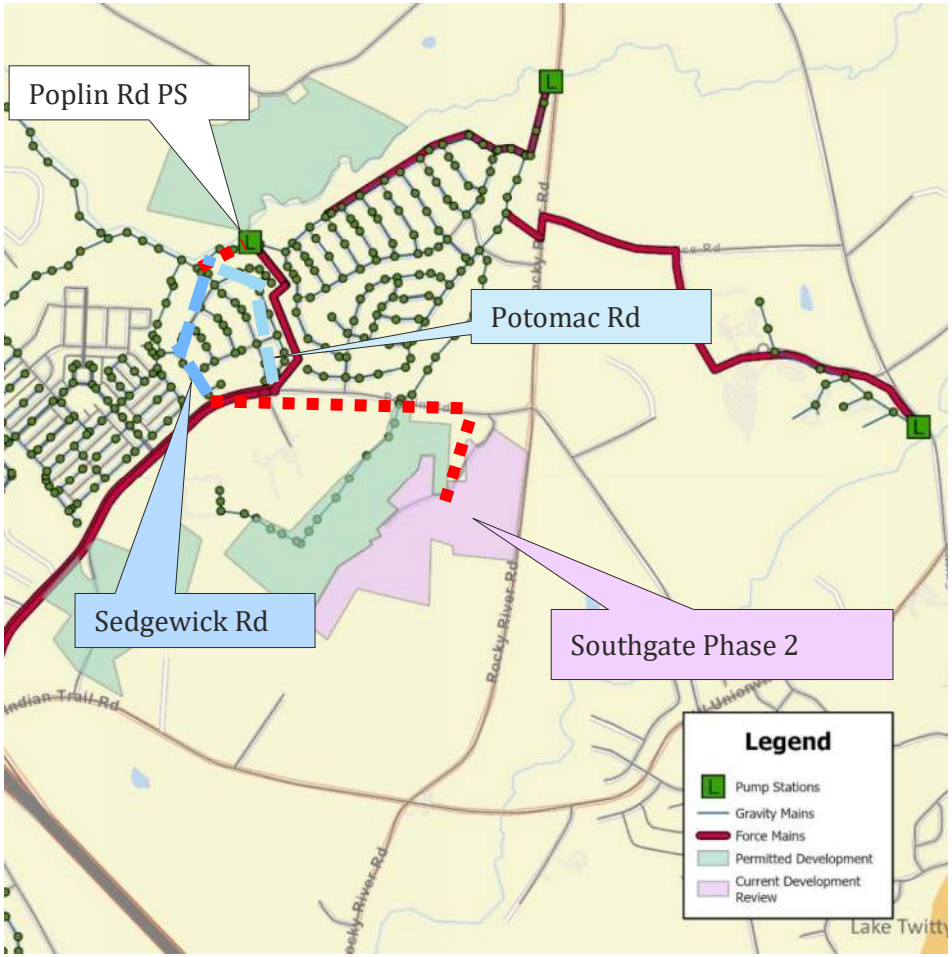
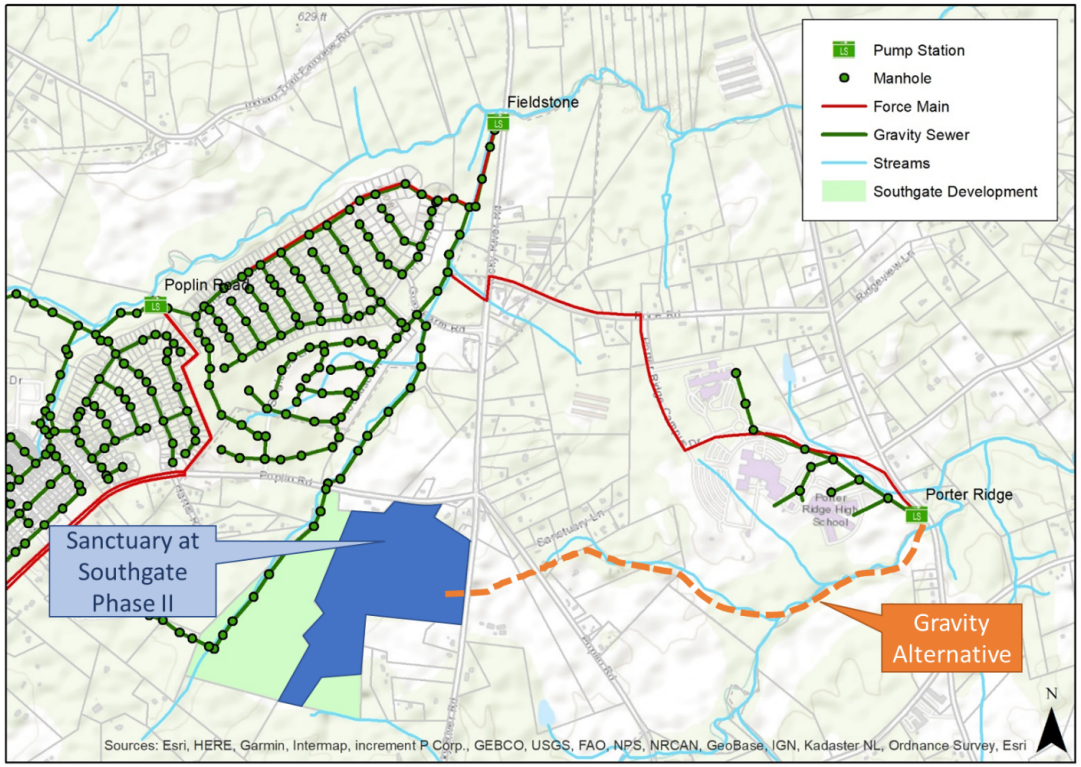


Figure 2 Development Location and Flow Paths

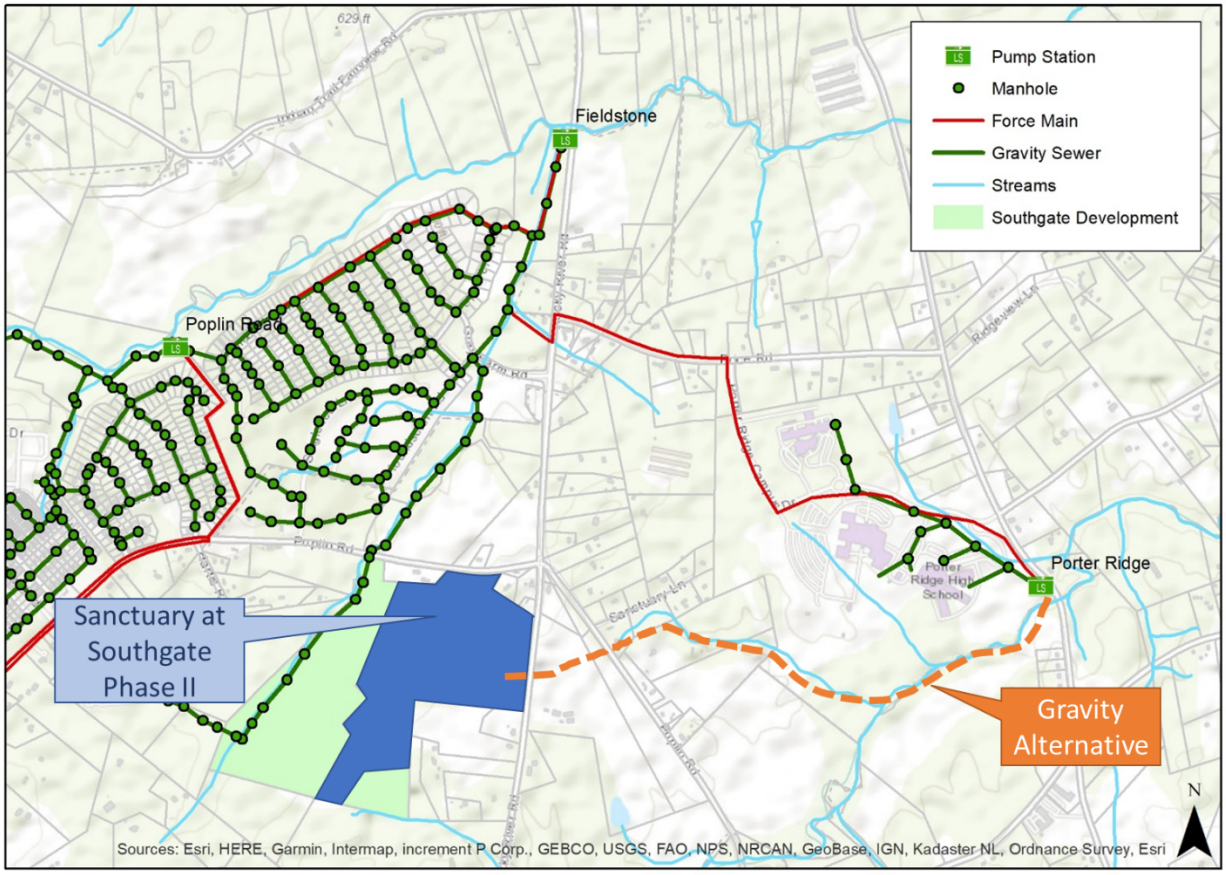
Note: Alternative 1 is defined in Black & Veatch's Phase 2 Wastewater Collection System Analysis, dated 8/24/2023, and Figure 2 is included in the report (See Appendix 6).

ALTERNATIVE 2



Note: The Alternative 2 graphic was developed by Black & Veatch and included in the Sanctuary at Southgate Gravity Alternative Calculations, dated 11/21/2023 (See Appendix 8).

Union County Water – Sanctuary at Southgate Gravity Calculations



<u>Known Information and Assumptions</u>:

- Sanctuary at Southgate is located at Poplin Rd and Rocky River Rd.
- The nearest Union County infrastructure downstream of the development is the Porter Ridge Pump Station
- Flow Calculations
    - Flow for the Sanctuary at Southgate Phase 2 project were outlined in the received sketch plan
- Slope assumptions using the approximate ground slope from Digital Elevation model:
    - The gravity sewer from the development location to the South Fork of Crooked Creek would be 4,900 ft. The elevation change is 24 ft. The ground slope is approximately 0.49%.
    - The sewer along the South Fork of Crooked Creek is 2200 ft and would need to be installed at minimum slope (0.4%).
- Length of sewer: 7,100 ft
- Manning's n=0.013

Estimated Flow in Sewer

	Avg Flow (gpd)	Wet Weather Flow (gpd)
Sanctuary at Southgate Phase II	97,870	255,175

0.255 mgd = 0.395 cfs

Pipe Size Calculations

$$d = \left(\frac{(Q * n)}{(0.46 * \sqrt{S})}\right)^{3/8} = \left(\frac{(0.395 * 0.013)}{(0.46 * \sqrt{0.004})}\right)^{3/8} = 0.50\ ft = 6\ in$$

Since the minimum gravity size is an 8=inch, a pipe diameter of **8 inches** is recommended for the gravity sewer.

Estimated Flow at Porter Ridge Pump Station

Porter Ridge Existing Firm Capacity = 180 gpm = 0.259 mgd

School WW Peaking Factor = 2.5

- Porter Ridge HS, assumed 1800 students, 100 faculty
  - 15 gal/student
  - 27,000 gpd
- Porter Ridge MS, assumed 1300 students, 70 faculty
  - 15 gal/student
  - 19,500 gpd
- Porter Ridge ES, assumed 600 students, 40 faculty
  - 12 gal/student
  - 7,200 gpd

	Avg Flow (gpd)	Wet Weather Flow (gpd)
Current Porter Ridge Flows (schools)	53,700	134,250
Sanctuary at Southgate Phase II	97,870	255,175
Total		**389,425**

0.389 mgd = 0.602 cfs = 270.4 gpm

Recommendation: Replace the Porter Ridge PS pumps with 275 gpm pumps at 105 ft of head. This larger size would not provide for any additional capacity for future upstream connections. The 6-inch force main is adequately sized. The velocity in the 6-inch force main would be about 3 fps at a flow of 270 gpm.

Fieldstone Pumps: The 2 pumps would need to be swapped for new pumps at a design point of 490 gpm at approximately 102 ft of head. This would be enough flow for the current obligated flows and the

Sanctuary at Southgate development. This would not allow for any capacity for future upstream connections.

Fieldstone Force Main: The 6-inch force main would be fine. At 490 gpm, the velocity in the force main is 5.5 fps, and the discharge pressure is reasonable.

Fieldstone Wet Well: The new pump would pump almost twice as much flow as the existing pumps. We would need to review the drawings to determine if improvements were needed to limit the number of on/off cycles.

Final List of Projects:

- 7,100 ft of 8-inch gravity sewer from the development site to the Porter Ridge PS
- 2 new pumps at the Porter Ridge PS (275 gpm at 105 feet of head)
- 2 new pumps at the Fieldstone PS (490 gpm at 102 feet of head)
- The pump sizing at each station is increasing by 30-50%. Wet Well Improvements may be required depending on size of new pumps and existing wet well, both ensure to fit the pumps themselves fit in the pump slots and that the size provides adequate volume to limit the number of on/off cycles. The sizing of the existing electrical systems and the generator should also be assessed to determine whether they can support the larger pumps.

