OSCAR-II **Treatment System**
Design Manual
Idaho
January, 2023

Manufactured by:

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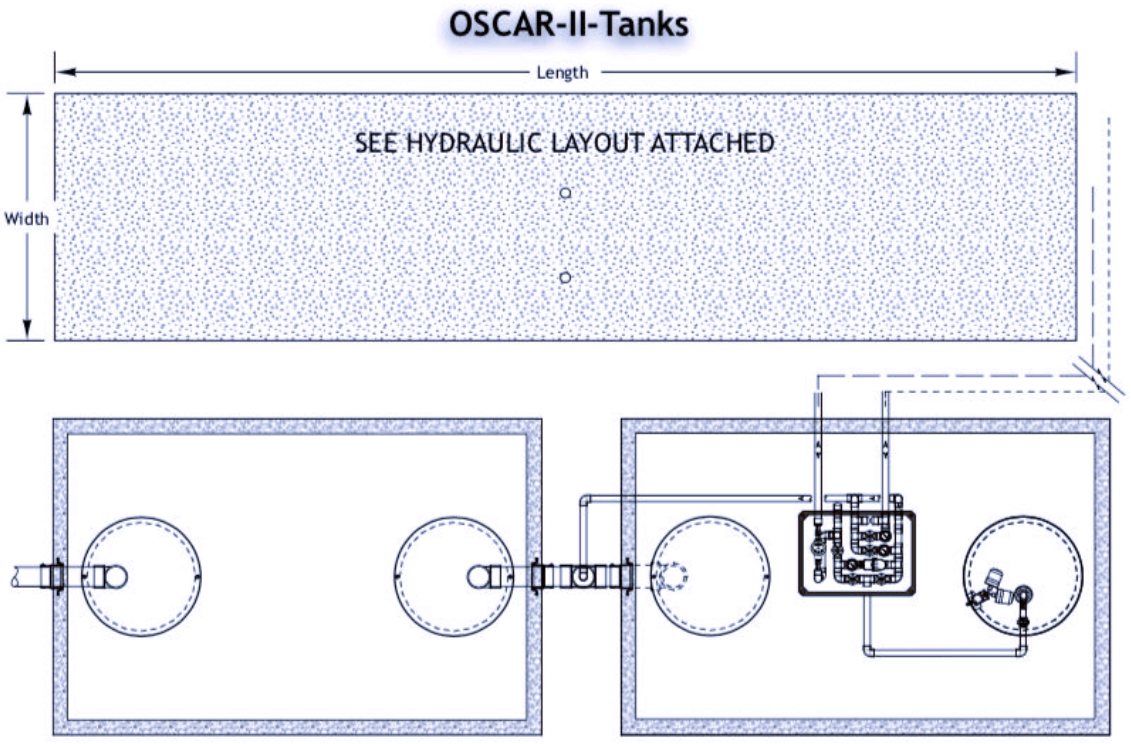
Introduction:



1,000 gallon Septic 1,000 gallon pump tank

The *OSCAR-II* (Onsite Sand Coil Area Recharge) is an at-grade onsite sewage dispersal component dosed with septic tank effluent. The *OSCAR-II* is comprised of a 12" layer of medium sand media and a series of custom manufactured Netafim Bioline drip tubing coils. The sand media is placed on a prepared soil surface. *OSCAR-II* coils are then placed on the sand media and then covered with another 6" of sand media. No other cover material is needed. To control erosion or inadvertent disturbance from children or animals the sand can be covered with jute mate or cover with a shallow layer of mineral soil. Another option is to spread straw over final cover until vegetative cover takes hold: plant grass seed or other ground cover as soon as possible. See appendix E for more details.

The sand/soil interface is the discharge point of the treated wastewater. Vertical separation is measured from the original soil surface prior to preparation and the restrictive layer. If enough soil depth is present, the basal area can be excavated to lower the profile of the OSCAR. Hydraulic loading rates must follow table *4-22, Secondary biological treatment system hydraulic application rates of the Technical Guidance Manual*, or as amended. See appendix F for table. Vertical separation must follow table 4-21, of the *Technical Guidance Manual*, or as amended. See appendix G.The septic tank

must be an approved septic tank (TGM Section 5.2 Approved Septic Tanks) and IDAPA 58.01.03.007.07. *OSCAR-II* system must be designed by Professional Engineer licensed in the State of Idaho.

Design:

Each ***OSCAR*** coil is designed to treat and dispose of 50 or 100 gpd of septic tank effluent, depending on the *OSCAR* coil model specified.

