EAGLE DRAINAGE DESIGN STANDARDS

November 17, 2015

City of Eagle
Planning & Zoning Department
P.O. Box 1520
Eagle, ID 83616

EAGLE DRAINAGE DESIGN STANDARDS

A. PURPOSE

1. These standards amend the "Design Standards for Storm Drainage Retention Facilities" adopted by Resolution 04-10 of the City Council.

2. These standards apply to drainage facility designs proposed on individual sites that are already platted. Storm drainage facilities for private roads shall be designed and constructed in accordance with the most current ACHD Drainage and Stormwater Management Standards.

3. Storm drainage facilities designed for all ACHD roadway projects and private developments impacting public rights-of-way are to be submitted to ACHD for review and approval.

4. Compliance with these standards does not relieve the design professional's responsibility for the design and compliance with all local, state and federal requirements.

B. SUBMITTAL REQUIREMENTS

1. Drainage facility designs for construction projects on individual sites that are already platted shall be included with the plans submitted to the Building Department.

2. All plans and related submittals shall be stamped and signed by a licensed professional per Eagle City Code 8.2A.10.C. All submittals for drainage facilities as described above shall include the following minimum items:

   a. Plan sheets/details
      - Adequately show the locations, materials, typical sections, design elevations, and seasonal high groundwater elevations for all proposed facilities
      - Detail drawings for all drainage facility structures
   b. Drainage Report and Calculations
      - General description of the site
      - All water features (wetlands, drainage/irrigation ditches, and natural waterways)
      - Drainage basin map using color/hatching to differentiate subbasins with each subbasin numbered
      - Calculations for runoff volumes, peak flow rates, facility sizing, absorption times
      - All calculations shall be provided on the design forms included within these standards

- Map identifying depth and extent of ponding for all facilities designed for less than the 100-year volume (for facilities located in DDA or TDA Overlay Districts)

c. Geotechnical Report
   - Subsurface exploration results and soil classifications
   - Infiltration rates
   - Seasonal high groundwater elevations
   - Any special considerations that may affect the storm drainage facilities

C. DESIGN CRITERIA

1. Runoff Coefficient

   a. Runoff coefficients for design shall be based on the following values.

Type of Surface	Runoff Coefficient (C)
Roof	0.95
Asphalt	0.95
Concrete	0.95
Gravel	0.50
Landscaped Areas	0.20
Unimproved Areas	0.15

   b. Composite runoff coefficients from tables for individual land usage shall not be used for design.

   c. Runoff quantity shall be based on actual components proposed or maximum sizes of buildings and impervious surfaces allowed by zoning or development agreement. In cases where improvement design is not final, maximum development allowed by zoning or development agreement shall be assumed.

2. Design Volume

   a. All drainage facilities shall be designed to store a design volume based on 1.0 inches of water over the drainage area utilizing the above runoff coefficients.

   b. Exception: Drainage facilities located within the Downtown Development Area (DDA) or Transitional Development Area (TDA) as shown in Exhibit A-1 within the Eagle Architecture and Site Design Book (EASD) shall be designed to store a design volume based on 0.85 inches of water over the drainage area utilizing the above runoff coefficients. However, the grading plan for the development shall clearly indicate the

extent of ponding/flooding from the 100-year storm event as calculated for all drainage facilities and demonstrate that this 100-year volume is retained entirely on the development site.

3. Infiltration

    a. Design volumes for drainage facilities shall not include infiltration during the design storm.

    b. Infiltration rates from the geotechnical report shall be used for determining the absorption time (time to empty the drainage facility after the design storm). The following criteria shall be met:

        - A FOS of safety of 2.0 shall be applied to the infiltration rate established in the geotechnical report.
        - All facilities must infiltrate 90% of the design volume within 48 hours.
        - A maximum infiltration rate of 8 inches/hour shall be used in calculating the time to infiltrate.

4. Peak Flow Rate

    a. Drainage facilities shall be designed to convey a peak flow rate for a storm with an intensity of 1.0 inches per hour (100-year, 1 hour storm).

    b. Exception: Drainage facilities located within the Downtown Development Area (DDA) or Transitional Development Area (TDA) as shown in Exhibit A-1 within the Eagle Architecture and Site Design Book (EASD) shall be designed to convey a peak flow rate for a storm with an intensity of 0.85 inches per hour (50-year, 1 hour storm).

5. Pretreatment

    a. All seepage beds and ponds shall be provided with pretreatment by utilizing an appropriately sized Sand & Grease Trap. Storm conveyance systems shall be designed so that velocities through the baffle opening of the Sand & Grease Trap are limited to a maximum of 0.50 feet per second.

    b. Sand & Grease Traps shall be in accordance with standard drawing SD-01.

