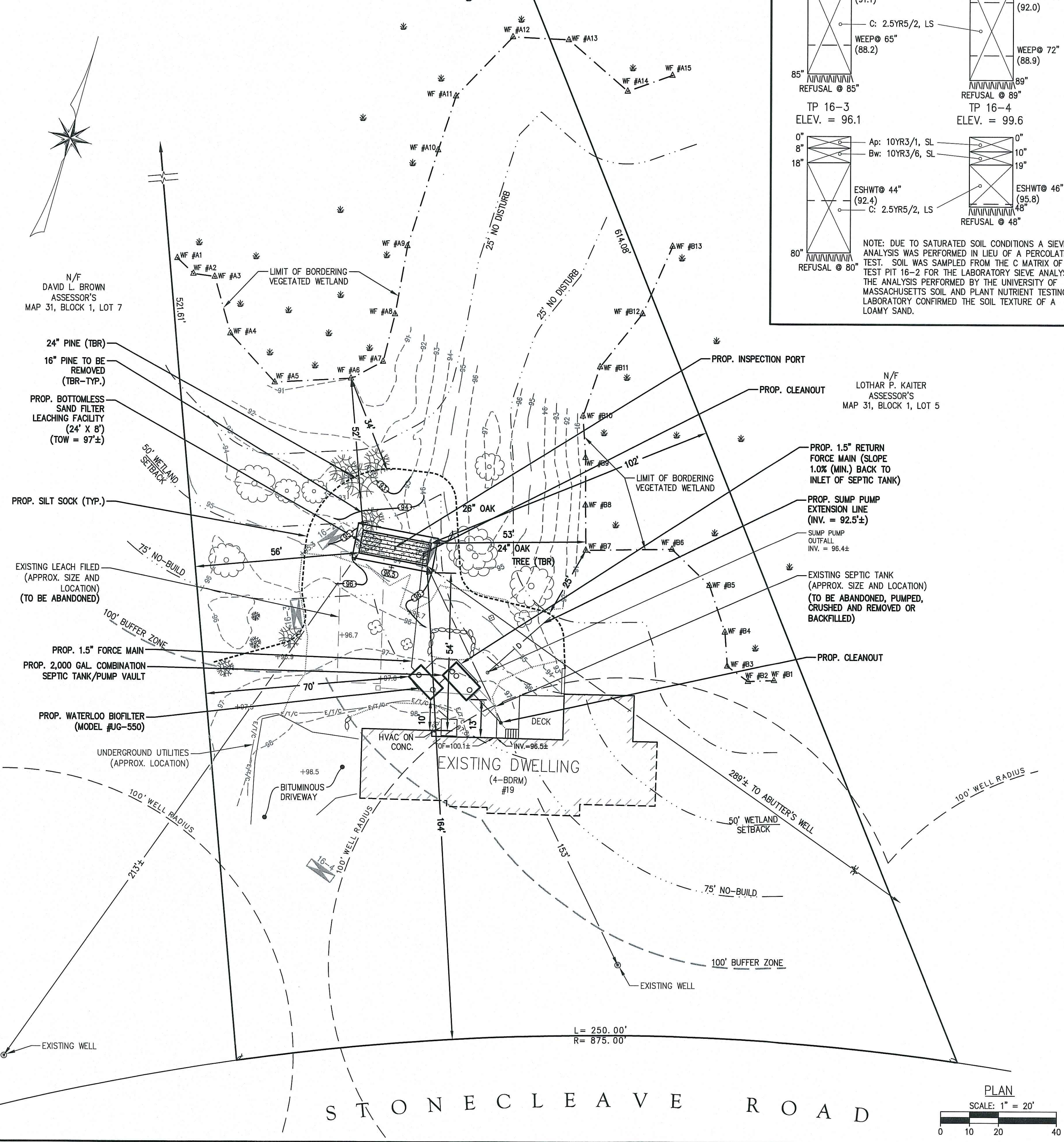


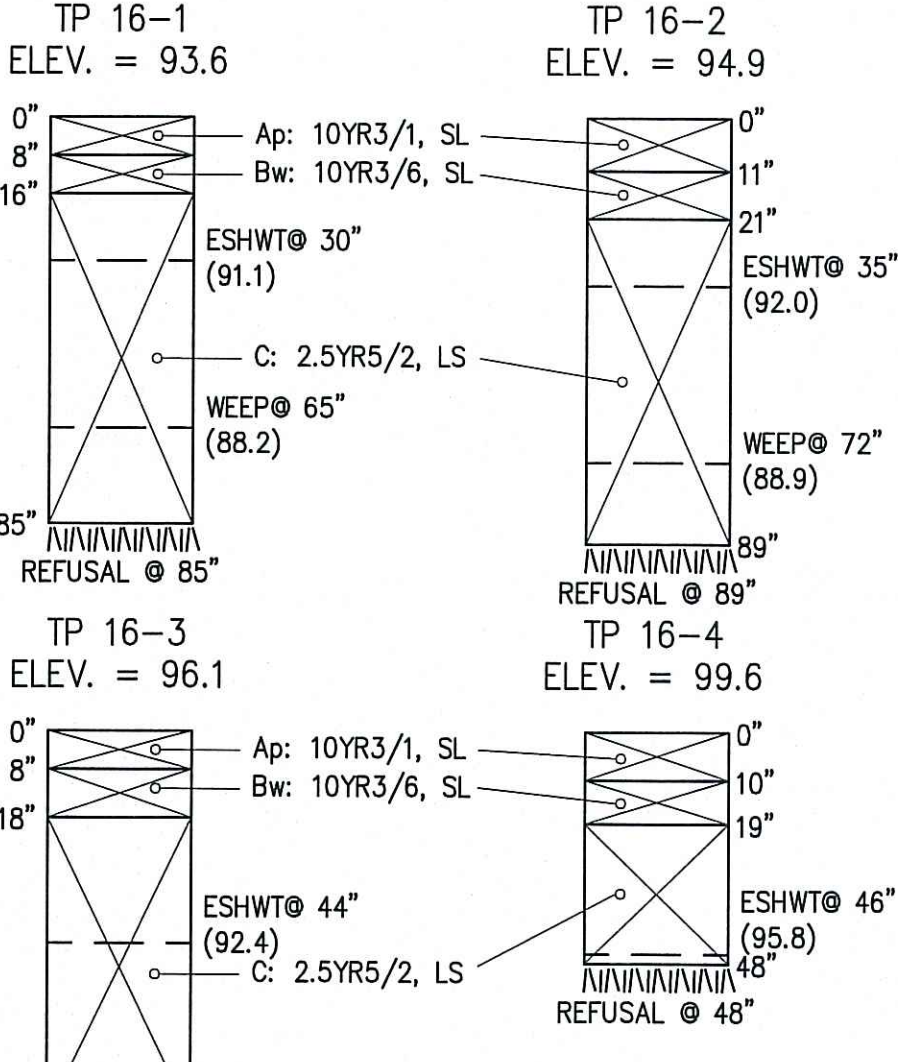
LEGEND:

- EXISTING GRADE 96 --- +95.7 ---
- BORDERING VEGETATED WETLANDS
- 25' NO DISTURB
- 50' WETLAND SETBACK
- 75' NO BUILD
- 100' BUFFER ZONE
- WETLAND FLAG
- TEST PIT TREE



SOIL LOGS

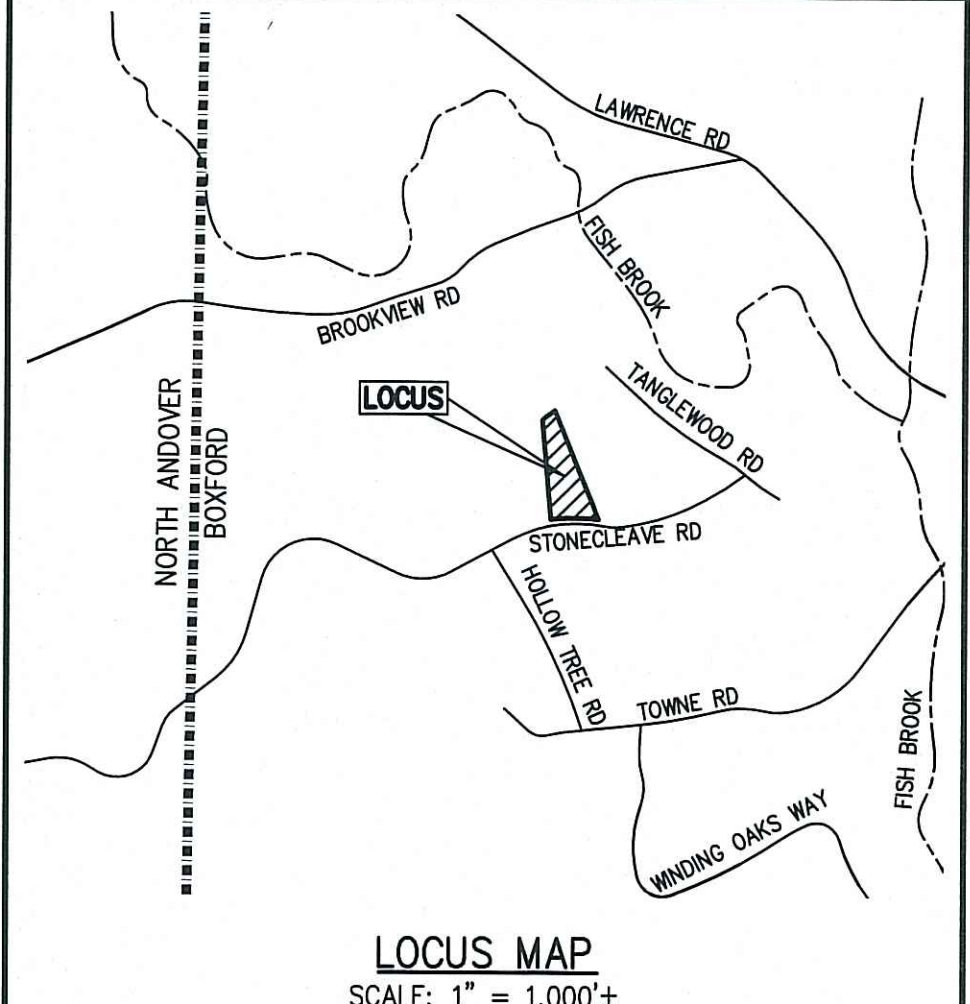
DATE PERFORMED: JUNE 9, 2016
 PERFORMED BY: ALEXANDER F. PARKER, SE #1848
 WITNESSED BY: MRS. KENDELL LONGO, BOXFORD BOH



NOTE: DUE TO SATURATED SOIL CONDITIONS A SIEVE ANALYSIS WAS PERFORMED IN LIEU OF A PERCOLATION TEST. SOIL WAS SAMPLED FROM THE C MATRIX OF TEST PIT 16-2 FOR THE LABORATORY SIEVE ANALYSIS. THE ANALYSIS PERFORMED BY THE UNIVERSITY OF MASSACHUSETTS SOIL AND PLANT NUTRIENT TESTING LABORATORY CONFIRMED THE SOIL TEXTURE OF A LOAMY SAND.