There are two models of *OSCAR* coils: OS-50 and OS-100. The OS-50 coils form a 5' diameter coil, rated at 50 gpd. The OS-100 coils form a 7' diameter coil, rated at 100 gpd. Tables III and IV dictate the overall minimum "shoulder" length for the corresponding design flow for each coil model. See appendix C for details of OS-100 foot print and specifications.

An *OSCAR* has two (2) sizing criteria: *hydraulic layout* and *basal area*. The hydraulic layout criterion includes the number of coils and how they are to be connected. The basal area refers to the overall foot print of the *OSCAR* sand/soil interface. Design flow rate for the basil area and hydraulic layout only shall be 150% of the required design flow of IDAPA 58.01.03.007.08. A three bedroom system (250 gpd x 150%) is designed at 375 gpd. The 375 gpd flow rate is used to determine number of coils and minimal basal area required.

Hydraulic Layout: Coils are arranged in laterals. Each lateral could be a single coil or a group of coils linked in series between the supply and flush manifolds, see tables. The *OSCAR* coils are timed dosed and flushed automatically.

The standard single family residence *OSCAR* layouts have design flows between 150 to 500 gpd. A 30 gpm, 110 volt, turbine pump (AY Mc Donald pump model 22050E2AJ), *LF1P-RF-BLWR* control panel, and a *Lowridge Onsite Technologies* headworks (model HWN-.7-RF) are required for the standard designs (see appendix B). This pump will perform in a large majority of design applications. The *OSCAR* must be timed dosed. See "Timer Settings" for details. System designs with flows above 500 gpd must be proportionally upsized. Call *Lowridge* for assistance when flow rates are above 600 gpd.

Table I depicts the number of OS-50 coils and laterals required for a given design flow using the AY McDonald pump. Table II depicts the number of OS-100 coils and laterals required for a given design flow using the same pump. The criteria in these tables ***must be*** followed. If a deviation is required, contact *Lowridge* for assistance.

The tables also indicate how much excess head, under the pump curve, is available for supply line elevation lift and friction loss. All manifolds, supply and flush lines are assumed to be 1" sch 40 PVC. The designer must calculate the total dynamic head (TDH) for the *OSCAR* supply line. Use the flow rate indicated under the heading "Flush GPM" in Table I or II for the corresponding design flow and coil model to calculate the friction loss of the supply line. If the calculated TDH is greater than the "Excess TDH" value in Table I or II, call

Lowridge for assistance. TDH is calculated by adding the friction loss of the supply line to the elevation lift from liquid level in pump tank to the *OSCAR* coils. Use the following Hazen-Williams formula to calculate friction loss. Always use the Flush Flow Rate values when calculating friction loss.

$$f=L(Q/K)^{1.85}$$

F= friction loss through pipe in feet of head
L= length of supply line in feet
Q= Flush GPM
K=47.8 (1" sch 40 PVC pipe)

TABLE I: Hydraulic Layout OS-50 coils

Design Flow	Total Coils	# of Lats.	Coils per lat.	Dose GPM	Flush GPM	Excess TDH
250	5	5	1	1.75	12.0	50′
300	6	3	2	2.1	12.0	50'
400	8	4	2	2.8	12.0	50′
450	9	3	3	3.15	12.0	50′
500	10	5	2	3.5	12.0	50′
600	12	4	3	4.2	12	50′

Design values in this table represent 150% of TGM design flows.

TABLE II: Hydraulic Layout OS-100 coils

Design Flow	Total Coils	# of Lats.	Coils per lat.	Dose GPM	Flush GPM	Excess TDH
300	3	3	1	2.1	12.0	50'
400	4	4	1	2.8	12.0	50′
500	5	5	1	3.5	12.0	50′
600	6	3	2	4.2	12.0	50'

Design values in this table represent 150% of TGM design flows.

TABLE III: Minimum Shoulder Lengths OS-50

Design Flow	Minimum Shoulder Length	Minimum Shoulder Length
Soil Group	A & B. C w/sloping site.	C w/zero % slope
250	28′	29′
300	33.5′	38′
400	44.5′	51′
450	50′	64′
500	55.5′	72′
600	66.5′	90′

The dimensions in Table III represent the minimum required length of the outer shoulder which include coils, spacing between coils, and shoulders. These lengths can be extended to match site conditions. Minimum shoulder spacing is 6". See illustration below for example of shoulder length. Design values in this table represent 150% of TGM design flows.