D. DRAINAGE FACILITY TYPES

1. Seepage Bed

    Seepage beds with infiltration through the bottom of the rock bed shall be designed and constructed in accordance with standard drawing SD-02 and the following requirements:

a. The seepage bed shall have a minimum 3-foot separation between the bottom of the rock bed and the seasonal high groundwater as established in the geotechnical report.
b. The bottom of all seepage beds shall have a layer of ASTM C-33 sand with a minimum depth of 18-inches. The sand layer depth shall be increased to 3-feet when infiltration rates for the site are over 8-inches/hour as provided in the geotechnical report. The sand layer shall not be included in calculating the volume provided for storage.
c. Seepage beds shall be separated a minimum of 10-feet from structures (foundations) unless a letter from an Idaho licensed engineer is provided indicating that a smaller setback is acceptable.
d. The rock bed shall consist of 1 ½" to 2" washed drain rock (uniform size). A void ratio of 40% shall be used for design.
e. The volume of seepage beds shall be increased by 15% to account for sediment.
f. The top and all sides of the seepage bed shall be protected with a nonwoven geotextile filter fabric with a minimum weight of 6 oz/sy.
g. Infiltration time shall be calculated using the bottom area of the seepage bed only.

2. Seepage Bed (Horizontal)

Horizontal seepage beds will only be allowed when a minimum 3-foot separation between the bottom of the rock bed and the seasonal high groundwater cannot be achieved. Horizontal seepage beds shall be designed and constructed in accordance with standard drawing SD-03 and the following requirements:

a. The seepage bed shall have a minimum 2-inch separation between the impermeable liner and the seasonal high groundwater as established in the geotechnical report.
b. The bottom of the seepage bed shall have an impermeable liner. All sides of the seepage bed without a sand filter shall have an impermeable liner. The impermeable liner shall be PVC or HDPE with a minimum thickness of 30 mils.
c. The top of the seepage bed and the sides of the sand window shall have a nonwoven geotextile filter fabric with a minimum weight of 6 oz/sy.
d. A sand filter window shall be installed along one side of the seepage bed with a minimum thickness of 3-feet. The volume of sand window shall not be included in calculating the volume provided for storage.
e. Seepage beds shall be separated a minimum of 10-feet from structures (foundations) unless a letter from an Idaho licensed engineer is provided indicating that a smaller setback is acceptable.
f. The rock bed shall consist of 1 ½" to 2" washed drain rock (uniform size). A void ratio of 40% shall be used for design.
g. The volume of seepage beds shall be increased by 15% to account for sediment.
h. Infiltration time shall be calculated using ½ the sidewall area of the seepage bed only.

3. Grassy Basins

   Grassy basins for storm water storage shall be designed and constructed in accordance with standard drawing SD-04 and the following requirements:

   a. The grassy basin side slopes shall be no steeper than 4:1 (H:V).
   b. A filter sand absorption bed having a volume not less than one percent (1%) of the computed design volume shall be installed at the lowest point of the basin. The sand absorption bed shall be covered with 2" drain rock or cobbles.
   c. The bottom of the basin shall be sloped to the low point at a minimum of 1%.
   d. The grassy basin shall have a minimum separation of 3-feet between the bottom of the basin and the seasonal high groundwater as established in the geotechnical report.
   e. Infiltration time shall be calculated using the water surface area at mid-depth.
   f. The following minimum freeboard shall be provided above the design water elevation:
      i. Design Depth less than or equal to 3 feet – 6" minimum freeboard
      ii. Design Depth greater than 3 feet – 12" minimum freeboard

4. Ponds

   Retention ponds that are excavated into groundwater shall meet the following requirements:

   a. Minimum depth of 6 feet below the seasonal high groundwater.
   b. A safety shelf shall be constructed around the perimeter of the pond in accordance with SD-05.
   c. Pond sideslopes shall be no steeper than 3:1 (H:V) above the safety shelf.
   d. Design volumes for retention of storm drainage shall be calculated above the seasonal high groundwater elevation.
   e. A minimum freeboard of 12" shall be provided above the design water elevation.

5. Other

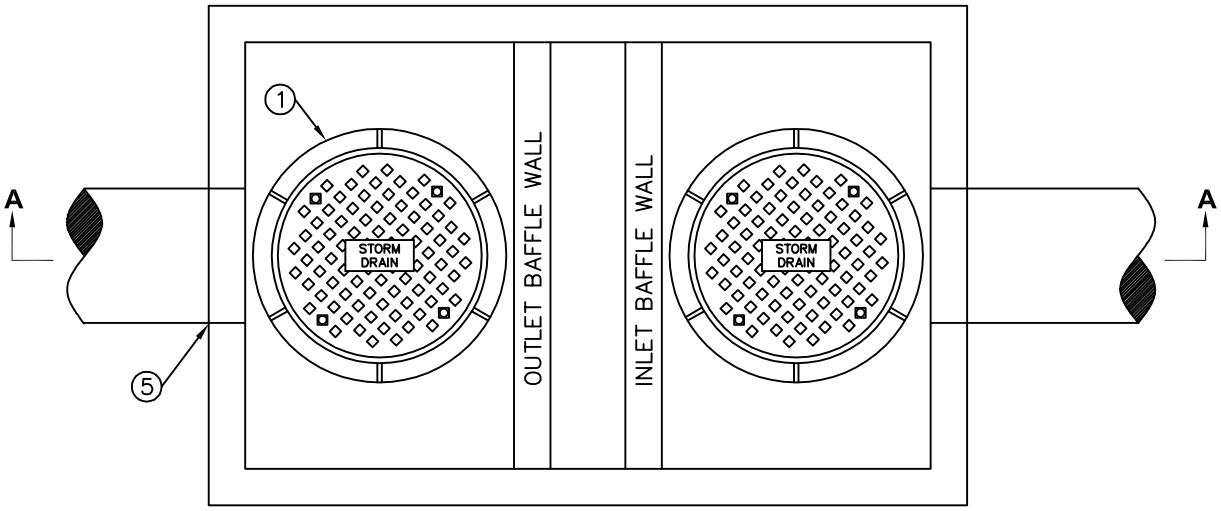
   Retention facilities other than seepage beds, grassy basins or ponds may be submitted as a proposed alternative. All alternatives shall be reviewed on a case-by-case basis with the intent to achieve the overall performance standards of the standard facilities.

