ISPLS 61st Annual Convention

January 16-18, 2013

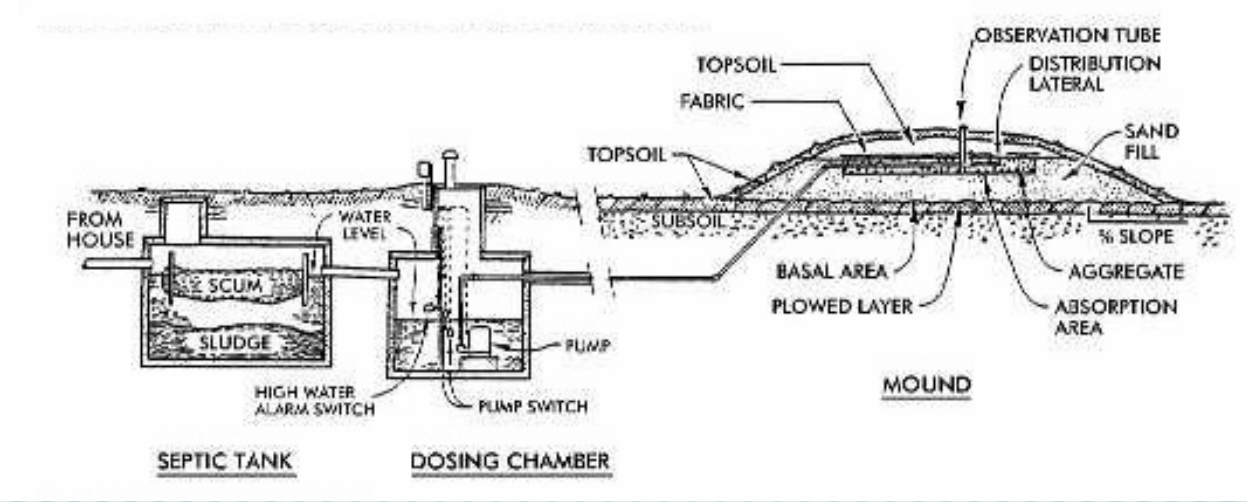
Indianapolis

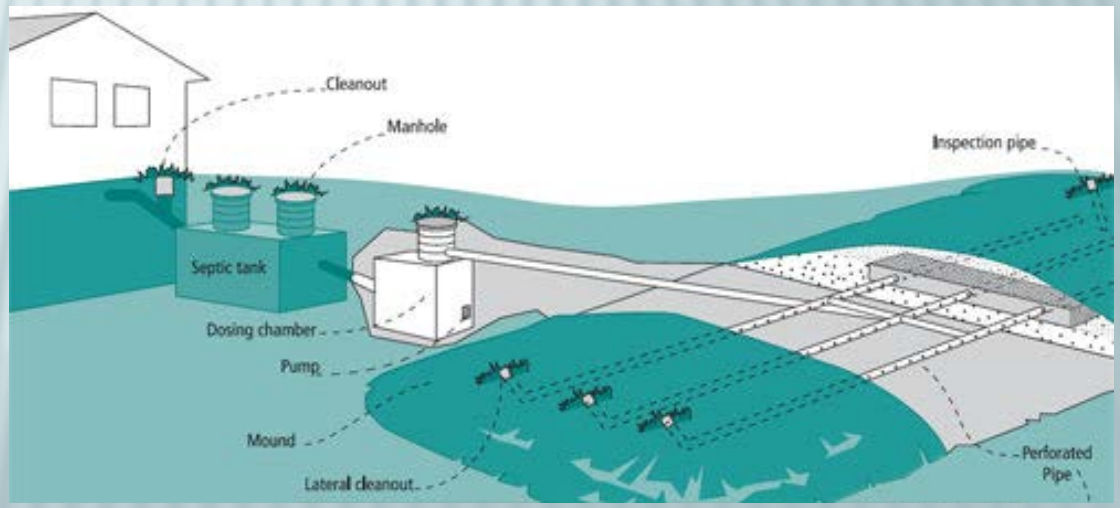
Denise H. Wright
Training Officer

Indiana State
Department of Health
Environmental Public Health Division

ELEVATED SAND MOUND DESIGN

ELEVATED SAND MOUND





Section 72

ESM SITE SUITABILITY

- Site evaluation
- On-site soils evaluation
- DDF

- Sufficient area
- Separation distances
- Dispersal area
- Topographic position
- Slope, water table, soils

Sec. 73. Onsite sewage system selection may be summarized in Table VI as follows:

Table VI - Table for Onsite Sewage System Selection based on requirements of 410 IAC 6-8.3

Site Requirements	Subsurface Trench Onsite Sewage Systems					Elevated Sand Mound Onsite Sewage Systems (Sec. 72)
	Gravity Flow[1] (Sec. 70, 71)		Flood Dosing or Alt. Fields[1] (Sec. 70, 71)	Flood Dosing[1] (Sec. 70, 71)	Pressure Dist (Sec. 70, 71)	
Slope	≤15%		≤15%	≤15%	≤15%	≤6%
Design Daily Flow	≥450	< 450	Any	Any	Any	Any
Acceptable Loading Rate Range for determining system size	≥0.25 ≤0.75	≥0.25 ≤0.75	≥0.25 ≤0.75	≥0.25 ≤0.75	≥0.25 ≤1.20	≥0.25 ≤1.20
Distance from Trench Bottom (ground surface for mounds) to Layer with a Soil Loading Rate < 0.25 gpd/ft^2	≥30	≥24	≥24	≥24	≥24	≥20
Distance from Trench Bottom (ground surface for mounds) to Layer with a Soil Loading Rate > 1.20 gpd/ft^2	≥24	≥24	≥24	≥24	≥24	≥20
Distance from Trench Bottom (ground surface for mounds) to Layer with a Soil Loading Rate = 1.20 gpd/ft^2	≥24	≥24	≥24	≥24	Press. Dist. required for SLR = 1.20	≥0
Distance from Trench Bottom (ground surface for mounds) to a Soil Horizon Developed from Wisconsin Glacial Till That Shows Effervescence[2]	≥30	≥24	≥24	≥24	≥24	≥20
Distance from Trench Bottom (ground surface for mounds) to Soil Horizon with < 20% Clay and > 35% Coarse Fragments by Volume	≥30	≥24	≥24	≥24	≥24	≥20
Distance from Trench Bottom (ground surface for mounds) to Soil Horizon with > 20% Clay and > 60% Coarse Fragments by Volume	≥30	≥24	≥24	≥24	≥24	≥20
Distance from Trench Bottom (ground surface for mounds) to Seasonal High Water Table[2]	≥24	≥24	≥24	≥24	≥24	≥20
Total Lineal Feet of Trench	≤500	≤500	≤500 for Alt. Fields	Any	Any	N/A

SUFFICIENT AREA

- For ESM you MUST use Table V.
- Note loading rates as compared to Table IV

Table V – Soil Loading Rates for Elevated Sand Mound Onsite Sewage Systems (in gpd/ft^2)

	SOIL STRUCTURE CLASSES							
SOIL TEXTURE CLASSES	Single Grain	Granular	Strong: Angular, Sub-Angular Blocky, Prismatic	Moderate: Angular, Sub-Angular Blocky, Prismatic	Weak: Angular, Sub-Angular Blocky, Prismatic; Platy[1]	Fragic Characteristics: Very Coarse Prismatic	Structureless, Massive, Friable, V. Friable	Structureless, Massive, Compact, Firm, V. Firm; Platy[2]
Gravel, Coarse Sand	>1.20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Loamy Coarse Sand, Medium Sand	1.20	1.20	N/A	N/A	1.20	N/A	N/A	N/A
Fine Sand, Loamy Sand, Loamy Fine Sand	0.60	0.60	N/A	0.60	0.60	N/A	0.60	N/A
Very Fine Sand, Loamy V. Fine Sand	0.50	0.50	N/A	0.50	0.50	N/A	0.50	N/A
Sandy Loam, Coarse Sandy Loam	N/A	0.60	N/A	0.60	0.60	0.00	0.60	0.00
Fine Sandy Loam, V. Fine Sandy Loam	N/A	0.60	N/A	0.60	0.60	0.00	0.60	0.00
Loam	N/A	0.50	0.50	0.50	0.50	0.00	0.50	0.00
Silt Loam, Silt	N/A	0.50	0.50	0.50	0.50	0.00	0.50	0.00
Sandy Clay Loam	N/A	0.50	0.50	0.50	0.50	0.00	0.50	0.00
Silty Clay Loam, Clay Loam, Sandy Clay	N/A	0.25	0.25	0.25	0.25	0.00	0.25	0.00
Silty Clay, Clay	N/A	0.25	0.25	0.25	0.25	N/A	0.25	0.00
Organic Soil Materials	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Limnic Soil Materials	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00
Bedrock	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A NOT APPLICABLE

[1] Naturally occurring platy structure.

[2] Platy structure caused by compaction has a soil loading rate of 0.00 gpd/ft^2 unless broken up by methods approved by the department.

ESM – "THE DEAL BREAKERS"

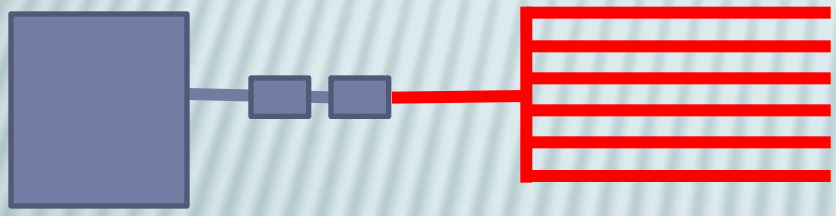
- ESM shall NOT be constructed when:
  - OSS site is adversely impacted by runoff, unless waters can be effectively diverted
  - Original grade is below Regulatory Flood Elevation
  - Area is subject to ponding
  - Located in a drainage way
  - If there is more than 12 inches of compacted soil, unless the compaction can be effectively amended.