APPENDIX 9 - NEW SANCTUARY AT SOUTHGATE PHASE II PUMP STATION CALCULATIONS

Pump Station Sizing and Cycles

Project Name:	Sanctuary at Southgate PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		LMK	

Wet Well Elevations

Ground Elev =	608.00	High Level Alarm Elev =	595.00
Sewer Invert Elev =	596.00	Lag Pump On Elev =	594.00
Force Main Discharge Elev =	603.33	Lead Pump On Elev =	593.00
Top of Pump Elev =	590.00	Pumps Off Elev =	590.50
Pump Suction Elev =	587.50	Low Level Alarm Elev =	590.00
Wet Well Sump Elev =	587.25		

Wet Well Dimensions

Wet Well Diameter =	6.00	Wet Well Active Storage Depth =	2.50
Wet Well Storage per Foot =	28.3 cf/ft	Wet Well Active Storage Volume =	**528.7 gal.**
Wet Well Storage per Foot =	211.5 gal./ft		

Pump Station Cycles

1. Cycles at Beginning of Life

Pump Rate at Beginning of Life =	225.00 gpm	Cycle Time T =	11.1 min.
Active Storage Volume =	528.7 gal.	Cycles Per Hour =	**5.38**
Design Daily Flow =	68.0 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour	Volume Pumped
1	225.00	224.00	2.36	528.73	531.09	0.11	531.09
50	225.00	175.00	3.02	10.57	13.60	4.41	679.80
67.97 gpm	225.00	157.03	3.37	7.78	11.15	5.38	757.57
100	225.00	125.00	4.23	5.29	9.52	6.30	951.71
150	225.00	75.00	7.05	3.52	10.57	5.67	1586.19
177.20 gpm	225.00	47.80	11.06	2.98	14.05	4.27	2489.05
224	225.00	1.00	528.73	2.36	531.09	0.11	118964.26

2. Cycles at End of Life

Pump Rate at End of Life =	200.00 gpm	Cycle Time T =	11.8 min.
Active Storage Volume =	528.7 gal.	Cycles Per Hour =	**5.09**
Design Daily Flow =	68.0 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour
1	200.00	199.00	2.66	528.73	531.39	0.11
50	200.00	150.00	3.52	10.57	14.10	4.26
67.97 gpm	200.00	132.03	4.00	7.78	11.78	5.09
100	200.00	100.00	5.29	5.29	10.57	5.67
150	200.00	50.00	10.57	3.52	14.10	4.26
177.20 gpm	200.00	22.80	23.19	2.98	26.18	2.29
199	200.00	1.00	528.73	2.66	531.39	0.11

Pump Station Major Losses

Project Name:	Sanctuary at Southgate PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	LMK		Date:	

Pump Station Major Losses

1. Static Head

Force Main Max CL Elevation =	630.00
Pump Suction Elevation =	587.50
Static Head =	**42.50 ft.**

2. Suction Head

Pumps Off Elev =	590.50
Pump Suction Elev =	587.50
Suction Head =	**-3.00 ft.**

3. Friction Head

Pipe Size (in.)	Pipe Material	Pipe Length (ft.)	Inside Diameter (in.)	B.O.L. Pump Rate (gpm)	B.O.L. Hazen Williams Coefficient	B.O.L. Velocity (ft/sec)	E.O.L. Pump Rate (gpm)	E.O.L. Hazen Williams Coefficient	E.O.L. Velocity (ft/sec)
4	DI	40	4.18	225	125	5.26	200	100	4.67
4	PVC-SDR 18	0	4.23	225	140	5.14	200	120	4.56
6	DI	0	6.40	225	125	2.24	200	100	1.99
6	PVC-SDR 18	5460	6.09	225	140	2.48	200	120	2.20
8	DI	0	8.55	225	125	1.26	200	100	1.12
8	PVC-SDR 18	0	7.98	225	140	1.44	200	120	1.28

Beginning of Life Friction Head = **21.87 ft.**

End of Life Friction Head = **23.56 ft.**

Pump Station Minor Losses and Total Head Losses

Project Name:	Sanctuary at Southgate PS	Designed By:	APG	Date:	12/20/2023
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Pump Station Minor Losses

1. Fitting Losses

Pipe Size (in.)	Fitting Description	Friction Loss Coefficient (k)	B.O.L. Velocity (ft/sec)	B.O.L. Head Loss (ft.)	E.O.L. Velocity (ft/sec)	E.O.L. Head Loss (ft.)
4	Std. 90° Bend	0.51	5.26	0.22	4.67	0.17
4	Std. 90° Bend	0.51	5.26	0.22	4.67	0.17
4	Plug Valve	0.31	5.26	0.13	4.67	0.11
4	Swing Check Valve	0.90	5.26	0.39	4.67	0.31
4	Tee-Branch	1.02	5.26	0.44	4.67	0.35
6	Tee-Through	0.90	2.24	0.07	1.99	0.06
6	4x6 Increase	0.28	2.24	0.02	1.99	0.02
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	45° Bend	0.24	2.24	0.02	1.99	0.01
6	22.5° Bend	0.12	2.24	0.01	1.99	0.01
6	22.5° Bend	0.12	2.24	0.01	1.99	0.01
6	Pipe Exit	1.00	2.24	0.08	1.99	0.06

Beginning of Life Friction Head = **1.94**

End of Life Friction Head = **1.53**

Pump Station Total Head Losses

1. Beginning of Life Total Head Losses

Static Head =	42.50
Suction Head =	-3.00
Friction Head Losses =	21.87
Fitting Head Losses =	1.94
Total System Head =	**63.31 ft.**

2. End of Life Total Head Losses

Static Head =	42.50
Suction Head =	-3.00
Friction Head Losses =	23.56
Fitting Head Losses =	1.53
Total System Head =	**64.60 ft.**

Pump Station System Table

Project Name:	Sanctuary at Southgate PS	Designed By:	APG	Date:	12/20/2023
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Pump Station Minor Losses

1. Fitting Losses

Pump Rate (gpm)	Avg. Velocity (ft/sec)	Fitting Head Loss (ft.)	B.O.L. Friction Head Loss (ft.)	B.O.L. Total System Head (ft.)	E.O.L. Friction Head Loss (ft.)	E.O.L. Total System Head (ft.)	Head from NP 3171 Pump Curve
0	0.00	0.00	0.00	39.50	0.00	39.50	183.5
50	0.55	0.08	1.31	40.89	1.74	41.32	
100	1.11	0.33	4.71	44.54	6.27	46.10	175.5
150	1.66	0.75	9.97	50.22	13.28	53.52	
200	2.21	1.33	16.98	57.81	22.60	63.44	167.5
250	2.77	2.08	25.66	67.24	34.16	75.74	
300	3.32	2.99	35.96	78.45	47.86	90.35	161.0
350	3.87	4.07	47.82	91.40	63.65	107.23	
400	4.42	5.32	61.22	106.04	81.49	126.31	154.0
450	4.98	6.74	76.13	122.36	101.33	147.57	
500	5.53	8.32	92.51	140.33	123.14	170.95	147.0
550	6.08	10.06	110.35	159.91	146.88	196.44	
600	6.64	11.98	129.62	181.10	172.53	224.01	142.5
650	7.19	14.05	150.31	203.86	200.07	253.63	
700	7.74	16.30	172.40	228.20	229.47	285.27	136.0

Anti-Floatation Sizing

Project Name:	Sanctuary at Southgate PS	Designed By:	APG	Date:	12/20/2023
Project Location:	UCPW in Indian Trail	Checked By:	APG	Date:	12/20/2023
BGE Project #:	7734-16	Revised By:			

Wet Well Dimensions

Top of Wet Well Elev =	609.00
Finished Grade Elev =	608.00
Wet Well Sump Elev =	587.25
Wet Well Diameter =	6.00 ft.
Top Slab Thickness =	1.00 ft.
Wall Thickness =	0.67 ft.
Base Thickness =	1.00 ft.
Antifloatation Base Diameter =	14.00 ft.
Antifloatation Base Thickness =	2.00 ft.
Depth of Wet Well embedded into Antifloatation Base =	2.00 ft.
Volume of Top Slab =	42.31 cu. ft.
Volume of Wet Well =	878.01 cu. ft.
Volume of Base =	42.31 cu. ft.
Vol. of Antifloatation Base =	223.25 cu. ft.
Total Vol. of Wet Well =	1185.89 cu. ft.

Buoyant Force of Wet Well = 73,999.37 lbs.

Unit Weights

Unit Weight of Concrete =	150 lbs./cu. ft.
Unit Weight of Saturated Soil =	105 lbs./cu. ft.
Unit Weight of Water =	62.4 lbs./cu. ft.

Wet Well Weights

Weight of Top Slab =	6,347.07 lbs.
Weight of Wet Well =	43,697.83 lbs.
Weight of Base =	6,347.07 lbs.
Weight. of Antifloatation Base =	33,487.27 lbs.
Total Weight of Wet Well =	89,879.24 lbs.

Soil Weight Above Antifloatation Base

Volume of Soil =	2204.58 cu. ft.
Weight of Soil =	231,480.77 lbs.

Anti-Buoyant Force of Wet Well = 146,404.53 lbs.

Factor of Safety = 1.98 FS Should be above 1.2

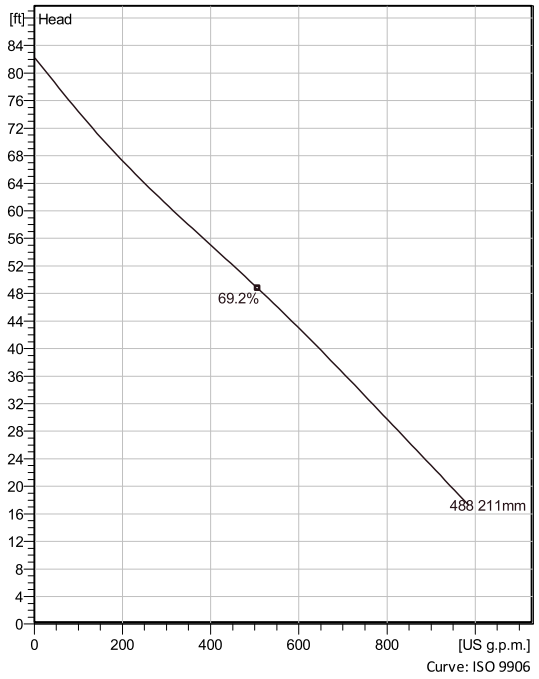
NP 3127 HT 3~ Adaptive 488

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3127.920 21-12-4AS-W IE3 11hp

Installation type
P - Semi permanent, Wet

Impeller diameter
211 mm

Discharge diameter
4 inch

Pump information

Impeller diameter
211 mm

Discharge diameter
4 inch

Inlet diameter
100 mm

Maximum operating speed
1800 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

Technical specification

Motor - General

Motor number N3127.920 21-12-4AS-W IE3 11hp	**Phases** 3~	**Rated speed** 1800 rpm	**Rated power** 11 hp
ATEX approved No	**Number of poles** 4	**Rated current** 12 A	**Stator variant** 60
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 920			

Motor - Technical

Power factor - 1/1 Load 0.90	**Motor efficiency - 1/1 Load** 92.1 %	**Total moment of inertia** 1.25 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.87	**Motor efficiency - 3/4 Load** 92.0 %	**Starting current, direct starting** 87 A	
Power factor - 1/2 Load 0.79	**Motor efficiency - 1/2 Load** 90.3 %	**Starting current, star-delta** 29 A	

Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

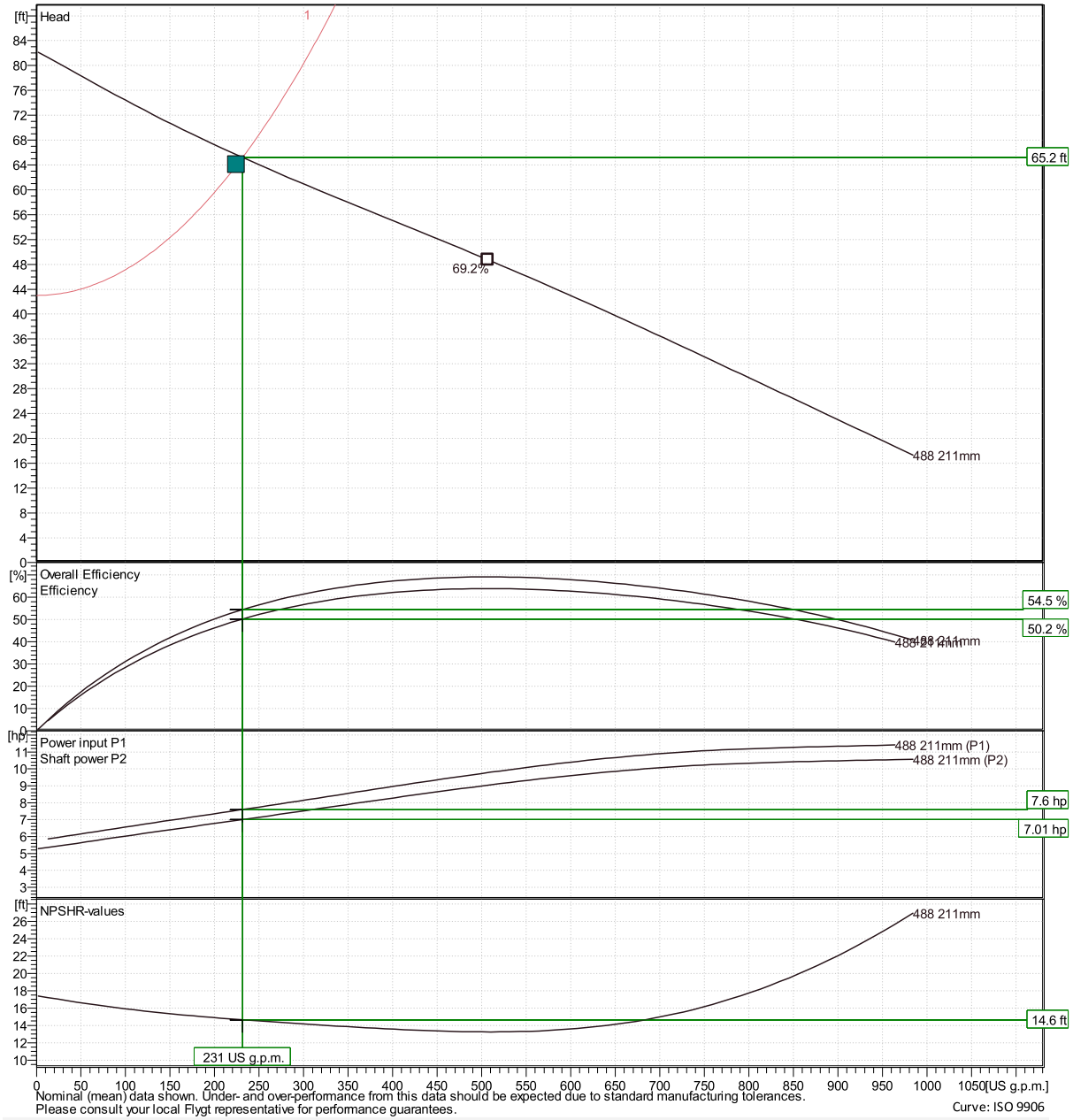
NP 3127 HT 3~ Adaptive 488

Performance curve

Duty point

Flow	Head
231 US g.p.m.	65.2 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

