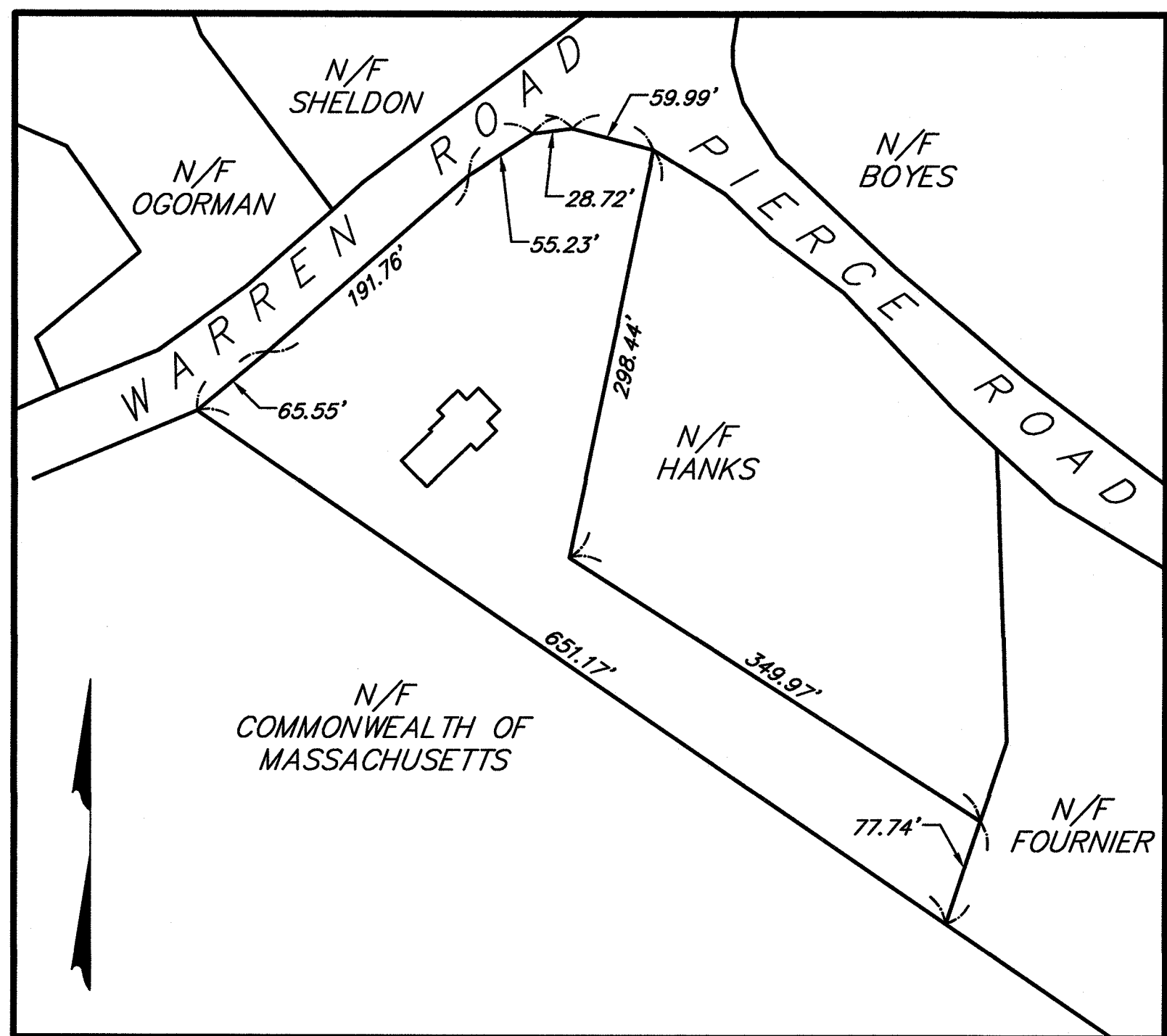
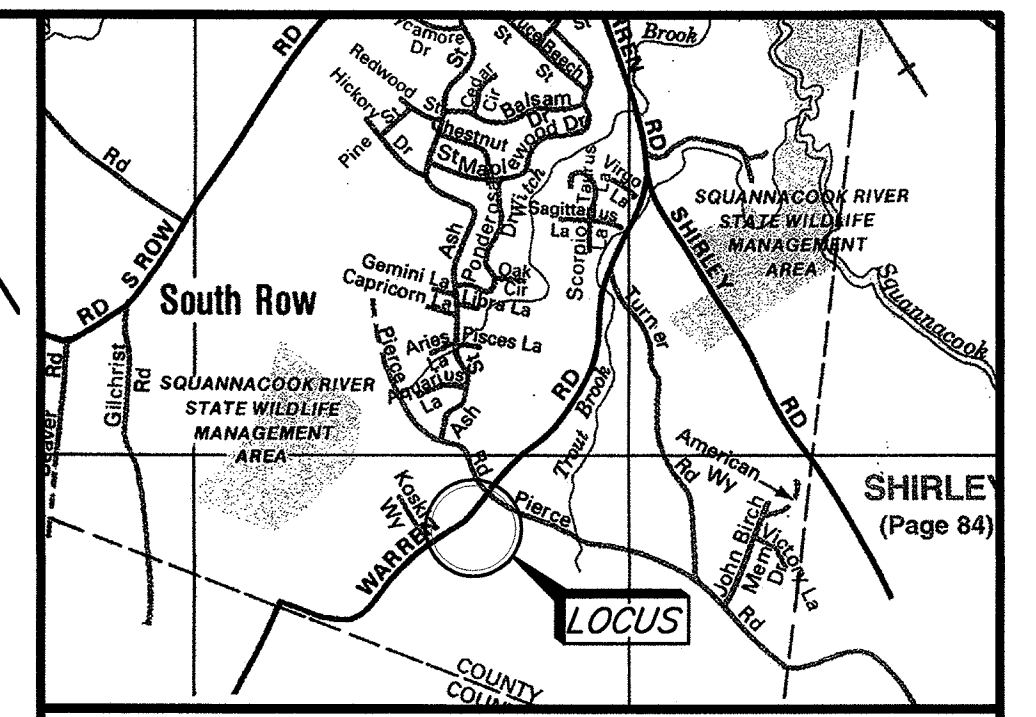
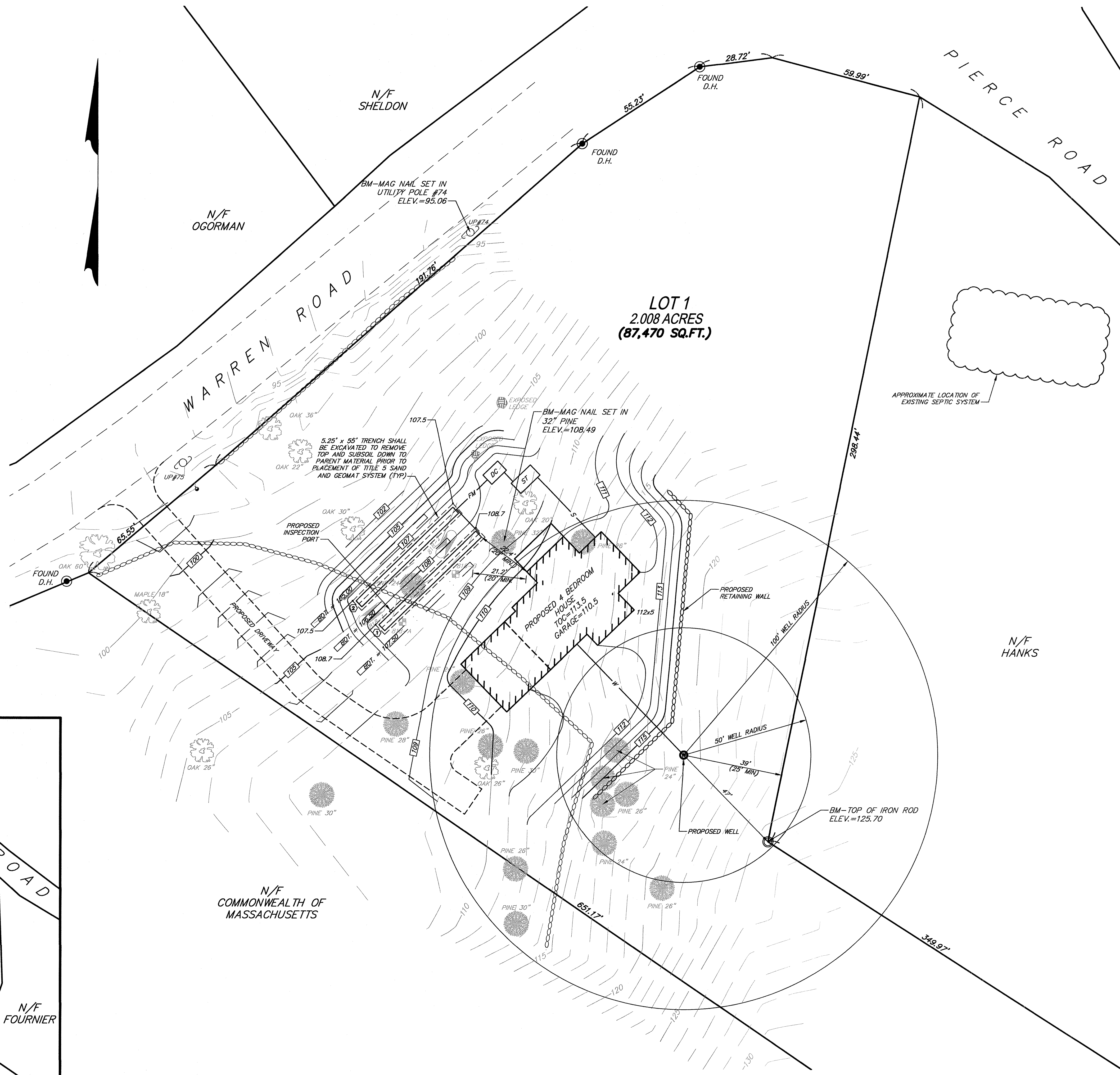


