

SANITARY SEWER PUMP STATION DESIGN CALCULATIONS

Proposed Step by Step Onsite Sewer Force Main
3303 E 8th Ave SE
Puyallup, Pierce County, Washington

Prepared for:
Step by Step
PO Box 488
Milton, WA 98354



01/10/2022

January 7th, 2022
Our Job No. 17376

Estimated Head Calculations:

a) Head Losses In Wetwell/Discharge Vault in Equivalent Feet of Pipe:

3" 90° Bend = 7.7 ft

3" Discharge Pipe Length = 6 ft

Equivalent Length of 3" Pipe = 13.7 ft

b) Head Losses In 3" FM:

3" 90° Bend = 7.7 ft

3" 11.25° Bend = 1.1 ft

3" 45° Bend = 4.1 ft

3" Forcemain Length = 490 ft

Equivalent Length of 3" Pipe = 502.9 ft

3-in FM[Pump Calcs]

Summary of 3" Force Main:

Effective Length of 3" FM = 502.9 + 13.7 = **516.6 ft**

I.D. of 3" FM Pipe = 2.826 in

C = 140

3" FM Velocity = 4.128 fps

Provide reference for friction loss equation [Pump Calcs]

Total Dynamic Head Calculation:

Hazen-Williams equation:

$$h_{100ft} = 0.2083(100/c)^{1.852} q^{1.852} / d_h^{4.8655}$$

Where

c = Hazen-Williams roughness constant

q = volumetric flow (gal/min)

d_h = inside hydraulic diameter (in)

$$h_{100ft} = 0.2083 \left(\frac{100}{140} \right)^{1.852} (82.6 \text{ gpm}^{1.852}) / (2.826 \text{ in}^{4.8655})$$

$$h_{100ft} = 2.53 \text{ ft} / 100ft$$

Static Head = 6.5 ft

Total Dynamic head (Q=82.6gpm, V=4.128 fps) = 6.5 + (516.6/100) * (2.53) = 19.57 ft

Provide reference (exhibit, appendix, etc) for existing pump system [Pump Calcs]

Force Main Sizing Calculations:

In accordance with criteria for sewage works design section C2-3.2, a minimum self-scouring velocity of 2 fps should be maintained. Velocity should not exceed 8 fps.

3" Force Main:

I.D. = 2.826 in

A = 0.0436 SF

Q = VA

Q = 82.6 GPM = 0.18 CFS

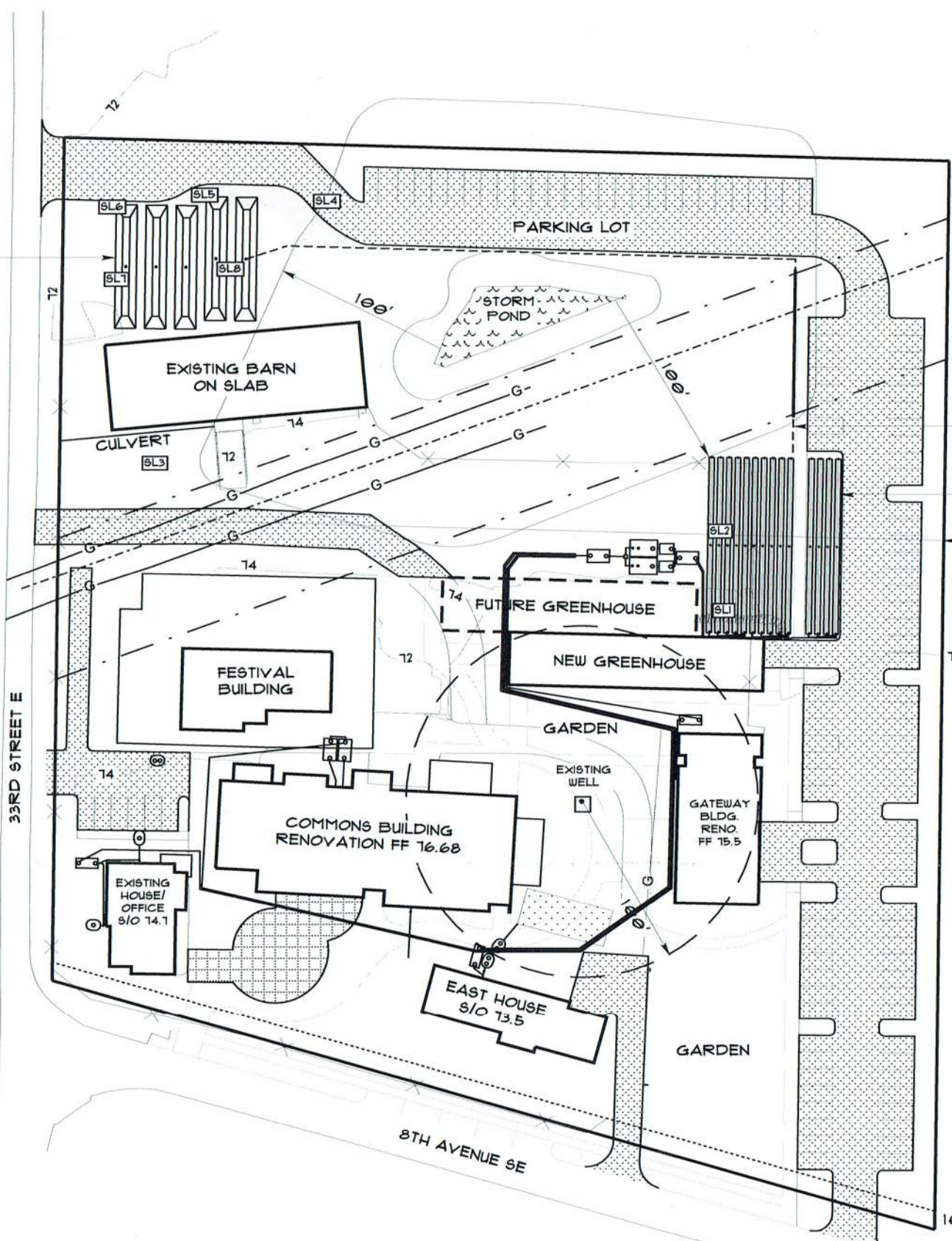
Velocity = 4.128 ft./sec.