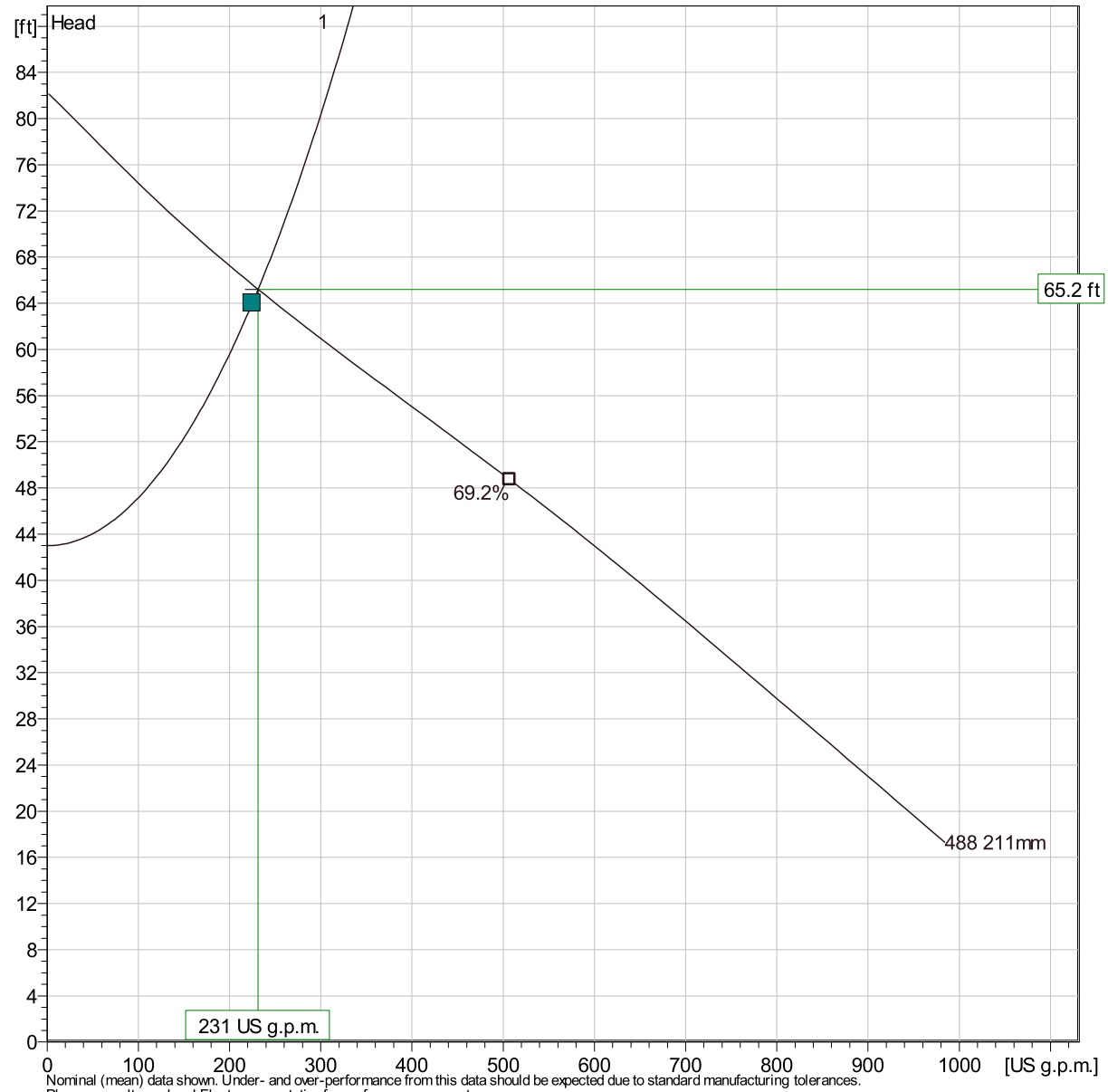
Curve: ISO 9906

Xylect-20620200	Dan Joyce		
Created on	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

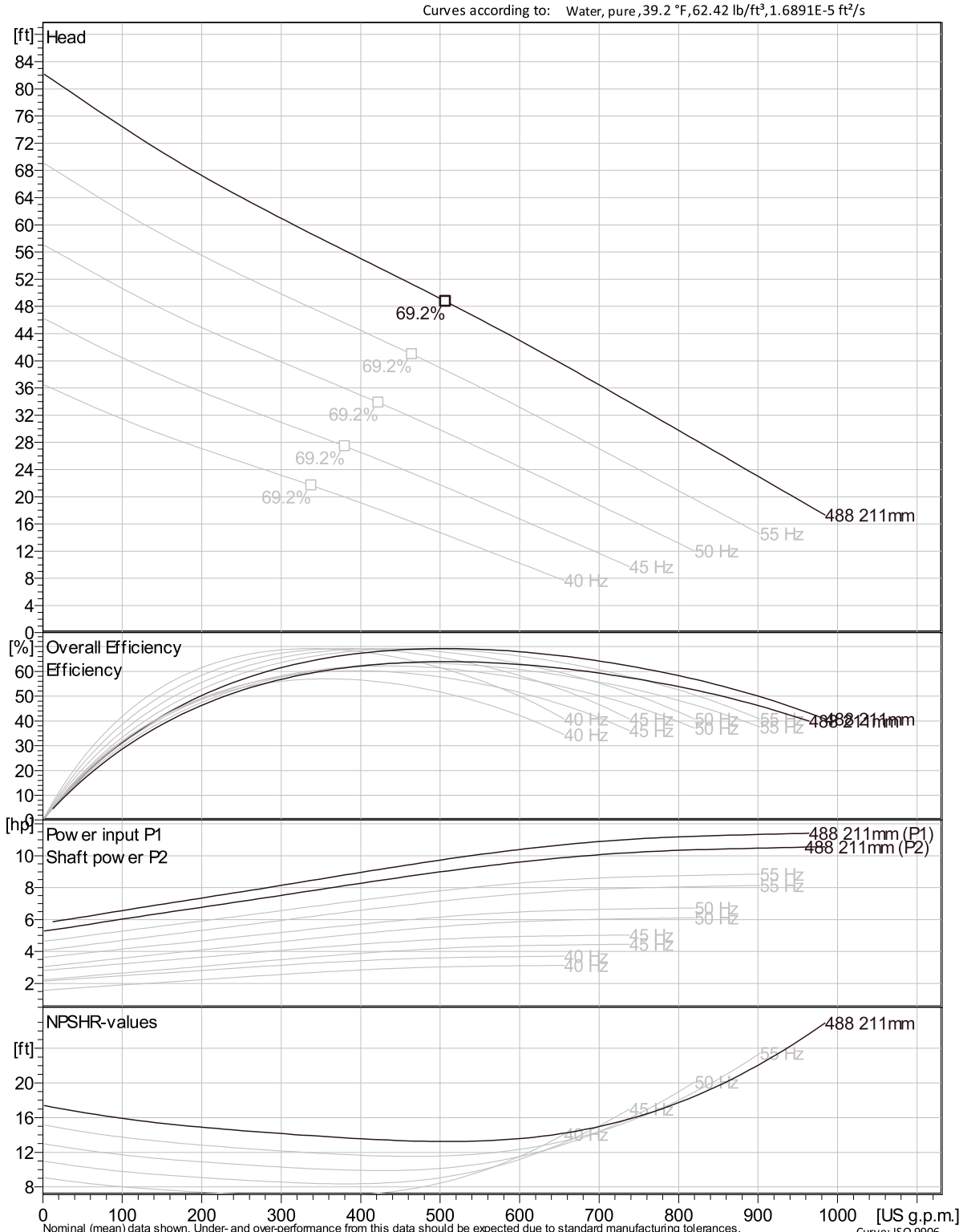
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	231	65.2	7.01	231	65.2	7.01	54.5 %	408	14.6

Project		**Created by**	Dan Joyce		
Block	Xylect-20620200	**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

VFD Curve

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

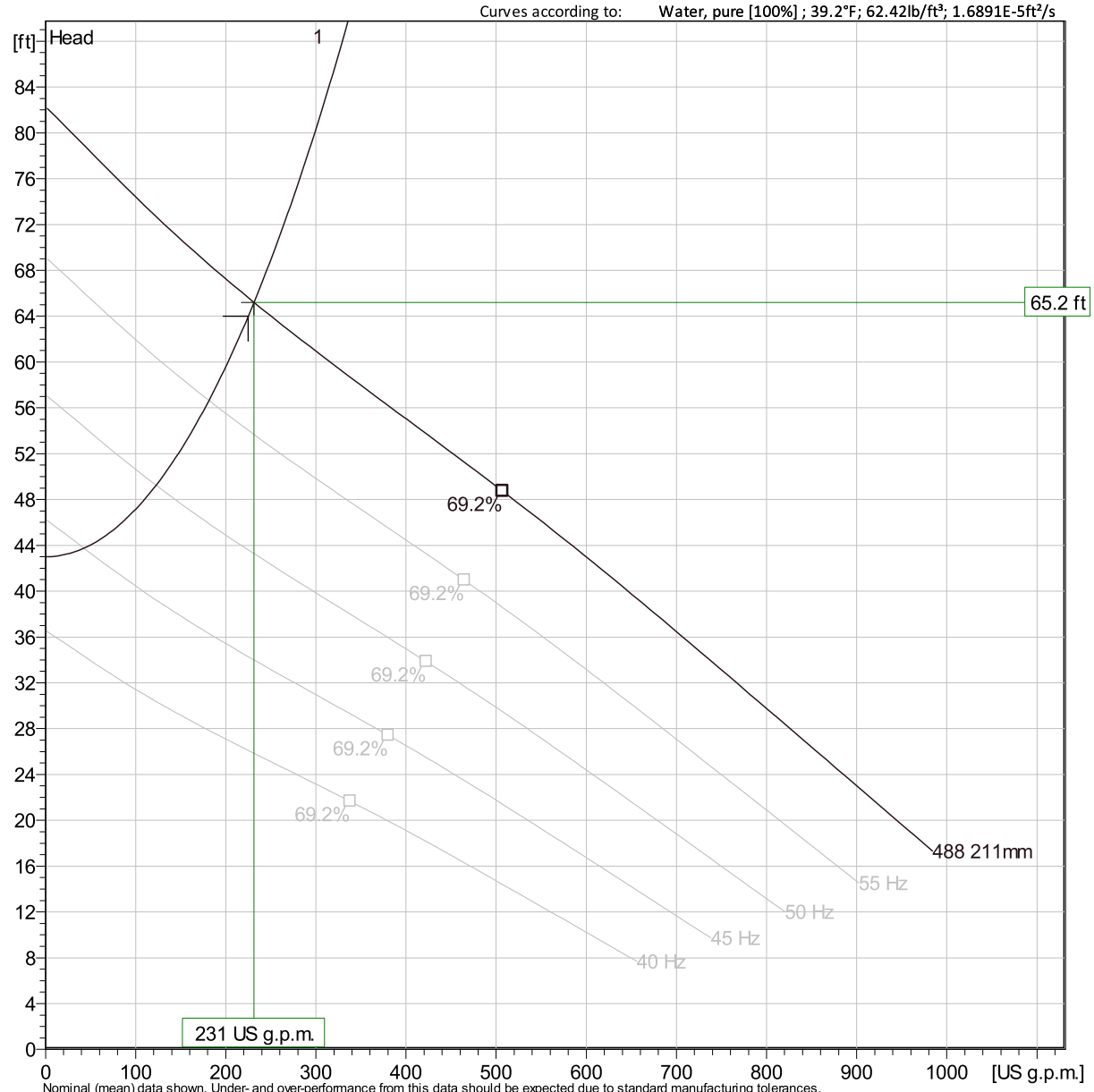
Curve: ISO 9906

Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating Characteristics

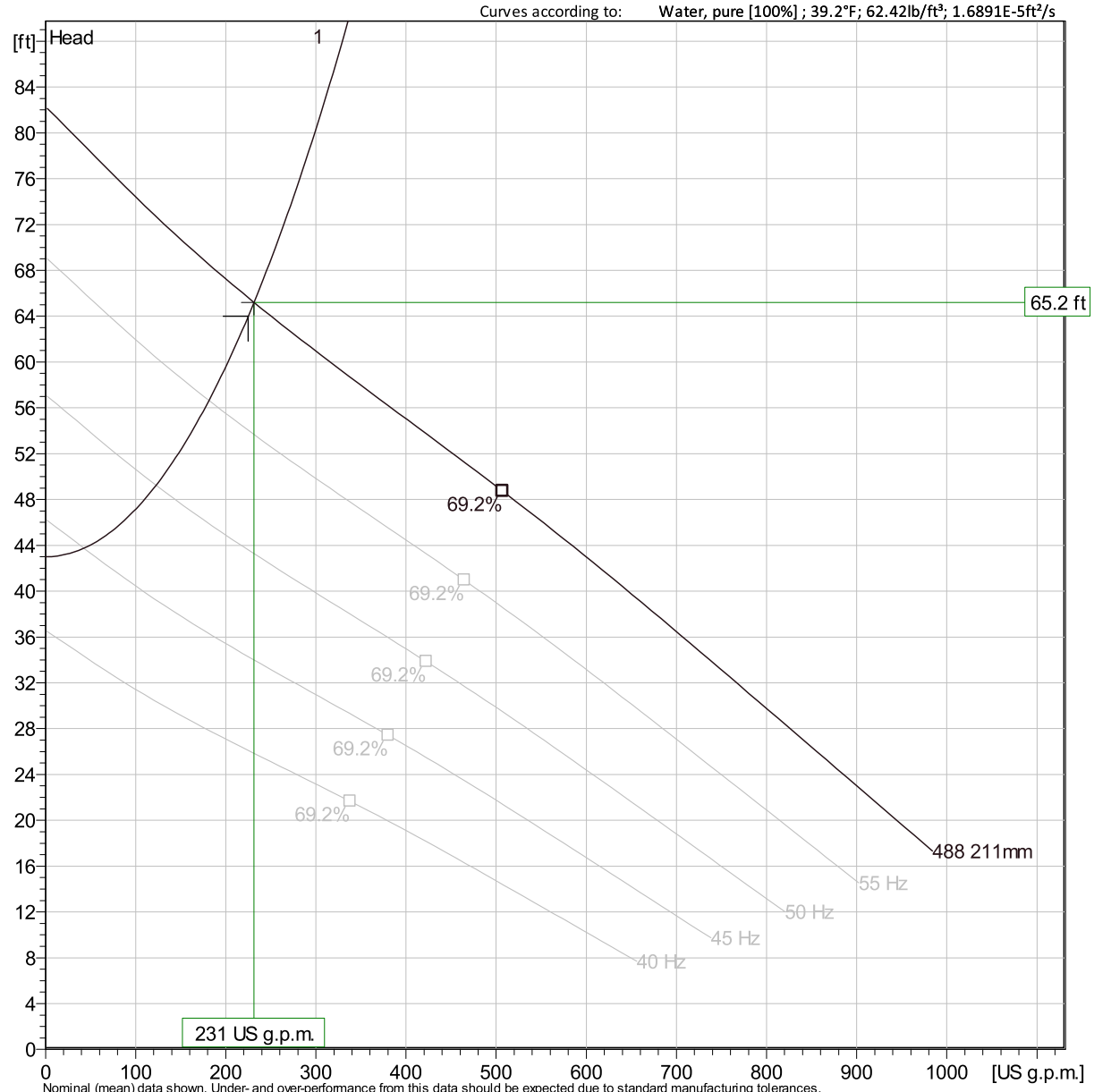
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	60 Hz	231	65.2	7.01	231	65.2	7.01	54.5 %	408	14.6
1	55 Hz	181	56.6	5.21	181	56.6	5.21	49.9 %	397	13
1	50 Hz	123	49.2	3.7	123	49.2	3.7	41.4 %	432	11.5
1	45 Hz	42.7	43.8	2.4	42.7	43.8	2.4	19.7 %	869	10.4

Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

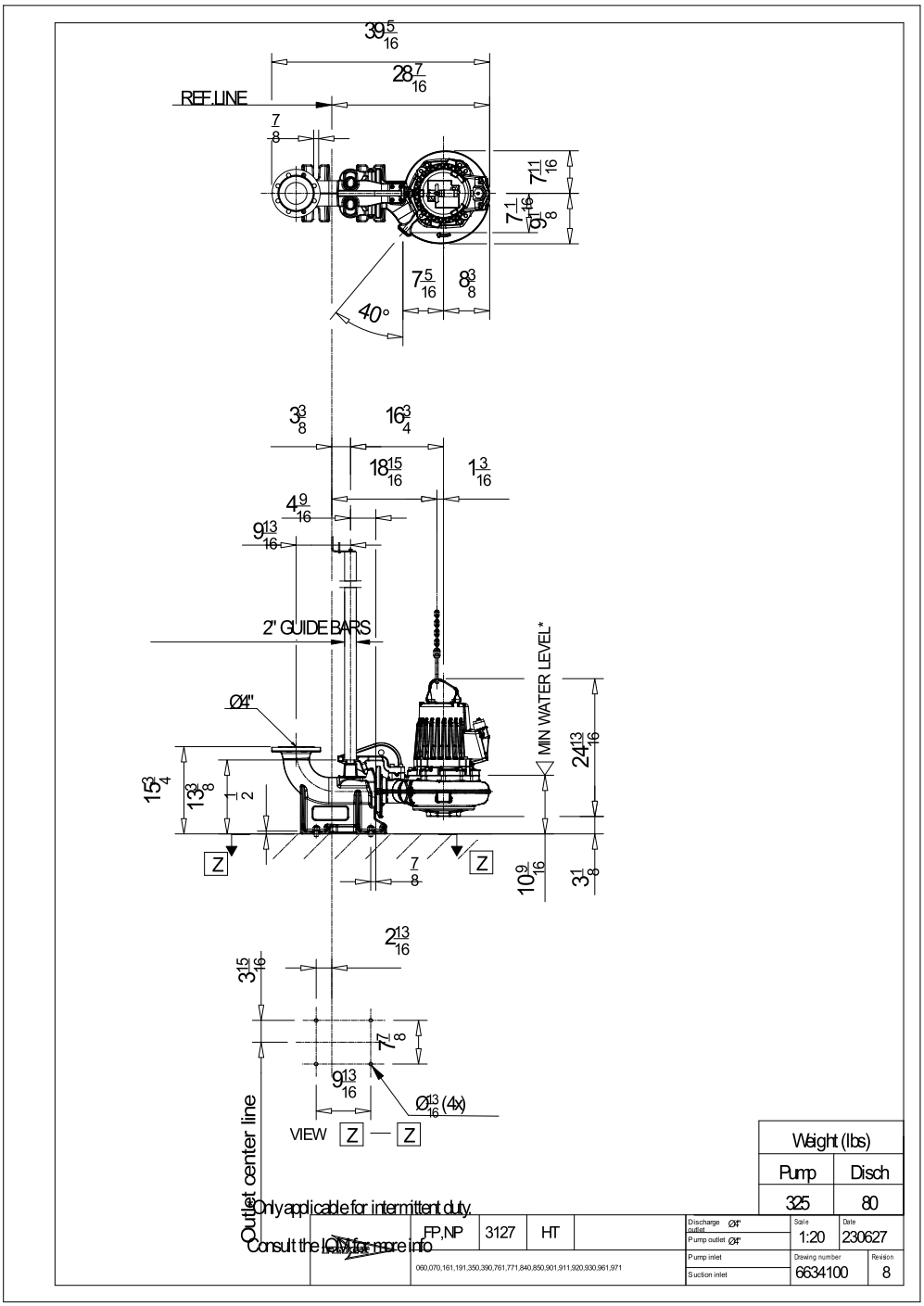
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	40 Hz									

Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3127 HT 3~ Adaptive 488

Dimensional drawing



Project	Xylect-20620200	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

APPENDIX 11 - ALTERNATIVE 1 LIFE CYCLE COST ANALYSIS

Life Cycle Cost Analysis
Sanctuary at Southgate Phase II Development
Alternative 1 - On-Site Pump Station with Gravity Sewer Connection at Annandale Subdivision

Inputs and Assumptions

Planning Period	20	Years
Discount Rate	1.55%	
Inflation	3.20%	

O&M Costs (% of Capital for Pump Stations)	3%
10-year Items (% of Total for Pump Stations)	5%
20-year Items (% of Total for Pump Stations)	60%
50-year Items (% of Total for Pump Stations)	35%

Initial Capitol Investment

Item	Quantity	UOM	Cost Per Unit	Cost
6" PVC Sanitary Sewer Force Main	5460	LF	$60	$327,600
New Sanctuary at Southgate Phase II Pump Station	1	LS	$963,000	$963,000
			Total	$1,290,600

Annual Costs

Electrical Cost	$0.08	kWH
Flygt NP 3127 HT 3~ 488		
Pump On Time Per Cycle (min)	11.15	
Pump Cycles Per Hour	5.38	
Flygt NP 3153 HT 3~ 466 Pump Horsepower	11	
Ave Daily Flow Rate (GPM)	68	
US MG / Year	35.73	
Pump Spec Energy (kWh/US MG)	408	
Yearly Cost of Electricity	**$1,166.33**	
Yearly Cost of Pump Station O&M	**$38,718.00**	
Total Yearly Costs at Year 0	**$39,884.33**	
Total Annual Costs NPV	$919,441.58	

Life-Cycle Replacement Costs

Cost 10-year Items at Year 0	$64,530.00
Cost 10-year Items at Year 10	$88,421.65
NPV of 10-Year Items at Year 10	$75,815.74
Cost 10-year Items at Year 20	$121,158.98
NPV of 10-Year Items at Year 20	$89,075.25
Cost 20-Year Items at Year 0	$774,360.00
Cost 20-Year Items at Year 20	$1,453,907.77
NPV of 20-Year Items at Year 20	$1,068,903.02
Total Life-Cycle Replacement Costs NPV	$1,233,794.00

Residual Values

Cost of 10-year Items at Year 20	$121,158.98
Cost of 20-year Items at Year 20	$1,453,907.77
Residual Value of 50-Year Items at Year 20	$271,026.00
Total Life-Cycle Replacement Residual Value at Year 20	$1,846,092.75
Total Residual Value NPV	$1,357,234.72

Total Net Present Value **$2,086,600.86**

APPENDIX 12 - PORTER RIDGE PUMP STATION CALCULATIONS

Pump Station Design Flows

Project Name:	Porter Ridge PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Proposed Uses

2. Phase II

Use	Units	Quantity Per Unit		Population	Daily Flow Per	Daily Flow Per Use
Existing Schools			1 Lot	0.0		53,700 gpd
Sanctuary at Southgate Single Family			1 Person	0.0		21,000 gpd
Sanctuary at Southgate Multi-Family and Commercial			1 Person	0.0		76,870 gpd

Design Flow

Proposed Flow =	151,570 gpd	Proposed Population =	people
Design Daily Flow =	151,570 gpd	Total Population =	people
Design Daily Flow =	**105.26 gpm**	Single Family Peaking Factor =	3.00
		Multi-Family and Commercial Peaking Factor =	2.50
Peak Hourly Flow =	389,425 gpd		
Peak Hourly Flow =	**270.43 gpm**		

Pump Station Sizing and Cycles

Project Name:	Porter Ridge PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		LMK	

Wet Well Elevations

Ground Elev =	590.00	High Level Alarm Elev =	577.50
Sewer Invert Elev =	577.92	Lag Pump On Elev =	576.75
Force Main Discharge Elev =	585.33	Lead Pump On Elev =	576.00
Top of Pump Elev =	573.00	Pumps Off Elev =	573.00
Pump Suction Elev =	570.50	Low Level Alarm Elev =	
Wet Well Sump Elev =	570.00		

Wet Well Dimensions

Wet Well Diameter =	6.00	Wet Well Active Storage Depth =	3.00
Wet Well Storage per Foot =	28.3 cf/ft	Wet Well Active Storage Volume =	**634.5 gal.**
Wet Well Storage per Foot =	211.5 gal./ft		

Pump Station Cycles

1. Cycles at Beginning of Life

Pump Rate at Beginning of Life =	300.00 gpm	Cycle Time T =	9.3 min.
Active Storage Volume =	634.5 gal.	Cycles Per Hour =	**6.46**
Design Daily Flow =	105.3 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour	Volume Pumped
1	300.00	299.00	2.12	634.48	636.60	0.09	636.60
50	300.00	250.00	2.54	12.69	15.23	3.94	761.37
105.26 gpm	300.00	194.74	3.26	6.03	9.29	6.46	977.40
160	300.00	140.00	4.53	3.97	8.50	7.06	1359.59
225	300.00	75.00	8.46	2.82	11.28	5.32	2537.90
270.43 gpm	300.00	29.57	21.46	2.35	23.81	2.52	6437.90
299	300.00	1.00	634.48	2.12	636.60	0.09	190342.82

2. Cycles at End of Life

Pump Rate at End of Life =	275.00 gpm	Cycle Time T =	9.8 min.
Active Storage Volume =	634.5 gal.	Cycles Per Hour =	**6.14**
Design Daily Flow =	105.3 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour
1	275.00	274.00	2.32	634.48	636.79	0.09
50	275.00	225.00	2.82	12.69	15.51	3.87
105.26 gpm	275.00	169.74	3.74	6.03	9.77	6.14
160	275.00	115.00	5.52	3.97	9.48	6.33
225	275.00	50.00	12.69	2.82	15.51	3.87
270.43 gpm	275.00	4.57	138.96	2.35	141.30	0.42
274	275.00	1.00	634.48	2.32	636.79	0.09

Pump Station Major Losses

Project Name:	Porter Ridge PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	LMK		Date:	

Pump Station Major Losses

1. Static Head

Force Main Max CL Elevation =	613.00
Pump Suction Elevation =	570.50
Static Head =	**42.50 ft.**

2. Suction Head

Pumps Off Elev =	573.00
Pump Suction Elev =	570.50
Suction Head =	**-2.50 ft.**

3. Friction Head

Pipe Size (in.)	Pipe Material	Pipe Length (ft.)	Inside Diameter (in.)	B.O.L. Pump Rate (gpm)	B.O.L. Hazen Williams Coefficient	B.O.L. Velocity (ft/sec)	E.O.L. Pump Rate (gpm)	E.O.L. Hazen Williams Coefficient	E.O.L. Velocity (ft/sec)
4	DI	0	4.18	300	125	7.01	275	100	6.43
4	PVC-SDR 18	0	4.23	300	140	6.85	275	120	6.28
6	DI	0	6.40	300	125	2.99	275	100	2.74
6	PVC-SDR 18	8000	6.09	300	140	3.30	275	120	3.03
8	DI	0	8.55	300	125	1.68	275	100	1.54
8	PVC-SDR 18	0	7.98	300	140	1.92	275	120	1.76