STANDARD DRAWINGS

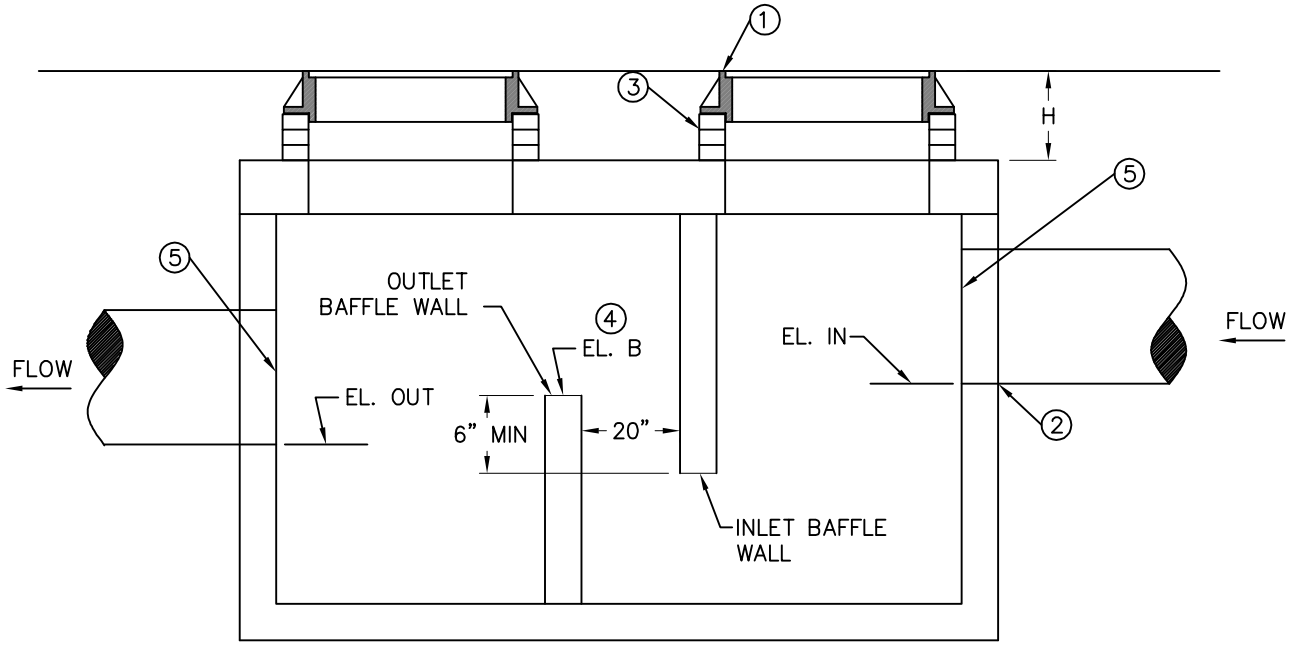
SD-01	Sand & Grease Trap
SD-02	Seepage Bed
SD-03	Horizontal Seepage Bed
SD-04	Grassy Basin
SD-05	Pond Safety Shelf

DESIGN FORMS

Form 1	Design Volume and Peak Flow
Form 2	Seepage Bed Design Form
Form 3	Horizontal Seepage Bed Design Form
Form 4	Grassy Basin Design Form



PLAN VIEW



SECTION A-A

NOTES

(A) DESIGN LOAD: AASHTO HS-25 HIGHWAY LOADING.
(B) ALL REINFORCING STEEL SHALL BE GRADE 60.
(C) MANHOLE FRAME, COLLAR, AND COVER SHALL BE PER ISPWC SD-616 AND SD-617.
(D) PROVIDE STEPS WHEN THE DISTANCE FROM TOP OF MANHOLE FRAME TO TOP OF BOX EXCEEDS 24".

LEGEND

1. MANHOLE FRAME AND COVER PER ISPWC SD-617 (TYPICAL)
2. LOCATION AND FLOW LINE ELEV. PER DESIGN PLANS. (TYPICAL)
3. $H \leq 12$" USE GRADE RINGS (TYPICAL).
   $12 < H \leq 24$" USE 24" DIA. RCP RISER.
   $24" < H \leq 120$" USE MANHOLE CONE AND 48" DIA RISERS.
4. EL. IN > EL. B BY 0.10' MIN
   EL. OUT < EL. B BY MIN OF 0.10'
5. WATERTIGHT SEAL
6. PRECAST BOX MANUFACTURER SHALL MARK FLOW DIRECTION AND LABEL INLET OR OUTLET ON SIDE OF BOX.

