<u>CIRCULAR DEQ 4</u>

MONTANA STANDARDS

FOR SUBSURFACE WASTEWATER

TREATMENT SYSTEMS

PART 2 of 2

2013 Edition

6.8. EVAPOTRANSPIRATION ABSORPTION AND EVAPOTRANSPIRATION SYSTEMS

6.8.1. General

Evapotranspiration absorption (ETA) systems are used where slow percolation rates or soil conditions would preclude the use of a standard absorption system.

Percolation tests conducted in accordance with Appendix A, with at least a 24-hour presoak of the hole prior to the test or a double-ring infiltrometer procedure outlined in ASTM D5093-02 must be conducted for all ETA systems, at the depth of the bottom of the bed.

Evapotranspiration systems (ET) are used where slow percolation rates or soil conditions would preclude the use of a soil absorption system or where discharge to the receiving soils is undesirable.

The primary difference between the ETA and ET system is the inclusion of a liner in ET systems.

ETA and ET systems should be used in conjunction with wastewater flow reduction strategies.

6.8.2. Location

6.8.2.1. ETA and ET systems must meet all minimum separation distances as stated in ARM Title 17, Chapter 36, subchapter 3 or 9, as applicable. Distances must be measured from the edge of the system.

6.8.2.2. ETA and ET systems must be level and must not be installed on land with a slope greater than 15 percent. Protective berms or drainage trenches must be installed to divert storm drainage and snow-melt run-off away from the system, if necessary.

6.8.3. Design

6.8.3.1. ETA and ET systems must not be deeper than 30 inches from the natural ground surface.

6.8.3.2. The fill material in the ETA and ET system must be washed coarse sand, drain rock meeting the requirements of Section 1.2.25, or other inert media approved by the reviewing authority. Information must be provided to document the void ratio used and, if available, the wicking characteristics of the material.

6.8.3.3. ETA and ET systems must be installed with the long dimension parallel to the land contour.

6.8.3.4. ET systems must include a watertight liner of at least 30-mil thickness to contain the effluent. Seams for a synthetic liner must be completely sealed in accordance with the manufacturer's recommendations and the liner must be keyed into the native soils at its edges.

6.8.3.5. A minimum of 2 inches of sand fill must be placed between the native soil surface and/or any projecting rocks and the liner.

6.8.3.6. Standard absorption trenches, gravelless trenches, other absorption systems, or distribution pipes may be used to distribute effluent in an ETA and ET system.

Standard absorption trenches, gravelless trenches and other absorption systems must be constructed in accordance with Subchapters 6.1 or 6.6 and this chapter. No reduction in absorption area sizing will be allowed for the use of gravelless or other trench technology in ETA or ET systems.

The spacing between standard absorption trenches, gravelless trenches, other trenches, or distribution pipes in an ETA or ET system must be a minimum of 6 feet and maximum of 8 feet measured on center.

Gravel trenches or leaching chambers are required for ET and ETA systems constructed with a sand media. These methods of distribution may be used, but are not required, for ET and ETA systems constructed with a gravel medium.

6.8.3.7. Soils with an initial percolation rate between 121 and 240 mpi, with a 24-hour presoak of the hole prior to the test, may use an ET or ETA system. All calculations must be submitted for review.

Soils with an initial percolation rate of 241 mpi or slower may use an ETA system if the percolation rate, determined in the field, using the ASTM D5093-02 double-ring infiltrometer procedure shows a rate between 121 and 240 mpi. All calculations must be submitted for review.

6.8.3.8. Calculated storage capacity must provide a factor of safety of at least 1.5 for storage loss over time caused by plugging of the voids due to evaporated salts and residuals wastewater flow rates.

6.8.3.9. Water balance sizing calculations for ETA and ET systems must be based on a one-year period. A water balance analysis may include pan evaporation data, precipitation for the wettest year in a 10-year period, soils absorption information from the site, transpiration, and other site-specific design information.

A. Pan evaporation information may be included in the water balance where it can be adequately demonstrated. Very few locations exist where data has been tabulated in Montana and calculations must address site-specific pan evaporation conditions.

B. The design must show that total water lost through evaporation and absorption equals or exceeds the total water gained through precipitation and effluent discharge. Precipitation information used must be for the wettest year in a 10-year period. Storage capacity must be built into the system to accommodate months with low evaporation.

C. Transpiration may be included in the water balance where it can be adequately demonstrated.

D. Other site-specific design information such as shade, area topography, or manmade structures must be considered.

6.8.4. Construction

6.8.4.1. Construction of an ET system must be initiated immediately after preparation of the liner.

6.8.4.2. Excavation for ETA systems may proceed only when the moisture content is below the soil's plastic limit. If a sample of soil taken at the depth of the proposed bottom of the system forms a ribbon, instead of crumbling, when one attempts to roll it between the hands, the soil is too wet to excavate.

6.8.4.3. ETA construction must be completed in such a manner to prevent compaction.

The fill material must be covered completely with an appropriate geotextile fabric, untreated building paper, or 2 inches of straw to prevent the soil cover from entering the media.

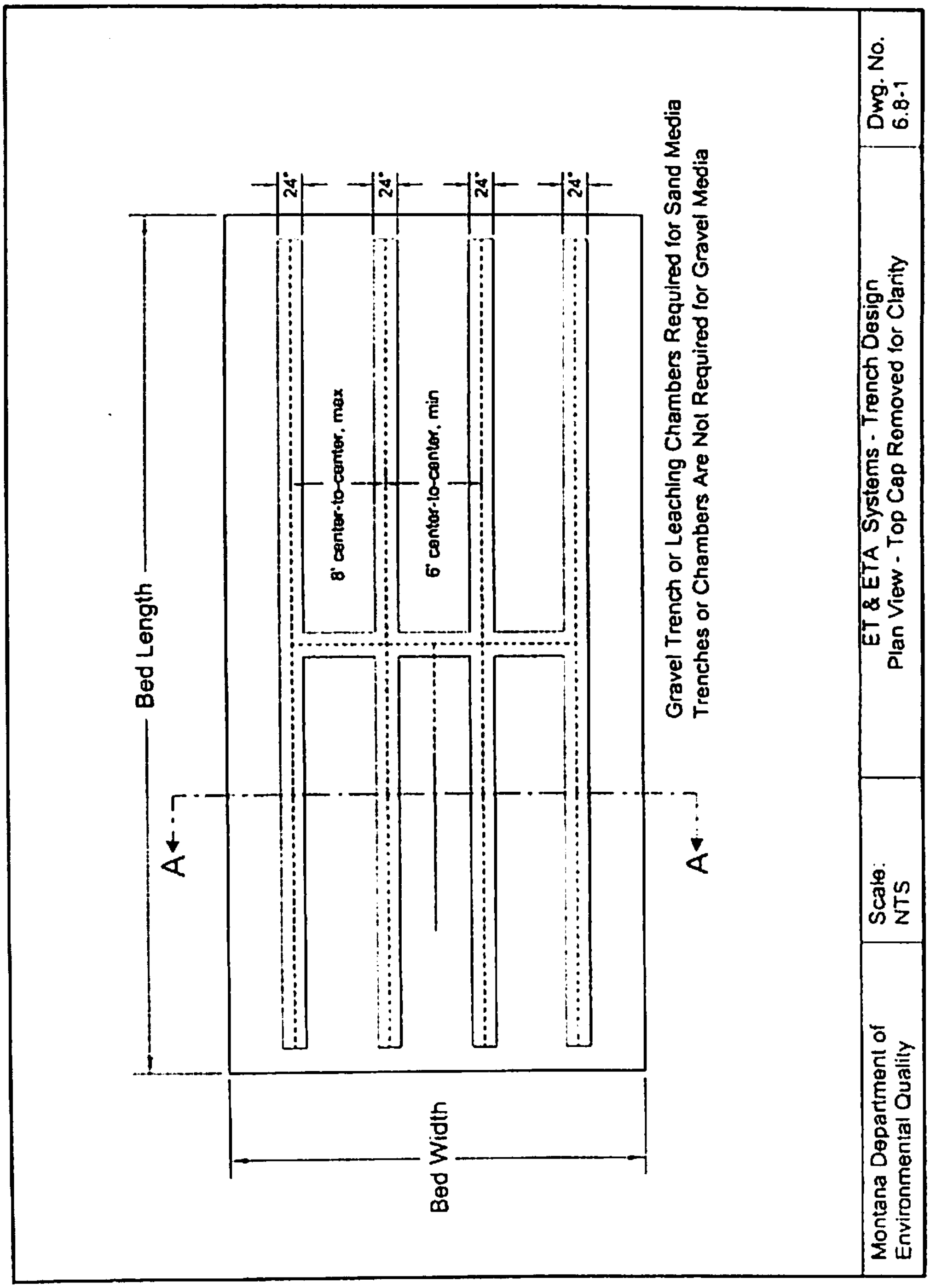
6.8.4.4. A 4-inch diameter standing check pipe with both ends capped (only the bottom cap should be glued) must be installed. Several 1/8-inch to 1/4-inch diameter holes should be drilled in the bottom half of the pipe and covered with a filter cloth sock. The check pipe should be anchored in fill material to prevent the pipe from being pulled out of the system.

6.8.4.5. The ETA and ET system must be covered with a minimum of 12 inches at the center of the system and 6 inches at the edge of the system of a suitable medium, such as sandy loam, loamy sand, or silt loam to provide drainage and aeration. These depths are measured after settling.

The topsoil cap must be immediately vegetated after construction with sod or other appropriate method.

6.8.5. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements in Appendix D. Certification and as-built plans are required in accordance with Appendix D.


Bed Length
Bed Width
24"
24"
24"
24"
8' center-to-center, max
6' center-to-center, min
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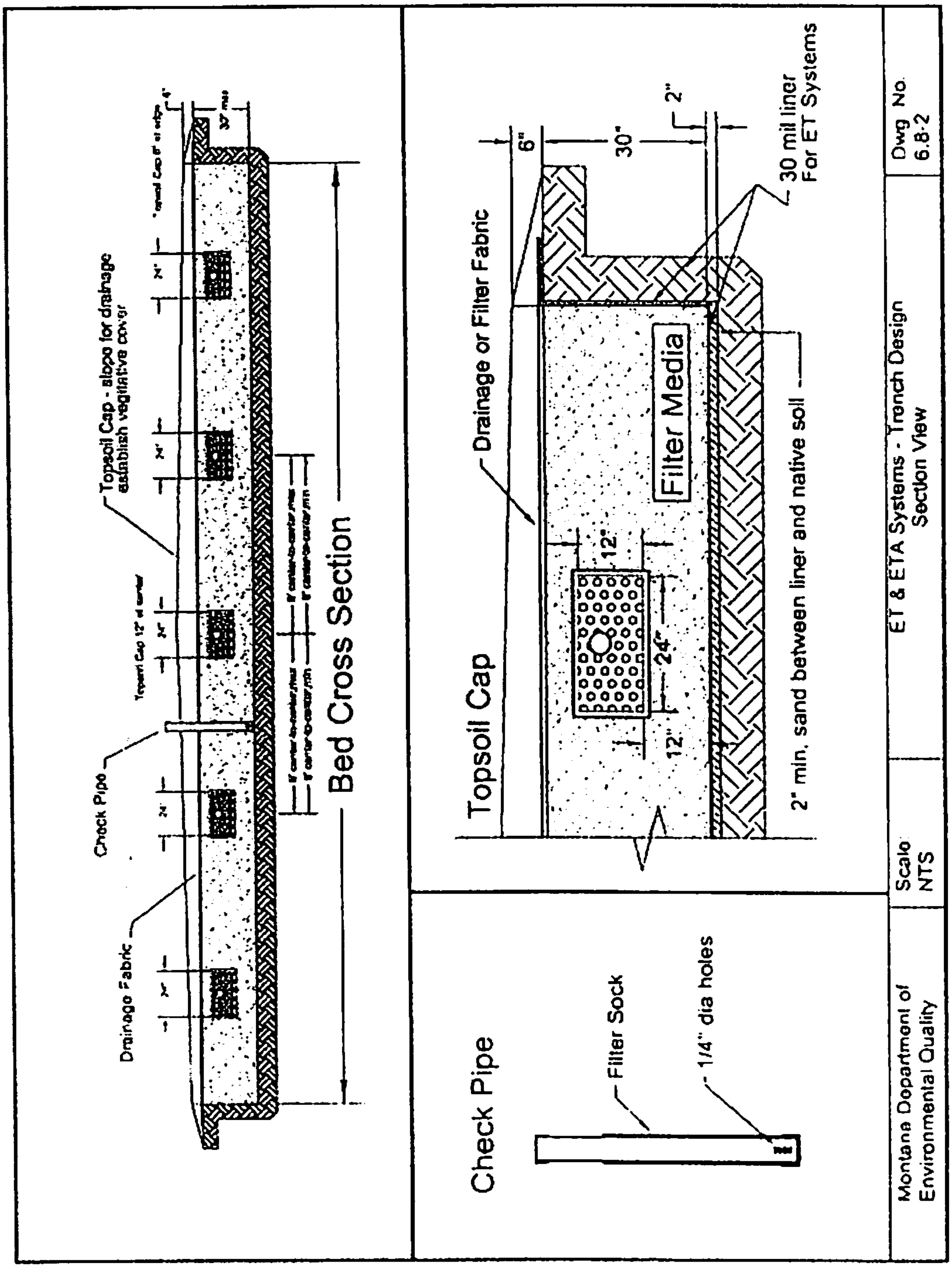
Gravel Trench or Leaching Chambers Required for Sand Media
Trenches or Chambers Are Not Required for Gravel Media
Montana Department of
Environmental Quality
Scale:
NTS
ET & ETA Systems - Trench Design
Plan View - Top Cap Removed for Clarity
Dwg. No.
6.8-1


Topsoil Cap - slope for drainage
establish vegitative cover
Check Pipe
Drainage Fabric
Bed Cross Section
Topsoil Cap
Drainage or Filter Fabric
6"
30"
2"
30 mil liner
For ET Systems
Filter Media
12"
24"
12"
2" min. sand between liner and native soil
Check Pipe
Filter Sock
1/4" dia holes
Montana Department of
Environmental Quality
Scale
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ET & ETA Systems - Trench Design
Section View
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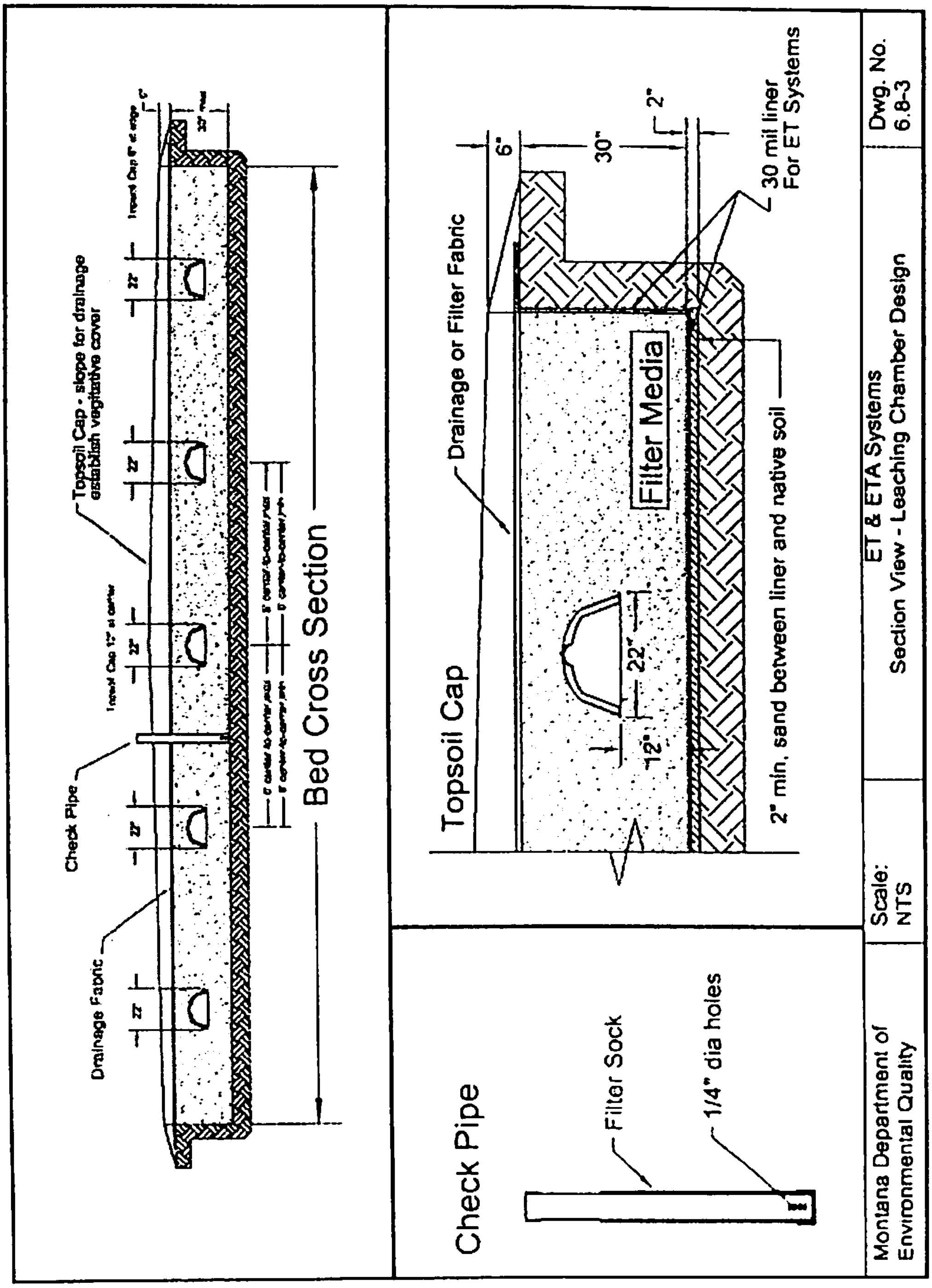
6.8-2


Topsoil Cap - slope for drainage establish vegitative cover
Check Pipe
Drainage Fabric
22"
Bed Cross Section
Topsoil Cap
Drainage or Filter Fabric
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30 mil liner
For ET Systems
Filter Media
22"
12"
2" min, sand between liner and native soil
Check Pipe
Filter Sock
1/4" dia holes
Montana Department of
Environmental Quality
Scale:
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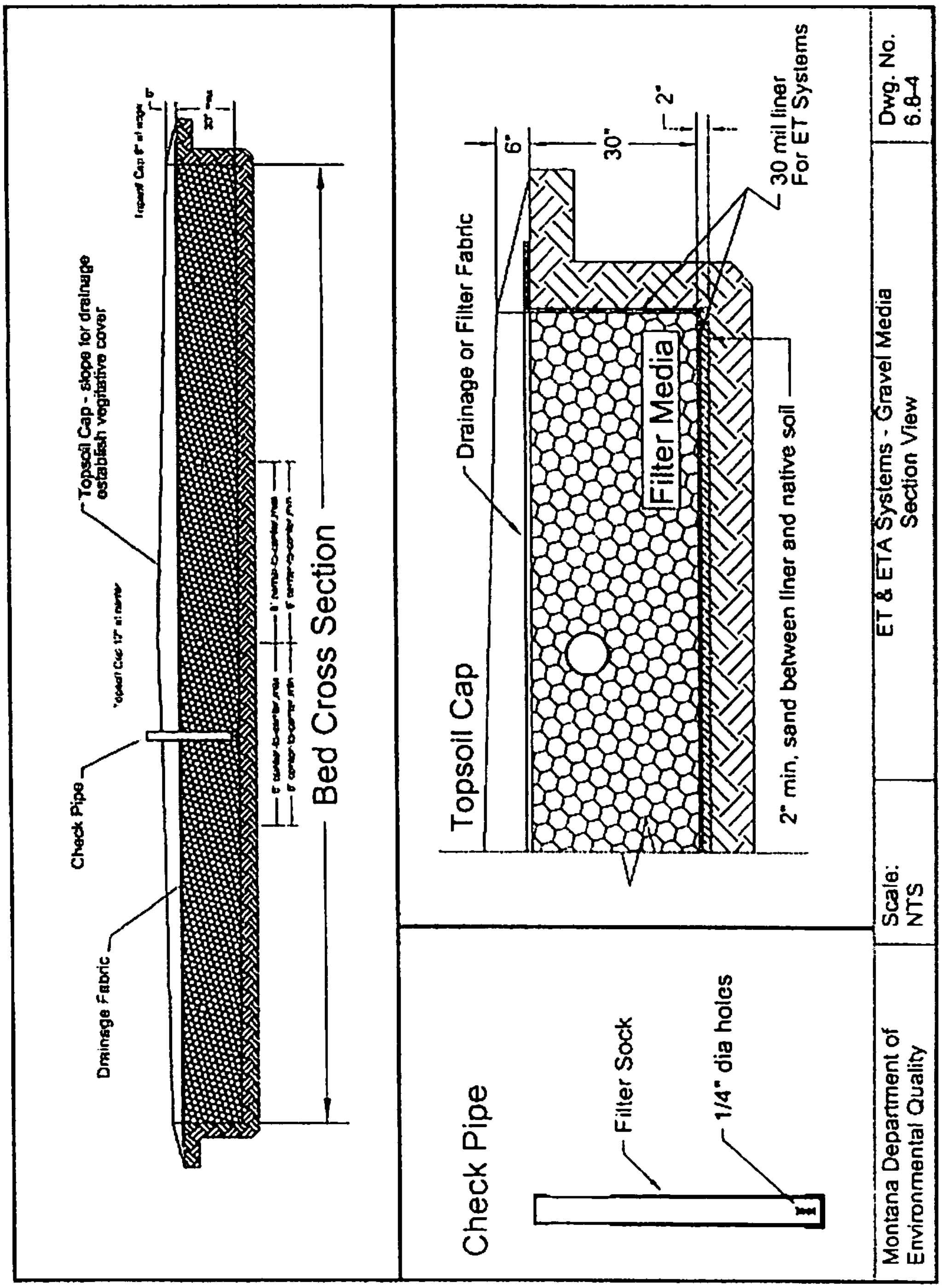
ET & ETA Systems
Section View - Leaching Chamber Design
Dwg. No.
6.8-3


Topsoil Cap - slope for drainage establish vegitative cover
Check Pipe
Drainage Fabric
Bed Cross Section
Drainage or Filter Fabric
Topsoil Cap
Filter Media
6"
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2"
30 mil liner For ET Systems
2" min, sand between liner and native soil
Check Pipe
Filter Sock
1/4" dia holes
Montana Department of Environmental Quality
Scale: NTS
ET & ETA Systems - Gravel Media Section View
Dwg. No. 6.8-4

6.9. SUBSURFACE DRIP

6.9.1. General

Subsurface drip systems are an efficient method for dispersal of wastewater and/or gray water into the soil in small volume doses throughout the day. Uniformly spaced drip emitters in flexible polyethylene tubing control the rate of wastewater discharge and are available in either turbulent flow or pressure compensating configurations.

