



Ohio's Research Initiative for Locals

Stormwater Best Management Practices for Local Roadways

2015-ORIL7

Post Construction Stormwater BMP Selection Tool

March 15, 2016

Meeting Agenda

- ORIL: ODOT's Research Initiative for Locals
- BMP Selection Tool Goals / Objectives
- Tool Development
- How the Tool Works
- Tool Demonstration
- Additional Resources

- **ORIL: ODOT's Research Initiative for Locals**
- BMP Selection Tool Goals / Objectives
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- Additional Resources

Brief Description of ORIL

- ORIL Purpose:
 - Provide research support for local agencies to address problems specific to the local roadway system.
- Local Public Agencies (LPAs) submit research ideas.
- ORIL board chooses projects
- Technical Advisory Committee (TAC) develops and RFP
- Researcher is chosen and research is performed



Meeting Agenda

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Project Overview - Goals

- “Establish a methodology for recommending proven storm water BMPs for use on Ohio's local roadway system that satisfy current regulations and are cost effective in terms of construction and maintenance by local governments.”
- “Provide local officials with a simplified tool to assist decision makers in selecting optimal BMPs for specific applications.”

Project Overview - Objectives

- Identify and screen literature highly applicable to research products, both national and Ohio-specific sources
- Gather information from Ohio roadway BMP stakeholders and apply to research products
- Develop and provide five BMP case studies as reference documents
- Develop and provide a BMP selection tool for Locals

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Project Team



G R E S H A M
S M I T H A N D
P A R T N E R S

- Assists ODOT in environmental compliance
- Developed stormwater BMP manuals across the country
- NCHRP research

Geosyntec 
consultants

- Manages International Stormwater BMP Database
- NCHRP research

Stormwater Best Management Practices for Local Roadways

2015-ORIL7

Proposing Organization:

GS&P/OH, INC.
(AN AFFILIATE OF GRESHAM,
SMITH AND PARTNERS)
155 EAST BROAD STREET
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Date of Original Submission:

MARCH 31, 2014

Date of Revised Submission:

JUNE 16, 2014

Date of Revised Submission 2:

JUNE 26, 2014

Requested ORIL Funding Amount:

\$179,690.50

Proposed Project Duration:

