Dry Pond Enhancements with Continuous Monitoring and Adaptive Control for Water Quality Benefit
Continuous Monitoring and Adaptive Control (CMAC)

- Stormwater Pond
- runoff
- infiltration
- water level sensor
- actuated valve
- outlet or pump
- NWS forecast
- control panel
- Adaptive use of storage - improved water quality and flood control
- Opti cloud software
- web-based dashboard
- Opti cloud software
- Opti cloud software
- Opti cloud software

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Hardware Components

- ACTUATED VALVE
- SOLAR POWER AND CONTROL PANEL
- LEVEL SENSOR
Passive Dry Ponds

- Basins designed to detain runoff for flood or peak discharge rate control
- Typically, lower pollutant removal potential compared to wet ponds

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International Stormwater BMP Database 2016 Summary Statistics, Table 2-21 (Clary et. al 2017)
Dry Pond with CMAC Performance

Passive Control Structure

CMAC
Dry Pond with CMAC Performance

9/19/2016 9:35AM

9/21/2016 10:04AM
Passive Dry Pond Crediting in Chesapeake Bay

- CBP
  - Reduced efficiencies when compared to wet ponds
  - Not included as a stormwater treatment (ST) practice
- Maryland - no pollutant removal associated with dry ponds

The composite for ST practices included wet ponds, constructed wetlands, sand filters, and wet swales. Dry ponds and Dry ED pond were omitted from the ST category since they have such low removal rates that they are typically not targets of retrofitting. The annual mass nutrient removal rates associated with each practice presented in Table A-4 was averaged for the composite practices, as shown in Table B-1 below.

Many current and future stormwater management structures may not meet the performance criteria specified in Section 1.2 above to qualify to be used as “stand-alone” practices for full WQ treatment. Reasons for this include poor longevity, poor performance, inability to decrease TSS by 80% and TP by 40%, or inadequate testing. Some of these practices include:

- catch basin inserts
- dry extended detention ponds
- water quality inlets and oil/grit separators
- hydro-dynamic structures
- filter strips
- grass channels
- street sweeping
CMAC Crediting in Chesapeake Bay

- Chesapeake Bay Program (approved November 2016)
  - Enhancement of existing BMPs
  - Conversion of existing BMPs

- Maryland Department of the Environment
  - Wet ponds and variants (approved January 2016)
  - Dry ponds (approved on interim basis March 2018) - 50% credit through April 2020
CMAC Dry Pond Study

- Goal: Evaluate the use of CMAC as a Dry Pond enhancement for water quality benefit
- Field monitoring to evaluate pollutant removal efficiency for: TSS, TN, and TP using automated sampling
- Continuously monitor rainfall and flow rate throughout the duration of the study (minimum 20 events)
- Removal efficiencies used for crediting: No baseline data
CMAC Dry Pond Site

- Level sensor in pond
- Valve/Actuator
- Rain gauge
- Downstream Autosampler
- Upstream Autosampler
- Opti Lightning
Online Dashboard

- Upstream Discharge
  - 05/16/2019 03:11
  - 0.01 cfs

- Downstream Discharge
  - Weir 1 Flow Rate
  - Weir 2 Flow Rate

- Upstream Water Level
  - 05/16/2019 20:00
  - 0.21 ftH2O

- Downstream Water Level
  - Weir 1 Water Level
  - Weir 2 Water Level
TSS Results...So far

- Through 13 events at CMAC dry pond site
  - Inflow range: 11 mg/L – 250 mg/L
  - Outflow range: 5.0 mg/L – 45 mg/L

- Retention and detention pond results taken from International BMP Database 2016 Summary Statistics (Clary et. al 2017)

- TSS Removal efficiencies:
  - CMAC: 82%
  - Retention: 75%
  - Detention: 64%
  - CBP ED: 60%
TP Results...So far

- Through 13 events at CMAC dry pond site
  - Inflow range: 0.09 mg/L – 0.61 mg/L
  - Outflow range: 0.04 mg/L – 0.56 mg/L

- Retention and detention pond results taken from International BMP Database 2016 Summary Statistics (Clary et. al 2017)

- TP Removal efficiencies:
  - CMAC: 30%
  - Retention: 55%
  - Detention: 17%
  - CBP ED: 20%
TN Results...So far

- Through 13 events at CMAC dry pond site
  - Inflow range: 0.32 mg/L – 5.7 mg/L
  - Outflow range: 0.44 mg/L – 4.7 mg/L

- Retention and detention pond results taken from International BMP Database 2016 Summary Statistics (Clary et. al 2017)

- TN Removal efficiencies:
  - CMAC: 23%
  - Retention: 23%
  - Detention: -3%
  - CBP ED: 20%
Next Steps

- Continue monitoring and sampling CMAC dry pond site
- Submit results for review to remove interim approval states
- Continue evaluating TSS sensors for control decisions
Questions?

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Senior Water Resources Engineer

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