Each emitter's pressure compensating feature controls discharge at a nearly constant rate along the entire drip line lateral's length over a wide range of pressures. Typically, the drip line is installed directly into the soil without aggregate or other media. Pumps fill and pressurize the drip line sufficiently to achieve uniform distribution.

Monitoring system function and performance along with effluent metering is essential to proper operation. The subsurface drip system is typically operated by an integrated controller programmed to activate the pumps to dose the drip line at appropriate intervals and duration. The controller must be programmable to perform a forward flush of the drip line and back flushing of a filter. The controller should also store operating data for documenting system performance and diagnosing system malfunctions.

6.9.2. Location

Subsurface drip systems must meet the site evaluation criteria of Chapter 2.

Subsurface drip systems must meet the location criteria in ARM Title 17, Chapter 36, subchapter 3 or 9, as applicable. The subsurface drip system may not be located where vehicles will cross the drip lines. Potable water lines may not pass under or through any part of the dispersal system.

Each submittal must address how the service provider can access the subsurface drip system for maintenance and how property use can be controlled to prevent unauthorized access to components.

6.9.3. Design

6.9.3.1. Wastewater Quantity and Quality Characterization

The quantity of expected wastewater or gray water shall be estimated using the guidelines outlined in Chapter 3 or Subchapter 6.10.

6.9.3.2. Materials

All subsurface drip system materials must be warranted by the manufacturer for use with sewage and be resistant to plugging from solids, bacterial slime, and root intrusion.

Fittings used to join the drip line to the distribution line and for flushing the manifolds must be installed in accordance with manufacturer's recommendations. Either compression or barb fittings may be specified, depending on the manufacturer's recommendations and system operating pressure.

6.9.3.3. System Components

A. Primary Treatment

All subsurface drip systems must include a septic tank in compliance with Chapter 5.

B. Advanced Wastewater Treatment System

An advanced wastewater treatment system is required prior to final subsurface disposal in compliance with Chapter 7.

C. Dosing System

Pressure distribution must be provided.

All subsurface drip systems must operate at pressures indicated in the manufacturer's specifications. These operating pressures are typically between 15 to 45 psi.

Timed dosing is required. A minimum number of 12 equally spaced doses per day are required. A method to track and verify dosing volumes and times, such as a digital control panel, pump elapsed time meters (ETMs), event counters, etc., must be provided.

D. Pumps/System Flushing

Pump selection must take into account the operating volume and pressure for the drip dispersal field when calculating the total dynamic head required for filter flushing and/or back flushing, field dosing, and drip line flushing. All disposal and flushing parameters must fall within the operational range of the pump selected.

All subsurface drip systems must include means to backwash the filters and flush drip lines and manifolds.

Filter backwash and drip line flushing must be automatic. Filter backwash and drip line flushing must be accomplished according to manufacturer's recommendations to prevent damage to the drip line and maintain product warranty.

Filter backwash and drip line flushing debris must be returned to the septic tank or the primary treatment tank.

Hose bibs are not allowed for use as a flushing component, to prevent cross contamination of potable water supply.

Field flushing velocity must be designed at the distal end of each drip line lateral connection. This velocity must be the same as required by the drip line manufacturer.

The flush return volume may not exceed the hydraulic capacity of the pretreatment unit.

E. Supply and Return Manifolds

Both supply and return manifolds are required on all subsurface drip systems.

F. Component Design and Construction

All piping, valves, fittings, level control switches, and all other components must be designed and manufactured to resist the corrosive effects of wastewater and common household chemicals.

G. Drip Line/Dispersal Line

Drip line tubing is typically a flexible polyethylene (PE) available in several diameters with a nominal 1/2 inch as the typical size in wastewater applications.

The drip line must be color coded purple by the manufacturer to be easily recognized as suitable for subsurface drip dispersal.

The drip line must be warranted fully by the manufacturer for protection against root intrusion for a minimum period of 10 years.

Drip lines should always be installed as level as possible on the contour line.

Drip lines must be installed to facilitate positive drainage back to the manifold. No standing water may pool within the system. Subsurface drip systems located on sloped sites must be designed and installed to prevent drainage to lower elevated components (drip lines, tanks, valve boxes, etc.).

Minimum installation depth for drip lines and manifolds is 8 inches beneath grade. Site specific characteristics and land use practices may require a deeper depth of installation.

Drip lines should be installed on 2-foot centers.

H. Emitters

Emitter size and type must be specifically designed for use in a subsurface drip system.

All subsurface drip systems must be equipped with self-cleaning, pressure compensating, or turbulent flow emitters.

Emitters should be installed on 2-foot intervals along the drip line with an effective subsurface infiltrative area of 4 square feet. This spacing may be altered for specific reuse systems per both the manufacturer's recommendations and the reviewing authority's approval. Spacing of emitters closer than 2 feet does not change the required subsurface infiltrative area.

The discharge rate of emitters may not vary by more than 10 percent over the entire drip line lateral in order to ensure that the effluent is uniformly distributed over the disposal area.

I. Filters

Designers shall specify the filter that is recommended by the drip line manufacturer.

All filters used must be resistant to corrosion. The manufacturer shall warrant the filters for wastewater use.

All filters must be sized to operate at a flow rate at least equal to the maximum design discharge rate of the system. Filter backwash must be included in calculating the maximum discharge rate, where applicable.

Filters may either require backwashing in accordance with manufacturer's recommendations or may be the continuously self-cleaning type.

All subsurface drip system filters must be readily accessible for inspection and servicing.

J. Flow Meter

Flow meters or some other means to monitor flow must be installed in a readily accessible location for reading and servicing. Flow meters must be warranted by the manufacturer for use with wastewater and must be accurate within the expected flow range of the installed system.

K. Electronic control panel

A controller capable of timed dosing and automatic line/filter flushing is required.

L. Air/Vacuum Relief Valve(s)

Air/vacuum relief valve(s) must be installed at the high point(s) of each supply or return manifold. All valves must be installed in a valve box with access to grade and include a gravel sump. They must have constant venting to the atmosphere.

M. Control Valves

Valves must be readily accessible for inspection and/or service, such as in a valve box with access to grade.

Control valves used for system flushing and zone distribution must operate automatically.

Pressure regulators are recommended for all subsurface drip systems.

Pressure gauge access points (Schrader valves or equal) are required at appropriate locations on system networks utilizing turbulent flow emitters to verify design and operational performance. Pressure gauge access points are recommended to be installed on all systems.

6.9.3.4. Sizing

Subsurface drip systems must be sized in accordance with soil descriptions of Chapter 2 and Appendix B. Unless otherwise approved by the reviewing authority, the effective width of the absorption area will be 2 feet per drip line.

No reduction in absorption field size will be granted for advanced wastewater treatment systems.

6.9.3.5 All subsurface drip systems must be designed to remain free flowing during freezing conditions. The reviewing authority may direct the timing for installation of the subsurface drip system to correspond to favorable weather conditions.

6.9.4 Construction

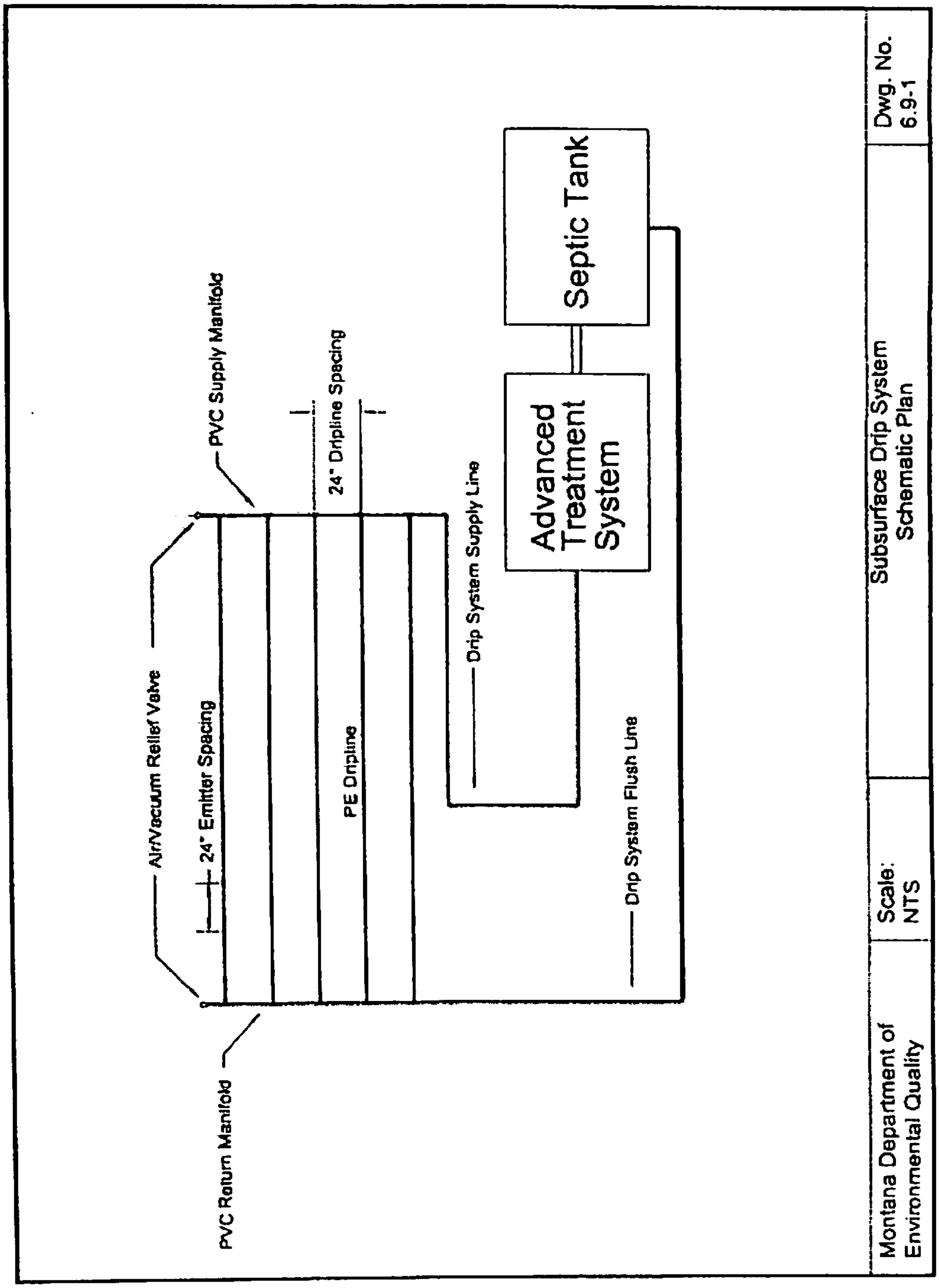
Installation instructions and recommendations vary by manufacturer. Installation knowledge and skill may be product-specific. Installers are responsible for obtaining proper training before attempting to install subsurface drip systems.

A ground cover (turf or other appropriate landscaping) must be planted over the dispersal field after installation to prevent erosion. Selection of the ground cover type and subsequent maintenance requirements must not compromise the integrity of the disposal area.

In addition to these standards, all systems must be constructed in accordance with manufacturer's recommendations.

6.9.5 Operation and Maintenance

A detailed set of plans and specifications and an operation and maintenance plan are required for all components of the system. The operation and maintenance plan must meet the requirements outlined in Appendix D.


Septic Tank
Advanced Treatment System
PVC Supply Manifold
24" Dripline Spacing
Drip System Supply Line
Air/Vacuum Relief Valve
24" Emitter Spacing
PE Dripline
Drip System Flush Line
PVC Return Manifold
Dwg. No. 6.9-1
Subsurface Drip System Schematic Plan
Scale: NTS
Montana Department of Environmental Quality

6.10 GRAY WATER IRRIGATION SYSTEMS

6.10.1. General

Gray water is untreated wastewater collected from bath tubs, showers, lavatory sinks, clothes washing machines, and laundry tubs. Gray water systems used in conjunction with a waste segregation system may also use wastewater collected from kitchens. Gray water can be contaminated with organic matter, suspended solids, or microorganisms that are potentially pathogenic. In general, treatment and disposal of gray water is subject to all applicable provisions in this Circular, except that gray water may be used for irrigation as provided in this chapter.

Gray water reuse within a building or residence, for uses such as toilet flushing, is permitted without review, provided that the gray water is ultimately disposed of by means of an approved wastewater treatment system that meets all applicable requirements of this Circular.

Gray water irrigation systems that meet the requirements of this chapter are not subject to the other chapters in this Circular, except as specifically referenced in this chapter.

6.10.2. Location

Gray water irrigation systems must meet the location criteria for gray water reuse set out in ARM Title 17, Chapter 36, subchapter 3 or 9, as applicable.

6.10.3. Design

6.10.3.1. The collection, storage, and distribution portions of a gray water irrigation system must be designed in accordance with this chapter. The reviewing authority may allow the use of other designs and material pursuant to the review of manufacturer's information and data to substantiate the proposed alternative.

6.10.3.2. Except for lots with waste segregation systems, lots with gray water irrigation systems must be served by an existing approved alternate wastewater treatment system that is adequate to treat both the gray water and the other wastewater from the lot. Lots with waste segregation systems must have an alternate approved waste water treatment system for treating gray water, although the system need not be installed if gray water irrigation is conducted pursuant to this chapter.

6.10.3.3. Gray water from kitchen sources may be used for irrigation only where a waste segregation system is used.

6.10.3.4. All effluent from sources that are not gray water must be disposed of in an approved wastewater system.

6.10.3.5. The reviewing authority may require sampling data to ensure that the strength of gray water used for irrigation does not exceed typical residential strength parameters.

6.10.3.6. Gray water irrigation systems must use subsurface dispersal. All systems must be a minimum of 6 inches below the ground surface. Ponding or water surfacing may not occur at any gray water irrigation location.

6.10.3.7. Gray water irrigation system designs may be augmented with potable water. If potable water is used to augment gray water for irrigation within the same distribution network, a method of backflow prevention for the potable water source must be included that is consistent with the requirements of ARM Title 17, Chapter 38, subchapter 3.

6.10.3.8. All gray water irrigation system piping and appurtenances must be easily identifiable as non-potable through the use of purple piping and continuous marking at a minimum of 4-foot intervals. Tanks, pumps, and other equipment must also be labeled as "non-potable" using a permanent label placed in a conspicuous location.

6.10.3.9. If a gray water irrigation system is proposed for a lot served by a public wastewater system, the reviewing authority may not approve the gray water system unless the managing entity of the public system provides a letter of approval.

6.10.3.10. Gray water design flow rates must be estimated as follows:

A. Estimated Residential Flow Rates:

To determine total flow rate for the gray water irrigation system, the number of occupants must be multiplied by the estimated flow shown in this subsection, Table 6.10-1.

Table 6.10-1

Number of occupants per residential living unit:		
	1st bedroom	2
	each additional bedroom	1
Flow for each occupant is:		
	showers, tubs, wash basins	25 gpd
	laundry	15 gpd
	kitchen	10 gpd

B. Estimated Nonresidential Flow Rates:

Nonresidential flow rates must be substantiated by the system designer in order to be approved by the reviewing authority.

6.10.3.11. Gray water irrigation systems must have a minimum absorption area based on soil types as described in accordance with Chapter 2 and Appendix B and Section

6.1.4.

6.10.3.12. Gray water irrigation systems that are not designed to prevent freezing must be used in conjunction with a supplemental year-round method for wastewater treatment and disposal that meets applicable state and local requirements.

6.10.3.13. When a supplemental year-round system is used, gray water irrigation systems must include a three-way diverter valve to easily direct gray water to the year-round wastewater treatment system when needed. A backflow prevention device must be installed to prevent black water from entering the gray water irrigation system.

6.10.3.14. The year-round wastewater treatment system must be sized to accept and treat the total flow from the gray water irrigation system together with any other effluent in the system.

6.10.3.15. A gray water irrigation system may not adversely impact the functioning of the year-round wastewater treatment system.

6.10.3.16. Gray water systems may be installed in fill.

6.10.4. Collection and Distribution

6.10.4.1. Hose bib or hose-type attachments, including frost-free hydrants, may not be present on a gray water irrigation system.

6.10.4.2. The design must include appropriate valves or other methods to isolate the surge tank, irrigation zones, and connection to a wastewater treatment system.

6.10.4.3. Surge tanks may be incorporated into a gray water irrigation system design. Surge tanks allow for uniform distribution of the gray water despite variable flow from the source. If a gray water irrigation system contains a surge tank, the tank must meet the following requirements:

A. Surge tanks used for the storage and distribution of gray water must be designed by the manufacturer for use with wastewater;
B. Surge tanks must be easily accessible for maintenance with a locking gasketed access opening or approved equivalent;
C. Surge tanks must be covered;
D. The minimum capacity of the surge tank must be 50 gallons;
E. Surge tanks may be installed either inside or outside a building, above or below ground;
F. Aboveground surge tanks must be installed on a level, 3-inch concrete slab or equivalent, and must be anchored to prevent overturning;
G. Below ground surge tanks must be installed in dry, level, well-compacted soil. Buoyancy of the surge tank must be prevented with appropriate construction where high ground water exists;

H. Surge tanks must be equipped with an overflow pipe of the same diameter as the gray water influent pipe. The overflow must be permanently connected to an approved wastewater treatment system. This connection should be made to the building sewer, or septic tank, if any. The overflow drain may not be equipped with a shutoff valve. For waste segregation systems without an approved alternate wastewater treatment system installed, the overflow from the surge tank must be connected to a second surge tank. The second surge tank must also connect to the gray water irrigation system;

I. Above ground surge tanks must be equipped with an emergency drain of the same diameter as the gray water influent pipe. The emergency drain must be permanently connected to an approved wastewater treatment system. This connection should be made to the building drain, building sewer, or septic tank, if any;

J. The surge tank must include a method of backflow prevention that complies with ARM Title 17, Chapter 38, subchapter 3;

K. Surge tanks must include vents to the atmosphere; and

L. If storage time within the collection system is going to exceed 24 hours, appropriate treatment for odor control may be necessary.

6.10.4.4. All gray water irrigation systems should include a filter to prevent the buildup of solids and to ensure proper system functioning. If no filter is included in the design, at least 3 valved irrigation zones must be designated. Each irrigation zone must have the required length of trench to accommodate the entire gray water flow per day with automatic valves to rotate the distribution of gray water between irrigation zones.

6.10.4.5. Gravity fed absorption trenches may not exceed 100 feet in length.

6.10.4.6. All pressure dosed gray water irrigation systems must meet the following minimum requirements:

A. Surge tanks must provide sufficient access to allow maintenance of the tank and pump. Surge tanks using a siphon should have a dose counter installed to check for continued function of the siphon;

B. High-water alarms must be provided for all surge tanks utilizing pumps;

C. The minimum dose volume must be equal to the drained volume of the discharge line and manifold plus a volume equal to at least 2 times the lateral volume;

D. The duration of each discharge should not exceed 15 minutes to promote uniform distribution and soil absorption;

E. The reserve volume of the dosing system surge tank must be at least equivalent to 25 percent of the design flow. This reserve volume is computed from the high-level alarm;

F. Cleanouts must be provided at the end of every lateral. Cleanouts must be within 6 inches of finished grade and should be made with either a long sweep elbow or 2 45-degree bends; and

G. Dosed irrigation systems should be field-tested to verify uniform distribution.

6.10.5. Operation and Maintenance, Certification, and As-builts

6.10.5.1. Property owners are responsible for proper operation and maintenance of their gray water irrigation systems. Gray water systems that include kitchen wastewater may have increased maintenance requirements.

6.10.5.2. All public gray water irrigation systems must submit a detailed set of plans, specifications, and an operation and maintenance plan to the reviewing authority in accordance with Appendix D. Certification and as-built plans are required in accordance with Appendix D.

6.11. ABSORPTION BEDS

6.11.1. General

Absorption beds may be used as replacement wastewater treatment systems in existing lots where standard absorption trenches cannot be utilized. Absorption beds may be used as replacement for previously approved seepage pits. Absorption beds may not be used on new lots without an existing wastewater treatment system that has been in continuous use and that was permitted by the reviewing authority.