Conclusion:

The existing 3,000 gallon septic pump tank was designed with a duplex pump system, each pump having a capacity of 82.6 gpm @ 18' of total dynamic head (see Appendix A for calculations). Based on the calculations above, the proposed force main has a total dynamic head of 19.57'. Therefore, the impact to the performance of the existing pump system is negligible.

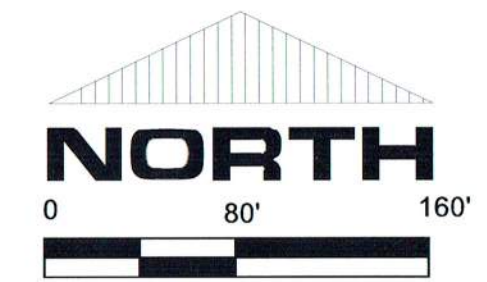
The existing 1,500 gallon settling tank, 3,000 gallon treatment tank, and two 3,000 gallon pump tanks provide ample emergency storage. The Step-by-Step facility has multiple portable generators that will be used to provide emergency power in the event of a power failure.

APPENDIX A



SOIL LOG
 TAKEN 10/24/2017 BY RIC WILKERSON
 WATER RECORDED 12/01/2017

- SL #1
 00-10" ROOTED SANDY LOAM
 10-16" ROOTED LOAMY FINE SAND
 16-46" FINE SAND
 46-51" MOTTLED VERY FINE SAND
 WATER AT 27"
- SL #2
 00-17" ROOTED SANDY LOAM
 17-32" ROOTED LOAMY FINE SAND
 32-52" FINE TO MEDIUM SANDS
 WATER AT 24"
- SL #3
 00-14" ROOTED SANDY LOAM
 14-36" ROOTED LOAMY FINE SAND WITH LIGHT MOTTLES
 36-48" FINE SAND WITH LIGHT MOTTLES
 48-59" MOTTLED VERY FINE SAND WITH LIGHT MOTTLES
 WATER AT SURFACE
- SL #4
 00-15" ROOTED SANDY LOAM
 15-28" ROOTED LOAMY FINE SAND
 28-48" FINE SAND
 48-58" MOTTLED VERY FINE SAND
 WATER AT 9"
- SL #5
 00-19" ROOTED SANDY LOAM
 19-34" ROOTED LOAMY FINE SAND
 34-46" FINE SAND
 46-55" MOTTLED VERY FINE SAND
 WATER AT 13"
- SL #6
 00-13" ROOTED SANDY LOAM
 13-31" ROOTED LOAMY FINE SAND WITH SILTY LENSES
 31-36" FINE SAND WITH SILTY LENSES
 36-48" MOTTLED VERY FINE SAND WITH SILTY LENSES
 WATER AT 12"
- SL #7
 00-13" ROOTED SANDY LOAM
 13-24" ROOTED LOAMY FINE SAND WITH SILTY LENSES
 24-38" FINE SAND WITH SILTY LENSES
 38-45" MOTTLED VERY FINE SAND WITH SILTY LENSES
 WATER AT 12"
- SL #8
 00-17" ROOTED SANDY LOAM
 17-45" ROOTED LOAMY FINE SAND
 WATER AT 18"