PROJECT NAME: HANKS	ST (H-10)	PLAN #: L-14172
JOB NUMBER: 32548		DATE: 12/28/2020
<b>BUOYANCY CALCULATIONS</b>		
DESCRIPTION: SEPTIC TANK		
TANK MANUFACTURER: SHEA		
ITEM NUMBER: TR-100 (H-10)		
TANK SIZE: 1,500 GAL.		
OUTSIDE DIMENSIONS:	LENGTH = 10.50 R.	ASSUMPTIONS: $\gamma_{water} = 62.4 \text{ lb/ft}^3$
	WIDTH = 5.67 R.	$\gamma_{soil} = 150.0 \text{ lb/ft}^3$
	HEIGHT = 5.67 R.	$\gamma_{soil} = 110.0 \text{ lb/ft}^3$
INSIDE DIMENSIONS:	LENGTH = 10.00 R.	
	WIDTH = 5.17 R.	
	HEIGHT = 5.00 R.	
SEASONAL HIGH GROUNDWATER ELEVATION =	104.0 R.	
TOP OF TANK ELEVATION =	107.4 R.	
BOTTOM OF TANK ELEVATION =	101.0 R.	
DEPTH OF SOIL COVER PROPOSED =	0.75 R.	
UPWARD FORCE OF GROUNDWATER (F)		
$F = PA$		
WHERE:	$P = (\text{GROUNDWATER ELEV.} - \text{BOT. OF TANK ELEV.}) \times \gamma_{water}$	
$A = \text{AREA OF TANK}$		
$F =$	7,000 Lb.	
DOWNWARD WEIGHT OF EMPTY TANK (W <sub>T</sub> )		
$W_T = (\text{OUTSIDE VOL. DIMENSIONS} - \text{INSIDE VOL. DIMENSIONS}) \times \gamma_{concrete}$		
$W_T =$	11,860 Lb.	
DOWNWARD WEIGHT OF SOIL COVER (W <sub>S</sub> )		
$W_S = \text{DEPTH OF SOIL COVER PROPOSED} \times \text{AREA OF TANK} \times \gamma_{soil}$		
$W_S =$	4,912 Lb.	
SUMMARY		
$W_T + W_S =$	16,772 Lb.	
$F =$	7,000 Lb.	
	0 Additional lbs. of ballast needed	