Absorption beds must meet the same requirements as standard absorption trenches as described in Subchapter 6.1, except where specifically modified in this chapter.

Rapid infiltration basins designed for effluent disposal rather than subsurface treatment must be designed in accordance with DEQ-2.

6.11.2. Design

6.11.2.1. Absorption beds must be more than 3 feet wide, and must be at least 2 feet in depth, unless a limiting condition requires a lesser depth, but in no case may the bed be less than 1 foot in depth.

6.11.2.2. Pressure distribution must be provided for all absorption beds with a minimum of 2 distribution pipes installed per system.

6.11.2.3. Distribution piping should be separated by a minimum of 30 inches and a maximum of 48 inches and 18 to 30 inches from the edge of the excavation.

6.11.2.4. Absorption bed sizing is determined by flows described in Chapter 3, the application rates in Chapter 2, along with the procedure described in Section 6.1.4 or by using the maximum area available. Absorption beds shall not be installed with soils that have percolation rates greater than 60 mpi.

6.11.3. Construction

6.11.3.1. Absorption beds may be constructed in accordance with Chapter 2 but must not be constructed on unstabilized fill.

6.11.3.2. The excavation must be filled with a minimum of 6 inches of washed rock or 6 inches of ASTM C-33-13 sand.

6.11.3.3. Distribution piping should be covered by 2 inches of drain rock meeting the requirements of Section 1.2.25.

6.11.3.4 Distribution piping must be installed to ensure uniform distribution of effluent.

6.11.3.5 Drain rock must be covered with an appropriate geotextile fabric, untreated building paper, or straw at least 4 inches in depth.

6.11.3.6 Backfill for beds should be loam type soils that do not form an impervious seal. High clay or silt content soils may not be used for backfill.

6.11.4. Gravelless or other absorption systems may be used in absorption beds. Gravelless or other absorption systems must be installed in accordance with Subchapter 6.6 and this subchapter. No reduction in sizing will be allowed for the use of gravelless or other systems in absorption beds.

7. ADVANCED WASTEWATER TREATMENT SYSTEMS

7.1. RECIRCULATING MEDIA TRICKLING FILTERS

7.1.1. General

These systems utilize aerobic, attached-growth treatment processes to biologically oxidize organic material and convert ammonia to nitrate (nitrification). A trickling filter consists of a bed of highly permeable medium to which a bio-film adheres in an unsaturated environment. Wastewater is applied to the top of the bed and trickles through the media. Microorganisms in the bio-film degrade organic material and may also nitrify the wastewater. An under-drain system collects the treated wastewater and any sloughed solids and transports it to a settling tank from which it is recirculated and trickled back through the media.

Due to the reduced amount of BOD_5 and TSS produced by this technology, the absorption system used for final disposal may be reduced, except where specifically prohibited in this Circular, for the following soil types:

A. For subsurface absorption systems constructed in soils with percolation rates between 3 and 50 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 50 percent;
B. For subsurface absorption systems constructed in soils with percolation rates between 51 and 120 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 25 percent.

The reviewing authority may request data from the recirculating trickling media filter to demonstrate performance criteria.

A separate subsurface absorption replacement area, sized without reductions, must be designated for each site using a recirculating trickling media filter.

Classification of a recirculating media trickling filter as a Level 1a, Level 1b, or Level 2 system for nutrient reduction, under ARM 17.30.718, must be made under separate application. The reviewing authority may impose additional design requirements for systems with extremely low BOD_5 levels to ensure adequate treatment of effluent in the soil.

7.1.2. Design

7.1.2.1. The design criteria must include, but not necessarily be limited to, primary treatment, filter size, filter media, organic loading, hydraulic loading, dosing rate, and recirculation rate. The level of treatment provided by the recirculating media trickling filter must be provided.

7.1.2.2. Recirculating media trickling filter systems must have a means of primary and secondary settling. Additional components such as pump chambers, pumps, controls, recirculation valves, etc. may be used as required.

7.1.2.3. Filter media must be resistant to spalling or flaking, and must be relatively insoluble in wastewater. The type, size, depth, volume, and clogging potential of the medium used must be based on published criteria and proven through monitoring and testing in accordance with Appendix D.

7.1.2.4. The vessel containing the media must be watertight and corrosion resistant.

7.1.2.5. Waste effluent must be distributed uniformly across the design surface area of the filter.

7.1.2.6. The means of aerating the media must be described.

7.1.2.7. The method of recirculation and recirculation rate must be discussed and justified to show adequate functioning of the system. The recirculation tank must meet the same material and construction specifications as a septic tank. The reviewing authority may require systems with large surge flows to have recirculation tank size based on the estimated or actual surge flow volume.

7.1.2.8. All recirculating trickling systems must operate in a manner such that, if a component of the system fails and treatment diminishes or ceases, untreated effluent will not be discharged to the absorption system. Systems must be equipped with adequate alarms.

7.1.3. A detailed set of plans and specifications and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements in Appendix D.

7.1.4. Gravelless or other absorption systems constructed in accordance with the requirements of Subchapter 6.6 may be used in lieu of a standard absorption trench. The use of gravelless trenches and other absorption systems will not qualify for any additional reduction beyond that listed in Section 7.1.1.

7.2. INTERMITTENT SAND FILTERS

7.2.1. General

The design criteria must include, but not necessarily be limited to, the type of usage, primary treatment, filter media, filtration rate, and dosage rate.

The wastewater strength discharged to the filter must not exceed residential strength wastewater. Intermittent sand filters must discharge to a subsurface absorption system.

Due to the reduced amount of BOD_5 and TSS produced by intermittent sand filters, the absorption system used for final disposal may be reduced for the following soil types except where specifically addressed in this Circular:

A. For subsurface absorption systems constructed in soils with percolation rates between 3 and 50 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 50 percent;
B. For subsurface absorption systems constructed in soils with percolation rates between 51 and 120 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 25 percent.

A separate subsurface absorption replacement area, sized without reductions, must be designated for each site using an intermittent sand filter.

Intermittent sand filters classified as Level 1a, Level 1b, or Level 2 systems, as defined in ARM 17.30.718, may have additional requirements beyond those listed in this Circular.

7.2.2. Design

7.2.2.1. The minimum area in any subsurface sand filter must be based upon flow rates as determined in Chapter 3.

7.2.2.2. The application rate for intermittent sand filters may not exceed 1.0 gpd/ft^2. This must be computed by dividing the effluent flow rate by the area, in square feet, of the filter.

7.2.2.3. A minimum of one 4-inch in diameter collection line must be provided at the bottom of the intermittent sand filter. The upper end of the collection line(s) must be provided with a 90-degree elbow turned up, a pipe to the surface of the filter, and a removable cap. The collection(s) line may be level. The bottom of the filter may be level or sloped to the collection line(s).

7.2.2.4. Distribution lines must be level and must be horizontally spaced a maximum of 3 feet apart, center-to-center. Orifices must be placed such that that there is at least one orifice for each 4 square feet of sand surface area. All intermittent sand filter dosing must be controlled by a programmable timer. The minimum depth of filter media must be 24 inches.

7.2.2.5. A watertight, 30-mil PVC liner, or equivalent, must be used to line the sand filter.

7.2.2.6. There must be a minimum of 2 inches of sand fill between the natural soil surface and/or any projecting rocks and the liner.

7.2.2.7. Washed drain rock meeting the requirements of Section 1.2.25 must be placed in the bottom of the system to provide a minimum depth of 8 inches in all places and to provide a minimum of 4 inches of material over the top of the collection lines.

7.2.2.8. The drain rock must be covered with a 3-inch thick layer of 1/4-inch to 1-inch washed gravel.

7.2.2.9. A minimum of 24 inches of filter sand media must be placed above the 1/4-inch to 1-inch washed gravel.

7.2.2.10. A layer of 1/4-inch to 1-inch washed gravel must be placed over the sand media, with at least 3 inches placed over the distribution lines and 3 inches placed under the distribution lines. The distribution pipes must be installed in the center of this layer, and all parts of the distribution system must drain between cycles.

7.2.2.11. An appropriate geotextile fabric, untreated building paper, or straw must be used to separate the top layer of washed gravel containing the distribution lines and the sand media to keep silt from moving into the sand while allowing air and water to pass through the fabric.

7.2.2.12. The intermittent sand filter must be backfilled with 6 inches at the edges to 8 inches at the center of a suitable medium, such as sandy loam or loamy sand that is then planted with sod or other shallow-rooted vegetative cover.

7.2.2.13. Monitoring pipes to detect filter clogging must be installed. A means for sampling effluent quality must be provided.

7.2.3. Pressure distribution in accordance with Subsection 4.2.3.3, except Subsection 4.2.3.3.D, must be provided for all sand filters.

7.2.4. The dose volume must not exceed 0.25 gallons per dose per orifice. The dose frequency must not exceed 1 dose per hour per zone. The dose tank must include a minimum surge volume of 1/2 the daily flow for individual or shared systems. For multiple-user and public systems, the applicant must demonstrate that a smaller surge volume is adequate. The surge volume is the liquid storage capacity between the "timer-on" float and the "timer-override" float. The "timer-override" float and the "high-water alarm" float may be combined. Note that the surge volume defined here is not the same as the reserve storage volume defined in Chapter 4.

7.2.5. Materials

7.2.5.1. Washed drain rock meeting the requirements of Section 1.2.25 must be a minimum of 1 inch in diameter to prevent clogging.

7.2.5.2. Washed gravel measuring 1/4-inch to 3/4 inch in diameter must meet the following gradation:

Sieve	Particle Size (mm)	Percent Passing
1 inch	25	100
3/4 inch	19	50 to 100
3/8 inch	9.5	30 to 80
No. 4	4.75	0 to 10
No. 8	2.36	0 to 2
No. 16	1.18	0 to 1

7.2.5.3. The filter media must be washed and free of clay or silt and contain the following criteria in place:

Sieve	Particle Size (mm)	Percent Passing
3/8 in	9.50	100
No. 4	4.75	95 to 100
No. 8	2.36	80 to 100
No. 16	1.18	45 to 85
No. 30	0.60	15 to 60
No. 50	0.30	3 to 10
No. 100	0.15	0 to 2

7.2.5.4. The intermittent sand filter must be covered by a suitable medium, such as sandy loam or loamy sand, to provide drainage and aeration. The material must be seeded, sodded, or otherwise provided with shallow-rooted vegetative cover to ensure stability of the installation.

7.2.6. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements in Appendix D. Certification and as-built plans are required in accordance with Appendix D.

7.2.7. Gravelless trenches and other absorption systems, constructed in accordance with the requirements of Subchapter 6.6, may be used in lieu of a standard absorption trench. The use of gravelless trenches and other absorption systems will not qualify for any additional reduction beyond that listed in Section 7.2.1.

7.3. RECIRCULATING SAND FILTERS

7.3.1. General

The design criteria must include, but not necessarily be limited to, the type of usage, primary treatment, filter media, filtration rate, and dosage rate. The wastewater strength discharged to the sand filter must not exceed residential strength wastewater. Recirculating sand filters must discharge to a subsurface absorption system.

Due to the reduced amount of BOD_5 and TSS produced by recirculating sand filters, the absorption system used for final disposal may be reduced for the following soil types except where specifically addressed in this Circular:

A. For subsurface absorption systems, constructed in soils with percolation rates between 3 and 50 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 50 percent;
B. For subsurface absorption systems constructed in soils with percolation rates between 51 and 120 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 25 percent.

A separate subsurface absorption replacement area, sized without reductions, must be designated for each site using a recirculating sand filter.

Recirculating sand filters classified as Level 1a, Level 1b, or Level 2 systems, as defined in ARM 17.30.718, may have additional requirements beyond those listed in this Circular.

7.3.2. Design

7.3.2.1. A watertight, 30-mil PVC liner, or equivalent must be used to line the sand filter. There must be a minimum of 2 inches of sand fill between the soil surface and/or any projecting rocks and the liner.

7.3.2.2. Entrance and exit points resulting in liner penetration must be water tight.

7.3.2.3. Drain rock meeting the requirements of Section 1.2.25 must be placed in the bottom of the filter, providing a minimum depth of 6 inches in all places and providing a minimum of 2 inches of material over the top of the collection lines. The drain rock must be covered with a 3-inch layer of 1/4-inch to 3/4-inch washed gravel meeting the gradation chart in Subsection 7.2.5.2. Drain rock for the under-drain lines must meet the requirements for a standard absorption system, except it must be a minimum of 1 inch in diameter to prevent clogging.

7.3.2.4. The depth of filter media must be at least 24 inches. The media must have a Uniformity Coefficient of 2 or less, must be washed, and must meet the following gradation:

Sieve	Particle Size (mm)	Percent Passing
1/2 in	12.5	100
3/8 in	9.50	50 to 95
No. 4	4.75	0 to 15
No. 8	2.36	0 to 1.6

7.3.2.5. The filter media must be covered with a layer of 3/4- to 1.5-inch washed gravel at least 6 inches thick. The distribution pipes must be installed in the center of this layer, and all parts of the distribution system must drain between cycles.

7.3.2.6. For sizing the filter, the application rate must not exceed 5 gallons per day per square foot of filter area. This must be computed by dividing the effluent flow rate, not considering the amount of recirculation, by the area, in square feet, of the filter.

7.3.2.7. The liquid capacity of the recirculation tank must be at least 1.5 times the daily design wastewater flow. The recirculation tank must meet the same material and construction specifications as a septic tank. The minimum liquid level in the recirculation tank must be at least 80 percent of the daily flow at all times during the 24-hour daily cycle. The reviewing authority may require systems with large surge flows to have recirculation tank size based on the estimated or actual surge flow volume.

7.3.2.8. The filter-effluent line passing through the recirculation tank must be provided with a control device that directs the flow of the filter effluent. The filter effluent will be returned to the recirculation tank for recycling or be discharged to the subsurface absorption system, depending upon the liquid level in the recirculation tank. The recirculation pump(s) must be located at the opposite end of the recirculation tank from the filter return line and the tank inlet(s).

7.3.2.9. The system must be designed with a minimum recirculation ratio of not less than four. Each orifice must be dosed at least every 30 minutes, and the maximum dose volume must be 2 gallons per orifice per dose. All recirculating sand-filter dosing must be controlled with a programmable timer.

7.3.2.10. A minimum of 1 4-inch in diameter collection line must be provided. The upper end of the collection line(s) must be provided with a sweep to the surface which includes a 90-degree elbow turned up, a pipe to the surface of the filter, and a removable cap. The collection line(s) may be level. The bottom of the filter may be level or sloped to the collection line(s)

7.3.2.11. Distribution lines must be level and must be horizontally spaced a maximum of 3 feet apart, center-to-center. Orifices must be placed such that there is at least one orifice for each 4 square feet of filter media surface area.

7.3.2.12. The effluent must be discharged in such a manner as to provide uniform distribution in accordance with Subsection 4.2.3.3, except for Subsection

4.2.3.3.D.

7.3.2.13. The distribution line must be designed for freezing conditions. The plans and engineering report will specify how this is accomplished.

7.3.2.14. Topsoil or other oxygen-limiting materials must not be placed over the filter.

7.3.3. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements in Appendix D. Certification and as-built plans are required in accordance with Appendix D.

7.3.4. Gravelless trenches and other absorption systems, constructed in accordance with the requirements of Subchapter 6.6, may be used in lieu of a standard absorption trench. The use of gravelless trenches and other absorption systems will not qualify for any additional reduction beyond that listed in Section 7.3.1.

7.4. AEROBIC WASTEWATER TREATMENT UNITS

7.4.1. General

Aerobic treatment units (ATUs) are concrete tanks or other containers of various configurations that provide for aerobic biodegradation or decomposition of the wastewater components in a saturated environment by bringing the wastewater in contact with air by some mechanical means. ATUs are exclusively proprietary products representing a wide variety of designs, materials, and methods of assembly.

Classification of ATUs as Level 1a, Level 1b, or Level 2 systems for nutrient reduction, under ARM 17.30.718, must be made under separate application.

All ATUs must discharge to a subsurface wastewater treatment system. This treatment system must be sized in accordance with Chapters 2; and 3; and Section 6.1.4. Aerobic treatment devices must demonstrate compliance with the testing criteria and performance requirements for NSF Standard No. 40 for Class 1 certification. This compliance may be demonstrated either through NSF, through a third independent party using comparable protocol, or through the testing requirements outlined in ARM 17.30.718 for 30 mg/L BOD_5 and 30 mg/L TSS only. ATUs may apply the following sizing reduction to the subsurface absorption area:

A. For subsurface absorption systems constructed in soils with percolation rates between 3 and 50 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 50 percent;
B. For subsurface absorption systems constructed in soils with percolation rates between 51 and 120 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 25 percent.

A separate subsurface absorption replacement area, sized without reductions, must be designated for each site using an ATU.

7.4.2. An adequate form of positive filtration will be required between the treatment device and the disposal component to prevent excessive solids from being carried over into the disposal component during periods of bulking.

7.4.3. ATU systems must provide primary treatment for wastewater through a septic tank that meets all of the requirements of Chapter 5. Designs for the use of an external trash rack will be evaluated on a case-by-case basis.

7.4.4. Access ports

7.4.4.1. Ground level access ports must be sized and located to facilitate installation, removal, sampling, examination, maintenance, and servicing of components or compartments that require routine maintenance or inspection.

7.4.4.2. Access ports must be protected against unauthorized intrusion. Acceptable protective measures include, but are not limited to, padlocks or covers that can be removed only with tools.

7.4.5. Failure sensing and signaling equipment

7.4.5.1. The ATU must possess a mechanism or process capable of detecting:

A. failure of electrical and mechanical components that are critical to the treatment process; and,
B. high liquid level conditions above the normal operation specifications.

7.4.5.2. The ATU must possess a mechanism or process capable of notifying the system owner of failure identified by the failure sensing components. The mechanism must deliver a visible and audible signal.

7.4.6. Installation

ATUs must be installed according to the manufacturer's instructions.

7.4.7. Sampling ports

7.4.7.1. A sampling port must be designed, constructed, and installed to provide easy access for collecting a water sample from the effluent stream. The sampling port may be located within the ATU or other system component, such as a pump chamber, provided that the wastewater stream being sampled is representative of the effluent stream from the ATU.

For ATUs using effluent disinfection to meet the fecal coliform criteria, the sampling port must be located downstream of the disinfection component, including the contact chamber if chemical disinfection is used, so that samples will accurately reflect disinfection performance.

7.4.7.2. Sampling ports must be protected against unauthorized intrusion, as described in Subsection 7.4.4.2.

7.4.8. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements outlined in Appendix D. Certification and as-built plans are required in accordance with Appendix D.

7.5. CHEMICAL NUTRIENT REDUCTION SYSTEMS

7.5.1. General

Chemical nutrient reduction systems are used to provide advanced treatment of septic tank effluent. The monitoring frequency must be sufficient to establish the treatment efficiency and response to varying wastewater flows, strengths, and climatic conditions. The reviewing authority will consider the complexity and maintenance required of the system, the stability of the processes, and the monitoring data in determining the adequacy, level of maintenance, and monitoring frequency of the system.

A means of securing continuous maintenance and operation of the system must be approved by the reviewing authority.

7.5.2. Design

Specific design criteria will not be outlined in this document due to the various alternatives and design complexity involved. The EPA manual, *On-Site Wastewater Treatment Systems Manual* (February 2002), pages TFS-41 to 52, will be used as a guideline for the design of these systems.

7.5.3. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements outlined in Appendix D. Certification and as-built plans are required in accordance with Appendix D.

7.6. ALTERNATIVE ADVANCED TREATMENT SYSTEMS

7.6.1. General

Alternative advanced treatment systems will be evaluated by the reviewing authority on a case-by-case basis.

7.6.2. Design

Specific design criteria will not be outlined in this document due to the various alternatives and design complexity involved.

Those systems that provide documentation or demonstrate through a third independent party that the unit is able to meet the testing criteria and performance requirements for NSF Standard No. 40 for Class 1 certification or meet the testing requirements outlined in ARM 17.30.718 for 30 mg/L BOD_5 and 30 mg/L TSS only may apply the following sizing reduction to the subsurface absorption area:

A. For subsurface absorption systems constructed in soils with percolation rates between 3 and 50 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 50 percent;
B. For subsurface absorption systems constructed in soils with percolation rates between 51 and 120 mpi as described in Chapter 2 and Appendix B, the final absorption area may be reduced by 25 percent.

A separate subsurface absorption replacement area, sized without reductions, must be designated for each site using an alternative advanced treatment system.

7.6.3. Classification as a Level 1a, Level 1b, or Level 2 system for nutrient reduction, under ARM 17.30.718, must be made under separate application. Additional design requirements may apply.

7.6.4. Operation and Maintenance, Certification, and As-builts

A detailed set of plans, specifications, and an operation and maintenance plan are required. The operation and maintenance plan must meet the requirements outlined in Appendix D. Certification and as-built plans are required in accordance with Appendix D.

8. MISCELLANEOUS

8.1. HOLDING TANKS

8.1.1. General

Holding tanks are used to hold wastewater until pumping occurs by a licensed septic tank pumping service and wastewater is disposed at an approved location. They are used for storage and do not, as part of their normal operation, dispose of or treat the wastewater.

8.1.2. Holding tanks are septic tanks that have no standard outlets and are modified to provide full time access for pumping.

8.1.3. Holding tanks must have a minimum capacity of 1,000 gallons. Larger tank capacity may be required by the reviewing authority.

8.1.4. Holding tanks must meet the construction standards for septic tanks in Chapter 5, except that no outlet opening shall be cast in the tank walls.

8.1.5. Holding tanks must have an audible or visual warning alarm that signals when the tank level has reached 75 percent of capacity. The tank must be pumped as soon as possible after the alarm is triggered and before the tank reaches 100 percent capacity.