SURFACE WATER IMPACT

PRESSURE DISTRIBUTION SYSTEMS

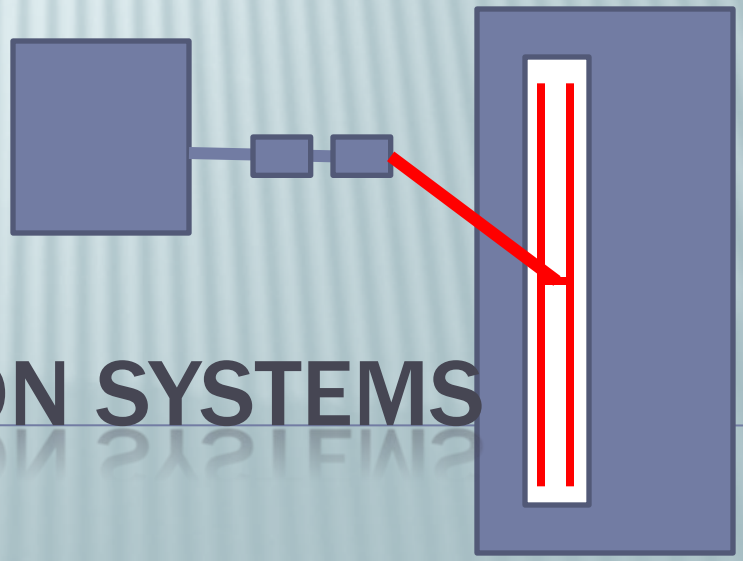
SUBSURFACE TRENCH PD

- Site slope ≤ 15%
- Limiting Layer ≥ 34” below grade
- 0.25 ≤ SLR ≤ 1.20 gpd/ft^2



ELEVATED SAND MOUND PD

- Site slope ≤ 6%
- Limiting Layer ≥ 20” below grade
- 0.25 ≤ SLR ≤ 1.20 gpd/ft^2



Section 79-88

ELEVATED SAND MOUND

Design Parameters

1. Aggregate Bed
2. Basal Area
3. Overall dimensions of the ESM
4. Pressure Distribution Network

Installation and Inspection Requirements

1. Prep work
2. Construction of ESM
3. Final Cover & Grade

AGGREGATE BED

- Contour, Contour, Contour!
- Size of Aggregate Bed
  - Area = $\frac{\text{DDF}}{1.2\ \text{gpd/ft}^2}$
  - **Maximum** Aggregate Bed Width $= 0.83\sqrt{\frac{\text{DDF X SLR}}{n}}$
  - Min. Width = 4’ Max. Width = 10’, 15’ or 20’
  - Length = $\frac{\text{Area}}{\text{Width}}$
- Bottom of aggregate bed must be level along its **length** and **width**.

AGGREGATE BED

- Geometry – Long and Narrow
  - The lower the SLR, the longer and narrower the bed has to be.
  - As the SLR increases, the aggregate bed can be more “boxy”

Example

Optimum Design for any soil loading rate

3 Bedroom Home

DDF=450gpd

Agg Bed = 375ft^2

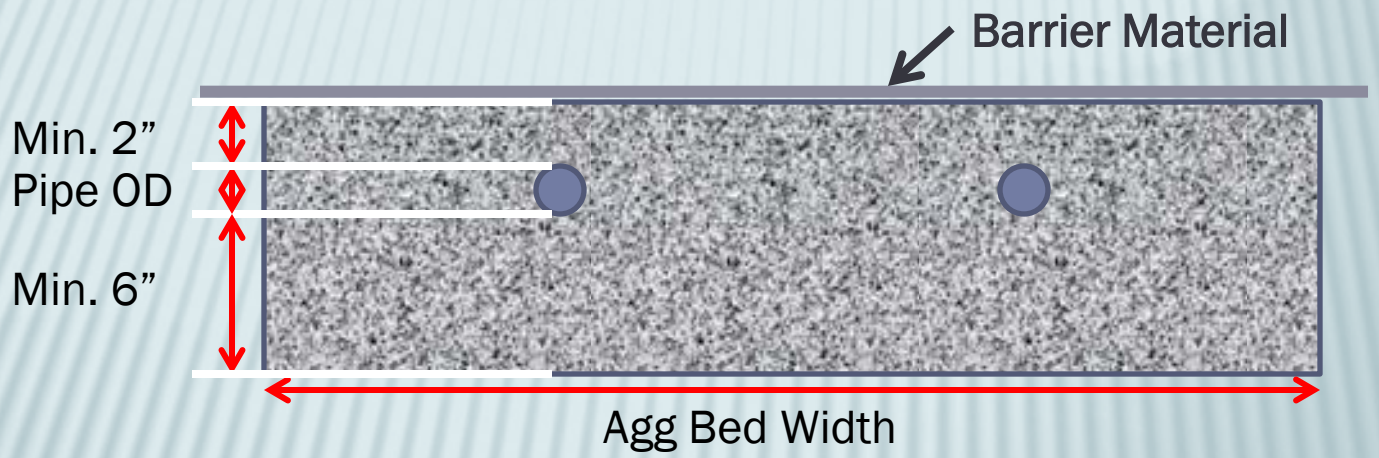
SLR = 0.25 Agg Bed = 5’ X 75’

SLR = 0.50 Agg Bed = 7’ X 53.5’

SLR = 0.75 Agg Bed = 8’ X 47’

AGGREGATE BED

- Stone and Pipe
- Cross sectional view



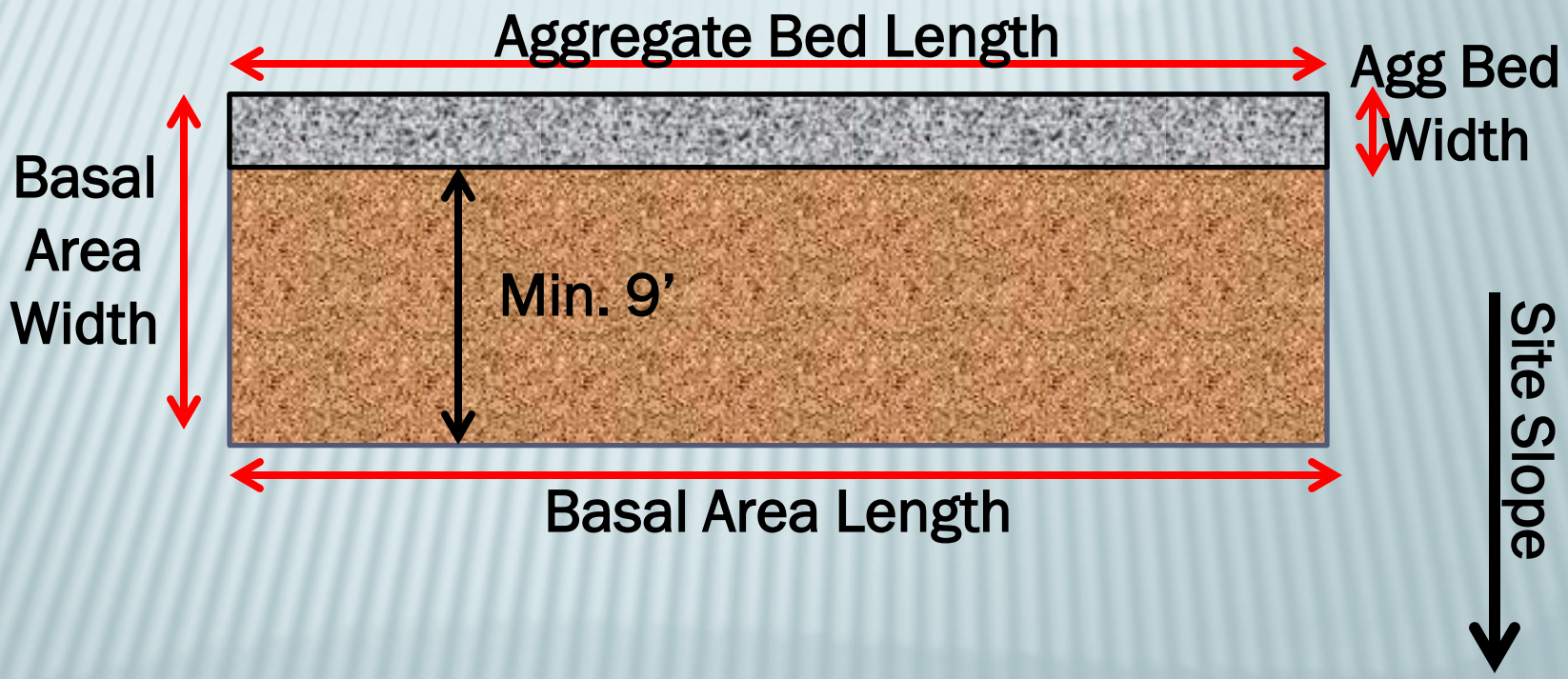
BASAL AREA

- Contour, Contour, Contour!
- Size of Basal Area
  - Area = $\frac{DDF}{SLR}$
  - Length = Length of the Aggregate Bed
  - Width = $\frac{Area}{Length}$
    - Minimum Basal Area Width

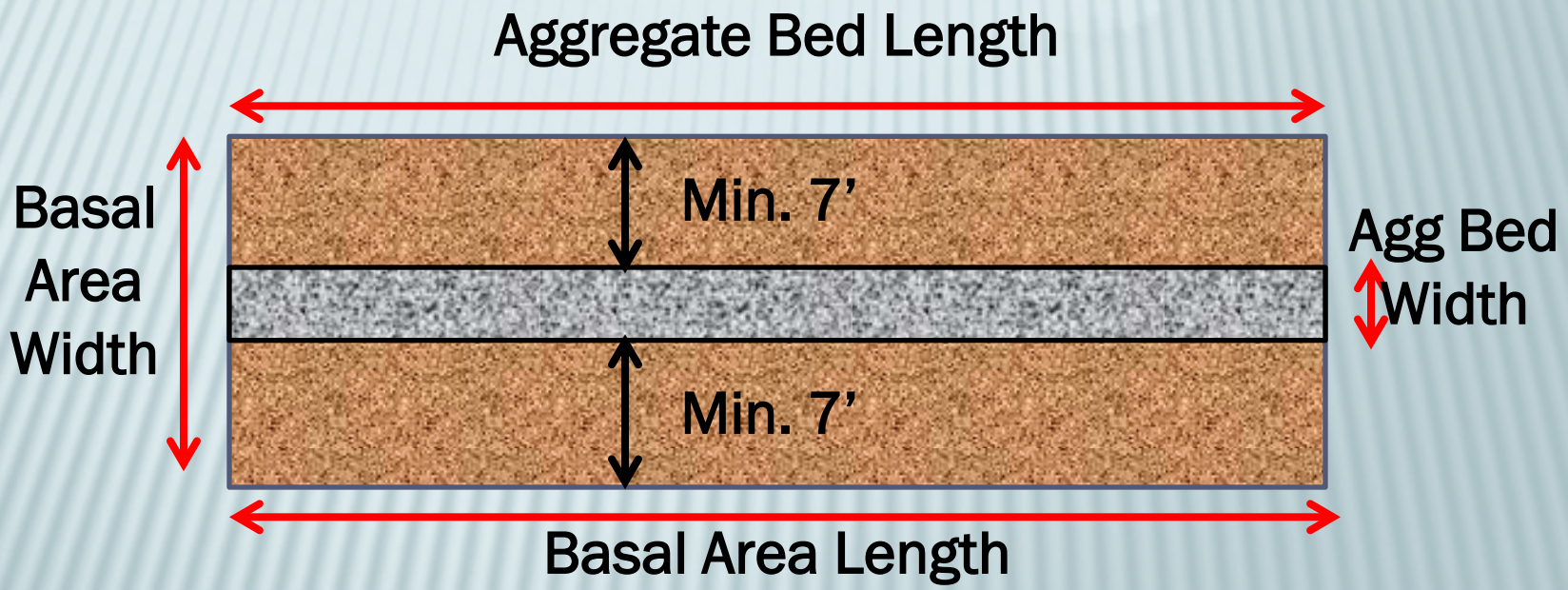
      Agg Bed Width + 14’ for level site