SITE NOTES:

1. RECORD OWNER: CHARLES J. & SERENA H. CAPERONIS, 19 STONECLEAVE ROAD, BOXFORD, MA 01921, BOOK 21584, PAGE 421
2. RECORD PLANS: PROPERTY LINE INFORMATION COMPILED FROM "DEFINITIVE PLAN ARDON FARM SECTION IV BOXFORD, MA" PREPARED BY HAYES ENGINEERING INC., DATED AUGUST 30, 1968, RECORDED WITH THE ESSEX REGISTRY OF DEEDS, PLAN BOOK 113, PLAN 98 AND SHOULD BE CONSIDERED APPROXIMATE.
3. WETLANDS: WETLANDS DELINEATED BY DEROSA ENVIRONMENTAL CONSULTING, INC. ON MAY 23, 2016.
4. WATER SUPPLY: THERE ARE NO KNOWN DRINKING WATER SUPPLY ZONE II'S AND NO KNOWN INTERIM WELHEAD PROTECTION ZONES ON THE SUBJECT PARCEL BASED ON THE DEPARTMENT OF ENVIRONMENTAL PROTECTION MAPS.
5. FLOOD PLAIN: THE AREA OF WORK ON THE PROPERTY IS SITUATED IN A ZONE "X" AS ILLUSTRATED ON THE MOST RECENT FLOOD INSURANCE RATE MAP PANEL 25009C-0242-F WITH EFFECTIVE DATE OF JULY 3, 2012.
6. DATUM: ELEVATION SHOWN HEREON ARE BASED ON AN ASSUMED DATUM.
7. EXISTING CONDITIONS: EXISTING CONDITIONS INFORMATION OBTAINED FROM A FIELD SURVEY PERFORMED BY THE MORIN-CAMERON GROUP, INC. IN JUNE 2016.
8. NATURAL HERITAGE: THE ENTIRE SUBJECT PARCEL IS LOCATED WITHIN THE NATURAL HERITAGE ESTIMATED HABITATS OF RARE WILDLIFE AND PRIORITY HABITATS OF RARE SPECIES SHOWN AS PH-1339 ON THE MOST CURRENT NATURAL HERITAGE MAPS.



BSF DESIGN CALCULATIONS:

EFFLUENT LOADING RATE FOR BOTTOMLESS SAND FILTER BASED ON RHODE ISLAND DEM REQUIREMENTS (TABLE 1): LOAMY SAND; GRANULAR, SUB-ANGULAR BLOCKY STRUCTURE - SOIL CATEGORY 3 - CATEGORY 1 SYSTEM: LOADING RATE = 3.5 GPD/SF

DESIGN FLOW = 4 BEDROOMS X 110 GAL/BEDROOM = 440 GPD

LEACHING AREA REQUIRED = 440 GPD / 3.5 GPD/SF = 126 SF

DESIGN FOR GRINDER (PER BOH REGULATIONS) = 126 GPD X 1.5 = 189 SF

USE 8' X 24' BOTTOMLESS SAND FILTER BED: AREA = 192 SF

SEPTIC TANK REQUIRED (TITLE 5 DESIGN FLOW): 110 GPD X 4 = 440 GPD X 200% = 880 GAL

USE: 2,000 GAL SEPTIC TANK/PUMP VAULT

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY THAT ALL EXISTING PLUMBING, WITH THE EXCEPTION OF ANY FOUNDATION DRAINS OR WATER SOFTENERS, SHALL BE TIED INTO NEW SEPTIC SYSTEM.
2. THIS PLAN IS TO SHOW THE DESIGN OF THE SUBSURFACE SEWAGE DISPOSAL SYSTEM ONLY. THE SYSTEM IS DESIGNED FOR FLOWS ESTIMATED UNDER DESIGN CRITERIA.
3. SYSTEM IS DESIGNED ONLY TO ACCOMMODATE SANITARY SEWAGE ASSOCIATED WITH NORMAL DOMESTIC USAGE AND CONSISTING OF WATER-CARRIED PUTRESCIBLE WASTE.
4. THE SYSTEM IS DESIGNED FOR A GARBAGE GRINDER, HOWEVER THE USE OF ONE IS NOT RECOMMENDED BY THE DESIGN ENGINEER.
5. THE PLAN SHOWS ONLY THOSE FEATURES THAT WERE VISUALLY APPARENT ON DATE OF THE TOPOGRAPHY.
6. THE INSTALLER OF THIS SYSTEM MUST BE LICENSED BY THE LOCAL BOARD OF HEALTH AND MUST HAVE ATTENDED THE OWT105 (INNOVATIVE & ALTERNATIVE TECHNOLOGIES) AND THE OWT125 (BOTTOMLESS SAND FILTER DESIGN AND INSTALLATION) COURSES AT THE NEW ENGLAND ON-SITE WASTEWATER TRAINING PROGRAM AT THE UNIVERSITY OF RHODE ISLAND IN KINGSTON, RI.
7. THERE ARE NO KNOWN WELLS WITHIN 100 FEET OF THE PROPOSED SOIL ABSORPTION SYSTEM.
8. DISPOSAL SYSTEM AREAS ARE TO BE RAKED (SCARIFIED) BEFORE INSTALLATION OF STONE. ALL STONES EXCEEDING 2 INCHES IN EXCAVATION ARE TO BE REMOVED FROM THE LEACHING AREA BED.
9. FINISHED SURFACE OF THE LEACHING AREA SHALL BE GRADED TO ASSURE WATER RUNOFF (2% MINIMUM SLOPE).
10. ALL DISTURBED AREAS TO BE LOAMED, SEEDED, AND MAINTAINED TO PREVENT EROSION.
11. THE SEPTIC TANK SHOULD BE PERIODICALLY INSPECTED AND MAINTAINED AND SHOULD BE PUMPED WHEN THE SLUDGE IN THE BOTTOM EXCEEDS 1/4 OF THE DEPTH.
12. ALTERNATE MANUFACTURERS FOR CONCRETE STRUCTURES AND EQUIPMENT SHOWN ON THESE PLANS MAY BE USED UPON THE WRITTEN APPROVAL OF THE DESIGN ENGINEER. ALTERNATE MANUFACTURERS WILL NOT BE USED IF THE USE OF THEIR EQUIPMENT REQUIRES DESIGN CHANGES.
13. NO CHANGES ARE TO BE MADE IN THE FIELD WITHOUT THE APPROVAL OF THE BOARD OF HEALTH OR ITS DESIGNEE AND THE DESIGN ENGINEER.
14. ALL WORK IS TO COMPLY WITH THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION AGENCY STATE SANITARY CODE, TITLE 5 AND ANY LOCAL BOARD OF HEALTH SUPPLEMENTARY REGULATIONS.
15. THE LOCAL BOARD OF HEALTH AGENT WILL CONDUCT PERIODIC INSPECTIONS AS NEEDED.
16. THESE PLANS AND SPECIFICATIONS ARE INTENDED TO BE EXPLANATORY OF THE WORK TO BE DONE AND OF EACH OTHER, BUT SHOULD ANY OMISSION, ERRORS, OR DISCREPANCIES APPEAR, THEY SHALL BE SUBJECT TO CORRECTION AND INTERPRETATION BY THE DESIGN ENGINEER THEREBY DEFINING AND FULFILLING THE INTENT OF THE PLANS. THE CONTRACTOR SHALL NOTIFY THE DESIGN ENGINEER OF ANY DISCREPANCIES PRIOR TO INSTALLATION.
17. FILL REQUIREMENT: REMOVE TOPSOIL/FILL MIX FOR A DISTANCE OF 5 FEET BEYOND THE LEACHING FACILITY. REPLACE WITH FILL AS SPECIFIED IN 310 CMR 15.000, "TITLE 5" SECTION 15.255 (3) OR ASTM C-33 SAND (SYSTEM SAND). FOR THE BOUNDARY OF THE SAND FILL REQUIREMENT, SEE PLAN VIEW, CROSS-HATCHED AREA ON SYSTEM PROFILE. A SIEVE ANALYSIS SHALL BE PERFORMED ON THE FILL MATERIAL TO BE USED. A COPY OF THE SIEVE ANALYSIS RESULTS SHALL BE SUBMITTED TO THE BOARD OF HEALTH.
18. ALL SYSTEM COMPONENTS SHALL BE MARKED WITH MAGNETIC MARKING TAPE IN ACCORDANCE WITH 310 CMR 15.221(11).
19. AN OPERATION AND MAINTENANCE CONTRACT IS REQUIRED FOR THE WATERLOO BIOFILTER AND BOTTOMLESS SAND FILTER.
20. THE DESIGN AND INSTALLATION SHALL COMPLY WITH THE MA DEP APPROVAL OF THE WATERLOO DATED NOVEMBER 5, 2012 AND THE BOTTOMLESS SAND FILTER APPROVAL DATED JULY 17, 2015.
21. PRIOR TO OBTAINING A CERTIFICATE OF COMPLIANCE FROM THE BOXFORD BOARD OF HEALTH THE SYSTEM OWNER SHALL RECORD IN THE CHAIN OF TITLE FOR THE PROPERTY A NOTICE DISCLOSING THE EXISTENCE OF THE ALTERNATIVE ON-SITE SYSTEM INCLUDING THE SECONDARY TREATMENT UNIT.