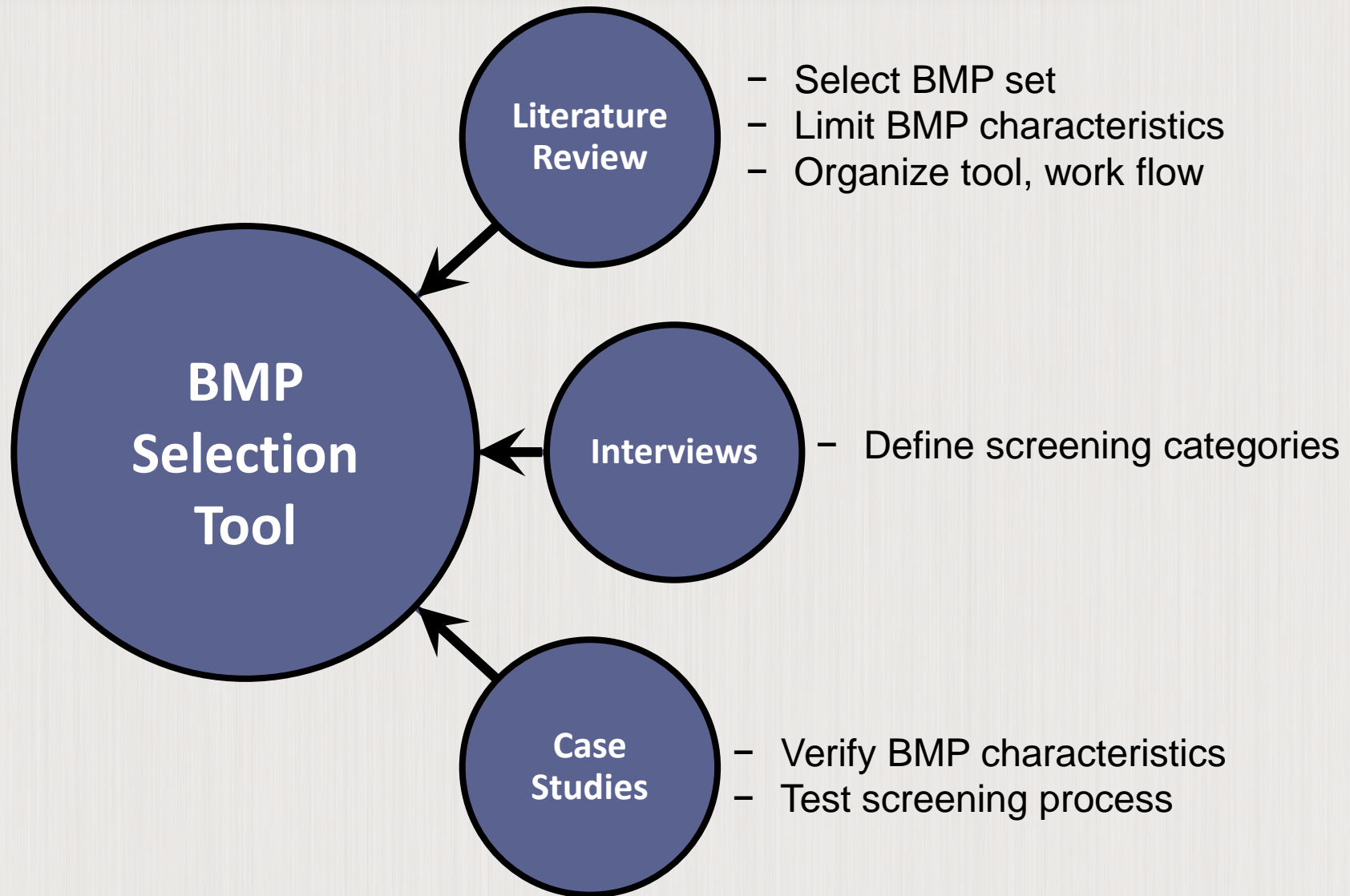
12 MONTHS



GS&P/OH, INC.
AN AFFILIATE OF
G R E S H A M
S M I T H A N D
P A R T N E R S



Tool Overview – Integration of Research Findings



Literature Review Findings

Objective: Identify best practices for local roadway BMPs applicable to Ohio

- Annotated bibliography (Appendix A)
- Memo to summarize key findings (Appendix B)
- Findings used to support tool development:
 - Definition of BMP set to be considered in tool
 - Identification of BMP screening criteria
 - Compilation of BMP characteristics in Detailed BMP Matrix
- Key areas of screening criteria
 - BMP function
 - Site conditions/constraints
 - Maintenance and costs
 - Aesthetics