TABLE IV: Minimum Shoulder Lengths OS-100

Design Flow	Minimum Shoulder Length
250	21′ 3″
300	21′ 3"
400	28′ 4″
450	35′ 6″
500	35' 6"
600	42.5′

The dimensions in Table IV represent the minimum required length of the shoulder which include coils, spacing between coils, and shoulder. These lengths can be extended to match site conditions. Minimum shoulder spacing is 6". See illustration below for example of shoulder length. Design values in this table represent 150% of TGM design flows.

Basal Area:

The basal area is comprised of the total area where the sand media is in contact with the receiving soil. The minimum required basal area is calculated by dividing the design flow rate by the soil loading rate specified in rule. A 3 bedroom design equals 250 gpd design flow rate. *Maximum basal area width on flat sites in soil sub-group C is 19.5'. See appendix H for details.* Coils must be evenly spaced along the basal length.

<u>Example, Soil type B-2 at 250 gpd.</u>

250 gpd x150% = 375 gpd
375 gpd ÷ 0.6 gpd/ft2 = 625 sq. ft.

Combining Hydraulic Layout and Basal Area Requirements:

To combine the coil layout and the basal area, start with the coil layout. Refer to Tables III or IV for minimum shoulder lengths. On flat sites, the coils should be placed in the center of the basal area. The coils will be arranged in a single line, although the line can be curved to match site contours. Also, no emitter shall be placed within 6" of the sand media shoulder.

On sloping sites the coils will be placed parallel to the contour and one edge of the coils must be placed within 12" of the upslope basal boundary. There must be at least 6" separation between sand shoulder and an emitter. With the OS-50 coils there must be at least 6" between the drip tubing in different coils. With the OS-100 coils there must be 12" spacing between the drip tubing in different coils. Side slopes of the sand media is at least a 1 to 1 slope. On slopes greater than 5% it is recommended to use a 3 to 1 slope on the side slopes for stability. Basal infiltrative area size will be calculated from the 1 to 1 slope values.

The following are examples of an *OSCAR* design with OS-50 coils.

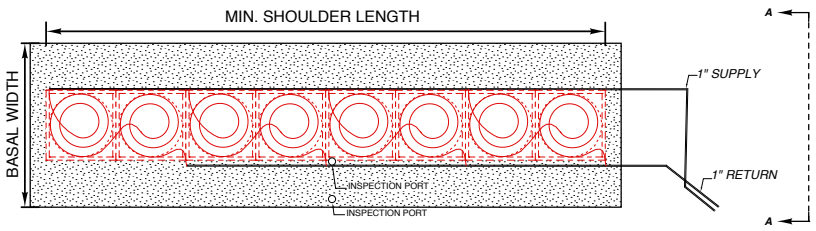


Illustration I

FLAT SITE (OS-50)

Example: (refer to Illustration I and Table III) three bedroom.

250 gpd x 1.5 = 375 gpd (design flow for OSCAR portion, only, not tanks)

375 gpd design flow, soil type B-2 (0.6 gpd/ft2), flat site

Basal area required = daily design flow ÷ soil loading rate

625 sq. ft. = 375 gpd ÷ 0.6 gpd/ft2

Minimum shoulder length (see Table III, round up to 400 gpd) is **44.5'**.

Minimum side slopes at 1 : 1 slope @ 12" (2 x 12" = 2') = 2'

Minimum basal length= shoulder length + side slopes
44.5' + 2' = 46.5'
Basal area width = required basal area ÷ minimum basal length
= 675 sq. ft. ÷ 46.5' = 14.51', say 15'

Basal area dimensions for soil type B-2 = 46.5' long x 15' wide.

SLOPING SITE (OS-50)

When calculating the required basal area for a sloping site the same process is used as a flat site except the side slope value must include the increased sand depth due to the sloping site. In order to keep the coils level on a sloping site, additional sand must be placed under the downslope side of the coil. The greater the sand hight, the greater the side slope. To calculate the additional sand depth use the following formula:

Diameter of coil x % slope of site

In the illustration below the 20% slope needs an additional 12" of sand to maintain a level coil network.

60" (diameter of coil) x 20% = 12"

The additional 12" of sand needs to be added to the minimum required sand of 12" to equate to the **24"** of sand on the downslope side of the coil.