8.1.6. Holding tanks installed where the seasonal ground water table may reach any portion of the tank must be evaluated for buoyancy by a qualified individual and flotation prevented. The tanks must be a single pour (seamless) tank design, and must be waterproofed against infiltration.

8.1.7. Holding tanks must meet the separation distances and other applicable requirements in ARM Title 17, Chapter 36, subchapter 3 or 9, as applicable.

8.2. SEALED (VAULT) PIT PRIVY

8.2.1. General

A sealed pit privy is an underground vault for the temporary storage of non-water-carried wastewater. The vault must be pumped periodically and the wastewater disposed of at a treatment site.

8.2.2. Construction

8.2.2.1. The vault must be watertight, constructed of durable material, and not subject to excessive corrosion, decay, frost damage, or cracking.

8.2.2.2. The vault may be used in a floodplain or high ground water area provided that the floor surface is 1 foot above the floodplain elevation and the weight of the structure is adequate to prevent the vault from floating during high ground water or a flood even when the vault is empty. The vault must be evaluated for buoyancy by a qualified individual and flotation prevented.

8.2.2.3. The access or pumping port should be located outside of any structure and should have a minimum diameter of 8 inches. This access must have a tight, locking lid.

8.2.2.4. The vault may be a modified septic tank with the inlet and outlet opening sealed. The toilet structure over the tank vault must meet construction standards for a pit privy, as described in Section 8.3.2.

8.2.3. Maintenance and Operation

The vault must be pumped prior to reaching the maximum capacity of the tank by a licensed septic tank pumper and wastewater is disposed of at an approved location.

8.3. UNSEALED PIT PRIVY

8.3.1. General

A pit privy is a building containing a stool, urinal, or seat over an excavation in natural soil for the disposal of undiluted black wastes (toilet wastes). Pit privies may only serve structures that have no pumping fixtures or running water (piped water supply). Pit privies must meet the location requirements of ARM Title 17, Chapter 36, subchapter 3 or 9, as applicable.

8.3.2. Construction

8.3.2.1. Pit privies must be located to exclude surface water.

8.3.2.2. Pit privy buildings must be constructed with openings no greater than 1/16 inch to prohibit access of insects.

8.3.2.3. The pit must be vented with a screened flu or vent stack having a cross-sectional area of at least 7 inches per seat and extending at least 12 inches above the roof of the building.

8.3.2.4. The pit privy must be constructed on a level site with the base of the building being at least 6 inches above the natural ground surface as measured 18 inches from the sides of the building.

8.3.2.5. The bottom of the pit should be between 3 feet and 6 feet below the original ground surface.

8.3.3. Abandoning Pit Privies

8.3.3.1. A pit privy should be abandoned when the waste comes within 16 inches of the ground surface.

8.3.3.2. A pit privy building should be either dismantled or moved to cover a new pit.

8.3.3.3. The abandoned pit must be filled with soil, free of rock, with sufficient fill material to allow for 12 inches or more of settling.

8.4. SEEPAGE PITS

8.4.1. General

Seepage pits may be used for replacement systems only. Seepage pits are excavations in which a subsurface concrete ring(s) is placed in drain rock to receive effluent from the septic tank.

8.4.2. Design

8.4.2.1. Seepage pits must be sized according to the permeability of the vertical stratum where wastewater will contact the soils.

8.4.2.2. A seepage pit that is excavated to a 4-foot depth and a 5-foot diameter must be equivalent to 50 square feet of absorption area.

8.4.2.3. A seepage pit must have a concrete ring with a minimum diameter of 3 feet and a minimum height of 3.5 feet. Concrete rings may be stacked to provide for additional absorption area.

8.4.2.4. The seepage pit must have 6 inches of drain rock meeting the requirements of Section 1.2.25 placed in the bottom of the excavation for bedding.

8.4.2.5. The concrete ring must have a minimum of 1 foot of drain rock meeting the requirements of Section 1.2.25 placed on the outside of the ring. A concrete lid shall be installed on each concrete ring or on the top-most concrete ring if stacked.

8.4.2.6. Schedule 40 piping, or equivalent strength, must be used to connect the septic tank or the distribution box to the concrete ring(s).

8.4.2.7. Drain rock must be covered with an appropriate geotextile fabric, untreated building paper, or straw at least 5 inches in depth.

8.4.2.8. Effluent distribution to multiple seepage pits must use a distribution box.

8.4.2.9. Seepage pits must not be installed in soils that have percolation rates greater than 60 mpi.

8.5. WASTE SEGREGATION

8.5.1. General

Waste segregation systems consist of dry disposal for human waste, such as various biological or composting and incinerator type systems, with separate disposal for gray water.

8.5.2. Location

A complete layout must be provided showing the location of the absorption system and the location of a replacement site with adequate area for a full-size system, if waste segregation is not used, or an alternate approved wastewater treatment system for future development needs.

8.5.3. Design

This Circular addresses the specific requirements relating to the use of composting and incinerating toilets. The reviewing authority may allow the use of other designs and materials pursuant to the review of manufacturer's information and data to substantiate the proposed alternative.

8.5.3.1. Composting Toilets

A. An applicant for a composting toilet must have documentation, or demonstrate through a third independent party, that the unit is able to meet the testing criteria and performance requirements for NSF Standard 41.

B. All materials used must be durable, easily cleanable, and impervious to strong acid or alkaline solutions and corrosive environments.

C. Composting toilets must be used in accordance with the manufacturer's recommendation to serve the anticipated number of persons.

D. The composting unit must be constructed to separate the solid fraction from the liquid fraction and produce a stable humus material with less than 200 most probable number (MPN) per gram of fecal coliform.

E. Bulking agents may be added to provide spaces for aeration and microbial colonization.

F. When operated at the design rated capacity, the device must be capable of accommodating full- or part-time usage.

G. Continuous forced ventilation to the outside (e.g. electric fan or wind-driven turbo vent) of the storage or treatment chamber must be provided. Ventilation components must be independent of other household venting systems. Venting connections must not be made to room vents or to chimneys. All vents must be designed to prevent flies and other insects from entering the treatment chamber. Vent conduits and pipes must be adequately insulated to prevent the formation of interior-condensed vapors.

H. Components in which biological activity is intended to occur must be insulated, heated, or otherwise protected from low temperature conditions.

In order to maintain the stored wastes at temperatures conducive to aerobic biological decomposition, it is recommended that the components maintain a temperature range of 20° C - 55° C (68° F - 130° F). The device must be capable of maintaining wastes within a moisture range of 40 percent to 75 percent.

I. The device must be designed to prevent the deposition of inadequately treated waste near the clean-out port. The solid end product (i.e. waste humus) must be stabilized to meet NSF criteria prior to removal at the clean-out port.

J. Any liquid overflow must be discharged to a disposal field designed and approved in accordance with this Circular.

K. The contents of a composting toilet shall be removed and disposed of in compliance with 40 CFR Part 503 and Title 75, Chapter 10, MCA.

L. The owner of a composting toilet shall maintain the waste disposal system.

8.5.3.2. Incinerating Toilets

A. Incinerating toilets may be electric or gas-fired.

B. An applicant for an incinerating toilet must have documentation, or demonstrate through a third independent party, that the unit is able to meet the testing criteria and performance requirements for NSF Standard 41.

C. Incinerating toilets must be used in accordance with the manufacturer's recommendation to serve the anticipated number of persons.

D. All gas-fired incinerating toilets must be plumbed and installed as per the manufacture's recommendation and local requirements.

E. An anti-foaming agent may be added to incinerating toilets to prevent boil-over of liquid waste.

F. When operated at the design rated capacity, the device must be capable of accommodating full- or part-time usage.

G. The contents of an incinerating toilet must be removed and disposed of in compliance with 40 CFR Part 503 and Title 75, Chapter 10, part 2, MCA.

H. Vapor and products of combustion must be vented. Ventilation components must be independent of other household venting systems.

I. Incinerating toilets must be installed and operated in accordance with local air pollution requirements.

J. The owner of an incinerating toilet shall maintain the waste disposal system.

8.6. EXPERIMENTAL SYSTEMS

8.6.1. General

Treatment systems not listed in this Circular may receive a waiver for use as experimental systems. Experimental systems may be considered only under the following conditions:

8.6.1.1. The applicant shall provide adequate information to the reviewing authority that ensures the system will effectively treat the wastewater in a manner that will prevent ground water contamination and will meet all of the requirements of ARM Title 17, Chapter 36, subchapter 9.

8.6.1.2. The applicant shall include a complete description of a scientific evaluation process to be carried out by a scientific, educational, governmental, or engineering organization.

8.6.1.3. The applicant shall provide for any funding necessary to provide adequate design, installation, monitoring, and maintenance.

8.6.1.4. A professional engineer, sanitarian, or other professional, acceptable to the reviewing authority, shall design the system.

8.6.2. Reviewing Authority

The reviewing authority may place any requirements or restrictions it deems necessary on an experimental system. All requirements for conventional systems must apply to experimental systems, except those specifically exempted by waiver. Applicants shall provide for inspections to be made by persons acceptable to the reviewing authority. Monitoring and inspections must be conducted as required by the reviewing authority. The monitoring and inspection results must be submitted to the reviewing authority. The reviewing authority may require that a redundant system (i.e., a system that meets the requirements of another chapter of this Circular) be installed in parallel with the experimental system.

8.6.3. Seller's Disclosure

Any person who sells a property containing an experimental system shall disclose all permit, monitoring, and maintenance requirements to the buyer.

8.6.4. Maintenance and Operation

8.6.4.1. Continuous maintenance and operation must be provided for the life of the system by a management entity acceptable to the reviewing authority. The type of entity required and the degree of management must be commensurate with the complexity of the system and the site conditions.

8.6.4.2. The management entity shall be responsible for monitoring the operation of the system.

8.6.4.3. Frequent inspections, as determined by the reviewing authority, of the mechanical equipment must be provided during the first 90-day start-up period.

8.6.4.4. The routine inspection schedule must be quarterly at a minimum.

8.6.4.5. Records, both of maintenance and performance, must be kept and made available to the reviewing authority upon request.

8.6.4.6. All manufacturers of experimental systems shall provide an operation and maintenance plan in accordance with Appendix D.

APPENDIX A - PERCOLATION TEST PROCEDURE

Properly conducted percolation tests may be needed to determine absorption system site suitability and to size the absorption system. If needed, percolation tests must be conducted within the boundary of the proposed absorption system. The percolation test must be completed by a qualified site evaluator approved by the reviewing authority. Some system designs may dictate different test procedures than those outlined below. Please see applicable chapters for further requirements.

Procedures outlined in ASTM D5093-02, Field Measurement of Infiltration Rate Using a Double-Ring Infiltrometer with a Sealed-Inner Ring, may be required in addition to those listed below.

Test Hole Preparation

1. Dig or bore holes 6 to 10 inches in diameter with vertical sides. The depth of the holes must be at the approximate depth of the proposed absorption trenches, typically 24 inches below ground. If the hole is larger than 6 to 8 inches, place a piece of 4-inch diameter, perforated pipe inside the hole, and fill the space between the pipe and the walls of the hole with drain rock. It is recommended that a sketch or photograph of the hole be provided to the reviewing authority.

2. Roughen or scratch the bottoms and sides of the holes to provide natural unsmeared surfaces. Remove loose material. Place about 2 inches of 3/4-inch washed gravel in the bottom of holes to prevent scouring during water addition.

3. Establish a reference point for measurements in or above each hole.

Soaking

1. Fill holes with clear water to a level of at least 12 inches above the gravel.

2. If the soil is coarser than sandy clay loam and the first 12 inches of water seeps away in 60 minutes or less, add 12 inches of water a second time. If the second filling seeps away in 60 minutes or less, the percolation test should be run immediately in accordance with the sandy soil test. If both the first and second fillings have percolation rates faster than 3 mpi, the test may be stopped.

3. If either the soil is sandy clay loam or finer, or the first 12 inches or the second 12 inches does not seep away in 60 minutes, the percolation test must be run in accordance with the test for other soils. In these other soils, maintain at least 12 inches of water in the hole for at least 4 hours to presoak the hole.

Sandy Soils Test (percolation rate of 10 mpi or faster)

This test is applicable to sandy soils only (percolation rate of 10 mpi or faster). Add water to provide a depth of 6 inches above gravel. Measure water level drop at least four times, in equally spaced intervals, in a 1-hour time period. Measure to nearest 1/4 inch. Refill to 6-inch depth after each measurement. Do not exceed 6-inch depth of water. Use final water-level drop to calculate rate.

Other Soils Test (percolation rate slower than 10 mpi)

This test is applicable to other soils (percolation rate slower than 10 mpi). Remove loose material on top of gravel. Add water to provide a depth of 6 inches above gravel. Measure water levels for a minimum of 1 hour. A minimum of 4 measurements must be taken. The test must continue until 2 successive readings yield percolation rates that do not vary by more than 15 percent, or until measurements have been taken for 4 hours. Do not exceed 6-inch depth of water. Use final water-level drop to calculate rate.

Records

Record the following information on the attached form and include as part of the application:

- Date(s) of test(s)
- Location, diameter, and depth of each test hole,
- Time of day that each soak period began and ended
- Time of day for beginning and end of each water-level drop interval
- Each water-level drop measurement
- Calculated percolation rate
- Name and signature of person performing test
- Name of owner or project name.

Rate Calculation

Percolation Rate = Time interval in minutes/water-level drop in inches.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name ______________________________

Project Name ______________________________

Lot of Tract Number ________________ Test Number ____________

Diameter of Test Hole ________________ Depth of Test Hole ____________

Date and Time Soak Period Began ____________ Ended ____________

Date Test Began ______________________________

Distance of the reference point above the bottom of the hole ________________

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

________________________ ________________________ ____________
Name (printed) Signature Date

____
Company

APPENDIX B - SOILS AND SITE CHARACTERIZATION

Accurate description of soil types must be based on information within Appendix B for evaluating the soils in the area of the proposed absorption system to determine if suitable conditions for wastewater treatment and disposal exist. Appendix B provides guidance for reporting soil characteristics using terminology generally accepted by the field of soil science. Application rate for wastewater treatment and disposal is based on soil characteristics using this terminology and the relative proportions of sand, silt and clay within a soil matrix.

Soil Texture

Soil texture refers to the weight proportion of the separates for particles less than 2 mm. Field criteria for estimating soil texture must be chosen to fit the soils of the area. Sand particles feel gritty and can be seen individually with the naked eye. Silt particles cannot be seen individually without magnification. They have a smooth feel to the fingers when dry or wet. In some places, clay soils are sticky, in others, they are not. Soils dominated by montmorillonite clays, for example, feel different than soils that contain similar amounts of micaceous or kaolinitic clay. The reviewing authority may require that field estimates of soil texture be checked against laboratory determinations and adjusted as necessary when soil texture cannot be identified.

Definitions of the soil texture classes according to distribution of size classes of mineral particles less than 2 mm in diameter are as follows:

Sands: 85 percent or more sand and the percentage of silt plus 1.5 times the percentage of clay is 15 or less.

Coarse sand: 25 percent or more very coarse and coarse sand and less than 50 percent any other single grade of sand.

Sand: 25 percent or more very coarse, coarse, and medium sand, but less than 25 percent very coarse and coarse sand, and less than 50 percent either fine sand or very fine sand.

Fine sand: 50 percent or more fine sand, or less than 25 percent very coarse, coarse, and medium sand, and less than 50 percent very fine sand.

Very fine sand: 50 percent or more very fine sand.

Loamy sands: At the upper limit, 85 to 90 percent sand and the percentage of silt, plus 1.5 times the percentage of clay, is 15 or more. -At the lower limit, 70 to 85 percent sand and the percentage of silt, plus twice the percentage of clay, is 30 or less.

Loamy coarse sand: 25 percent or more very coarse and coarse sand and less than 50 percent any other single grade of sand.

Loamy sand: 25 percent or more very coarse, coarse, and medium sand, but less than 25 percent very coarse and coarse sand, and less than 50 percent either fine sand or very fine sand.

Loamy fine sand: 50 percent or more fine sand or less than 50 percent very fine sand and less than 25 percent very coarse, coarse, and medium sand.

Loamy very fine sand: 50 percent or more very fine sand.

Sandy loams: 20 percent or less clay and 52 percent or more sand and the percentage of silt, plus twice the percentage of clay, exceeds 30, or less than 7 percent clay, less than 50 percent silt, and between 43 and 52 percent sand.

Coarse sandy loam: 25 percent or more very coarse and coarse sand and less than 50 percent any other single grade of sand.

Sandy loam: 30 percent or more very coarse, coarse, and medium sand, (but less than 25 percent very coarse and coarse sand), and less than 30 percent either fine sand or very fine sand.

Fine sandy loam: 30 percent or more fine sand and less than 30 percent, or between 15 to 30 percent very coarse, coarse, and medium sand, or more than 40 percent fine and very fine sand, at least half of which is fine sand, and less than 15 percent very coarse, coarse, and medium sand.

Very fine sandy loam: 30 percent or more very fine sand or more than 40 percent fine and very fine sand, at least half of which is very fine sand, and less than 15 percent very coarse, coarse, and medium sand.

Loam: 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Silt loam: 50 percent or more silt and 12 to 27 percent clay or 50 to 80 percent silt and less than 12 percent clay.

Silt: 80 percent or more silt and less than 12 percent clay.

Sandy clay loam: 20 to 35 percent clay, less than 28 percent silt, and 45 percent or more sand.

Clay loam: 27 to 40 percent clay and 20 to 45 percent sand.

Silty clay loam: 27 to 40 percent clay and less than 20 percent sand.

Sandy clay: 35 percent or more clay and 45 percent or more sand.

Silty clay: 40 percent or more clay and 40 percent or more silt.

Clay: 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Necessarily, these verbal definitions are somewhat complicated. The texture triangle is used to resolve problems related to word definitions. The eight distinctions in the sand and loamy sand groups provide refinement greater than can be consistently determined by field techniques. Only those distinctions that are significant and that can be consistently made in the field should be applied.

Particle Size Distribution

Particle size distribution (fine earth or less than 2 mm) is determined in the field mainly by feel. The content of rock fragments is determined by estimating the proportion of the soil volume that they occupy.

Soil

The United States Department of Agriculture uses the following size separates for the <2 mm mineral material:

Very coarse sand: 2.0 – 1.0 mm
Coarse sand: 1.0 – 0.5 mm
Medium sand: 0.5 – 0.25 mm
Fine sand: 0.25 – 0.10 mm
Very fine sand: 0.10 – 0.05 mm
Silt: 0.05 – 0.002 mm
Clay: <0.002 mm

The texture classes are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. Subclasses of sand are subdivided into coarse sand, sand, fine sand, and very fine sand. Subclasses of loamy sands and sandy loams that are based on sand size are named similarly.

Rock Fragments

Rock fragments are unattached pieces of rock 2 mm in diameter, or larger, that are strongly cemented or more resistant to rupture. Rock fragments include all sizes that have horizontal dimensions less than the size of a pedon.

Rock fragments are described by size, shape, and, for some, the kind of rock. The classes are pebbles, cobbles, channers, flagstones, stones, and boulders. If a size or range of sizes predominates, the class is modified as, for example: "fine pebbles," "cobbles 100 to 150 mm in diameter," and "channers 25 to 50 mm in length."

Gravel is a collection of pebbles that have diameters ranging from 2 to 75 mm. The terms "pebble" and "cobble" are usually restricted to rounded or subrounded fragments. However, they can be used to describe angular fragments if they are not flat. Words like chert, limestone, and shale refer to a kind of rock, not a piece of rock. The upper size of gravel is 3 inches (75 mm). The 5-mm and 20-mm divisions for the separation of fine, medium, and coarse gravel coincide with the sizes of openings in the "number 4" screen (4.76 mm) and the "3/4-inch" screen (19.05 mm) used in engineering.

The 75-mm (3-inch) limit separates gravel from cobbles. The 250-mm (10-inch) limit separates cobbles from stones and the 600-mm (24-inch) limit separates stones from boulders. The 150-mm (channers) and the 380-mm (flagstones) limits for thin, flat fragments follow conventions used for many years to provide class limits for plate-shaped and crudely spherical rock fragments that have about the same soil use implications as the 250-mm limit for spherical shapes.

Rock Fragments in Soil

The adjectival form of a class name of rock fragments (Appendix B, Table B-1) is used as a modifier of the textural class name: "gravelly loam," and "stony loam." The following classes, based on volume percentages, are used:

Less than 15 percent: No adjectival or modifying terms are used in writing for contrast with soils having less than 15 percent pebbles, cobbles, or flagstones. The adjective "slightly" may be used, however, to recognize those soils used for special purposes.

15 to 35 percent: The adjectival term of the dominant kind of rock fragment is used as a modifier of the textural terms: "gravelly loam," "channery loam," and "cobbly loam."

35 to 60 percent: The adjectival term of the dominant kind of rock fragment is used with the word "very" as a modifier of the textural term: "very gravelly loam" and "very flaggy loam."

More than 60 percent: If enough fine earth is present to determine the textural class (approximately 10 percent or more by volume), the adjectival term of the dominant kind of rock fragment is used with the word "extremely" as a modifier of the textural term: "extremely gravelly loam," and "extremely bouldery loam." If there is too little fine earth to determine the textural class (less than about 10 percent by volume), the terms "gravel," "cobbles," "stones," or "boulders" are used as appropriate.