PROJECT NAME: HANKS	PC (H-10)	PLAN #: L-14172
JOB NUMBER: 32548		DATE: 12/28/2020
<b>BUOYANCY CALCULATIONS</b>		
DESCRIPTION: PUMP DOSING CHAMBER		
TANK MANUFACTURER: SHEA		
ITEM NUMBER: TR-100 (H-10)		
TANK SIZE: 1,000 GAL.		
OUTSIDE DIMENSIONS:	LENGTH = 8.00 R.	ASSUMPTIONS: $\gamma_{water} = 62.4 \text{ lb/ft}^3$
	WIDTH = 5.17 R.	$\gamma_{soil} = 150.0 \text{ lb/ft}^3$
	HEIGHT = 5.67 R.	$\gamma_{soil} = 110.0 \text{ lb/ft}^3$
INSIDE DIMENSIONS:	LENGTH = 7.50 R.	
	WIDTH = 4.67 R.	
	HEIGHT = 5.00 R.	
SEASONAL HIGH GROUNDWATER ELEVATION =	103.3 R.	
TOP OF TANK ELEVATION =	107.4 R.	
BOTTOM OF TANK ELEVATION =	101.7 R.	
DEPTH OF SOIL COVER PROPOSED =	0.75 R.	
UPWARD FORCE OF GROUNDWATER (F)		
$F = PA$		
WHERE:	$P = (\text{GROUNDWATER ELEV.} - \text{BOT. OF TANK ELEV.}) \times \gamma_{water}$	
$A = \text{AREA OF TANK}$		
$F =$	4,568 Lb.	
DOWNWARD WEIGHT OF EMPTY TANK (W <sub>T</sub> )		
$W_T = (\text{OUTSIDE VOL. DIMENSIONS} - \text{INSIDE VOL. DIMENSIONS}) \times \gamma_{concrete}$		
$W_T =$	8,988 Lb.	
DOWNWARD WEIGHT OF SOIL COVER (W <sub>S</sub> )		
$W_S = \text{DEPTH OF SOIL COVER PROPOSED} \times \text{AREA OF TANK} \times \gamma_{soil}$		
$W_S =$	3,412 Lb.	
SUMMARY		
$W_T + W_S =$	12,400 Lb.	
$F =$	4,568 Lb.	
	0 Additional lbs. of ballast needed	

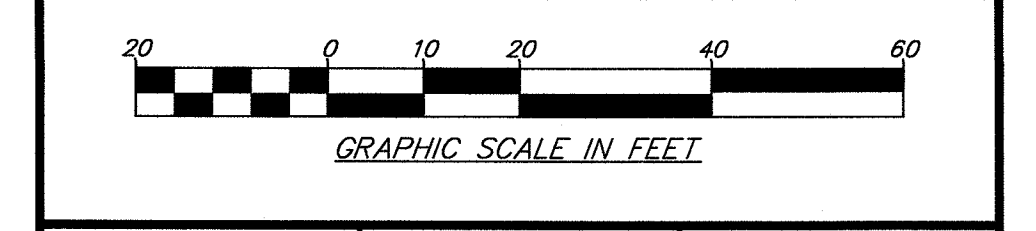


KEY MAP  
1"=100'



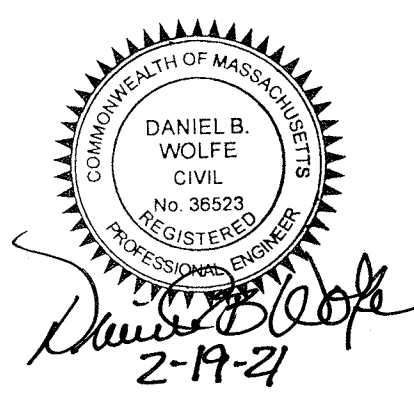
LOCUS MAP  
NOT TO SCALE

<b>LEGEND</b>		
	EXISTING CONTOUR	
	PROPOSED CONTOUR	
	PERCOLATION TEST HOLE	
	OBSERVATION TEST HOLE	
	SEWER LINE	
	WATER LINE	
	EDGE OF WETLANDS	



SURV: SPM/CRH	CALC.: KRC	DRAFT: KRM
NER: 801-30,31	DEED: 686.37-85	CHECK: DBW

<b>REVISIONS</b>	
1/12/20	Original endorsement
2/19/21	Conventional reserve area, inspection port location, top and subsoil removal