LOCAL B.O.H. VARIANCE REQUESTS

	STATE (TITLE 5)	LOCAL (BOH)	REQUEST
MINIMUM SETBACK DISTANCE BETWEEN LEACHING FACILITY AND WETLAND RESOURCE AREAS (BOXFORD BOARD OF HEALTH REGULATIONS, CHAPTER 201, SECTION 9(B))	50'	100'	52'
MINIMUM SETBACK DISTANCE BETWEEN LEACHING FACILITY AND WETLAND RESOURCE AREAS WITH PERC RATE LESS THAN 5 MPI (BOXFORD BOARD OF HEALTH REGULATIONS, CHAPTER 201, SECTION 9(E))	50'	150'	52'

LOCAL UPGRADE APPROVAL:

1. 310 CMR 15.405(1)(i): USE OF A SIEVE ANALYSIS IN LIEU OF A PERCOLATION TEST: PROVIDED: SIEVE ANALYSIS

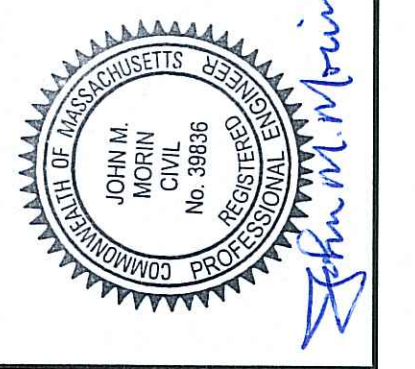
BOTTOMLESS SAND FILTER SIZING

INPUT	
PRETREATMENT CATEGORY	1 choose
SOIL CATEGORY WITHIN 18" OF BSF'S BOTTOM	3 choose
(1 bedroom = 165 gal/day) TOTAL FLOW THE BSF IS DESIGNED FOR	660 gallons/day
DESIRED BSF LENGTH	24 feet
(enter 0 if you want program to calculate) DESIRED BSF WIDTH	8 feet O.K!!
(use same in pump calcs.) DESIRED ORIFICE SPACING	16 inches O.K!!
DESIRED LATERAL SPACING	16 inches O.K!!
(from pump calculations) TOTAL NUMBER OF ORIFICES	108 orifices
OUTPUT	
approx.) MINIMUM LATERAL LENGTH FOR PUMP CALCULATIONS	22.67 feet
(approximate) MANIFOLD LENGTH FOR PUMP CALCULATIONS	6.57 feet
CHECK FOR LATERAL LENGTH	O.K!!
(from Table 1 - Guidance Document) MAXIMUM LOADING RATE	3.50 gal/sq.ft./day
REQUIRED BSF AREA	188.57 sq.ft.
BSF AREA PROVIDED	192.00 sq.ft. O.K!!
BSF WIDTH	8.00 feet
CALCULATED NUMBER OF LATERALS	6.00 laterals
DISTANCE FROM BSF EDGE TO FIRST AND LAST LATERALS	8.00 inches O.K!!
w/out fittings) DISTANCE FROM EDGE OF BSF TO LATERAL ENDS	4.00 inches O.K!!
NUMBER OF ORIFICES PER LATERAL	18.00 orifices O.K!!
DESIGNED LOADING RATE	3.44 gal/sq.ft./day

BSF MATERIAL NOTES:

1. BOTTOMLESS SAND FILTER MEDIA IS AVAILABLE FROM: HOLLISTON SAND COMPANY, INC. P.O. BOX 1168 SLATERSVILLE, RI. 02876 PHONE: 401-766-5010 (*INSTALLER SHALL OBTAIN SIEVE ANALYSIS FOR BOTTOMLESS SAND FILTER SAND FROM HOLLISTON SAND COMPANY, INC.)
2. ROUNDED OR NATURAL PEA GRAVEL IS AVAILABLE FROM: BENTLEY WARREN 89 NEWBURYPORT TURNPIKE IPSWICH, MA 01938 PHONE: 978-356-5000
3. COLD WEATHER ORIFICES ARE AVAILABLE FROM: WASTEWATER TECHNOLOGIES, INC. 19 PRECAST ROAD MILTON, VT 05468 PHONE: 877-212-3219
4. (2) POLYCB2 BSF COVER SCREENS (OR EQUAL) ARE AVAILABLE FROM: PRO-TECT INDUSTRIES P.O. BOX 6240 FORT MYERS BEACH, FL 33932 PHONE: 239-463-1664

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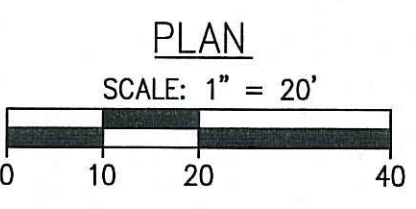


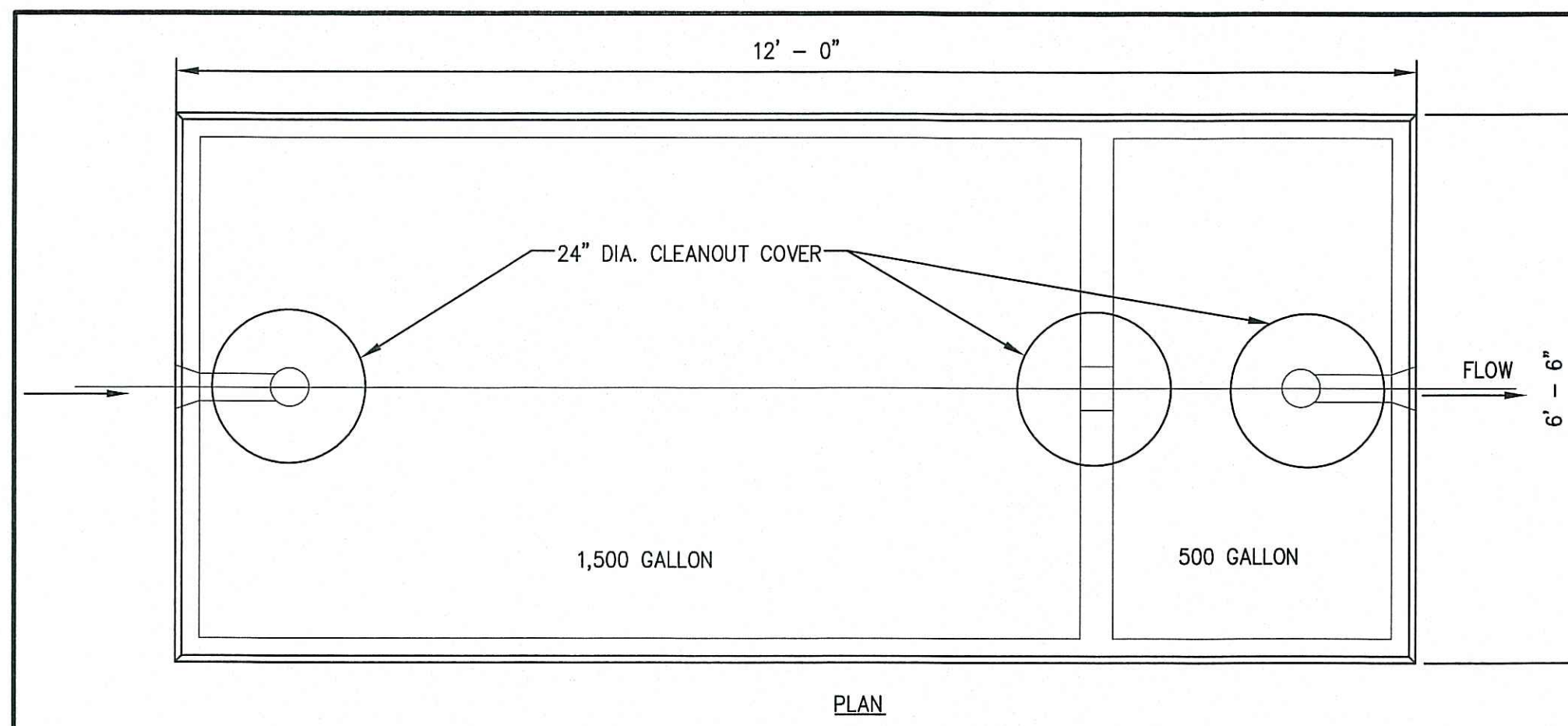
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 DRAFTED BY: WAS
 CHECKED BY: JMM
 APPROVED BY: JMM
 SCALE: 1"=20'
 DATE: JULY 29, 2016

NO.	REVISIONS	DATE	DESCRIPTION

SANITARY DISPOSAL SYSTEM REPAIR PLAN
 IN
BOXFORD, MASSACHUSETTS
19 STONECLEAVE ROAD
 (ASSESSOR'S MAP 31, BLOCK 1, LOT 6)
 PREPARED FOR:
SERENA CAPERONIS

DRAWING NO.
S - 3464
 SHEET NO.
1 OF 3



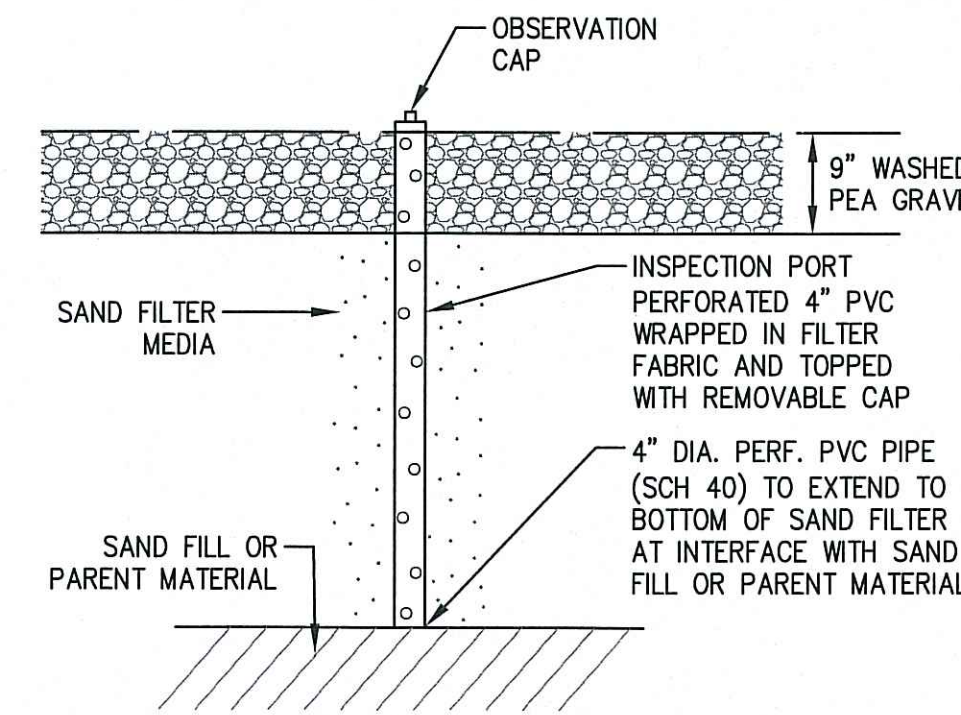


BUOYANCY CALCULATIONS:

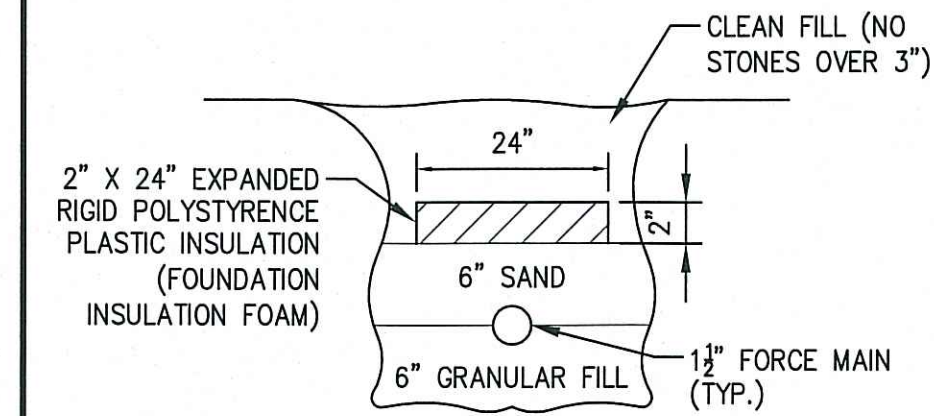
E.S.H.W.T. @ ELEV. = 93.6' ±
 (E.S.H.W.T. ASSUMED 44" BELOW EXISTING GRADE = 97.3'±)
 WEIGHT OF TANK = 15,685 LBS.
 WEIGHT OF FILL = 12'-0" X 6'-6" X 1.5' = 117 C.F. X 100 LBS/C.F. = 11,700 LBS
 FB (BUOYANT FORCE) = 12'-0" X 6'-6" X 3.5' = 273 C.F. X 62.4 LBS/C.F. = 17,036 LBS
 TOTAL WEIGHT (↓) = 15,685 + 11,700 = 27,385 LBS
 27,385 LBS (↓) > 17,036 LBS (↑)
 (F.S. = 1.60)

EMERGENCY STORAGE

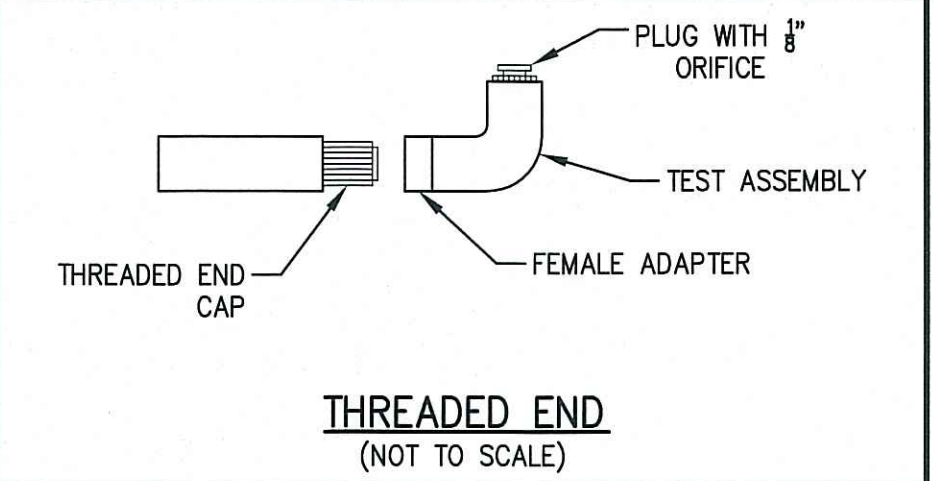
INSIDE DIMENSIONS = 11.33' X 5.83'
 STORAGE = 11.33' X 5.83' X 1'12" X 7.48 GAL/CFT = 41.1 GAL/IN
 ALARM @ 39", INLET INVERT @ 51"
 STORAGE ABOVE ALARM = (51" - 39") X 41.1 GAL/IN = 493.2 GAL



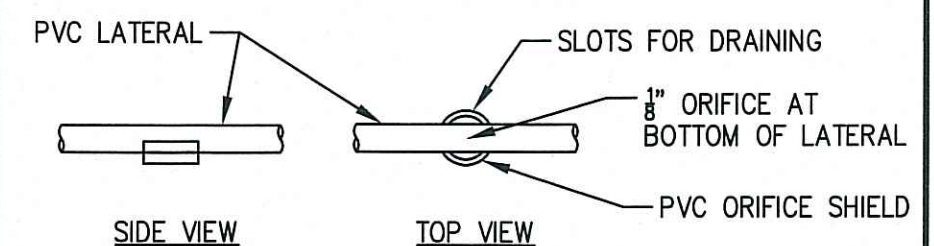
INSPECTION PORT DETAIL
 (NOT TO SCALE)



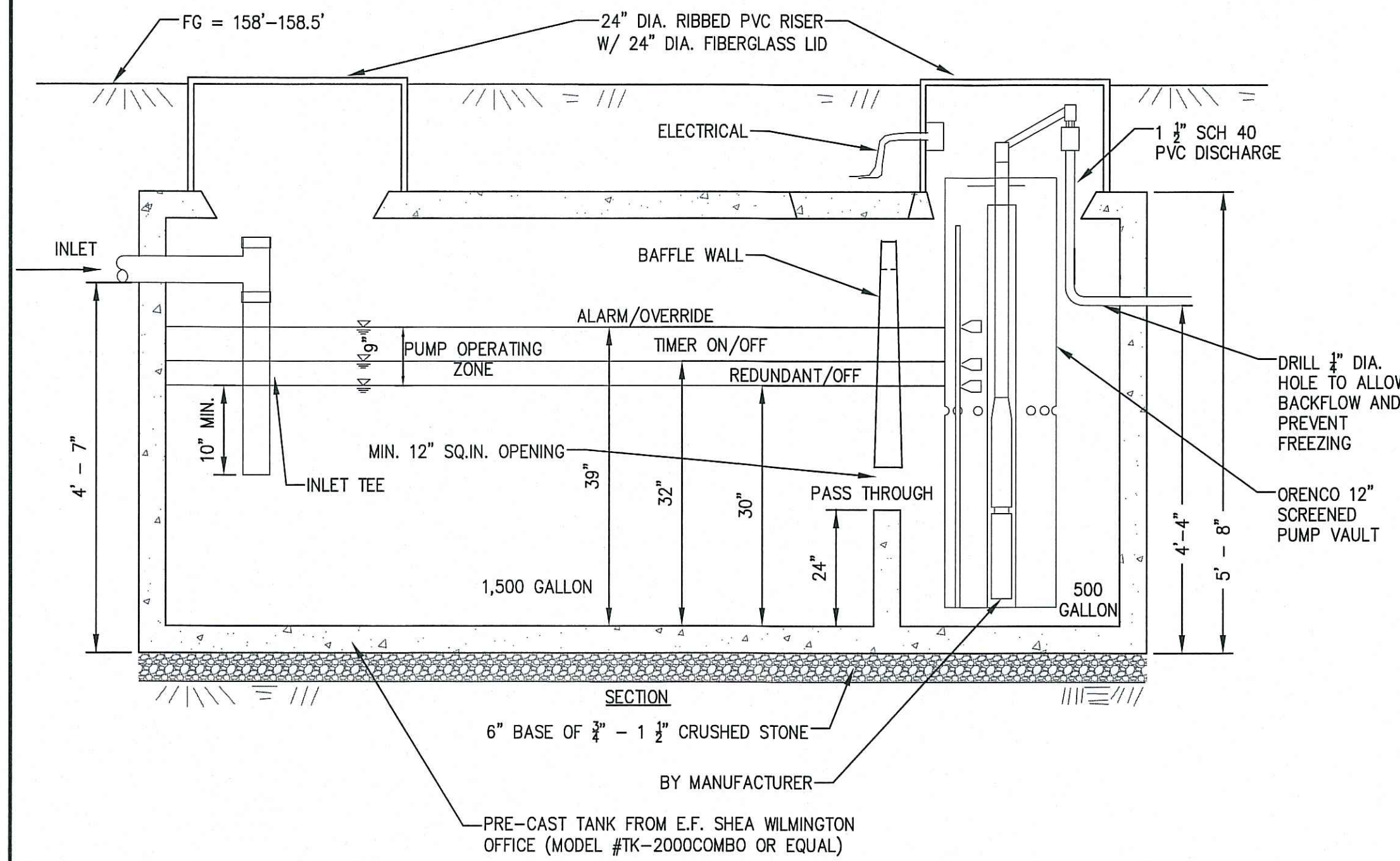
INSULATED TRENCH
 (NOT TO SCALE)



