Final Report

Stormwater Best Management Practices Effectiveness Review

Prepared for

Oregon Association of Clean Water Agencies

May 2005

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CH2MHILL

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Acknowledgements

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SECTION 1

Introduction

This project was initiated by the Oregon Association of Clean Water Agencies (ACWA) in early 2004 to assist member agencies in fulfilling the requirements of National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permits. As described in the Request for Proposals (RFP), the project was intended to:

> *…establish a common basis for assessing and documenting BMP effectiveness for use by Oregon MS4 NPDES permittees in fulfilling the evaluation and reporting requirements of the new and renewed NPDES Phase I stormwater permits, especially in relation to the 303(d) and TMDL water quality related evaluation and reporting elements. In addition to providing support for NPDES Phase I reporting requirements, the product of this project will also provide support for NPDES Phase II stormwater management planning efforts and assessment of BMP effectiveness necessary to comply with stormwater groundwater injection wells under the Oregon Underground Injection Control (UIC) regulations. A guidance tool will be developed to identify the best available information that can be used to efficiently allocate resources in the selection and implementation of BMPs. The guidance tool will also be used to support future BMP monitoring and reporting efforts. Significant gaps in existing available and current information about BMP effectiveness will be identified so that jurisdictions will be able to assess and modify their stormwater program monitoring to address informational needs while making the best use of the significant investment that has already been made to date on BMP evaluations.*

The RFP envisioned the deliverable product to include the following elements:

- *Compiled results of a literature survey that identifies findings from relevant, scientifically valid, and applicable national and other regional studies and scientifically valid local studies regarding the pollutant reduction effectiveness and the construction and operational costs of structural and nonstructural water quality BMPs. The survey will also identify data gaps and limitations.*
- *A database that includes local (i.e., Oregon) BMP monitoring data that has been collected using acceptable QA/QC limits. The acceptable QA/QC parameters and the database platform will be discussed with the Technical Advisory Committee.*
- *A narrative that explains which questions about BMP effectiveness remain unanswered or partially unanswered, prioritizes data needs, and makes recommendations regarding the studies and data necessary to answer those questions. The narrative will also include a recommendation for conducting coordinated statewide monitoring in Oregon to work towards addressing data gaps. The recommendation should address the broad outlines of how to best collect the data (study design, rough number of samples, parameters, BMPs, outfall vs. instream, storm vs. dry runoff, event duration, etc.) and what types of analytical/statistical tools should be used to provide the desired answers. The narrative will stress consistency of data collection analyses and reporting so that BMP effectiveness can be compared side-by-side to the extent possible and/or practical.*
- *A series of charts – likely one per BMP – that show marginal cost per unit of pollutant removed for different types of BMPs and water quality parameters. Costs should include both capital and O&M.*

- *A spreadsheet that calculates pollutant reductions by providing a standard range of pollutant reduction figures and/or effluent qualities for each BMP for a number of water quality parameters, based on acreage or other quantity units to be input by MS4 permittees. The spreadsheet will be accompanied by a narrative and footnotes that describe and justify the pollutant reduction figures associated with each BMP.*

  The tools should be adequate for Phase I permit holders to use as a partial basis for the BMP program effectiveness review required in the MS4 Permit Renewal Submittal (see pending Phase I NPDES MS4 permits).

ACWA established a Technical Advisory Committee (TAC) to help guide the project, and to provide opportunity for regular interaction between the contractor and ACWA as the project proceeded. The project was designed to include several workshops with the TAC. Membership on the TAC was restricted to the ACWA members helping to fund the project, listed in the Acknowledgments section of this report.

This project is intended to provide Oregon municipalities with a common basis for assessing and documenting Best Management Practice (BMP) performance. This information can then be used by the municipalities and others to assist in:

- Development of BMP performance measures
- Development of pollutant reduction benchmarks for TMDL pollutants
- Selection and prioritization of BMPs for inclusion in municipality management plans
- Determination of BMP effectiveness for Underground Injection Control (UIC) requirements

SECTION 2

Project Description

This section provides a detailed description of project evolution, methodology, and database development. Data gaps and recommendations for future monitoring are summarized.

