SECTION 2 - STORMWATER TREATMENT PRACTICE PERFORMANCE CLAIM

1. Performance Claim

In accordance with VADEQ Guidance Memo No. GM21-2006 dated September 15, 2021 we understand the department will assign total phosphorus (TP) removal based on WADOE GULD certification or NJDEP certification. Also, the Department will evaluate nutrient and sediment removal effectiveness verified and certified by additional state, regional or national certification programs on a case-by-case basis.

Attachments 2 includes our NJDEP certification letter and Attachment 3 includes verification/certification letters from the States of Maine and Vermont which demonstrate the FocalPoint achieves a **minimum 50% TP and minimum 80% TSS removal**. Maine and Vermont are two self-verifying and self-certifying States where the phosphorus removal efficiency assigned to innovative or proprietary stormwater treatment practices is 60%.

Additionally, a summary of the results from a NAVFAC- EXWC commissioned field study that utilized Washington State TAPE protocols to collect and report the data is included below. The Technical Report (TR-NAVFAC-EXWC-EV-2004) issued April 2020 is included in Attachment 3.

NAVFAC-EXWC and ESTCP demonstrated and validated a full scale, modular, 100 gpm hybrid LID-BMP system that decreased metal concentrations within stormwater runoff from high-risk industrial areas to ultra-low NPDES permit limits at their Navy's Fleet Readiness Center Metal Finishing Complex located at Naval Base Point Loma in San Diego, CA. The system consisted of three components – a fabric wrapped wire mesh gabion, the FocalPoint HPMBS (also referred to as the LID component in the study) and a high flow polishing filter bed consisting of clean stone, bone char and FS50 (alumina activated) media.

Samples upstream and downstream of each component were collected to assess individual performance as well as overall system performance. Fourteen (14) out of the sixteen (16) events monitoring were qualifying rainfall events according to TAPE. The results for the FocalPoint HPMBS component are provided in Table 1-3 below. Table 3 includes the phosphorus removal results followed by three methods of assessing overall removal efficiency, which demonstrate the FocalPoint system achieves a minimum 50% TP removal efficiency.

Table 1: Rainfall/Runoff Characteristics

Event Date	Rain (in)	Number of Aliquots (Inf/Eff)	Peak flow (GPM)	Total Flow (Gallons)	Storm Duration (Hours)	Overflow LID/BMP (Gallons)
2/27/18*	0.15	4/4	27	514	3.5	0/0
3/10/18*	0.29	4/3	5	705	9.75	0/0
11/29/18+	0.67	10/10	60	2,270	25.5	0/0
12/5/18+	1.47	11/11	35	2,171	33.75	0/0
1/5/19	0.71	11/11	51	2,924	11.5	234/292
1/12/19	0.34	11/11	43	2,595	4.5	0/0
1/14/19	0.40	24/24	45	5,944	6.5	0/0
1/31/19	0.71	3.5/24	49	4,632	4.16	0/0
2/13/19	1.15	24/24	54	22,700	26.67	0/21
2/20/19+	0.09	9/11	14	2,200	21.16	0/0
3/2/19	0.15	10/10	12	2164	7.16	0/0
3/11/19	0.47	24/24	41	11,859	11.33	0/0
3/20/19	0.14	NA	47	1593	3.75	0/0
3/21/19	0.29	18/18	58	3090	1	774/199
4/29/19	0.2	10/10	11	1350	25.92	0
5/10/19	0.33	14/14	36	3600	36.6	0

* TAPE qualifying rain event requirements not met. Data will not be included in TAPE application. Gabion influent and effluent sample collection location not adjacent to one another.

\+ Rain event has period greater than 6 hours without 0.04-inch rain. Data will be included in TAPE application.

Table 2: Total Suspended Sediment performance

Event #	Event Date	TSS Influent EMC – mg/L	TSS Effluent EMC – mg/L	TAPE Performance Goal Met	24-hr Rainfall Depth - in
1	2/27/18*	19	6.1	Yes	0.15
2	3/10/18*	8.2	5.2	Yes	0.29
3	11/29/18+	23.9	41.7	No	0.67
4	12/5/18+	10.7	4.8	Yes	1.47
5	1/5/19	8.1	3	Yes	0.71
6	1/12/19	15.9	3	Yes	0.34
7	1/14/19	14.4	8.8	Yes	0.40
8	1/31/19	12.9	3.2	Yes	0.71
9	2/13/19	15.3	1.3	Yes	0.15
10	2/20/19+	58	2.9	Yes	0.09
11	3/2/19	100	2.5	Yes	0.15
12	3/11/19	11.2	2.6	Yes	0.47
13	3/20/19	-	-	-	0.14
14	3/21/19	12.1	-	-	0.29
15	4/29/19	74.3	2.3	Yes	0.20
16	5/10/19	74.3	ND	Yes	0.33