CITY OF EAGLE DRAINAGE DESIGN STANDARDS	SAND AND GREASE TRAP	STANDARD DRAWING NO. SD-01

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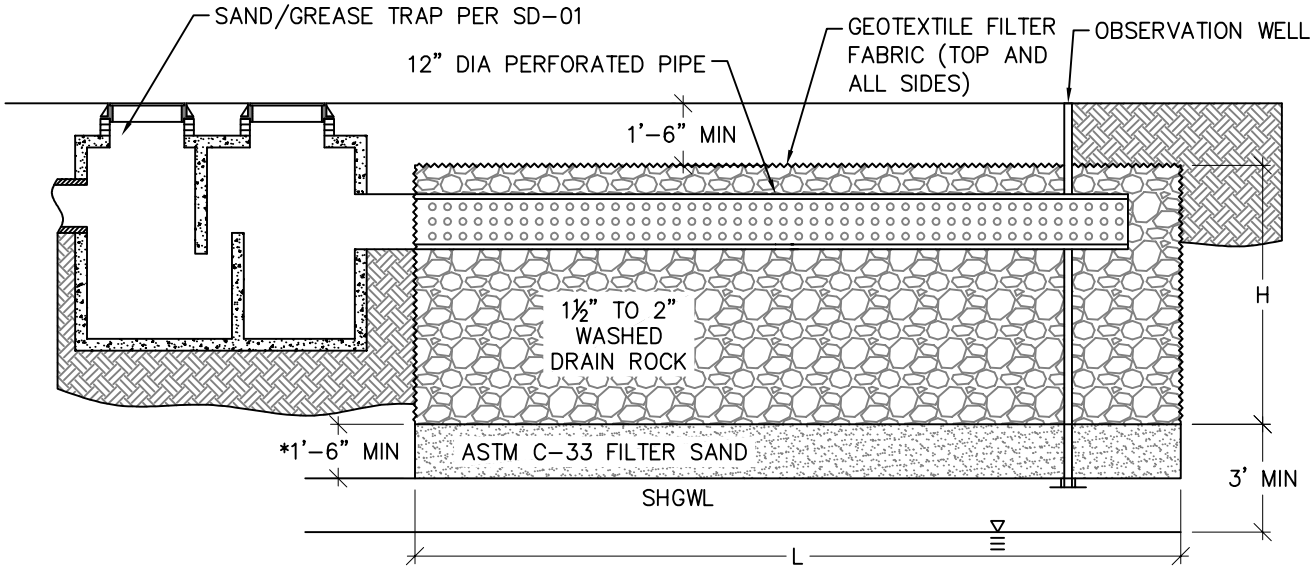
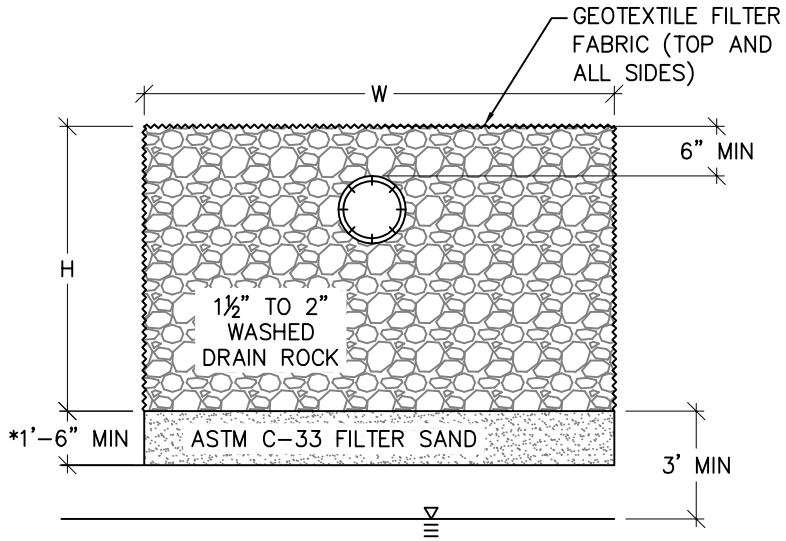


* FILTER SAND LAYER SHALL BE INCREASED TO 3'-0" MINIMUM WHEN SITE INFILTRATION EXCEEDS 8 INCHES/HR

1. ALL GEOTEXTILE SEAMS SHALL OVERLAP 1 FOOT MINIMUM.
2. PERFORATED PIPE INVERT MUST BE BELOW PIPE INVERT INTO SAND AND GREASE TRAP PER SD-01.
3. BED WIDTH SHALL REMAIN CONSTANT.
4. A MINIMUM 1'-6" COVER FROM TOP OF BED TO FINISH GRADE IS REQUIRED.