SHEET TITLE:  
SEWAGE DISPOSAL SYSTEM

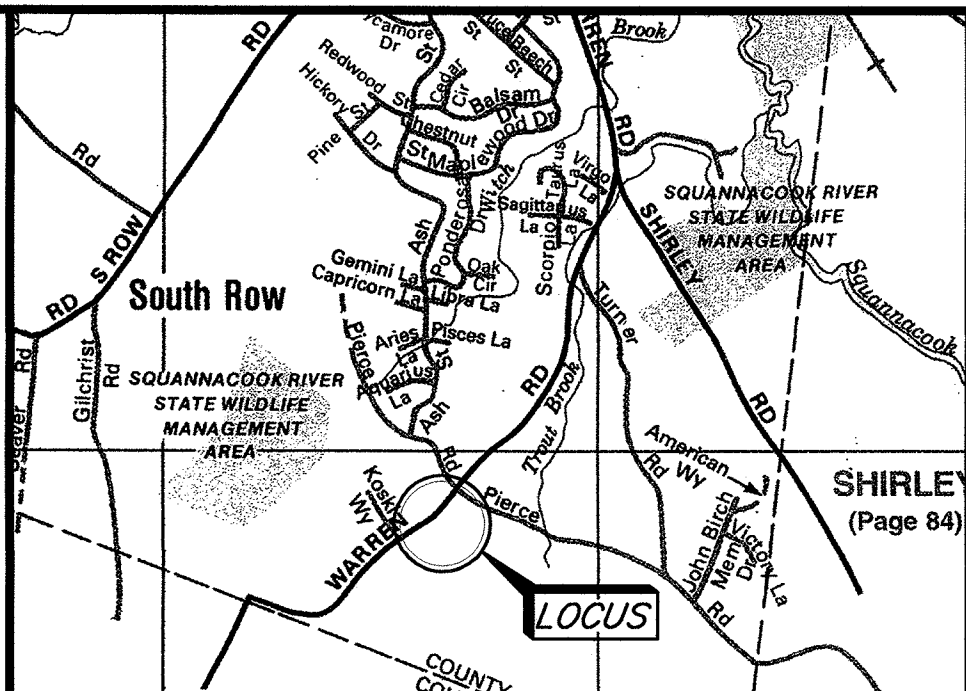
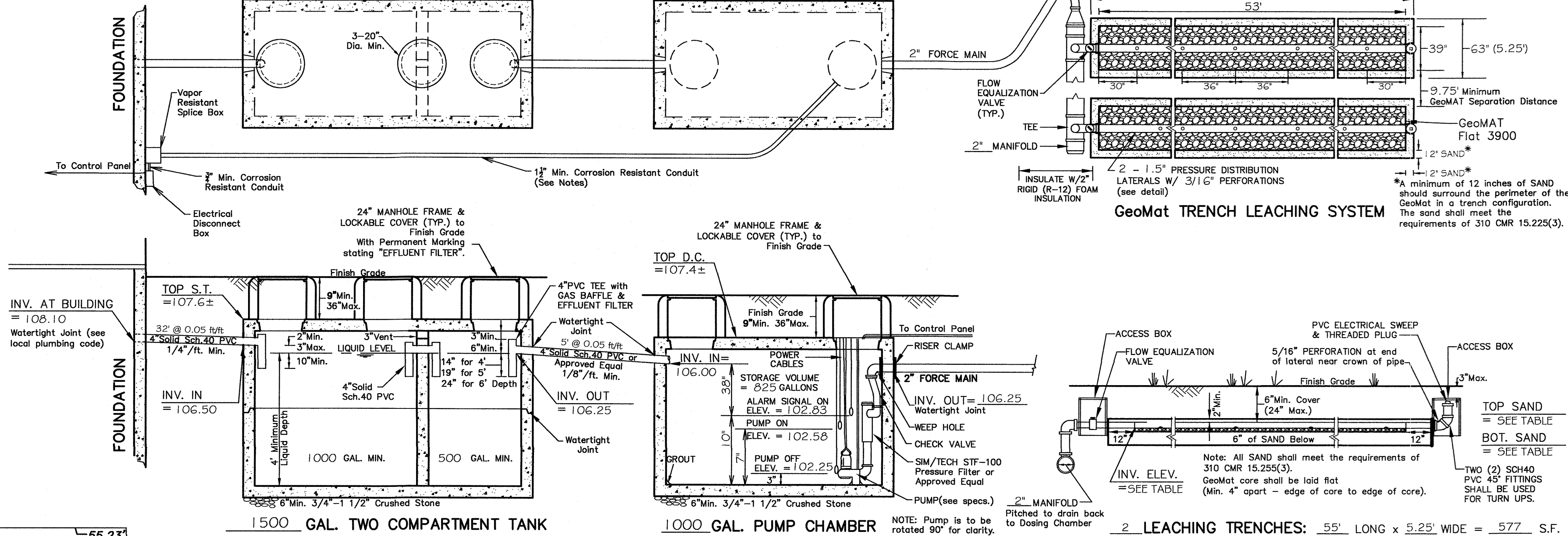
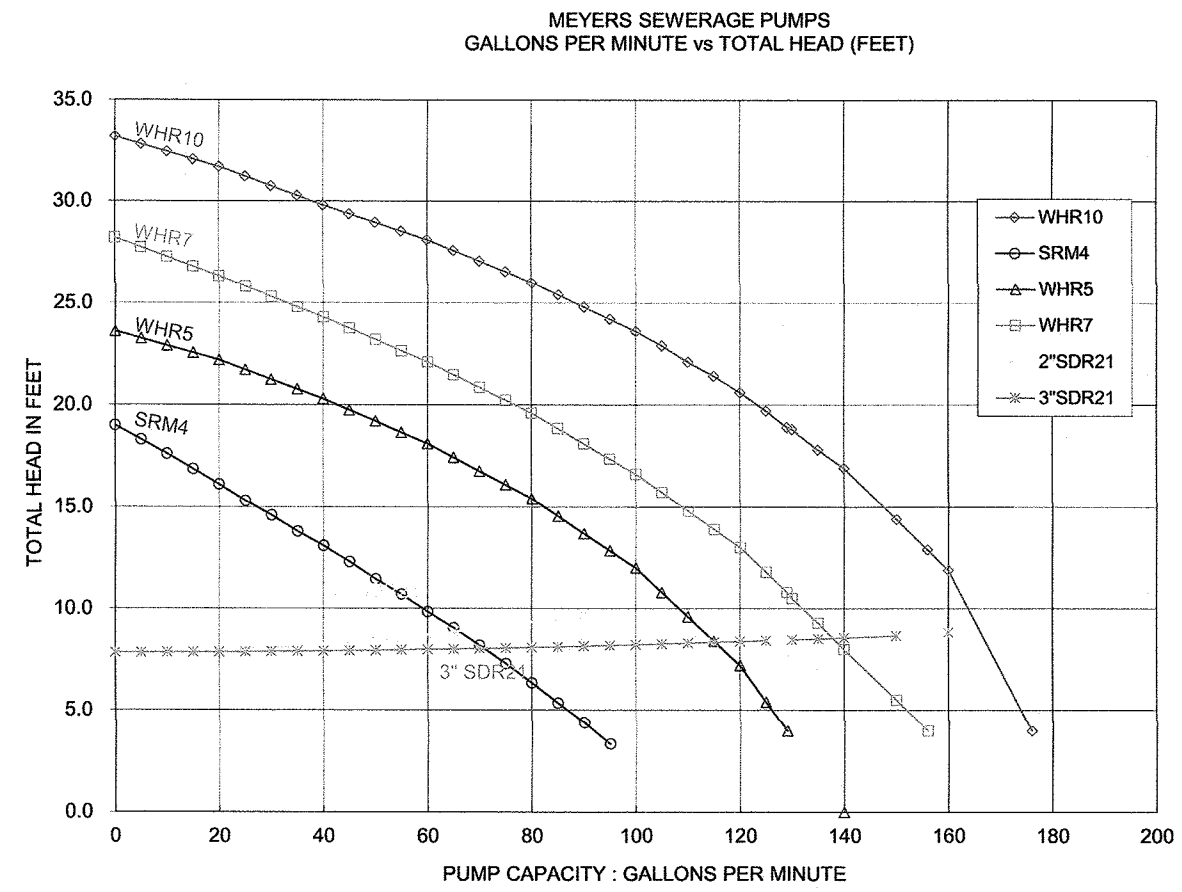
DESIGNED FOR: RICHARD HANKS & KAREN HILL