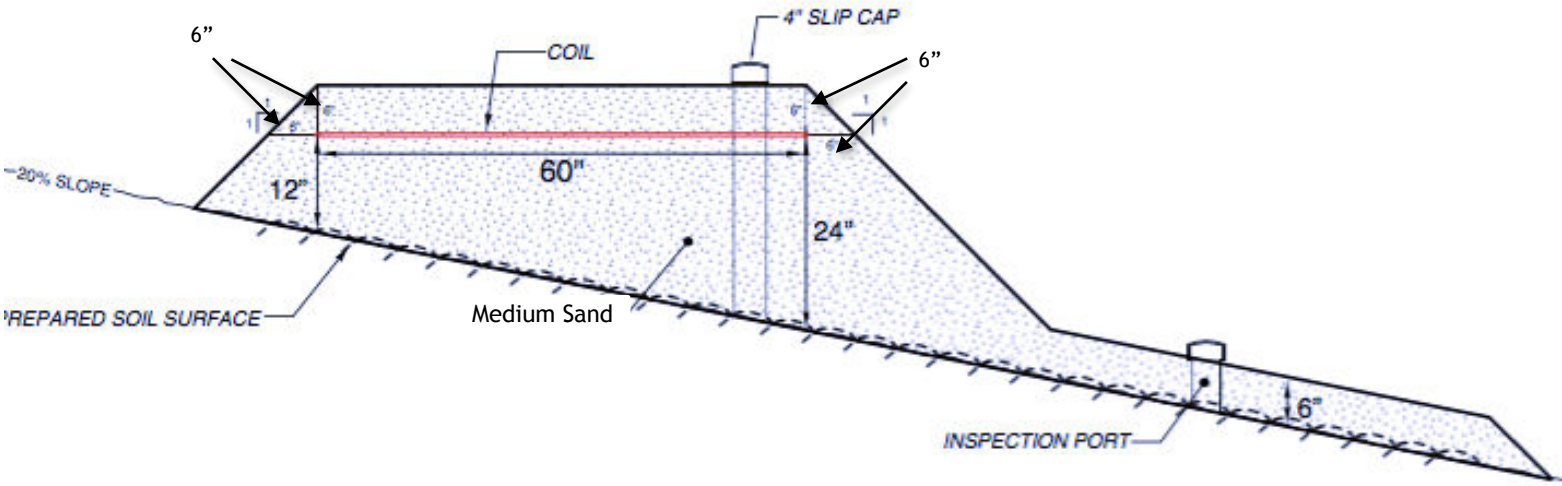


Illustration II.

Example: (refer to illustration II, not to scale), three bedroom

375 gpd design flow, soil B-2 (0.6 gpd/ft2), sloping site

Basal area required = daily design flow ÷ soil loading rate

625 sq. ft. = 375 gpd ÷ 0.6 gpd/ft2

Minimum shoulder length (see Table III) is **44.5’**.

Minimum side slopes at 1 : 1 slope @ 24” (24” x 2) = **4’**

Minimum basal area length = shoulder length + side slopes= **44.5’ + 4’ = 48.5’**
Basal area width = required basal area ÷ minimum basal length
675 sq. ft. ÷ 48.5’ = 13.91’ or 14’= required infiltrative area

Add side slope stabilization value to minimum basal length by multiplying “Minimum side slope” value by **2** and than add this value to basal length.

Minimum side slope (4’) x 2 = 8’
Minimum basal area length (47.5’ + 8’= 55.5’)

Overall basal area dimensions for soil type B-2 = 55.5’ long x 14’ wide.

Timer Settings:

The *OSCAR* system must be timed dosed. Timer settings for the *OSCAR* are short and very frequent (3 minutes and 38 seconds off and 22 seconds on). Because the supply line will drain between doses the "on" times will need to be increased to compensate for the drain back volume.

The timer settings for the *OSCAR* can be changed for two reason:

1. The *OSCAR* is installed down slope from the discharge tank. The timer settings may need to be modified to avoid over dosing the *OSCAR* and a vacuum breaker must be installed on the supply line inside the pump chamber to prevent siphoning. Pump down hill to the *OSCAR* should be the last option and is not recommended. Call *Lowridge* for assistance in changing timer settings.
2. In colder climates where the supply line needs to drain between doses, the "on time" will need to be increased to compensate for filling the supply line prior to each dose. Add more time to the "on" time equal to the amount of time it takes to pressurize the headworks.

Freeze Protection:

To avoid freezing, the plumbing must drain between each dose. Always install the discharge tank at or below the elevation of the OSCAR. The headworks must be placed directly on top of the discharge tank. The pluming must be sloped to allow liquid to drain from the OSCAR coils, manifolds, supply and flush lines back through the headworks into the tank.
It may be necessary to install the treatment tank near the house and the discharge tank near the OSCAR location.

The coils must be installed level. The supply and flush manifolds must be graded to allow drainage between cycles. (See Figure 4).