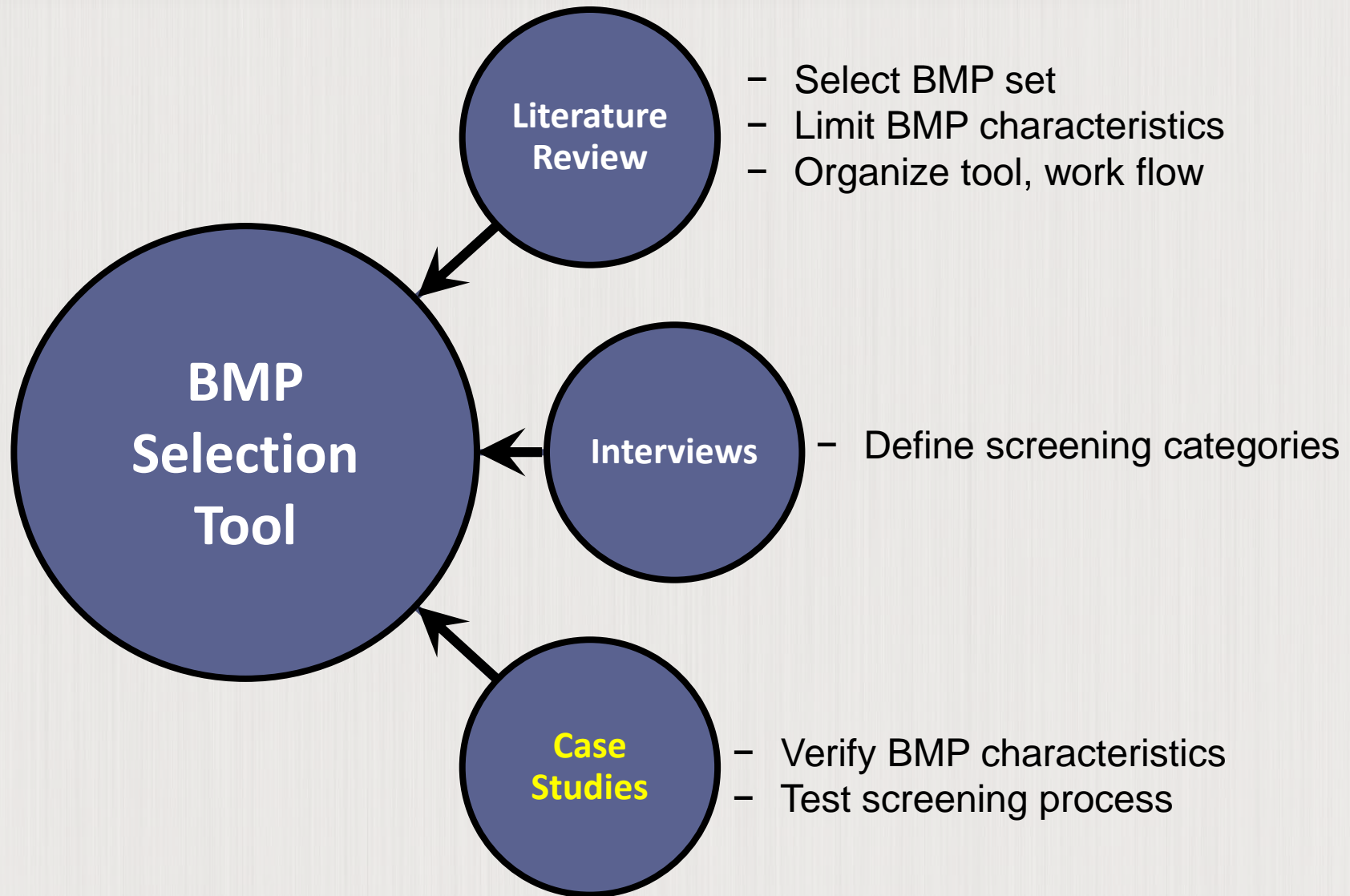


- Interviewee selection basis:
 - Cross section of geographic and roadway applications
 - Broad representation of stakeholder roles and expertise
- Interview execution
 - Initial outreach to 30+ people
 - 23 interviews completed with BMP stakeholders across Ohio

Interview Findings

- Interviewee selection basis:
 - Cross section of geographic and roadway applications
 - Broad representation of stakeholder roles and expertise
- Common themes from interviews
 - Space required for BMPs not considered until late in design
 - Not all designers may have adequate BMP understanding
 - Limited resources available for BMP O&M
 - Implementation hindered due to limited understanding
 - Aesthetics of BMPs are important to Locals and public
- Interview findings integrated into screening questions

Tool Overview – Integration of Research Findings



Selected Case Studies

| BMP Type | Location | Owner |
|------------------------------|----------------|-------------------|
| Bioretention with Underdrain | Northwest Ohio | City of Toledo |
| Constructed Wetland | Northeast Ohio | City of Kent |
| Manufactured Device | Northeast Ohio | City of Green |
| Permeable Pavement | Central Ohio | City of Columbus |
| Vegetated Biofilter/Swale | Northeast Ohio | ODOT (District 4) |



Case Study Elements

- Project background
- BMP functional description
- Design constraints and BMP selection
- Construction lessons learned
- General O&M considerations
- Cost considerations
- Figures
- Site photos

| Basic Project Information | |
|---|--|
| BMP Functions | Water Quality Treatment* |
| Drainage Area Treated | 7.0 acres |
| BMP Design Methodology | Ohio DNR Rainwater and Land Development Manual |
| Location | Northwest Ohio |
| Cost per Impervious Area Treated | \$32,000/acre |
| Owner | City of Toledo |
| Designer | City of Toledo |
| *Water quality treatment not a regulatory requirement for this specific project | |

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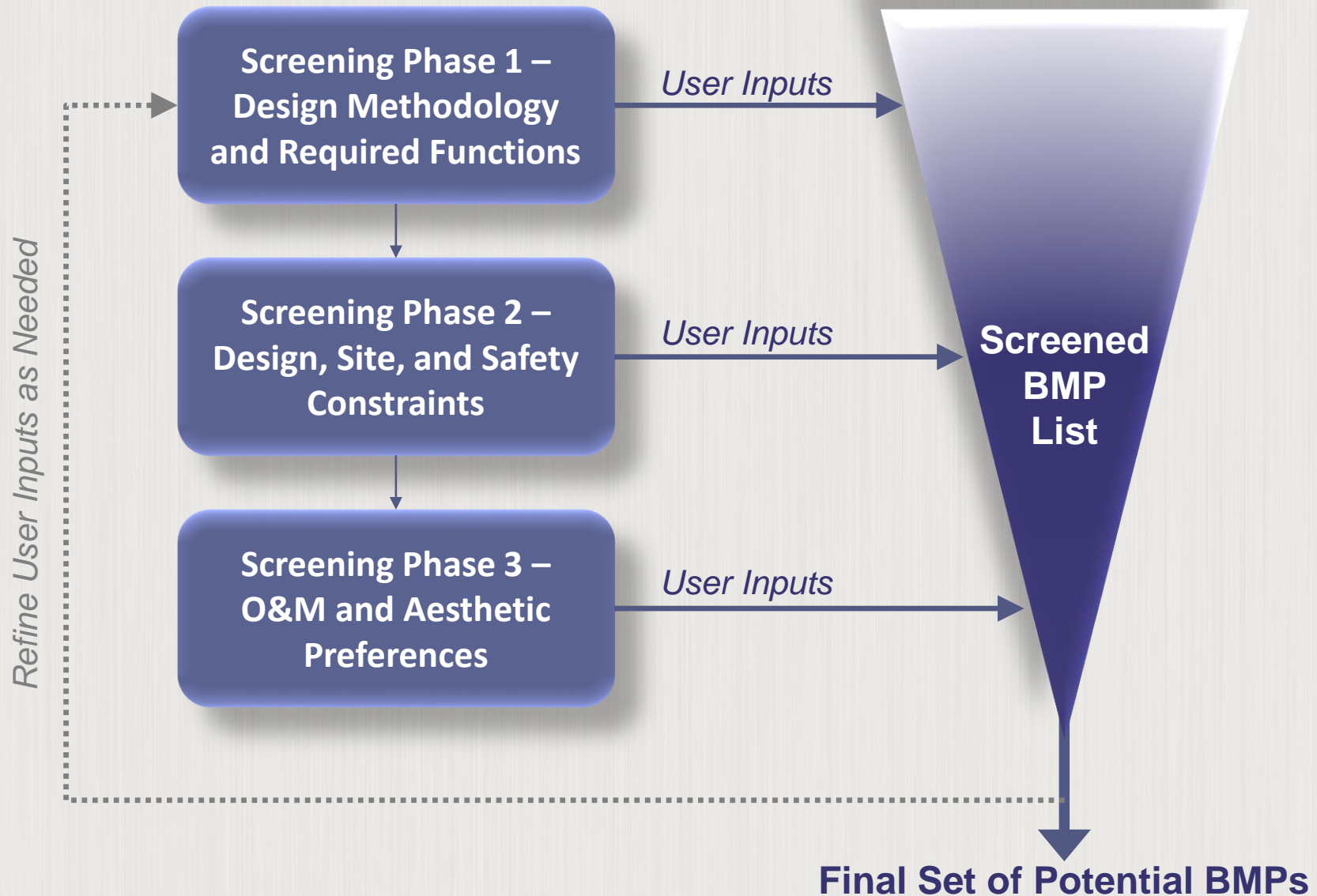
Tool Overview – Notes About Intended Use

- Tool screens BMPs for a single BMP application
- Quality of tool output depends on tool input
- Over-screening is possible, may require iteration
- Engineering judgment required for final BMP selection

Tool Overview – Main Menu

| | |
|------------------------------|---|
| <i>Reference --></i> | <u><i>Detailed BMP Matrix</i></u> |
| <u>Step 1 --></u> | <u><i>Determine Post-Construction Applicability</i></u> |
| <u>Step 2 --></u> | <u><i>Review List of BMPs Included in Tool</i></u> |
| <u>Step 3A --></u> | <u><i>Answer Questions for Screening Phase 1</i></u> |
| <u>Step 3B --></u> | <u><i>Review Screening Phase 1 Results</i></u> |
| <u>Step 4A --></u> | <u><i>Answer Questions for Screening Phase 2</i></u> |
| <u>Step 4B --></u> | <u><i>Review Screening Phase 2 Results</i></u> |
| <u>Step 5A --></u> | <u><i>Answer Questions for Screening Phase 3</i></u> |
| <u>Step 5B --></u> | <u><i>Review Screening Phase 3 Results</i></u> |
| <u>Step 6 --></u> | <u><i>Review Final BMP List After Screening</i></u> |

Tool Overview – 3-Phase Screening Process



SINGLE SCREENING PHASE

USER DATA ENTRY (“A” STEP)

- Define project and site characteristics
- Define preferences and requirements



SCREENING RESULTS (“B” STEP)

- Tool compares user data to BMP limitations
- “Incompatible” BMPs screened out

Tool Overview – Detailed BMP Matrix

- Matrix is database of BMP characteristics
 - 23 BMP-specific rows
 - Variety of characteristic-specific columns
- Used as basis for all screening decisions
- Definition of BMP characteristics
 - From literature review
 - Screening purposes, **NOT** planning and design
 - Specific to Ohio and roadway projects

Tool Overview – Regulatory Applicability

- Added based on interview feedback
- Confirm applicable requirements before BMP screening
- Confirm applicability of CGP
 - Not draining to combined sewer
 - Meets disturbance area threshold
- Confirm if Routine Maintenance exclusion applies

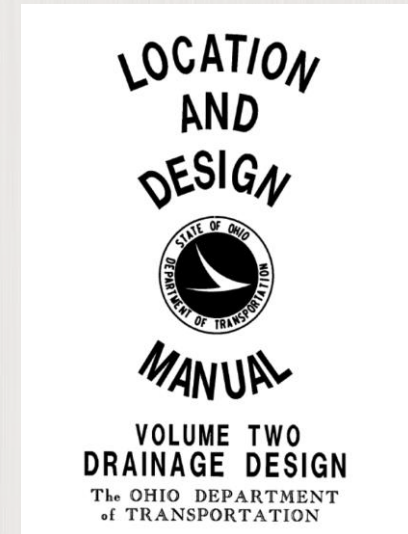


Tool Overview – BMPs Included in Tool

- BMP Categories
 - Underground Systems
 - Linear Systems
 - Basin Systems
 - Pavement Systems
- Regulatory Acceptance
 - ODOT L&D Vol. 2 standard BMPs for quality, quality/quantity
 - CGP pre-approved / “standard” BMPs (CGP Table 2)
 - CGP “alternative” BMPs

Tool Overview – Screening Phase 1 (Step 3A)

- Define initial BMP set / requirements
 - ODOT L&D (quantity / quality control)
 - CGP (standard BMP requirements)
 - “Alternative” BMPs and need for peak flow control
- Identify any additional required BMP functions (outside of those in CGP)
 - Quantity – peak flow limits and runoff volume / infiltration
 - Quality – target pollutants other than TSS



Tool Overview – Screening Phase 2 (Step 4A)

- Technical constraints
 - Siting constraints / available space
 - Hydraulic drop
 - Infiltration constraints
 - BMP inflow methods
- Safety considerations
 - Permanent pool
 - Depth of temporary ponding

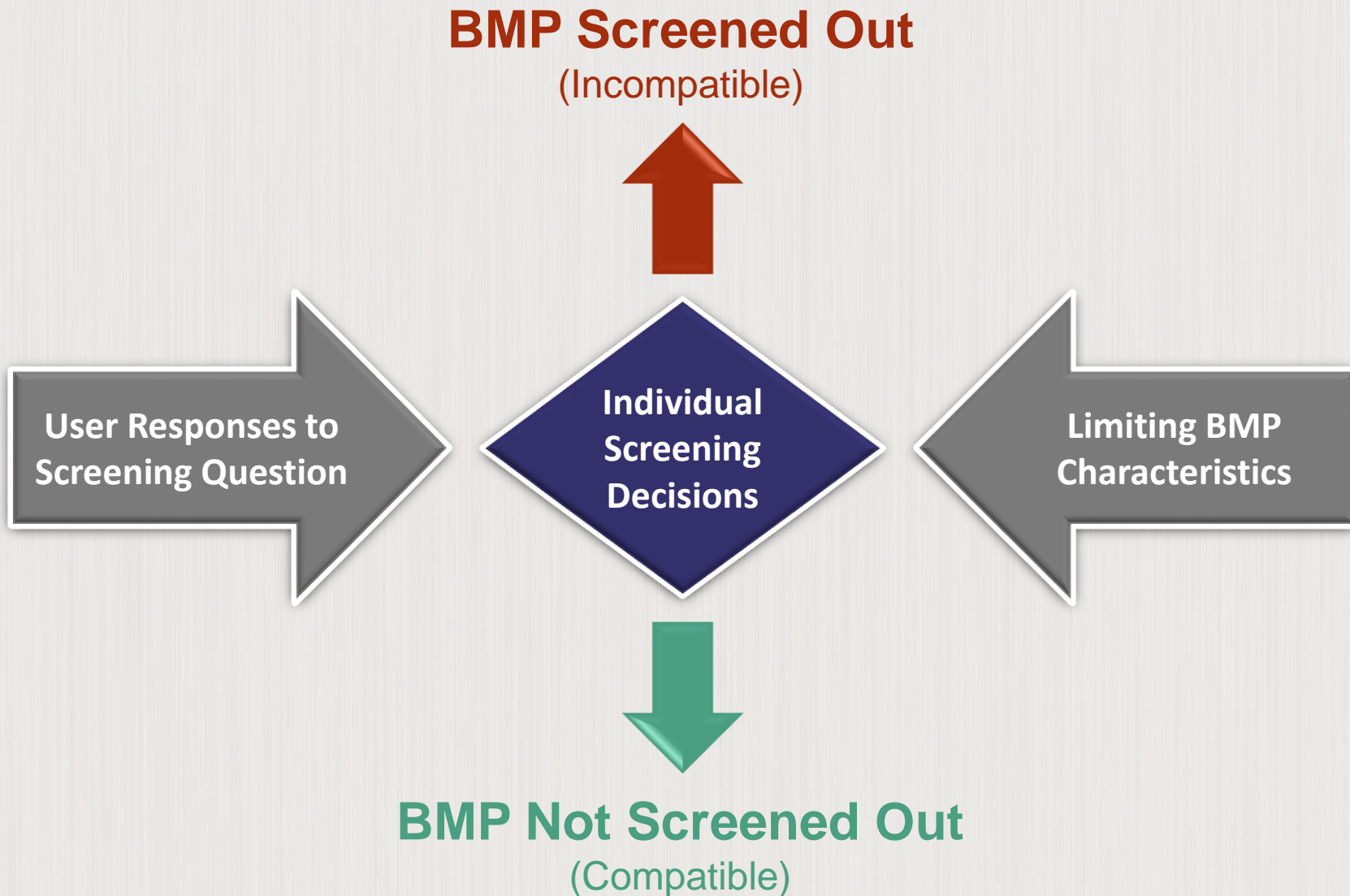


Tool Overview – Screening Phase 3 (Step 5A)

- Operations and maintenance constraints
 - Availability of equipment
 - Confined space entry
 - Level of effort not used in screening – review with results
- Aesthetic preferences
 - Use of native or ornamental plants
 - Subsurface / invisible to public



Tool Overview – Screening Decisions (“B”)



Tool Overview – Screening Decisions (“B”)

BMP Screening Status
Prior to This Phase

Screening Results in
This Phase

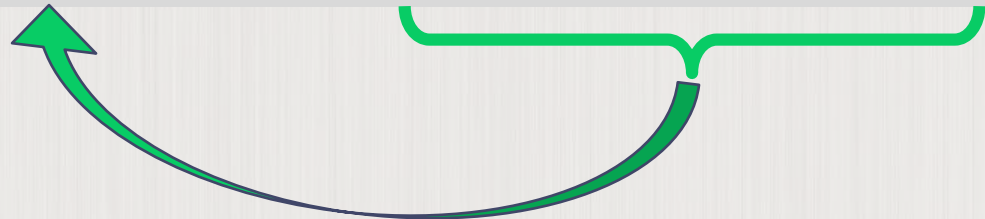
BMP Screening Status
After This Phase

Individual Screening
Decisions in This Phase

Step 5B

implementation. If the remaining pool of BMPs is small, please revisit your responses to A-5A before proceeding to Step 6 to see the final BMP list after screening. Please refer to the updated BMP Matrix for further details.

| Category | Screened BMP List | Previous Results After Phase 2 Screening | Overall Phase 3 Screening Assessment | Compiled Results After Phase 3 Screening | Screening Analysis by Topic | | | | |
|---------------------|---|--|--------------------------------------|--|-----------------------------|----------------|----------------------|-------------------|------------|
| | | | | | O&M (5A.1) | | | Aesthetics (5A.2) | |
| | | | | | Vector truck | Street Sweeper | Confined Space Entry | Native Vegetation | Subsurface |
| Underground Systems | Hydrodynamic Separator | Not Screened Out | Incompatible | SCREENED-OUT | Incompatible | Compatible | Compatible | Compatible | Compatible |
| | Underground Detention and Sedimentation Vault | Not Screened Out | Incompatible | SCREENED-OUT | Incompatible | Compatible | Incompatible | Compatible | Compatible |
| | Modular Manufactured Filtration Systems | SCREENED-OUT | Incompatible | SCREENED-OUT | Incompatible | Compatible | Compatible | Compatible | Compatible |
| | Multi-Chamber Treatment Train | SCREENED-OUT | Incompatible | SCREENED-OUT | Incompatible | Compatible | Incompatible | Compatible | Compatible |
| | Subsurface Bed Filters | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Compatible | Incompatible | Compatible | Compatible |
| | Infiltration Gallery | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Compatible | Incompatible | Compatible | Compatible |
| Linear Systems | Subsurface Flow Wetland | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Vegetated Filter Strip | Not Screened Out | Compatible | Not Screened Out | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Shoulder Media Filter Drain | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Infiltration Trench | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Vegetated Biofilter / Swale | Not Screened Out | Compatible | Not Screened Out | Compatible | Compatible | Compatible | Compatible | Compatible |
| Basin Systems | Wetland Channel | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Bioretention With Underdrain | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Bioretention Without Underdrain | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Constructed Wetland | Not Screened Out | Compatible | Not Screened Out | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Wet Extended Detention Basin | Not Screened Out | Compatible | Not Screened Out | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Dry Extended Detention Basin | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Infiltration Basin | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| Pavement Systems | Surface Bed Filter | SCREENED-OUT | Compatible | SCREENED-OUT | Compatible | Compatible | Compatible | Compatible | Compatible |
| | Permeable Pavement - Infiltration | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Incompatible | Compatible | Compatible | Compatible |
| | Permeable Pavement - Extended Detention | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Incompatible | Compatible | Compatible | Compatible |
| | Permeable Friction Course (PFC) Overlay | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Incompatible | Compatible | Compatible | Compatible |
| | Permeable Shoulder w/ Stone Reservoir | SCREENED-OUT | Incompatible | SCREENED-OUT | Compatible | Incompatible | Compatible | Compatible | Compatible |



Tool Overview – Final BMP List (Step 6)

Screening Phase 1
Results (10 BMPs)

Screening
Results

Final Results After
Three Phases (4 BMPs)

Compare O&M, Cost for
Final Set of BMPs

Step 6 - Review Final BMP List After Screening

GUIDANCE: This tab summarizes the final BMP list after the screening phases. BMPs that were "Not Screened Out" in all three phases of screening meet user-defined criteria in all three phases of screening. If the remaining BMP list is too limiting, users are encouraged to revisit the phases where preferable BMPs were screened out, and confirm user responses to screening questions.

| Category | BMP Name | BMP Tool Screening Results | | | O&M Level of Effort ¹ | Capital Cost Range ² (Per Acre Treated) |
|---------------------|---|--|--|--|----------------------------------|---|
| | | Phase 1 Screening Results (Steps 3A/3B) | Phase 2 Screening Results (Steps 4A/4B) | Phase 3 Screening Results (Steps 5A/5B) | | |
| Underground Systems | Hydrodynamic Separator | Not Screened Out | Not Screened Out | SCREENED OUT | Medium | \$\$ |
| | Underground Detention and Sedimentation Vault | Not Screened Out | Not Screened Out | SCREENED OUT | Medium | \$\$\$\$ |
| | Modular Manufactured Filtration Systems | SCREENED OUT | SCREENED OUT | SCREENED OUT | High | \$\$\$ |
| | Multi-Chamber Treatment Train | SCREENED OUT | SCREENED OUT | SCREENED OUT | High | \$\$\$\$ |
| | Subsurface Bed Filters | SCREENED OUT | SCREENED OUT | SCREENED OUT | High | \$\$\$\$ |
| | Infiltration Gallery | SCREENED OUT | SCREENED OUT | SCREENED OUT | Medium | \$\$\$\$ |
| | Subsurface Flow Wetland | SCREENED OUT | SCREENED OUT | SCREENED OUT | Medium | \$\$\$\$ |
| Linear Systems | Vegetated Filter Strip | Not Screened Out | Not Screened Out | Not Screened Out | Low | \$ |
| | Shoulder Media Filter Drain | SCREENED OUT | SCREENED OUT | SCREENED OUT | Low | \$\$\$ |
| | Infiltration Trench | Not Screened Out | SCREENED OUT | SCREENED OUT | Low | \$\$\$ |
| | Vegetated Biofilter / Swale | Not Screened Out | Not Screened Out | Not Screened Out | Low | \$ |
| | Wetland Channel | SCREENED OUT | SCREENED OUT | SCREENED OUT | High | \$\$\$ |
| Basin Systems | Bioretention With Underdrain | Not Screened Out | SCREENED OUT | SCREENED OUT | Medium | \$\$\$ |
| | Bioretention Without Underdrain | SCREENED OUT | SCREENED OUT | SCREENED OUT | Medium | \$\$\$ |
| | Constructed Wetland | Not Screened Out | Not Screened Out | Not Screened Out | High | \$\$\$\$ |
| | Wet Extended Detention Basin | Not Screened Out | Not Screened Out | Not Screened Out | High | \$\$\$\$ |
| | Dry Extended Detention Basin | Not Screened Out | SCREENED OUT | SCREENED OUT | Medium | \$\$\$ |
| | Infiltration Basin | Not Screened Out | SCREENED OUT | SCREENED OUT | Low | \$\$\$ |
| Pavement Systems | Surface Bed Filter | SCREENED OUT | SCREENED OUT | SCREENED OUT | Medium | \$\$\$\$ |
| | Permeable Pavement - Infiltration | SCREENED OUT | SCREENED OUT | SCREENED OUT | Low | \$\$\$ |
| | Permeable Pavement - Extended Detention | SCREENED OUT | SCREENED OUT | SCREENED OUT | Low | \$\$\$ |
| | Permeable Friction Course (PFC) Overlay | SCREENED OUT | SCREENED OUT | SCREENED OUT | Low | \$ |
| | Permeable Shoulder w/ Stone Reservoir | SCREENED OUT | SCREENED OUT | SCREENED OUT | Low | \$ |

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- **Tool Demonstration**
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Tool Demonstration – Excel

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- ORIL website: <http://oril.transportation.ohio.gov>
 - Stormwater Best Management Practices for Local Roadways
- BMP Tool (Excel file)
- Final Report, including appendices
 - Useful background information
- Executive Summary
- Results Presentation Video

ORIL Research Process

- Sept/Oct: Locals submit research ideas
- Nov/Dec: ORIL Board reviews ideas
- Jan/Feb: Develop RFPs
- Mar/Apr: Researchers submit proposals
- May/Jun: Select researchers



- ODOT Statewide Planning & Research website:
<http://www.dot.state.oh.us/Divisions/Planning/SPR/Research/Pages/default.aspx>
- Current RFP: Assessment of Volume Reduction for Post Construction Stormwater Management
- Particle Size Distribution for Ohio's Runoff
- Waste Management of Street Sweeping and Storm Water Systems
- Exfiltration Trench for Post Construction BMP
- Vegetated Biofilter for Post Construction BMP
- Highway Construction Effect on Runoff Peak and Volume

- Office of Hydraulic Engineering Website:
<http://www.dot.state.oh.us/Divisions/Engineering/Hydraulics/Pages/default.aspx>
- Current L&D Vol. 2
- Design aids
- Standard drawings
- Calculations sheets
- Presentations

Upcoming Training Opportunities

- May 4-6: Ohio Stormwater Association Annual Conference
- April 25 – May 31: ODOT Post Construction BMP Design
 - Day-long class covering BMP design
 - April 25: Columbus
 - April 27: Lebanon
 - May 11: Akron
 - May 23: Columbus
 - May 25: Marietta
 - May 31: Bowling Green

Questions?

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