ADDRESS: 158 WARREN ROAD  
TOWNSEND, MA

LOT NO.: 1	ASSESSOR MAP: 31	ASSESSOR PARCEL: 21.1
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**DAVID E. ROSS ASSOCIATES, INC.**  
CIVIL ENGINEERS - LAND SURVEYORS  
ENVIRONMENTAL CONSULTANTS  
6 Lancaster County Road  
P.O. Box 795  
Harvard, MA 01451-0795  
978-772-6232  
FAX 978-772-8258  
www.davidross.com

SCALE: 1"=20'	DATE: JANUARY 2021
REF: --	PLAN NO.: L-14172
JOB NO.: 32548	SHEET NO.: 1 of 2

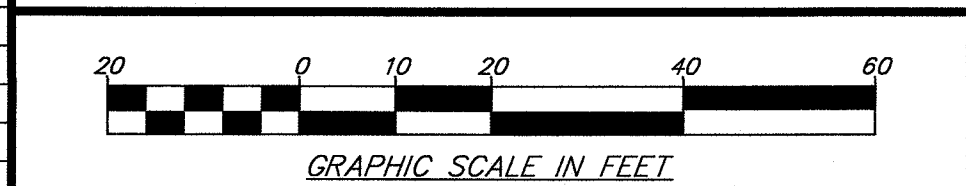


LOCUS MAP  
NOT TO SCALE

NOTES  
GARBAGE DISPOSALS AND WATER SOFTENERS SHALL NOT BE USED WITH THE GeoMAT LEACHING SYSTEM.  
GeoMAT LEACHING SYSTEM DESIGNED IN ACCORDANCE WITH GENERAL USE APPROVAL ISSUED TO GEOMATRIX SYSTEMS, LLC, JANUARY 11, 2017, MODIFIED MARCH 13, 2017, LAST MODIFIED JULY 14, 2017, TRANSMITTAL #W2/7826, AND THE STANDARD CONDITIONS FOR ALTERNATIVE SOIL ABSORPTION SYSTEMS, DATED MARCH 5, 2016.

OBSERVATION TEST HOLE DATA BY NEIL GORMAN, D.E.R.A., INC. WITNESSED BY RICK METCALF, N.A.B.H. 8/31/18

TEST	ELEVATION	SOIL TYPE	MOISTURE
81B-1	105.2'	Ap 0'-4" SANDY LOAM	
		Bw 4'-22" SANDY LOAM	
		C 22'-112" GRAVELLY SANDY LOAM W/ LENSES OF LOAMY SAND	
		MOTTLING AT 36" GROUNDWATER OBSERVED AT 108"	
		NO REFUSAL E.S.H.W.T. AT 36" (102.2)	
81B-2	105.2'	Ap 0'-4" SANDY LOAM	
		Bw 4'-24" SANDY LOAM	
		C 24'-108" GRAVELLY SANDY LOAM	
		MOTTLING AT 42" GROUNDWATER OBSERVED	
		NO REFUSAL E.S.H.W.T. AT 42" (101.7)	

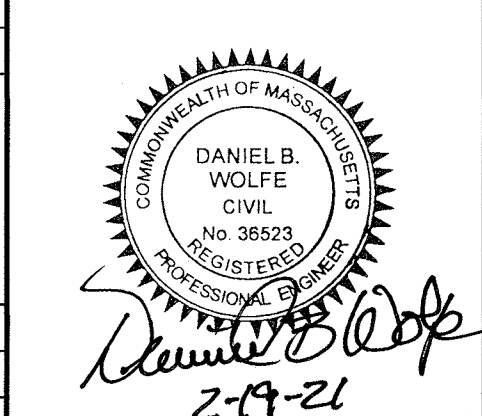


LINE NUMBER	TOP OF SAND	LATERAL INV. ELEV.	BOTTOM OF GeoMAT	BOTTOM OF SAND
1	108.25	108.08	108.00	107.50
2	107.00	106.83	106.75	106.25

SURV.	SPM/CRH	CALC.	KRC	DRAFT	KRM
NO.	801-30,31	DEED:	68637-85	CHECK:	DBW

REVISIONS

1/12/20 Original endorsement  
2/19/21 Two compartment tank, tank risers, conventional system reserve area, minimum cover increased, flow equalization valve box, pump curve, top of sand elevation