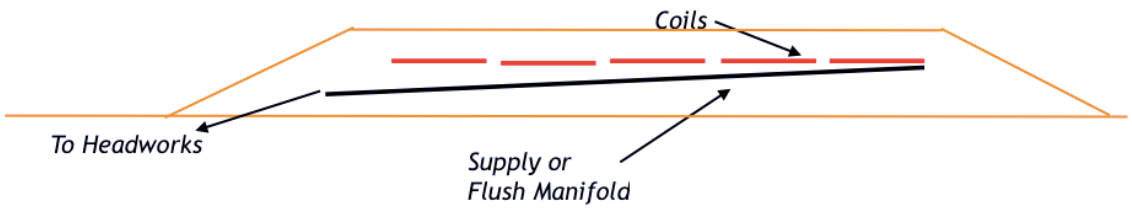


Illustration III.

Appendix A

Media:

Medium sand.

Appendix B:

OSCAR Parts list.

Each OSCAR unit will include:

- LF1P-RF-BLWR control panel
- 30 gpm 1/2 hp turbine pump
- OS-50 or OS-100 Coils
- PVC fittings and drip tubing adapters
- HWN-.7-RF, reverse flush headworks*
- Solid ½" poly tubing for connections
- Tank adapter w/cold weather drain

*When the OSCAR system is preceded with treatment system meeting a treatment level of no more than 15 mg/l of CBOD5 and TSS a manual headworks (HWN-.7-man) may be used.

Appendix C: OS-50 & OS-100 Coil Detail.

OS-50: The OS-50 OSCAR coil is made with 25' of custom Netafim Bioline with 0.42 gph emitters @ 6" spacing (50 emitters), an average of 2 emitters per sq. ft. Each pre-assembled coil has a minimum area of 25 sq. ft. (5' x 5'). There must be a minimum of 6" spacing between each coil and a minimum of 6" spacing between any coil and the shoulder edge. Table III contains the minimum shoulder length for a given design flow. The "shoulder length" is the total minimum distance from the outside shoulder edge of the first coil to the opposite end shoulder of the last coil. This dimension includes all the coils, coil spacing, and shoulder spacing on each end.

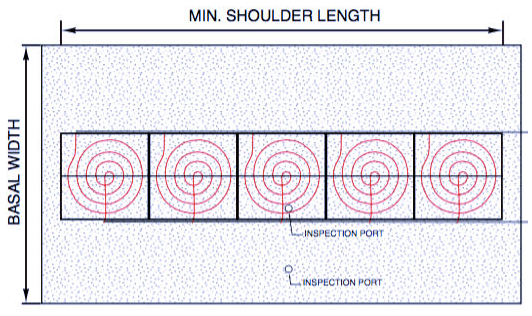


Illustration VI: 500 gpd with OS-100 coils:

OS-100: The OS-100 OSCAR coil is made with 50’ of custom Netafim Bioline with 0.42 gph emitters @ 6” spacing (100 emitters), an average of 2 emitters per sq. ft. Each coil has a minimum area of 50 sq. ft. (85” x 85”). The actual coil diameter is 73”. There must be a 12” minimum spacing between the tubing of differing OS-100 coils and a 6” spacing between any tubing and the shoulder edge. Table IV contains the minimum shoulder length for a given design flow. The “shoulder length” is the total minimum distance from the outside shoulder edge of the first coil to the opposite end shoulder of the last coil. This dimension includes all the coils, coil spacing, and shoulder spacing on each end. See illustration below.

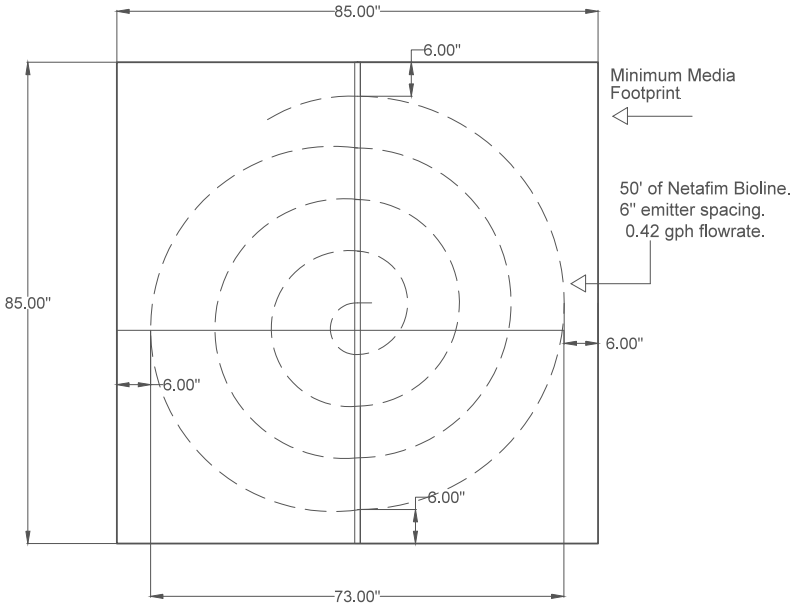


Illustration VII: OS-100 detail. The OS-100 OSCAR coil contains 100- 0.42 gph Netafim emitters in a 50 sq. ft. foot print. Emitter concentration is 2 emitters per sq. ft. Design flow for each OS-100 is 100 gpd.