Project Evolution

This project evolved through a series of steps, including developing BMP and parameter lists for the BMP effectiveness review, conducting a TAC member survey, and evaluating survey results.

Best Management Practice and Parameter Lists

An initial task for the project was to determine the BMPs and parameters to include in the literature review for BMP effectiveness.

BMP List

The TAC developed a list of BMPs to be included in the literature review. This list was considered a balance between all possible BMPs and a manageable number to include in the project. The final TAC-approved BMP list is presented in Table 2-1.

TABLE 2-1
Final BMP List for Effectiveness Review

BMP Category	BMP
Operations and Maintenance	Street sweeping
	Leaf/needle pickup
	Catch basin cleaning
	Sediment manhole cleaning
	Line maintenance
	Pollution reduction maintenance procedures
	Facilities maintenance inspection and enforcement
	Illicit discharge prevention and control (includes spills)
	Landscape management
Structural	Catch basin type
	Filters (sand/leaf/other media)
	Centrifugal Separator
	Sediment manhole
	Drain inlet devices (wool/cloth/other—such as absorbent mats/bags and filter bags)
	Oil/water separator
	Soakage trenches/infiltration basins
	Vegetative swales

TABLE 2-1
Final BMP List for Effectiveness Review

BMP Category	BMP
	Filter strips
	Wet ponds
	Dry ponds
	Constructed wetlands
	Planters (flow-through and infiltration)
Site Design/Building Code	Green roofs
	Porous pavement
	Tree planting
	Impervious surface reduction
	Commercial vehicle washing/fueling/loading
	Mobile commercial washing controls (vehicle/building)
	Water-way setback/riparian protection
Education	Public education
	(Two-phase approach: high-level screening first, followed by refinement and prioritization)*
Erosion Prevention	Erosion prevention and sediment control for construction

*Following literature review, the TAC requested modification to the pollutant loadings model PLOAD to include consideration of watershed-wide activities, such as public education. This modification was made to the version of PLOAD developed for this project. See Page 2-6.

Parameter List

As a first cut, any parameter included in any total maximum daily load (TMDL) or 303(d) list for any of the TAC member jurisdictions was included in the overall list. This list was then expanded to include some additional pollutants. The issue of surrogates for some pollutants was discussed by the TAC, as discussed in the next subsections.

Metals. TAC agreed to focus on the major metals of concern: Lead (Pb), Copper (Cu), Zinc (Zn), Cadmium (Cd), Chromium (Cr), Nickel (Ni), Manganese (Mn), and Iron (Fe).

TPH. TAC discussed how total petroleum hydrocarbon (TPH) has been used as a surrogate for such things as organic solvents. Overall, the TAC decided to include TPH in literature review.

Temperature. Temperature is not a stormwater issue; however, some BMPs can be beneficial for temperature. Supporting literature was requested.

DO. Dissolved oxygen (DO) issues are the result of other pollutants. Therefore, the TAC removed DO from the list.

Flow. This parameter was requested to be on the list because it is an “overlay” of controlling other pollutant loads.

Dieldrin and Aldrin. The TAC decided to not use TSS or turbidity as a surrogate for dieldrin because that approach was not successful in the Johnson Creek TMDL analysis. Therefore, dieldrin (and aldrin) was added to the list.

The final TAC-approved parameter list is presented in Table 2-2.

TABLE 2-2
Final Parameter List for Effectiveness Review

Metals (dissolved, total recoverable)—Focus on Pb, Cu, Zn, Cd, Cr, Ni, Mn, Fe
Mercury
Arsenic
Phosphorus, Total (maybe also ortho)
Nitrate
Bacteria (fecal coliform, E. Coli)
Temperature
Total Suspended Solids (also surrogate for DDT)
Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Organic Carbon
Turbidity
Total Petroleum Hydrocarbons
Poly Aromatic Hydrocarbons
Polychlorinated Biphenyls
Dieldrin/Aldrin
Dioxin
BTEX (benzene, toluene, ethyl benzene, xylene)
Flow

Effluent Concentration as BMP Effectiveness Measure

An early discussion by the TAC dealt with the appropriate measure to use for the project's analysis of BMP effectiveness. The "traditional" measurement of effectiveness is percent removal—that is, how much of a pollutant, expressed as a percentage, is removed by a particular BMP. As the TAC discussed, recent information (Strecker et al., 2004) indicates that a more robust measure of BMP effectiveness is actually the effluent concentration, or the concentration of a pollutant exiting a particular BMP. This implies that the effluent concentration of a pollutant is somewhat independent of the influent concentration. The TAC recommended that effluent concentration be the preferred measurement of BMP effectiveness. The final database produced for the project contains information expressed both as percent removal and as effluent concentration.

TAC Member Survey

Early in the project a survey was conducted of TAC members to help guide the literature review and BMP effectiveness database construction. The survey asked the following questions.

1. Do you have suggestions and guidance for BMP studies from the Pacific Northwest and California to include in the review?

2. What types of BMP information will be of most use to your stormwater management program? Please select the five most useful items from this list, and add any others:

   - Effectiveness at reducing pollutants
   - Effectiveness at achieving desired effluent quality
   - Effectiveness at reducing discharge volumes
   - Importance of and description of relevant physical variables
   - Costs to implement, operate and maintain
   - Lifecycle costs
   - Ease of maintenance
   - Constructability
   - Regulatory acceptability
   - Public perceptions
   - Side benefits/impacts
   - Applicability
   - Cost of measuring effectiveness
   - Anecdotal comments/observations/cautions with respect to design, construction, operation or maintenance

3. Would you prefer the database to be in Microsoft *Access*® or *Excel* or another format?

Survey Results

Several TAC members provided suggestions and guidance for BMP studies. All of these studies were included in the literature review. The five "most useful items" requested for a focused literature review were:

- Effectiveness at reducing pollutants
- Effectiveness at achieving desired effluent quality
- Effectiveness at reducing discharge volumes
- Importance of and description of relevant physical variables
- Costs to implement, operate, and maintain

The TAC determined that *Access* was an appropriate platform for the BMP Effectiveness database. A survey of TAC members showed that all members had *Access 2000* or a later version.

A summary of responses to the survey is included in Appendix A.

Literature Review

A total of 48 references were reviewed for the study (see Appendix B). These references were gathered from the following sources:

- TAC Team
- CH2M HILL library and personnel
- Library search
- On-line search

The literature review focused on relevant, scientifically valid, and applicable national and other regional studies and scientifically valid local studies regarding the pollutant reduction effectiveness and the construction and operational costs of the applicable BMPs. Only 17 of the 48 references contained percent removal or effluent concentration data, or cost data applicable to the BMPs and constituents in this study. Most of these references are compilations of BMP studies. The data from these 17 references were input into the database (discussed in the next subsection).

BMP Effectiveness Database

Research summaries from the literature review are presented in *Access* format. Any BMP study that provided percent removal or effluent concentration data was included. Each study is categorized according to BMP category (operations and maintenance, structural, site design/building code, education, and erosion prevention). Included in each BMP study summary (provided the information was available) are general site and location information, bibliographic information, and percent removal and effluent concentration data for constituents on the final parameter list. Percent removal and effluent concentration data are provided as presented in the study: mean, median, high, and low. Also included is any information found in the studies regarding the five "most useful items" requested for a focus of review (as decided in the survey discussed above):

- Effectiveness at reducing pollutants
- Effectiveness at achieving desired effluent quality
- Effectiveness at reducing discharge volumes
- Importance of and description of relevant physical variables
- Costs to implement, operate, and maintain

The database includes 310 BMP effectiveness studies, and 47 cost-related studies (note that some studies overlap across BMP category). There are four options, presented on the opening page of the database, in which to navigate through the database:

1. *Browse BMPs by BMP*—Allows the user to search for BMP studies according to BMP category. This pathway leads to all relevant information about each study, as well as percent removal or effluent concentration, or cost data.

2. *Browse BMPs by Constituent*—Allows the user to search for BMP study by constituent. Data and study information are presented in a spreadsheet format.

3. *References*—References BMP studies that provide percent removal or effluent concentration data, or cost data applicable to the BMPs and constituents in this study. A link to the reference is provided, if available. Information on the reference's quality control (QC) procedure is presented.

4. *Set Up Data and Codes*—Allows the user to add, remove, or change BMP studies, constituents, BMPs, references, and any additional information in the database.

The *Access* format allows users to extract specific data, perform statistical analysis, and enter additional study data. Ultimately, this database allows the user to extract the necessary data for use in PLOAD.

A draft version of the database was delivered to ACWA in December 2004. The final database was delivered to ACWA in March 2005.

PLOAD Model

Description

PLOAD is a GIS-based model that CH2M HILL has developed for EPA to calculate pollutant loadings. PLOAD is more robust than typical spreadsheet tools, and it estimates sources of pollution on an annual average basis for any user-specified pollutant. PLOAD will integrate with the database of BMP information that is being developed for this project. The PLOAD model will enable ACWA members to estimate pollutant loadings resulting from future development, and it will also assess the water quality improvements that may be achieved through implementation of BMPs. The inputs to PLOAD include:

- GIS land use data
- GIS basin delineation
- GIS BMP site and drainage delineation
- GIS point source location
- Land use pollutant loading rates or Event Mean Concentrations (EMCs)
- Land use impervious surface factor tables
- BMP pollutant reduction/effectiveness factors
- Annual rainfall amounts

PLOAD will evaluate pollutant loads for the specified basins with or without BMPs. After the pollutant loads have been determined, PLOAD may be used to generate a variety of graphic plots. Listed below are the product options.

- Total Pollutant Loads by Basin—Map and Table
- Pollutant Loads Per Acre by Basin—Map and Table
- Event Mean Concentration (EMC) by Basin—Map and Table

PLOAD Customization

The public domain version of PLOAD is based on Arc View 3.2. A survey of TAC members revealed that all jurisdictions were using Arc GIS 8.x, and all had either updated to 9.0, or were planning to in the near future. The TAC therefore decided to pursue obtaining PLOAD in Arc GIS 9.0.

The following tasks were added to the project scope:

- Migrate PLOAD to Arc GIS 9.0
- Develop ACWA Modules—effluent concentration and flow reduction

ACWA PLOAD Modifications

The TAC requested that PLOAD modifications be developed for the following scenarios: BMPs in series, and watershed-wide activities (street sweeping, education). These modifications are described in the PLOAD User's Manual.

PLOAD License

A license agreement was negotiated between CH2M HILL and ACWA, which licensed the basic PLOAD model to ACWA for its use, and also describes the ACWA Modules as owned by ACWA. The license agreement is included in Appendix C.

PLOAD Deliverables

A beta version of PLOAD version 5.0 with ACWA Modules was delivered to ACWA in late December 2004.

Patches to improve the performance of PLOAD were issued on February 10, February 22, and March 14, 2005.

The final PLOAD version 5.0 with ACWA Modules was delivered to ACWA on April 29, 2005.

Data Gaps and Recommendations for Future Monitoring

The literature review showed that limited data are available to evaluate the performance of many BMPs. This scenario presents a challenge nationally for selecting BMPs and defending requirements to use them.

Analysis

The entire database was analyzed to identify the BMPs that have seldom, or never, been monitored and the constituents that are infrequently sampled in monitoring studies. To analyze these data gaps, a table was prepared for each constituent on the final parameter list (a total of 42 constituents). Each table contains an evaluation of the constituent versus the BMPs. A summary of these tables was also prepared to evaluate the following factors for all constituents and BMPs evaluated for this project (see Appendix D for tables):

- All data
- Data for conventional pollutants (BOD, COD, TOC, E. coli, fecal coliform, flow, nitrate, temperature, TP, TPH, TSS, and turbidity)
- Data for metals (Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, and Zn)
- Data for organics (aldrin, dieldrin, dioxin, BTEX, PCB, and PAH)
- Likelihood of obtaining additional information
- Relative ease of obtaining new monitoring results
- Prevalence of current use of BMP (this information was collected by a vote taken at the 01/28/05 meeting)
- Critical emerging BMP (this information was collected by a vote taken at the 01/28/05 meeting)

Results

The literature review component of this project included a thorough review of all available resources that contain performance data of BMPs. As such, the likelihood of obtaining additional information at this time is low in all cases. In addition, the relative ease of obtaining new monitoring results is expensive in a majority of the cases. No studies, and therefore no data, were available for the following BMPs:

TABLE 2-3
BMPs – No Effectiveness Data

Leaf/Needle Pick-up	Illicit Discharge Prevention and Control
Sediment Manhole Cleaning	Landscape Management
Line Maintenance	Tree Planting
Pollution Reduction	Impervious Surface Reduction
Maintenance Procedures	Waterway Setback/Riparian Protection
Facilities Maintenance	Mobile Commercial Vehicle Washing Controls
Inspection and Enforcement	

The only constituents not provided in a study were BTEX and PAHs.

At the January 28, 2004, TAC meeting, with 11 jurisdictions present, TAC members voted on whether the BMPs in the literature review were widely used, or were a critical emerging technology. These voting results are available in Appendix D. The TAC identified BMPs that are widely used (six or more ACWA jurisdictions implement or are planning to implement), or are critical emerging technologies (six or more votes) for which there is no available performance data for conventional pollutants. The identified BMPS present the greatest need for research, as follows:

TABLE 2-4
BMPs from Table 2-3 – Widely Used or Critical Emerging Technology

Leaf/Needle Pick-up	Inspection and Enforcement
Sediment Manhole Cleaning	Illicit Discharge Prevention and Control
Line Maintenance	Tree Planting
Pollution Reduction	Impervious Surface Reduction
Maintenance Procedures	Waterway Setback/Riparian Protection
Facilities Maintenance	

Pollution Reduction, Illicit Discharge Prevention and Control, Tree Planting, Waterway Setback/Riparian Protection and *Leaf/needle Pick-up* pose significant challenges in terms of the cost or the ability to isolate effects and detect changes as a result of a BMP.

Beyond these priorities, there are many BMPs that lack monitoring data for metals or organics. These represent a second tier in terms of priorities for research.

Table 2-5 presents the summary of the literature review and includes information on the TAC voting described above.

Suggested Priorities for Research

Below are suggested priorities for research by the jurisdictions.

1. Widely used or emerging BMPs for which no data exists, even for conventional pollutants. If these technologies are tested, also obtain data on metals and organics.
2. BMPs missing data for key regulatory parameters required by all jurisdictions monitoring programs or widely included in 303d lists and TMDLs.
3. BMPs missing data for key regulatory parameters required by individual jurisdictions monitoring programs.

It would be valuable for stormwater managers in Oregon to obtain additional information on the performance of certain stormwater BMPs to facilitate more informed decisions and substantiate the BMP value when requirements for BMPs are challenged.

There are several advantages to having an independent research organization such as a university or a professional society conduct the research. University research may be more independent and objective and the results are subjected to formal, professional peer review. Research conducted by a research organization typically has better quality assurance and control. The results are typically more widely distributed and available than if an individual agency conducts the research. A mechanism to pool financial resources and contract for the research to such an organization would be helpful (for example, ACWA). In Washington State, the American Public Works Association Stormwater Managers Committee identified these issues, applied for an initial grant from the Department of Ecology, and created the Center for Urban Water Resources in 1990. A primary mission of the Center is to conduct research on the performance of stormwater BMPs. The Center has been valuable and has become nationally recognized. (Note: The Center for Urban Water Resources has since merged with the Center for Streamside Studies to become the Center for Water and Watershed Studies. It is currently in the process of changing names again to become the Water Center.) The local needs of Oregon are also shared across the country. Therefore, it would be appropriate to conduct such research by pooling financial resources nationally.

Limitations in data exist and always will. However, there is enough information to make reasonable decisions and apply BMPs in most cases—the limitations in data need not be an excuse to not act.