      Agg Bed Width + 9’ for sloping site

BASAL AREA / AGGREGATE BED LOCATION
SLOPING SITE
½% < SLOPE ≤ 6%

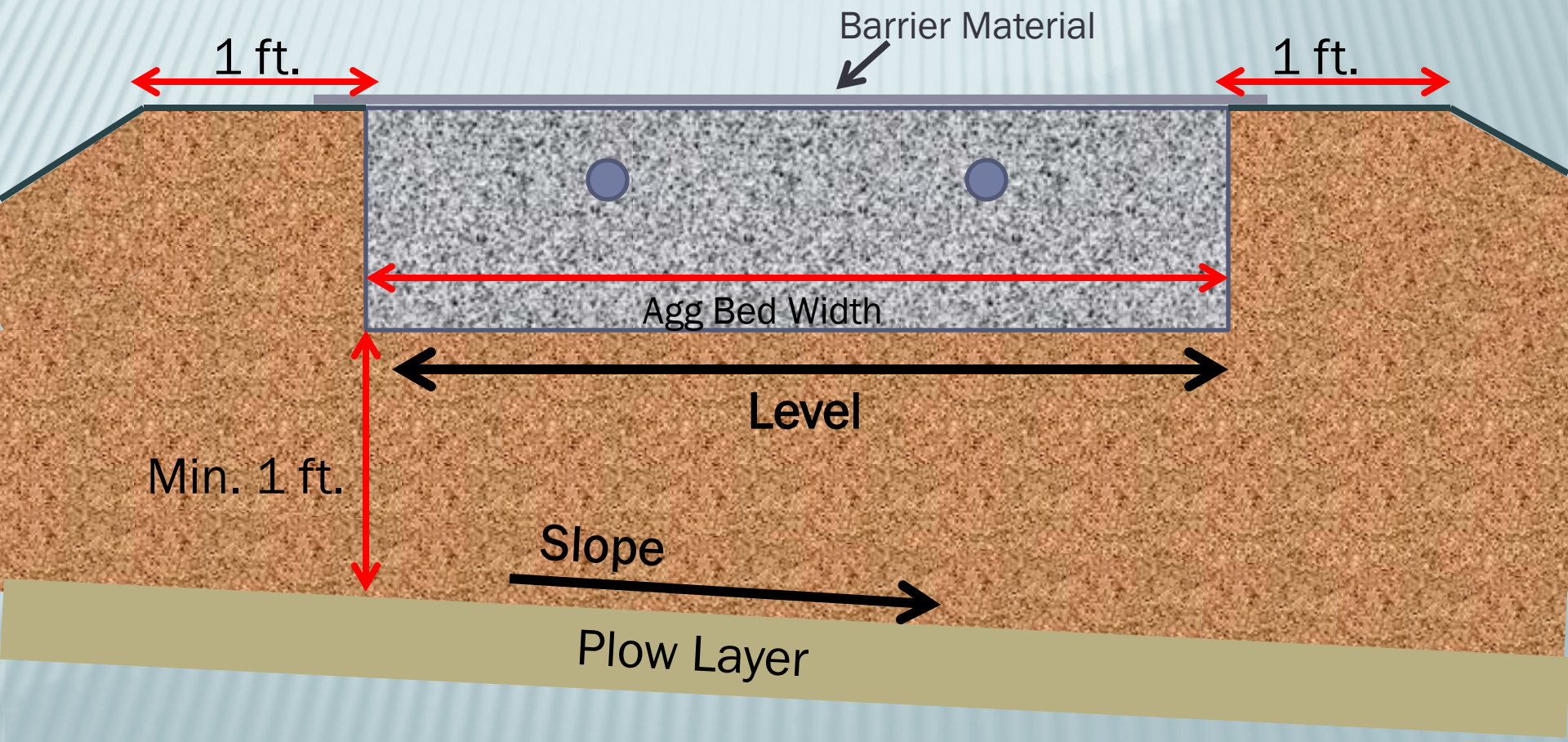


BASAL AREA / AGGREGATE BED LOCATION
LEVEL SITE
SLOPE ≤ ½%



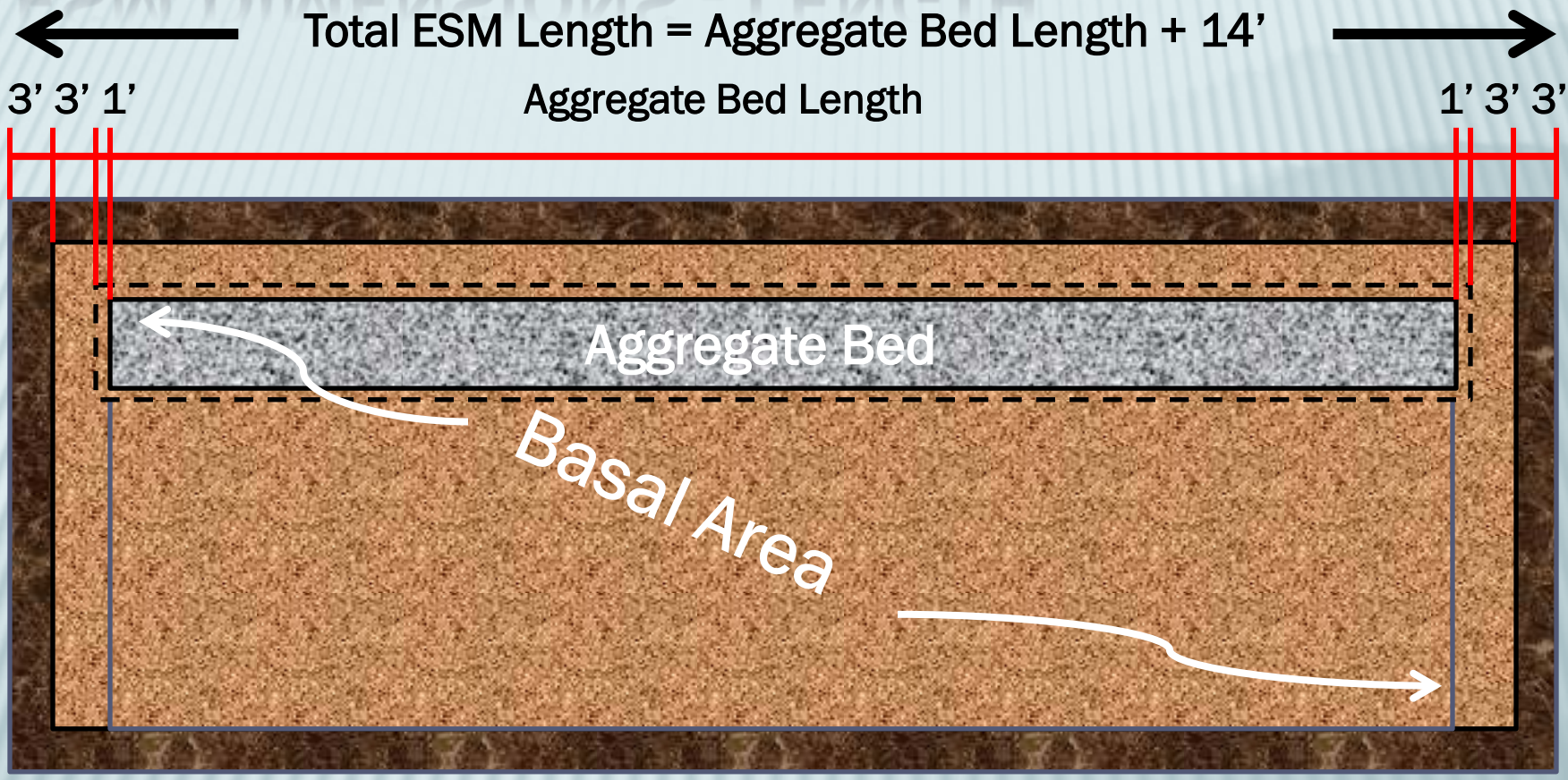
ESM INSTALLATION

- Aggregate Bed level from side to side and end to end.



AGGREGATE BED - CONSTRUCTED

ESM DIMENSIONS - LENGTH



1’ Sand Border Surrounding Aggregate Bed

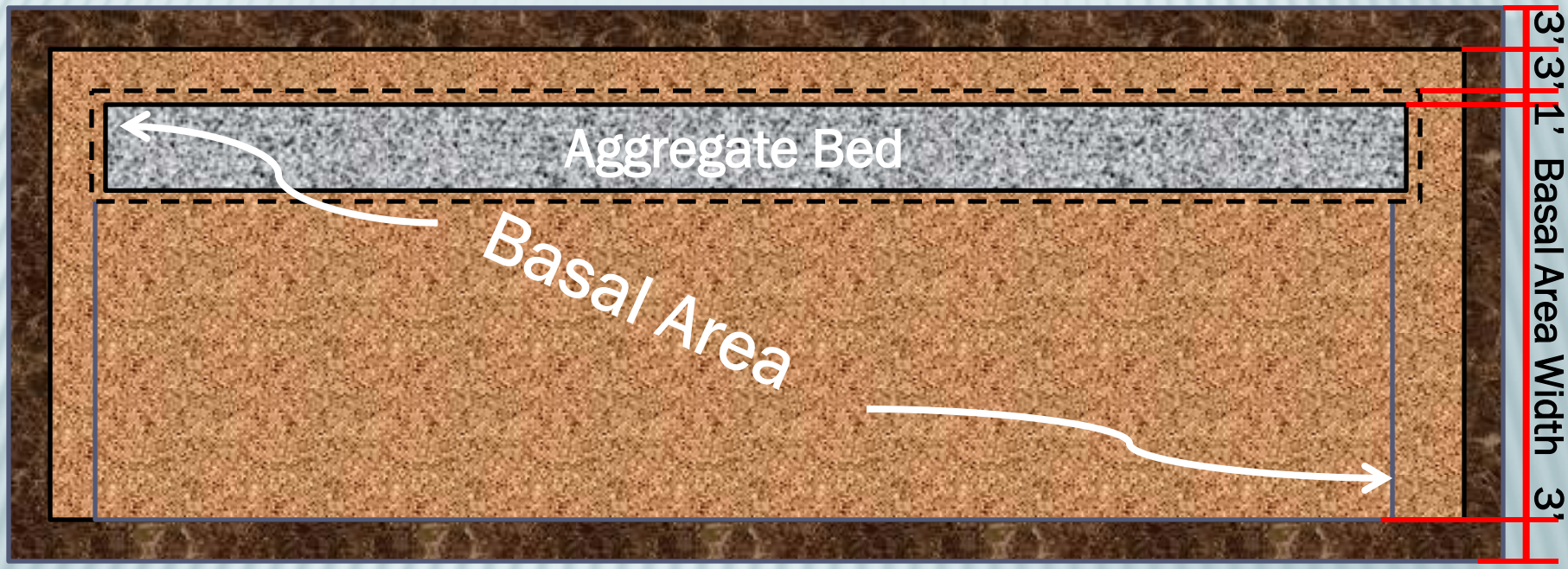
3’ sand on both ends and on upslope side