CITY OF EAGLE DRAINAGE DESIGN STANDARDS	SEEPAGE BED	STANDARD DRAWING NO. SD-02

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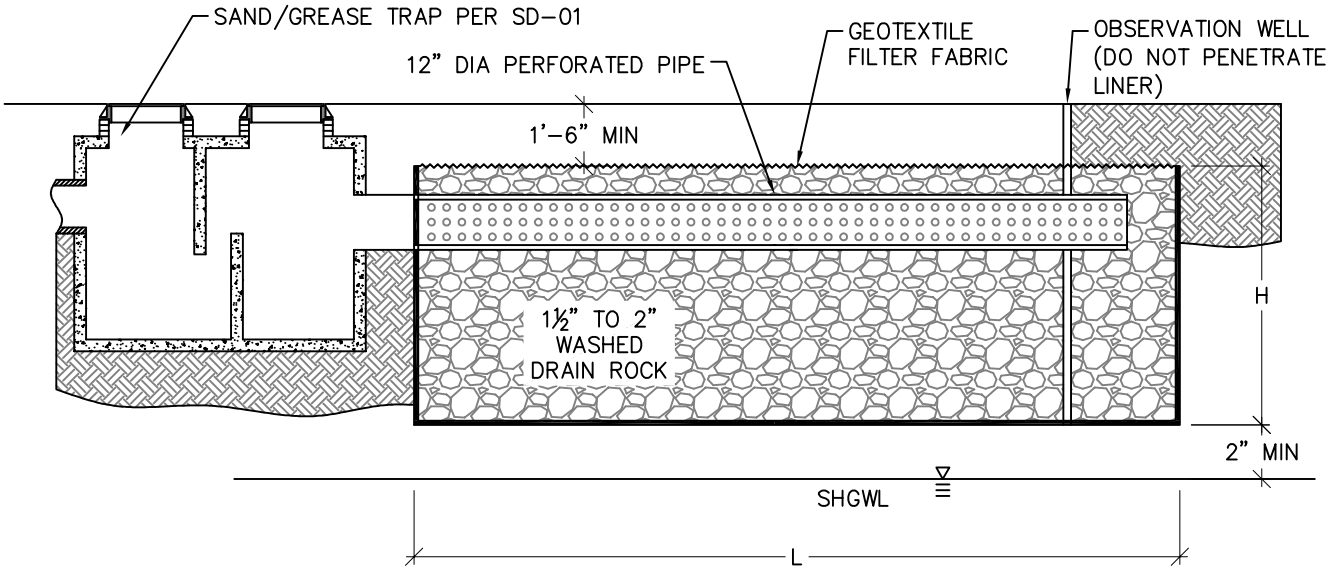
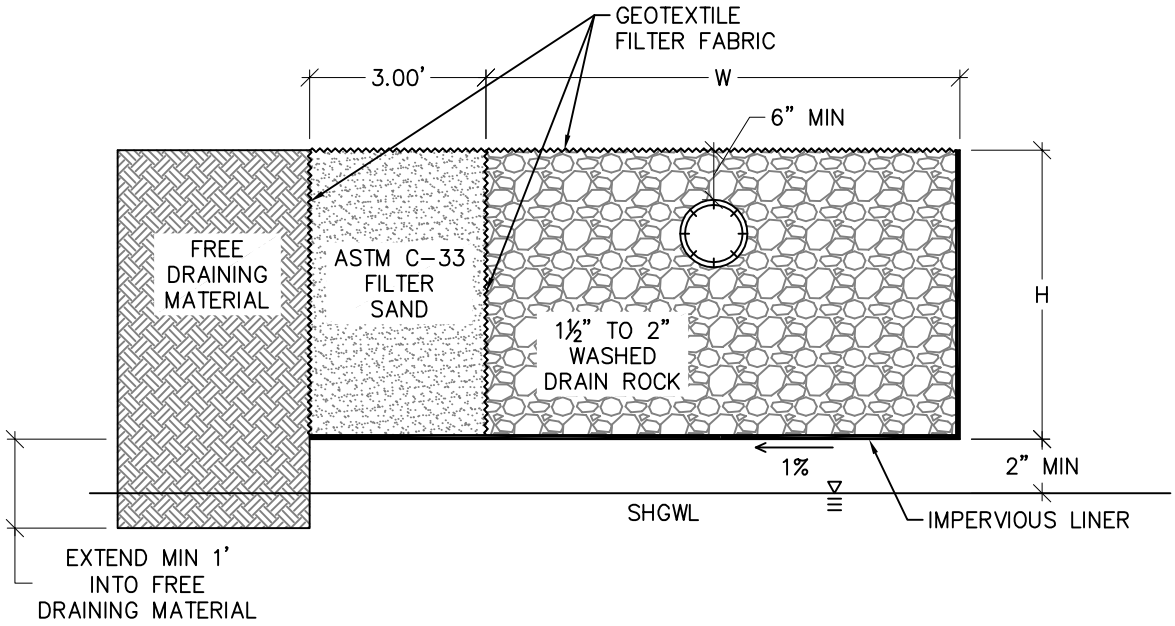


1. ALL GEOTEXTILE SEAMS SHALL OVERLAP 1 FOOT MINIMUM.
2. IMPERVIOUS LINER SEAMS MUST BE SEALED OR OVERLAPPED MINIMUM 1'.
3. PERFORATED PIPE INVERT MUST BE BELOW PIPE INVERT INTO SAND AND GREASE TRAP PER SD-01.
4. BED WIDTH SHALL REMAIN CONSTANT.
5. A MINIMUM 1'-6" COVER FROM TOP OF BED TO FINISH GRADE IS REQUIRED.