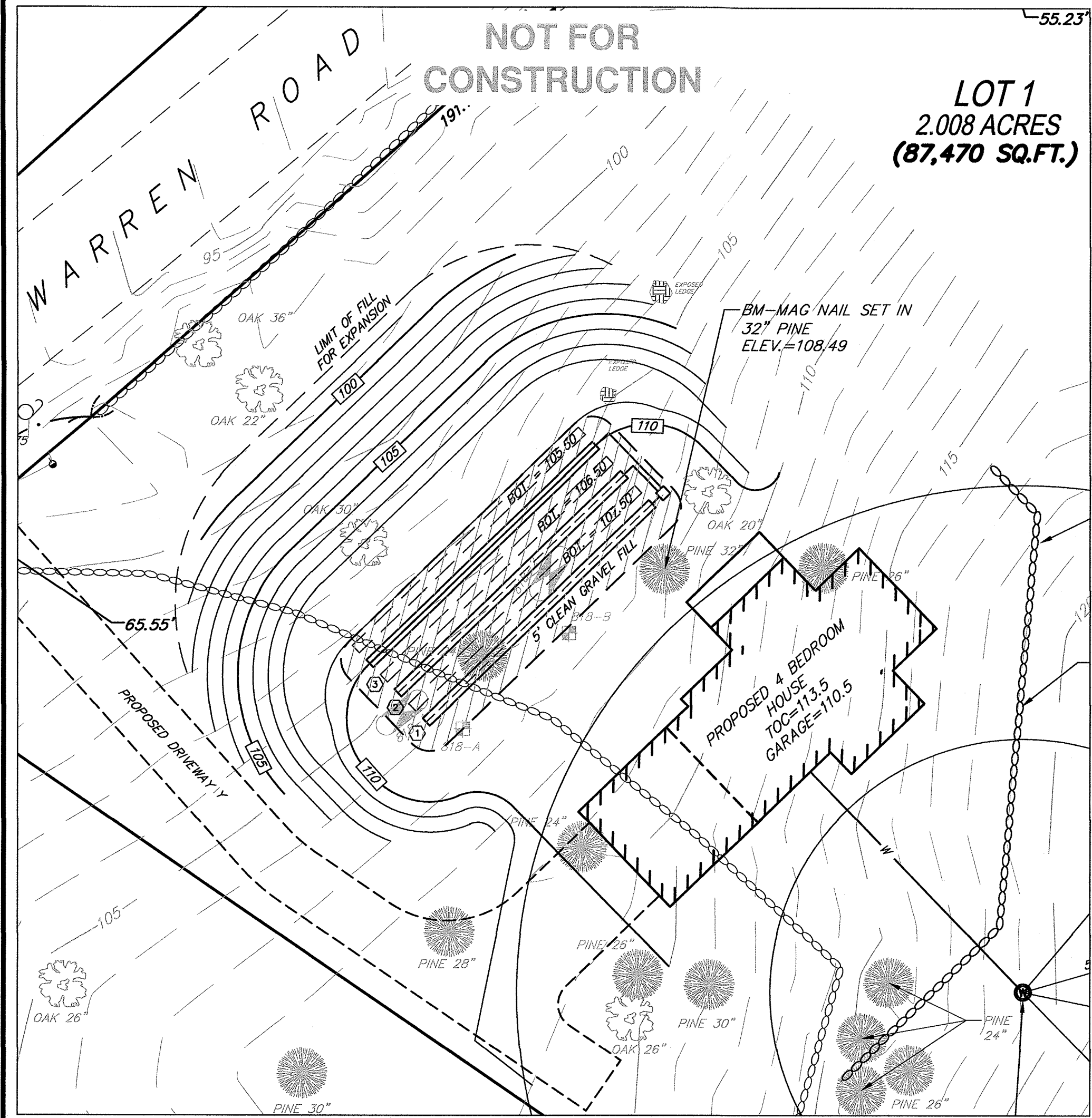


SHEET TITLE:  
**SEWAGE DISPOSAL SYSTEM**  
DESIGNED FOR:  
**RICHARD HANKS & KAREN HILL**  
ADDRESS:  
**158 WARREN ROAD TOWNSEND, MA**

LOT NO.: 1	ASSESSOR MAP: 31	ASSESSOR PARCEL: 21.1
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SCALE: 1"=20'  
DATE: JANUARY 2021  
REF.: --  
PLAN NO.: L-14172  
JOB NO.: 32548  
SHEET NO.: 2 of 2



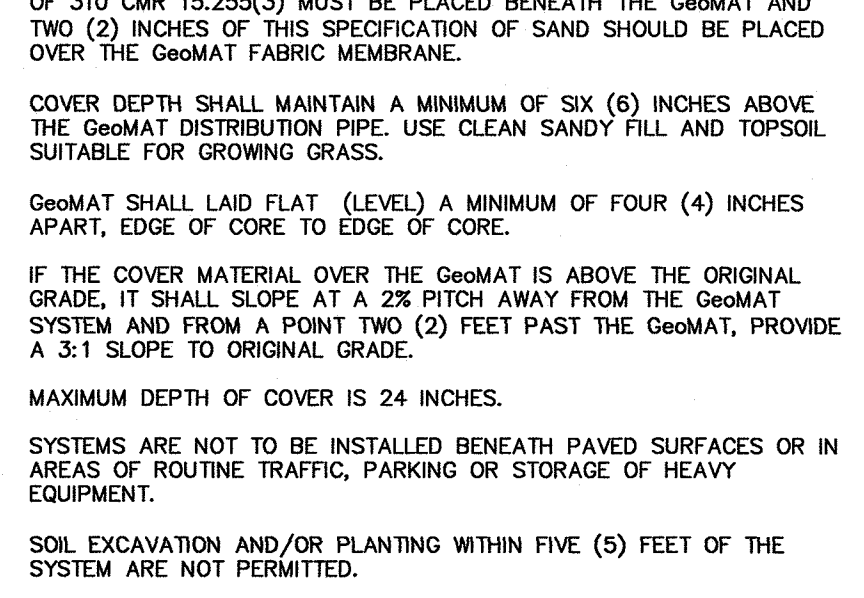
**SEPTIC TANK**  
SEPTIC TANK SHALL BE A PRECAST, REINFORCED CONCRETE TANK MADE WATER-TIGHT. CONSTRUCTION MATERIALS AND DIMENSIONS SHALL CONFORM TO TITLE 5 AND AASHTO HS 10 REQUIREMENTS AND PLACED ON A STABLE MECHANICALLY COMPACTED LEVEL BASE.  
TANK / SYSTEM TO BE VENTED THROUGH THE BUILDING PLUMBING SYSTEM AS REQUIRED BY BUILDING CODE.  
TANK SHOULD BE INSPECTED, MAINTAINED AND BE PUMPED OUT WHEN SLUDGE DEPTH IN THE BOTTOM EXCEEDS ONE FOURTH OF THE TOTAL LIQUID DEPTH.  
AT LEAST THREE 20" MANHOLES SHALL BE PROVIDED. INLET & OUTLET MANHOLES WITH RISERS AND LOCKABLE COVERS TO FINISH GRADE. ALL OTHERS TO WITHIN 6" OF FINISH GRADE.

