What is a Complete Design?

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Current Version Updated 5/14/14!!

A Complete Design will Avoid Permitting Delays!

Use most up to date design forms. Current available version is dated ~~6/13/13, but a new one is coming~~.

http://septic.umn.edu/formsandsheets

What type of design can YOU design?

- Designer levels
  - Basic: Type I- III up to 2,500 gpd
  - Intermediate: + Type IV up to 2,500 gpd
  - Advanced: >2,500 gpd and high strength waste (HSW)

Permit Determination - ISTS

- If the SSTS is designed to:
  - receive 5,000 gpd or less,
  - the system is classified as an Individual SSTS (ISTS)
  - regulated by a local ordinance in compliance with chapter 7080

Permit Determination - MSTS

- If the SSTS is designed to
  - receive 5,001 gpd to 10,000 gpd
  - the system is classified as a mid-sized SSTS (MSTS)
  - regulated by a local ordinance in compliance with chapter 7081

Nitrogen Removal

- 2500 -5,000 gpd
  - If discharging to an aquifer, need BMP's
  - List of BMP's from MPCA
- 5,000 – 10,000 gpd
  - If discharging to an aquifer, need to meet 10 mg/l Total N at nearest well or property boundary
  - If not discharging to an aquifer, BMP's

Permit Determination - LSTS

- If a single SSTS or group of SSTS
- Under single ownership
- Within one-half mile of each other
- Designed to treat an average design flow greater than 10,000 gallons per day
- The system requires is a LSTS and requires a SDS permit from the MPCA

Who can design & review?

	< 2,500 gpd Domestic Strength	2,501 to 5,000 gpd	5,001 to 10,000 gpd
Type I, II or III	Designer/ Inspector	Advanced Designer/ Inspector	Advanced Designer
Type IV	Intermediate Designer/ Inspector	Advanced Designer/ Inspector	Advanced Designer
Type IV for HSW	Advanced Designer/ Inspector	Advanced Designer/ Inspector	Advanced Designer/ Inspector
Type V	PE/PSS w/ ID	PE/PSS w/ AD	PE/PSS w/ AD

Class V injection well

- Class V Wells
  - All single family dwellings which discharge non-sewage
  - All multiple family dwellings
  - Establishments that have the capacity to serve over 20 people that have subsurface discharges

Class V Injection Well

- Requirements:
  - submit basic inventory information (on website or in manual)
  - operate the well such that a underground source of water is not endangered
- If met, the operation of the Class V well is authorized by rule

Assistance available to help those gaining "Advanced Certifications"

1. Customized tutoring
2. Field day with CEUs
   - July 23rd
   - Near Marshall
3. Audit class again for free if you do not pass on first try

Design, installation and inspection of the building sewers?

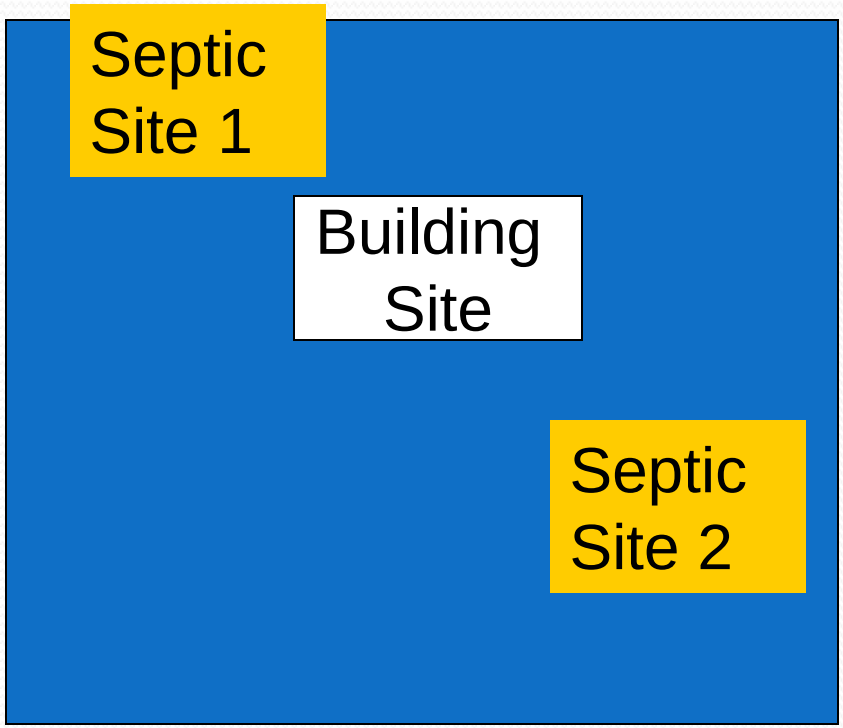
- Plumbing code
- Inspection? Local plumbing inspector?
- Commercial project – State plumbing inspector
- As SSTS Inspector you can look at this pipe but can not perform an official plumbing inspection
- Pipelayer card/bond required to install
- This may change in the future

Overall design requirements

- 2 Sites
- Site protection
- Maintenance route
- Design
  - Site evaluation
  - Site map
  - Design
  - Cert. Statement
    - Designer
    - Homeowner (Carver County)
      - New Condensed Summary Sheet for Homeowner to sign - # of Bedrooms, Garbage Disposal, Lift in the Basement, Property Lines,)

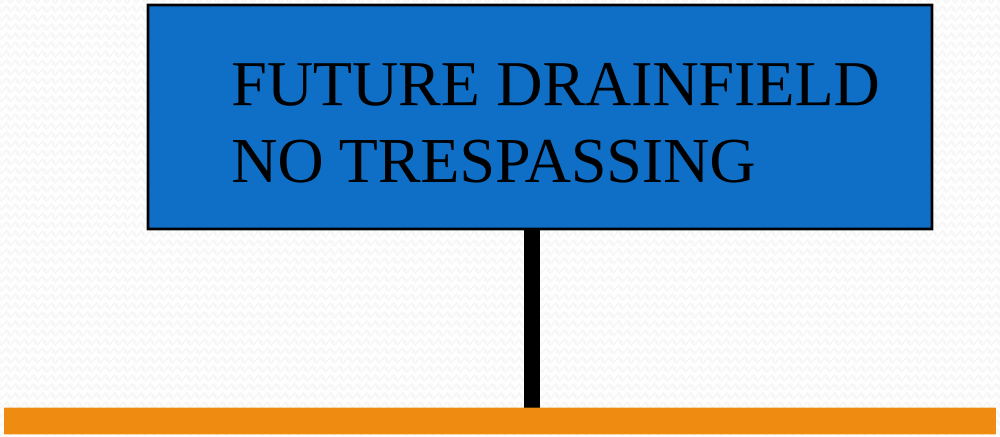
Two Soil Treatment Areas

- Newly-platted Lots
  - > 1 / 23 / 96
- 7082.0100
  - Subpart 3.A.6.
- Type I sizing
- Does not apply to existing lots
- Does not dictate what is installed



Site Protection

- Lack of adequate fencing →Delays Building Permit
- "Protect from disturbance, compaction, other damage by staking, fencing, posting or other effective method."
- New Construction
  - Snow fencing recommended with sign
  - Stakes at corners
- Future
  - Include in design
  - Inform homeowner



Field Evaluation Requirements

- See Soil Observation Log
- Lot lines
- Surface Features
  - **the percent and direction of the slope** at the proposed system location;
  - vegetation types;
  - any evidence of cut or filled areas or disturbed or compacted soil;
  - the flooding or run-on potential; and
  - a geomorphic description.

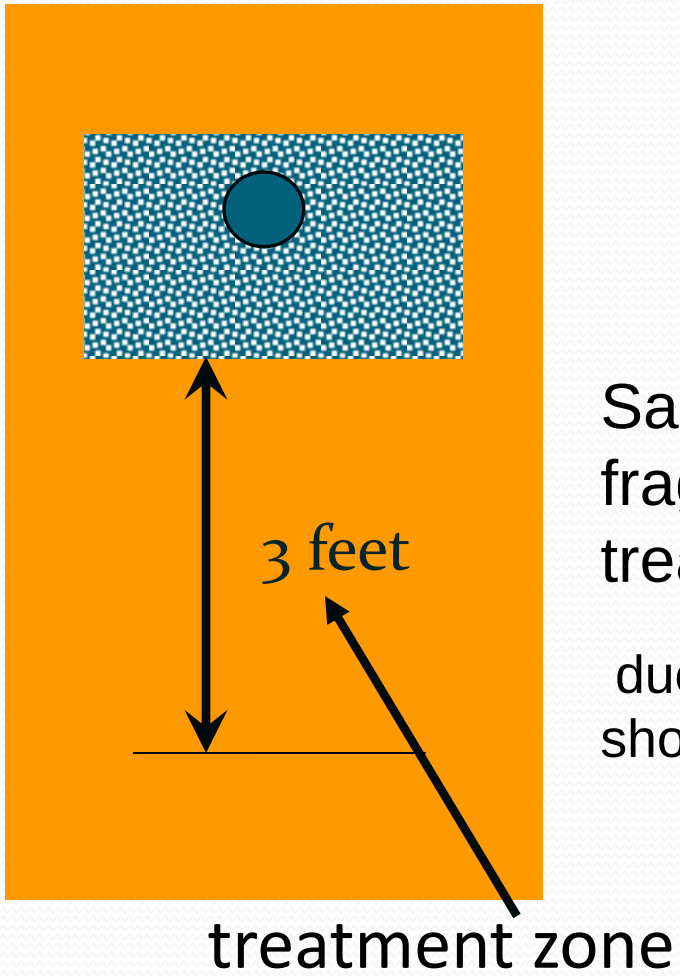
How Many Soil Observations?