CITY OF EAGLE DRAINAGE DESIGN STANDARDS	HORIZONTAL SEEPAGE BED	STANDARD DRAWING NO. SD-03

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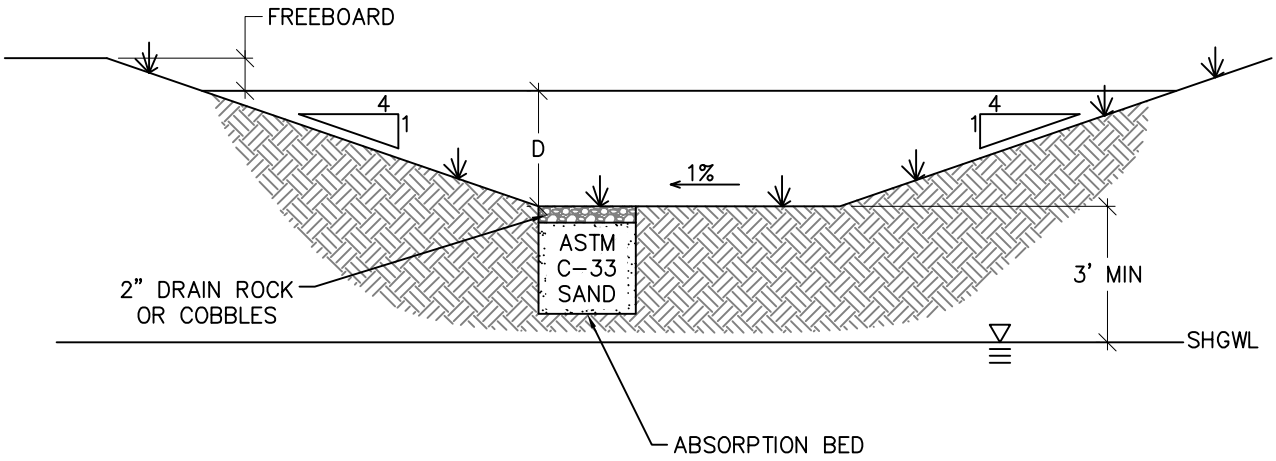

① FREEBOARD: D<3': FREEBOARD = 6" MIN
D>3': FREEBOARD – 12" MIN

② MINIMUM 3' SEPARATION FROM SEASONAL HIGH GROUND WATER LEVEL.

③ SLOPE W 1% TOWARDS ABSORPTION BED.

④ ABSORPTION BED MUST BE SIZED AT 1% VOLUME OF DESIGN STORM.

⑤ SIDE SLOPES SHALL NOT BE STEEPER THAN 4:1 (H:V).

CITY OF EAGLE DRAINAGE DESIGN STANDARDS	GRASSY BASIN	STANDARD DRAWING NO. SD-04

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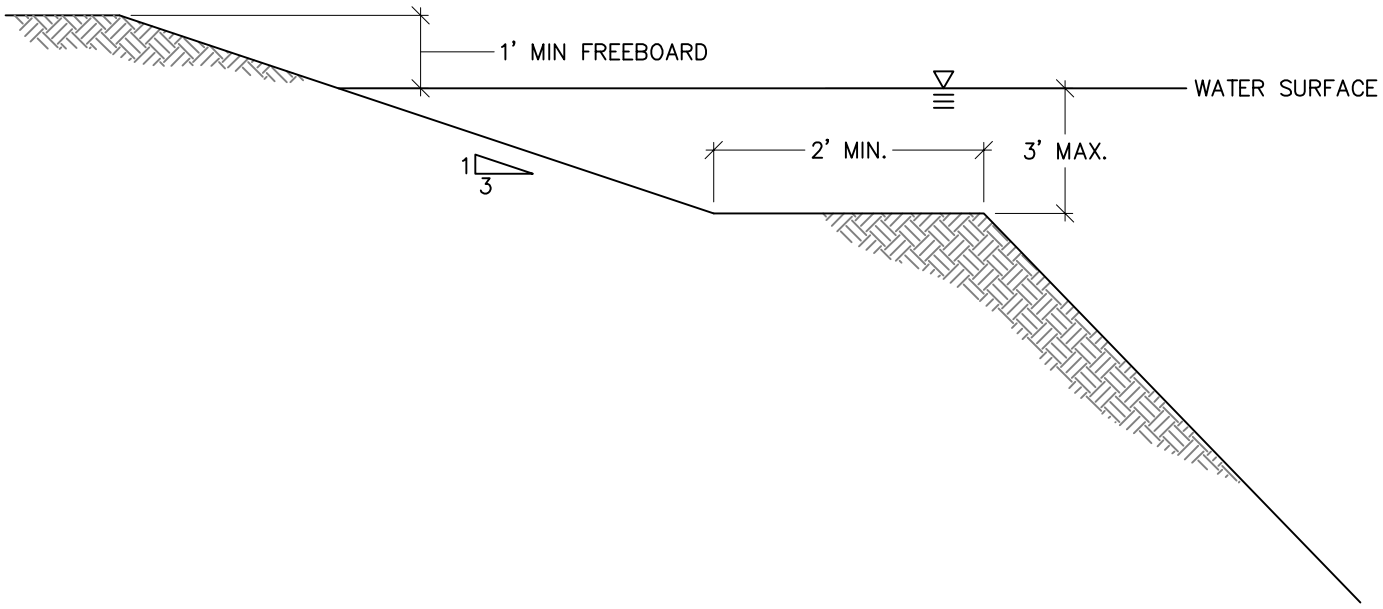

① SAFETY SHELF SHALL BE CONSTRUCTED AROUND THE PERIMETER OF THE POND.