3’ Soil cap on both ends and both sides

Sloping Site

ESM DIMENSIONS - WIDTH

Total ESM Width = Basal Area Width + 10’



1’ Sand Border Surrounding Aggregate Bed

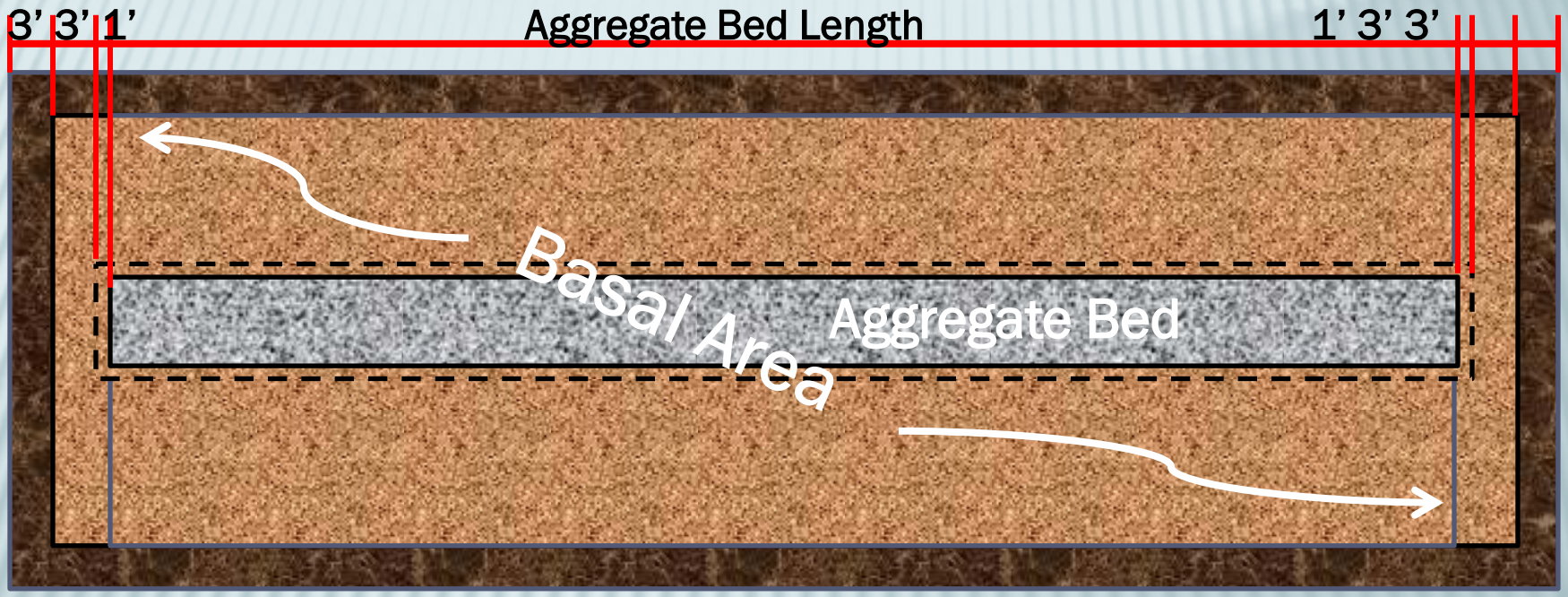
3’ sand on both ends and on upslope side

3’ Soil cap on both ends and both sides

Sloping Site

ESM DIMENSIONS - LENGTH

Total ESM Length = Aggregate Bed Length + 14’



1’ Sand Border Surrounding Aggregate Bed

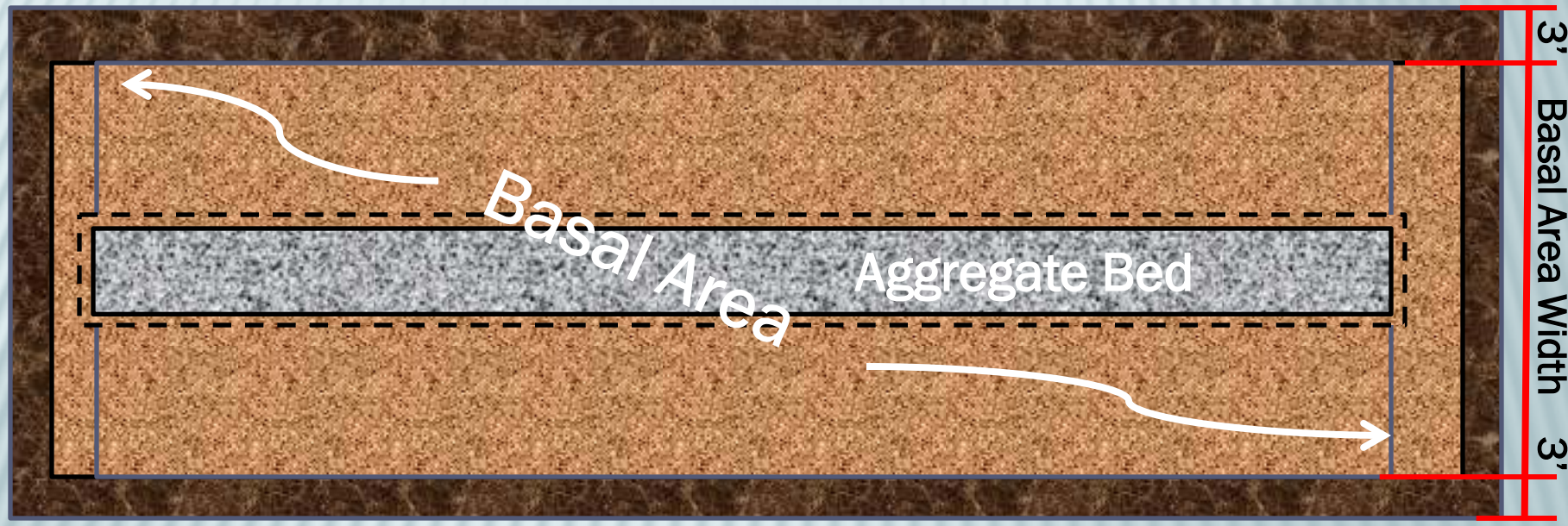
3’ sand on both ends

3’ Soil cap on both ends and both sides

Level Site

ESM DIMENSIONS - WIDTH

Total ESM Width = Basal Area Width + 6’



1’ Sand Border Surrounding Aggregate Bed

3’ sand on both ends

3’ Soil cap on both ends and both sides

Level Site

ESM PRESSURE DISTRIBUTION NETWORK

- Effluent Pump
- Effluent Force Main
- Manifold
- Pressure Distribution Laterals

ESM: PRESSURE DISTRIBUTION NETWORK

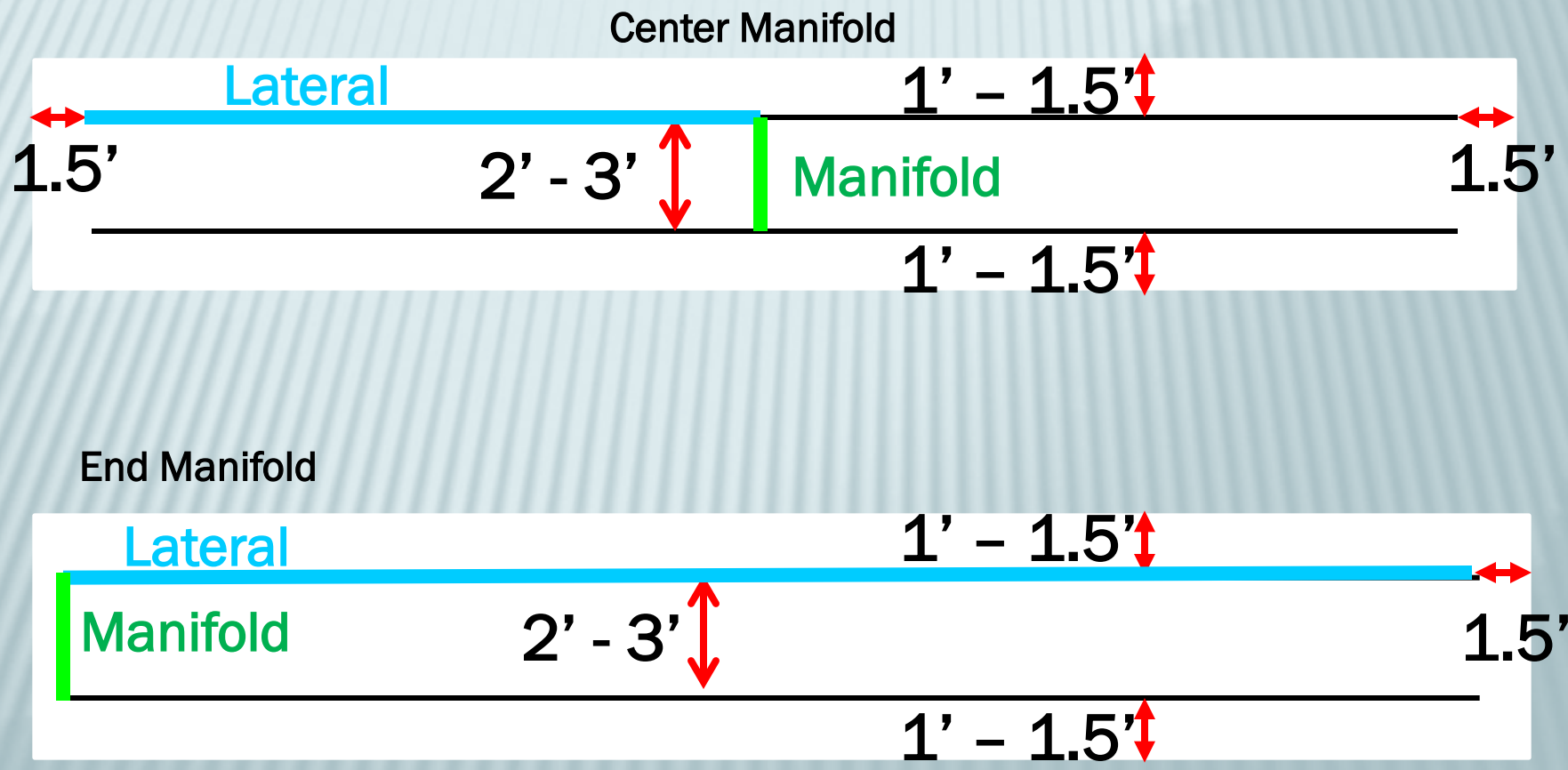
- Effluent Pump
  - TDH = Static Head + Friction Loss + 3.0’ (Design head)
  - Dose Volume = 1/4 DDF + Drainback (if any)
- Effluent Force Main
  - Approach to ESM
    - On level sites (slope ≤ ½%), from either end of the ESM
    - On sloping sites (½% < slope ≤ 6%), from the upslope side.(preferred)
  - Diameter = 1½” – 4”