RESERVE DRAINFIELD
 (5) 12' X 10' BIOFILTER BASINS
 2500 GPD

75' GAS PIPELINE EASEMENT

FUTURE RESERVE DRAINFIELD TIGHTLINE
 SLEEVED THROUGH GAS PIPELINE EASEMENT

PRIMARY DRAINFIELD
 (14) 100 LF LATERALS, 1440 LF

SEGREGATION LINE FOR TAX PURPOSES ONLY

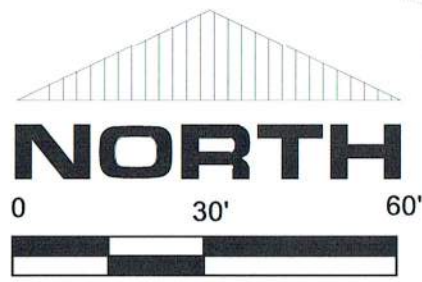
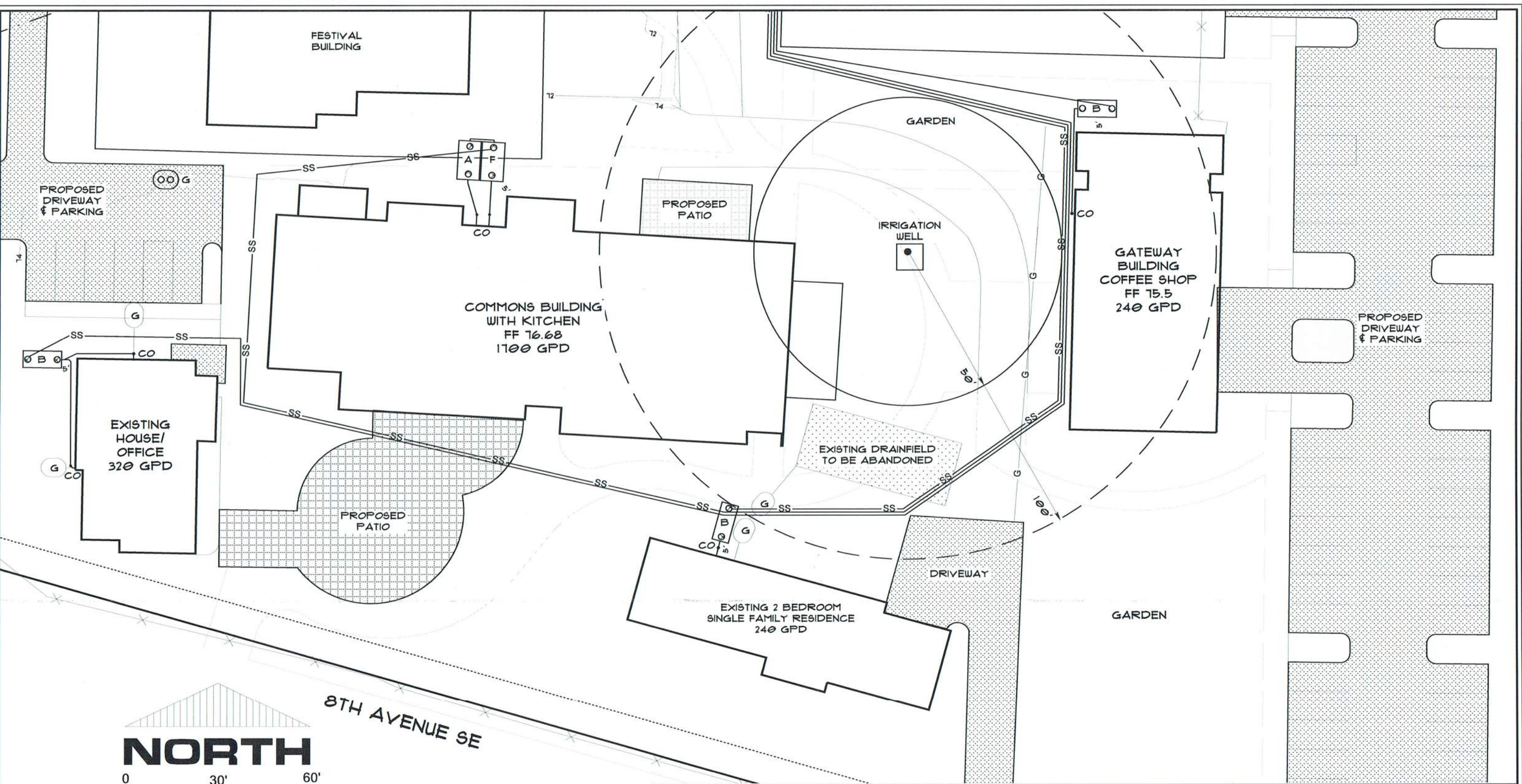
10' POWER EASEMENT



THIS IS NOT A SURVEY. SITE FEATURES, TOPOGRAPHY, ELEVATIONS & BENCHMARKS ARE BASED ON ASSUMED DATUM PROVIDED BY THE OWNER & PIERCE COUNTY PLANNING RECORDS & ARE INTENDED ONLY FOR THE APPROVAL & CONSTRUCTION OF THE SEPTIC SYSTEM DESIGN. WILKERSON INC. RECOMMENDS THAT A LICENSED SURVEYOR, (PLS) ALWAYS BE USED TO SET CORNERS, ESTABLISH LOT LINES & DETERMINE ELEVATIONS.

| | | |
|---|--|--|
| SEPTIC SYSTEM DESIGN | | SITE ADDRESS: 611 & 103 33RD STREET SE PARCEL NUMBER: 04-20-25-3-010 & -011 LOT NUMBER: 2 OF BLR 2015-12-24-5001 |
| WILKERSON & ASSOCIATES, INC. SITE EVALUATIONS SOILS ANALYSIS SEPTIC DESIGNS RICHARD L. WILKERSON RICWILKERSON@COMCAST.NET | | CLIENT: STEP BY STEP FSC PO BOX 488 MILTON, WA 98354 C/O JEFF BROWN 253.606.8324 |
| 6712 GLEN ECHO LANE S.W. LAKEWOOD, WA 98499 PHONE: 253.584.2404 CELL: 253.380.9109 | | DATE: 01/05/2018 PAGE 1 OF 4 PAGES |