- Minimum
  - Code - 3 per Site within borders of system
  - Required- understand the site
  - One in the worst location
  - Exposed pit or by hand auguring or probing
  - Minimum depth = to the periodically saturated layer, to the bedrock, or three feet below the proposed depth of the system
- Recommended
  - 3-5 per Site
  - Variation= More observations

Fragments and Sands

- Sandy soil with 35% or greater coarse fragments is equal to a percolation rate of less than 0.1 MPI
- Effluent moves through these soils too fast for effective treatment to occur

Limited Treatment Layers

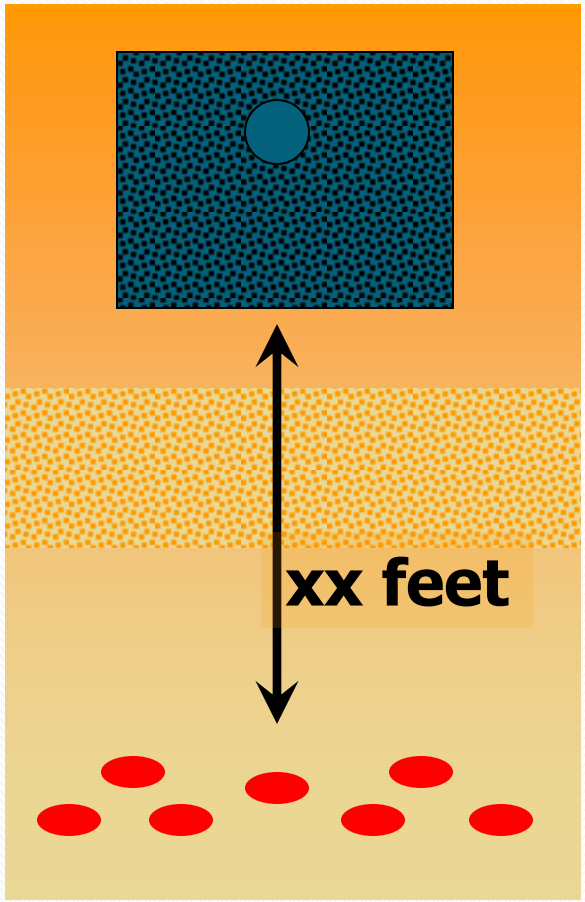


Sand with coarse fragments provides less treatment

due to low surface area and short residence time

Limited Treatment Layers

- Any <u>sandy soil</u> layers in which has 35 to 50% percent coarse fragments is credited at 50% treatment value
- Any soil layers in which has greater than 50% percent coarse fragments is not credited for treatment value



Rapidly Permeable Soils - Treatment

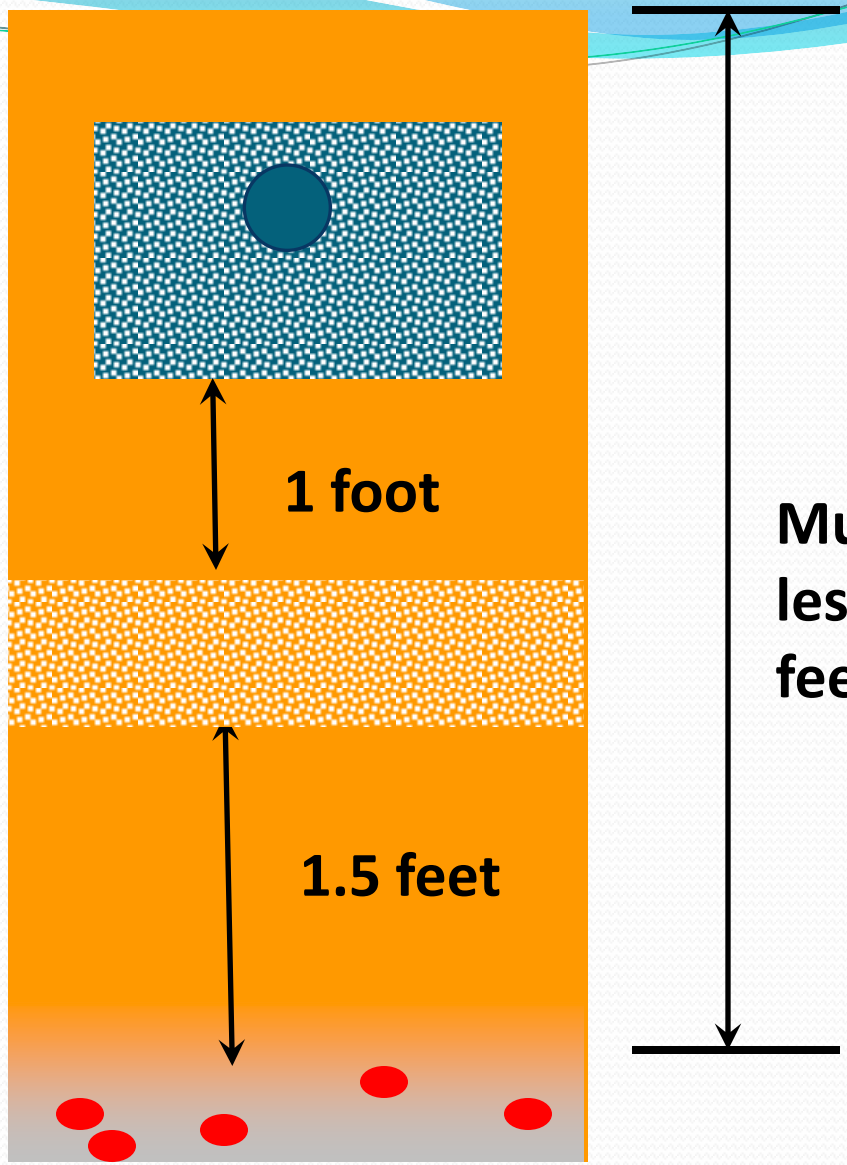
% Coarse Fragments	Non-sandy Textures	All sandy textures
0 - 35%	100% T	100% T
36 - 50%	**100% T**	**50% T**
>50%	NT	NT

100% T = Full Treatment 50% T = ½ Treatment Credit

NT = No Treatment

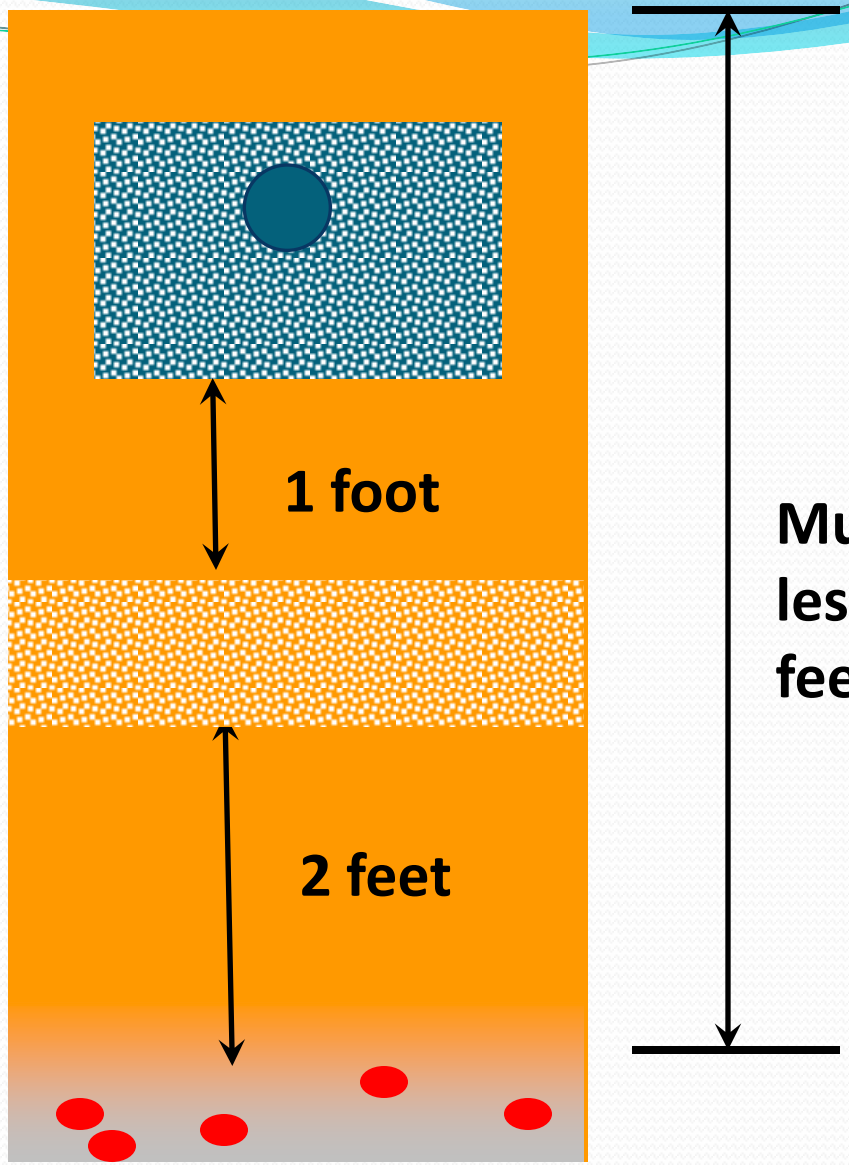
Example

40 % Coarse Fragments → 1 foot = 6”



Example

More than 50 % Coarse Fragments → **1 foot = 0”**



Can you reuse components?