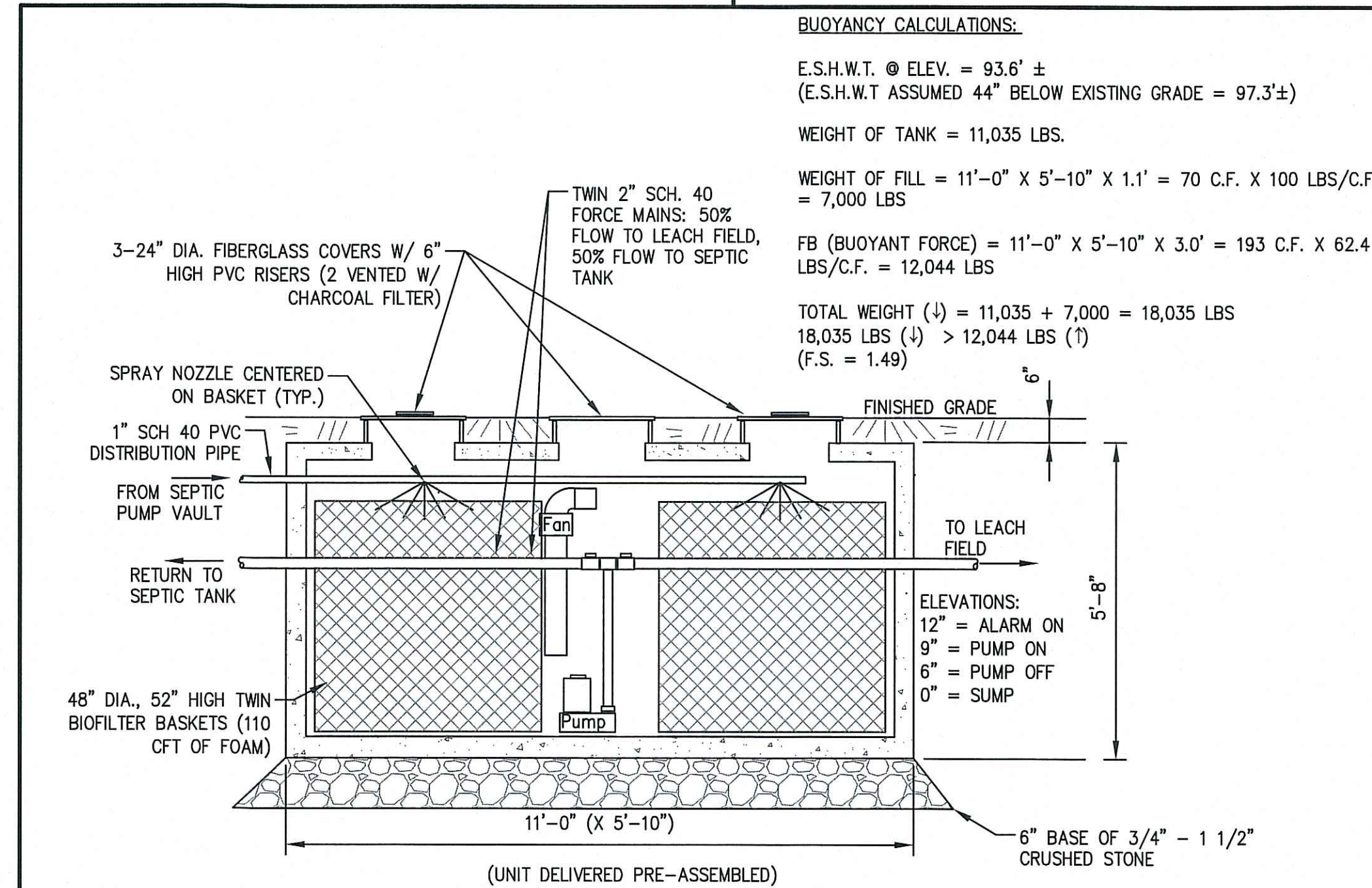
THREADED END
 (NOT TO SCALE)



COLD WEATHER ORIFICE SHIELD
 (NOT TO SCALE)

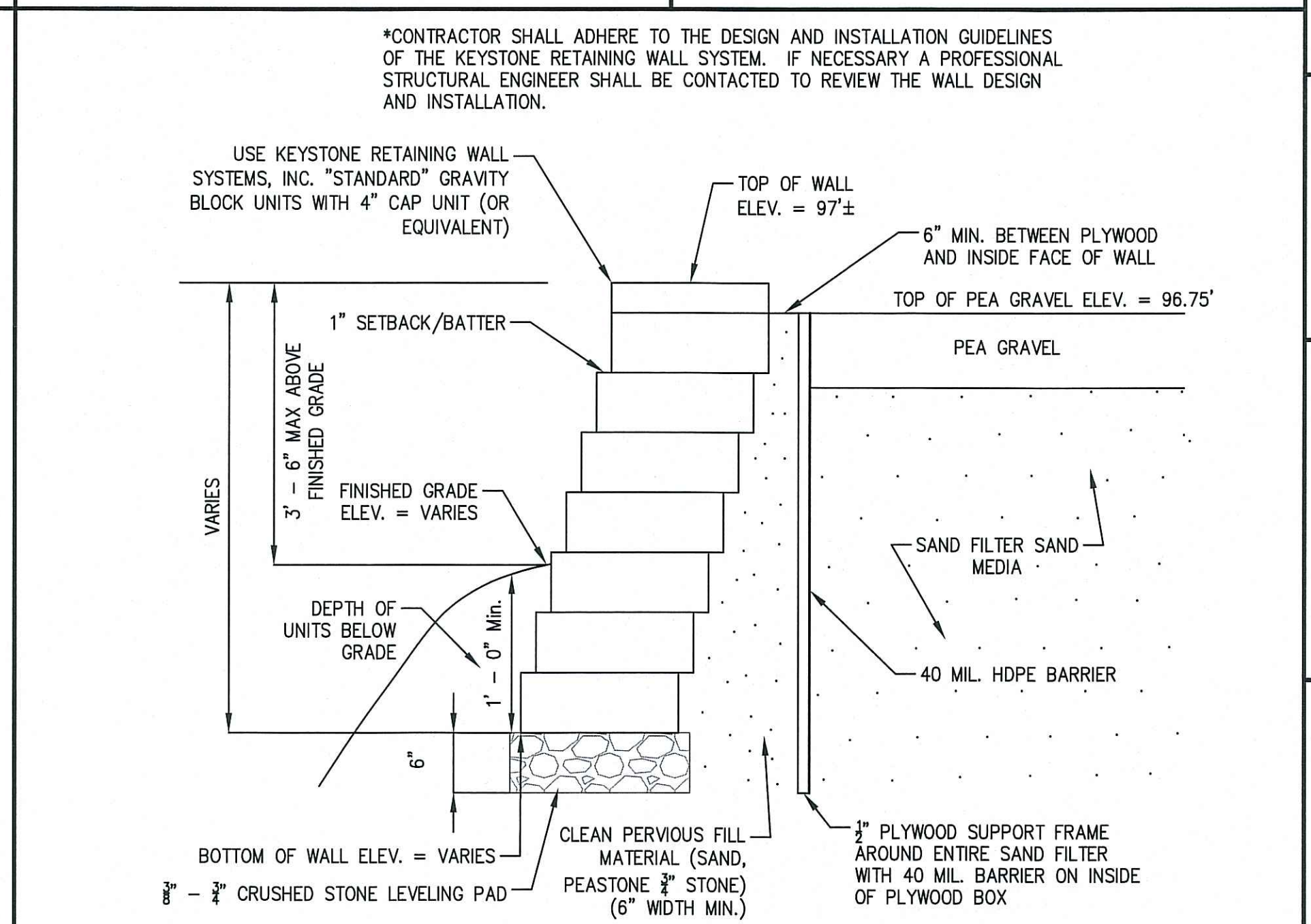


2,000 GAL. COMBINATION SEPTIC TANK/PUMP CHAMBER
 (NOT TO SCALE)



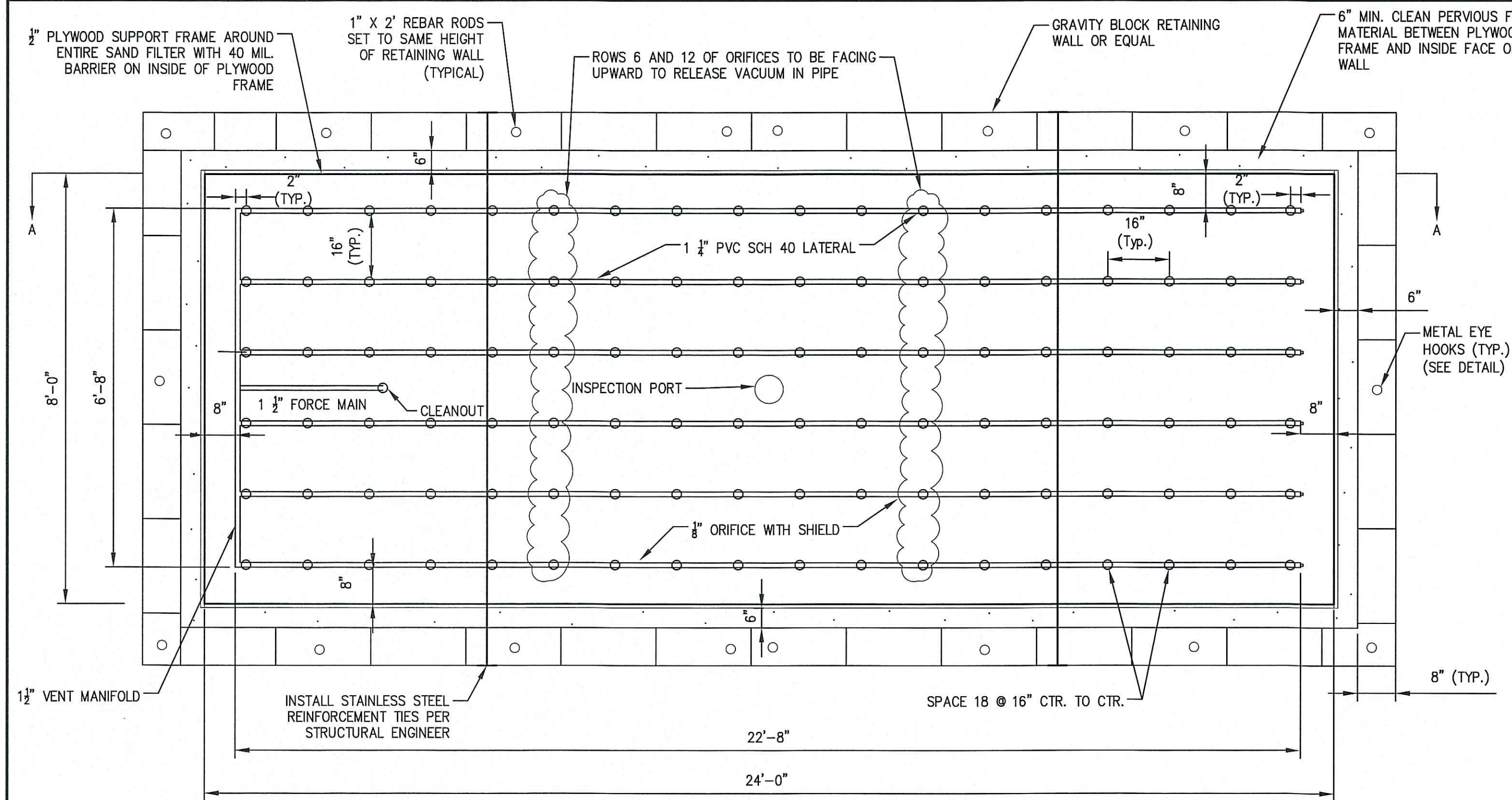
WATERLOO BIOFILTER
 (MODEL # UG-550)
 (NOT TO SCALE)