EXPIRES 11/20/18
 01/05/2018



- KEY**
- A GREASE INTERCEPTOR (TO BE DESIGNED BY OTHERS)
 - B 1500 GALLON PUMP TANK
 - C 3000 GALLON SETTLING TANK
 - D 4500 GALLON MICROFAST 1.5 ATU TANK
 - E 1200 GALLON TANK
 - F 3000 GALLON PUMP TANK
 - G EXISTING SEPTIC TANK TO BE DECOMMISSIONED

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SEPTIC SYSTEM DESIGN

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SITE EVALUATIONS SOILS ANALYSIS SEPTIC DESIGNS

RICHARD L. WILKERSON
 RICWILKERSON@COMCAST.NET

6712 GLEN ECHO LANE S.W. PHONE: 253.584.2404
 LAKEWOOD, WA 98499 CELL: 253.380.9109

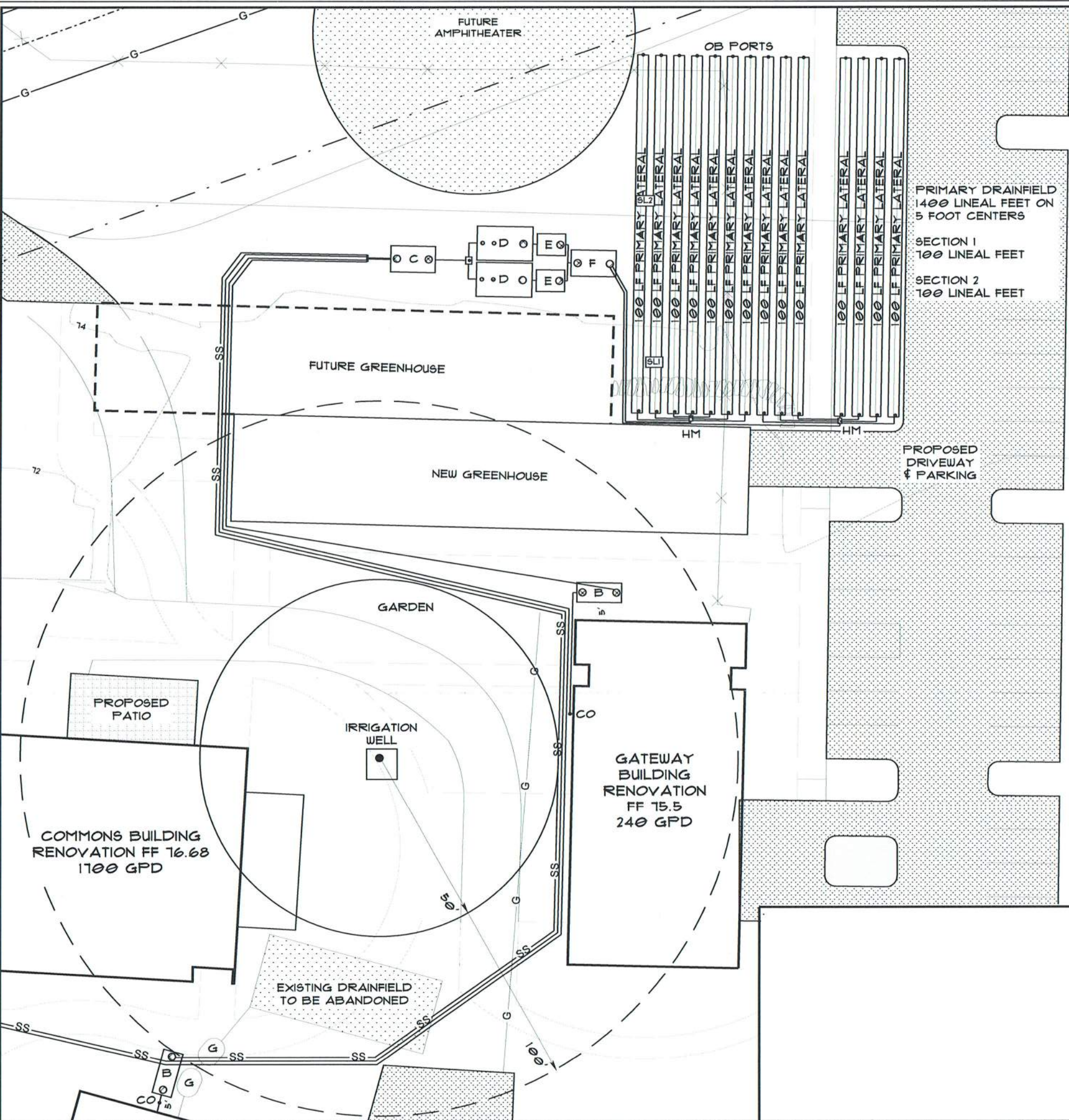
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EXPIRES 11/20/18
03/13/2018