**PUMP CHAMBER**  
GENERAL: ALL WORKMANSHIP, MATERIALS AND CONSTRUCTION SHALL CONFORM TO FEDERAL, STATE AND LOCAL CODES, WHETHER SPECIFIED HEREIN OR NOT. ALL PIPING, CONTROLS AND PUMP ARE SUBJECT TO APPROVAL BY THE DESIGN ENGINEER.  
CHAMBER: THE CHAMBER SHALL BE A PRECAST, REINFORCED CONCRETE SEPTIC TANK WITH PRE-FITTED BOOTS. CONSTRUCTION MATERIALS AND DIMENSIONS SHALL CONFORM TO TITLE 5 AND AASHTO HS 10 TO LOADING REQUIREMENTS AND SHALL BE PLACED ON A STABLE MECHANICALLY COMPACTED LEVEL BASE. ONE TANK MANHOLE SHALL EXTEND TO FINISHED GRADE AND BE MADE WATER-TIGHT. COVER SHALL BE METAL AND WEIGH 50 LBS. (MINIMUM) AND HAVE AN INSIDE DIAMETER 1 1/2 TIMES MAXIMUM PUMP DIMENSION AND HAVE A 24" INSIDE DIAMETER MINIMUM. CHAMBER TO BE VENTED VIA BUILDING PLUMBING SYSTEM TO ROOF. IF THE CHAMBER IS TO BE UNDER PAVED SURFACES OR SUBJECT TO VEHICULAR LOADING, THE CHAMBER, ALL MANHOLES AND EXTENSIONS SHALL BE RATED TO WITHSTAND AASHTO HS-20 DIRECT LOADING (HEAVY DUTY).  
PUMPS: PUMP SHALL BE A NON-CLOG SUBMERSIBLE SEWAGE PUMP CAPABLE OF PASSING A 1 1/4" DIAMETER SOLID AND STRINGY MATERIAL. PUMPS SHALL HAVE A 1/2 HP (MINIMUM) MOTOR AND SHALL BE CAPABLE OF PUMPING 2000 GALLONS PER MINUTE (GPM) AGAINST A TOTAL DYNAMIC HEAD (TDH) OF 9.04 FEET.  
ENGINEER SPECIFIED PUMP: MEYERS SRM4 OR EQUIVALENT.  
PUMP SIZE AND SPECIFICATIONS ARE BASED UPON THE PROPOSED DOSING CHAMBERS ELEVATIONS AND LOCATION SHOWN HEREON. ANY ALTERATIONS SHALL BE APPROVED BY THE DESIGN ENGINEER.  
CONTROLS: PUMP AND ALARM SHALL BE ACTIVATED BY MECHANICAL FLOAT SWITCHES AS SHOWN. THREE FLOATS ARE REQUIRED. FLOATS AND PUMP POWER CABLE ARE TO BE SUSPENDED FROM AND TIED TO A 1 1/2" DIAMETER, STEEL REBAR WITH HOSE CLAMPS. THE REBAR SHALL BE SECURELY AND PERMANENTLY ANCHORED TO THE SIDES AND/OR THE WALL OF THE CHAMBER.  
THE INTERIOR OF THE PUMP CHAMBER IS A CORROSIVE ENVIRONMENT AND EXPLOSIVE GASES MAY BE PRESENT. ALL WIRING AND ELECTRICAL EQUIPMENT MUST COMPLY WITH CURRENT ELECTRICAL CODE AND ALL APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.  
NO SPLICES ARE ALLOWED INSIDE THE PUMP CHAMBER. ELECTRIC LINES ARE TO BE CONTINUOUS FROM THE PUMP AND FLOAT SWITCHES TO A VAPOR PROOF, STRAIN RELIEF SPLICE BOX LOCATED OUTSIDE OF THE PUMP CHAMBER. VAPOR PROOF SPLICE BOX MAY BE ATTACHED TO THE EXTERIOR OF THE HOUSE OR LOCATED INSIDE AN ELECTRICAL PULL BOX. AN ELECTRICAL DISCONNECT BOX ATTACHED TO THE OUTSIDE OF HOUSE IS REQUIRED.  
MINIMUM SIZE OF CORROSION RESISTANT CONDUIT FROM PUMP CHAMBER TO SPLICE BOX IS 1 1/2". MINIMUM CONDUIT SIZE FROM SPLICE BOX TO DISCONNECT BOX IS 3". BOTH ENDS OF ALL CONDUITS ARE TO BE SEALED WITH DUCT SEAL TO PREVENT THE TRANSMISSION OF VAPORS AND GAS.  
THE DIMENSIONAL SETTINGS OF THE FLOATS (SEE DOSING CHAMBER DETAIL ON THIS SHEET) ARE THE ELEVATIONS AT WHICH THE FLOATS ARE TO ACTIVATE/INACTIVATE THE PUMP AND/OR ALARM. THE FLOAT LEVEL CONTROLS SHALL BE SET TO OPERATE AT THE ELEVATIONS INDICATED. THESE ELEVATIONS SHALL BE ADJUSTED BY THE INSTALLER TO ENSURE FUNCTION ACCORDING TO THESE SPECIFIC ELEVATIONS.  
THE CONTROL PANEL SHALL BE HOUSED IN A NEMA-1 CONTROL BOX SUITABLE FOR USE WITH ALL OF THE 'COMPONENT MANUFACTURERS' STANDARDS FOR THE EQUIPMENT USED AND SHALL HAVE AN AUDIO ALARM AND VISUAL ALARM WITH A MANUAL SILENCER. THE CONTROL PANEL SHALL BE INSTALLED IN A SUITABLE LOCATION INSIDE OF THE BUILDING. ALARM SHALL BE ON A SEPARATE CIRCUIT FROM THE PUMP. ALL ELECTRICAL WORK SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL BUILDING CODE REQUIREMENTS.  
FLOW EQUALIZATION VALVES SHALL BE INSTALLED BETWEEN THE MANIFOLD AND THE BEGINNING OF EACH LATERAL TO PROVIDE EQUAL HEAD / FLOW OF EFFLUENT TO ALL ROWS.  
PIPING: PIPING FROM PUMP TO 3' OUTSIDE TANK SHALL BE 2" SCHEDULE 40 (SDR-21) SOLVENT-WELDED PVC OR ABS. CHECK VALVE SHALL BE 2" BALL-TYPE WITH 2 HOSE CLAMP CONNECTIONS AT EACH SIDE OF THE JOINT. RISER CLAMPS WITH PVC INSERTS ARE REQUIRED AT PUMP CHAMBER. ALL PIPING SHALL BE SHIELDED FROM ANY ABRASION (INCLUDING FORCE MAIN).  
FORCE MAIN: FORCE MAIN SHALL HAVE 4" MINIMUM COVER EXCEPT WITHIN 5' OF THE CHAMBER AND MANIFOLD WHICH SHALL BE INSULATED WITH 2" RIGID PRE-MOLDED POLYSTYRENE INSULATION. FORCE MAIN SHALL BE 1.5" SDR-21 PVC TIGHT JOINT PIPE. JOINTS SHALL BE SOLVENT-WELDED. TRANSITION BETWEEN DOSING CHAMBER PIPING AND FORCE MAIN SHALL BE WITH A 2" PVC UNION SOCKET. ALL PIPES SHALL BE SET IN 6" OF SAND AND BE SNAKED TO ALLOW FOR CONTRACTION AND BE LAID TO PROVIDE A DOWNWARD GRADIENT FROM THE CHAMBER TO THE MANIFOLD TO THE CHAMBER. ALL JOINTS SHALL BE WATER AND PRESSURE TIGHT WITH NO LEAKAGE ALLOWED.  
A PORTION OR ALL OF THE FORCE MAIN MAY BE PROPOSED TO BE INSTALLED ABOVE THE FROST LINE. THOSE PORTIONS, IN ACCORDANCE WITH TITLE 5 310 CMR 15.225(3) SHALL BE INSULATED ADEQUATELY OR BE MADE SELF DRAINING.