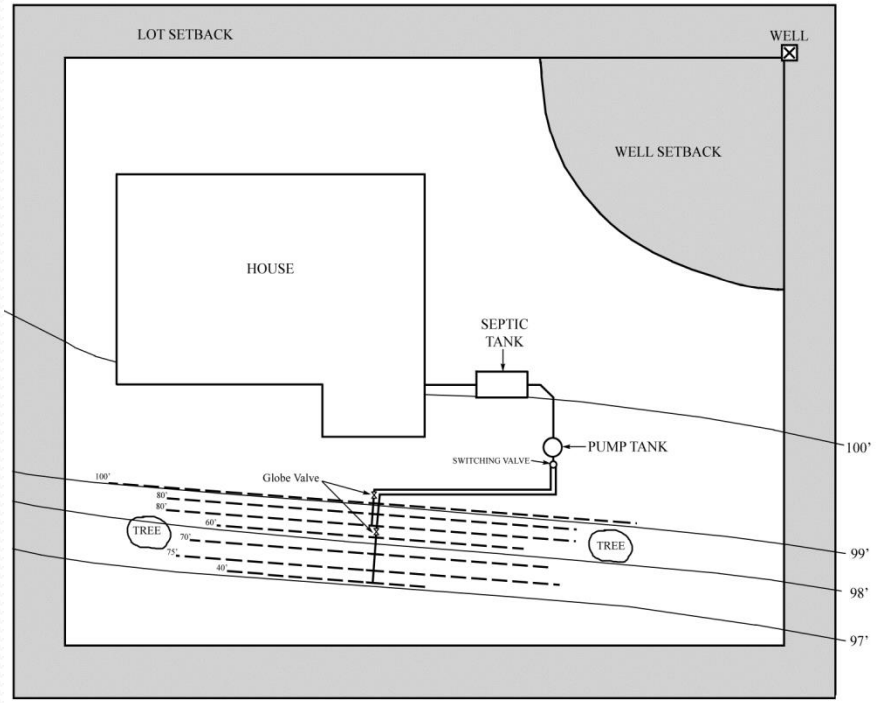
- Be careful
- Identify who is responsible to confirm water tightness of tanks
  - Designer or Installer
  - Tanks pumped?

Drainage

- Identify natural drainage patterns on site
  - Flow
  - Floodplain and floodway
- Where does stormwater from improvements go?
  - Downspouts, impervious cover
- Treatment systems: runoff from fields
  - Water shedding
  - Multiple zones: drainage paths between zones

Complete Plan

- Date of field evaluation and design (and revision date of needed)
- All components specified
- Component size specified
- Component location specified
- Maintainability of components

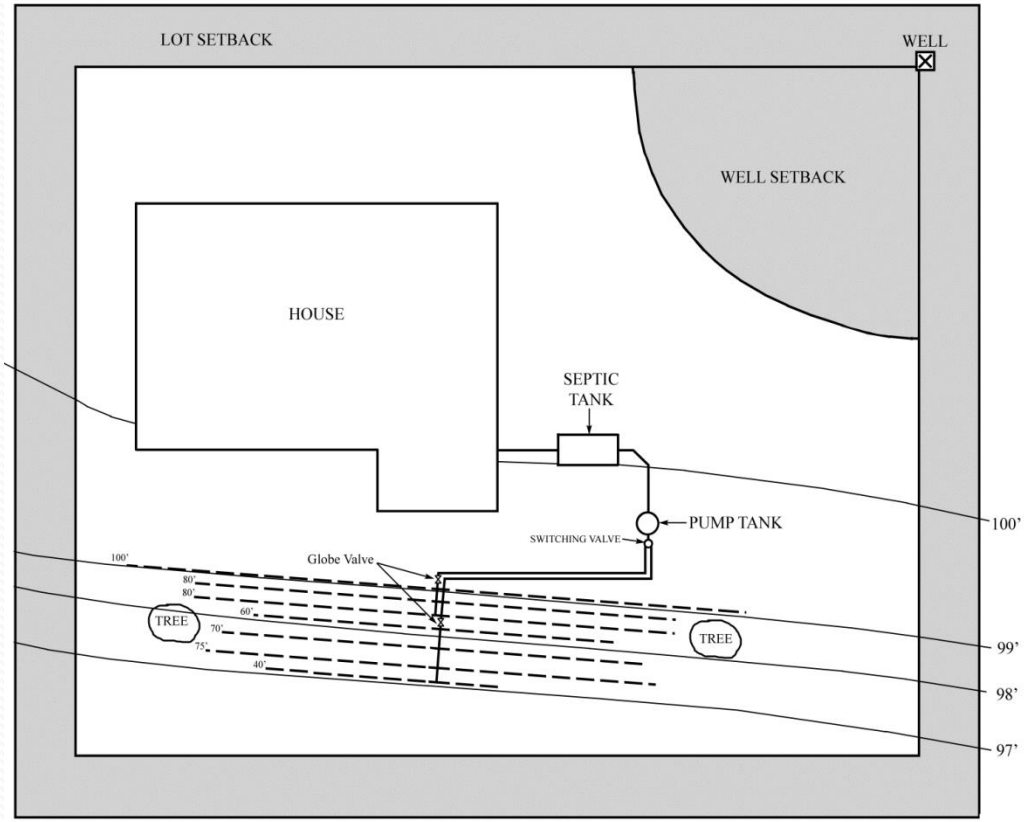


What should be on a site plan?

- Site features
  - Existing
  - Proposed
- Topographic plan
- Bench mark
- Drainage plan
- 100-year flood plain
- Water wells
- Property lines
- Replacement areas?
- Location of soil evaluation
- Features needing horizontal separation
  - Water supply lines
    - Public and private
  - Water features
    - Streams, ponds, lakes, rivers, creeks, salt water, retention ponds
  - Surface improvements
  - Easements
    - Underground and overhead
  - Steep slopes & drainage

Site plan

- Graphical representation of site
  - Existing features
  - Proposed features
  - Horizontal setbacks
    - Water bodies
    - Property lines
    - Wells
    - Others