② SIDE SLOPES SHALL NOT BE STEEPER THAN 3:1 (H:V) ABOVE THE SAFETY SHELF.

CITY OF EAGLE DRAINAGE DESIGN STANDARDS	POND SAFETY SHELF	STANDARD DRAWING NO. SD-05 G:\CLIENTS\EG\15-0051\Standard Details

FORM 1
DESIGN VOLUME AND PEAK FLOW

Project: _____

Engineer: _____

Drainage Site: _____ (Drainage Basin)

1. Drainage Area Calculation:

   Equivalent Area

Surface Type	**A** **Area (sq. ft)**	**C** **Runoff Coeff.**	**A x C** **Equivalent Area (sq. ft)**
Roof		0.95	
Asphalt		0.95	
Concrete		0.95	
Gravel		0.50	
Landscape		0.20	
Unimproved		0.15	
Total Equivalent Area (sq. ft), $\mathbf{A_{eq}}$			

2. Runoff Volume:

   100-year Volume

   $V_{100} = A_{eq}\ x\ 1.0\ x\ \left(\frac{1\ ft}{12\ in}\right)$

   $V_{100} = (\_\_\_\_\_)\ x\ 1.0\ x\ \left(\frac{1\ ft}{12\ in}\right)$

   $V_{100} = (\_\_\_\_\_)$ Cubic Feet

   50-year Volume ***(Only for projects in DDA or TDA Overlay District)***

   $V_{50} = A_{eq}\ x\ 0.85\ x\ \left(\frac{1\ ft}{12\ in}\right)$

   $V_{50} = (\_\_\_\_\_)\ x\ 0.85\ x\ \left(\frac{1\ ft}{12\ in}\right)$

   $V_{50} = (\_\_\_\_\_)$ Cubic Feet

3. Pre-Development Runoff:

If development has allowable discharge of pre-development volume, V_{pd}, then:

(Note: If no pre-development discharge allowed, then $V_{D100} = V_{100}$ and $V_{D50} = V_{50}$)

$V_{D100} = V_{100} - V_{pd}$

$V_{D100} =$ (_____) − (_____)

V_{D100} = (_____) **Cubic Feet**

$V_{D50} = V_{50} - V_{pd}$

$V_{D50} =$ (_____) − (_____)

V_{D50} = (_____) **Cubic Feet** **(*Only for DDA or TDA Overlay District)***

Attach documentation from drainage receiver granting permission to discharge and calculations or measurement of actual pre-development drainage volume.

4. Peak Flow: (For Facilities with Sand and Grease Traps Only)

100-year Peak Flow

$Q_{100} = A_{eq}\ x\ 1.0\ x\ \left(\frac{1\ acre}{43560\ sf}\right)$

$Q_{100} =$ (_____) $x\ 1.0\ x\ \left(\frac{1\ acre}{43560\ sf}\right)$

$Q_{100} =$ (_____) cfs

50-year Peak Flow ***(Only for projects in DDA or TDA Overlay District)***

$$Q_{50} = A_{eq}\ x\ 0.85\ x\ \left(\frac{1\ acre}{43560\ sf}\right)$$

$$V_{50} = (\_\_\_\_\_)\ x\ 0.85\ x\ \left(\frac{1\ acre}{43560\ sf}\right)$$

$$Q_{50} = (\_\_\_\_\_)\ \text{cfs}$$

To limit velocity through the sand and grease trap throat to 0.5 feet per second, the peak design flows shall not exceed the following maximum flows for the selected sand and grease trap size:

Tank Size	Max Flow
1000 gallon tank, Approximate inside dimension of 4'x8'x6'; 20-inch baffle spacing	3.33 cfs
1500 gallon tank; Approximate inside dimension of 5'x7'x7'; 20-inch baffle spacing	4.17 cfs

FORM 2
SEEPAGE BED DESIGN FORM

Project: _____

Engineer: _____

Drainage Site: _____ (Drainage Basin)

1. Design Volume (From FORM 1):

   For projects within the DDA or TDA Overlay District use V_{D50}, otherwise, use V_{D100}

   $V_D =$ (_____) Cubic Feet

2. Size Seepage Bed:

   Bed Dimensions (rock only):

   Length of Bed: $L =$ (_____) feet

   Width of Bed: $W =$ (_____) feet

   Height of Bed: $H =$ (_____) feet

   Total Volume of Bed: $V_B = W\ x\ H\ x\ L$

   $V_B =$ (_____) Cubic Feet

   Volume of voids in rock:
   (Porosity of 1 ½" to 2" Drain Rock n=0.40)

   $V_V = V_B\ x\ 0.40$

   $V_V =$ (_____) Cubic Feet

   Effective Volume (Adjust for 15% Sedimentation):

   $V_E = V_V\ x\ 0.85 =$ (_____) Cubic Feet

3. Check that volume provided is greater than design volume:

   Is $V_E > V_D$? If no, resize rock bed.