Appendix D: OSCAR Cover Options.

There may be a desire to cover the OSCAR with something additional to the specified medium sand. Options include:

- landscaping jute mat held down with staples with grass seed or ground cover plantings
- a thin layer of mineral soil low in organic content (<10% organics)

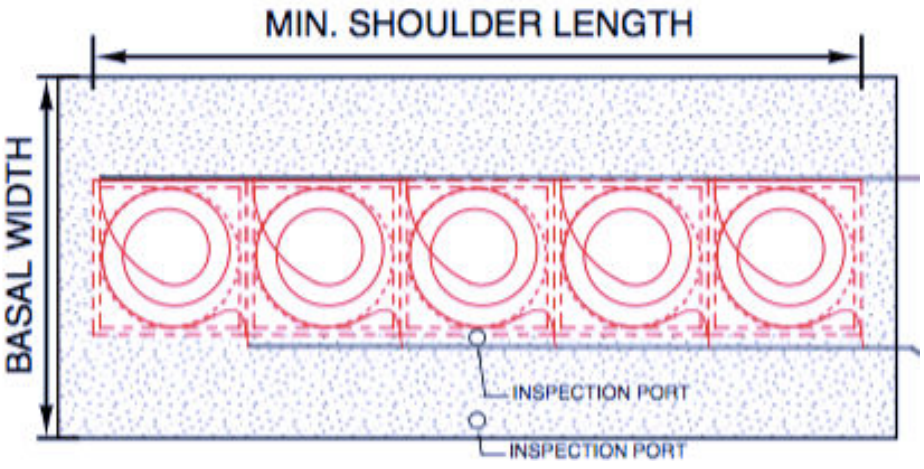
Do Not Cover Sand with:

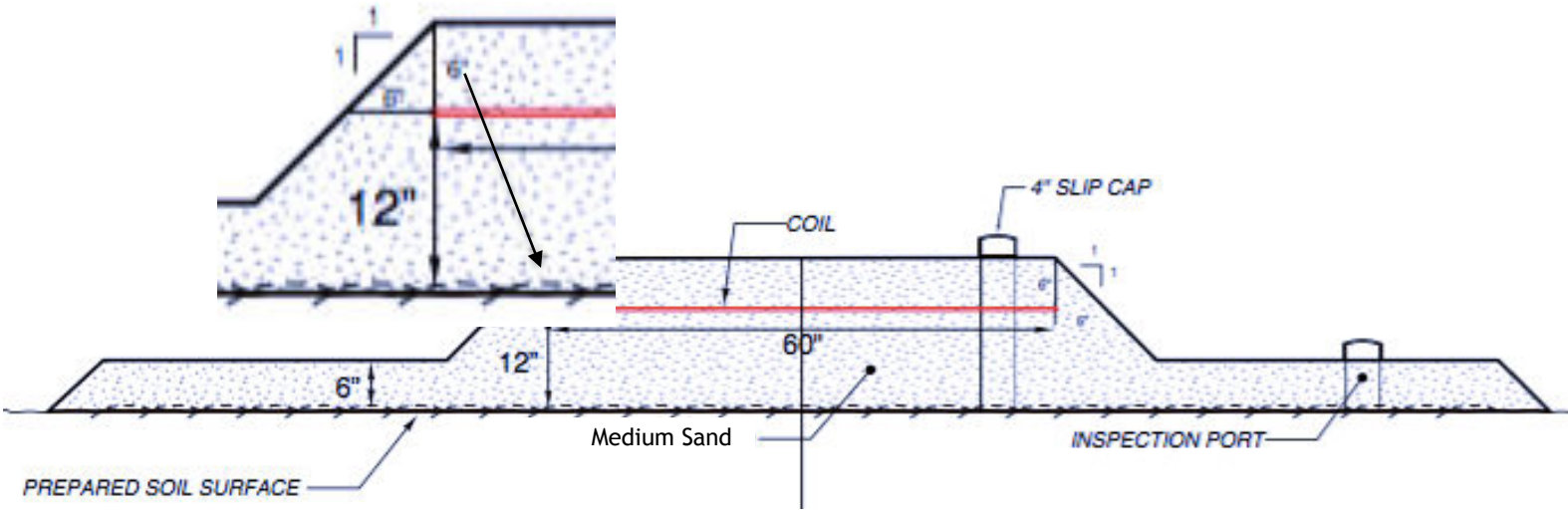
- organic mix (manufactured top soil from compost)
- filter fabric