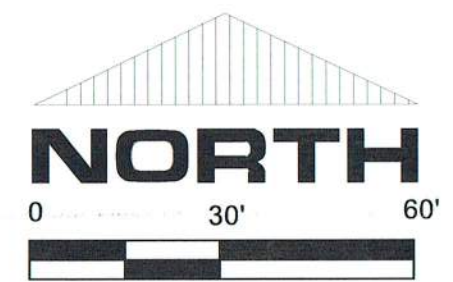
SEGREGATION LINE FOR TAX PURPOSES ONLY

PRIMARY DRAINFIELD
1400 LINEAL FEET ON
5 FOOT CENTERS
SECTION 1
100 LINEAL FEET
SECTION 2
100 LINEAL FEET

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WATER RECORDED 12/01/2017

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32-52" FINE TO MEDIUM SANDS
WATER AT 24"



- KEY
- A GREASE INTERCEPTOR (TO BE DESIGNED BY OTHERS)
 - B 1500 GALLON PUMP TANK
 - C 3000 GALLON SETTLING TANK
 - D 4500 GALLON MBR 1.5 TANK
 - E 1200 GALLON TANK
 - F 3000 GALLON PUMP TANK
 - G EXISTING SEPTIC TANK TO BE DECOMMISSIONED

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DATE: 03/13/2018 PAGE 3 OF 5 PAGES