ESM PRESSURE DISTRIBUTION NETWORK

- Manifold
  - Size
    - DDF ≤ 750 gpd, manifold is 2”
    - DDF > 750 gpd, manifold is 2” or the same size as the effluent force main, whichever is greater (no >4”)
  - Location
    - In the Aggregate Bed
    - Each lateral is connected individually to the manifold

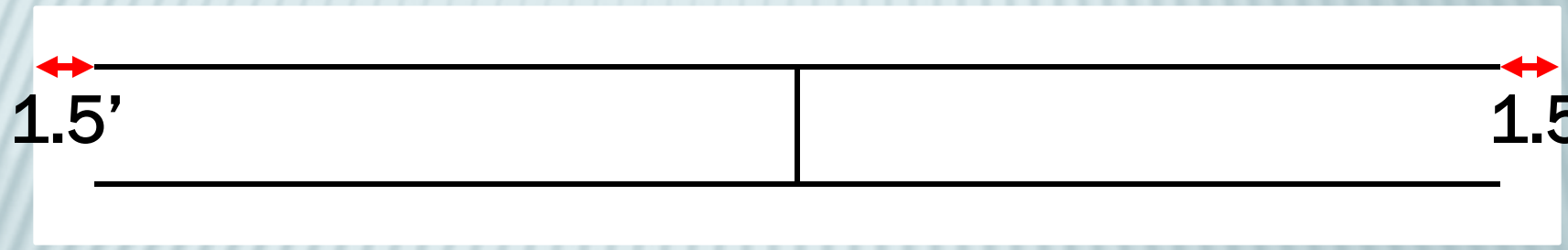
MANIFOLD / PD LATERALS

- Plan View



ESM PRESSURE DISTRIBUTION NETWORK

- Pressure Distribution Laterals
  - Length = $\frac{\text{Agg Bed Length} - 3}{2}$

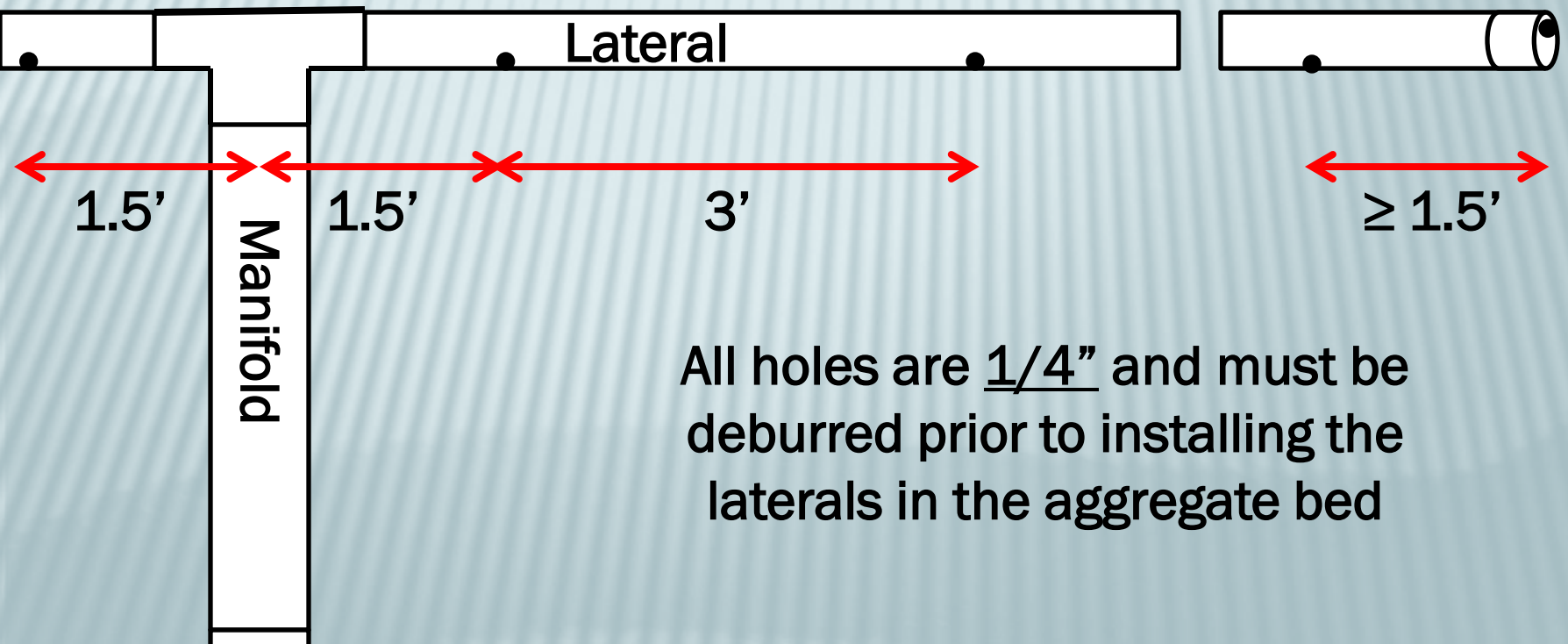


  - Diameter – dependent upon lateral length

Lateral Length	L ≤ 25’	25’ < L ≤ 40’	40’ < L ≤ 55’
Lateral Diameter	1 inch	1 ¼ inch	1 ½ inch

ESM PRESSURE DISTRIBUTION NETWORK

- Hole Placement
  - 1st hole is 1.5’ from center of manifold
  - 3’ on center
  - Last hole is at least 1.5’ from hole in endcap



All holes are 1/4” and must be deburred prior to installing the laterals in the aggregate bed

ESM COMPONENT SELECTION

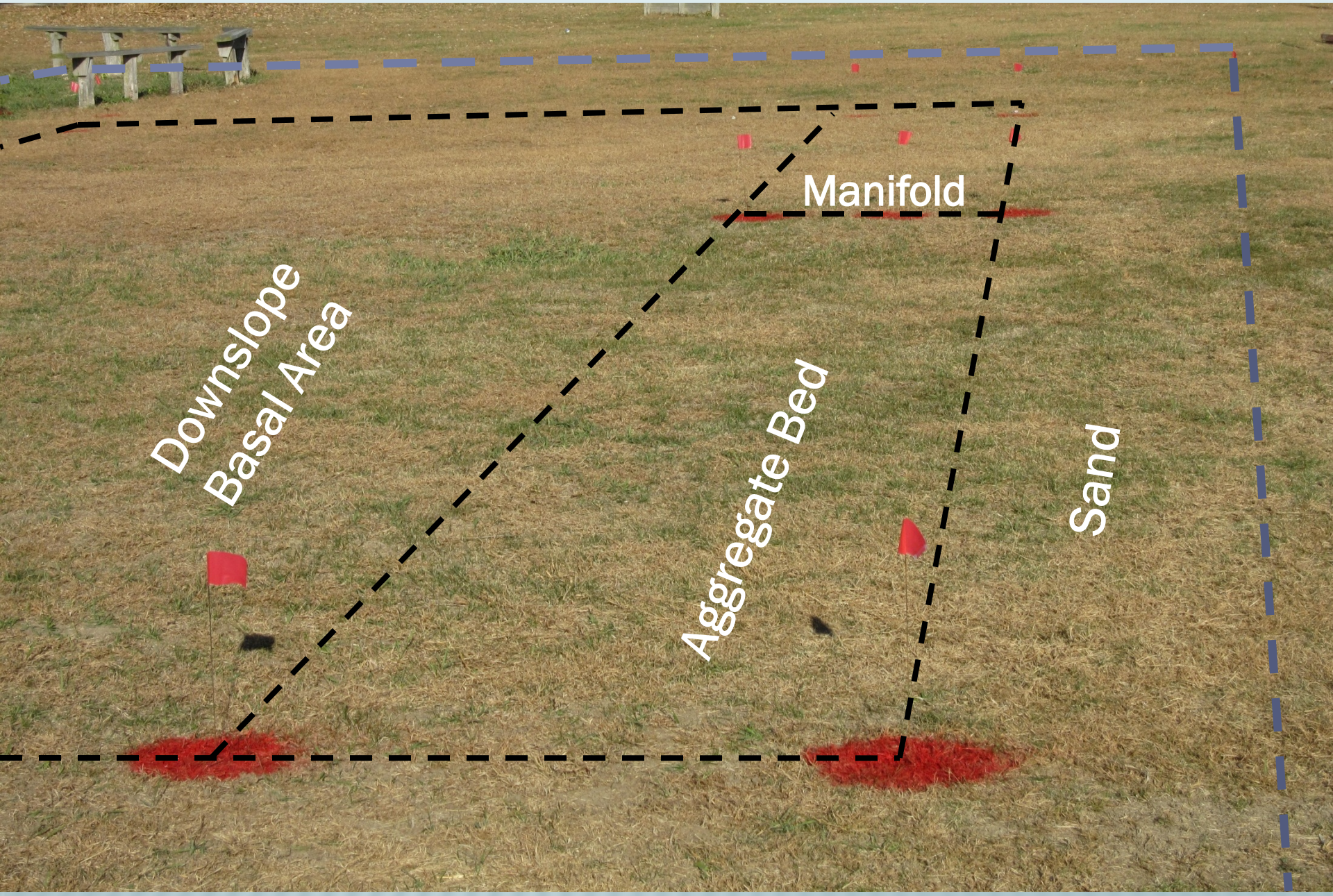
- Effluent pump
  - Calculate GPM
  - Calculate TDH

  Remember…A pump that is too big for the project is a potential problem to proper system performance

- Dosing Tank
  - IEHA-WWMC Residential Onsite Sewage System Effluent Pump Sizing and Dose Tank Sizing Guidance Document – DRAFT
  - On the IEHA website in Feb/March 2013

ESM INSTALLATION

- Preparing the site
  - Stake out and protect the site
    - Soil absorption field
    - Dispersal area
    - Drainage
    - Set aside area (if required)
    - Future expansion area (if required)
  - Cut and remove excessive vegetation at the site
    - Don’t scrape the site
    - Cut vegetation must be removed from the site.