The intent is not to have too much additional cover over the final sand layer. Placing too much cover will inhibit plant root growth. Because the sand is in effect sub-surfaced irrigated, grass and other ground cover will grow rapidly, forming a firm protective cover over the OSCAR. At the end of the first growing season the sand layer is as firm a soil to walk on.

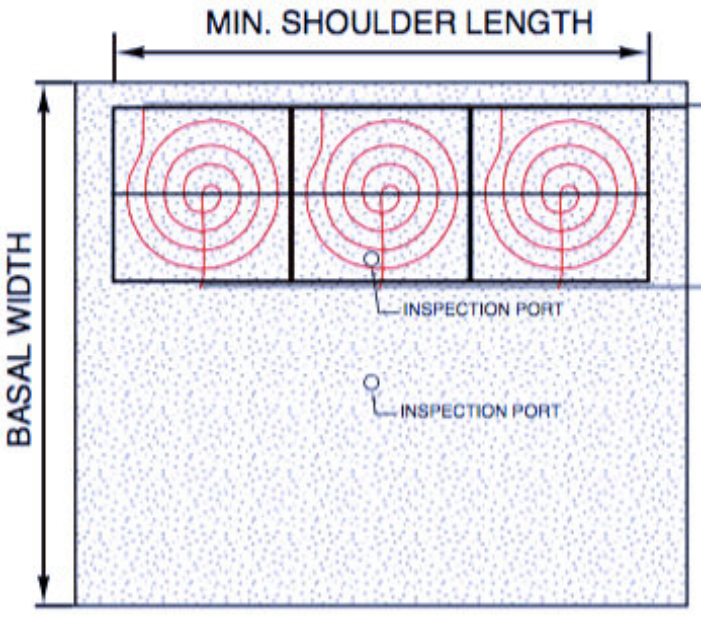
Appendix E: Sample Drawings

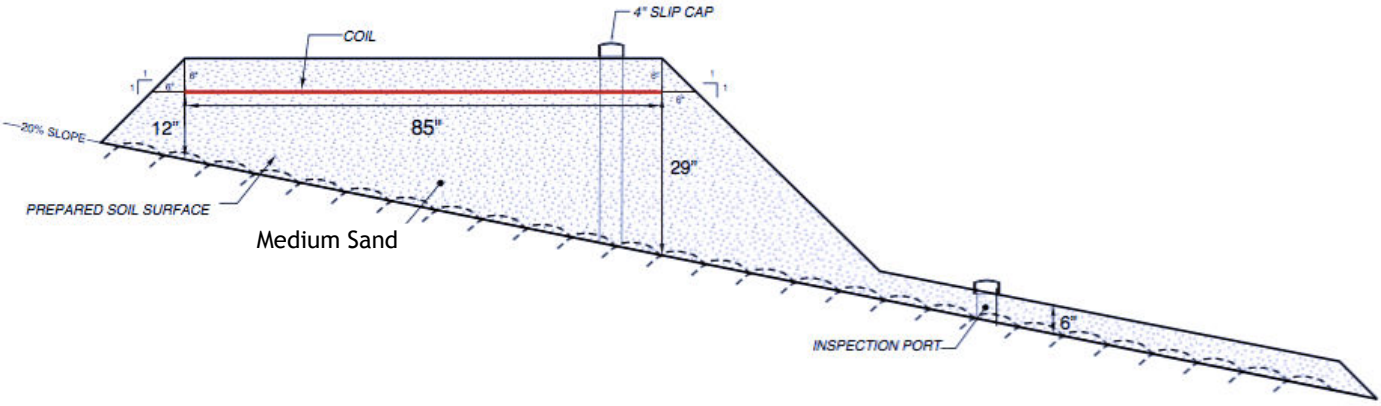
OS-250-5




1
1
6"
6"
12"
4" SLIP CAP
COIL
1
1
6"
6"
60"
12"
6"
Medium Sand
INSPECTION PORT
PREPARED SOIL SURFACE

OS-300-7S


MIN. SHOULDER LENGTH
BASAL WIDTH
INSPECTION PORT
INSPECTION PORT



Appendix F: Hydraulic loading rates

Table 4-22. Secondary biological treatment system hydraulic application rates*

Soil Design Subgroup	Application Rate (gallons/square foot/day)
A-1	1.7
A-2a	1.2
A-2b	1.0
B-1	0.8
B-2	0.6
C-1	0.4
C-2	0.3