ELEVATIONS

BENCHMARK ELEVATION

WEST HOUSE

PLUMBING STUBOUT 14.70
PUMP TANK INLET 14.00

PUMP ELEVATION 10.00

COMMON BUILDING

PLUMBING STUBOUT 13.70

GREASE INTERCEPTOR INLET 13.00

GREASE INTERCEPTOR OUTLET 12.70

PUMP TANK INLET 12.40

PUMP ELEVATION 68.40

EAST HOUSE

PLUMBING STUBOUT 13.50

PUMP TANK INLET 13.00

PUMP ELEVATION 69.00

GATEWAY BUILDING

PLUMBING STUBOUT 12.50

PUMP TANK INLET 12.00

PUMP ELEVATION 68.00

BIOBARRIER MBR

SETTLING TANK INLET 12.50

SETTLING TANK OUTLET 12.20

MBR TANK INLETS 11.90

MBR TANK OUTLETS 11.60

SETTLING TANK INLETS 11.30

SETTLING TANK OUTLETS 11.00

PUMP TANK INLET 10.70

PUMP ELEVATION 66.70

DRAINFIELD

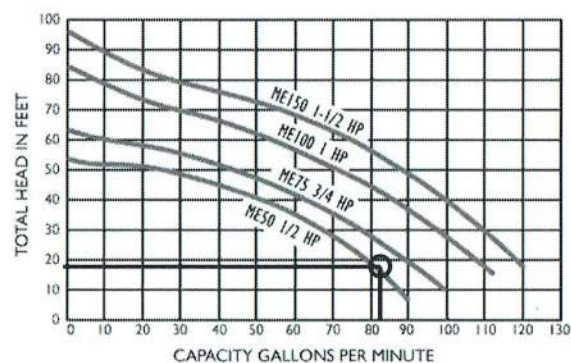
HEADER MANIFOLD 13.50

DRAINFIELD INVERT (HI) 13.33

SEPTIC SYSTEM SPECIFICATIONS & DESIGN NOTES

- CONSTRUCTION AND MATERIALS SHALL CONFORM TO THE LATEST REGULATIONS, GUIDELINES AND POLICIES OF THE TACOMA-PIERCE COUNTY HEALTH DEPARTMENT AND WSDOH. THIS SYSTEM REQUIRES PERIODIC MAINTENANCE AND AN OPERATIONS AND MAINTENANCE AGREEMENT WITH THE TPCHD. THE APPROVAL OF THE DESIGN AND INSTALLATION DOES NOT INSURE CONTINUOUS TROUBLE-FREE SERVICE.
- THIS IS NOT A SURVEY. PROPERTY LINES, CORNERS, TOPOGRAPHY, ELEVATIONS, AND BENCHMARK ARE BASED ON ASSUMED DATUM AND ARE SOLELY INTENDED FOR USE BY THE SEPTIC SYSTEM DESIGNER, TPCHD AND INSTALLER. THIS PLAN IS FULLY COPYRIGHTED.
- NO EXCAVATION OR ALTERATION AFFECTING THE DRAINFIELD SITE IS PERMITTED. ENCROACHMENTS INTO THE DRAINFIELD AREA MAY RENDER THE SITE UNUSABLE. RE-DESIGNS AND/OR ECONOMIC LOSSES DUE TO DAMAGE SHALL BE AT THE OWNERS EXPENSE.
- ALL WATER LINES MUST BE 18 INCHES ABOVE CROSSED SEWER LINES AND SLEEVED IF WITHIN 10 FEET OF ANY SEPTIC SYSTEM COMPONENT. THERE ARE NO EXCEPTIONS TO THIS REQUIREMENT.
- INSTALLER TO DIVERT ALL STORM DRAINAGE FLOW AWAY FROM SEPTIC SYSTEM COMPONENTS.
- THIS SYSTEM IS NOT DESIGNED FOR THE USE OF A GARBAGE DISPOSAL. THE USE OF SUCH A DEVICE WILL CAUSE SEPTIC SYSTEM FAILURE FOR WHICH THE OWNER ACCEPTS RESPONSIBILITY.
- NO CHANGES OR ALTERATIONS ARE TO BE MADE TO THIS PLAN WITHOUT THE EXPRESS PERMISSION OF THE DESIGNER. THE INSTALLER SHALL NOTIFY THE DESIGNER IN THE EVENT OF DISCOVERY OF POOR SOIL, HIGH WATER TABLE, OR DISCREPANCIES FROM THE ORIGINAL PLAN. WORK PERFORMED UNDER ALTERED SITE CONDITIONS IS AT THE INSTALLERS RISK AND THE DESIGNER SHALL BE HELD HARMLESS.
- INSTALLER SHALL POST PERMITS IN A CONSPICUOUS LOCATION DURING CONSTRUCTION. MISSING PERMITS WILL BE THE RESPONSIBILITY OF THE INSTALLER AND A FEE WILL BE CHARGED TO THE INSTALLER TO REPRODUCE MISSING PERMITS.
- INSTALLER SHALL NOTIFY THE DESIGNER IMMEDIATELY FOLLOWING INSTALLATION FOR FINAL INSPECTION. INSTALLER IS RESPONSIBLE FOR PRESSURE TESTING AND PROVIDING COMPLETED BACKFILL FORM TO DESIGNER. ADDITIONAL INSPECTIONS DUE TO IMPROPER INSTALLATION WILL BE CHARGED TO THE INSTALLER. ALL CHARGES MUST BE PAID PRIOR TO REQUESTING ADDITIONAL INSPECTION.
- THIS SYSTEM IS DESIGNED FOR THE STEP BY STEP FAMILY SUPPORT CENTER. PLEASE SEE ATTACHED SHEET FOR FLOW BREAKDOWN. SYSTEM WILL REQUIRE A GREASE TRAP, TO BE DESIGNED BY OTHERS. MAXIMUM DAILY WASTE WATER FLOW SHALL NOT EXCEED 2500 GPD WITH A MAXIMUM WASTE STRENGTH OF 200 MG/L BOD5; 100 MG/L TSS; & 15MG/L FOG. EXCEEDING THE MAXIMUM LEVELS WILL CAUSE SEPTIC SYSTEM FAILURE FOR WHICH THE OWNER IS RESPONSIBLE.
- THE CALCULATED SOIL LOAD RATE IS 0.6 GALLONS PER SQUARE FOOT PER DAY, WITH A REQUIRED DRAINFIELD ABSORPTION AREA OF 4200 SQUARE FEET, 1400 LINEAL FEET.
- INSTALL (3) STATE CERTIFIED WATERPROOF, NORTHWEST CASCADE BZP 1500 GALLON SINGLE COMPARTMENT CONCRETE TANKS. INSTALL 24 INCH RISERS WITH COMPATIBLE, WATERPROOF SCREWDOWN LIDS OVER MANHOLES TO FINAL GRADE. INSTALL 4 INCH PVC CLEANOUTS WITH THREADED CAPS BETWEEN STUBOUTS AND TANKS.
- INSTALL A STATE CERTIFIED WATERPROOF, EVERGREEN PRECAST EP 3000 GALLON PUMP CHAMBER WITH 24 INCH WATERPROOF RISERS AND SCREWDOWN LIDS OVER MANHOLE TO FINAL GRADE.
- INSTALL (4) LIBERTY PRG101 (115 V, 1 HP) GRINDER PUMPS OR EQUIVALENT. DYNAMIC HEAD IS SHOWN ON PUMP CURVE. REQUIRED PUMP CAPACITY IS 29 GPM.
- INSTALL (4) SJE RHOMBUS IFS CONTROL PANELS (IFS11W114H8AC) WITH TIMER, COUNTER AND ELAPSED TIME METER. INSTALLER SHALL SET WEST HOUSE TIMER TO DOSE (12) 26 GALLON CYCLES PER DAY, COMMON BUILDING TIMER TO DOSE (12) 141 GALLON CYCLES PER DAY, EAST HOUSE TIMER TO DOSE (12) 20 GALLON CYCLES PER DAY, AND GATEWAY BUILDING TIMER TO DOSE (12) 20 GALLON CYCLES PER DAY. INSTALLER TO VERIFY SETTINGS BY PERFORMING DRAWDOWN AND RUN TIME TESTS. TEST RESULTS SHALL BE PROVIDED TO THE DESIGNER. ALL CONTROLS SHALL USE SWITCHES, FLOATS, TIMER, CYCLE COUNTER AND ELAPSED TIME METER COMPATIBLE WITH THE PUMPS AND ALARMS. SET HIGH WATER ALARMS AS SHOWN ON PUMP TANK DETAILS.
- TRANSPORT LINES TO BIOBARRIER TANKS ARE APPROXIMATELY 2049 FEET OF 2 INCH SCHEDULE 40 PVC PIPE. INSTALL BACKFLOW VALVES ON TRANSPORT LINES INSIDE PUMP TANKS.
- INSTALL A STATE CERTIFIED WATERPROOF, EVERGREEN PRECAST EP 3000 GALLON SETTLING TANK WITH 24 INCH WATERPROOF RISERS AND SCREWDOWN LIDS OVER MANHOLE TO FINAL GRADE. INSTALL BIOMICROBICS SANTEE FILTER WITH TEE HANDLE TO WITHIN 6 INCHES OF TANK LID.
- INSTALL (2) STATE-CERTIFIED WATERPROOF, 4500 GALLON TANKS WITH 24 INCH WATERPROOF RISERS AND SCREWDOWN LIDS OVER MANHOLES TO FINAL GRADE. INSTALL BIOMICROBICS BIOBARRIER MBR 1.5 COMPONENTS INSIDE EACH TANK AS PER MANUFACTURER SPECIFICATIONS AND GUIDELINES (SPECIFICATION SHEETS ATTACHED).
- INSTALL (2) BIOBARRIER CONTROL PANELS TO CONTROL THE BIOBARRIER PUMPS. SET HIGH WATER ALARMS IN BIOBARRIER TANKS AT 2250 GALLONS.
- INSTALL (2) STATE-CERTIFIED WATERPROOF, NORTHWEST CASCADE BZP 1200 GALLON SETTLING TANKS WITH 24 INCH WATERPROOF RISERS AND SCREWDOWN LIDS OVER MANHOLES TO FINAL GRADE.
- INSTALL A STATE-CERTIFIED WATERPROOF, EVERGREEN PRECAST EP 3000 GALLON PUMP CHAMBER WITH 24 INCH WATERPROOF RISERS AND SCREWDOWN LIDS OVER MANHOLES TO FINAL GRADE.
- INSTALL AN SJE RHOMBUS IFS CONTROL PANEL (IFS11W114H8AC) WITH TIMER, COUNTER AND ELAPSED TIME METER. INSTALLER SHALL SET TIMER TO DOSE (12) 208 GALLON CYCLES PER DAY. SET HIGH WATER ALARM TO ACTIVATE AT 148 GALLONS ABOVE OFF FLOAT.
- INSTALL (2) MYERS ME100 (115 V, 1 HP) EFFLUENT PUMPS OR EQUIVALENT. TOTAL DYNAMIC HEAD IS 18 FEET. (LIFT 1', TRANSPORT 8', HEADER 1', RESIDUAL 2'). REQUIRED PUMP CAPACITY IS 82.6 GPM (140 AT .59).
- TRANSPORT LINES TO DRAINFIELD ARE APPROXIMATELY 167 FEET OF 2 INCH SCHEDULE 40 PVC PIPE. INSTALL BACKFLOW VALVES ON TRANSPORT LINES INSIDE PUMP TANK.
- TWO HEADER MANIFOLDS TO BE INSTALLED ABOVE HIGHEST DRAINFIELD LATERAL ELEVATION. MANIFOLDS TO BE 1.5 INCH SCHEDULE 40 PVC PIPE. INSTALL MANIFOLD PVC CHECK AND BALL VALVES IN CARSON BOXES.
- LATERAL LINES TO TOTAL 1400 LINEAL FEET, (14) 100 FOOT LATERALS, OF 1.5 INCH SCHEDULE 40 PVC PIPE. DRILL 3/16 INCH ORIFICES ON 5 FOOT CENTERS, SPRAY DIRECTED UP. LATERALS TO BE INSTALLED LEVEL WITH CONTOURS. USE ADS ARC 36 LP CHAMBERS IN 36 INCH WIDE TRENCHES INSTALLED ON 5 FOOT CENTERS. INSTALL VENTILATION AND OBSERVATION PORTS WITH CAPS AT LATERAL CENTERS AND ENDS. REFER TO TRENCH DETAIL FOR CONSTRUCTION DEPTH AND MATERIAL SPECIFICATIONS.
- LOT SIZE IS APPROXIMATELY 6.23 ACRES, AT 271,379 SQUARE FEET.