4. Check time to drain design volume:

Infiltration Rate: $I =$ (_____) in/hr From Geotechnical Report

Effective Infiltration Rate, provide for FOS = 2.0:

$$I_E = I/2.0 \quad \text{in / hr}$$

$$I_E = (\_\_\_\_\_)/2.0$$

$$I_E = (\_\_\_\_\_) \text{ in / hr (Maximum of 8 in/hr)}$$

Infiltration Area = Bottom Area of Seepage Bed, A_B

$$A_B = W \; x \; L$$

$$A_B = (\_\_\_\_\_) \; x \; (\_\_\_\_\_) \quad \text{square feet}$$

$$A_B = (\_\_\_\_\_) \quad \text{square feet}$$

Time to Infiltrate 90% of Design Volume, T_i

$$T_i = \frac{V_D \; x \; 0.90}{A_B \; x \; I_E \; x \left(\frac{1 \; ft}{12 \; in}\right)}$$

$$T_i = \frac{(\_\_\_\_\_) \; x \; 0.90}{(\_\_\_\_\_) \; x \; (\_\_\_\_\_) \; x \left(\frac{1 \; ft}{12 \; in}\right)} \text{ hours}$$

$$T_i = (\_\_\_\_\_) \text{ hours}$$

Is $T_i \leq 48 \; hours$; If no, resize rock bed

FORM 3
HORIZONTAL SEEPAGE BED DESIGN FORM

Project: _____

Engineer: _____

Drainage Site: _____ (Drainage Basin)

1. Design Volume (From FORM 1):

   For projects within the DDA or TDA Overlay District use V_{D50}, otherwise, use V_{D100}

   $V_D =$ (_____) Cubic Feet

2. Size Seepage Bed:

   Bed Dimensions (rock only):

   Length of Bed: $L =$ (_____) feet

   Width of Bed: $W =$ (_____) feet

   Height of Bed: $H =$ (_____) feet

   Total Volume of Bed: $V_B = W\ x\ H\ x\ L$

   $V_B =$ (_____) Cubic Feet

   Volume of voids in rock:
   (Porosity of 1 ½" to 2" Drain Rock n=0.40)

   $V_V = V_B\ x\ 0.40$

   $V_V =$ (_____) Cubic Feet

   Effective Volume (Adjust for 15% Sedimentation):

   $V_E = V_V\ x\ 0.85 =$ (_____) Cubic Feet

3. Check that volume provided is greater than design volume:

   Is $V_E > V_D$? If no, resize rock bed.

4. Check time to drain design volume:

Infiltration Rate: $I =$ (_____) in/hr From Geotechnical Report

Effective Infiltration Rate, provide for FOS = 2.0:

$$I_E = I/2.0 \quad \text{in / hr}$$

$$I_E = (\_\_\_\_\_)/2.0$$

$$I_E = (\_\_\_\_\_) \text{ in / hr (Maximum of 8 in/hr)}$$

Infiltration Area = ½ of Sidewall Area, A_S

$$A_S = 0.5\ x\ H\ x\ L$$

$$A_S = 0.5\ x\ (\_\_\_\_\_)\ x\ (\_\_\_\_\_) \text{ square feet}$$

$$A_S = (\_\_\_\_\_) \text{ square feet}$$

Time to Infiltrate 90% of Design Volume, T_i

$$T_i = \frac{V_D\ x\ 0.90}{A_S\ x\ I_E\ x\left(\frac{1\ ft}{12\ in}\right)}$$

$$T_i = \frac{(\_\_\_\_\_)\ x\ 0.90}{(\_\_\_\_\_)\ x\ (\_\_\_\_\_)\ x\left(\frac{1\ ft}{12\ in}\right)} \text{ hours}$$

$$T_i = (\_\_\_\_\_) \text{ hours}$$

Is $T_i \leq 48\ hours$; If no, resize rock bed

FORM 4
GRASSY BASIN DESIGN FORM

Project: _____

Engineer: _____

Drainage Site: _____ (Drainage Basin)

1. Design Volume (From FORM 1):

   For projects within the DDA or TDA Overlay District use V_{D50}, otherwise, use V_{D100}

   $V_D =$ (_____) Cubic Feet

2. Basin Size:

   Basin Area (mid-depth): $A_{0.5D} =$ (_____) square feet

   Design Depth: $D =$ (_____) feet

   Total Volume of Basin: $V_B = A_{0.5D}\ x\ D$

   $V_B =$ (_____) Cubic Feet

3. Check that volume provided is greater than design volume:

   Is $V_B > V_D$? If no, resize basin.

4. Check time to drain design volume:

   Infiltration Rate: $I =$ (_____) in/hr From Geotechnical Report

   Effective Infiltration Rate, provide for FOS = 2.0:

   $I_E = I/2.0$ in / hr

   $I_E =$ (_____)$/2.0$

   $I_E =$ (_____) in / hr (Maximum of 8 in/hr)

   Infiltration Area = Basin Area at mid-depth, $A_{0.5D}$

Time to Infiltrate 90% of Design Volume, T_i

$$T_i = \frac{V_D \; x \; 0.90}{A_{0.5D} \; x \; I_E \; x \left(\frac{1 \; ft}{12 \; in}\right)}$$

$$T_i = \frac{(\_\_\_\_\_) \; x \; 0.90}{(\_\_\_\_\_) \; x \; (\_\_\_\_\_) \; x \left(\frac{1 \; ft}{12 \; in}\right)} \text{ hours}$$

$$T_i = (\_\_\_\_\_) \text{ hours}$$

Is $T_i \leq 48 \; hours$; If no, resize basin