Manifold
Downslope
Basal Area
Aggregate Bed
Sand

PROTECTION OF SITE

ESM INSTALLATION

- Preparing the site
  - Install effluent force main
    - From the end (level site) or upslope (sloping site)
    - Min. 16” deep
    - Must drain unless installed below frost line
    - Bring up in manifold area at least 3’ above grade and temporarily cap
  - **Call for an INSPECTION**
    - Vegetation removal
    - Soil moisture
    - Plowing?

ESM INSTALLATION

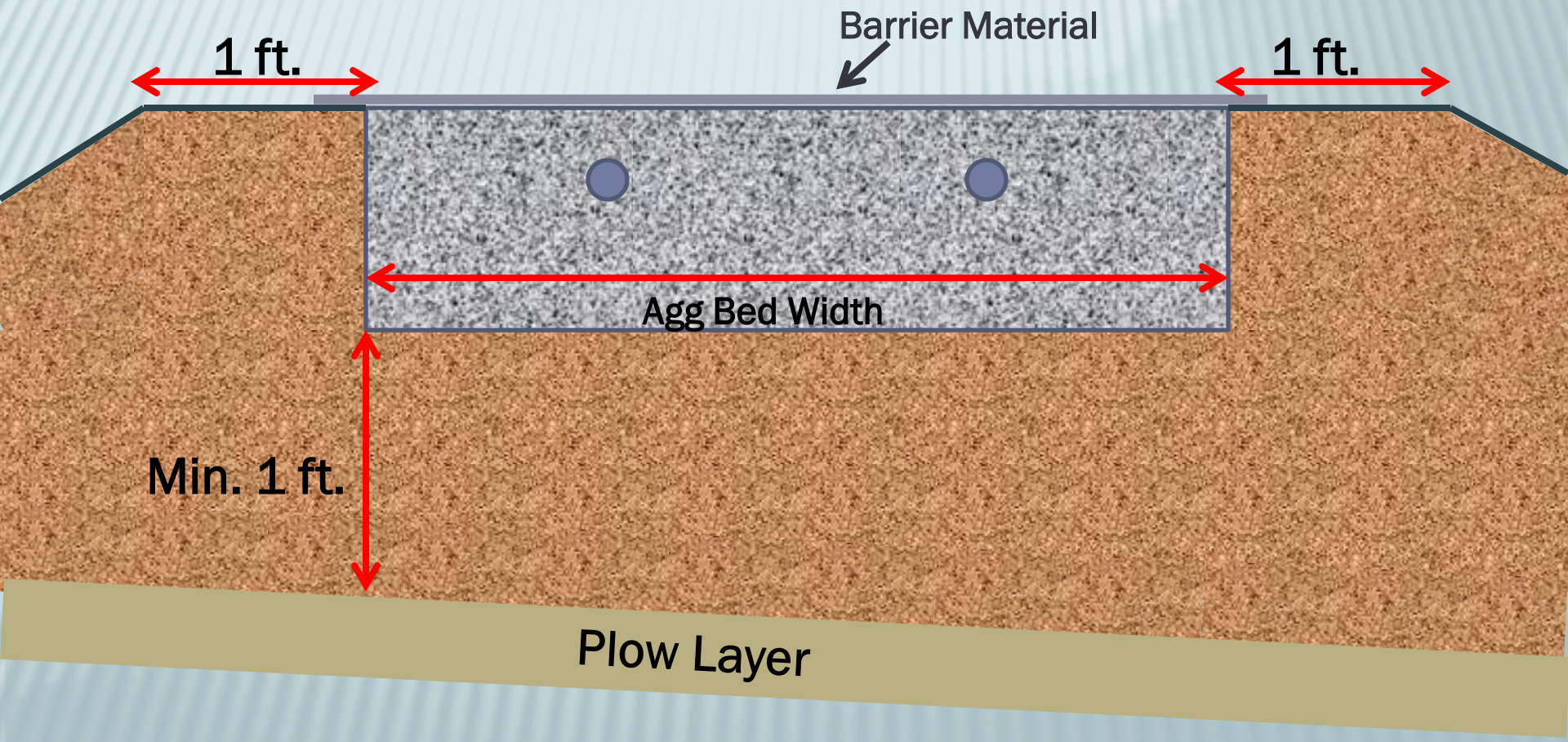
- Preparing the site
  - Tilling
    - **Parallel to contour – along the length of the ESM**
    - Proper equipment
      - Moldboard plow, min. 2 bottoms, one pass, furrows turned upslope
      - Chisel plow
      - Bulldozer with ripper
      - Backhoe (where approved!)
    - **7” – 14” deep**
    - **2” below any compaction identified at the site**
    - **LHD may require field supervision of tilling**

ESM INSTALLATION

- Basal Area
  - INDOT Specification 23 sand
  - Placed immediately on plowed surface
  - Min. 12” under the aggregate bed
  - Placement
    - Level sites – from either end
    - Sloping sites – from either end or the upslope side
  - 1’ wide border of sand surrounding aggregate bed and level with top of aggregate bed
  - Min. 6” sand under tires/tracks

ESM INSTALLATION

- Sand Border



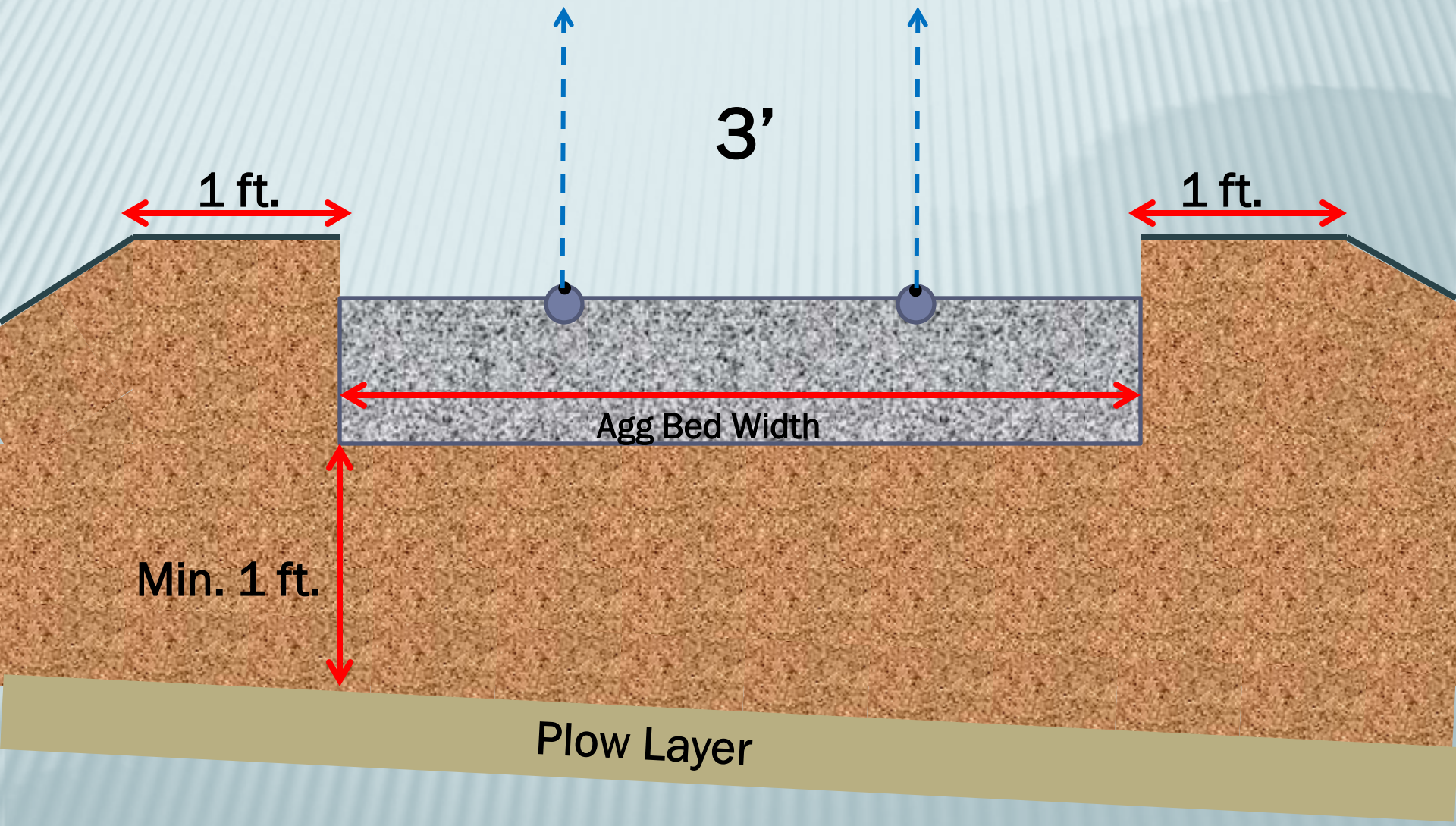
ESM INSTALLATION

- Construction of Aggregate Bed
  - INDOT Spec 23 sand must be raked smooth
  - 6” aggregate under pipe
  - 2” aggregate above pipe
  - Barrier material – side to side, end to end
- **Call for INSPECTION!**
  - Prior to completing aggregate bed for pressure check

ESM INSTALLATION

- Pressure check inspection
  - All joints properly glued except the laterals to the manifold
  - Turn laterals so holes face up
  - 3’ residual head
  - Must have water in dosing tank and electricity connected to pump