The class limits apply to the volume of the layer occupied by all pieces of rock larger than 2 mm. The soil generally contains fragments smaller or larger than those identified in the term. For example, a stony loam usually contains pebbles, but "gravelly" is not mentioned in the name. The use of a term for larger pieces of rock, such as boulders does not imply that the pieces are entirely within a given soil layer. A simple boulder may extend through several layers.

Table B-1
Terms for Rock Fragments

Shape and size	Noun	Adjective
Spherical, cubelike, or equiaxial:		
2-75 mm diameter	Pebbles	Gravelly
2-5 mm diameter	Fine	Fine gravelly
5-20 mm diameter	Medium	Medium gravelly
20-75 mm diameter	Coarse	Coarse gravelly
75-250 mm diameter	Cobbles	Cobbly
250-600 mm diameter	Stones	Stony
> 600 mm diameter	Boulders	Bouldery
Flat:		
2-150 mm long	Channers	Channery
150-380 mm long	Flagstones	Flaggy
380-600 mm long	Stones	Stony
> 600 mm long	Boulders	Bouldery

Table B-2
Classes of Surface Stones and Boulders in Terms of Cover and Spacing

Class	Percentage of surface covered	Distance in meters between stones or boulders if the diameter is:			Name
		0.25m	0.6m	1.2m	
1	0.01 - 0.1	>8	>20	>37	Stony or bouldery
2	0.1 - 3.0	1 - 8	3 - 20	6 - 37	Very stony or very bouldery
3	3.0 - 15	0.5 - 1	1 - 3	2 - 6	Extremely stony or extremely bouldery
4	15 - 50	0.3 - 0.5	0.5 - 1	1 - 2	Rubbly
5	50 - 90	<0.3	<0.05 - 1	<1	Very rubbly

Soil Color

Elements of soil color descriptions are the color name, the Munsell notation, the water state, and the physical state: "brown (10YR 5/3), dry, crushed, and smoothed."

Physical state is recorded as broken, rubbed, crushed, or crushed and smoothed. The term "crushed" usually applies to dry samples and "rubbed" to moist samples. If unspecified, the surface is broken. The color of the soil is recorded for a surface broken through a ped, if a ped can be broken as a unit.

The color value of most soil material becomes lower after moistening. Consequently, the water state of a sample is always given. The water state is either "moist" or "dry." The dry state for color determinations is air-dry and should be made at the point where the color does not change with additional drying. Color in the moist state is determined on moderately moist or very moist soil material and should be made at the point where the color does not change with additional moistening. The soil should not be moistened to the extent that glistening takes place, as color determinations of wet soil may be in error because of the light reflection of water films.

Munsell notation is obtained by comparison with a Munsell system color chart. The most commonly used chart includes only about 1/5 of the entire range of hues. It consists of about 250 different colored papers, or chips, systematically arranged on hue cards according to their Munsell notations.

The Munsell color system uses 3 elements of color – hue, value, and chroma – to make up a color notation. The notation is recorded in the form: hue, value/chroma – for example, 5Y 6/3.

Hue is a measure of the chromatic composition of light that reaches the eye. The Munsell system is based on five principle hues: red (R), yellow (Y), green (G), blue (B), and purple (P). Five intermediate hues representing midpoints between each pair of principle hues complete the 10 major hue names used to describe the notation. The intermediate hues are yellow-red (YR), green-yellow (GY), blue-green (BG), purple-blue (PB), and red-purple (RP).

Value indicates the degree of lightness or darkness of a color in relation to a neutral gray scale. On a neutral gray (achromatic) scale, value extends from pure black (0/) to pure white (10/). The value notation is a measure of the amount of light that reaches the eye under standard lighting conditions.

Chroma is the relative purity or strength of the spectral color. Chroma indicates the degree of saturation of neutral gray by the spectral color. The scales of chroma for soils extend from /0 to a chroma of /8 as the strongest expression of color used for soils.

Conditions for Measuring Color

The quality and intensity of the light affect the amount and quality of the light reflected from the sample to the eye. The moisture content of the sample and the roughness of its surface affect the light reflected. The visual impression of color from the standard color chips is accurate only under standard conditions of light intensity and quality. Color determination may be inaccurate early in the morning or late in the evening. When the sun is low in the sky or the atmosphere is smoky, the light reaching the sample and the light reflected is redder. Even though the same kind of light reaches the color standard and the sample, the reading of sample color at these times is commonly one or more intervals of hue redder than at midday. Colors also appear different in the subdued light of a cloudy day than in bright sunlight. If artificial light is used, as for color determinations in an office, the light source used must be as near the white light of midday as possible. With practice, compensation can be made for the differences, unless the light is so subdued that the distinctions between color chips are not apparent. The intensity of incidental light is especially critical when matching soil to chips of low chroma and low value.

Roughness of the reflecting surface affects the amount of reflected light, especially if the incidental light falls at an acute angle. The incidental light should be as nearly as possible at a right angle. For crushed samples, the surface is smoothed and the state is recorded as "dry, crushed, and smoothed."

Recording Guidelines

Uncertainty exists under field conditions. Measurements of color are reproducible by different individuals within 2.5 units of hue (1 card) and 1 unit of value and chroma.

Dominant color is the color that occupies the greatest volume of the layer. Dominant color (or colors) is always given first among those of a multicolored layer. It is judged on the basis of colors of a broken sample. For only 2 colors, the dominant color makes up more than 50 percent of the volume. For 3 or more colors, the dominant color makes up more of the volume of the layer than any other color, although it may occupy less than 50 percent.

Mottling refers to repetitive color changes that cannot be associated with compositional properties of the soil. Redoximorphic features are a type of mottling that is associated with wetness. A color pattern that can be related to the proximity to a ped surface of other organizational or compositional feature is not mottling. Mottle description follows the dominant color. Mottles are described by quantity, contrast, color, and other attributes in that order.

Quantity is indicated by three areal percentage classes of the observed surface:

Few: less than 2 percent
Common: 2 to 20 percent
Many: more than 20 percent

The notations must clearly indicate to which colors the terms for quantity apply.

Size refers to dimensions as seen on a plane surface. If the length of a mottle is not more than 2 or 3 times the width, the dimension recorded is the greater of the 2. If the mottle is long and narrow, as a band of color at the periphery of a ped, the dimension recorded is the smaller of the 2 and the shape and location are also described. Three size classes are used:

Fine: smaller than 5 mm
Medium: 5 to 15 mm

Coarse: larger than 15 mm

Contrast refers to the degree of visual distinction that is evident between associated colors:

Faint: Evident only on close examination, faint mottles commonly have the same hue as the color to which they are compared and differ by no more than 1 unit of chroma or 2 units of value. Some faint mottles of similar but low chroma and value differ by 2.5 units (one card) of hue.

Distinct: Readily seen but contrast only moderately with the color to which they are compared. Distinct mottles commonly have the same hue as the color at which they are compared, but differ by 2 to 4 units of chroma or 3 to 4 units of value, or differ from the color to which they are compared by 2 units (1 card) of hue, but by no more than 1 unit of chroma or 2 units of value.

Prominent: Contrast strongly with the color to which they are compared. Prominent mottles are commonly the most obvious color feature of the section described. Prominent mottles that have medium chroma and value commonly differ from the color to which they are compared by at least 5 units (two pages) of hue, if chroma and value are the same, at least 4 units of value or chroma, if the hue is the same, or at least 2 units of chroma or 2 units of value, if hue differs by 2.5 units (one card).

Contrast is often not a simple comparison of one color with another, but is a visual impression of the prominence of the one color against a background, commonly involving several colors.

Soil Structure

Soil structure refers to units composed of primary particles. The cohesion within these units is greater than the adhesion among units. As a consequence, under stress, the soil mass tends to rupture along predetermined planes or zones. Three planes or zones, in turn, form the boundary. A structural unit that is the consequence of soil development is called a ped. The surfaces of peds persist through cycles of wetting and drying in place. Commonly, the surface of the ped and its interior differ as to composition or organization, or both, because of soil development.

Some soils lack structure and are referred to as structureless. In structureless layers or horizons, no units are observable in place or after the soil has been gently disturbed, such as by tapping a space containing a slice of soil against a hard surface or by dropping a large fragment on the ground. When structureless soils are ruptured, soil fragments, single grains, or both, result. Structureless soil material may be either single grain or massive. Soil material of single grains lacks structure. In addition, it is loose. On rupture, more than 50 percent of the mass consists of discrete mineral particles.

Some soils have simple structure, each unit being an entity without component smaller units. Others have compound structure, in which large units are composed of smaller units separated by persistent planes of weakness.

In soils that have structure, the shape, size, and grade (distinctness) of the units are described.

Field terminology for soil structure consists of separate sets of terms designating each of the 3 properties, which by combination form the names for structure.

Shape

Several basic shapes of structural units are recognized in soils:

Platy: The units are flat and platelike. They are generally oriented horizontally. A special form, lenticular platy structure, is recognized for plates that are thickest in the middle and thin toward the edges.

Prismatic: The individual units are bounded by flat to rounded vertical faces. Units are distinctly longer vertically and the faces are typically casts or molds of adjoining units. Vertices are angular or subrounded. The tops of prisms are somewhat indistinct and normally flat.

Columnar: The units are similar to prisms and are bounded by flat or slightly rounded vertical faces. The tops of columns, in contrast to those prisms, are very distinct and normally rounded.

Blocky: The units are block like or polyhedral. They are bounded by flat or slightly rounded surfaces that are casts of the faces of surrounding peds. Typically, blocky structural units are nearly equidimensional but grade to prisms and to plates. The structure is described as angular blocky if the faces intersect at relatively sharp angles. The structure is described as subangular blocky if the faces are a mixture of rounded and plane faces and the corners are mostly rounded.

Granular: The units are approximately spherical or polyhedral and are bounded by curved or very irregular faces that are not casts of adjoining peds.

Size

Five classes are employed: very fine, fine, medium, coarse, and very coarse. The size limits differ according to the shape of the units. The size limit classes are given in Appendix B, Table B-3. The size limits refer to the smallest dimension of plates, prisms, and columns.

Table B-3
Size Classes of Soil Structure

Size Classes	Platy[1]	Prismatic & Columnar	Blocky	Granular
		Shape of Structure		
	mm	mm	mm	mm
Very Fine	<1	<10	<5	<1
Fine	1 – 2	10 – 20	5 – 10	1 – 2
Medium	2 – 5	20 – 50	10 – 20	2 – 5
Coarse	5 – 10	50 – 100	20 – 50	5 – 10
Very Coarse	>10	>100	>50	>10

[1] In describing plates, "thin" is used instead of "fine" and "thick" instead of "coarse."

Grade

Grade describes the distinctness of units. Criteria are the ease of separation into discrete units and the proportion of units that hold together when the soil is handled. Three classes are used:

Weak: The units are barely observable in place. When gently disturbed, the soil material parts into a mixture of whole and broken units and much material that exhibits no planes of weakness. Faces that indicate persistence through wet-dry-wet cycles are evident if the soil is handled carefully. Distinguishing structurelessness from weak structure is sometimes difficult. Weakly expressed structural units in virtually all soil materials have surfaces that differ in some way from the interiors.

Moderate: The units are well formed and evident in undisturbed soil. When disturbed, the soil material parts into a mixture of mostly whole units, some broken units, and material that is not in units. Peds part from adjoining peds to reveal nearly entire faces that have properties distinct from those of fractured surfaces.

Strong: The units are distinct in undisturbed soil. They separate cleanly when the soil is disturbed. When removed, the soil material separates mainly into whole units. Peds have distinctive surface properties.

Three terms for soil structure are combined in order (1) grade, (2) size, (3) shape. "Strong fine granular structure" is used to describe a soil that separates almost entirely into discrete units that are loosely packed, roughly spherical, and mostly between 1 and 2 mm in diameter.

Compound Structure

Smaller structural units may be held together to form larger units. Grade, size, and shape are given for both, and the relationship of one set to the other is indicated: "strong medium blocks within moderate coarse prisms" or "moderate coarse prismatic structure parting to strong medium blocky."

Concentrations

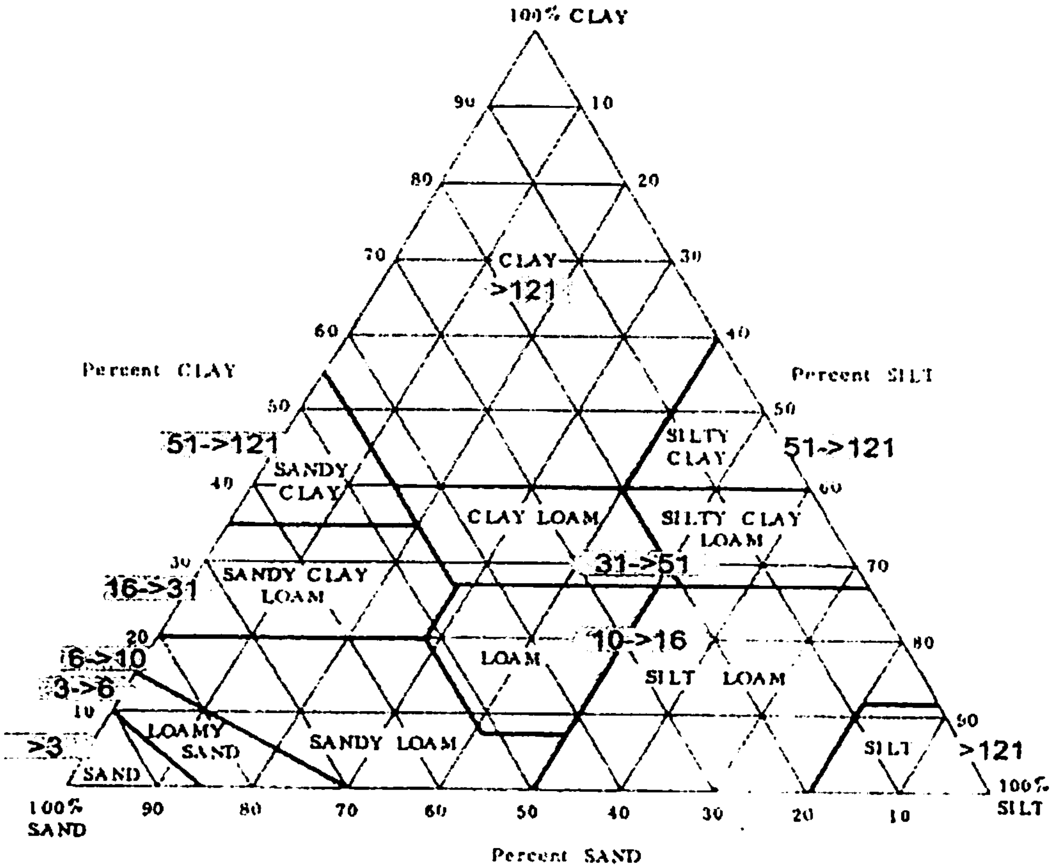
The features discussed here are identifiable bodies within the soil that were formed by pedogenesis. Some of these bodies are thin and sheetlike, some are nearly equidimensional, and others have irregular shapes. They may contrast sharply with the surrounding material in strength, composition, or internal organization. Masses are non-cemented concentrations of substances that commonly cannot be removed from the soil as a discrete unit. Most accumulations consist of calcium carbonate, fine crystals of gypsum or more soluble salts, or iron and manganese oxides. Except for very unusual conditions, masses have formed in place.

Nodules and concretions are cemented bodies that can be removed from the soil intact. Composition ranges from material dominantly like that of the surrounding soil to nearly pure chemical substances entirely different from the surrounding material.

Concretions are distinguished from nodules on the basis of internal organization. Concretions have crude internal symmetry organized around a point, a line, or a plane. Nodules lack evident, orderly internal organization.

Textural Triangle

Soil Percolation Rate min/in



APPENDIX C - GROUND WATER OBSERVATION WELL INSTALLATION AND MEASURING PROCEDURES

Observation Schedule

Observation must be done during the time when ground water levels are highest. This is typically during spring runoff or during the irrigation period, but may also be at some other time during the year. Observation must be done weekly or more frequently during the appropriate periods of suspected high ground water. Observation must include at least two weeks of observation prior to and after the ground water peak, otherwise the reviewing authority may reject the results. The applicant is encouraged to consult with the state and/or county before installing wells. The monitoring of the observation well must be completed by a qualified site evaluator as defined in Section 1.2.68 approved by the reviewing authority.

Surface water levels may be indicative of the ground water levels that may peak several weeks after spring runoff and irrigation seasons.

Local conditions may indicate that there is more than one geologic horizon that can become seasonally saturated. This may require observation wells to be installed at different horizons. The well should be placed in, but not extended through, the horizon that is to be monitored.

The reviewing authority may refuse to accept seasonal high ground water data when the total precipitation for the previous year, defined as May 1 of the previous year to April 30 of the current year, of April 1 snowpack equivalent, measured at the nearest officially recognized observation station, is more than 25 percent below the 30-year historical average. This is based upon the definition of drought conditions created by the National Drought Mitigation Center. The reviewing authority may consider soil morphology and data from nearby ground water observation sites with similar soil, geology, and proximity to streams or irrigation ditches, if available, to determine maximum ground water elevation during periods of drought.

Where to Install

The observation well(s) must be installed within 25 feet of the proposed absorption trench and on the same elevation. The reviewing authority may require the placement of the well(s) in an exact location. Additional observation wells may be required if the recommended observation sites show ground water higher than 6 feet below the ground surface.

Installation Process

The observation well must be installed vertically into a dug or drilled hole.

A slotted water well pipe should be used that is 2 to 4 inches in diameter and 10 feet long.

A. Slotted pipe (PVC is the most common material) with slot sizes between 40 and 100 (i.e. slot widths between 0.04 and 0.10 inches wide) is suggested. Slots should be horizontal and spaced at intervals less than or equal to 0.5 inches.

B. Check with the reviewing authority to determine if an alternate well material is acceptable.

The pipe should be perforated from 1 foot below the ground surface to 8 feet below the ground surface unless multiple horizons exist.

The casing must be unperforated 1 foot below the ground surface to the top of the observation well. The well must extend at least 2 feet above the ground surface.

The top of the observation well must be sealed with a watertight cap.

The area around the well must be backfilled with native material to 1 foot below the ground surface.

The observation well must be sealed in such a manner that prevents surface runoff from running along the outside of the well casing. The well should be sealed from 1 foot below the ground surface to slightly above grade to allow for subsidence and to maintain a positive ground slope away from well casing. The material used to seal the well can be either fine-grained material or bentonite.

Each observation well should be flagged to facilitate locating the well and labeled with the lot number, location, and subdivision name.

Measuring Procedures

Lower a measuring tape or stick to the water level and measure the distance from the water level to the top of the pipe (see example on next page). Water levels should be measured to the nearest inch. A plunking device or electronic water sensor can also be used. Data should be submitted in a similar form to that of the example.

Measure the distance from the top of the pipe to the natural ground surface (B distance) (see example). Then measure the distance from the top of the pipe to the water level (A distance) (see example). Subtract B from A. This value equals the actual separation between the water table and the natural ground surface.

Decommissioning

The applicant should consult with the reviewing authority before decommissioning observation wells.

Ground Water Observation Results

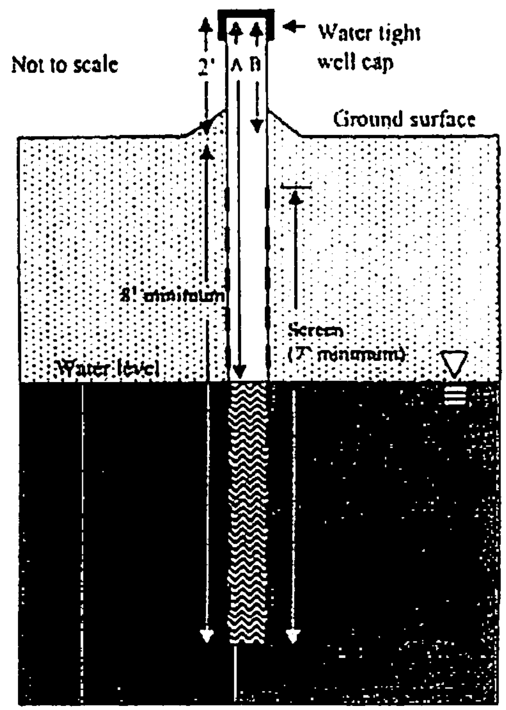
Monitored By:
Location:
Section ________ Township________ Range ____ Lot #______
Observation Well # ______

Other Location Information:

Date	Time	A (inches)	B (inches)	A-B (inches)

A= Distance to top of casing to the ground water level in pipe (inches)
Note: If the observation pipe is dry, enter the total depth measured and "dry" in this column.
B= Distance from top of casing to the natural ground surface (inches)

Ground Water Observation Well Design



APPENDIX D - OPERATION AND MAINTENANCE PLAN

Continued service and maintenance of the wastewater system must be addressed for the life of the system by an approved operation and maintenance plan.

The owner of the residence or facility is responsible for assuring proper operation and providing timely maintenance of the system. A copy of the approved operation and maintenance plan must be given to the local health department for their files. Some health departments may require that this document be presented in electronic format. If observations reveal a system failure, absorption trench failure, or history of effluent ponding within the absorption trench, the owner of the system must take appropriate action. Notification to the local health department and, if appropriate, the service provider must be made within two business days if any unit of the system fails to function properly.

The reviewing authority will consider the complexity and maintenance required of the system along with the stability of the processes in determining the adequacy, level of maintenance, and monitoring frequency of the system. The monitoring frequency should be sufficient to establish the treatment efficiency and response to varying wastewater flows, strengths, and climatic condition.

The operation and maintenance plan must include: an owner's manual, a system installation manual, an operation and maintenance manual, and as-built plans with the name of the designer and installer.