Topographic plan

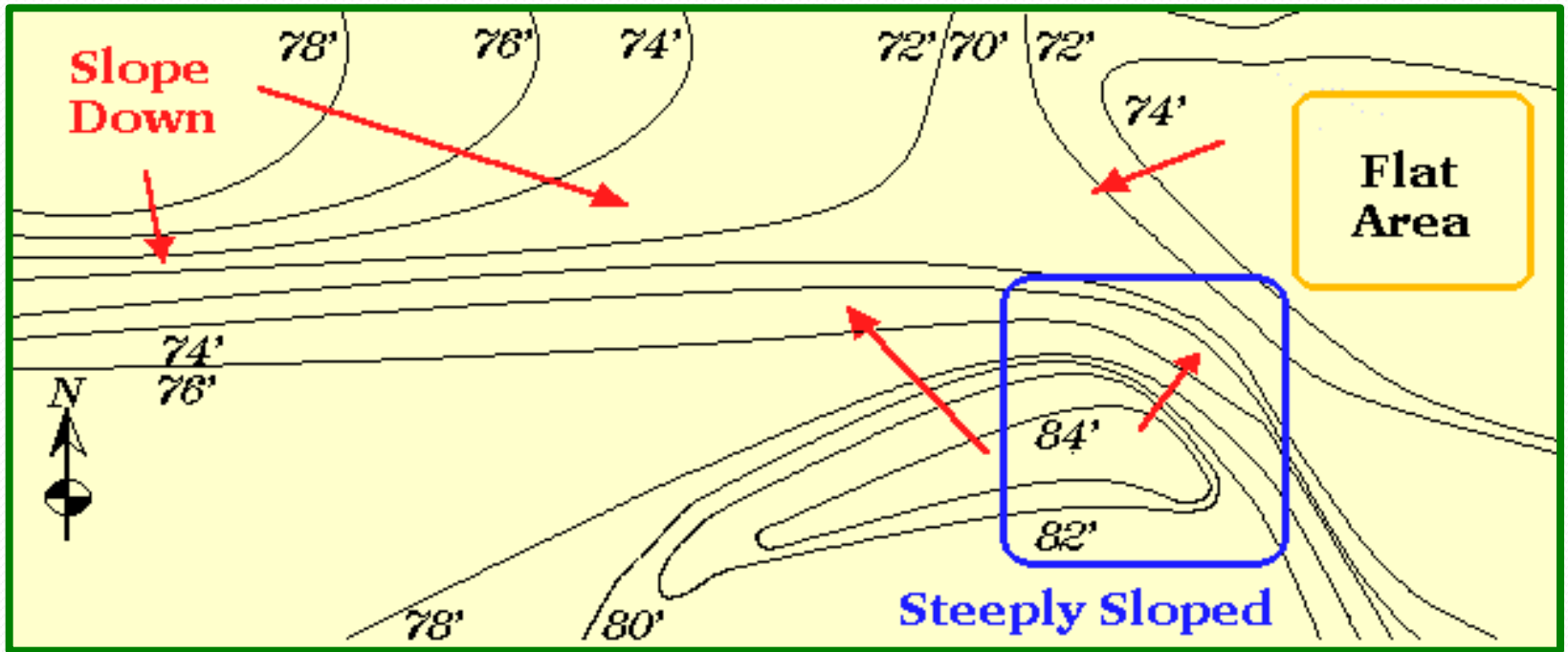
- Map representing the changes in elevation on a site
- Contour lines are the representation, on the plan, of the variation in elevation
- Elevation in landscape is relative to a known point - bench mark

Elevations required on every design

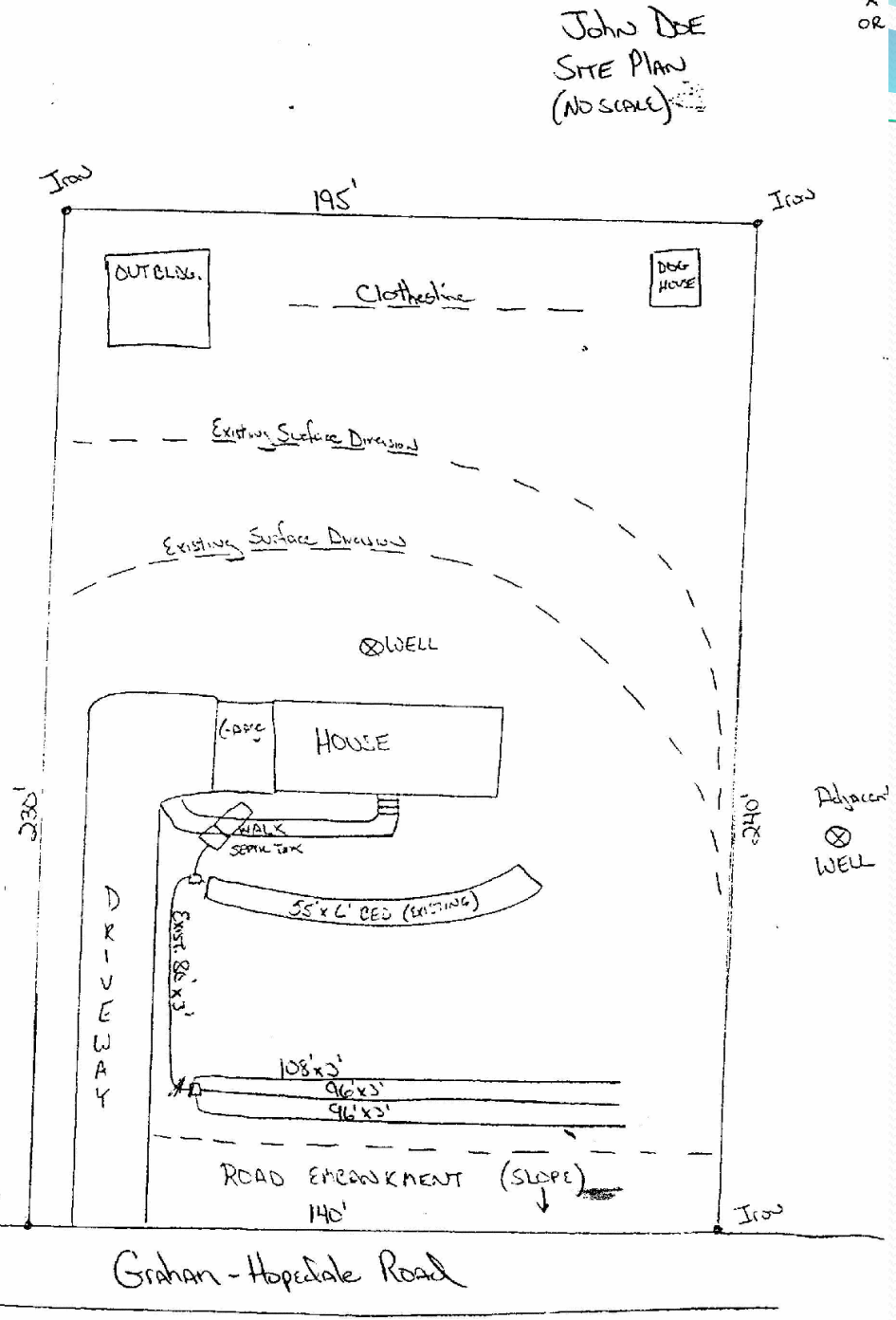
- Soil observations
- System depth
- Benchmark
  - A fixed point of known elevation in the landscape set at a reasonable distance from the installation site
  - It can be referenced to a national or local datum or it can be set arbitrarily
  - Without a bench mark, the installer cannot accurately set elevations at the site
- Label these on your map!

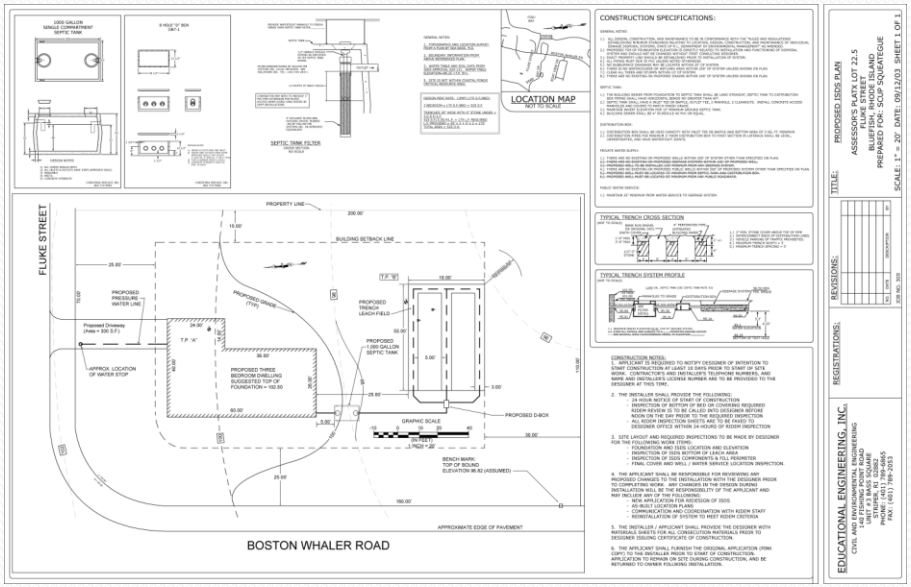
Topographic plan

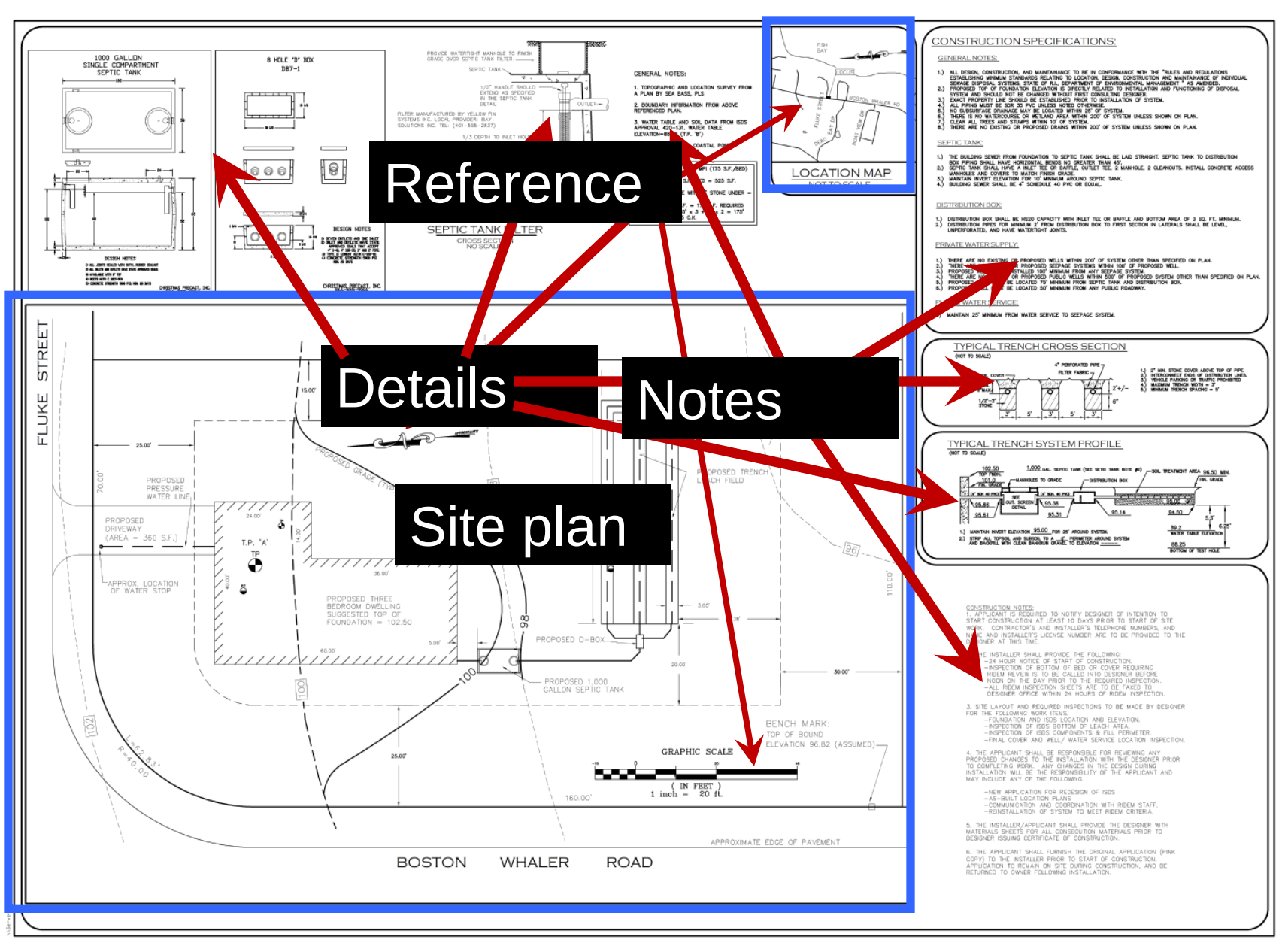
- Contour lines: lines with the same elevation
  - Need to note the elevation change
  - Distance between contour lines shows slope
- Drainage paths can be inferred

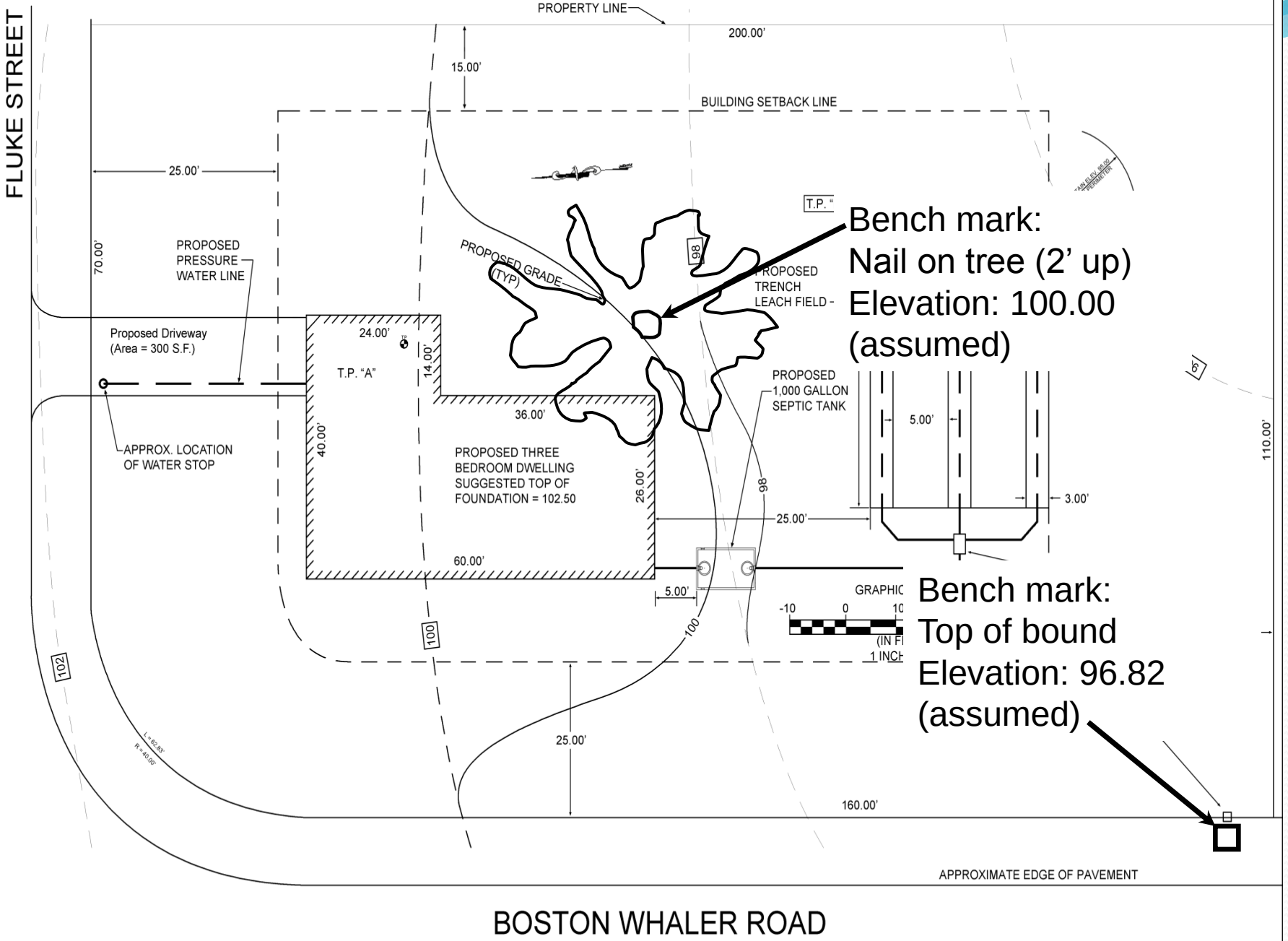


Old School Versus New



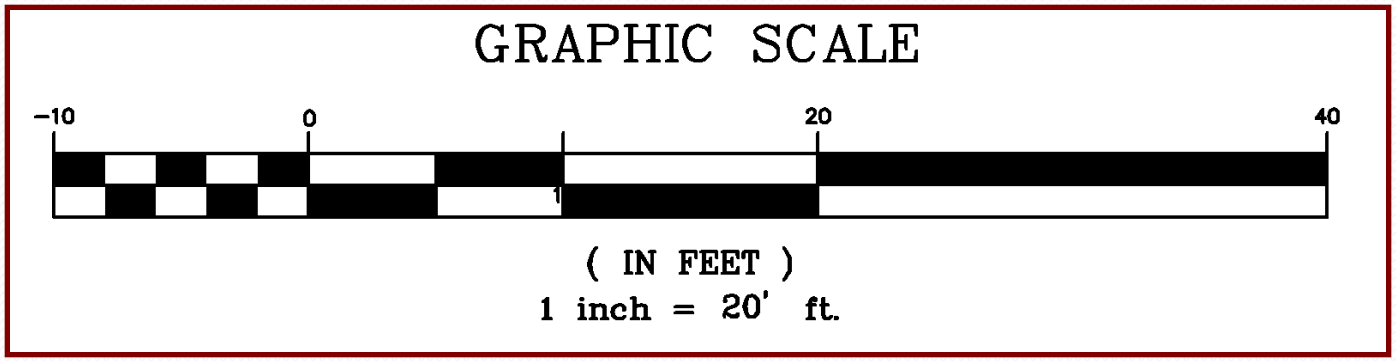



Reference
Details
Notes
Site plan
Title block
1000 GALLON SINGLE COMPARTMENT SEPTIC TANK
8 HOLE "D" BOX DB7-1
SEPTIC TANK FILTER
GENERAL NOTES:
LOCATION MAP
CONSTRUCTION SPECIFICATIONS:
GENERAL NOTES:
SEPTIC TANK:
DISTRIBUTION BOX:
PRIVATE WATER SUPPLY:
TYPICAL TRENCH CROSS SECTION
TYPICAL TRENCH SYSTEM PROFILE
FLUKE STREET
PROPOSED PRESSURE WATER LINE
PROPOSED DRIVEWAY (AREA = 360 S.F.)
APPROX. LOCATION OF WATER STOP
PROPOSED THREE BEDROOM DWELLING SUGGESTED TOP OF FOUNDATION = 102.50
PROPOSED D-BOX
PROPOSED 1,000 GALLON SEPTIC TANK
PROPOSED TRENCH LEACH FIELD
BENCH MARK: TOP OF BOUND ELEVATION 96.82 (ASSUMED)
GRAPHIC SCALE
(IN FEET) 1 inch = 20 ft.
APPROXIMATE EDGE OF PAVEMENT
BOSTON WHALER ROAD
CONSTRUCTION NOTES:
PROPOSED ISDS PLAN
ASSESSOR'S PLAT X LOT 22.5
FLUKE STREET
BLUEFISH, RHODE ISLAND
PREPARED FOR: SCUP SQUEATEGUE
SCALE: 1" = 20' DATE: 02/10/09 SHEET 1 OF 1
JOB NO. 309
EDUCATIONAL ENGINEERING, INC.
CIVIL AND ENVIRONMENTAL ENGINEERING
140 FISHING POINT ROAD
UNIT #3 BASS SQUARE
STRIPER, RI 02888
PHONE: (555) 555-6865
FAX: (555) 555-2053