NOTE: ALL WATERLOO BIOFILTER COMPONENTS SHALL BE OBTAINED FROM CLEAR WATER INDUSTRIES, IPSWICH, MA., 978-356-0779



GRAVITY RETAINING WALL SYSTEM
 (NOT REINFORCED)
 (NOT TO SCALE)

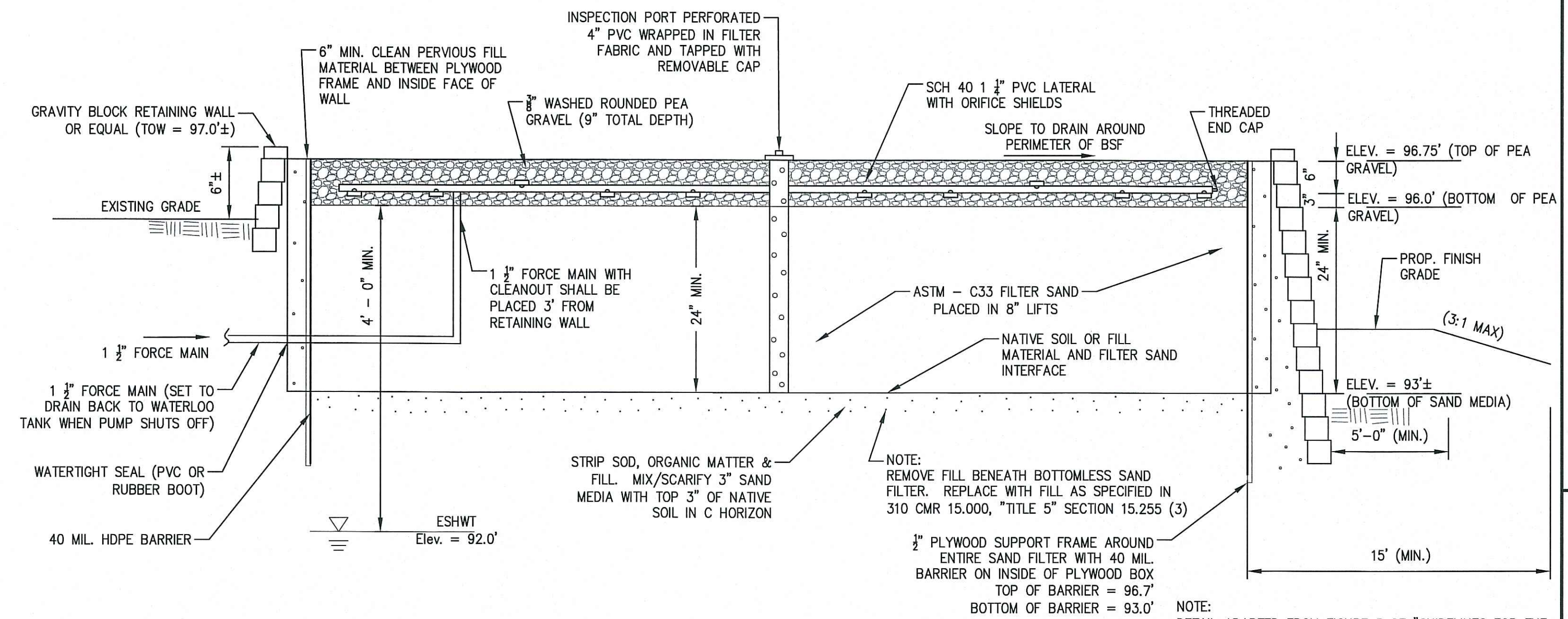
*CONTRACTOR SHALL ADHERE TO THE DESIGN AND INSTALLATION GUIDELINES OF THE KEYSTONE RETAINING WALL SYSTEM. IF NECESSARY A PROFESSIONAL STRUCTURAL ENGINEER SHALL BE CONTACTED TO REVIEW THE WALL DESIGN AND INSTALLATION.



~ TYPICAL TOP VIEW ~

NOTE: ADAPTED FROM FIGURE 5 OF "GUIDELINES FOR THE DESIGN AND USE OF BOTTOMLESS SAND FILTERS" DATED NOVEMBER 2001 BY RHODE ISLAND D.E.M.

BOTTOMLESS SAND FILTER (8' X 24')
 (NOT TO SCALE)



~ TYPICAL CROSS SECTION (A-A) ~

NOTE: DETAIL ADAPTED FROM FIGURE 5 OF "GUIDELINES FOR THE DESIGN AND USE OF BOTTOMLESS SAND FILTERS" DATED NOVEMBER 2001 BY RHODE ISLAND D.E.M.

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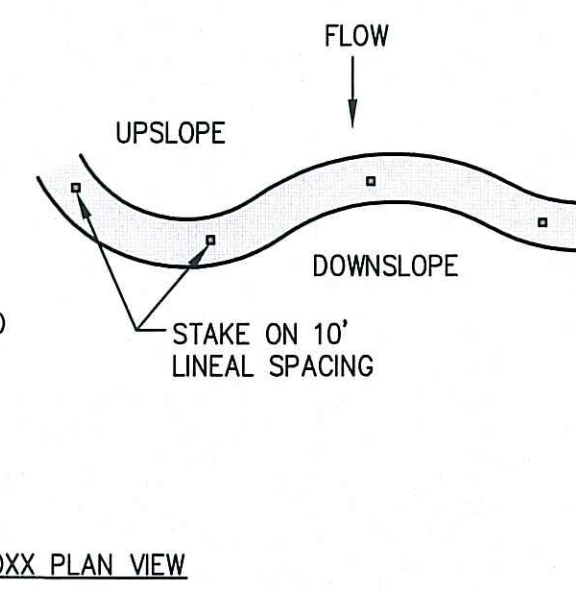
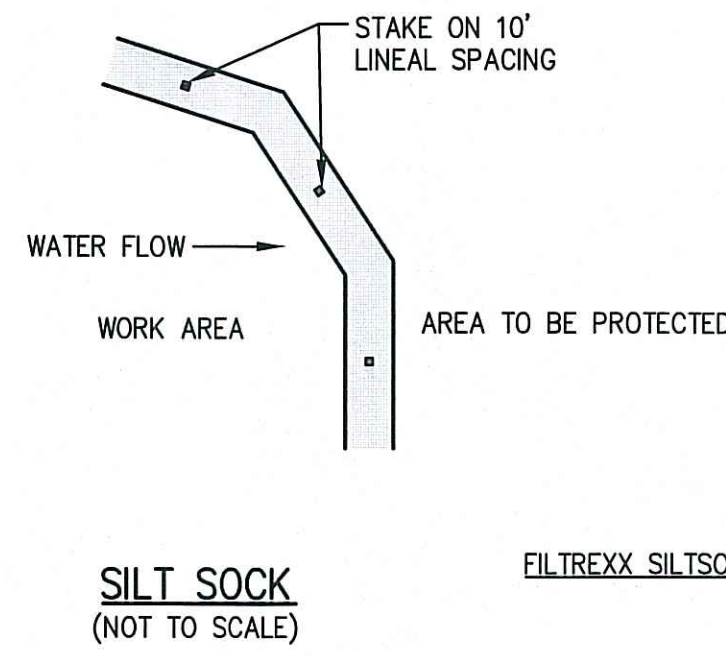
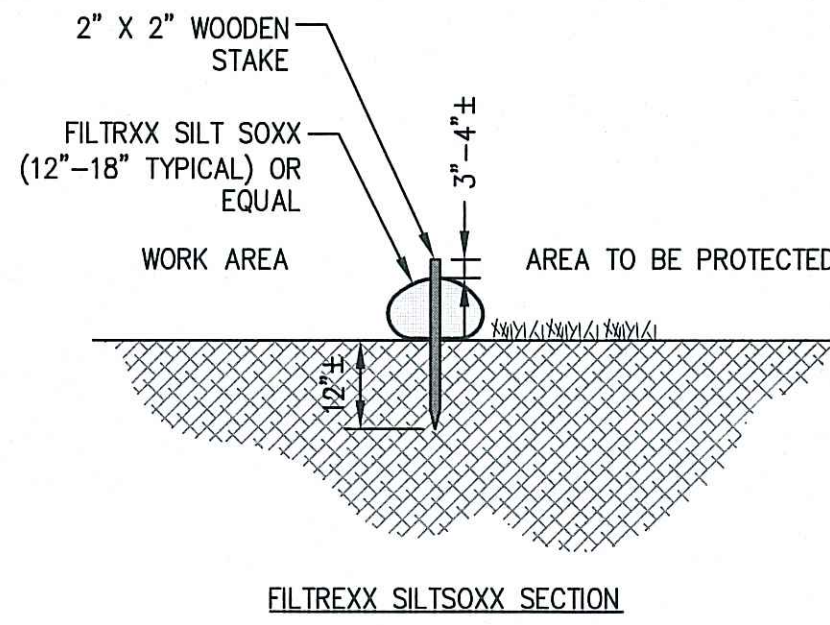
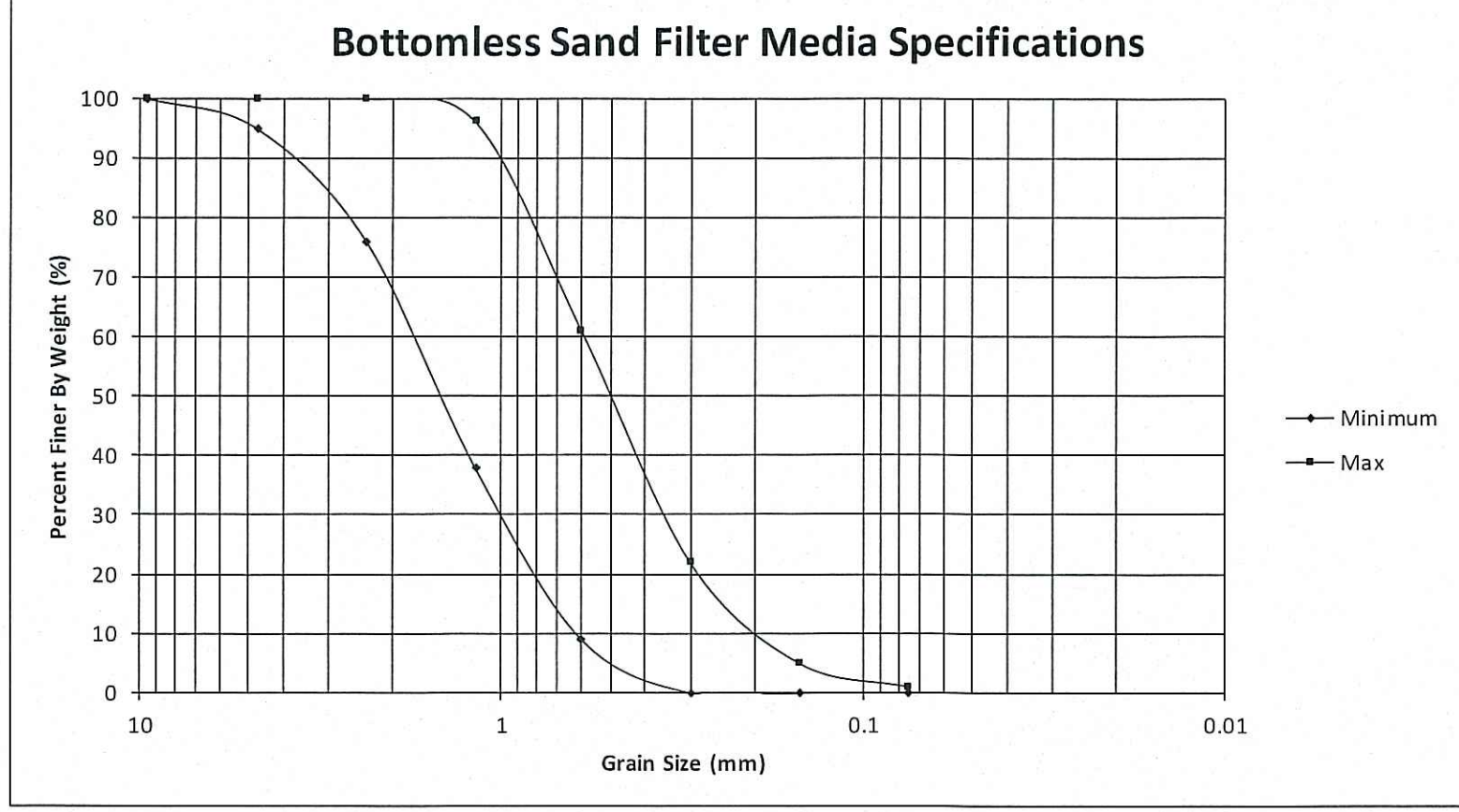