*Idaho Department of Environmental Quality Technical Guidance Manual

Appendix G:

Table 4-21 soil loading rates. **from the Technical Guidance Manual**

Limiting Layer	Flow < 2,500 GPD All Soil Types	Flow >or =2,500 GPD All Soil Types
Impermeable layer	2	4
Fractured Rock or very porous layer	1	2
Normal high ground water	1	2
Seasonal high ground water	1	2

*Idaho Department of Environmental Quality Technical Guidance Manual

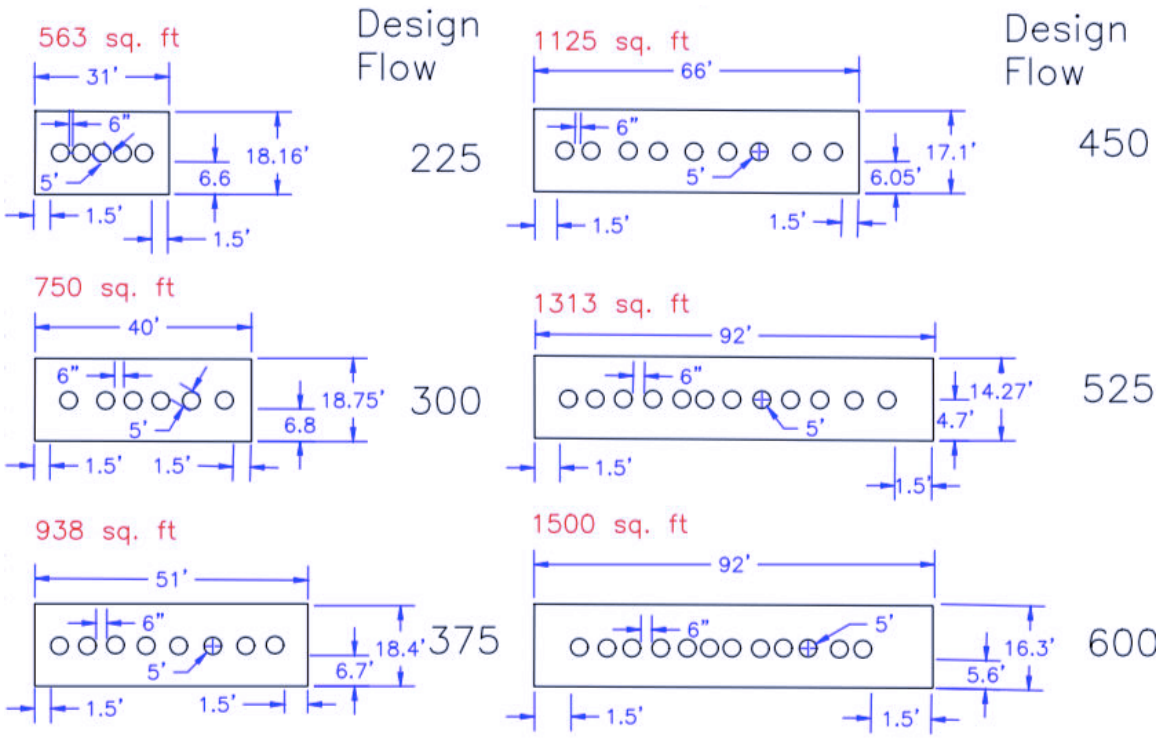
Appendix H: Designs in soil sub-group C, zero percent slope

In soil sub-group C when the slope is zero, there is a concern that the flow of effluent from the coils to the edge of the basal area will be hindered. For this reason several additional limitations are imposed:

- Only OS-50 coils can be used.
- Coils must be placed in the center of the basal area, length wise.
- Use minimum shoulder lengths from Table III, Soil Group C w/zero % slope column.
- Maximum distance between a coil and the edge of the basal area shall not exceed 7.25 feet in any direction. The minimum shoulder length already includes a 6" separation from the end of the row of coils to the shoulder edge. Therefore, the maximum distance between the ends of the shoulder length to the basal end is a maximum of 6.75'.
- Maximum basal area width is 19.5'.

Separation between coils can be increased to a maximum of 18" between coils.

Soil Group C-1, Flat Site Guides:



Soil Group C-2, Flat Site Guides: