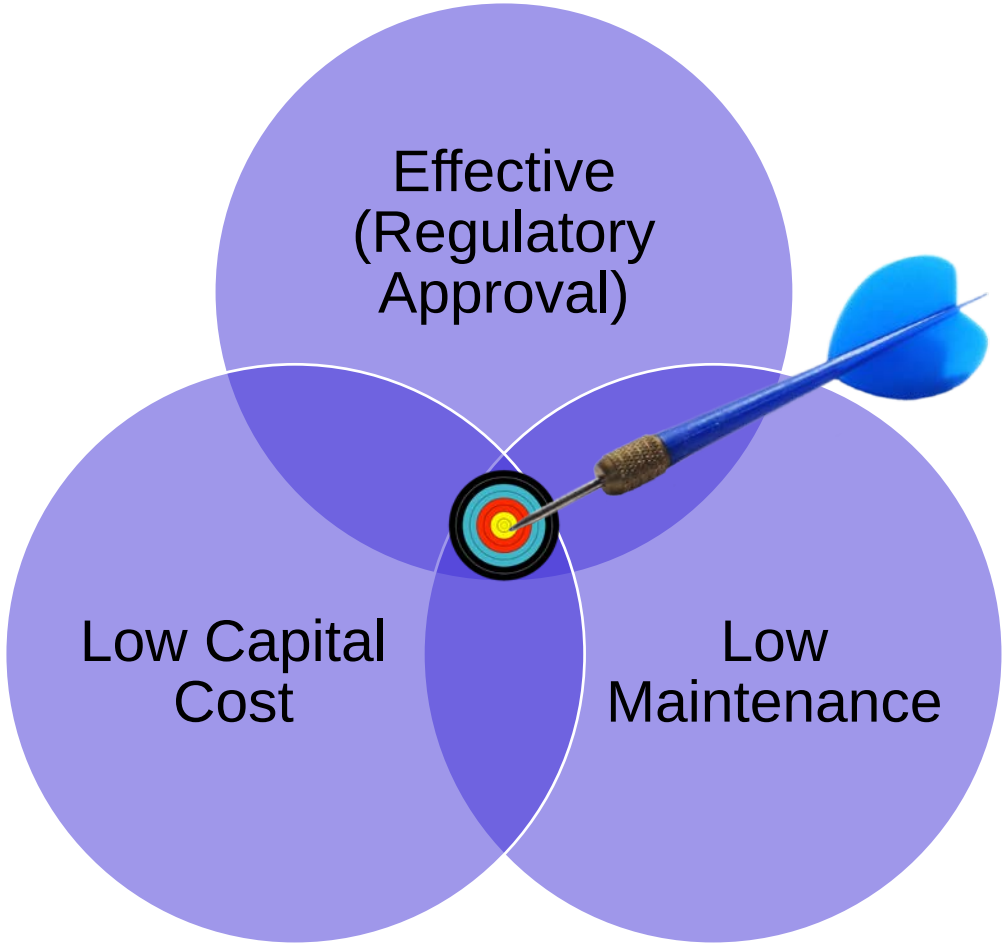
Catch Basin Inserts for Ohio Roadways

Gresham Smith
GS-OH Inc.
An Affiliate of Gresham Smith

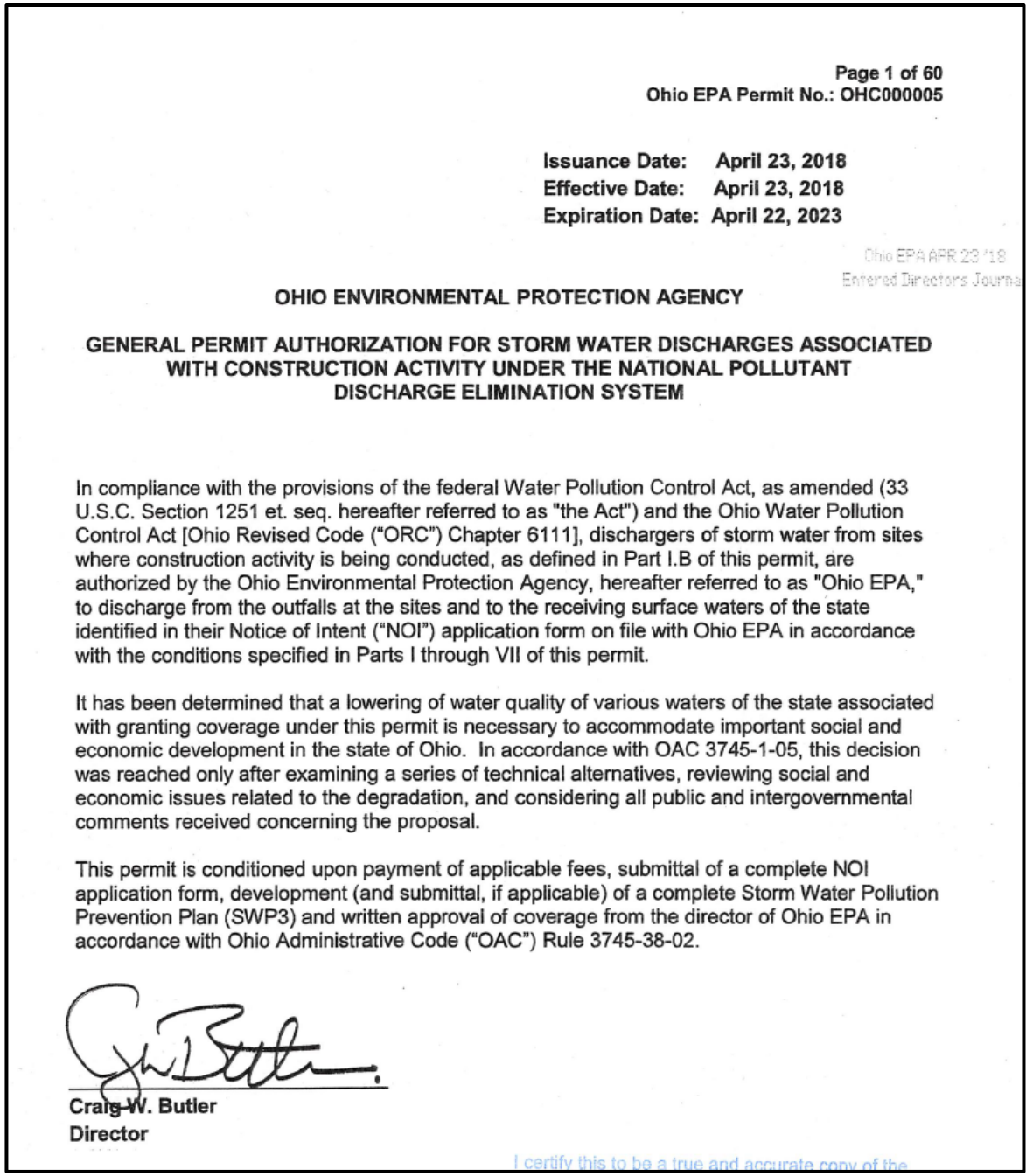
Prepared for and in cooperation with the
Ohio Department of Transportation

Most Desirable Post-Construction BMPs



NPDES Construction General Permit (CGP)

1. Post-Construction BMPs
2. Manufactured Systems Allowed for ODOT
3. ODOT L&D has testing criteria



Page 1 of 60
Ohio EPA Permit No.: OHC000005

Issuance Date: April 23, 2018
Effective Date: April 23, 2018
Expiration Date: April 22, 2023

Ohio EPA APR 23 '18
Entered Directors Journa

OHIO ENVIRONMENTAL PROTECTION AGENCY

GENERAL PERMIT AUTHORIZATION FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et. seq. hereafter referred to as "the Act") and the Ohio Water Pollution Control Act [Ohio Revised Code ("ORC") Chapter 6111], dischargers of storm water from sites where construction activity is being conducted, as defined in Part I.B of this permit, are authorized by the Ohio Environmental Protection Agency, hereafter referred to as "Ohio EPA," to discharge from the outfalls at the sites and to the receiving surface waters of the state identified in their Notice of Intent ("NOI") application form on file with Ohio EPA in accordance with the conditions specified in Parts I through VII of this permit.

It has been determined that a lowering of water quality of various waters of the state associated with granting coverage under this permit is necessary to accommodate important social and economic development in the state of Ohio. In accordance with OAC 3745-1-05, this decision was reached only after examining a series of technical alternatives, reviewing social and economic issues related to the degradation, and considering all public and intergovernmental comments received concerning the proposal.

This permit is conditioned upon payment of applicable fees, submittal of a complete NOI application form, development (and submittal, if applicable) of a complete Storm Water Pollution Prevention Plan (SWP3) and written approval of coverage from the director of Ohio EPA in accordance with Ohio Administrative Code ("OAC") Rule 3745-38-02.

Craig W. Butler
Director

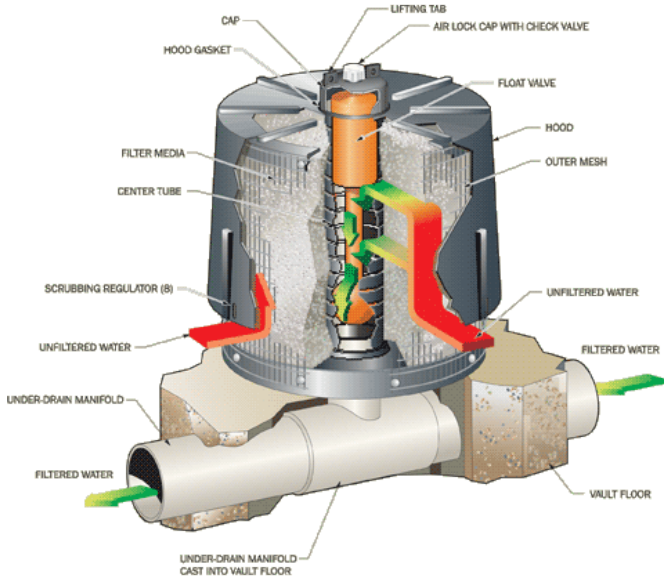
I certify this to be a true and accurate copy of the

Manufactured Systems

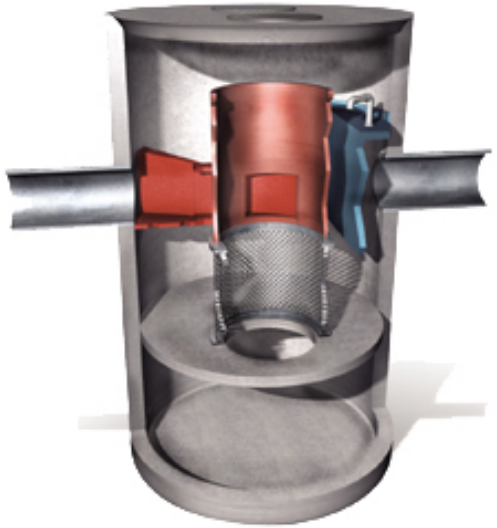
Cartridge/Membrane/Media Filters: Physical filtering

Hydrodynamic Separators: Settling and some screen filtering

Catch Basin Inserts: Filtering at catch basin



Cartridge (Contech)

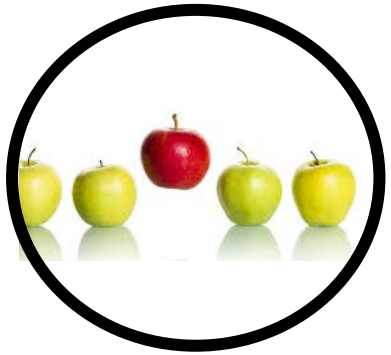


Hydro. Sep. (Contech)

Basin Insert (Contech)

ODOT Research

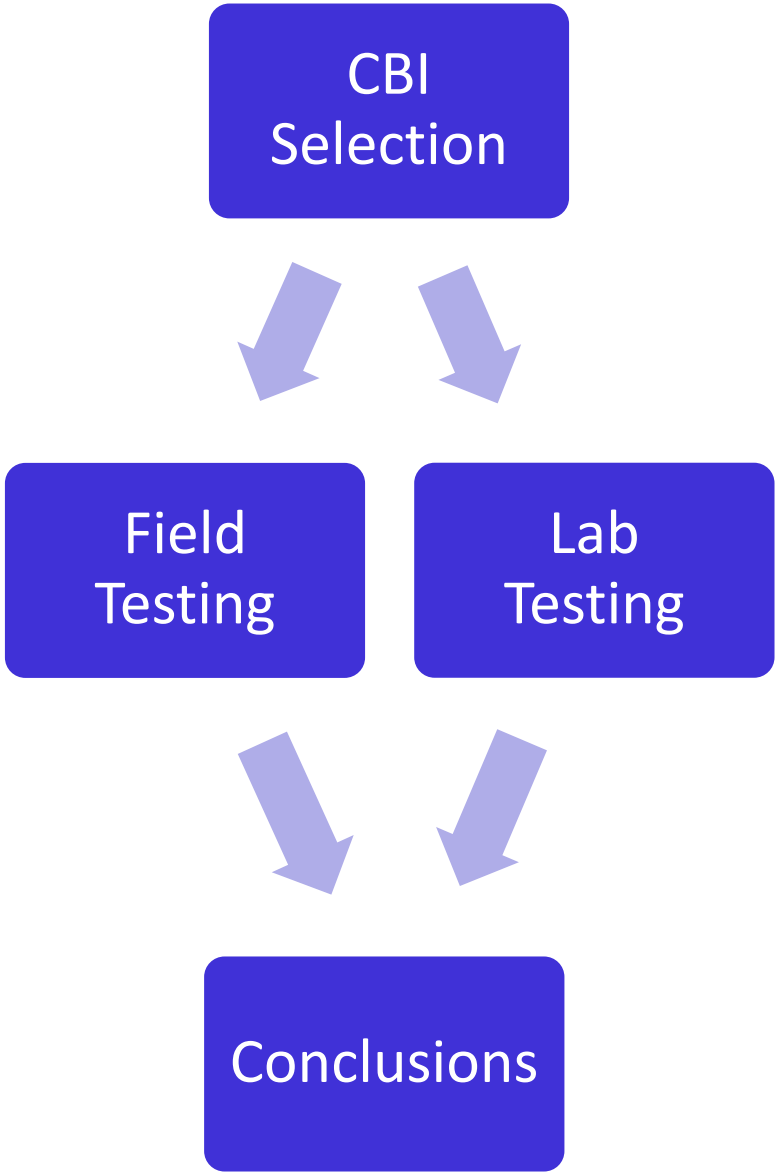
Primary Elements of the Research



CBI selection

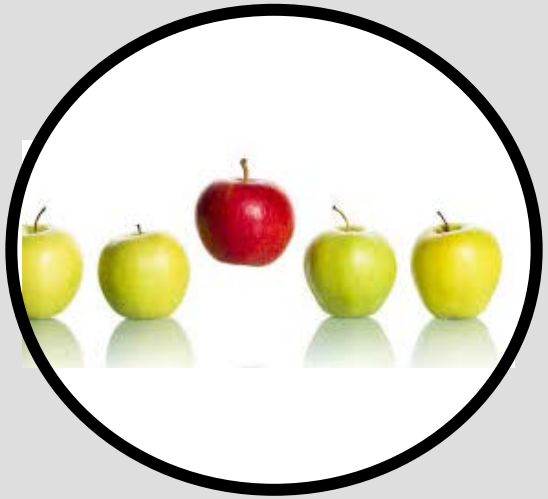
Field Testing

Lab Testing



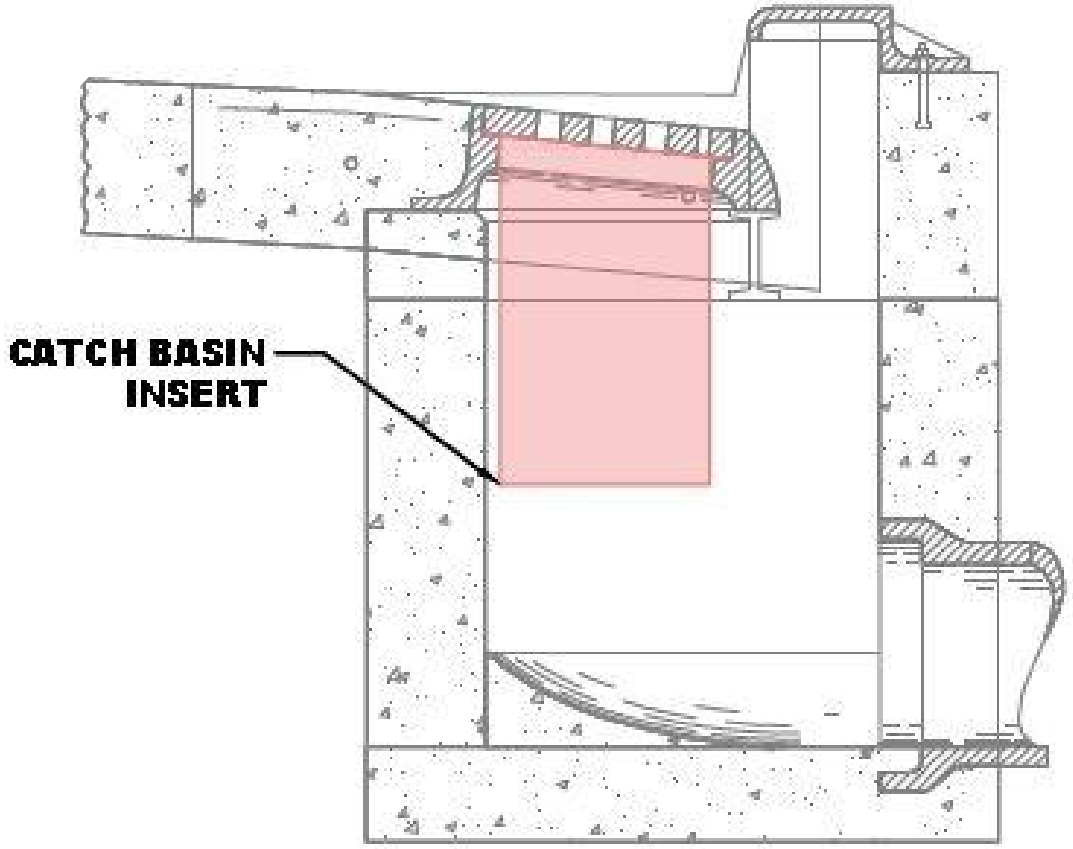
Catch Basin Inserts for Ohio Roadways Research and Results

1. CBI Selection
2. Field Testing
3. Lab Testing
4. Conclusions



CBI Selection– Two Criteria

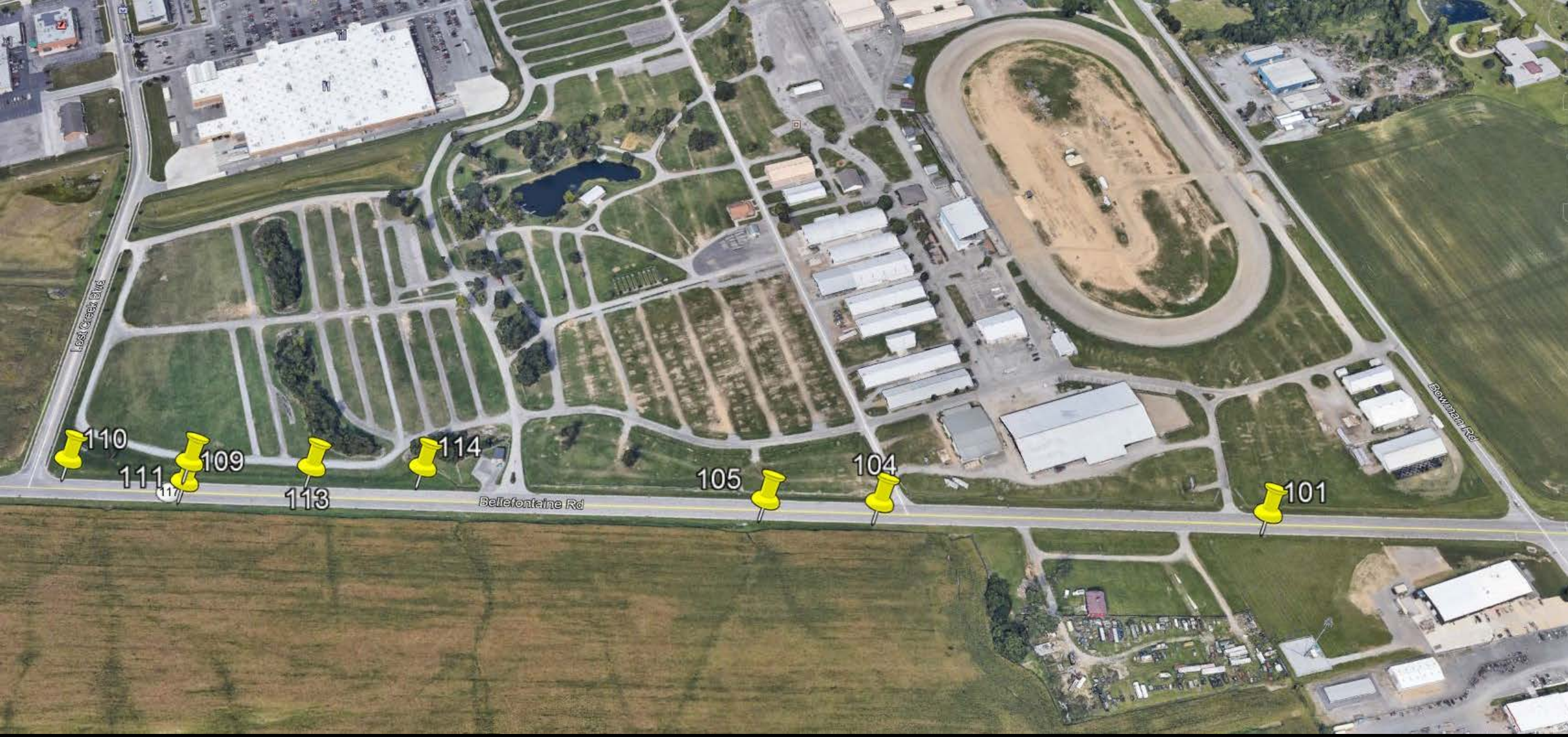
- 80% sediment retention
- Fit a standard ODOT Catch Basin Type 3A



CBI Selection – The Most Likely to Succeed

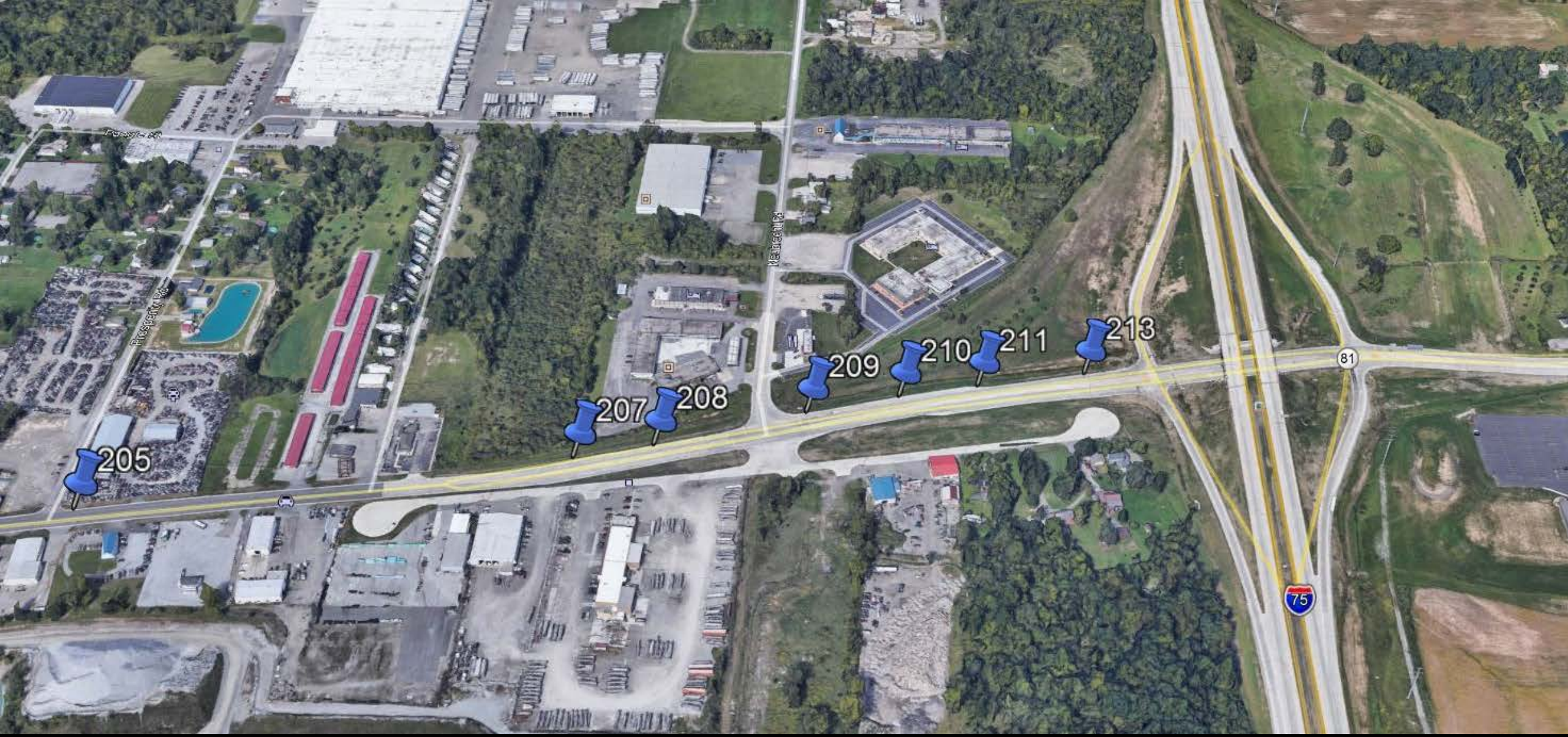
Catch Basin Inserts for Ohio Roadways Research and Results

1. CBI Selection
2. Field Testing
   - Site Selection
   - Installation and Inspection
   - Maintenance and Removal
3. Lab Testing
4. Conclusions



Installation

Site 1 CBI distribution



Installation

Site 2 CBI distribution

Installation

- Installed in accordance with manufacturer’s recommendations
- Most CBIs required “throat block”
- Some CBIs slightly modified to allow for installation

Installation– Throat Block

- Curb opening blocked to direct all stormwater into the grate
- 7 of 8 CBIs required throat block

Installation– Potential Issues

- Imperfect catch basin construction
- CBI frame
- Intrusion of catch basin conduits

Monthly Inspections

- Six inspections conducted within 24 hours of a runoff event
- Looking for standing water or sediment/debris accumulations
- Maintenance required for standing water or half full of debris

Maintenance Activity

Debris removal and measurement

Backflush with water

CBI Reinstalled

Field Testing Results

- Removed if standing water observed after CBI has been maintained
- 5 CBIs remained installed for the duration of the study
- 9 CBIs removed within the first 7 months

		1	2	3	4	5	6	7	8	9	10	11	12
Adsorb-It™				I	F	M	C	M	C	R			
Adsorb-It™				I	F	M	C	M	C	R			
DrainPac™	I	F	F	F	F	M	F	M	F	F	F	F	R
FlexStorm®	I	F	C	M	F	M	C	R					
FlexStorm®	I	F	C	M	F	M	C	R					
Flo-Gard Plus®	I	F	F	F	F	M	F	M	F	F	F	F	R
Flo-Gard Plus®	I	F	F	F	F	M	F	M	F	F	F	C	R
Gullywasher©	I	F	C	M	F	M	C	R					
Gullywasher©	I	F	C	M	C	R							
Storm Sentinel®	I	F	C	M	F	M	C	R					
Storm Sentinel®	I	F	C	M	C	R							
Triton™			I	F	F	M	F	M	F	R			
Triton™			I	F	F	M	F	M	F	F	F	C	R
WQS	I	F	F	F	F	M	F	M	F	M	F	C	R
WQS	I	F	F	F	F	M	F	M	F	M	F	C	R

KEY
I = Installed; F = Functioning; M = Maintained; C = Clogged; R = Removed

Field Test Conclusions

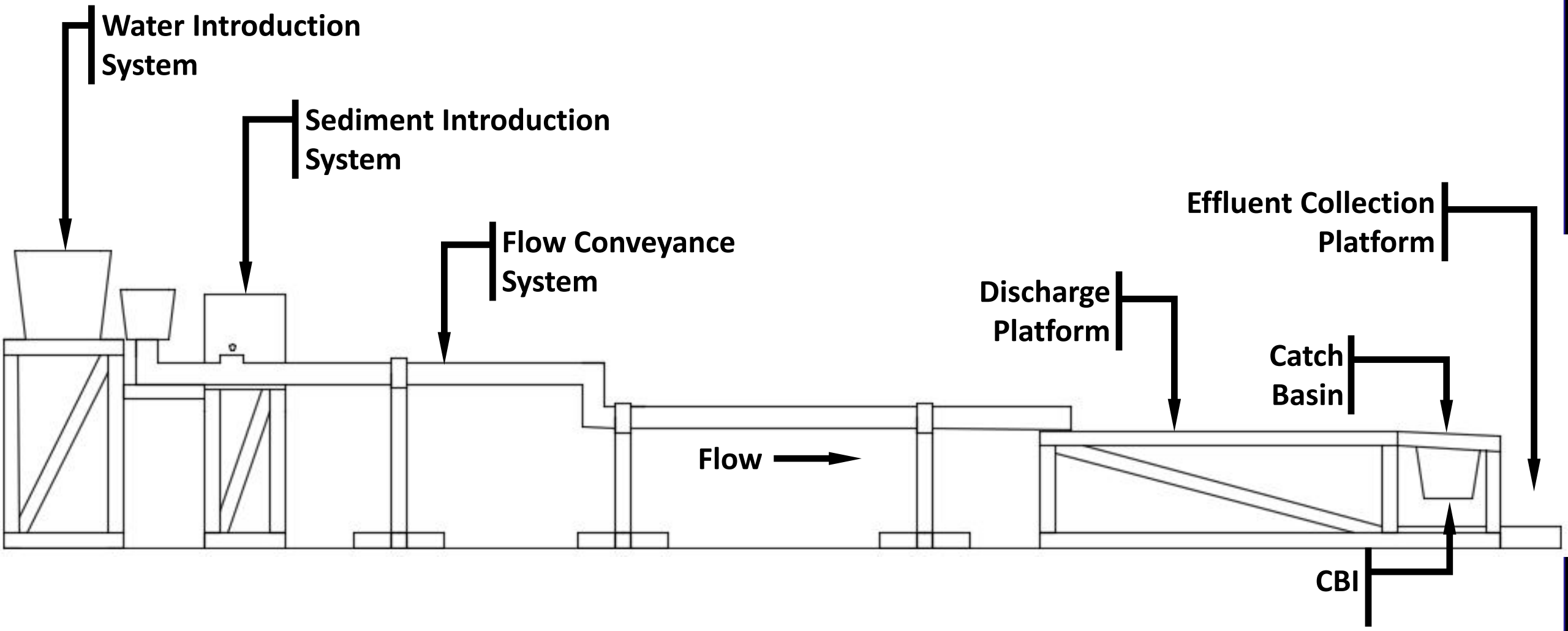
- Only 1 CBI installed without modification to standard CB-3A
- CBIs with rigid frames may need modification to fit
- CBIs profile/depth may conflict with pipes inside catch basin
- Maintenance required every 2-5 months

Catch Basin Inserts for Ohio Roadways Research and Results

1. CBI Selection
2. Field Testing
3. Lab Testing
   - Testing
   - Results
4. Conclusions

Lab Testing

- Large-scale CBI testing apparatus was constructed
- Meets ODOT L&Dv2 requirements
- Testing conditions
    1. Influent flow rates
    2. Soil types



Lab Testing

Schematic of CBI Testing Apparatus

Testing Flow Rate

Water Quality Flow (WQf)

$$WQ_f = CiA$$

Water Quality Volume (WQv)

$$WQ_v = \frac{PAC_q}{12}$$

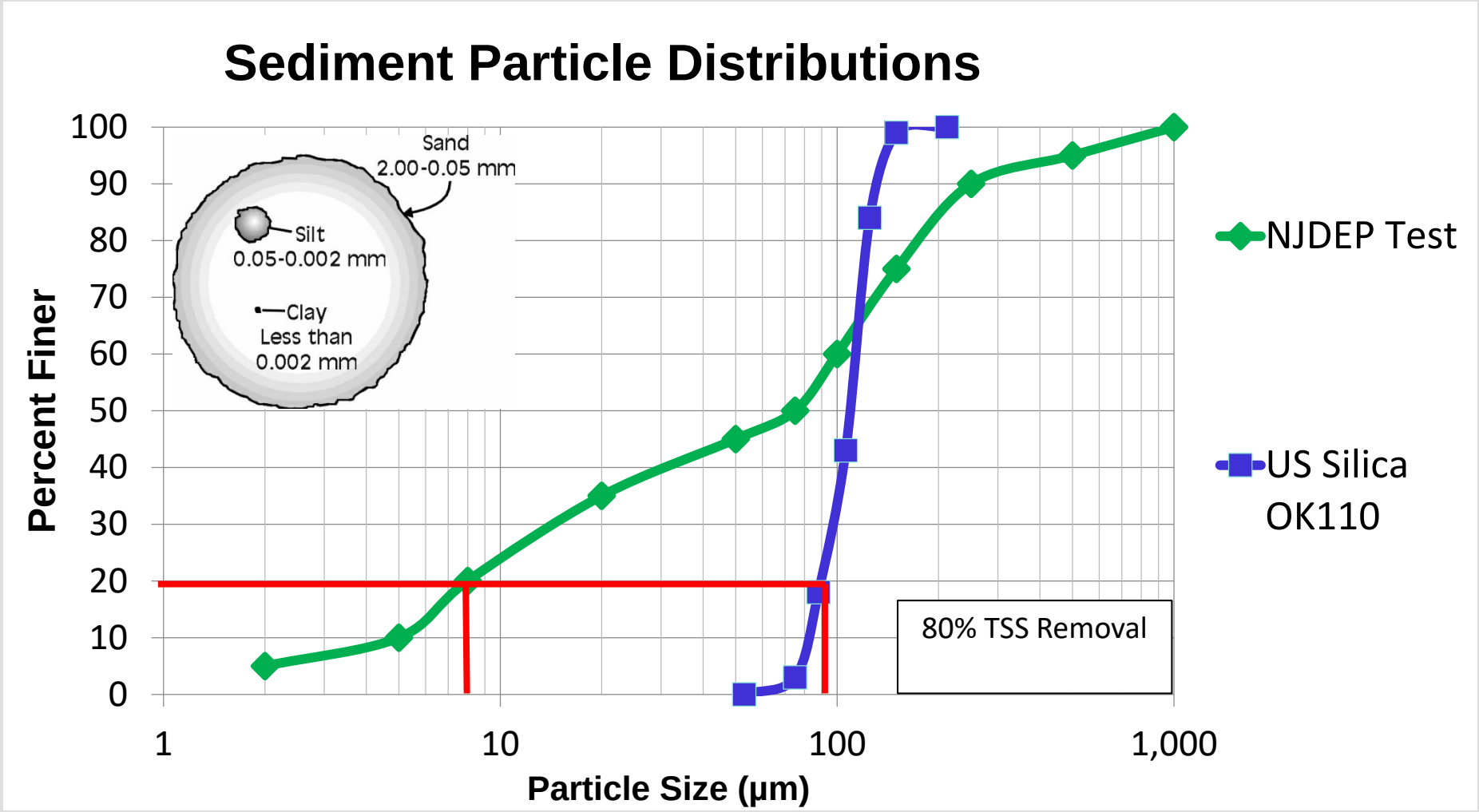
NOTE: calculations based on CGP effective at the beginning of research

Drainage Area Size	Drainage Area (acre)	Flow Rate (ft^3/s)	Volume (ft^3)	Duration (min)
Small	0.1	0.06	252	70
Medium	0.2	0.12	504	70
Large	0.3	0.18	756	70


OK110 Silica Sand


Sandy Loam

Testing: Particle Size Distribution



ORIGINAL CONFIGURATION

MODIFIED FOR DIRECT DISCHARGE

Performance Testing

- Low, medium, and high flow rates
- TARP sandy loam and OK110 soil types
- Sediment retention measured to determine CBI performance

Sediment Retention Performance

Product Name	Sheet Flow OK110			Direct Discharge OK110			Direct Discharge Sandy Loam		
	0.06 ft³/s	0.12 ft³/s	0.18 ft³/s	0.06 ft³/s	0.12 ft³/s	0.18 ft³/s	0.06 ft³/s	0.12 ft³/s	0.18 ft³/s
Adsorb-It™	77.2	64.4	48.7	96.2	82.5	64.3	85.4	64.2	50.5
DrainPac™	36.0	46.1	47.1	79.8	64.8	62.7	68.1	46.8	38.4
FlexStorm®	51.2	56.8	46.5	71.3	50.2	36.3	65.4	58.3	43.9
Flo-Gard Plus®	7.3	1.0	0.7	10.4	0.8	2.2	24.7	19.8	22.0
Gullywasher©	75.8	58.8	41.0	67.1	47.8	35.7	51.7	38.1	33.4
Storm Sentinel®	59.2	41.0	21.7	71.3	38.5	26.0	41.6	30.1	20.3
Triton™	59.4	49.0	45.2	68.5	59.7	44.9	40.4	38.4	36.4
WQS	2.7	27.3	26.8	27.1	51.4	53.9	42.7	49.4	50.5

Performance Testing Results

- Two products met 80% sediment retention (for low flow)
    1. Adsorb-It™
    2. DrainPac™
- Sediment retention decreased with flow rate increase

Low Flow Rate Results

Product Name	Sediment Retention OK110 Silica Sand	Sediment Retention TARP Sandy Loam Soil
Adsorb-It™	96.2	85.4
DrainPac™	79.8	68.1
FlexStorm®	71.3	65.4
Flo-Gard Plus®	10.4	24.7
Gullywasher©	67.1	51.7
Storm Sentinel©	71.3	41.6
Triton™	68.5	40.4
WQS	27.1	42.7

Longevity Testing

- Low flow rate tested with each soil type
- Consecutive testing on CBIs until failure
    1. Cumulative sediment retention below 80%
    2. Structural failure

Longevity Testing Results

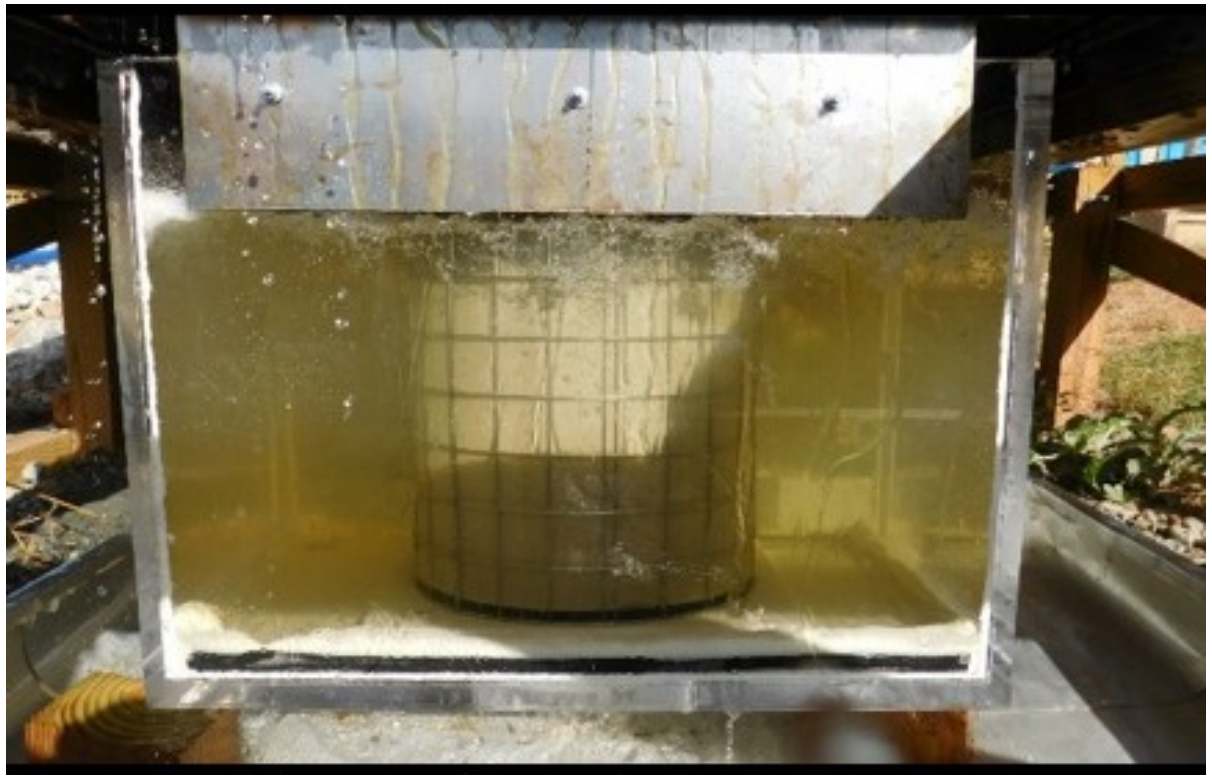
- Performance degraded with multiple simulated storm events
- 6 of the 8 CBIs did not justify testing past 2 tests with OK110 sand
- 2 CBIs fell below 80% sediment retention after 3rd or 4th test (OK110)
- None of the units met 80% retention for more than 1 test with sandy loam

Longevity Testing Sediment Retention

		L1	L2	L3	L4	L5
Adsorb-It™	Indiv.	95.6%	88.4%	72.4%	55.7%	-
	Cumul.	-	92.0%	85.7%	78.9%	-
DrainPac™	Indiv.	80.0%	81.7%	68.4%	78.1%	40.6%
	Cumul.	-	80.9%	76.7%	77.0%	69.7%

Lab Test Conclusions

- 6 CBIs below 80% sediment retention on all tests
- 2 CBIs met 80% on certain tests
- CBIs met 80% sediment retention for maximum of 3 consecutive events
- Leak between CB frame and CBIs



Catch Basin Inserts for Ohio Roadways Research and Results

1. CBI Selection
2. Field Testing
   - Site selection
   - Installation and Inspection
   - Maintenance and Removal
3. Lab Testing
   - Testing
   - Results
4. Conclusions

Conclusions

Conclusions Summary

No units met both requirements

1. DrainPac™ and Adsorb-It™ met sediment retention requirement
2. Triton™ met installation into CB-3A requirement

Product Name	Installed in CB Without Modification	80% Sediment Retention OK110 Silica Sand	80% Sediment Retention Sandy Loam Soil
Storm Sentinel®	No	No	No
DrainPac™	No	Yes	No
FlexStorm®	No	No	No
Gullywasher©	No	No	No
Flo-Gard Plus®	No	No	No
WQS	No	No	No
Triton™	Yes	No	No
Adsorb-It™	No	Yes	Yes

Note: Sandy Loam is more representative of Ohio runoff.

Conclusions Summary– CBIs as Post-Construction BMPs

Adsorb-It™ and Drainpac™ *might* work if:

- No more than 0.1 acres per catch basin
- Install one catch basin filter in every catch meet treatment requirements
- Add block to safely cover inlet throat
- Clean/Replace each filter about every month, and more often if there has been more than 1.5 inches of precipitation, grass cutting, leaf litter, or snow and ice.
- Maintain forever

None of the Catch Basin Inserts Could Be Post-Construction BMPs for ODOT

Thanks to the Research Team:

- Auburn University
- Davey Resource Group
- ODOT Central Office and District 7 Staff

Full Report Available on ODOT's Research Website--

Catch Basin Inserts for Ohio Roadways

Questions?

Tom Dietrich, P.E.

Tom.Dietrich@greshamsmith.com

614.221.0678

Gresham Smith