FLUKE STREET
PROPERTY LINE
200.00'
15.00'
BUILDING SETBACK LINE
25.00'
70.00'
PROPOSED PRESSURE WATER LINE
Proposed Driveway (Area = 300 S.F.)
APPROX. LOCATION OF WATER STOP
24.00'
T.P. "A"
14.00'
40.00'
36.00'
PROPOSED THREE BEDROOM DWELLING SUGGESTED TOP OF FOUNDATION = 102.50
60.00'
26.00'
PROPOSED GRADE (TYP)
98
PROPOSED TRENCH LEACH FIELD
PROPOSED 1,000 GALLON SEPTIC TANK
5.00'
3.00'
25.00'
5.00'
100
102
25.00'
160.00'
110.00'
APPROXIMATE EDGE OF PAVEMENT
BOSTON WHALER ROAD
Bench mark:
Nail on tree (2' up)
Elevation: 100.00
(assumed)
Bench mark:
Top of bound
Elevation: 96.82
(assumed)

Scale

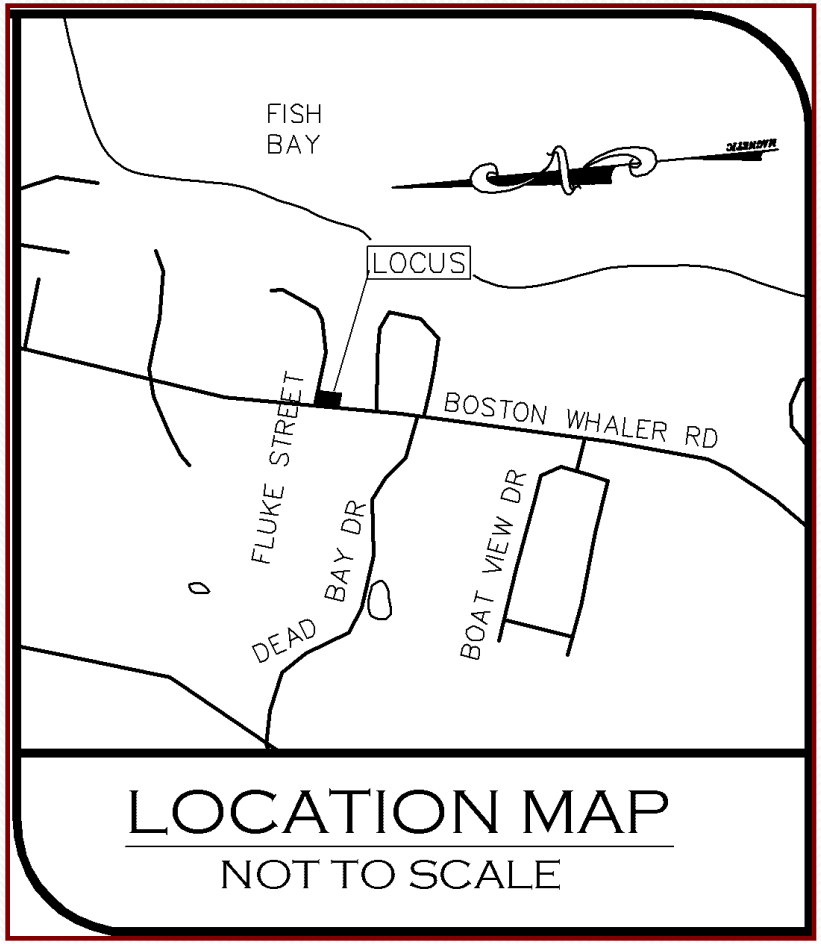
Represents the relative size of the objects on the site plan to the size of the objects in real life

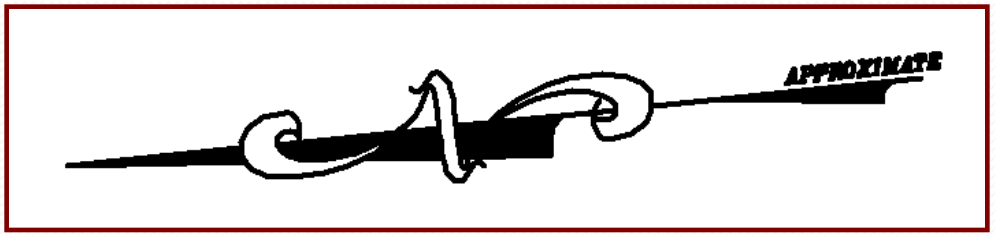


Engineers' scales such as 20 scale (1" = 20') mean that every inch in the scale represents 20 feet in real life

North Arrow

helps the reviewer orientate him/herself





North arrow on site plan

Dwelling Estimates

- Bedrooms
- *Look at the house plans, Assessor's Records-Carver County GIS available*
- Area
- Watch for
  - Unfinished space
    - 1 bedroom
  - Multi-generation families
    - More than 2 people per bedroom
  - In-home businesses or hobbies

Clear water

- Groundwater
- Cooling water
  - Ice makers
- Pool water
- Water conditioners
  - Ion exchange
    - Water softener
    - Iron filter
  - Membrane
    - Reverse osmosis

Should stay out of the System

What is Domestic versus High Strength Wastewater (HSW)?

- Chapter 7080 & CIDWT glossary definition of HSW

1) Influent having
   - BOD_5 > 300 mg/L,
   - and/or TSS > 200 mg/L,
   - and/or fats, oils, and grease (FOG) > 50 mg/L entering a pretreatment component

2) Effluent from a septic tank or other pretreatment component that has:
   - BOD_5 > 170 mg/L,
   - and/or TSS > 60 mg/L,
   - and/or (FOG) > 25 mg/L and is applied to an infiltrative surface

Restaurants and Facilities with Food Preparation

- Rule REQUIRES domestic strength waste prior to soil treatment with either sufficient detention time or pretreatment
- Design Guidance
  - "Additional septic tank capacities or equalization tanks with pretreatment may be necessary for high strength waste sources"
  - Product registration for HSW aerobic treatment units (on line)

PRETREATMENT = TYPE 4 OR 5 AD DESIGNER & INSPECTION

Chisago County Adult Care Facility Evaluation

Funding Source: Chisago County, Karcher Foster Services, Inc. and UMN

Completed Research– Chisago County

- Evaluation of adult care facilities
  - Sample and evaluate 6 systems experiencing issues serving adults with various physical challenges
  - High flows, chemicals and pharmaceuticals are creating VERY challenging waste stream
- Recommend design and management updates

Result

Flow

Site	Flow, gpd		
	Mean Ave.	Operating	Design
A.	321 ± 13	525	750
B.	462 ± 6	420	600
C.	326 ± 22	420	600
D.	630 ± 19	525	750
E.	521 ± 6	840	1200
F	491 ± 23	525	750

Organic loading

Site	BOD_5, mg/L		
	Mean Ave.	Min.	Max.
A.	143 ± 31.0	80.8	166
B.	129 ± 12.4	110	147
C.	193 ± 34.2	159	235
D.	144 ± 41.5	93.4	195
E.	182 ± 49.9	119	244
F.	132 ± 64.9	48.7	191
G.	64 ± 30.7	38.6	114

Healthy Bacteria?