ESM INSTALLATION INSPECTION PRESSURE CHECK



PRESSURE CHECK

3 foot throughout the length of the pressure distribution laterals

ESM INSTALLATION

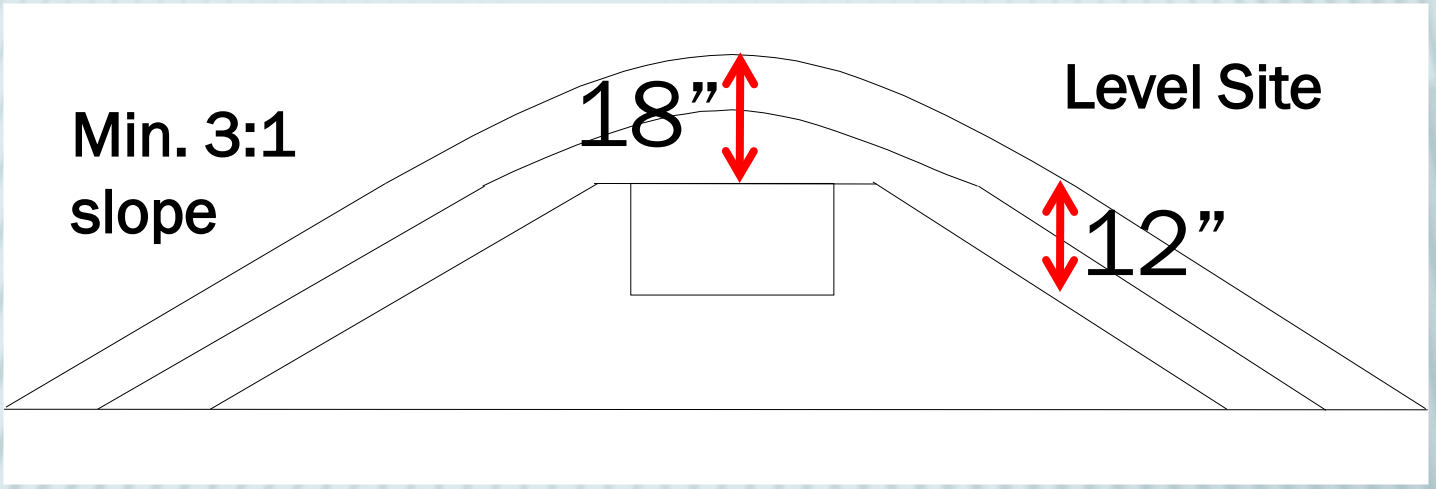
- Complete aggregate bed
  - **Make sure to turn holes down and glue laterals to manifold after pressure check is approved!**
  - Remainder of aggregate
  - Barrier material
    - Cover aggregate from end to end and side to side
    - Multiple passes

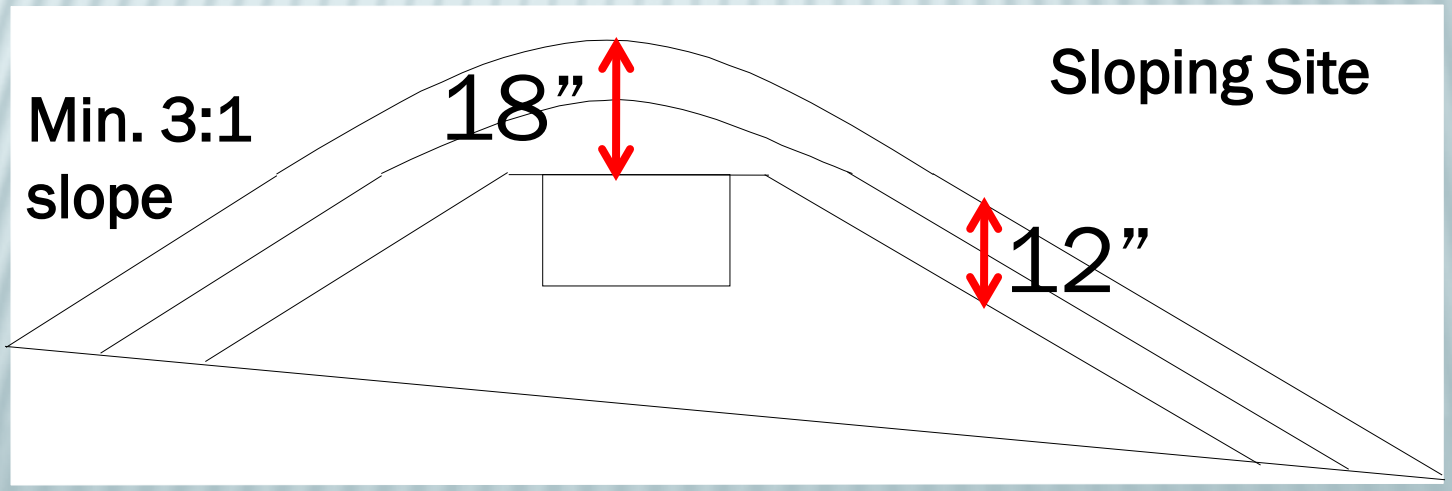
ESM INSTALLATION

- Cover material
  - Rake surface of INDOT Spec 23 sand smooth
  - Till area around sand if not tilled previously
  - Texture other than sand or loamy sand
  - Min. 12” with an additional 6” placed down the center of the aggregate bed
  - Level site – place from the ends
  - Sloping site – place from the ends or upslope
  - Min. 3:1 final grade

RAKE SMOOTH…NOT!

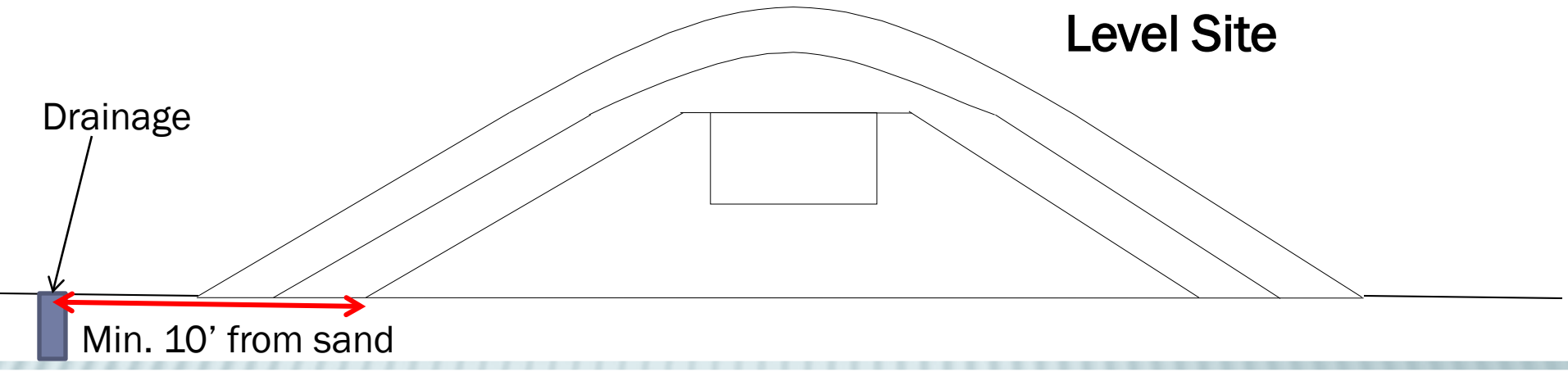
ESM INSTALLATION

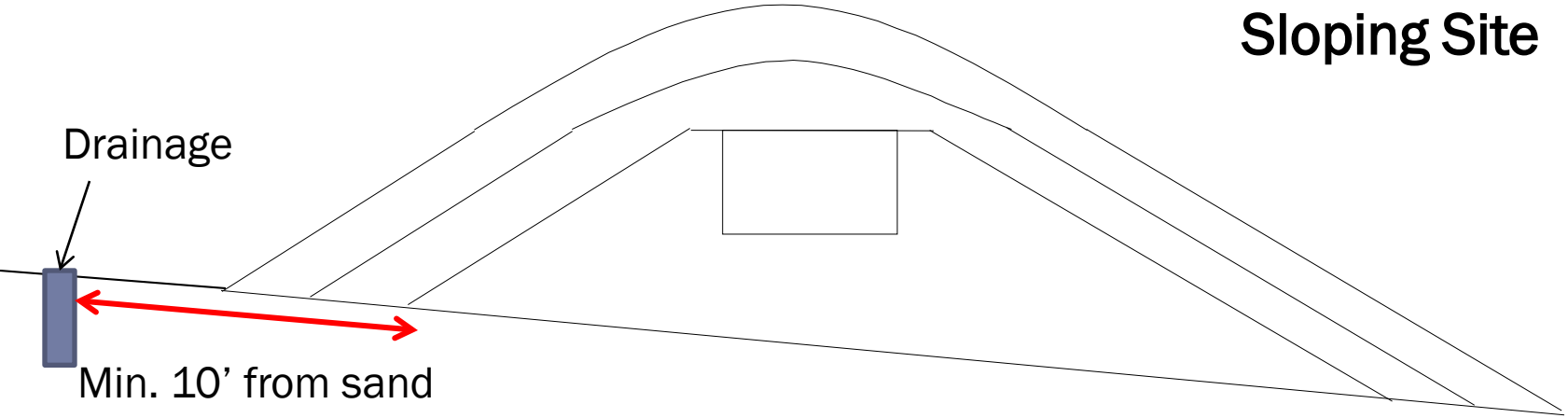




SOIL MATERIAL COVER: SO IMPORTANT

ESM INSTALLATION - DRAINAGE





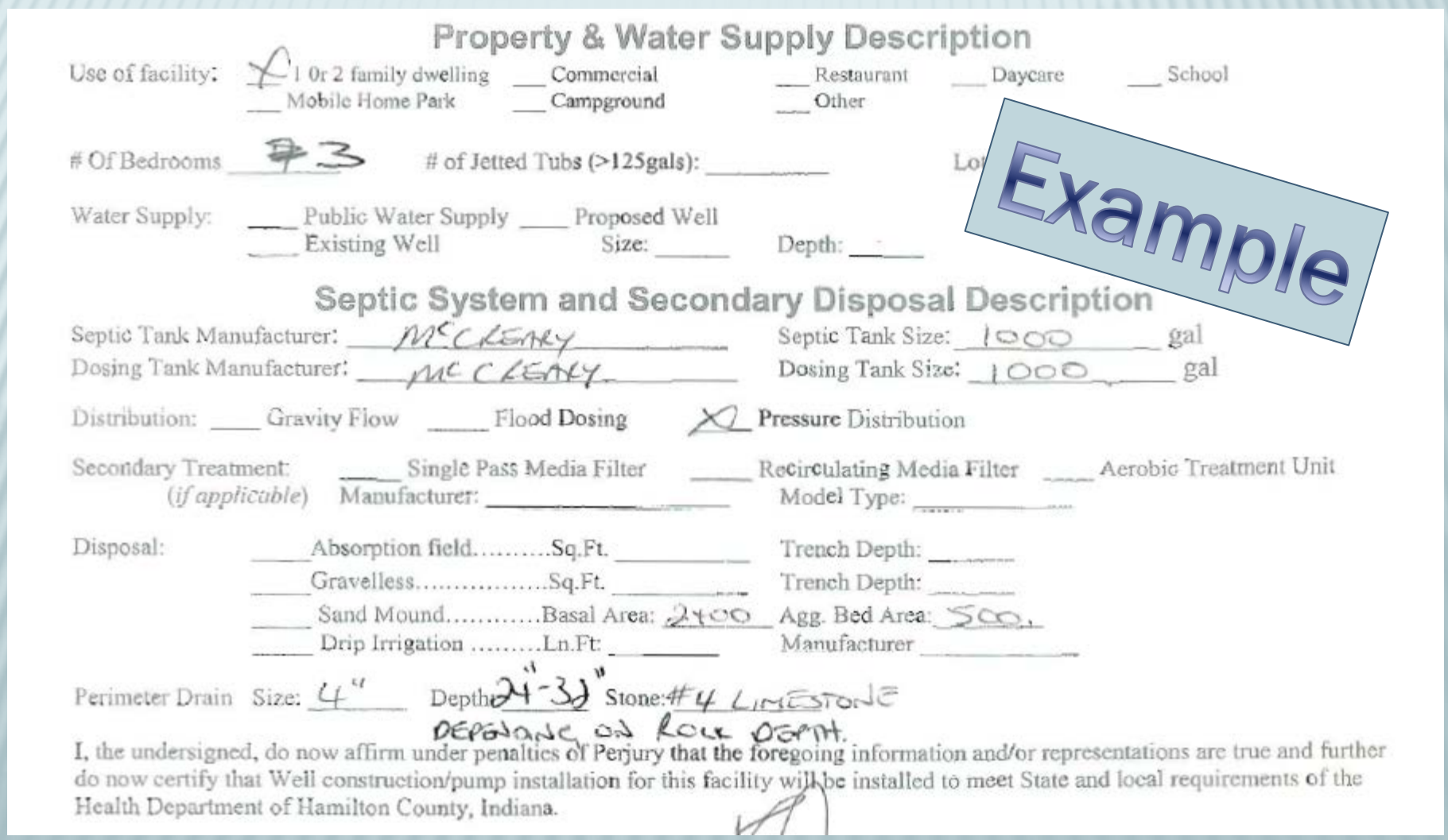
ELEVATED SAND MOUND

In a back yard with rolling topography

ELEVATED SAND MOUND

Protected from livestock traffic

HEALTH DEPARTMENT PERMIT APPLICATION



Property & Water Supply Description

Use of facility: X 1 Or 2 family dwelling ___ Commercial ___ Restaurant ___ Daycare ___ School
___ Mobile Home Park ___ Campground ___ Other

Of Bedrooms 3 # of Jetted Tubs (>125gals): _____ Lo

Water Supply: ___ Public Water Supply ___ Proposed Well
___ Existing Well Size: _____ Depth: _____

Example

Septic System and Secondary Disposal Description

Septic Tank Manufacturer: McCREARY Septic Tank Size: 1000 gal
Dosing Tank Manufacturer: McCREARY Dosing Tank Size: 1000 gal

Distribution: ___ Gravity Flow ___ Flood Dosing X Pressure Distribution

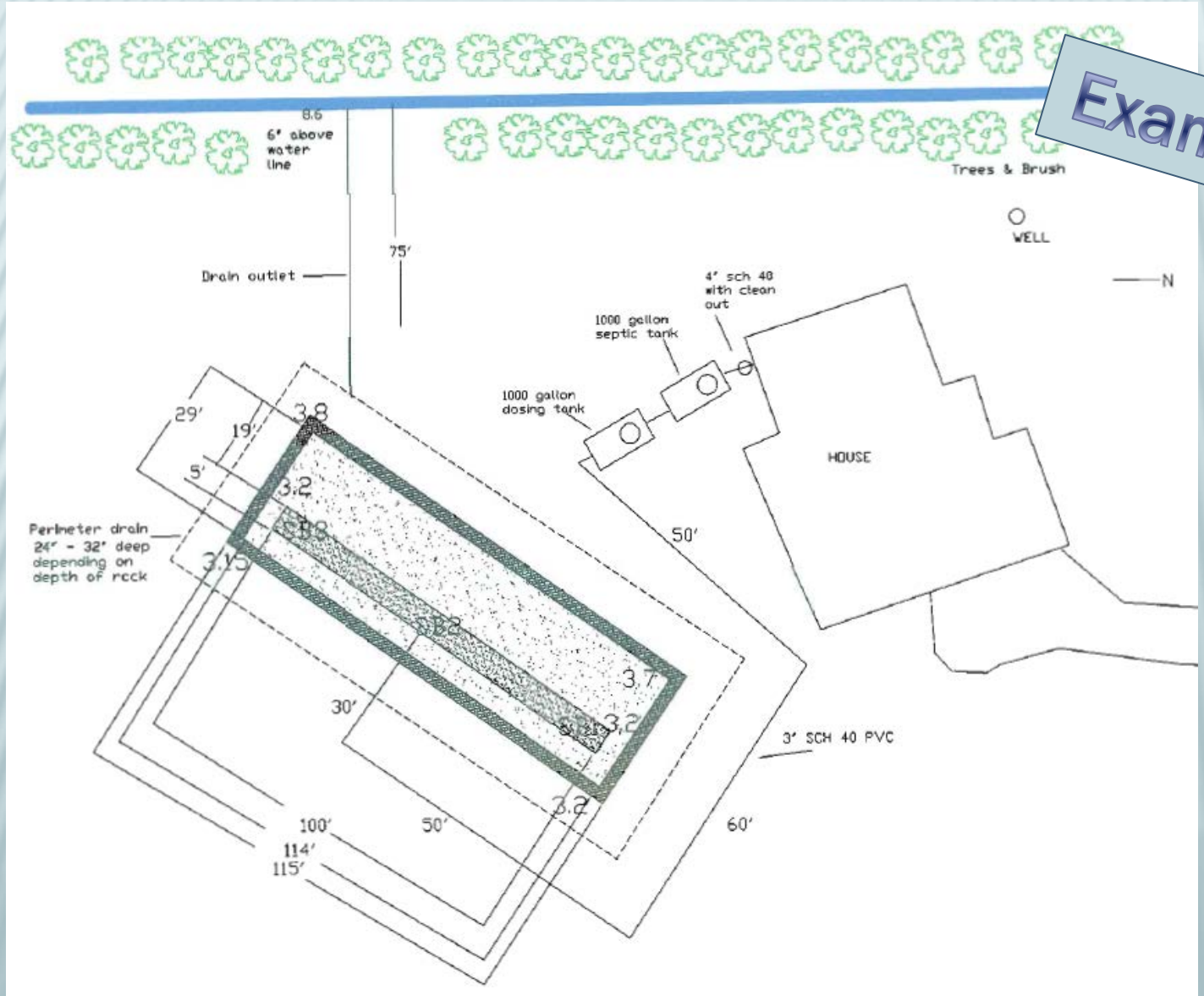
Secondary Treatment: ___ Single Pass Media Filter ___ Recirculating Media Filter ___ Aerobic Treatment Unit
(*if applicable*) Manufacturer: _____ Model Type: _____

Disposal:
___ Absorption field.....Sq.Ft. _____ Trench Depth: _____
___ Gravelless.....Sq.Ft. _____ Trench Depth: _____
___ Sand Mound.....Basal Area: 2400 Agg. Bed Area: 500
___ Drip Irrigation .....Ln.Ft: _____ Manufacturer _____

Perimeter Drain Size: 4" Depth 24"-36" Stone: #4 LIMESTONE
DEPENDANCE ON ROCK DEPTH.

I, the undersigned, do now affirm under penalties of Perjury that the foregoing information and/or representations are true and further do now certify that Well construction/pump installation for this facility will be installed to meet State and local requirements of the Health Department of Hamilton County, Indiana.

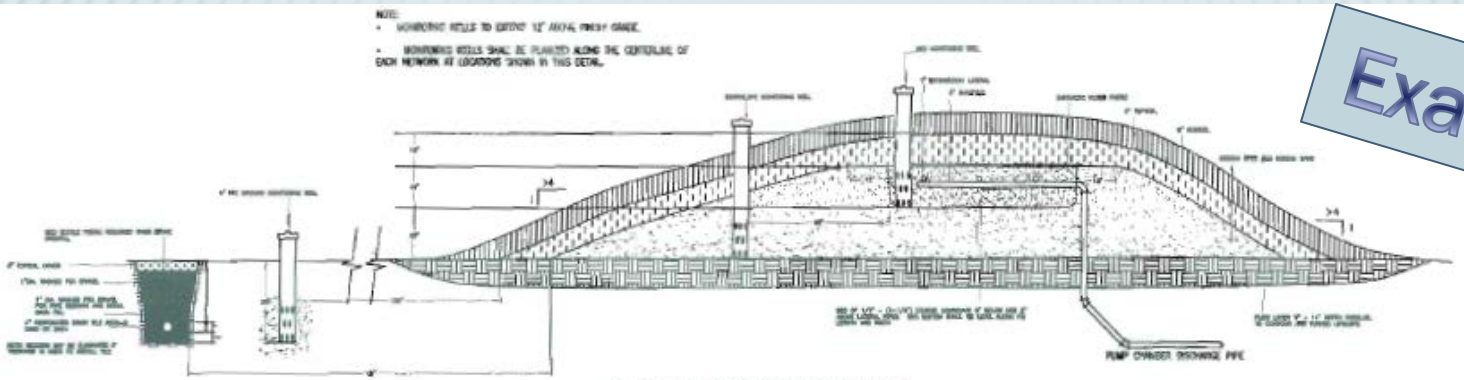
PLAN SUBMITTAL FOR PERMIT APPLICATION



Site View

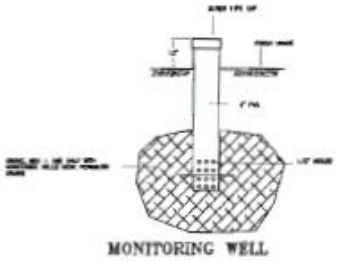
PLAN SUBMITTAL FOR PERMIT APPLICATION

Example



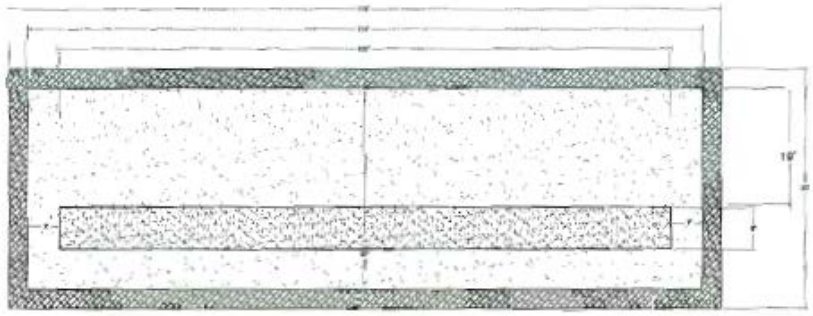
MOUND CROSS SECTION

System View



MONITORING WELL

DISTRIBUTION NETWORK



MOUND LAYOUT

CONTACT INFORMATION

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dhwright@isdh.in.gov
317-412-2136

Web sites for today's materials and additional resources:

www.eph.isdh.in.gov (Indiana State Dept of Health)

www.iowpa.org (Indiana Onsite Wastewater Professional Assoc.)

(Jan. 28-29, 2013-Camp Camby)

www.extension.purdue.edu/NENV (Purdue University)

www.pumpershow.com **(Feb. 25-28, 2013-Indy)**