TAPE Performance Goal
20-100 mg/L TSS Influent, Effluent Criteria ≤ 20 mg/L TSS
100-200 mg/L TSS Influent, ≥ 80% TSS removal
≥ 200 mg/L TSS Influent, ≥ 80% TSS removal
ND – non-detect

* TAPE qualifying rain event requirements not met. Data was not be included in data review under TAPE. Gabion influent and effluent sample collection location not adjacent to one another.
+ Rain event has period greater than 6 hours without 0.04-inch rain. Data was included in TAPE review.
Where event mean influent concentrations were greater than 20 mg/L, 4 out of the 5 events showed greater than 90% TSS removal. Event 3 is considered an outlier when looking across all 16 events.

Table 3: Total Phosphorus performance

Event #	Event Date	TP Influent EMC – mg/L	TP Effluent EMC – mg/L	% Removal	24-hr Rainfall Depth - in
1	2/27/18*	-	-	-	0.15
2	3/10/18*	-	-	-	0.29
3	11/29/18+	0.719	0.116	84	0.67
4	12/5/18+	0.218	0.046	79	1.47
5	1/5/19	0.198	0.040	80	0.71
6	1/12/19	0.153	0.034	78	0.34
7	1/14/19	0.080#	0.056	30#	0.40
8	1/31/19	0.106	0.045	58	0.71
9	2/13/19	0.044#	0.040	9#	0.15
10	2/20/19+	0.102	0.017	83	0.09
11	3/2/19	0.827	0.026	97	0.15
12	3/11/19	-	-	-	0.47
13	3/20/19	-	-	-	0.14
14	3/21/19	-	-	-	0.29
15	4/29/19	-	-	-	0.20
16	5/10/19	-	-	-	0.33
	Mean	0.272	0.046	**66%**	

Overall Mean Reduction

RE = (0.272-0.046)/0.272 = **83%**

* TAPE qualifying rain event requirements not met. Data will not be included in TAPE application.

+ Rain event has period greater than 6 hours without 0.04-inch rain. Data was included in TAPE application.

Influent concentration was below 0.1 mg/L, which per TAPE performance goals are not used in evaluating removal efficiency and provided here to show the department the entire range of events.

Method 1

Using the TAPE bootstrapping calculator to compute the one-tailed 95% confidence interval around the mean pollutant removal efficiency, the lower 95% removal efficiency for total phosphorus was **72%**. As explained in the footnote of Table 3 above, events 7 and 9 were not included in this analysis because influent concentrations are very low for assessing any BMP, including non-proprietary conventional bioretention.

Enabling Macros

Macros must be enabled in order for the spreadsheet to work. Consult the Help Menu in the version of Microsoft Excel you are using for instructions on enabling macros.

Macro Description

The macro uses a "bootstrapping" procedure to calculate either the one-tailed upper 95% confidence interval around the mean effluent concentration, or the one-tailed lower 95% confidence interval around the mean pollutant removal efficiency. To perform these calculations, the macro randomly resamples the original data to create 5000 datasets with the same number of values as the original data. The mean of each resampled dataset is then calculated. The 5000 means are then sorted in ascending order. The one-tailed upper 95% confidence interval around the mean effluent concentration is the mean with the rank of 4750 out of 5000. The one-tailed lower 95% confidence interval around the mean pollutant removal efficiency is the mean with the rank of 250 out of 5000. THIS MACRO SHOULD ONLY BE USED WHEN THERE ARE 10 OR MORE DATA POINTS FOR EFFLUENT CONCENTRATION OR POLLUTANT REMOVAL EFFICIENCY. See references in accompanying worksheet for more detailed information on bootstrapped confidence intervals.

1. Clear any previous effluent and remove data by clicking on the Clear Data button

2. Enter effluent concentration and remove efficiency data in columns K and L

○ Upper 95% confidence limit for effluent concentration
◉ Lower 95% confidence limit for removal efficiency

4. Click on the calculate button [Calculate]

Lower 95% for removal efficiency (%) 72.286

Effluent Concentration	Removal Efficiency (%)
0.116	77
0.046	79
0.04	80
0.034	78
0.045	58
0.017	83
0.026	95

[Clear Data]

Method 2

Arithmetic mean removal efficiency across all nine (9) events, including the lower efficiencies associated with influent concentrations less than 0.1 mg/L. The mean removal efficiency per this method for total phosphorus was **66%.**

Method 3

The removal efficiency calculated using the overall event mean influent/effluent concentrations The removal efficiency per this method for total phosphorus was **83%**. In conclusion, these methods demonstrate removals of 72%, 66% and 83% respectively, and well above the 50% removal rate we are seeking from VADEQ.