Site	Greater Variance?
A.	No
B.	Yes
C.	Yes
D.	Yes
E.	No
F.	No
G.	---

Other Factors

- Found ***Many*** other chemicals

Surfactants

Concentration (mg/L MBAS)	Potential Effects
≥1.0	Risk of long-term accumulation of surfactants in soil, leading to decreased hydraulic conductivity and increased water repellence
10	Inhibition of hydrolysis, leading to greater accumulation of solids in anaerobic sewage treatment systems
30	Direct degradation of soil structure and decrease in hydraulic conductivity

Site	Anionic Surfactants (MBAS), mg/L
A.	2.0
B.	0.76
C.	3.8
D.	8.6
E.	1.5
F.	3.4
G. Control Site	2.7

Recommendations

- Install water saving devices (showers, sinks, laundry)
- Limit use of cleaners and sanitizers to the minimal amount needed
- Use natural cleaners whenever possible
- Educate staff and residents on proper disposal of non-organic materials
- Update systems with code compliant systems with increased hydraulic capacity
- Consider installing advanced treatment units to break down pharmaceuticals and personal care products prior to soil

Minnesota Department of Transportation (MnDOT) Rest Stop Evaluation

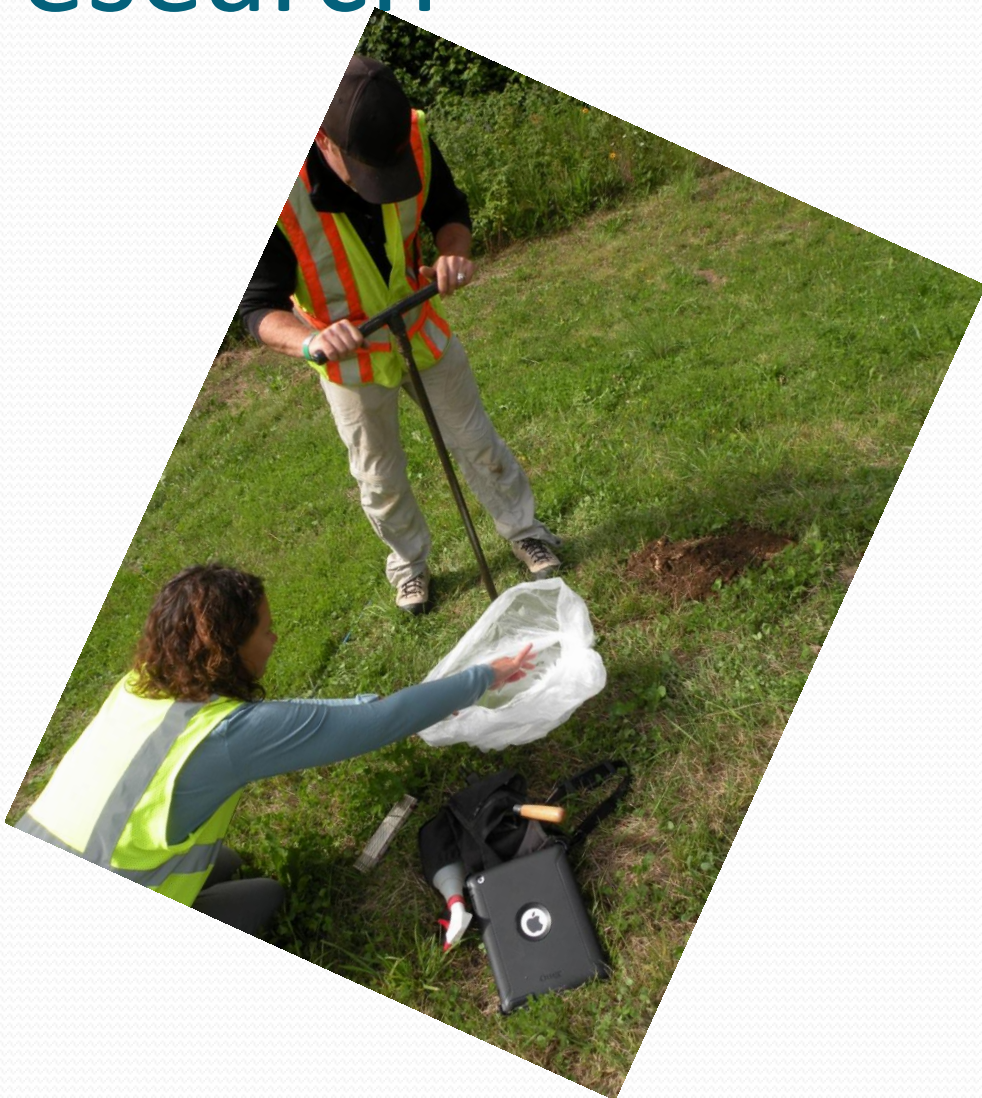
Funding Source: MnDOT and University of Minnesota

Research Background

- Minnesota Department of Transportation (MnDOT) owns and operates 51+ septic systems serving the rest stops, truck garages and scales across Minnesota
- Little information exists or has been evaluated regarding
  - Flows
  - Waste strength
  - Chemical usage
- Many systems are 30+ years old
- Majority only have pretreatment in a septic tank
- Difficult site conditions
  - Compaction, fill soils, setbacks, etc

More in-depth research

- 2 sites selected where new system are being installed this spring/summer
- Evaluating contaminant fate and transport
- Groundwater mounding



Project status

- Have inspected 25 of 51 systems
- Remainder will be assessed in 2014

Preliminary Data – Rest Stops

Site	BOD	COD	COD: BOD	TSS	Phos.	Nitrogen
#1	97	366	4	23	8.8	38
#4	99	275	3	60	7.6	111
#5	123	615	5	54	15.6	123
#7	226	615	3	60	17.2	130
#8	117	269	2	49	10.6	77
#9	<60	147		44	10.6	57

Data continued

Site	BOD	COD	COD: BOD	TSS	Phos.	Nitrogen
11	303	776	2.6	60	23.8	256
12	328	732	2.2	53	24.3	217
13	398	710	1.8	72	22.6	242
14	164	525	2.6	37	21.2	209
16	264	526	2.0	42	13.9	146

Data – advanced treatment

Site	BOD	COD	COD: BOD	TSS	Phos.	Nitrogen
#10, septic	254	472	2	34	13.6	98
#10, recirc	ND	63.8		ND	12.3	NA
#17, septic	355	650	1.8	67	18.6	192
#17, pump tank	ND	235		38	19.4	193
#15, pump tank	28	119	4.3	4.3	18.4	110

Further data analysis needed

- Get full data set
- Resample outliers
- Coorelations with?
  - Flow
  - Tank capacity
  - Management

Tank Burial

- Tanks "must" not have more than 4 feet cover (unless otherwise allowed by LGU) for new <u>dwellings</u>

At A Glance Listing Of Registered Sewage Tanks

Subsurface Sewage Treatment Systems

Registered Sewage Tanks

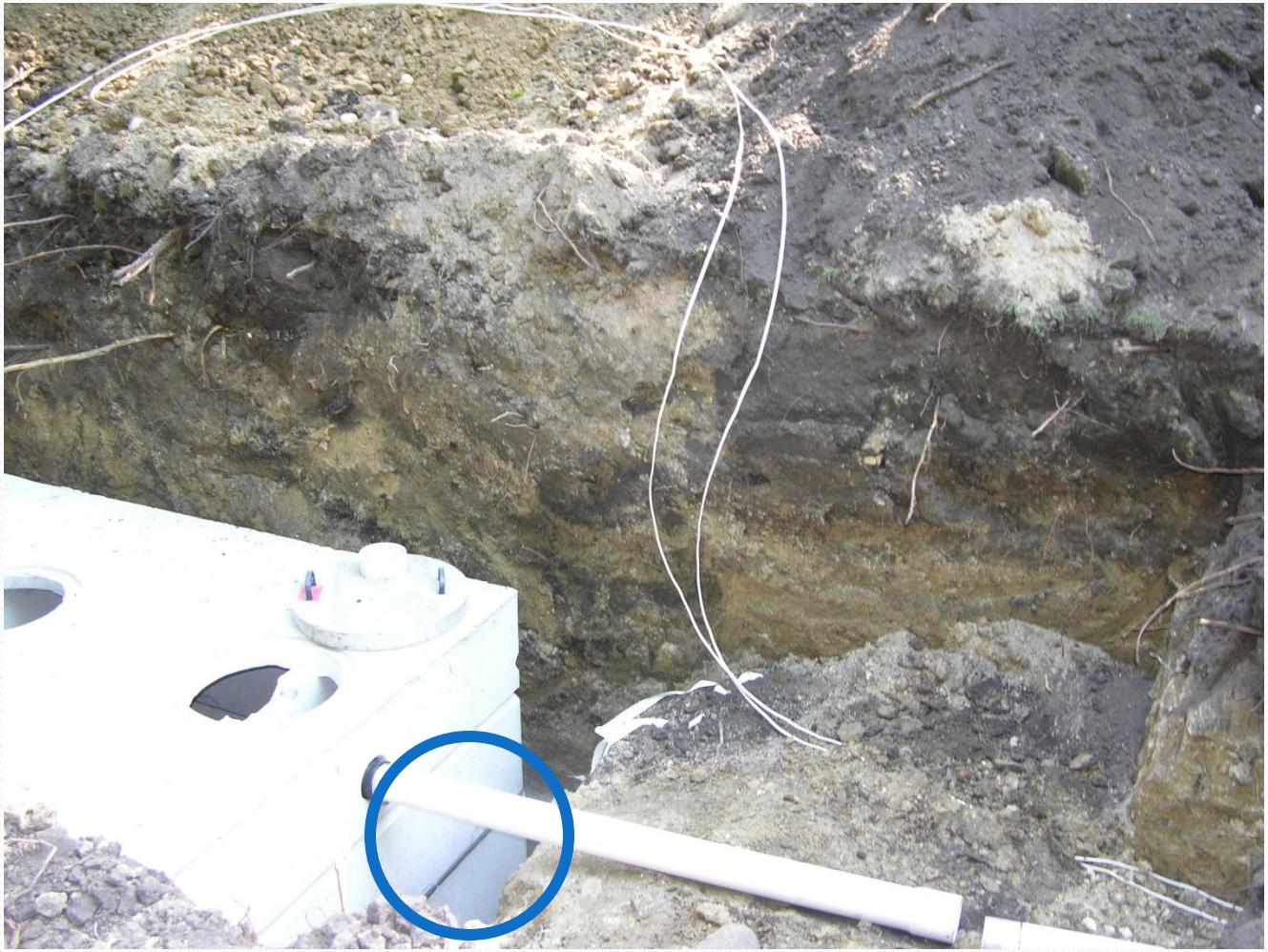
Sewage tank manufacturers name and location of manufacturers	Type of material	Maximum depth of burial (feet)*	Smallest size (gallons)	Largest size (gallons)
Adrian Tile Company Adrian, MN	Concrete	4 to 5	750	1600
AK Industries Plymouth, IN	Polyethylene	4	1000	1300
Alanen Concrete Cloquet, MN	Concrete	4	500	1500
Al's Concrete La Crescent, MN	Concrete	5 to 7	750	3000
Amcon Block and Precast St. Cloud, MN	Concrete	7	600	2000
Bakker Bros. Construction Ruthton, MN	Concrete	8 to 9	1000	2500
Belle Plaine Block & Tile Belle Plaine, MN	Concrete	2 to 10	500	2500
Brown Wilbert Fargo, ND	Concrete	4 to 8	600	2500
Brown Wilbert Lakeville, MN	Concrete	4 to 8	600	2500

Tank Insulation

- If the top tank is less than two feet from final grade, insulate to R-value of 10
- Maintenance hole covers shall be insulated to an R-value of 10

Insulation options

Avoid joints in excavated area



Risers - Watertight

2012/11/21

Water tight seals

- Boot may be cast into the tank or pressed into a smooth hole with an expanding clamp.
- Stainless steel hose clamp seals boot to pipe
- Flexible – allows some pipe movement but maintains sealed

Plastic pipe penetration seals

- Cast-in plastic fitting
- Flexible – allows some pipe movement

PVC pipe penetration seal

- Cast-in PVC fitting
- Connecting pipe cements into fitting
- Inflexible connection
- Pipe will need support during backfill
- Stress created if any settling occurs

Questionable seals

Type III Systems - (old term “other”)

- Type I systems modified to meet unusual soil systems
- For fill and disturbed soils
- Perc rates over 120 mpi [0.1 gpd/sqft]
- Downsized soil treatment area with flow equalization
- Less than 12” of unsaturated soils
  - Be careful of wetlands

Fill Soils

- Fill soils commonly have mixed colors and textures
- Typically soil is placed on top of wet locations
- Destroys soil structure

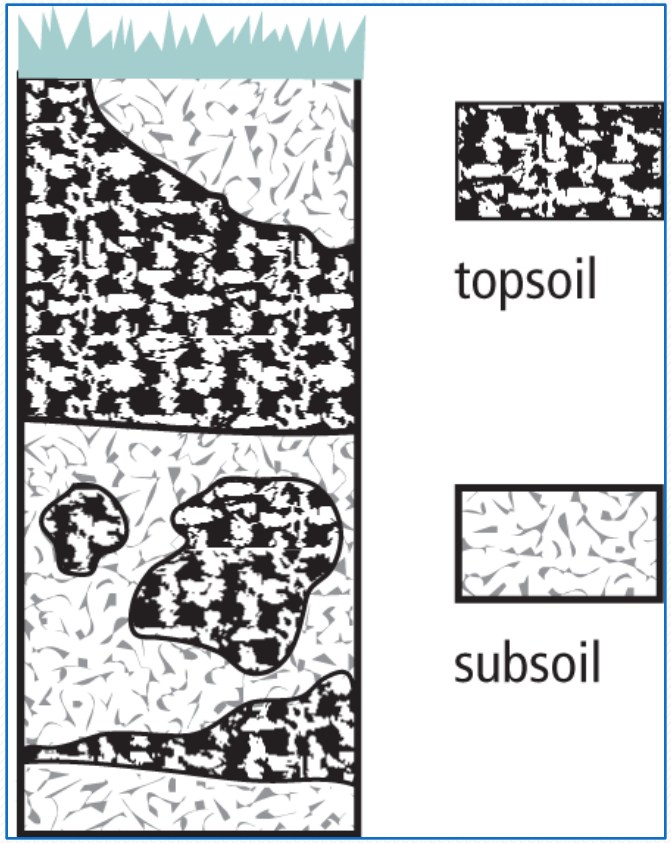


Figure 4.14

Cut Areas

- Areas where top soil and/or subsoil has been removed exposing parent material
  - Compaction due to machinery
  - Loss of soil structure
  - Redox features may have been removed

  (Top soils maybe added to establish vegetation)
- A <u>restrictive</u> condition likely occurs at this interface, slowing the movement of water

Cut/Fill Solutions

- All type III systems
  - Not natural soil
- Perc test only determines sizing
- Fill soils- assume wet to the surface
  - Redox features have not had time to form
- Cut-assuming compaction at surface
- Solution -mound with 3 ft of sand lift

Management Plans and Operating Permits

Requirements for Local Programs

- Management Plans
  - Required for new and replacement systems
  - Prepared by designer
  - Submitted to LGU before construction permit is pulled

Management Plans

- Owners taking responsibility for their systems!
- A plan that specifies performance expectations for systems including:
  - periodic examination,
  - adjustment,
  - testing, and
  - other operational requirements

Management Plans

- Provides information to the owner on O/M
- Information for the Maintainer and Service Provider, too
- Communication tool among the owner and practitioners

for **SALCOR ULTRAVIOLET (UV) LIGHT DISINFECTION DEVICE MANAGEMENT PLAN**

This Management Plan identifies some basic requirements for proper operation and maintenance of the Salcor 3G Ultraviolet Light (UV) disinfection device for residential use. Refer to Salcor's detailed Operation and Maintenance Manual for detailed instructions on proper operation and maintenance requirements.

Information regarding the Salcor UV disinfection device can be found at the Minnesota Pollution Control Agency's website at: http://www.pca.state.mn.us/programs/ists/productregistration.html.

SYSTEM COMPONENT	TASK	FREQUENCY	RESPONSIBLE PARTY
Salcor UV disinfection device	Monitor alarm*	On-going	Homeowner
	Check influent/effluent quality odor, color, turbidity	Every six months before cleaning and replacing the bulb	Homeowner or Service Provider
	Collect sample for fecal coliform bacteria	Every six months before cleaning and/or replacing the bulb	Service Provider
	Clean bulb	Every six months	Service Provider
	Replace bulb	May be needed if sampling results do not meet prescribed Treatment Level A or B	Service Provider
		A minimum of every two years per manufacturer	Service Provider

Content of Management Plans

- Maintenance requirements
- Operational requirements
- Monitoring requirements
- Owner required to notify LGU when Plan not met
- Location of reserve area
- Other local requirements

Management Plan Templates

- See website
- Type I
- Type IV
  - Proprietary treatment products

Who is MOWA?

- MOWA is the association representing everyone in the decentralized wastewater industry in Minnesota
  - Including: Licensed onsite professionals, engineers, soil scientists, educators, state and local regulators, suppliers and manufacturers.
- Founded in 1975, MOWA has over 500 members and is a non-profit business association whose primary objective is the betterment of public health through sound principles and procedures.

MOWA
minnesota onsite wastewater association

What does MOWA do?

30+ years of positive effect on the Industry through active involvement in:

- Education
- Legislation
- Government relations
- Better rules and regulation

MOWA
minnesota onsite wastewater association

2014 MOWA training

- Summer Seminar
  - Belle Plaine Block and Tile hosting
  - Soils CE track
  - Inspection and hands-on track
  - July 11th

Winter Convention

Jan 26-28, 2015
Bloomington

- Local and National speakers
- Rotated around the state
- Business Tracks
- See new products at the Vendor show

MOWA
minnesota onsite wastewater association

- Visit **MOWA-MN.com** for more information
  - Click on applications & renewal from membership application
  - Sign up for email notification
  - View the calendar of events
  - View presentations from previous MOWA events
- Board members are always available to talk to you about issues, concerns, or questions you may have
  - View board member listing on website

Questions

septic.umn.edu