



**DATE:** December 16th, 2014  
**TO:** Engineering Consultants  
**FROM:** David Johnson, PE, Development Manager  
**SUBJECT:** Proprietary Water Quality Units

Since the implementation of MSD's Water Quality requirements in August of 2013, many Green Management Practices (GMPs), which have greatly improved the quality of stormwater runoff in Jefferson County through the capture/treatment of the first 0.6 inches of rainfall, have been submitted to the MSD Development office.

A GMP that is frequently submitted are Proprietary Water Quality Units (See Ch. 18.5.19 of the MSD Design Manual). These units have proven to be very popular because of their small footprint, ease of maintenance, and efficiency. There are many of these products on the market (along with several different manufacturers) and it is often difficult to determine if one meets MSD's Specifications. The following design requirements are to be used when comparing and selecting a Water Quality Unit.

Proposed Water Quality Units **must achieve a Total Suspended Solids (TSS) removal efficiency of 80% based on an OK-110 ( $D_{50} = 110 \mu\text{m}$ ) particle size distribution** for the peak flow rate ( $Q_p$ ) as specified in Table 18.3-C of the MSD Design Manual.

Many engineers and developers have asked if MSD has a list of "approved" Water Quality Units. MSD formally adheres to reciprocity on selection utilizing the "City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide" (attached). **Water Quality Units approved by the City of Indianapolis for the above specifications may be considered "approved" for use in Jefferson County for the flow rate listed.**

If a unit is not on the list, the design engineer must submit third party certification of performance (such as New Jersey Department of Environmental Protection, New Jersey Corporation of Advanced Technology, Maine Department of Environmental Protection, etc.) to show that the proposed unit meets MSD's specifications, for MSD review and approval for use.

If you have any questions, please feel free to contact the MSD Development Team at 502-540-6000

cc: MSD Development Team  
Steve Emly



# City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

(Check  
<http://www.indy.gov/eGov/City/DPW/Business/Specs/Pages/UpdatedStormWaterManual.aspx>  
 for current Selection Guide)

**Table 1**  
**Rate Based SQUs**

Performance Matrix for Manufactured SQUs that remove 80% or more of Test Particles

*PLEASE NOTE: All SQUs shall be configured as off-line units unless the 10-year flow (per the Stormwater Design and Construction Specification Manual) is less than the approved treatment flow rate.*

**Table 1**

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)
Stormceptor® <small>2,3</small>	STC 450	0.37
	STC 900	0.83
	STC1200	0.83
	STC 1800	0.83
	STC 2400	1.38
	STC 3600	1.38
	STC 4800	2.30
	STC 6000	2.30
	STC 7200	3.22
	STC 11000	4.59
	STC 13000	4.59
STC 16000	6.43	
Downstream Defender® <small>1,2</small>	4 Foot Diameter	1.3
	6 Foot Diameter	3.58
	8 Foot Diameter	7.35
	10 Foot Diameter	12.85
VortSentry® <sup>2</sup>	VS30	0.28
	VS40	0.58
	VS50	1.01
	VS60	1.60
	VS70	2.35
	VS80	3.28
Vortechs® <small>1,2</small>	1000	0.49
	2000	1.00
	3000	1.75

# City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)
	4000	2.76
	5000	4.05
	7000	5.66
	9000	7.59
	11000	9.88
	16000	15.59
	PC1319 or 1319 CIP	19.04
	PC1421 or 1421 CIP	22.92
	1522 CIP	27.23
	1624 CIP	32.00
	1726 CIP	37.24
	1827 CIP	42.96
	1929 CIP	49.17
	2030 CIP	55.90
	2131 CIP	63.15
	2233 CIP	70.94
	2334 CIP	79.28
	2436 CIP	88.18
	2538 CIP	97.66
	2639 CIP	107.72
	2740 CIP	118.37
	2842 CIP	129.64
	2943 CIP	141.53
3045 CIP	154.05	
3146 CIP	167.21	
3349 CIP	195.49	
3958 CIP	296.83	
4060 CIP	316.23	
Aqua-Swirl™ 2,3	AS-2	0.26
	AS-3	0.50
	AS-4	0.98
	AS-5	1.47
	AS-6	2.32
	AS-7	3.40
	AS-8	4.75
	AS-9	6.38
	AS-10	8.30
	AS-12	13.10