**GeoMAT LEACHING SYSTEM**  
GeoMAT LEACHING SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS OF THE MASSACHUSETTS GeoMAT LEACHING SYSTEM DESIGN MANUAL FOR PRESSURE AND GRAVITY APPLICATIONS, DATED SEPTEMBER 2017. GeoMAT IS A PRODUCT OF GEOMATRIX, 114 MILL ROCK ROAD EAST, OLD SAYBROOK, CT 06475 (860-510-0730, www.geomatrixsystems.com).  
ALL LOAM, LARGE BOULDERS OR FOREIGN MATERIAL ENCOUNTERED DURING EXCAVATION ARE TO BE REMOVED FROM THE LEACHING AREA.  
AVOID WORKING SOILS THAT ARE MOIST OR WET BECAUSE THEY CAN EASILY SMEAR AND COMPACT.  
PROPERLY SCARIFY THE DRAIN FIELD BASE BEFORE INSTALLING COMPONENTS.  
A MINIMUM OF SIX (6) INCHES OF SAND MEETING THE REQUIREMENTS OF 310 CMR 15.225(3) MUST BE PLACED BENEATH THE GeoMAT AND TWO (2) INCHES OF THIS SPECIFICATION OF SAND SHOULD BE PLACED OVER THE GeoMAT FABRIC MEMBRANE.  
COVER DEPTH SHALL MAINTAIN A MINIMUM OF SIX (6) INCHES ABOVE THE GeoMAT DISTRIBUTION PIPE. USE CLEAN SANDY FILL AND TOPSOIL SUITABLE FOR GROWING GRASS.  
GeoMAT SHALL LAID FLAT (LEVEL) A MINIMUM OF FOUR (4) INCHES APART, EDGE OF CORE TO EDGE OF CORE.  
IF THE COVER MATERIAL OVER THE GeoMAT IS ABOVE THE ORIGINAL GRADE, IT SHALL SLOPE AT A 2% PITCH AWAY FROM THE GeoMAT SYSTEM AND FROM A POINT TWO (2) FEET PAST THE GeoMAT, PROVIDE A 3% SLOPE TO ORIGINAL GRADE.  
MAXIMUM DEPTH OF COVER IS 24 INCHES.  
SYSTEMS ARE NOT TO BE INSTALLED BENEATH PAVED SURFACES OR IN AREAS OF ROUTINE TRAFFIC, PARKING OR STORAGE OF HEAVY EQUIPMENT.  
SOIL EXCAVATION AND/OR PLANTING WITHIN FIVE (5) FEET OF THE SYSTEM ARE NOT PERMITTED.

**GeoMAT LEACHING SYSTEM**  
SCHEDULE 40 (SDR-21) SOLVENT-WELDED PVC OR ABS. CHECK VALVE SHALL BE 2" BALL-TYPE WITH 2 HOSE CLAMP CONNECTIONS AT EACH SIDE OF THE JOINT. RISER CLAMPS WITH PVC INSERTS ARE REQUIRED AT PUMP CHAMBER. ALL PIPING SHALL BE SHIELDED FROM ANY ABRASION (INCLUDING FORCE MAIN).  
FORCE MAIN: FORCE MAIN SHALL HAVE 4" MINIMUM COVER EXCEPT WITHIN 5' OF THE CHAMBER AND MANIFOLD WHICH SHALL BE INSULATED WITH 2" RIGID PRE-MOLDED POLYSTYRENE INSULATION. FORCE MAIN SHALL BE 1.5" SDR-21 PVC TIGHT JOINT PIPE. JOINTS SHALL BE SOLVENT-WELDED. TRANSITION BETWEEN DOSING CHAMBER PIPING AND FORCE MAIN SHALL BE WITH A 2" PVC UNION SOCKET. ALL PIPES SHALL BE SET IN 6" OF SAND AND BE SNAKED TO ALLOW FOR CONTRACTION AND BE LAID TO PROVIDE A DOWNWARD GRADIENT FROM THE CHAMBER TO THE MANIFOLD TO THE CHAMBER. ALL JOINTS SHALL BE WATER AND PRESSURE TIGHT WITH NO LEAKAGE ALLOWED.  
A PORTION OR ALL OF THE FORCE MAIN MAY BE PROPOSED TO BE INSTALLED ABOVE THE FROST LINE. THOSE PORTIONS, IN ACCORDANCE WITH TITLE 5 310 CMR 15.225(3) SHALL BE INSULATED ADEQUATELY OR BE MADE SELF DRAINING.

**GeoMAT LEACHING SYSTEM (PRESSURE DOSED-CROSS SECTION)**  
NOT TO SCALE



**DESIGN CRITERIA**  
GARBAGE GRINDERS - NOT PERMITTED  
FLOWS: 4 BEDROOMS AT 110 GPD = 440 GPD (330 GPD MIN.)  
SEPTIC TANK REQUIRED: ( 1500 GAL. MIN.)  
440 GPD X 2.0 = 880 GAL. TANK  
LEACHING AREA PROVIDED:  
A. BASIS 5 MIN./IN. PERCOLATION RATE  
B. SIDEWALL AREA PROVIDED 372 S.F.  
372 S.F. X 0.60 GPD/SF = 223 GPD  
C. BOTTOM AREA PROVIDED = 372 S.F.  
372 S.F. X 0.60 GPD/SF = 223 GPD  
D. TOTAL G.P.D. PROVIDED 446  
E. TOTAL SF. PROVIDED 744

**TRADITIONAL PRIMARY TRENCH ELEVATION SCHEDULE**  
3 TRENCHES 62L x 2W x 1D = 744 S.F.

TRENCH NUMBER	TOP STONE	HIGH INV. ELEV.	LOW INV. ELEV.	BOTTOM STONE
1	109.81	109.31	109.00	108.00
2	108.81	108.31	108.00	107.00
3	107.81	107.31	107.00	106.00

FUTURE EXPANSION: 3 TRENCHES 62L x 2W x 1D = 744 S.F. (BOTTOM ELEVATIONS SHOWN IN PLAN VIEW ABOVE)

**TRADITIONAL LEACHING SYSTEM DESIGN**  
(FOR PROOF OF FEASIBILITY ONLY - NOT FOR CONSTRUCTION)  
SCALE 1"=20'

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