Beginning of Life Friction Head = **51.65 ft.**

End of Life Friction Head = **58.48 ft.**

Pump Station Minor Losses and Total Head Losses

Project Name: Porter Ridge PS | Designed By: APG | Date: 12/20/2024
Project Location: UCPW in Indian Trail | Checked By: | Date:
BGE Project #: 7734-16 | Revised By: | Date:

Pump Station Minor Losses

1. Fitting Losses

Pipe Size (in.)	Fitting Description	Friction Loss Coefficient (k)	B.O.L. Velocity (ft/sec)	B.O.L. Head Loss (ft.)	E.O.L. Velocity (ft/sec)	E.O.L. Head Loss (ft.)
4	Std. 90° Bend	0.51	7.01	0.39	6.43	0.33
4	Std. 90° Bend	0.51	2.99	0.07	2.74	0.06
4	Plug Valve	0.31	2.99	0.04	2.74	0.04
4	Swing Check Valve	0.90	2.99	0.13	2.74	0.11
4	Tee-Branch	1.02	2.99	0.14	2.74	0.12
6	Tee-Through	0.90	2.99	0.13	2.74	0.11
6	4x6 Increase	0.28	2.99	0.04	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	45° Bend	0.24	2.99	0.03	2.74	0.03
6	22.5° Bend	0.12	2.99	0.02	2.74	0.01
6	22.5° Bend	0.12	2.99	0.02	2.74	0.01
6	Pipe Exit	1.00	2.99	0.14	2.74	0.12

Beginning of Life Friction Head = **1.74**
End of Life Friction Head = **1.46**

Pump Station Total Head Losses

1. Beginning of Life Total Head Losses

Static Head =	42.50
Suction Head =	-2.50
Friction Head Losses =	51.65
Fitting Head Losses =	1.74
Total System Head =	**93.39 ft.**

2. End of Life Total Head Losses

Static Head =	42.50
Suction Head =	-2.50
Friction Head Losses =	58.48
Fitting Head Losses =	1.46
Total System Head =	**99.94 ft.**

Pump Station System Table

Project Name:	Porter Ridge PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Pump Station Minor Losses

1. Fitting Losses

Pump Rate (gpm)	Avg. Velocity (ft/sec)	Fitting Head Loss (ft.)	B.O.L. Friction Head Loss (ft.)	B.O.L. Total System Head (ft.)	E.O.L. Friction Head Loss (ft.)	E.O.L. Total System Head (ft.)	Head from NP 3171 Pump Curve
0	0.00	0.00	0.00	40.00	0.00	40.00	183.5
50	0.55	0.08	1.88	41.96	2.50	42.58	
100	1.10	0.33	6.77	47.10	9.00	49.33	175.5
150	1.65	0.75	14.33	55.07	19.05	59.80	
200	2.20	1.33	24.39	65.72	32.44	73.77	167.5
250	2.75	2.08	36.86	78.94	49.02	91.10	
300	3.30	2.99	51.65	94.64	68.69	111.68	161.0
350	3.85	4.07	68.69	112.76	91.36	135.43	
400	4.40	5.32	87.94	133.26	116.96	162.28	154.0
450	4.96	6.74	109.35	156.08	145.43	192.17	
500	5.51	8.32	132.88	181.20	176.73	225.05	147.0
550	6.06	10.06	158.50	208.57	210.81	260.87	
600	6.61	11.98	186.19	238.16	247.63	299.60	142.5
650	7.16	14.05	215.90	269.96	287.15	341.20	
700	7.71	16.30	247.63	303.93	329.34	385.64	136.0

Anti-Floatation Sizing

Project Name:	Porter Ridge PS	Designed By	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:	APG	Date:	12/20/2024
BGE Project #:	7734-16	Revised By:	0	LMK	

Wet Well Dimensions

Top of Wet Well Elev =	591.00
Finished Grade Elev =	590.00
Wet Well Sump Elev =	570.00
Wet Well Diameter =	6.00 ft.
Top Slab Thickness =	1.00 ft.
Wall Thickness =	0.67 ft.
Base Thickness =	1.00 ft.
Antifloatation Base Diameter =	14.00 ft.
Antifloatation Base Thickness =	2.00 ft.
Depth of Wet Well embedded into Antifloatation Base =	2.00 ft.
Volume of Top Slab =	42.31 cu. ft.
Volume of Wet Well =	846.28 cu. ft.
Volume of Base =	42.31 cu. ft.
Vol. of Antifloatation Base =	223.25 cu. ft.
Total Vol. of Wet Well =	1154.15 cu. ft.

Buoyant Force of Wet Well = 72,019.09 lbs.

Unit Weights

Unit Weight of Concrete =	150 lbs./cu. ft.
Unit Weight of Saturated Soil =	105 lbs./cu. ft.
Unit Weight of Water =	62.4 lbs./cu. ft.

Wet Well Weights

Weight of Top Slab =	6,347.07 lbs.
Weight of Wet Well =	42,118.39 lbs.
Weight of Base =	6,347.07 lbs.
Weight. of Antifloatation Base =	33,487.27 lbs.
Total Weight of Wet Well =	88,299.80 lbs.

Soil Weight Above Antifloatation Base

Volume of Soil =	2120.86 cu. ft.
Weight of Soil =	222,690.36 lbs.

Anti-Buoyant Force of Wet Well = 141,915.75 lbs.

Factor of Safety = 1.97

Pump Station Design Flows

Project Name:	Fieldstone PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Proposed Uses

2. Phase II

Use	Units	Quantity Per Unit		Population	Daily Flow Per Unit	Daily Flow Per Use
Existing Flows			1 Lot	0.0		90,000 gpd
Permitted Flows			1 Lot	0.0		122,180 gpd
Sanctuary at Southgate Single-Family			1 Person	0.0		21,000 gpd
Sanctuary at Southgate Multi-Family and Commercial			1 Person	0.0		76,870 gpd

Design Flow

Proposed Flow = 310,050 gpd

Design Daily Flow = 310,050 gpd

Design Daily Flow = **215.31 gpm**

Peak Hourly Flow = 785,625 gpd

Peak Hourly Flow = **545.57 gpm**

Proposed Population = people

Total Population = people

Single Family Peaking Factor = 3.00

Multi-Family and Commercial Peaking Factor = 2.50

Pump Station Sizing and Cycles

Project Name:	Fieldstone PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:			LMK

Wet Well Elevations

Ground Elev =	591.82	High Level Alarm Elev =	570.50
Sewer Invert Elev =	570.42	Lag Pump On Elev =	570.00
Force Main Discharge Elev =	588.50	Lead Pump On Elev =	569.00
Top of Pump Elev =	566.50	Pumps Off Elev =	566.50
Pump Suction Elev =	563.53	Low Level Alarm Elev =	
Wet Well Sump Elev =	563.20		

Wet Well Dimensions

Wet Well Diameter =	10.00	Wet Well Active Storage Depth =	2.50
Wet Well Storage per Foot =	78.5 cf/ft	Wet Well Active Storage Volume =	**1468.7 gal.**
Wet Well Storage per Foot =	587.5 gal./ft		

Pump Station Cycles

1. Cycles at Beginning of Life

Pump Rate at Beginning of Life =	600.00 gpm	Cycle Time T =	10.6 min.
Active Storage Volume =	1468.7 gal.	Cycles Per Hour =	**5.64**
Design Daily Flow =	215.3 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour	Volume Pumped
1	600.00	599.00	2.45	1468.69	1471.15	0.04	1471.15
150	600.00	450.00	3.26	9.79	13.06	4.60	1958.26
215.31 gpm	600.00	384.69	3.82	6.82	10.64	5.64	2290.73
300	600.00	300.00	4.90	4.90	9.79	6.13	2937.39
450	600.00	150.00	9.79	3.26	13.06	4.60	5874.78
545.57 gpm	600.00	54.43	26.98	2.69	29.68	2.02	16190.78
599	600.00	1.00	1468.69	2.45	1471.15	0.04	881216.74

2. Cycles at End of Life

Pump Rate at End of Life =	560.00 gpm	Cycle Time T =	11.1 min.
Active Storage Volume =	1468.7 gal.	Cycles Per Hour =	**5.41**
Design Daily Flow =	215.3 gpm		

Inflow Rate (gpm)	Pump Rate (gpm)	Net Flow Rate Out (gpm)	Draw Down Time (gpm)	Time to Fill (min)	Cycle Time (min)	Cycles Per Hour
1	560.00	559.00	2.63	1468.69	1471.32	0.04
150	560.00	410.00	3.58	9.79	13.37	4.49
215.31 gpm	560.00	344.69	4.26	6.82	11.08	5.41
300	560.00	260.00	5.65	4.90	10.54	5.69
450	560.00	110.00	13.35	3.26	16.62	3.61
545.57 gpm	560.00	14.43	101.80	2.69	104.49	0.57
559	560.00	1.00	1468.69	2.63	1471.32	0.04

Pump Station Major Losses

Project Name:	Fieldstone PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	LMK		Date:	

Pump Station Major Losses

1. Static Head

Force Main Max CL Elevation =	625.00
Pump Suction Elevation =	563.53
Static Head =	**61.47 ft.**

2. Suction Head

Pumps Off Elev =	566.50
Pump Suction Elev =	563.53
Suction Head =	**-2.97 ft.**

3. Friction Head

Pipe Size (in.)	Pipe Material	Pipe Length (ft.)	Inside Diameter (in.)	B.O.L. Pump Rate (gpm)	B.O.L. Hazen Williams Coefficient	B.O.L. Velocity (ft/sec)	E.O.L. Pump Rate (gpm)	E.O.L. Hazen Williams Coefficient	E.O.L. Velocity (ft/sec)
4	DI	0	4.18	600	125	14.02	560	100	13.09
4	PVC-SDR 18	0	4.23	600	140	13.69	560	120	12.78
6	DI	0	6.40	600	125	5.98	560	100	5.58
6	PVC-SDR 18	4400	6.09	600	140	6.61	560	120	6.17
8	DI	0	8.55	600	125	3.35	560	100	3.13
8	PVC-SDR 18	0	7.98	600	140	3.85	560	120	3.59

Beginning of Life Friction Head = **102.40 ft.**

End of Life Friction Head = **119.88 ft.**

Pump Station Minor Losses and Total Head Losses

Project Name: Fieldstone PS
Project Location: UCPW in Indian Trail
BGE Project #: 7734-16

Designed By: APG
Checked By:
Revised By:

Date: 12/20/2024
Date:
Date:

Pump Station Minor Losses

1. Fitting Losses

Pipe Size (in.)	Fitting Description	Friction Loss Coefficient (k)	B.O.L. Velocity (ft/sec)	B.O.L. Head Loss (ft.)	E.O.L. Velocity (ft/sec)	E.O.L. Head Loss (ft.)
4	Std. 90° Bend	0.51	14.02	1.56	13.09	1.36
4	Std. 90° Bend	0.51	5.98	0.28	5.58	0.25
4	Plug Valve	0.31	5.98	0.17	5.58	0.15
4	Swing Check Valve	0.90	5.98	0.50	5.58	0.44
4	Tee-Branch	1.02	5.98	0.57	5.58	0.49
6	Tee-Through	0.90	5.98	0.50	5.58	0.44
6	4x6 Increase	0.28	5.98	0.16	5.58	0.14
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	45° Bend	0.24	5.98	0.13	5.58	0.12
6	22.5° Bend	0.12	5.98	0.07	5.58	0.06
6	22.5° Bend	0.12	5.98	0.07	5.58	0.06
6	Pipe Exit	1.00	5.98	0.56	5.58	0.48

Beginning of Life Friction Head = **5.89**
End of Life Friction Head = **5.13**

Pump Station Total Head Losses

1. Beginning of Life Total Head Losses

Static Head =	61.47
Suction Head =	-2.97
Friction Head Losses =	102.40
Fitting Head Losses =	5.89
Total System Head =	**166.79 ft.**

2. End of Life Total Head Losses

Static Head =	61.47
Suction Head =	-2.97
Friction Head Losses =	119.88
Fitting Head Losses =	5.13
Total System Head =	**183.51 ft.**

Pump Station System Table

Project Name:	Fieldstone PS	Designed By:	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:		Date:	
BGE Project #:	7734-16	Revised By:		Date:	

Pump Station Minor Losses

1. Fitting Losses

Pump Rate (gpm)	Avg. Velocity (ft/sec)	Fitting Head Loss (ft.)	B.O.L. Friction Head Loss (ft.)	B.O.L. Total System Head (ft.)	E.O.L. Friction Head Loss (ft.)	E.O.L. Total System Head (ft.)	Head from NP 3171 Pump Curve
0	0.00	0.00	0.00	58.50	0.00	58.50	183.5
50	0.55	0.08	1.03	59.61	1.37	59.95	
100	1.10	0.32	3.72	62.54	4.95	63.77	175.5
150	1.65	0.72	7.88	67.10	10.48	69.70	
200	2.20	1.28	13.42	73.20	17.84	77.63	167.5
250	2.75	2.00	20.27	80.78	26.96	87.47	
300	3.30	2.88	28.41	89.79	37.78	99.16	161.0
350	3.85	3.92	37.78	100.20	50.25	112.67	
400	4.40	5.13	48.37	111.99	64.33	127.95	154.0
450	4.96	6.49	60.14	125.13	79.99	144.98	
500	5.51	8.01	73.08	139.59	97.20	163.71	147.0
550	6.06	9.69	87.18	155.37	115.95	184.14	
600	6.61	11.53	102.40	172.44	136.20	206.23	142.5
650	7.16	13.54	118.75	190.78	157.93	229.97	
700	7.71	15.70	136.20	210.39	181.14	255.34	136.0

Anti-Floatation Sizing

Project Name:	Fieldstone PS	Designed By	APG	Date:	12/20/2024
Project Location:	UCPW in Indian Trail	Checked By:	APG	Date:	12/20/2024
BGE Project #:	7734-16	Revised By:	0	LMK	

Wet Well Dimensions

Top of Wet Well Elev =	592.82
Finished Grade Elev =	591.82
Wet Well Sump Elev =	563.20
Wet Well Diameter =	10.00 ft.
Top Slab Thickness =	1.00 ft.
Wall Thickness =	0.67 ft.
Base Thickness =	1.00 ft.
Antifloatation Base Diameter =	14.00 ft.
Antifloatation Base Thickness =	2.00 ft.
Depth of Wet Well embedded into Antifloatation Base =	2.00 ft.
Volume of Top Slab =	101.00 cu. ft.
Volume of Wet Well =	2890.58 cu. ft.
Volume of Base =	101.00 cu. ft.
Vol. of Antifloatation Base =	105.88 cu. ft.
Total Vol. of Wet Well =	3198.46 cu. ft.
Buoyant Force of Wet Well =	**199,583.92 lbs.**

Unit Weights

Unit Weight of Concrete =	150 lbs./cu. ft.
Unit Weight of Saturated Soil =	105 lbs./cu. ft.
Unit Weight of Water =	62.4 lbs./cu. ft.