# City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

Manufactured SQU		SQU System Model	Max Treatment Flow (cfs)
<b>CDS Technologies<sup>1,2</sup></b>	<b>Offline</b>	CDS4	1.10
		CDS5	1.10
		CDS6	3.85
		CDS7	4.49
		CDS8	6.60
		CDS10	16.02
<b>ADS / Hancor Stormwater Quality Units<sup>2</sup></b>		3620WQB	0.7
		3640WQB	1.6
		4220WQB	0.86
		4240WQB	1.83
		4820WQB	1.13
		4840WQB	2.39
		6020WQB	1.47
<b>KriStar FloGard<sup>2</sup></b>		DVS -36	0.24
		DVS -48	0.50
		DVS -60	0.87
		DVS -72	1.38
		DVS -96	2.83
		DVS -120	4.94
		DVS -144	7.79
<b>Baysaver<sup>2</sup></b>		0.5K	0.22
		1K	0.28
		3K	0.92
		5K	1.90
		10K	3.43
<b>StormTrap<sup>®2</sup></b>		SSWQ-2x4	0.36
		SSWQ-3x6	0.80
		SSWQ-3x8	1.07
		SSWQ-4x8	1.43
		SSWQ-4x9	1.61
		SSWQ-5x10	2.23
<b>StormTrap<sup>®2</sup></b>		SSWQ-5x12	2.68
		SSWQ-6x12	3.21
		STWQ-2	3.52
		STWQ-3	5.29
		STWQ-4	7.05
		STWQ-5	9.03
		STWQ-6a	10.80
		STWQ-6b	10.76
		STWQ-7a	12.78
		STWQ-7b	12.89
STWQ-8	15.10		
STWQ-9	16.86		
STWQ-10	19.00		

# City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)
	STWQ-12	22.97
	STWQ-55	109.57
	STWQ-105	211.16
	STWQ-153	308.99
	STWQ-200	403.80
	STWQ-I	4.12
	STWQ-II	1.95
	STWQ-III	3.93
	STWQ-IV	1.85
	STWQ-V	1.85
	STWQ-VI	3.75
Prinsco <sup>1,2</sup>	STWQ-VII	1.76
	WQU3620	0.75
	WQU3640	1.6
	WQU4220	0.88
	WQU4240	1.86
	WQU4820	1.15
	WQU4840	2.44
First Defense <sup>2,3</sup>	WQU6020	1.48
	WQU6040	3.14
Haviland <sup>2</sup>	4 Foot Diameter	0.70
	6 Foot Diameter	2.00
	SWQU 36X20-B	0.75
	SWQU 36X40-B	1.5
	SWQU 42X20-B	0.8
	SWQU 42X40-B	1.8
	SWQU 48X20-B	1.1
	SWQU 48X40-B	2.4
SWQU 60X20-B	1.4	
SWQU 60X40-B	3.1	

<sup>1</sup> Temporary Approval

<sup>2</sup> Off-line use only

<sup>3</sup> Not Approved for use with an open grate top (i.e. an inlet)

# City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide

## Volume Based SQUs\*

Table 2

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)
Stormvault® <sup>2</sup>	N/A	N/A*

\*Storage volume to be calculated per Chapter 700, Section 701.04

## Appendix I

### Design Treatment Flow Rate Determination

For

Table 1 SQUs

#### Stormwater Quality Flow Rate Determination – Table 1 SQUs

The design flow rate for manufactured stormwater quality units (SQUs) shall be determined using the SCS runoff methodology as outlined below.

1. Delineate the watershed basin(s) to be served by the proposed SQU(s). Tabulate the total impervious and pervious areas. *Please note impervious and pervious area runoff rates MUST be calculated as separate basins. The sizing calculation assumes the impervious area is connected directly to the SQU and the Tc calculation must be adjusted for this assumption (i.e. no flow over grass) for the impervious basin. This can be accomplished by creating two basins, one with an area equivalent to the total impervious area and the other with an area equivalent to the total pervious area of the delineated watershed to be served by the SQU.*
2. Determine the time-of-concentration (Tc) using the TR-55 methodology (Worksheet 3) for each basin. A minimum 5-minute Tc may be assumed for the impervious basin.
3. Calculate the curve numbers (CN) for each basin, using CN=98 for the impervious basin.
4. Determine the peak discharge from the 0.3 in storm using the appropriate Huff, 50% rainfall distribution (Storm duration 0 up to and including 6 hrs – 1<sup>st</sup> Quartile, 6.1 to 12 hrs – 2<sup>nd</sup> Quartile, 12.1 to 24 hrs – 3<sup>rd</sup> Quartile. See Table below for Huff ordinates.). A single hydrograph for each basin should be determined and all basin hydrographs added to determine the peak flow. Storm durations of 15-, 30- and 45 minutes as well as 1-, 2-, 3- 6- 12- and 24- hours should be checked to determine the peak SQU flow.

**Huff Ordinates Table IA**

% Storm Time	Indianapolis Huff Quartile			
	1 <sup>st</sup> Quartile	2 <sup>nd</sup> Quartile	3 <sup>rd</sup> Quartile	4 <sup>th</sup> Quartile
0	0.00	0.00	0.00	0.00
10	20.00	6.50	5.26	6.67
20	40.80	18.13	11.55	14.25
30	54.95	35.85	17.06	20.00
40	62.50	52.94	24.24	26.09
50	68.75	67.86	37.78	33.33
60	76.67	76.52	58.33	40.00
70	83.05	83.81	78.03	50.00
80	89.70	90.67	88.68	68.57
90	95.00	95.89	95.29	88.37
100	100.00	100.00	100.00	100.00



Appendix II

Alternate Approval Methods

*(This page intentionally blank)*

## Appendix III

### Stormceptor Checklists

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of a dipstick tube equipped with a ball valve (e.g. Sludge Judge®).
- \_\_\_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_\_\_ 10. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_\_\_ 11. A detail drawing of the floating debris capture device where applicable.
- \_\_\_\_\_ 12. Written instruction for inspection the floating debris capture device and methods of debris removal where applicable.
- \_\_\_\_\_ 13. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a Stormceptor SQU submitted for approval by the City of Indianapolis:

- \_\_\_\_\_ 1. The elevation of the outlet pipe should be a minimum of 1” (0.0833’) below the elevation of the inlet pipe.

- \_\_\_\_\_ 2. There is a minimum requirement for 2 ft of cover above the crown of the pipe to grade for the unit.
- \_\_\_\_\_ 3. A 6" stone base should be shown on the detail.
- \_\_\_\_\_ 4. The backfill should be specified as required by the adjoining pipe.
- \_\_\_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 6. Detail of connecting structures and diversion for off-line configurations should be included.
- \_\_\_\_\_ 7. Detail of the floating debris capture device if appropriate.

The following requirements should be addressed in drainage design reports:

- \_\_\_\_\_ 1. The design storm must not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. The velocity of the water entering the unit must be below 4.27 ft/s up to the treatment design flow rate.
- \_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.
- \_\_\_\_\_ 5. Diversion structure design should be documented with calculations as appropriate.

## Appendix IV

### Checklists for Downstream Defender

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of specific equipment (e.g. Sludge Judge®).
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_ 11. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a Downstream Defender SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.
- \_\_\_ 2. A 6” stone base should be shown on the detail.
- \_\_\_ 3. The backfill should be specified as required by the adjoining pipe.
- \_\_\_ 4. Detail drawing of SQUs should be included on plans.

\_\_\_\_\_ 5 Detail of connecting structures and diversion weirs etc. for off-line configurations should be included. Inverts of inlets and outlet should be labeled to clearly show the submerged inlet of the unit(s).

The following requirements should be addressed in drainage design reports:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.
- \_\_\_\_\_ 4. Diversion structure design should be documented with calculations as appropriate.

## Appendix V

### Checklist for VortSentry

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (c.g. Sludge Judge®).
- \_\_\_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_\_\_ 10. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_\_\_ 11. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a VortSentry SQU submitted for approval by the City of Indianapolis:

- \_\_\_\_\_ 1. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.
- \_\_\_\_\_ 2. A 6” stone base should be shown on the detail.
- \_\_\_\_\_ 3. The backfill should be specified as required by the adjoining pipe.
- \_\_\_\_\_ 4. Detail drawing of SQUs should be included on plans.

\_\_\_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.

The following requirements should be addressed in drainage design reports:

\_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.

\_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).

\_\_\_\_\_ 3. Diversion structure design should be documented with calculations as appropriate.

\_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix VI

### Checklist for Vortechs Systems

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. Inspection of each chamber for sediment should be addressed.
- \_\_\_ 11. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a Vortechs SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.
- \_\_\_ 2. A 6” stone base should be shown on the detail.
- \_\_\_ 3. The backfill should be specified as required by the adjoining pipe.



- \_\_\_\_ 4. Detail drawing of SQUs should be included on plans.
- \_\_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.
- \_\_\_\_ 6. Note on detail for contractor to level unit.

The following requirements should be addressed in drainage design reports:

- \_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_ 3. Inlet must be 90 degrees to side of unit.
- \_\_\_\_ 4. The unit MUST be off-line if peak design flow greater than 100 gpm / ft<sup>2</sup> (0.22275 cfs / ft<sup>2</sup>) of treatment (grit) chamber.
- \_\_\_\_ 5. Diversion structure design should be documented with calculations as appropriate.
- \_\_\_\_ 6. The 10-yr pipe capacity up and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix VII

### Checklists for Aqua-Swirl

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. Inspection of each chamber for sediment should be addressed.
- \_\_\_ 11. Use of adsorbent pads for oil removal from unit should be discussed.
- \_\_\_ 12. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_ 13. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing an Aqua-Swirl SQU submitted for approval by DMD/ DPW:

- \_\_\_ 1. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.

- \_\_\_\_\_ 2. A base of 12” of Class I material, as defined by ASTM D 2321, compacted to 95% proctor density must be provided.
- \_\_\_\_\_ 3. Backfill must be Class I, compacted to 90% proctor density, extend at least 3.5 ft beyond the outside of the unit and for the full height.
- \_\_\_\_\_ 4. The connection is made with a flexible connector and a sheer guard.
- \_\_\_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 6. Detail of connecting structures and diversion weirs etc. for the off-line configurations should be included.
- \_\_\_\_\_ 7. A reinforced concrete pad must be provided when traffic loading (roadway, parking areas) is anticipated. The pad should extend 12” beyond the outside diameter of the unit.
- \_\_\_\_\_ 8. Bollards should be installed around the unit in non-traffic areas.

The following requirements should be addressed in drainage design **reports**:

- \_\_\_\_\_ 1. The first flush design storm should not create a hydraulic tailwater condition on the SQU outlet. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. Diversion structure design should be documented with calculations as appropriate.
- \_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix VIII

### Checklists for CDS Technologies

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8".
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_ 3. Oil removal procedure during routine cleanout (if equipped with oil baffle or if sorbants are used).
- \_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. Inspection of both inner and outer areas of the screen for sediment should be addressed.
- \_\_\_ 11. Disposal according federal, state and local requirements should also be noted for sediments etc.
- \_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a CDS SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. The 2400  $\mu\text{m}$  must be specified and shown on the detail drawing. The 4800 $\mu\text{m}$  screen should not be approved.
- \_\_\_ 2. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.
- \_\_\_ 3. A 6" stone base should be shown on the detail.

- \_\_\_\_\_ 4. The backfill should be specified as required by the adjoining pipe.
- \_\_\_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.
- \_\_\_\_\_ 7. A minimum 24" access opening / casting should be shown.

The following requirements should be addressed in drainage design reports:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. Diversion structure design should be documented with calculations as appropriate.
- \_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix IX

### Checklists for Stormvault®

The following notes / maintenance items should be included in the Operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. A detailed cleaning procedure should be provided.
- \_\_\_ 2. A maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. The Manual must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. Inspection of each chamber or treatment zone should be addressed.
- \_\_\_ 11. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a Stormvault SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. The backfill should be specified as required by the manufacturer and copies provided on the plans.
- \_\_\_ 2. Detail drawing of SQUs should be included on plans.
- \_\_\_ 3. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.

The following requirements should be addressed in drainage design **reports**:

- \_\_\_\_\_ 1. The WQv should be calculated per Chapter 700 and the outlet sized to detain that volume over 24 hrs.
- \_\_\_\_\_ 2. The design of the diversion structure should be documented.
- \_\_\_\_\_ 3. Diversion structure design should be documented with calculations as appropriate.
- \_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix X

### Checklists for ADS / Hancor SQU

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8", and not just referenced to diameter of unit.
- \_\_\_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_\_\_ 7. Inspection and maintenance of connecting manhole and diversion weir should be included in narrative and checklist.
- \_\_\_\_\_ 8. Detail drawing of proposed SQU should be included as well as diversion structure.
- \_\_\_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_\_\_ 10. Disposal according federal, state and local requirements should also be noted for sediments etc.
- \_\_\_\_\_ 11. THE MANUAL MUST CLEARLY NOTE THE UNIT MUST BE REFILLED WITH WATER AFTER EACH CLEANING.
- \_\_\_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing an ADS / Hancor SQU submitted for approval by the City of Indianapolis:

- \_\_\_\_\_ 1. The bedding / backfill must be #57 or #8 stone.
- \_\_\_\_\_ 2. The installation details (6 steps) provided by the manufacturer should be included on the plans. They are available from the website.
- \_\_\_\_\_ 3. Concrete collar around risers for traffic loading conditions.



- \_\_\_\_\_ 4. The minimum cover above the crown of the pipe to grade for the unit as required by manufacturer.
- \_\_\_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 6. Detail of connecting structures and diversion weirs etc. should be included.
- \_\_\_\_\_ 7. A minimum of two 24" access opening / casting should be shown.
- \_\_\_\_\_ 8. All diversion structures and connecting pipes should meet the current Stormwater Design and Construction Specification Manual requirements.

The following requirements should be addressed in drainage design reports:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. Diversion structure design should be documented with calculations as appropriate. The diversion should be designed to limit the flow to the unit.
- \_\_\_\_\_ 4. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix XI

### Checklists for FloGard Dual Vortex Hydrodynamic Separator

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8”.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of a dipstick tube equipped with a ball valve (e.g. Sludge Judge®). The manufacturer recommends removal of floating debris and hydrocarbon prior to sediment gauging.
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer. The O & M Manual should also note material removed should be disposed in accordance to all federal, state and local requirements.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a FloGard SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. There is a minimum requirement for 2 ft of cover above the crown of the pipe to grade for the unit.
- \_\_\_ 2. A 6” stone base should be shown on the detail.
- \_\_\_ 3. The backfill should be specified as required by the adjoining pipe.
- \_\_\_ 4. Detail drawing of SQUs should be included on plans.
- \_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.

The following requirements should be addressed in drainage **design reports**:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. All in-line applications must include detailed hydraulic gradeline calculations to document the 10-year design storm will have a water surface below the crown of the pipe.

## Appendix XII

### Checklists for BaySaver Stormwater Quality Unit

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 2 ft.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of a dipstick tube equipped with a ball valve (e.g. Sludge Judge®).
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer. The O & M Manual should also note material removed should be disposed in accordance to all federal, state and local requirements.
- \_\_\_ 6. A minimum inspection frequency of 3 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. A minimum cleaning frequency of 12 months should be specified in the narrative and on the tabular inspection schedule.
- \_\_\_ 8. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 9. Detail drawing of proposed SQU should be included.
- \_\_\_ 10. Refill with water of the primary and storage manholes after cleaning must be addressed.
- \_\_\_ 11. Immediate cleanout of oil and fuel spills should be stated in the O & M manual.
- \_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a BaySaver SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. There is a minimum requirement for 1 ft of cover above the crown of the separator to grade for the unit.
- \_\_\_ 2. A 6" stone base should be shown on the detail.
- \_\_\_ 3. The backfill should be specified as flowable fill or crushed stone, ¾" or smaller.

- \_\_\_\_\_ 4. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included.
- \_\_\_\_\_ 6. The easement around the unit should include the primary and storage manholes as well as the separator unit.

The following requirements should be addressed in drainage **design reports**:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. All in-line applications must include detailed hydraulic gradeline calculations to document the 10-year design storm will have a water surface below the crown of the pipe.

## Appendix XIII

### Checklists for StormTrap Stormwater Quality Unit

The following notes / maintenance items should be included in the operations and maintenance Manual (**O & M Manual**):

- \_\_\_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8", and not just referenced to diameter of unit. The optional sediment marker may be referenced as an alternative.
- \_\_\_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_\_\_ 7. Inspection and maintenance of connecting manhole and diversion weir should be included in narrative and checklist.
- \_\_\_\_\_ 8. Detail drawing of proposed SQU should be included as well as diversion structure.
- \_\_\_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_\_\_ 10. Disposal according federal, state and local requirements should also be noted for sediments etc.
- \_\_\_\_\_ 11. THE MANUAL MUST CLEARLY NOTE IF THE UNIT MUST BE REFILLED WITH WATER AFTER EACH CLEANING.
- \_\_\_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a StormTrap SQU submitted for approval by the City of Indianapolis:

- \_\_\_\_\_ 1. The bedding / backfill must be ¾" stone.

- \_\_\_\_\_ 2. The installation details provided by the manufacturer should be included on the plans. They should include backfilling requirements (backfill both sides with ¾" gravel such that the difference in height between the two sides never exceeds 2 ft.), bedding requirements, etc.
- \_\_\_\_\_ 3. 6 inch minimum cover for traffic loading conditions should be shown.
- \_\_\_\_\_ 4. The minimum cover above the crown of the pipe to grade for the unit as required by manufacturer.
- \_\_\_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_\_\_ 6. Detail of connecting structures and diversion weirs etc. should be included.
- \_\_\_\_\_ 7. 24 inch" access opening / casting should be shown for each chamber (floatable and sediment units).
- \_\_\_\_\_ 8. All diversion structures and connecting pipes should meet the current Stormwater Design and Construction Specification Manual requirements.

The following requirements should be addressed in drainage design **reports**:

- \_\_\_\_\_ 1. The units can be combined in a modular fashion. The report should clearly document / explain the combination used and the resulting applicable treatment rate.
- \_\_\_\_\_ 2. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 3. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 4. Diversion structure design should be documented with calculations as appropriate. The diversion should be designed to limit the flow to the unit, i.e. maximum flow 3.7 cfs.
- \_\_\_\_\_ 5. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.

## Appendix XIII

### Checklists for Prinsco Stormwater Quality Unit

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 8", and not just referenced to diameter of unit.
- \_\_\_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of any specific equipment (e.g. Sludge Judge®).
- \_\_\_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_\_\_ 4. The O & M Manual should specify entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_\_\_ 7. Inspection and maintenance of connecting manhole and diversion weir should be included in narrative and checklist.
- \_\_\_\_\_ 8. Detail drawing of proposed SQU should be included as well as diversion structure.
- \_\_\_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_\_\_ 10. Disposal according federal, state and local requirements should also be noted for sediments etc.
- \_\_\_\_\_ 11. THE MANUAL MUST CLEARLY NOTE IF THE UNIT MUST BE REFILLED WITH WATER AFTER EACH CLEANING.
- \_\_\_\_\_ 12. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all plans referencing a PRINSCO SQU submitted for approval by the City of Indianapolis:

- \_\_\_\_\_ 1. The bedding / backfill must meet ASTM D2321 Class 1 specifications.
- \_\_\_\_\_ 2. The installation details provided by the manufacturer should be included on the plans. They should include backfilling requirements (backfill both sides with material such that the difference in height between the two sides never exceeds 2 ft.), bedding requirements, etc.



- \_\_\_ 3. 24 inch minimum cover for traffic loading conditions should be shown.
- \_\_\_ 4. The minimum cover above the crown of the pipe to grade for the unit as required by manufacturer.
- \_\_\_ 5. Detail drawing of SQUs should be included on plans.
- \_\_\_ 6. Detail of connecting structures and diversion weirs etc. should be included.
- \_\_\_ 7. 24 inch" access opening / casting should be shown for each chamber (floatable and sediment units).
- \_\_\_ 8. Casting should be specified and must not be supported by the HDPE risers.
- \_\_\_ 9. All diversion structures and connecting pipes should meet the current Stormwater Design and Construction Specification Manual requirements.

The following requirements should be addressed in drainage design reports:

- \_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff Quartile, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_ 3. Diversion structure design should be documented with calculations as appropriate. The diversion should be designed to limit the flow to the unit, i.e. maximum flow 1.2 cfs.
- \_\_\_ 4. The 10-year pipe capacity up and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-year storm is below the crown of the pipe as required by the Design Manual.

## Appendix XIV

### Checklists for First Defense

The following notes / maintenance items should be included in the operations and Maintenance Manual (**O & M Manual**):

- \_\_\_ 1. The maximum sediment depth should be clearly specified, e.g. 26 inches for the 4-ft diameter model and 36 inches for the 6-ft diameter model.
- \_\_\_ 2. Graphical and written description of sediment measuring procedure. This should include the use of specific equipment (e.g. Sludge Judge®). *The manufacturer recommends removal of the floatables prior to sediment measurement.*
- \_\_\_ 3. Oil removal procedure during routine cleanout.
- \_\_\_ 4. The O & M Manual should specify if entry into the SQU should be considered an OSHA confined space and guidelines followed.
- \_\_\_ 5. The O & M Manual should clearly state water and sediment from cleaning procedures should NOT be dumped into a sanitary sewer.
- \_\_\_ 6. A minimum inspection frequency of 6 months should be specified in the narrative and the tabular inspection schedule.
- \_\_\_ 7. Off-line configurations must include inspection and maintenance of connecting manhole and diversion weir.
- \_\_\_ 8. Detail drawing of proposed SQU should be included.
- \_\_\_ 9. Note in the manual to clean unit immediately if there is a hydrocarbon spill (e.g. gasoline or oil).
- \_\_\_ 10. A note should be provided indicating disposal of all sediment must be in accordance with all federal, state and local requirements.
- \_\_\_ 11. Cleanout should be specified for once a year at a minimum.

The following items should be specified on all **plans** referencing a First Defense SQU submitted for approval by the City of Indianapolis:

- \_\_\_ 1. The minimum cover above the crown of the pipe to grade for the unit should be as required by Stormwater Design Manual.
- \_\_\_ 2. A 6" stone base should be shown on the detail.
- \_\_\_ 3. The backfill should be specified as required by the adjoining pipe.

- \_\_\_\_\_ 4. Detail drawing of SQUs should be included on plans. *The drawings must clearly demonstrate the access opening is located in the center of the structure and not offset.*
- \_\_\_\_\_ 5. Detail of connecting structures and diversion weirs etc. for off-line configurations should be included. Inverts of inlets and outlet should be labeled clearly.
6. The maximum depth from the surface to the bottom of the unit must not exceed 15 feet.
7. A hard surface access must be included no farther than 10 feet from the access to the unit.
8. The access must be a minimum 24 inches in diameter.
9. The unit shall have a single pipe inlet.

The following requirements should be addressed in drainage design **reports**:

- \_\_\_\_\_ 1. The design storm should not create a hydraulic tailwater condition on the SQU. A first flush hydraulic gradeline evaluation should be included in the report.
- \_\_\_\_\_ 2. The design storm should be the peak runoff for a 0.3 inch rainfall depth using the appropriate Huff, 50% rainfall distribution. The contributing watershed should be modeled with the pervious and impervious areas inputted as separate areas (i.e. not combined using a single curve number).
- \_\_\_\_\_ 3. The 10-yr pipe capacity up- and downstream of any diversion structure should be documented with calculations to demonstrate the water surface for the 10-yr storm is below the crown of the pipe as required by the Design Manual.
- \_\_\_\_\_ 4. Diversion structure design should be documented with calculations as appropriate.