SURVEY BY: PW/SR
 DRAFTED BY: WAS
 CHECKED BY: JMM
 APPROVED BY: JMM
 SCALE: 1"=20'
 DATE: JULY 29, 2016

NO.	REVISIONS	DATE	DESCRIPTION

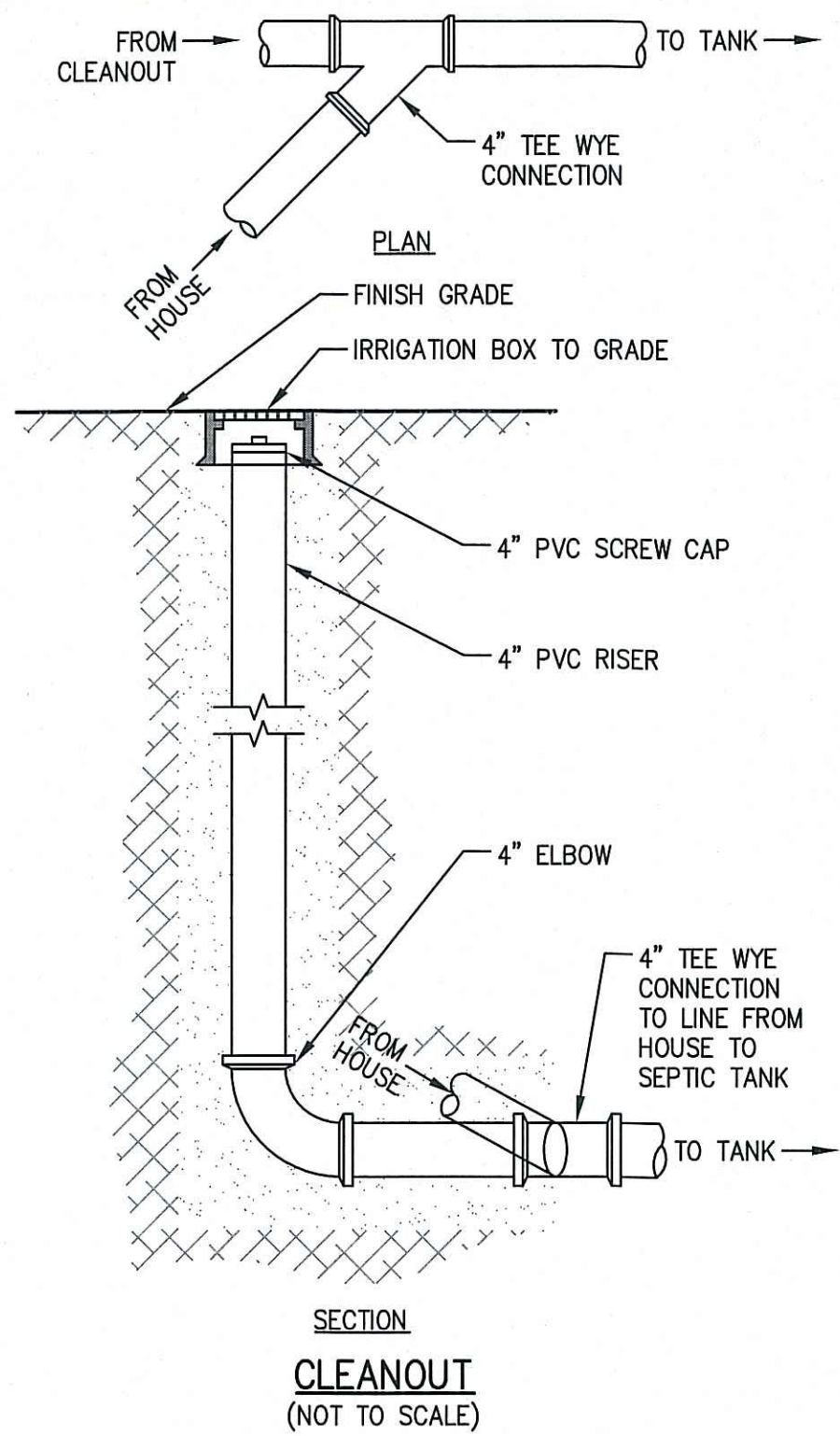
SANITARY DISPOSAL SYSTEM REPAIR PLAN
 IN
BOXFORD, MASSACHUSETTS
19 STONECLEAVE ROAD
 (ASSESSOR'S MAP 31, BLOCK 1, LOT 6)
 PREPARED FOR:
SERENA CAPERONIS

DRAWING NO.
S - 3464
 SHEET NO.
2 OF 3



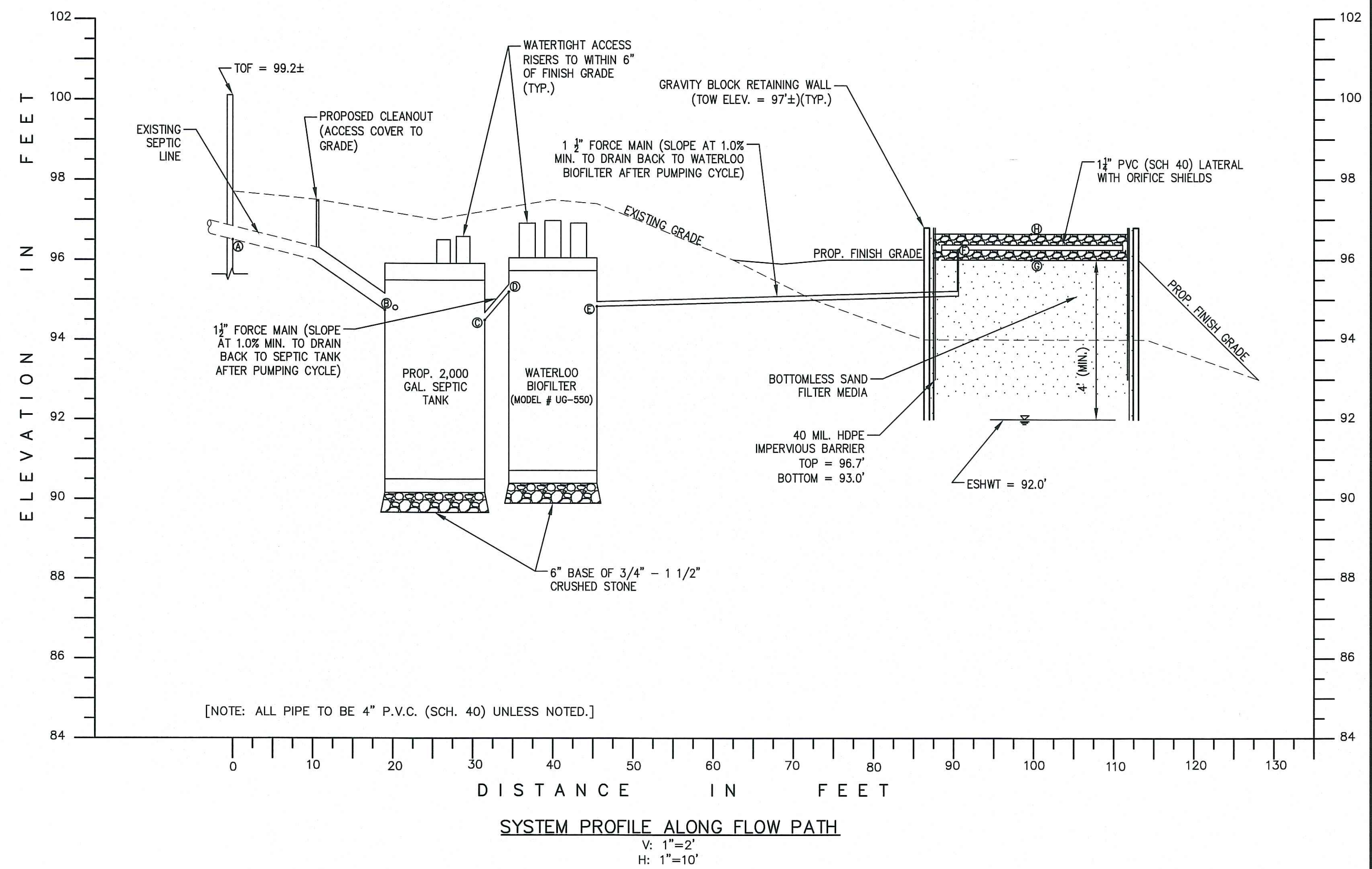
CATEGORY 1 B.S.F. PUMP CYCLE TIME INTERVALS