Wet Well Weights

Weight of Top Slab =	15,149.81 lbs.
Weight of Wet Well =	96,416.19 lbs.
Weight of Base =	15,149.81 lbs.
Weight. of Antifloatation Base =	15,881.79 lbs.
Total Weight of Wet Well =	142,597.61 lbs.

Soil Weight Above Antifloatation Base

Volume of Soil =	1462.18 cu. ft.
Weight of Soil =	153,529.24 lbs.
Anti-Buoyant Force of Wet Well =	**145,566.01 lbs.**
Factor of Safety =	**0.73**

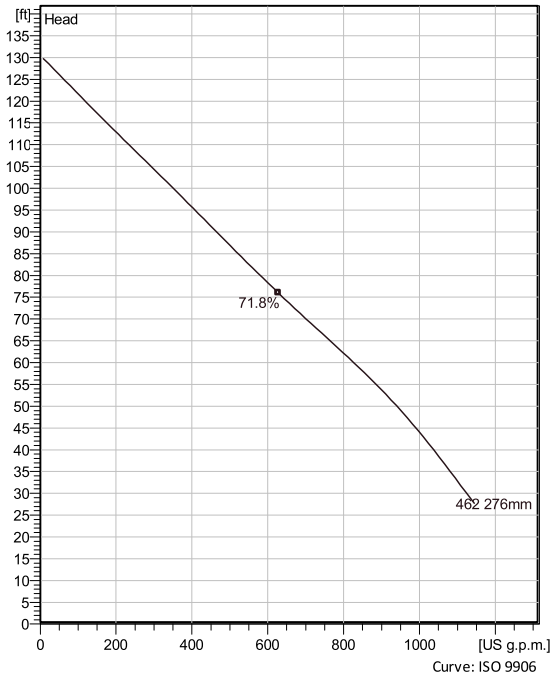
NP 3153 HT 3~ 462

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3153.185 21-18-4AA-W 20hp

Installation type
P - Semi permanent, Wet

Impeller diameter
276 mm

Discharge diameter
4 inch

Pump information

Impeller diameter
276 mm

Discharge diameter
4 inch

Inlet diameter
150 mm

Maximum operating speed
1755 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

Technical specification

Motor - General

Motor number N3153.185 21-18-4AA-W 20hp	**Phases** 3~	**Rated speed** 1755 rpm	**Rated power** 20 hp
ATEX approved No	**Number of poles** 4	**Rated current** 26 A	**Stator variant** 5
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.83	**Motor efficiency - 1/1 Load** 87.5 %	**Total moment of inertia** 2.38 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.77	**Motor efficiency - 3/4 Load** 89.0 %	**Starting current, direct starting** 148 A	
Power factor - 1/2 Load 0.66	**Motor efficiency - 1/2 Load** 89.0 %	**Starting current, star-delta** 49.3 A	

Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

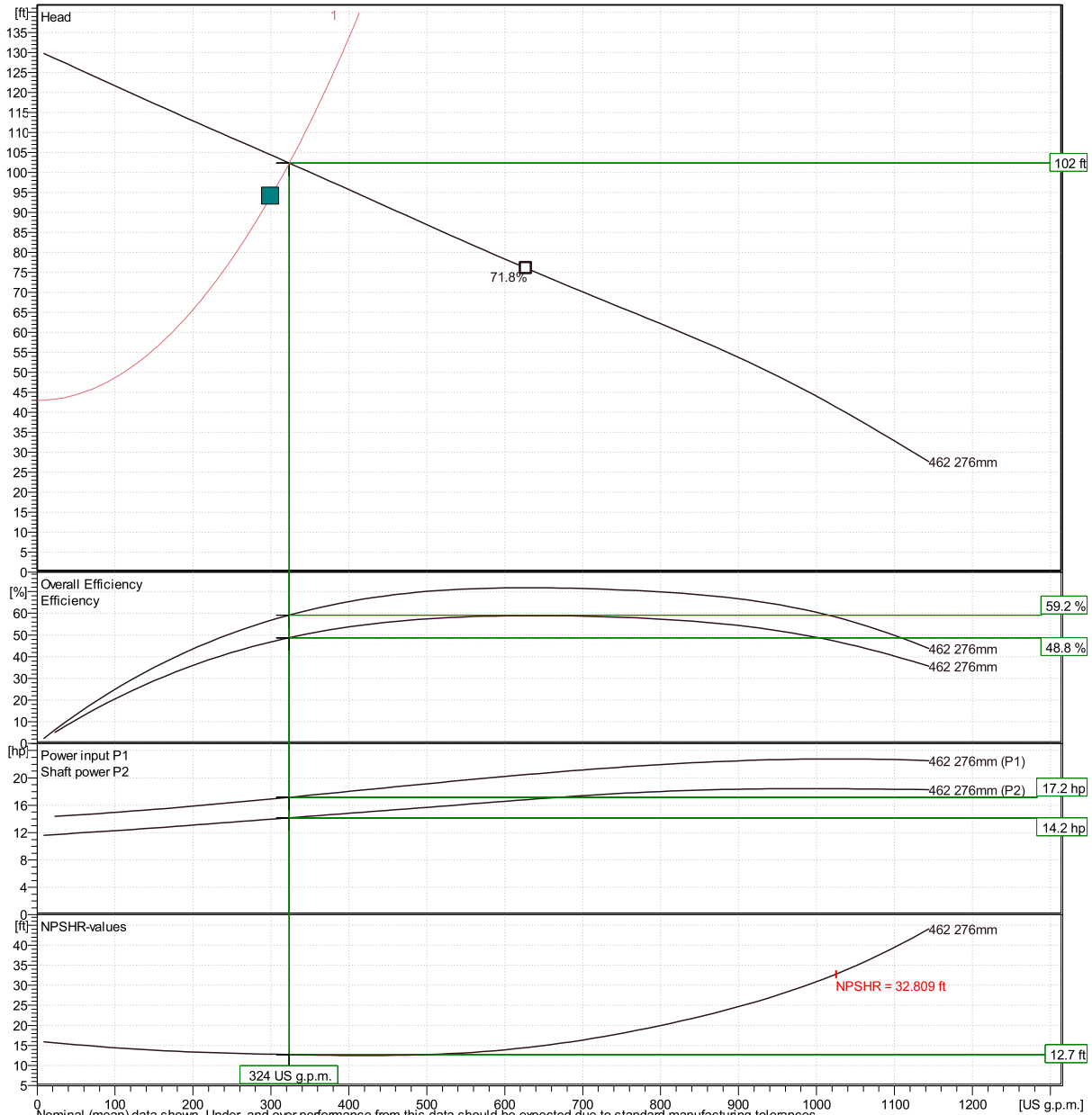
NP 3153 HT 3~ 462

Performance curve

Duty point

Flow	Head
324 US g.p.m.	102 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

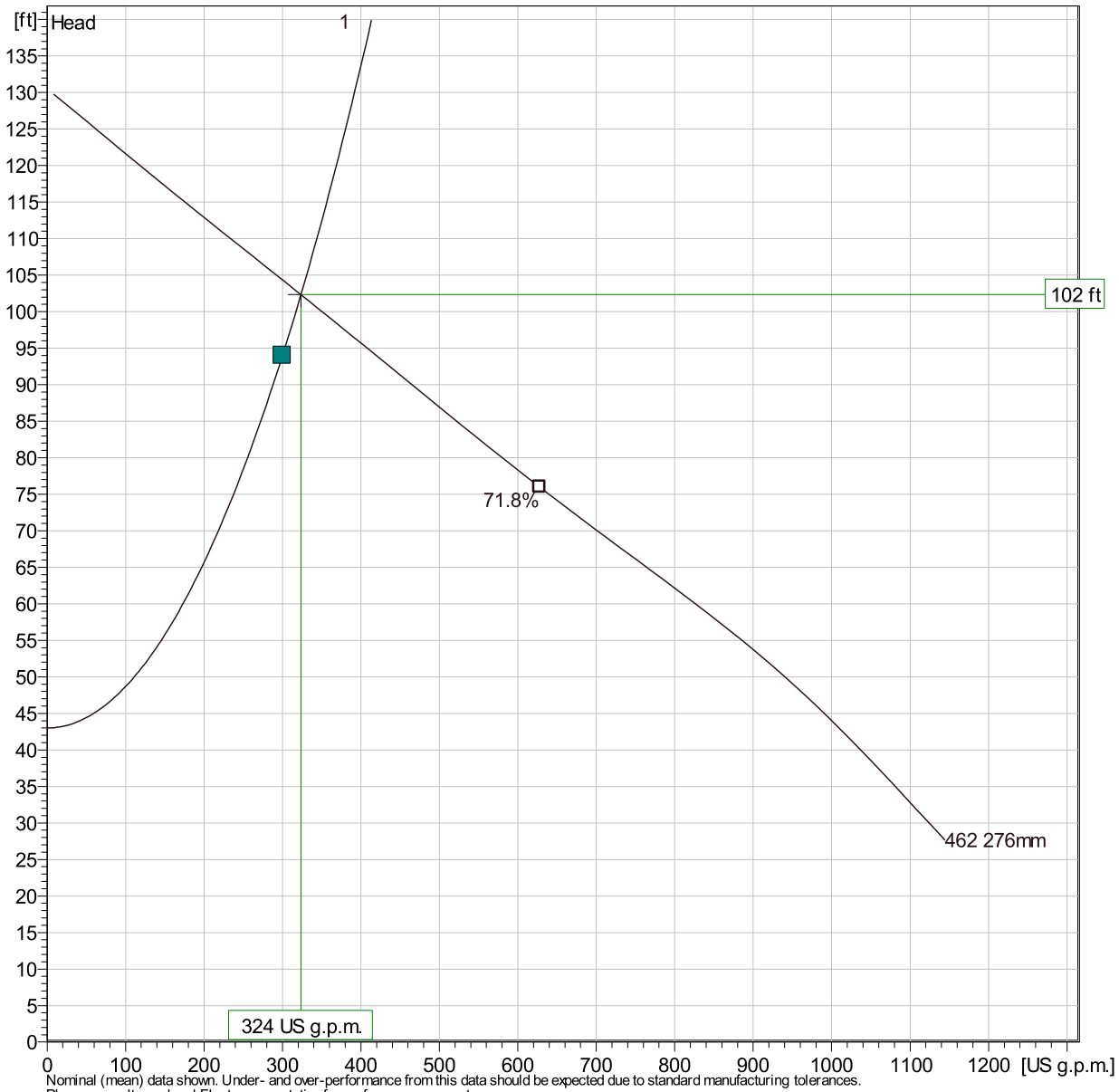
Curve: ISO 9906

Xylect-20620257	Dan Joyce		
Created on	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	324	102	14.2	324	102	14.2	59.2 %	660	12.7

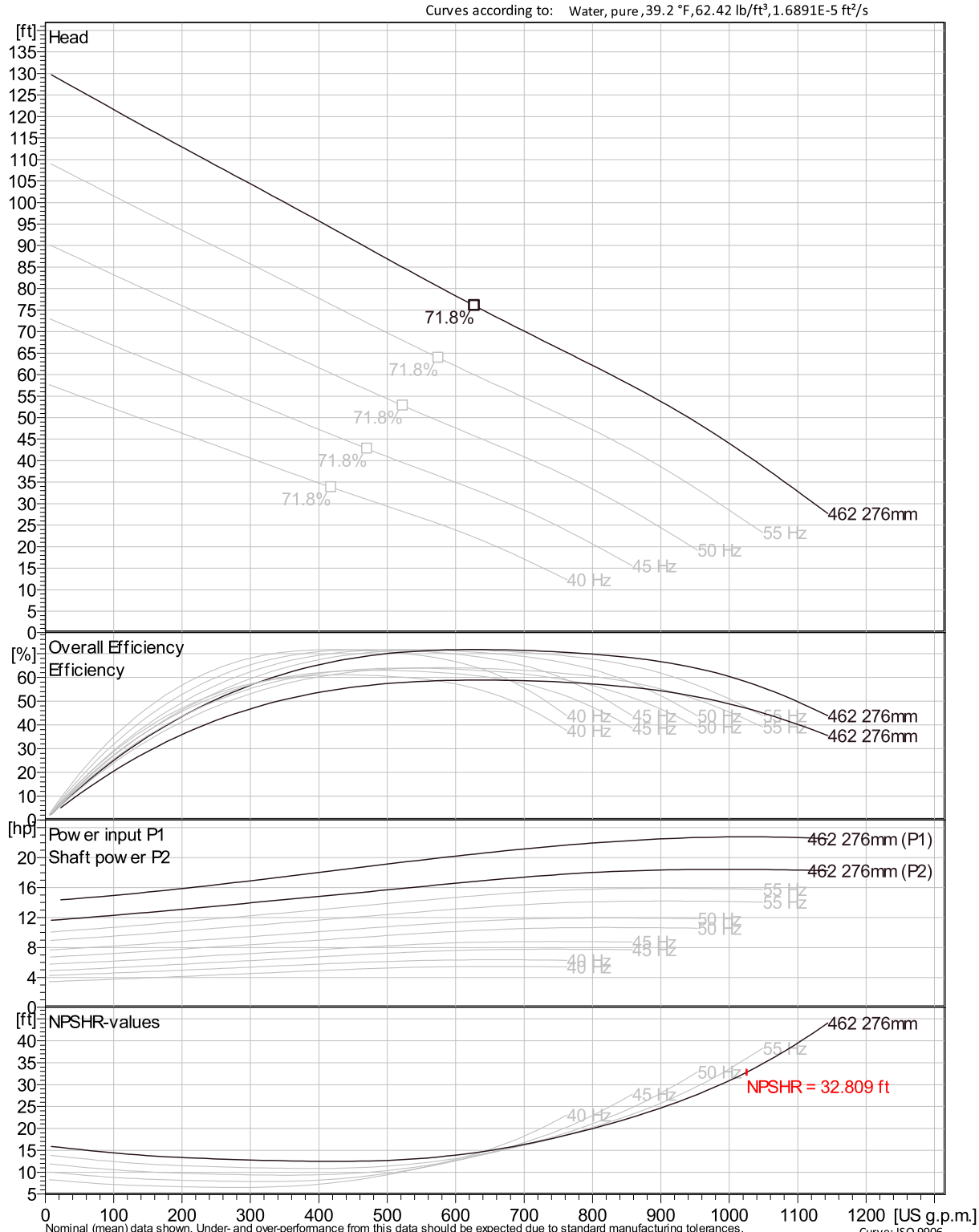
Project		**Created by**	Dan Joyce		
Block	Xylect-20620257	**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