ME100 PUMP CURVE



SEPTIC DESIGN SPECIFICATIONS



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SITE EVALUATIONS SOILS ANALYSIS SEPTIC DESIGNS

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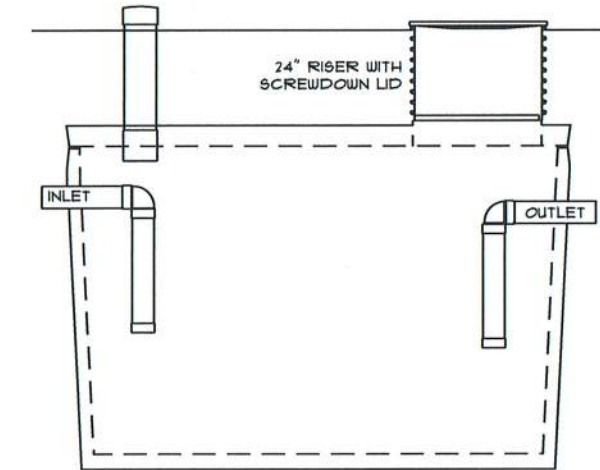
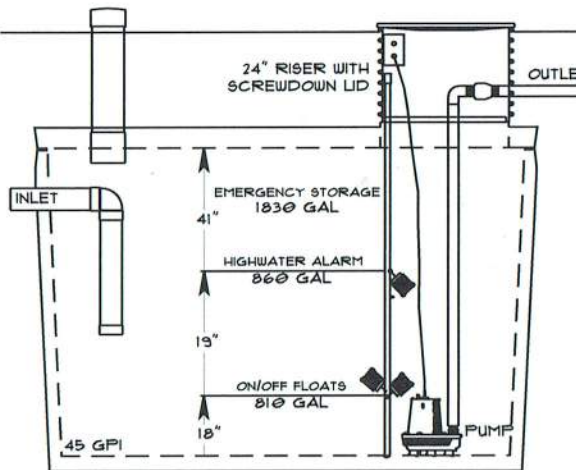
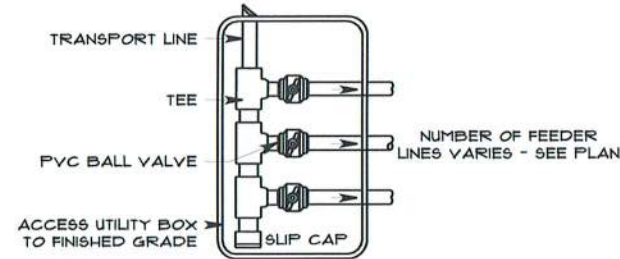
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BIOBARRIER TANK DETAIL