INPUT	
FLOW PER DAY	680 gallons
# OF ORIFICES PER DOSE (OR PUMP)	100 orifices
PUMPS ACTUAL OPERATING POINT (FLOW)	39 gpm
GALLONS PER ORIFICE PER DOSE (≈0.25)	0.15 gallon
# OF ZONES	1 zones
IS THERE A CHECK VALVE (with no weephole)?	no choose
ALTERNATING PUMPS?	no choose
PLEASE ILLUSTRATE THIS LINE	2 choose
LENGTH OF B.S.F.	24 feet
WIDTH OF B.S.F.	8 feet
LATERAL NOMINAL DIAMETER	3/4 inches
LATERAL LINE PIPE CLASS/SCHEDULE	40 choose
(per zone) LATERAL LENGTH	22.87 feet
(per zone) # OF LATERALS	5 laterals
PUMP BASIN DIAMETER	66.93 inches
OUTPUT	
TOTAL NUMBER OF ORIFICES IN B.S.F.	100 orifices
(better if less than 24 hrs/day) (per pump) RUN TIME	0.53 hrs/day
TIME THE PUMP RUNS DURING DRAWDOWN EVENT	0.53 minutes
(approx.) TIME THE PUMP IS OFF AFTER A DRAWDOWN EVENT	34.78 minutes
GALLONS NEEDED	21.73 gallons
PUMP BASIN GALLONS PER VERTICAL FOOT	399.50 gallons
DRAWDOWN	0.85 feet
CHECKS	
TOTAL CYCLES PER PUMP (per day)	40.74 cycles
TOTAL CYCLES PER ZONE (per day) (24÷(X×#Z))	40.74 cycles
HYDRAULIC LOADING RATE (CHECK WITH YOUR DESIGN)	3.44 gal/sq.ft./d
INPUT THE PIPE INFORMATION IF EFFLUENT RETURNS TO PUMP TANK	
DISCHARGE ASSEMBLY DIAMETER	1.12 inches
TRANSPORT LINE NOMINAL DIAMETER	1.12 inches
TRANSPORT LINE PIPE CLASS/SCHEDULE	40 choose
MANIFOLD NOMINAL DIAMETER	1.12 inches
MANIFOLD LINE PIPE CLASS/SCHEDULE	40 choose
DISCHARGE ASSEMBLY LENGTH	3 feet
TRANSPORT LINE LENGTH	43 feet
(per zone) MANIFOLD LENGTH	8.7 feet
VOLUME TO FILL-UP	5.53 gallons
TIME NEEDED FOR PIPE FILL-UP	0.14 minutes
TOTAL TIME PER DAY FOR FILL-UP	5.70 minutes



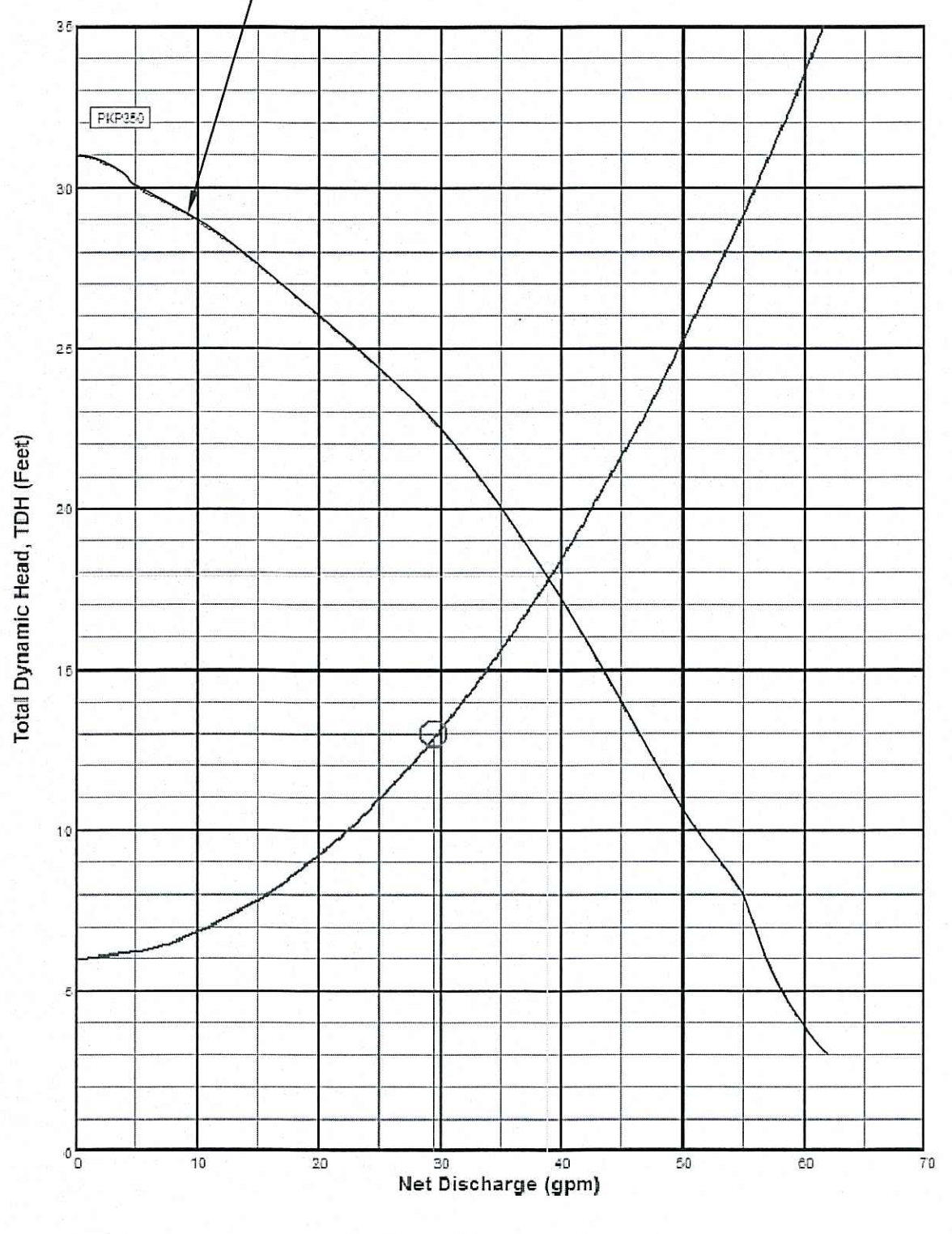
SCHEDULE OF INVERTS

- Ⓐ INV. FOUNDATION = 96.5'±
- Ⓑ SEPTIC TANK IN = 94.72'
- Ⓒ SEPTIC TANK OUT = 94.47'
- Ⓓ WATERLOO IN = 95.21'
- Ⓔ WATERLOO OUT = 94.96'
- ⓐ INV. BSF LATERALS = 96.25'
- ⓑ BOTTOM OF BSF GRAVEL = 96.0'
- ⓒ TOP OF BSF GRAVEL = 96.75'



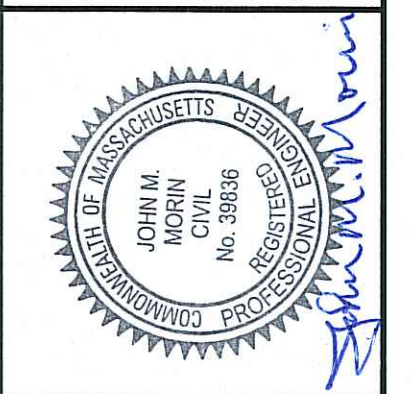
Pump Selection for a Pressurized System - Single Family Residence Project
Caperton - 19 Stonecleave Road, Boxford

Parameters	
Discharge Assembly Size	1.50 inches
Transport Length	43 feet
Transport Pipe Class	40
Transport Line Size	1.50 inches
Distributing Valve Model	None
Max Elevation Lift	8 feet
Manifold Length	6.7 feet
Manifold Pipe Class	40
Manifold Pipe Size	1.50 inches
Number of Laterals per Cell	5
Lateral Length	23 feet
Lateral Pipe Class	40
Lateral Pipe Size	1.25 inches
Orifice Size	1/8 inches
Orifice Spacing	1.33 feet
Residual Head	2 feet
Flow Meter	None
*Add-on Friction Losses	0 feet
Calculations	
Minimum Flow Rate per Orifice	0.27 gpm
Number of Orifices per Zone	100
Total Flow Rate per Zone	29.0 gpm
Number of Laterals per Zone	6
% Flow Differential 1st/Last Orifice	0.8 %
Transport Velocity	4.7 fps
Frictional Head Losses	
Loss through Discharge	2.0 feet
Loss in Transport	2.2 feet
Loss through Valve	0.0 feet
Loss in Manifolds	0.1 feet
Loss in Laterals	0.0 feet
Loss through Flowmeter	0.0 feet
*Add-on Friction Losses	0.0 feet
Pipe Volumes	
Vol of Transport Line	4.5 gals
Vol of Manifold	0.7 gals
Vol of Laterals per Zone	10.7 gals
Total Volume	15.9 gals
Minimum Pump Requirements	
Design Flow Rate	29.6 gpm
Total Dynamic Head	12.9 feet



System Curve: —
Pump Curve: —
Pump Optimal Range: —
Operating Point: □
Design Point: ◻

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SURVEY BY: PW/SR
DRAFTED BY: WAS
CHECKED BY: JMM
APPROVED BY: JMM
SCALE: 1"=20'
DATE: JULY 29, 2016

NO.	DESCRIPTION	DATE

SANITARY DISPOSAL SYSTEM REPAIR PLAN
IN
BOXFORD, MASSACHUSETTS
19 STONECLEAVE ROAD
(ASSESSOR'S MAP 31, BLOCK 1, LOT 6)
PREPARED FOR:
SERENA CAPERONS

DRAWING NO. S - 3464
SHEET NO. 3 OF 3