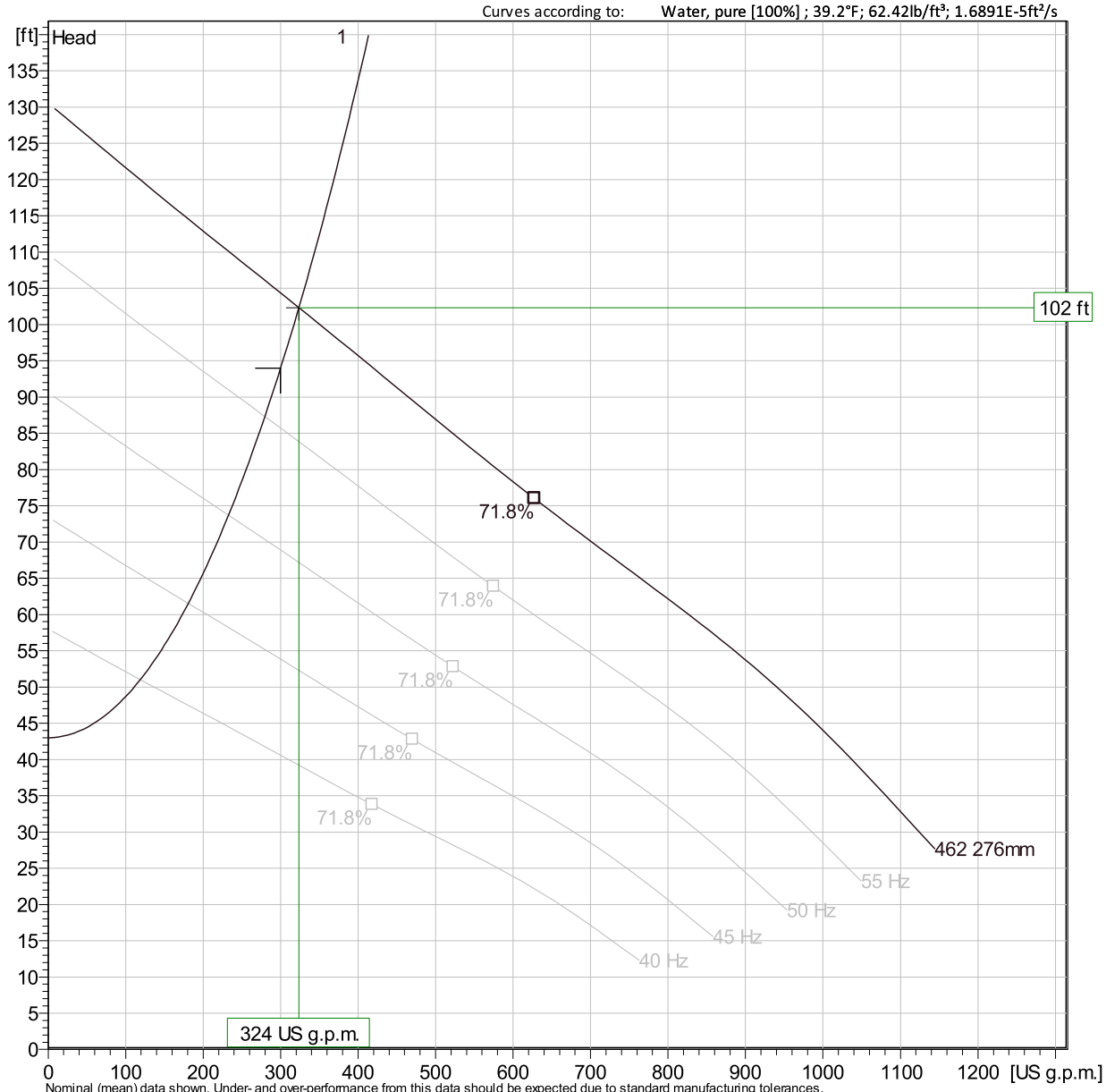
Curve: ISO 9906

Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating Characteristics

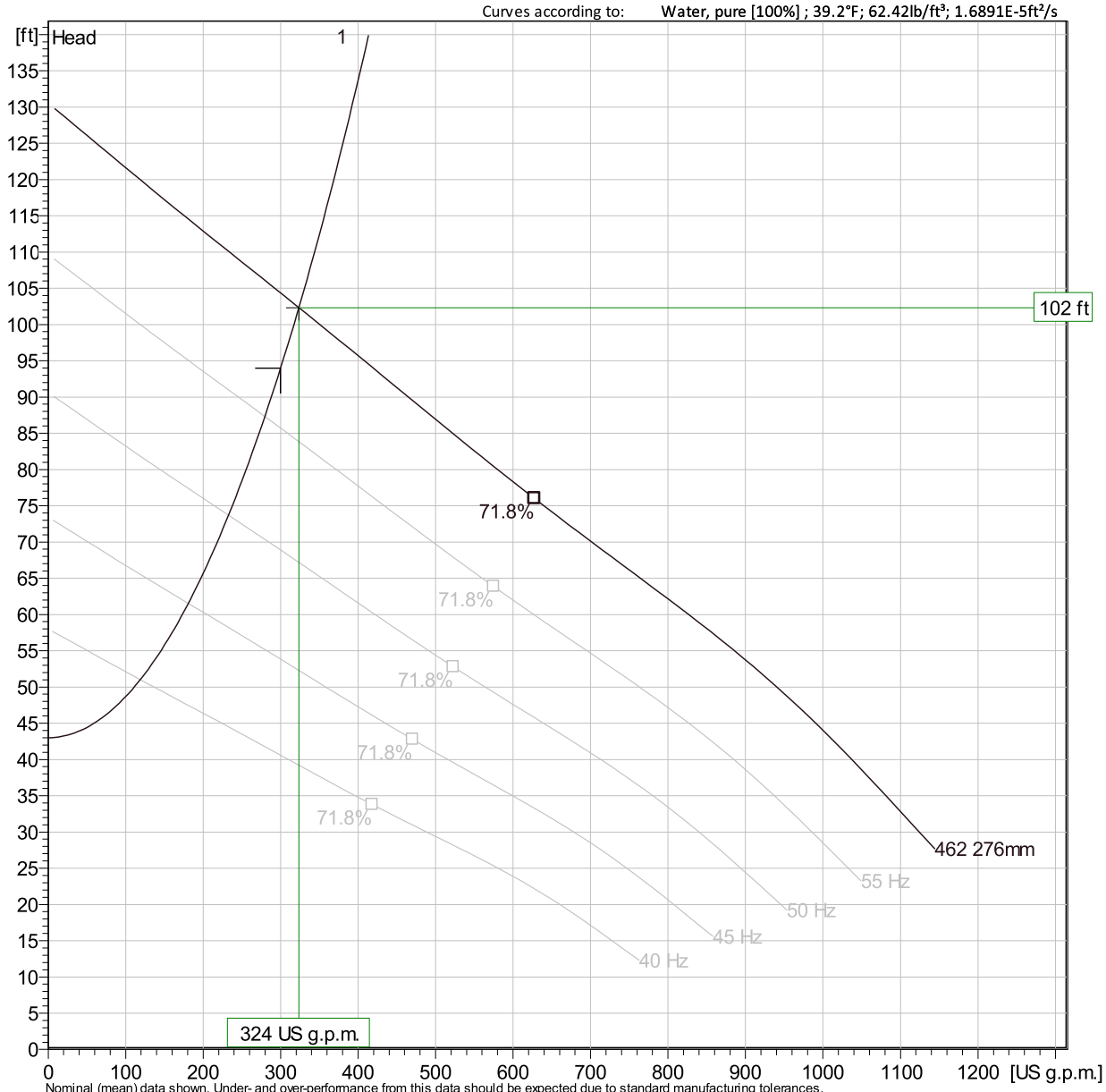
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	60 Hz	324	102	14.2	324	102	14.2	59.2 %	660	12.7
1	55 Hz	280	87.3	10.8	280	87.3	10.8	57.3 %	537	11.1
1	50 Hz	233	73.7	7.97	233	73.7	7.97	54.4 %	481	9.63
1	45 Hz	181	61.5	5.68	181	61.5	5.68	49.6 %	452	8.26

Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

VFD Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

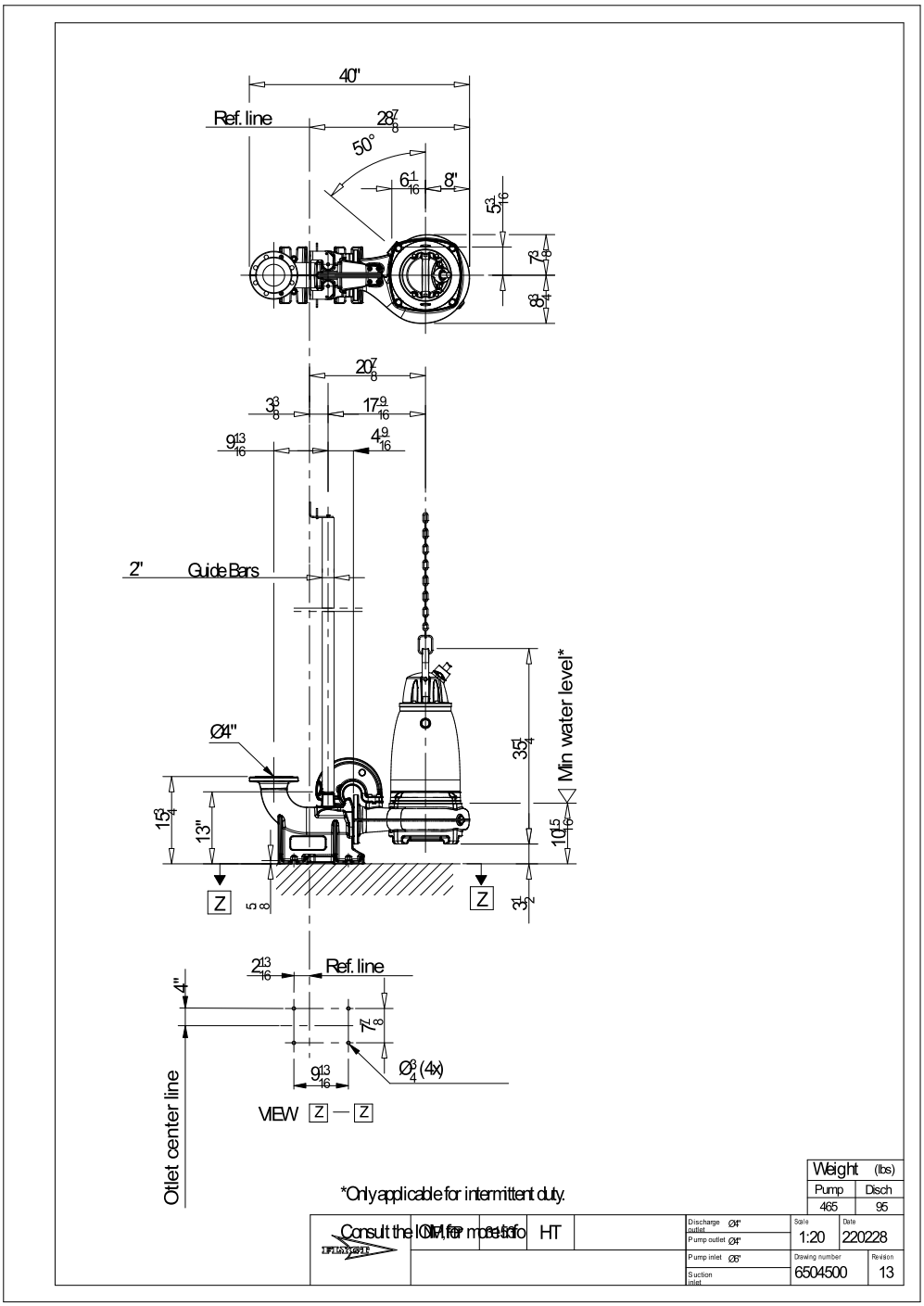
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	40 Hz	119	51	3.83	119	51	3.83	40.1 %	487	7.07

Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

NP 3153 HT 3~ 462

Dimensional drawing



Project	Xylect-20620257	**Created by**	Dan Joyce		
Block		**Created on**	9/16/2024	**Last update**	9/16/2024

PERFORMANCE CURVE

DATE	REPORT	ISSUE	PRODUCT
2024-09-16	Fieldstone PS	17	NP3202.185 HT

NUMBER OF BLADES	TOTAL MOMENT OF INERTIA	RATED SPEED
2	10 lbft2	1770 RPM

POLES	PHASES	FREQUENCY
4	3	60 Hz

VOLTAGE / COUPLING	RATED POWER
460 V / D	60.0 HP / 45.0 kW

RATED CURRENT	STARTING CURRENT
68 A	425 A

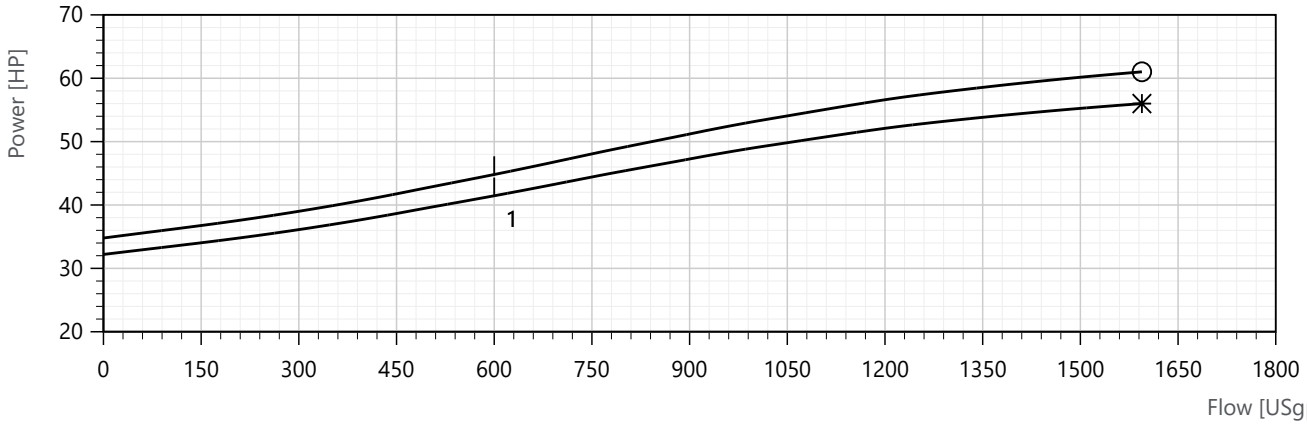
STARTING TORQUE	MAX TORQUE
320 Nm	650 Nm

IMPELLER DIAMETER
344 mm

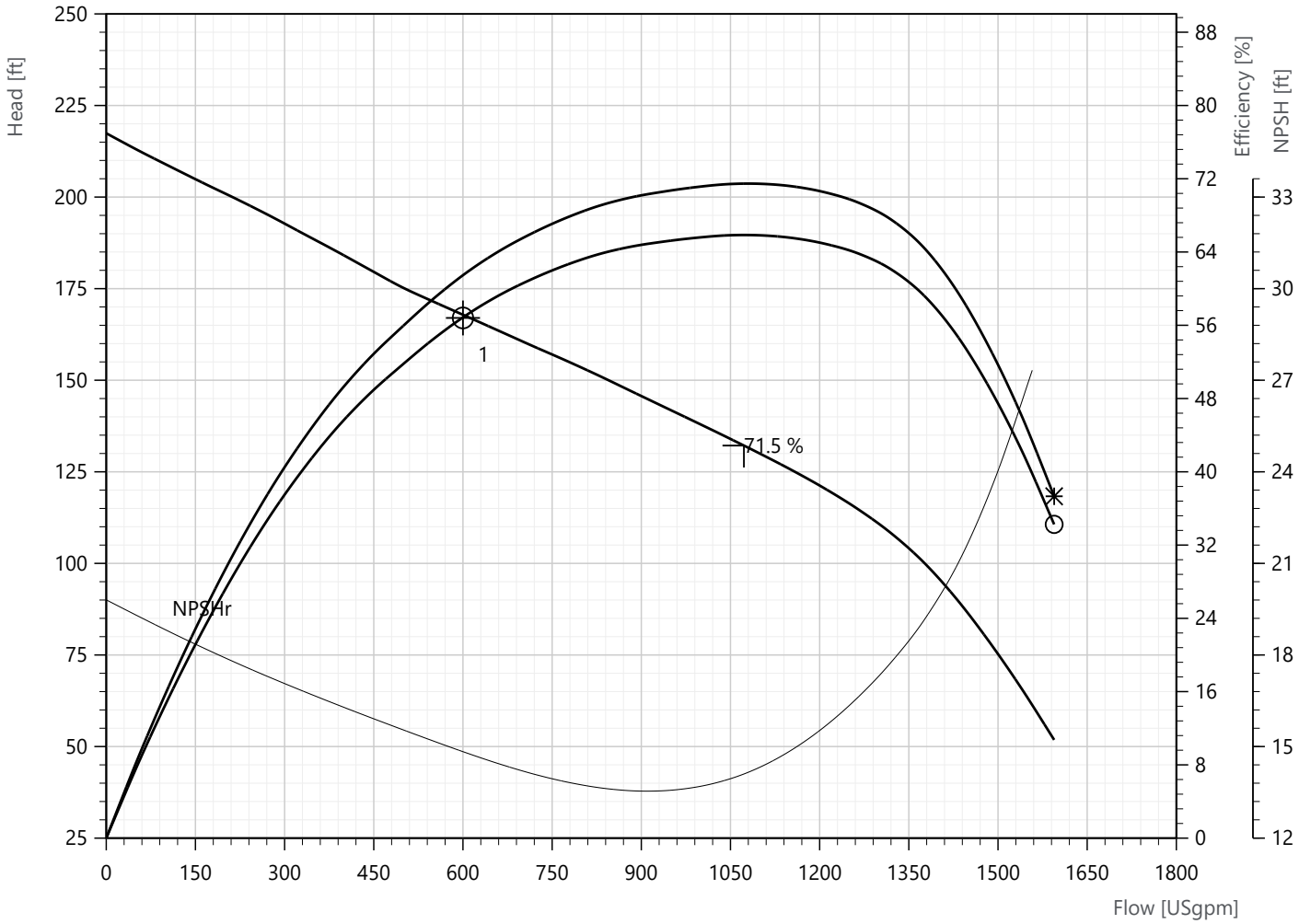
MOTOR TYPE / STATOR
30-24-4AA/01

MOTOR ISSUE	DUTY CLASS
11	S1

	1/1-RATED POWER	3/4-RATED POWER	1/2-RATED POWER
MOTOR COS PHI	0.91	0.88	0.82
MOTOR EFFICIENCY	91.5 %	92.4 %	92.5 %



Duty points	Flow [USgpm]	Head [ft]	Power [HP]	Efficiency [%]	NPSHr [ft]	Standard	Guarantee (-> no guarantee
1	600	167	(44.8) (41.5)	(56.9) (61.5)	(14.8)	HI 14.6-2022	2B QH Guarantee



NOTE:
CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER
* : PUMP EFFICIENCY / SHAFT POWER
O : OVERALL EFFICIENCY / INPUT POWER
NPSHR = NPSH3 + MARGIN
NO OPERATION ALONG DASHED CURVE.

AUTHOR:
DAN JOYCE

APPENDIX 16 - ALTERNATIVE 2 LIFE CYCLE COST ANALYSIS

Life Cycle Cost Analysis
Sanctuary at Southgate Phase II Development
Alternative 2 - Off-Site Gravity Sewer Connection to Porter Ridge Pump Station
New Gravity Sanitary Sewer Line

Inputs and Assumptions

Planning Period	20	Years
Discount Rate	1.55%	
Inflation Rate	3.20%	

O&M Costs (% of Capital for Gravity Systems)	1%
10-year Items (% of Total for Gravity Systems)	5%
20-year Items (% of Total for Gravity Systems)	0%
50-year Items (% of Total for Gravity Systems)	95%

Initial Capitol Investment

Item	Quantity	UOM	Cost Per Unit	Cost
8" PVC Gravity Sanitary Sewer Line	7100	LF	$80	$568,000
Manholes	23	EA	$5,000	$115,000
Clearing & Grubbing	10	AC	$7,500	$75,000
Temporary Construction Easement Acquisition	10	AC	$50,000	$500,000
Sanitary Sewer Easement Acquisition	5	AC	$100,000	$500,000
			Total	$1,758,000

Annual Costs

Yearly Cost of Gravity System O&M	$6,830
Total Annual Costs NPV	$157,450

Life-Cycle Replacement Costs

Cost of 10-Year Items at Year 0	$34,150
Cost of 10-Year Items at Year 10	$46,794
NPV of 10-Year Items at Year 10	$40,123
Cost of 10-Year Items at Year 20	$64,119
NPV of 10-Year Items at Year 20	$47,140
Cost 20-Year Items at Year 0	$0
Cost of 20-Year Items at Year 20	$0
NPV of 20-Year Items at Year 20	$0
Total Life-Cycle Replacement Costs NPV	$87,262

Residual Values

Cost of 10-Year Items at Year 20	$64,119
Cost of 20-Year Items at Year 20	$0
Residual Value of 50-Year Items at Year 20	$389,310
Total Life-Cycle Replacement Residual Value at Year 20	$453,429
Total Residual Value NPV	$333,358

Total Net Present Value **$1,669,354.47**

Life Cycle Cost Analysis
Sanctuary at Southgate Phase II Development
Alternative 2 - Off-Site Gravity Sewer Connection to Porter Ridge Pump Station
Porter Ridge Pump Station Upgrades

Inputs and Assumptions

Planning Period	20	Years
Discount Rate	1.55%	
Inflation	3.20%	

O&M Costs (% of Capital for Pump Stations)	3%
10-year Items (% of Total for Pump Stations)	5%
20-year Items (% of Total for Pump Stations)	60%
50-year Items (% of Total for Pump Stations)	35%

Initial Capitol Investment

Item	Quantity	UOM	Cost Per Unit	Cost
Porter Ridge PS Upgrades	1	LS	$430,000	$430,000
			Total	$430,000

Annual Costs

Electrical Cost	$0.08	kWH
Porter Ridge PS - Flygt NP 3153 HT 3~ 462		
Pump On Time Per Cycle (min)	9.29	
Pump Cycles Per Hour	6.46	
Ave Daily Flow Rate (GPM)	105.26	
US MG / Year	55.34	
Pump Spec Energy (kWh/US MG)	660	
Yearly Cost of Electricity	$2,921.79	
Yearly Cost of Pump Station O&M	$12,900.00	
Total Yearly Costs at Year 0	$15,821.79	
Total Annual Costs NPV	$364,735.14	

Life-Cycle Capital Replacement Costs

Cost 10-Year Items at Year 0	$21,500.00
Cost 10-Year Items at Year 10	$29,460
NPV of 10-Year Items at Year 10	$25,260.16
Cost 10-Year Items at Year 20	$40,367.55
NPV of 10-Year Items at Year 20	$29,677.95
Cost 20-Year Items at Year 0	$258,000.00
Cost 20-Year Items at Year 20	$484,410.62
NPV of 20-Year Items at Year 20	$356,135.36
Total Replacement Costs NPV	$411,073.47

Residual Values

Cost 10-Year Items at Year 20	$40,368
Cost 20-Year Items at Year 20	$484,411
Residual Value of 50-Year Items at Year 20	$90,300
Total Life-Cycle Replacement Residual Value at Year 20	$615,078
Total Residual Value NPV	$452,201

Total Net Present Value	**$753,607.36**

Life Cycle Cost Analysis
Sanctuary at Southgate Phase II Development
Alternative 2 - Off-Site Gravity Sewer Connection to Porter Ridge Pump Station
Fieldstone Pump Station Upgrades

Inputs and Assumptions

Planning Period	20	Years
Discount Rate	1.55%	
Inflation	3.20%	

O&M Costs (% of Capital for Pump Stations)	3%
10-year Items (% of Total for Pump Stations)	5%
20-year Items (% of Total for Pump Stations)	60%
50-year Items (% of Total for Pump Stations)	35%

Initial Capitol Investment

Item	Quantity	UOM	Cost Per Unit	Cost
Fieldstone PS Upgrades	1	LS	$642,000	$642,000
			Total	$642,000

Annual Costs

Electrical Cost	$0.08	kWH
Fieldstone PS - Flygt NP 3202.185 HT		
Pump On Time Per Cycle (min)	10.64	
Pump Cycles Per Hour	5.64	
Ave Daily Flow Rate (GPM)	215.31	
US MG / Year	113.19	
Pump Spec Energy (kWh/US MG)	660	
Yearly Cost of Electricity	$5,976.17	
Yearly Cost of Pump Station O&M	$19,260.00	
Total Yearly Costs at Year 0	$25,236.17	
Total Annual Costs NPV	$581,761.96	

Life-Cycle Capital Replacement Costs

Cost 10-Year Items at Year 0	$32,100.00
Cost 10-Year Items at Year 10	$43,985
NPV of 10-Year Items at Year 10	$37,714.01
Cost 10-Year Items at Year 20	$60,269.69
NPV of 10-Year Items at Year 20	$44,309.86
Cost 20-Year Items at Year 0	$385,200.00
Cost 20-Year Items at Year 20	$723,236.31
NPV of 20-Year Items at Year 20	$531,718.38
Total Replacement Costs NPV	$613,742.25

Residual Values

Cost 10-Year Items at Year 20	$60,270
Cost 20-Year Items at Year 20	$723,236
Residual Value of 50-Year Items at Year 20	$134,820
Total Life-Cycle Replacement Residual Value at Year 20	$918,326
Total Residual Value NPV	$675,147

Total Net Present Value	**$1,162,357.23**