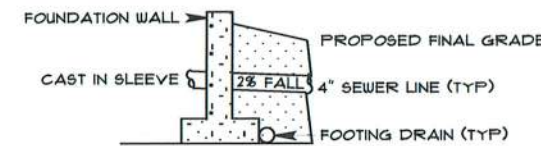
BZP 3000 PUMP TANK DETAIL

BZP 1200 TANK DETAIL

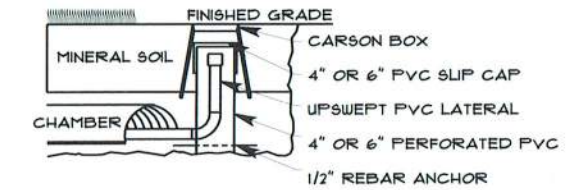
HEADER MANIFOLD DETAIL



RECOMMENDED BUILDING SEWER STUBOUT DETAIL

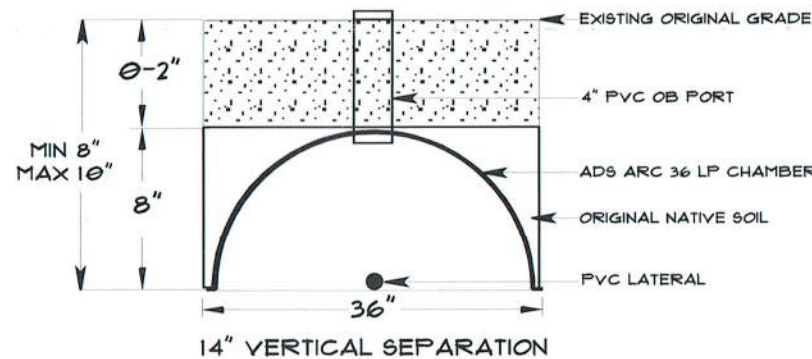


LATERAL PORT DETAIL

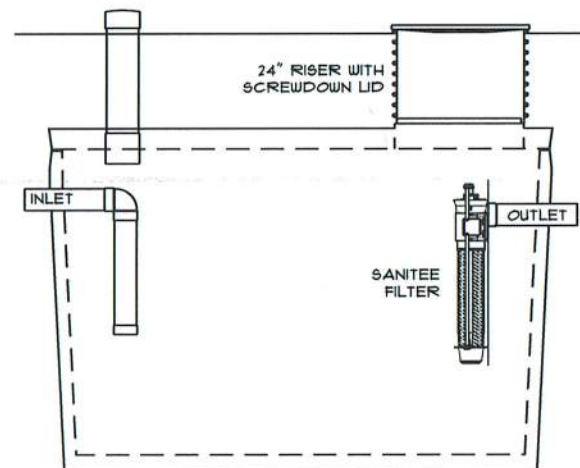


CHAMBER TRENCH DETAIL

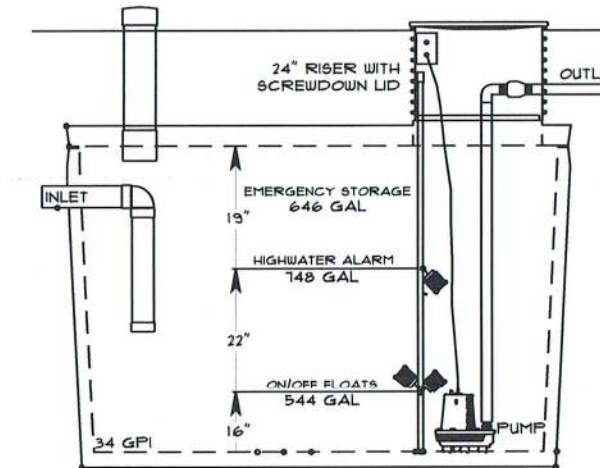
MINIMUM 6" SANDY SOIL COVER REQUIRED



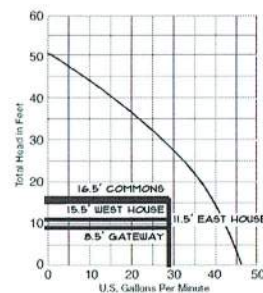
3000 GALLON TANK DETAIL



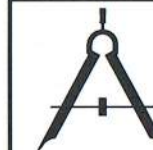
BZP 1500 PUMP TANK DETAIL



LIBERTY PRG101 PUMP CURVE



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