Certification and As-builts

The following wastewater treatment systems require certification and as-builts:

Public Wastewater Systems, regardless of type, in accordance with ARM 17.38.101
Cut, Fill, and Artificially Drained Systems
Drainfields that serve 10 or More Living Units
High Strength Wastewater Treatment Systems
Alternative Wastewater Collection Systems
Raw Wastewater Pumping Stations
Elevated Sand Mounds
Evapotranspiration Absorption and Evapotranspiration Systems
Gray Water Irrigation Systems
Intermittent Sand Filters
Recirculating Sand Filters
Aerobic Wastewater Treatment Units
Chemical Nutrient Reduction Systems
Alternate Advanced Treatment Systems

The wastewater system owner may not commence or continue the operation of the wastewater systems listed above, or any portion of such system, prior to certifying by letter to the reviewing authority that the system, or portion of the system constructed, altered, or extended to that date, was completed in accordance with plans and specifications approved by the reviewing authority. Within 90 days after the completion of construction, alteration, or extension of the wastewater

Comprehensive instruction in the operation and maintenance of the system must be provided to the reviewing authority and must include:

A. Maintenance procedures and schedules for all components;

B. Requirements and recommended procedures for periodic removal of residuals from the system;

C. A detailed procedure for visually evaluating function of system components: and

D. Safety concerns that may need to be addressed.

As-built Plans

A comprehensive set of as-built plans must be submitted to the reviewing authority and include the name of the designer and installer. As-builts will be added to the operation and maintenance plan after initial approval and construction of the system.

Proprietary and High Strength Wastewater Treatment Systems

In addition to the requirements of this Appendix, all proprietary and high strength wastewater treatment systems must have both an initial and a renewed service contract for the life of the system. Service contracts must include:

A. Owner's name and address;

B. Property address and legal description;

C. Local health department permit requirements;

D. Detail of service to be provided. The owner must be notified, in writing, about any improper system function that cannot be remedied during the time of inspection, and an estimate for the date of correction;

E. Schedule of service provider duties. Initial 2-year service policies must stipulate a minimum of 4 inspection/service visits, scheduled at least once every 6 months over the 2-year period, during which electrical, mechanical, and other components are inspected, adjusted, and serviced;

F. Cost and length of service contract/time period;

G. Details of product warranty; and

H. Owner's responsibilities.

For subsurface wastewater treatment systems, classified under ARM 17.30.718 as Level 1a, Level 1b, or Level 2 for nutrient reduction, the system vendor or manufacturer must offer an operation and maintenance plan that meets the requirements of this Appendix and ARM 17.30.718.

APPENDIX E - DESIGN EXAMPLES

ESM - Elevated Sand Mound Example

ELEVATED SAND MOUND - DESIGN EXAMPLE

Parameters:

4-bedroom house

Design Flow: 350 gallons per day (gpd)

Land Slope: Flat

Underlying Soil Type: Clay Loam

Soil Application Rate: 0.3 gallons per day per square foot (gpd/sf)

Sand Loading Rate per DEQ-4: 0.8 gpd/sf

Basal Loading Rate per DEQ-4: 0.3 gpd/sf

Bed size based upon sand loading rate:

350 gpd ÷ 0.8 gpd/sf = 438 sf of required absorption area.

Required Minimum Basal Area based upon soil loading rate:

350 gpd ÷ 0.3 gpd/sf = 1,167 sf of Basal Area required.

Montana Department of Environmental Quality	Scale: NTS	Elevated Sand Mound Design Parameters	Dwg. No. ESM-1

BED DESIGN

438 sf of bed required.

§6.6.3.7 requires a minimum 3:1 ratio of length to width.

Let "x" = width, then "3x = length

Thus:

$3x^2 = 438$

$x = \sqrt{438/3}$

x = 12.08' ; 3x = 32.25'

Round to 12.5' x 37.5' so §6.6.3.7 is still met.

Check Basal Area Requirements:

Overall Width of Mound:

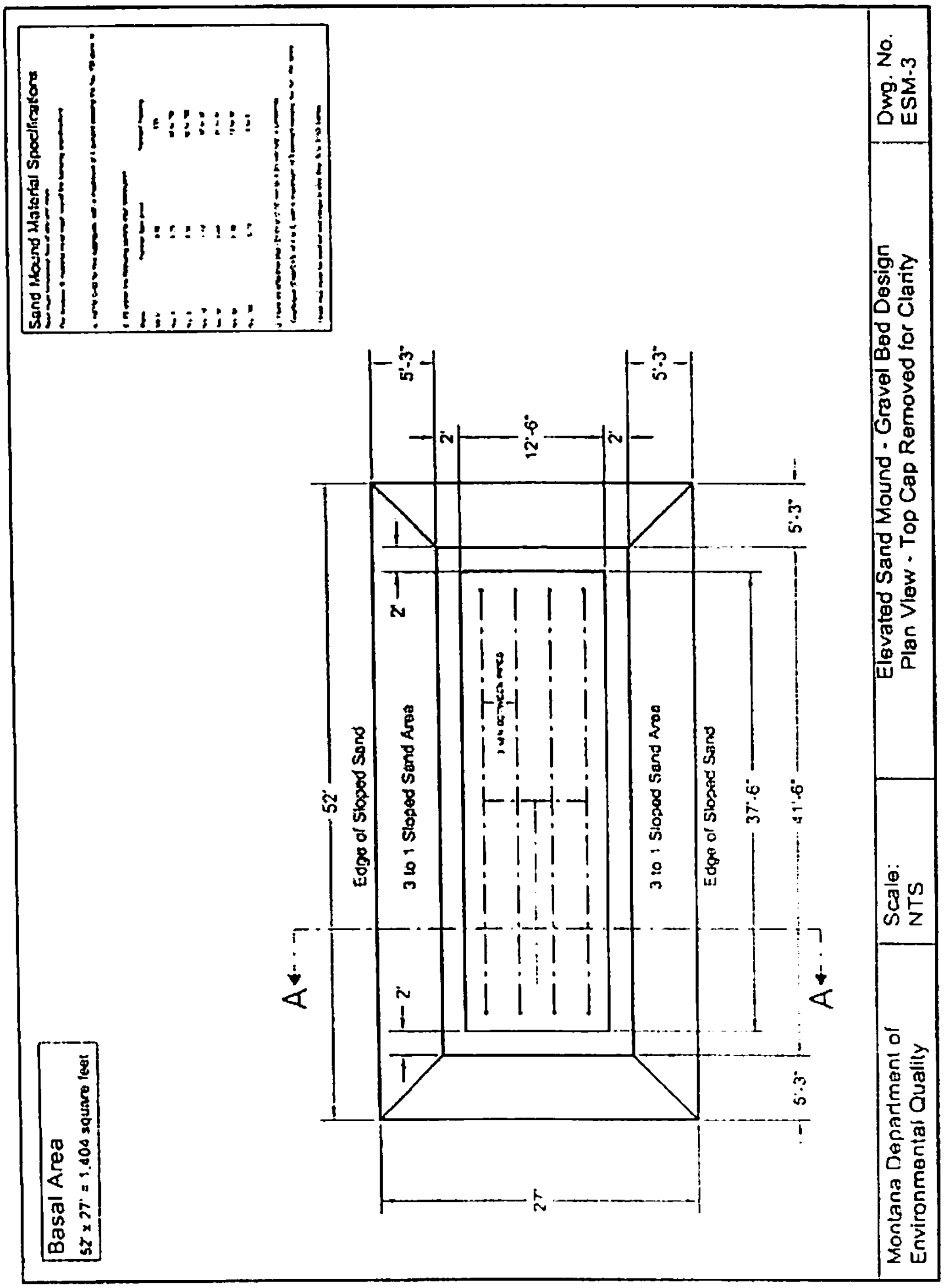
5.25' + 2' + 12.5' + 2' + 5.25' = 27'

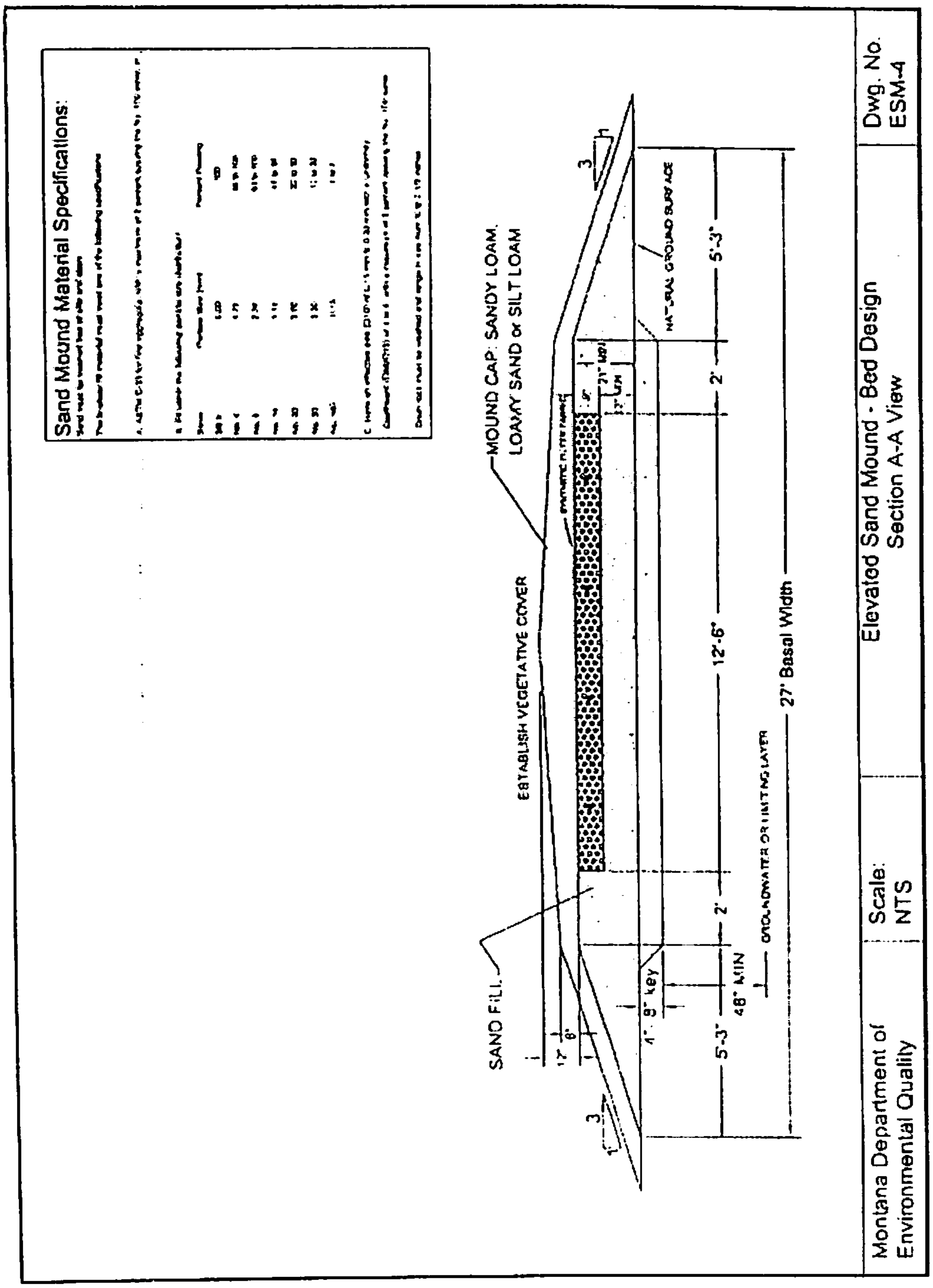
Overall Length of Mound:

5.25' + 2' + 37.5' + 2' + 5.25' = 52'

52' x 27' = 1,404 sf > 1,167 sf so §6.6.3.3 requirement met

Montana Department of Environmental Quality	Scale: NTS	Elevated Sand Mound Gravel Bed Design Parameters	Dwg. No. ESM-2


Sand Mound Material Specifications
Basal Area
52' x 27' = 1,404 square feet
A
52'
Edge of Sloped Sand
3 to 1 Sloped Sand Area
2'
5'-3"
12'-6"
37'-6"
41'-6"
27'
Elevated Sand Mound - Gravel Bed Design
Plan View - Top Cap Removed for Clarity
Montana Department of
Environmental Quality
Scale:
NTS
Dwg. No.
ESM-3


Sand Mound Material Specifications:
MOUND CAP: SANDY LOAM, LOAMY SAND or SILT LOAM
ESTABLISH VEGETATIVE COVER
SAND FILL
NATURAL GROUND SURFACE
GROUNDWATER OR LIMITING LAYER
3
1
12"
6"
1'
8" key
48" MIN
5'-3"
2'
12'-6"
2'
5'-3"
27' Basal Width
Montana Department of Environmental Quality
Scale: NTS
Elevated Sand Mound - Bed Design
Section A-A View
Dwg. No. ESM-4

LEECHING BED DESIGN

438 sf of bed required.

§6.6.3.7 requires a minimum 3:1 ratio of length to width.

Let "x" = width, then "3x = length

Thus

$3x^2 = 438$

$x = \sqrt{438/3}$

x = 12.08' ; 3x = 32.25'

Round to 15' x 36' for standard 3' wide x 4' long chambers: §6.6.3.7 is met.

Check Basal Area Requirements:

Overall Width of Mound:

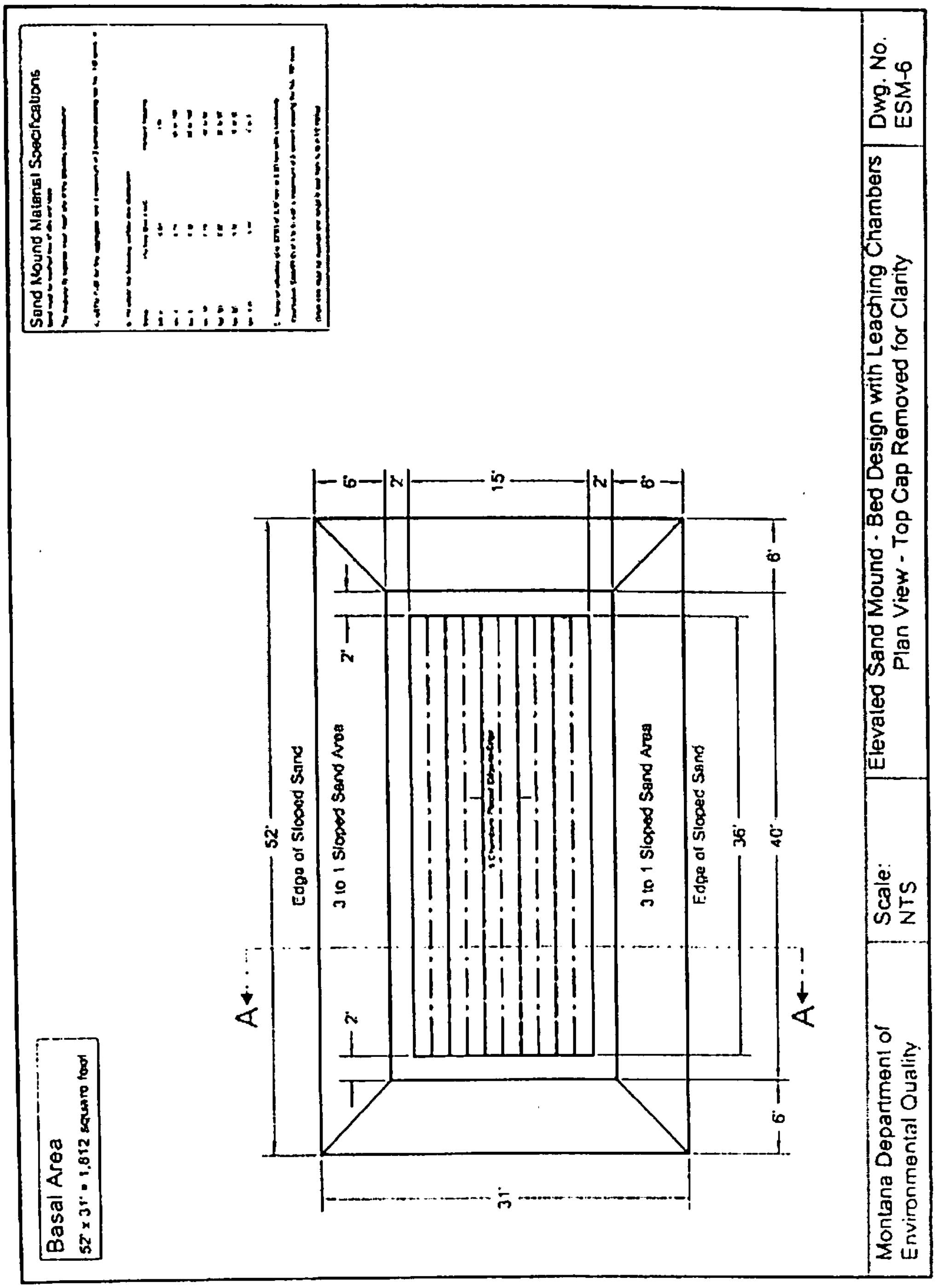
6' + 2' + 15' + 2' + 6' = 31'

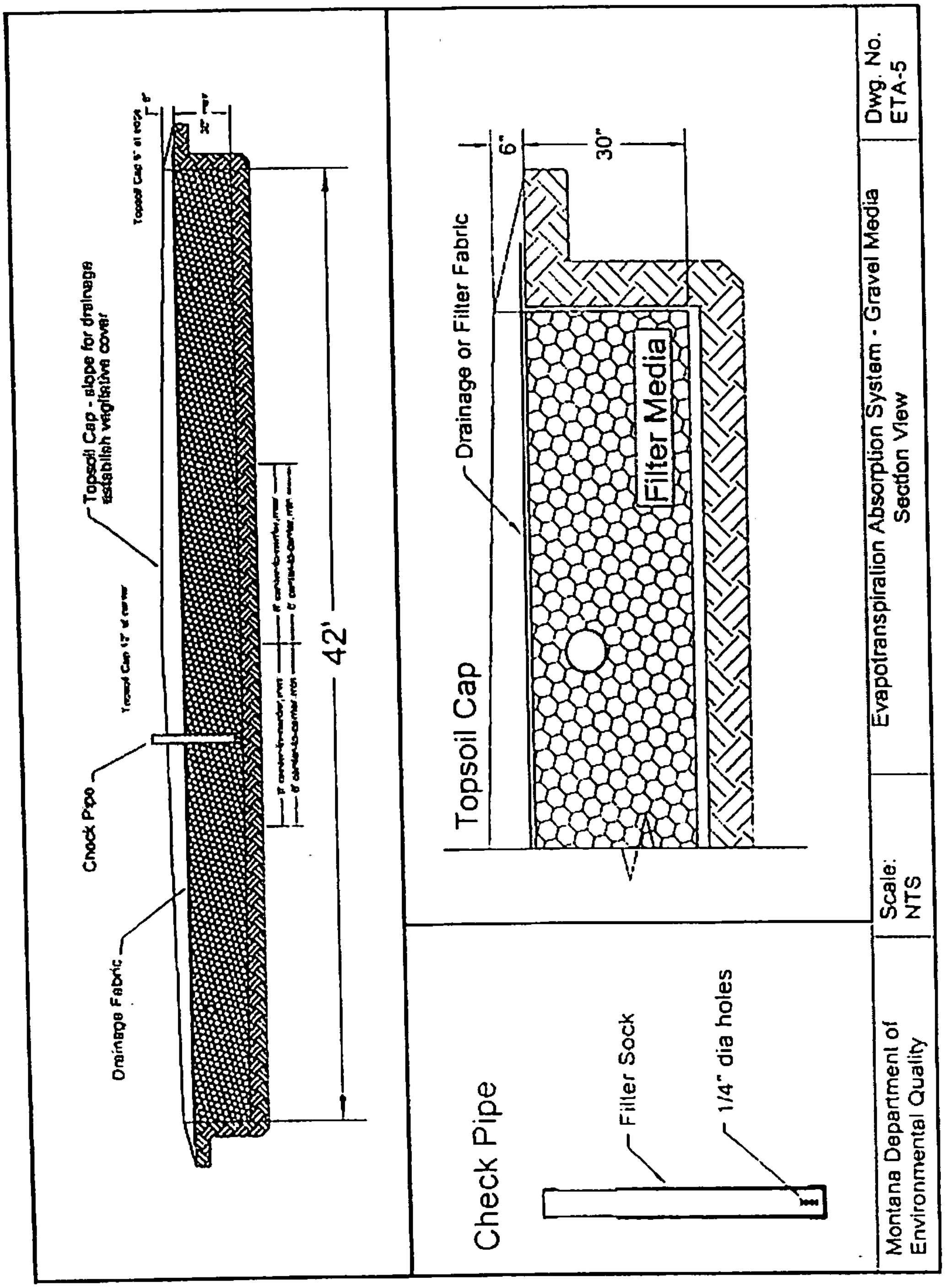
Overall Length of Mound:

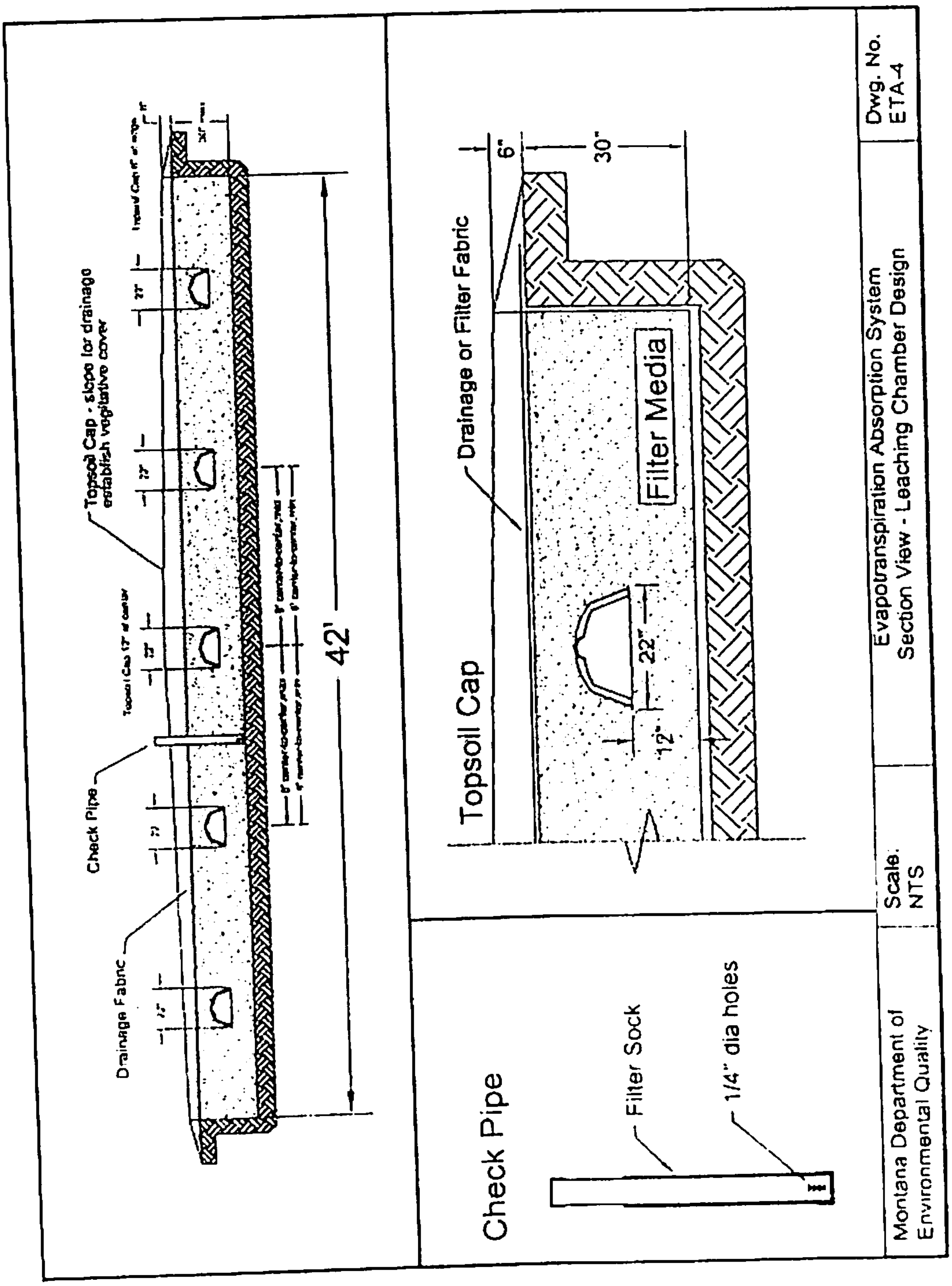
6' + 2' + 36' + 2' + 6' = 52'

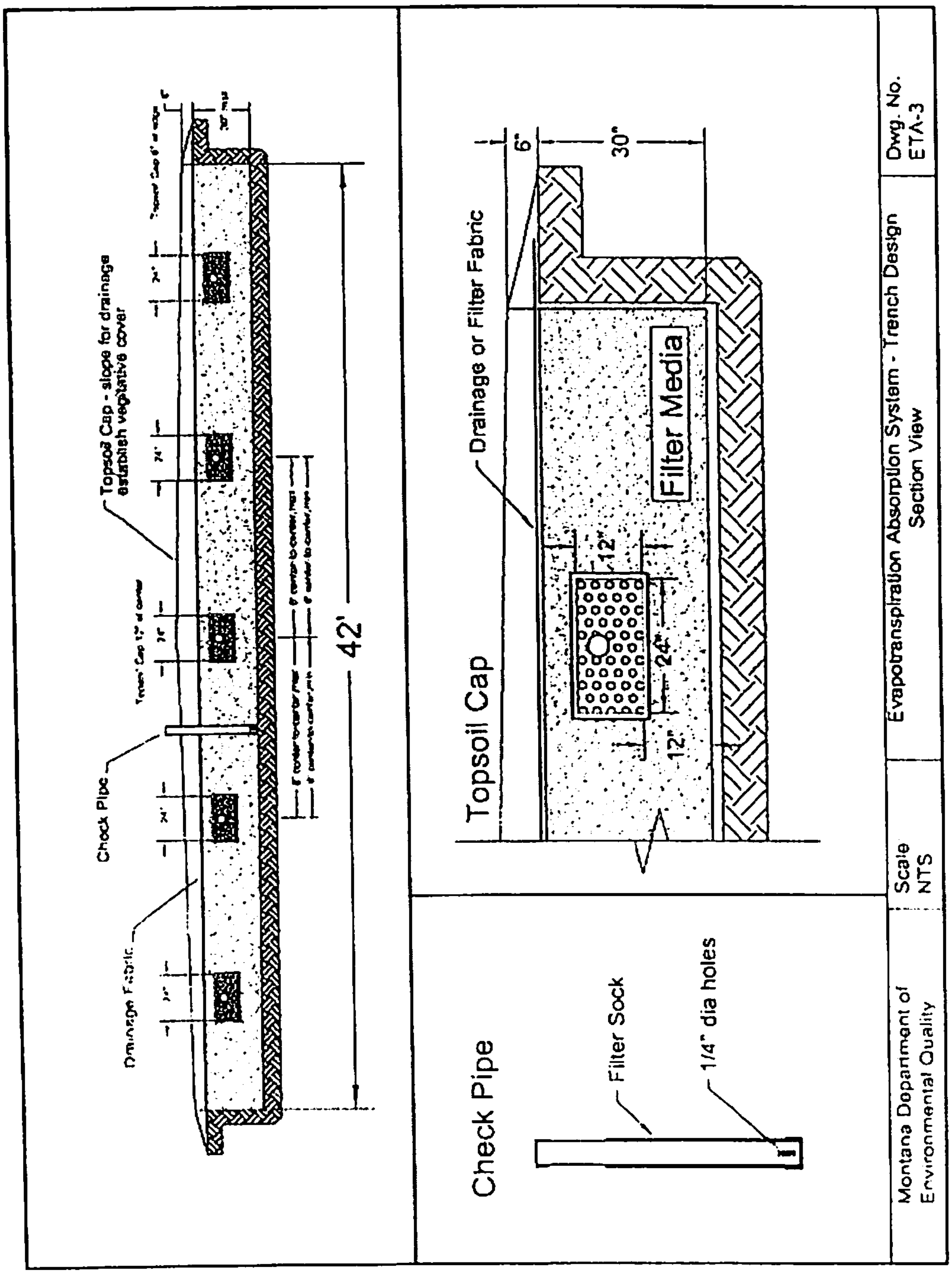
52' x 31' = 1,612 sf > 1,167 sf so §6.6.3.3 requirement met

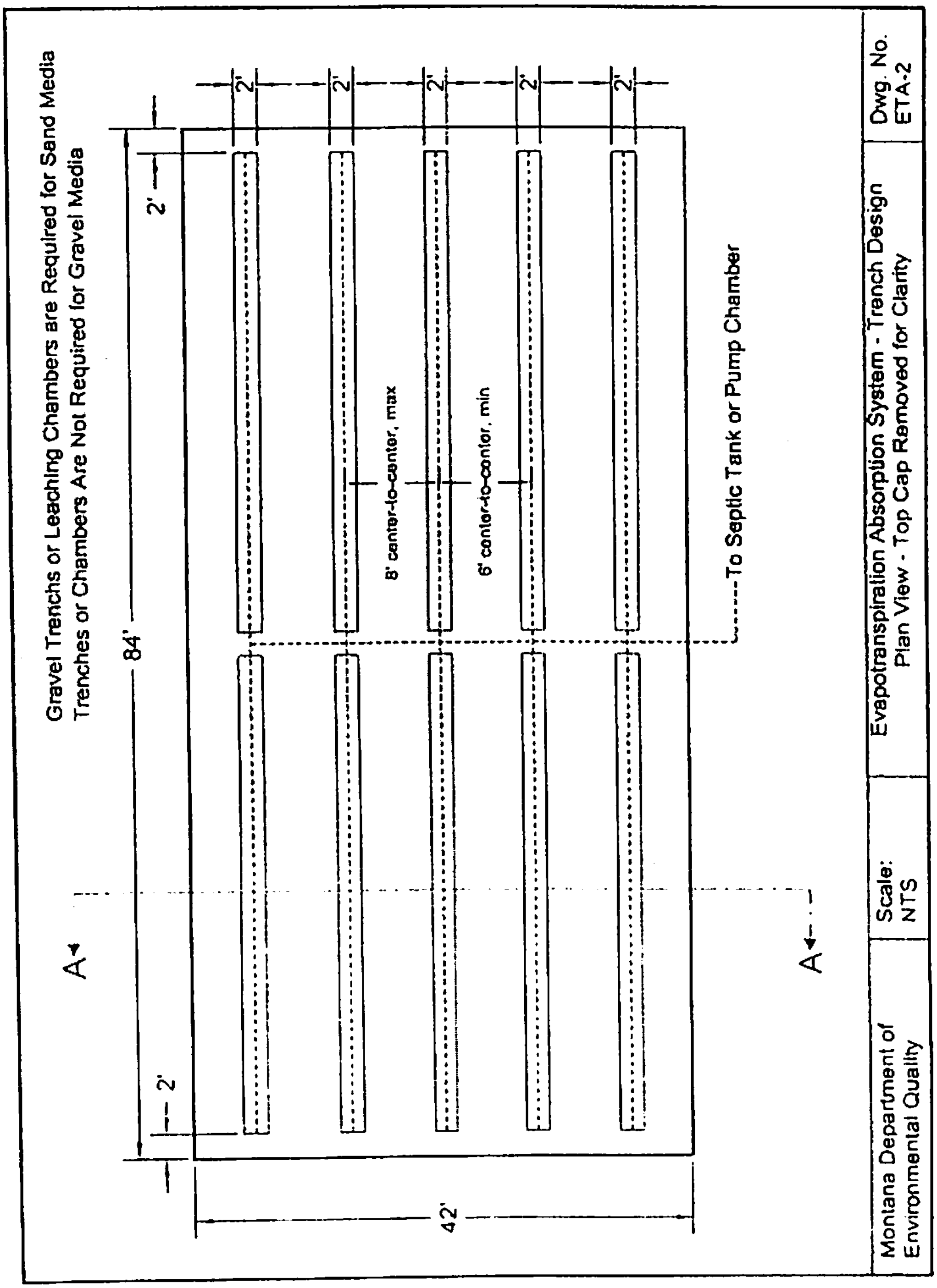
Montana Department of Environmental Quality	Scale 1" = 1' - 0"	Elevated Sand Mound Leeching Chamber Bed Design Parameters	Dwg. No. ESM-5


Sand Mound Material Specifications
Basal Area
52' x 31' = 1,612 square feet
52'
Edge of Sloped Sand
3 to 1 Sloped Sand Area
36'
40'
31'
6'
2'
15'
A
Montana Department of Environmental Quality
Scale: NTS
Elevated Sand Mound - Bed Design with Leaching Chambers
Plan View - Top Cap Removed for Clarity
Dwg. No. ESM-6


Topsoil Cap - slope for drainage establish vegetative cover
Check Pipe
Drainage Fabric
42'
Topsoil Cap
Drainage or Filter Fabric
Filter Media
6"
30"
Check Pipe
Filter Sock
1/4" dia holes
Montana Department of Environmental Quality
Scale: NTS
Evapotranspiration Absorption System - Gravel Media Section View
Dwg. No. ETA-5


Topsoil Cap - slope for drainage
establish vegetative cover
Check Pipe
Drainage Fabric
42'
Drainage or Filter Fabric
6"
30"
Topsoil Cap
Filter Media
22"
12"
Check Pipe
Filter Sock
1/4" dia holes
Dwg. No.
ETA-4
Evapotranspiration Absorption System
Section View - Leaching Chamber Design
Scale:
NTS
Montana Department of
Environmental Quality


Topsoil Cap - slope for drainage establish vegetative cover
Check Pipe
Drainage Fabric
42'
Topsoil Cap
Drainage or Filter Fabric
6"
30"
Filter Media
12"
24"
12"
Check Pipe
Filter Sock
1/4" dia holes
Montana Department of Environmental Quality
Scale NTS
Evapotranspiration Absorption System - Trench Design
Section View
Dwg. No. ETA-3


Gravel Trenchs or Leaching Chambers are Required for Sand Media
Trenches or Chambers Are Not Required for Gravel Media
84'
2'
2'
2'
42'
8' center-to-center, max
6' center-to-center, min
To Septic Tank or Pump Chamber
A
A
Montana Department of
Environmental Quality
Scale:
NTS
Evapotranspiration Absorption System - Trench Design
Plan View - Top Cap Removed for Clarity
Dwg. No.
ETA-2

ETA Evapotranspiration Absorption System Example

EVAPOTRANSPIRATION ABSORPTION SYSTEM - DESIGN EXAMPLE

Parameters: 4-bedroom house near Terry; design flow 350 gallons per day (gpd)

Land Slope: Flat; Underlying Soil Type: Clay

Soil Application Rate Based Upon Percolation Test: 0.15 gpd/sf (Section 6.7.3.5)

Bed Material Void Ratio 40 %

Required Factor of Safety: 1.5 (per Section 6.7.3.7)

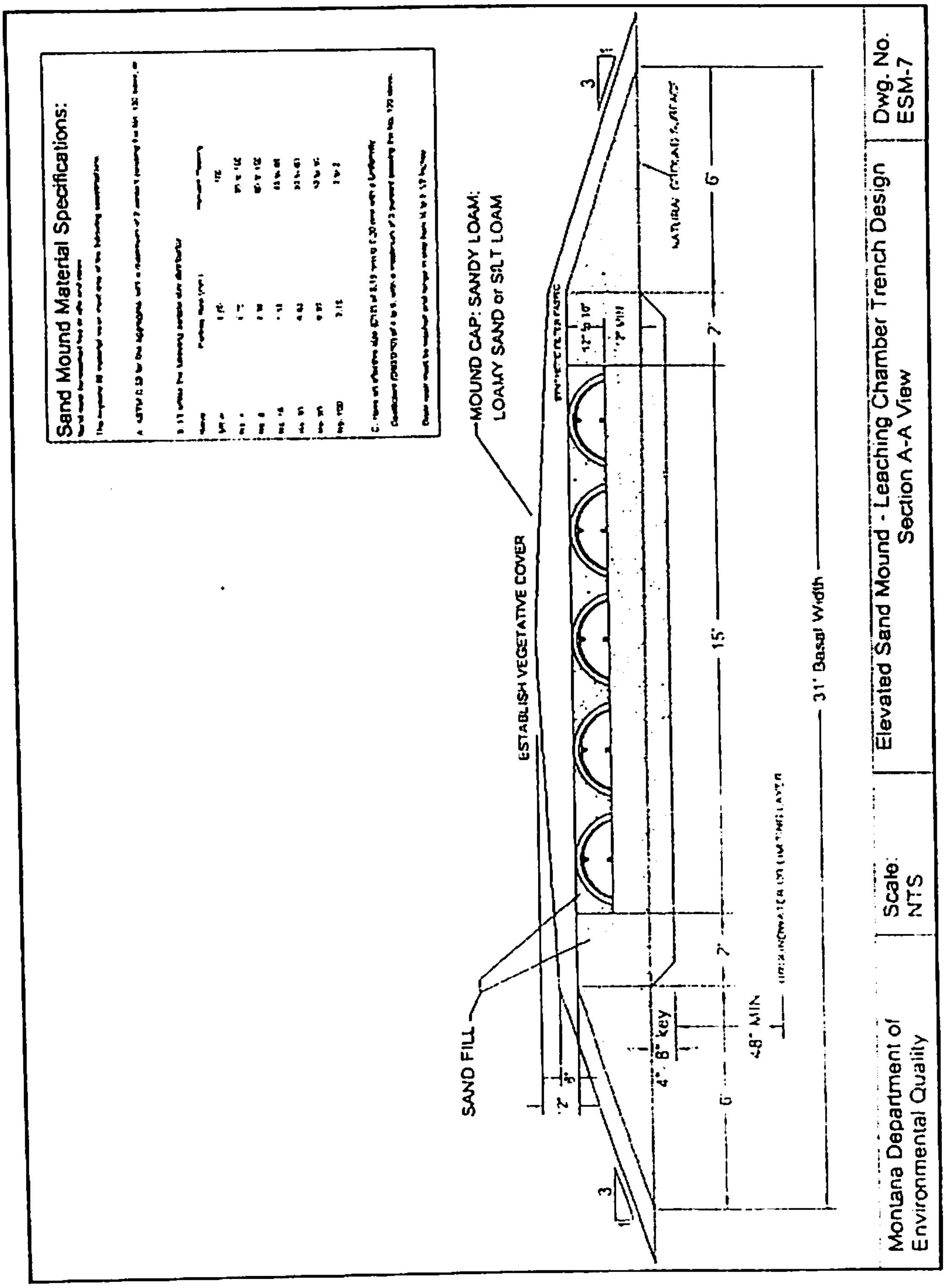
ET Bed Size Based Upon Maximum Allowed Application Rate: 0.15gpd/sf (per Section 6.7.3.5)

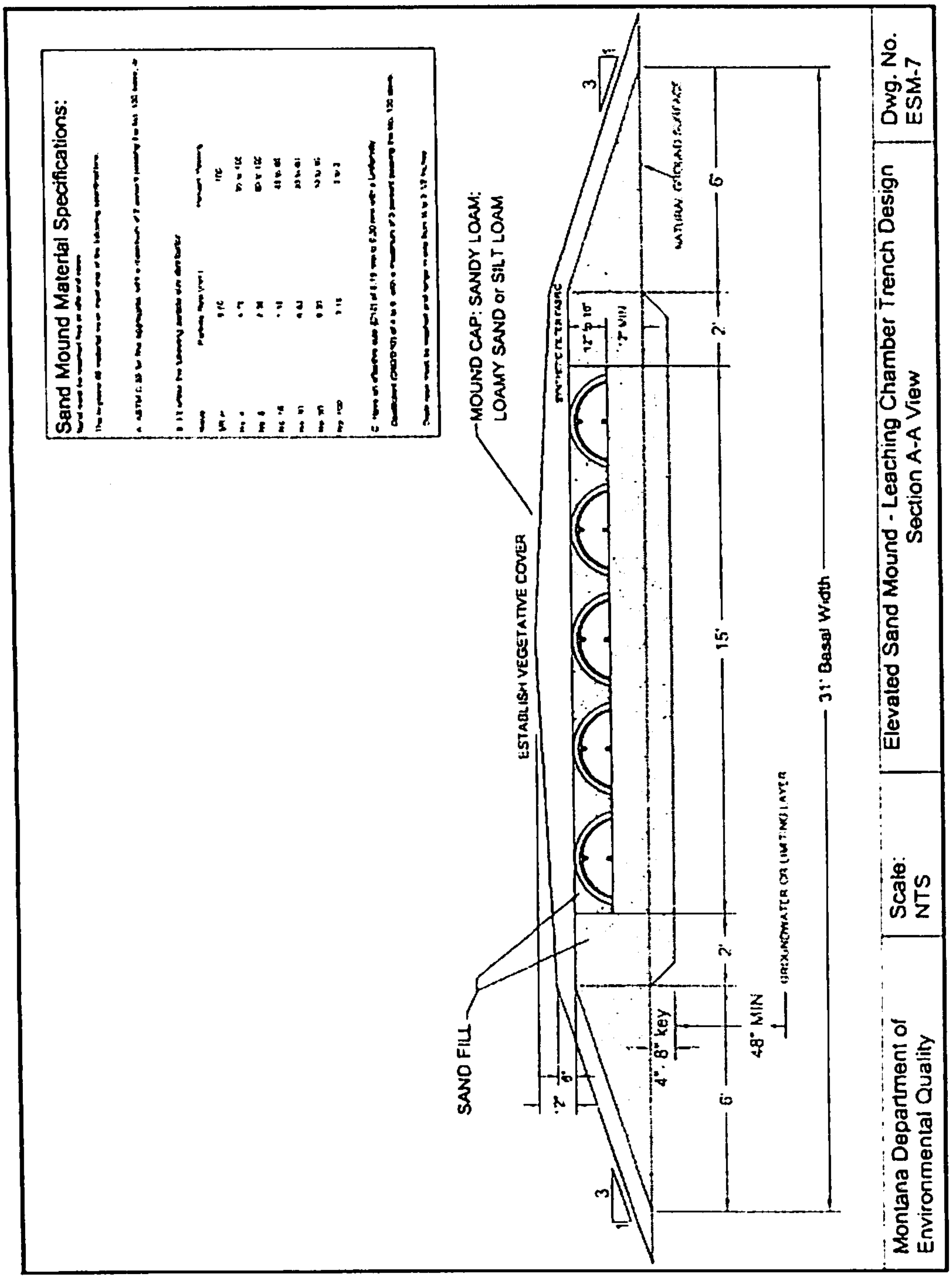
350/0.15 = 2,333 square feet. 2,333 square feet x 1.5 factor of safety = 3,500 square feet

Bed Dimensions: Square 59' x 59'

Bed Dimensions: 2:1 Rectangle 42' x 84'

Montana Department of Environmental Quality	Scale: NTS	Evapotranspiration Absorption System Design Parameters	Dwg. No. ETA-1


Sand Mound Material Specifications:
MOUND CAP: SANDY LOAM; LOAMY SAND or SILT LOAM
ESTABLISH VEGETATIVE COVER
SAND FILL
3
1
2"
4"- 8" key
48" MIN
6'
7'
15'
7'
6'
31' Basal Width
Montana Department of Environmental Quality
Scale: NTS
Elevated Sand Mound - Leaching Chamber Trench Design
Section A-A View
Dwg. No. ESM-7


Sand Mound Material Specifications:
MOUND CAP: SANDY LOAM, LOAMY SAND or SILT LOAM
ESTABLISH VEGETATIVE COVER
SAND FILL
4" - 8" key
48" MIN
3
1
6'
2'
15'
31' Basal Width
Elevated Sand Mound - Leaching Chamber Trench Design
Section A-A View
Dwg. No.
ESM-7
Scale:
NTS
Montana Department of
Environmental Quality

ETA Evapotranspiration Absorption System Example

EVAPOTRANSPIRATION ABSORPTION SYSTEM - DESIGN EXAMPLE

Parameters: 4-bedroom house near Terry; design flow 350 gallons per day (gpd)

Land Slope: Flat;   Underlying Soil Type: Clay

Soil Application Rate Based Upon Percolation Test: 0.15 gpd/sf (Section 6.7.3.5)

Bed Material Void Ratio 40 %

Required Factor of Safety: 1.5 (per Section 6.7.3.7)

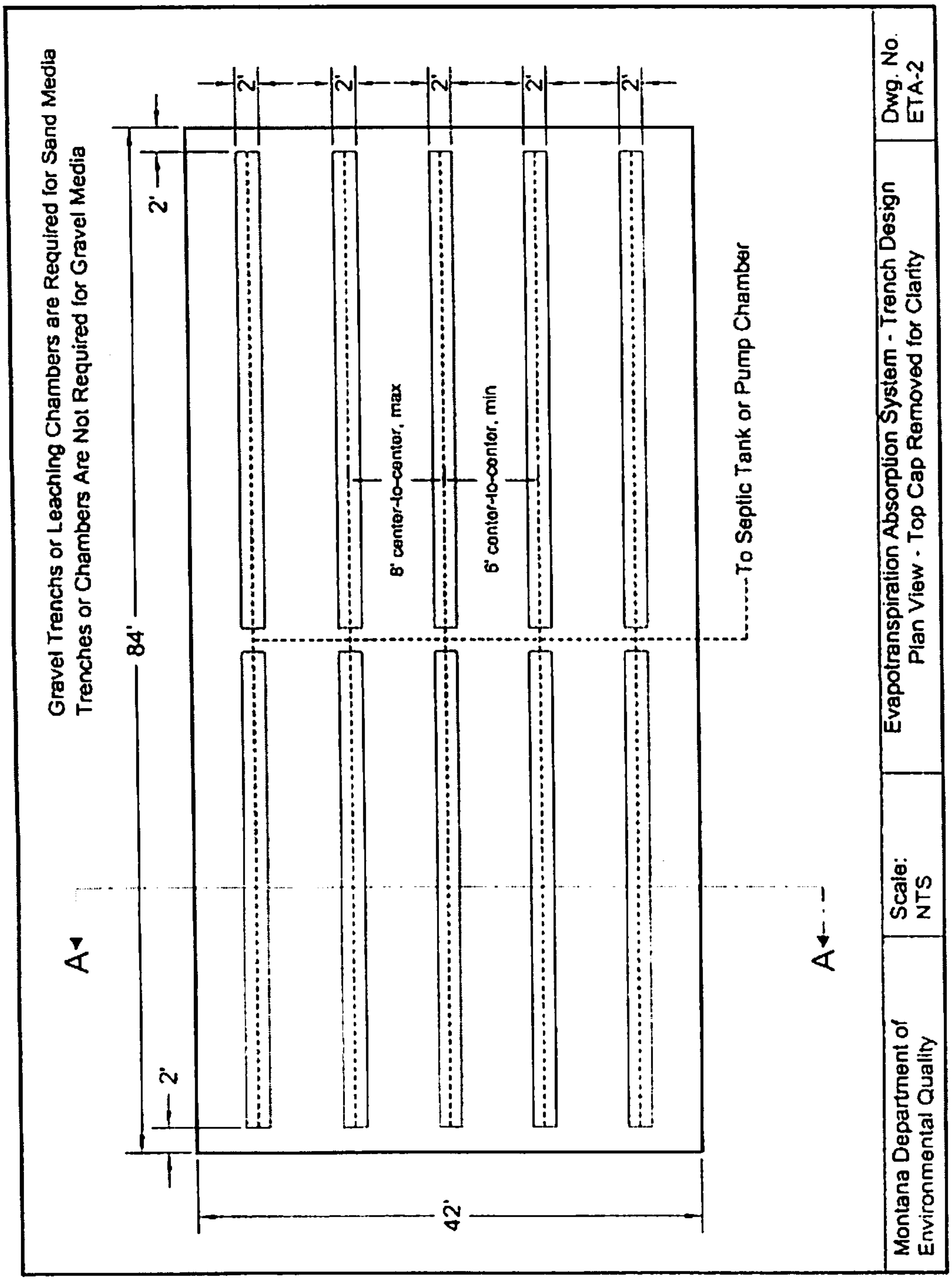
ET Bed Size Based Upon Maximum Allowed Application Rate: 0.15gpd/sf (per Section 6.7.3.5)

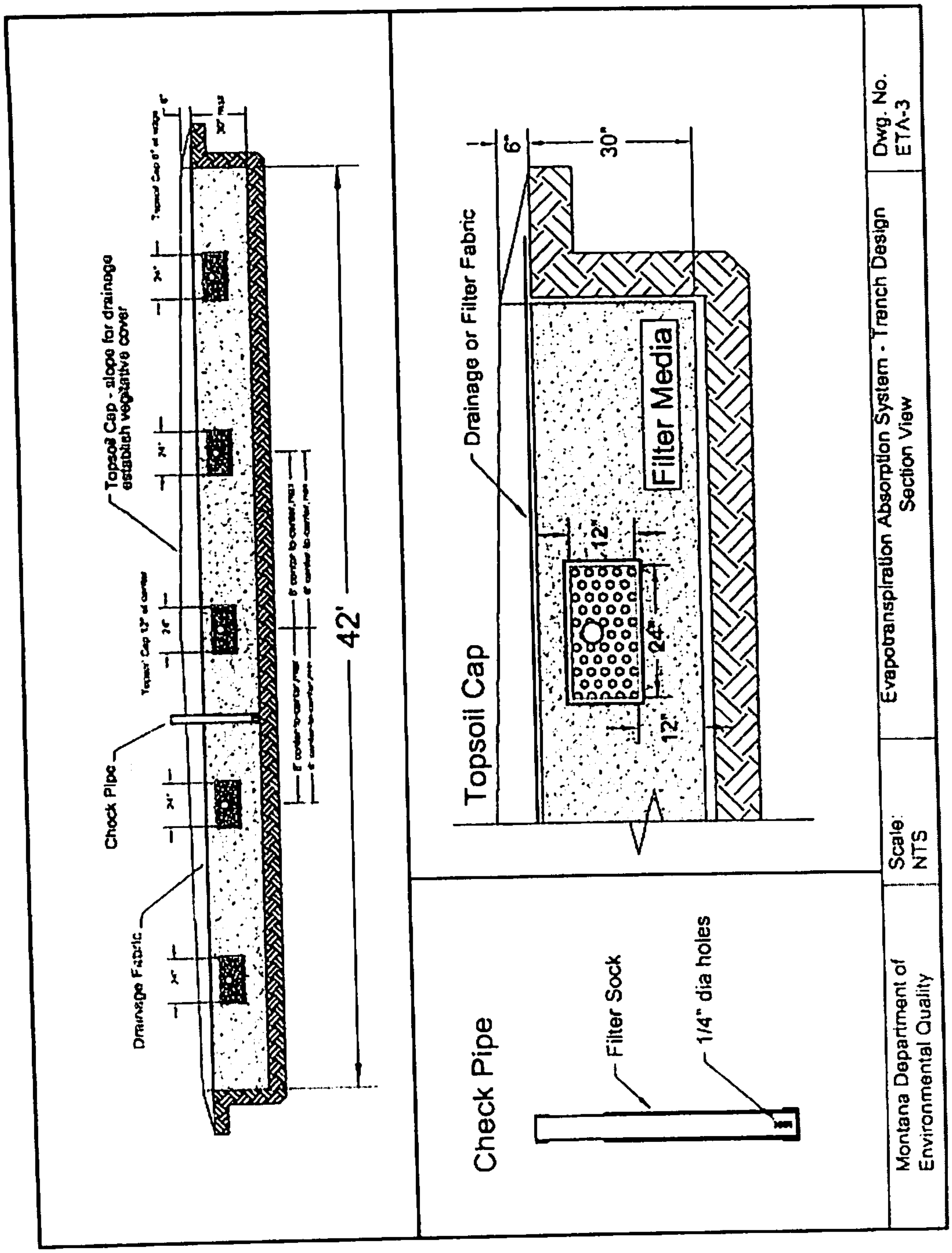
350/0.15 = 2,333 square feet.   2,333 square feet x 1.5 factor of safety = 3,500 square feet

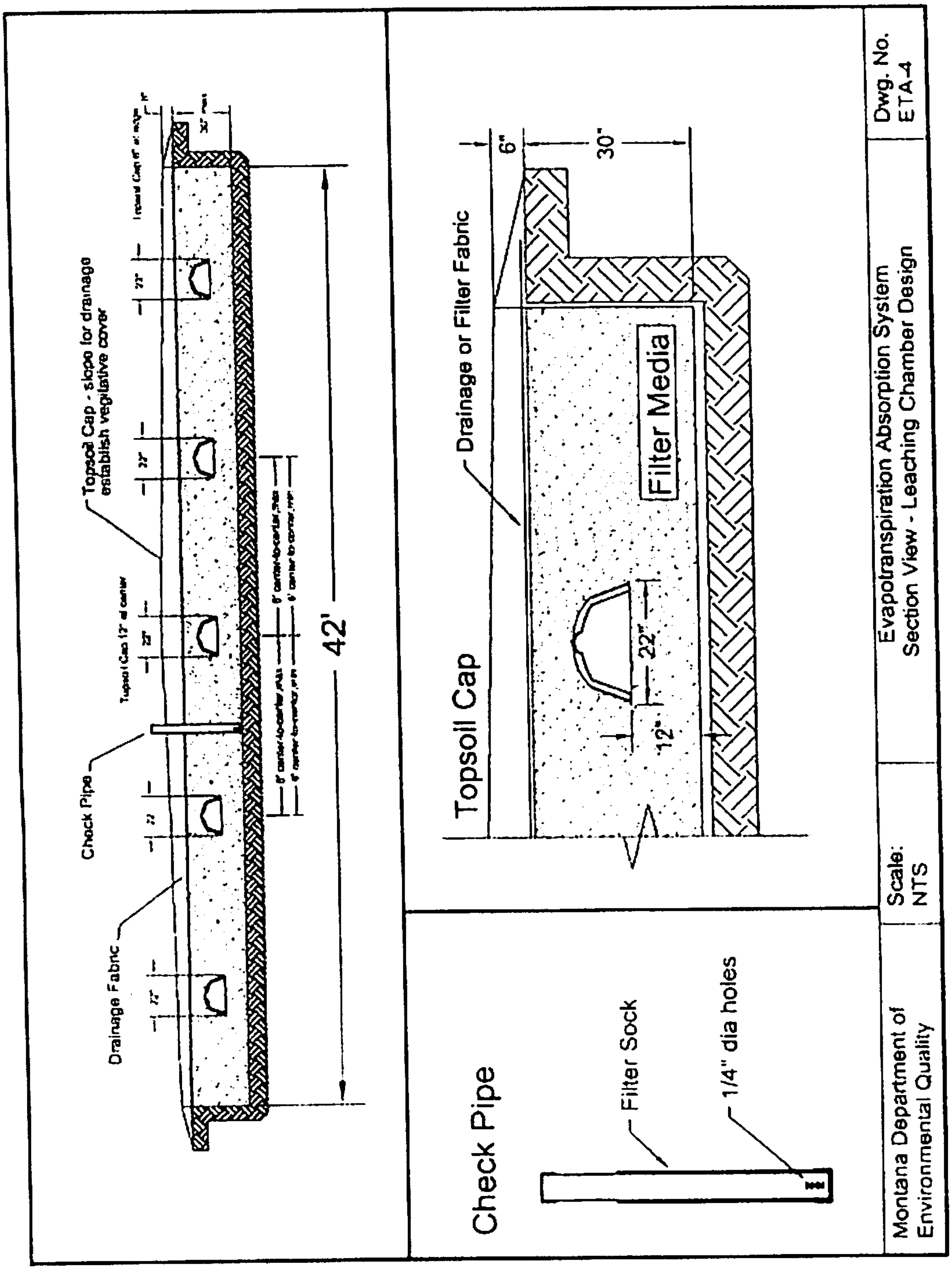
Bed Dimensions: Square 59' x 59'

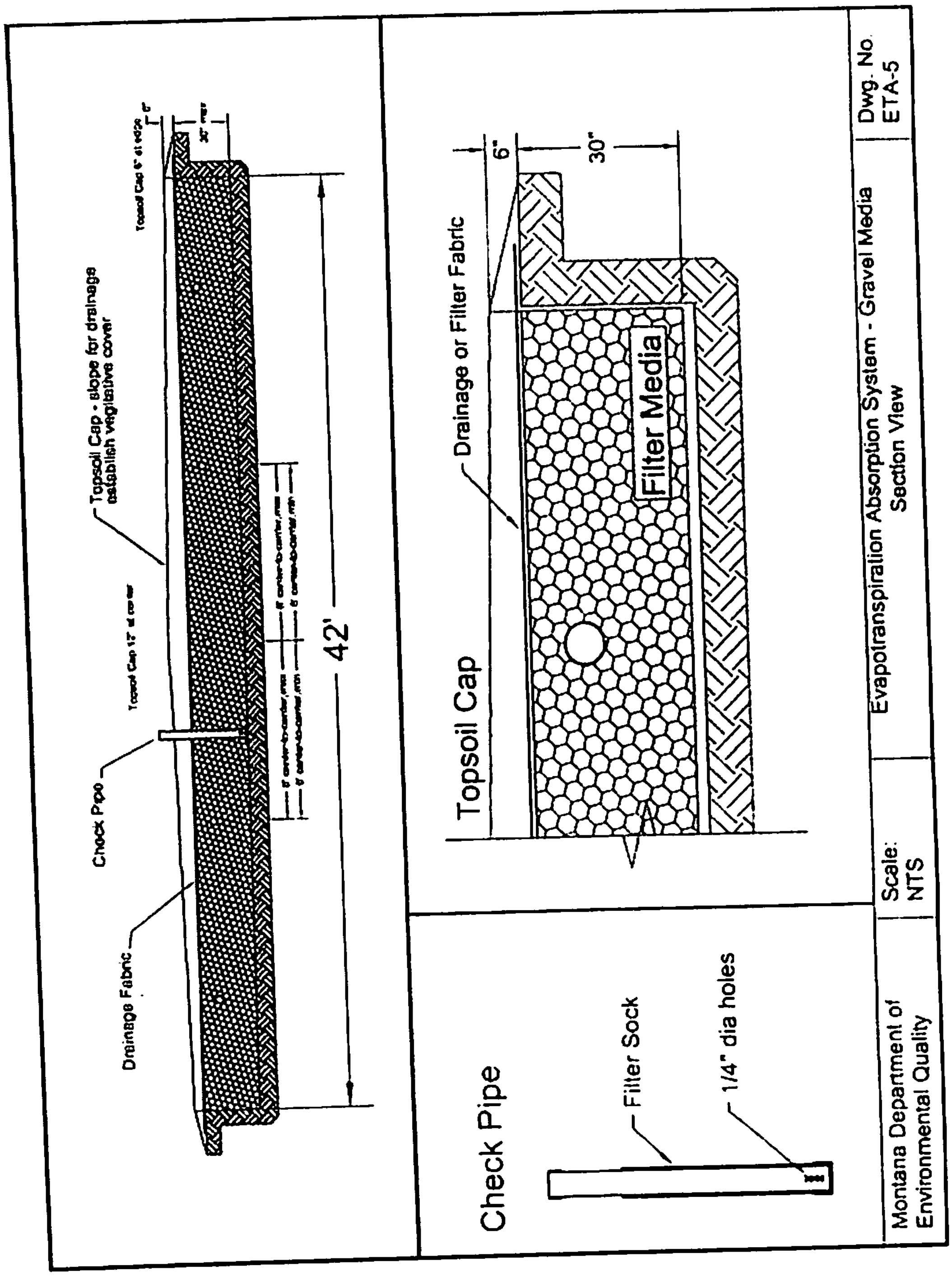
Bed Dimensions: 2:1 Rectangle 42' x 84'

Montana Department of Environmental Quality	Scale: NTS	Evapotranspiration Absorption System Design Parameters	Dwg. No. ETA-1


Gravel Trenches or Leaching Chambers are Required for Sand Media
Trenches or Chambers Are Not Required for Gravel Media
84'
2'
2'
2'
2'
2'
2'
2'
2'
42'
8' center-to-center, max
6' center-to-center, min
To Septic Tank or Pump Chamber
A
A
Montana Department of
Environmental Quality
Scale:
NTS
Evapotranspiration Absorption System - Trench Design
Plan View - Top Cap Removed for Clarity
Dwg. No.
ETA-2


Topsoil Cap - slope for drainage establish vegetative cover
Check Pipe
Drainage Fabric
42'
Drainage or Filter Fabric
Topsoil Cap
Filter Media
6"
30"
12"
24"
12"
Check Pipe
Filter Sock
1/4" dia holes
Evapotranspiration Absorption System - Trench Design
Section View
Dwg. No.
ETA-3
Scale:
NTS
Montana Department of
Environmental Quality


Topsoil Cap - slope for drainage
establish vegitative cover
Check Pipe
Drainage Fabric
42'
Topsoil Cap
Drainage or Filter Fabric
6"
30"
Filter Media
22"
12"
Check Pipe
Filter Sock
1/4" dia holes
Evapotranspiration Absorption System
Section View - Leaching Chamber Design
Dwg. No.
ETA-4
Scale:
NTS
Montana Department of
Environmental Quality


Topsoil Cap - slope for drainage establish vegitative cover
Check Pipe
Drainage Fabric
Topsoil Cap 12" at center
Topsoil Cap 6" at edge
42'
Drainage or Filter Fabric
Topsoil Cap
Filter Media
6"
30"
Check Pipe
Filter Sock
1/4" dia holes
Evapotranspiration Absorption System - Gravel Media
Section View
Dwg. No.
ETA-5
Scale:
NTS
Montana Department of
Environmental Quality

APPENDIX F
Documents Adopted by Reference And Other Referenced Documents

A Montana agency adopting a standard by reference in a rule must provide a citation to the material adopted by reference and a statement of the general subject matter of the omitted rule and must state where a copy of the omitted material may be obtained. § 2-4-307(2), Montana Code Annotated (MCA). Standards developers have copyrights that protect against unauthorized use of their standards, and an agency cannot, without permission, provide free paper or internet copies of those standards. Table 1, column 2, provides the web address where the sources of all standards being proposed for adoption by reference in DEQ-4 can be purchased. Copies of the documents also may be viewed at the Helena office of the Public Water and Subdivision Section, Department of Environmental Quality, 1520 East 6th Ave., Helena, MT.

Table 1

Adopted-by-Reference	Web Addresses Where Documents can be Purchased
ASTM C117-13	http://global.ihs.com
ASTM D5093-02	http://global.ihs.com
ASTM D3034-08	http://global.ihs.com
ASTM D1785-12	http://global.ihs.com
ASTM D3350-12	http://global.ihs.com
ASTM D2729-11	http://global.ihs.com
ASTM D2241-09	http://global.ihs.com
ASTM C1227-12	http://global.ihs.com
ASTM C150-12	http://global.ihs.com
ASTM C 990-09	http://global.ihs.com
ASTM C 33-13	http://global.ihs.com
IAPMO/ ANSI Z1000-07	http://webstore.ansi.org

IAPMO PS 63-2005	http://iapmomembership.org
ACI 318-11	http://www.concrete.org

Table2 contains web addresses to other sources of information referenced in DEQ-4.

Table2

Underwriters Laboratories (http://www.ul.com)
Canadian Standards Association (http://www.csagroup.org)
National Electric Code Class 1, Division 2 locations (http://www.osha.gov)
ANSI/NSF Standard 46 (http://www.nsf.org)
USDA Soils Report (http://www.nrcs.usda.gov)
NSF Standard 40 (for class 1 certification) (http://www.nsf.org)
"The Wisconsin Mound Soil Absorption System Siting, Design, and Construction Manual", January 2000 (recommended) (http://www.soils.wisc.edu)
EPA Manual, "On-Site Wastewater Treatment Systems Manual", February 2002, pages TFS 41 to 52 (http://www.norweco.com)
NSF Standard 41 (http://www.nsf.org)
National Drought Mitigation Center (definition of drought) (http://drought.unl.edu)
MSU Extension Service, "Septic Tank and Drainfield Operations" (http://msuextension.org)
MSU Extension Service, "Maintenance and Septic System Inspection and Troubleshooting" (http://msuextension.org)