FIGURE 2-5
BMP Data Gap Summary Table

		BMP											
		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Summary of 42 spreadsheets													
No data					X		X	X	X	X	X	X	X
No data (Conventional[1])					X		X	X	X	X	X	X	X
No data (Metals)					X		X	X	X	X	X	X	X
No data (Organics[2])		X	X	X	X	X	X	X	X	X	X	X	X
Ease of Filling Data Gap													
likelihood of finding good existing data	high or low	low	low	low	low	low	low	low	low	low	low	low	low
level of effort to obtain data (difficulty/expense of conducting study)	high, med or low	med	med	med	high	med	med	med	high	high	high	med	high
BMP Issues													
prevalence of BMP use	votes[3]	2	7	11	7	11	9	9	9	1	11	8	10
critical emerging BMP technology	votes[3]	8	4	2	1	0	4	0	2	9	0	9	5

		BMP											
		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Summary of 42 spreadsheets													
No data		X											
No data (Conventional[1])		X											
No data (Metals)		X			X								
No data (Organics[2])		X		X	X	X	X	X	X		X	X	X
Ease of Filling Data Gap													
likelihood of finding good existing data	high or low	low	low	low	low	low	low	low	low	low	low	low	low
level of effort to obtain data (difficulty/expense of conducting study)	high, med or low	high	med	med	med	med	med	med	med	med	med	med	med
BMP Issues													
prevalence of BMP use	votes[3]	1	2	6	3	9	3	8	1	8	8	2	0
critical emerging BMP technology	votes[3]	4	2	4	5	0	2	2	7	2	1	0	0

		BMP										
		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Summary of 42 spreadsheets												
No data						X	X		X	X		
No data (Conventional[1])						X	X		X	X		
No data (Metals)						X	X		X	X	X	
No data (Organics[2])		X	X	X	X	X	X	X	X	X	X	X
Ease of Filling Data Gap												
likelihood of finding good existing data	high or low	low	low	low	low	low	low	low	low	low	low	low
level of effort to obtain data (difficulty/expense of conducting study)	high, med or low	med	med	med	med	high		med	med	high	high	med
BMP Issues												
prevalence of BMP use	votes[3]	6	1	1	3	9	3	0	2	9	10	11
critical emerging BMP technology	votes[3]	1	8	7	7	5	6	3	2	6	3	1

[1] Conventional: BOD, COD, TOC, E. Coli, Fecal, Flow, Nitrate, Temperature, TP, TPH, TSS, Turbidity
[2] Organics: Aldrin, Dieldrin, Dioxin, BTEX, PCBs, PAHs
[3] A vote was taken at the 01/28/05 ACWA meeting. Each vote represents a jurisdiction.

Conducting research will require careful thinking, clear definition of goals, definition of how the information will shape management decisions, and a research work plan. The research work plan should include:

- Background
- Goals

- Sample locations
- Parameters
- Schedule
- The number of samples and how they should be collected
- Target storm events and ambient conditions to be sampled
- How samples will be analyzed in the laboratory
- How data will be evaluated
- Plan for mobilization and demobilization
- Detailed and thorough Quality Assurance and Quality Control Plan

The number of events and samples collected is determined by a statistical analysis of the variability in the parameters being evaluated. The more variability in results, the more samples are required. Often, approximately 20 events are required for most stormwater parameters. Sampling should include individual runoff events and should allow annual loading estimates to be identified.

EPA and ASCES have published guidance on stormwater BMP monitoring. This guidance describes the monitoring phases as follows:

- Phase 1: Determine the objectives and scope of your monitoring program
- Phase 2: Develop the monitoring plan in view of your objectives
- Phase 3: Implement the monitoring plan
- Phase 4: Evaluate and report the results of monitoring

The Washington State APWA Stormwater Managers Committee has developed a detailed testing protocol for monitoring BMPs and their protocol has been adopted by the Department of Ecology (available on the Ecology Web site at http://www.ecy.wa.gov/biblio/0210037.html).

Summary of Project Workshops

A series of nine project workshops were conducted in 2004 and early 2005.

Workshop 1: April 28, 2004

The first project workshop with the TAC provided an introduction to the project, and initial work to identify the BMPs and pollutants of concern to include in the literature review. Following the workshop, the list of BMPs and pollutants was further refined through e-mail correspondence.

Workshop 2: May 26, 2004

At this workshop the BMP and pollutant lists were further refined, and the final TAC-approved lists are presented in Tables 2-1 and 2-2.

Workshop 3: June 8, 2004

This workshop focused on a demonstration of the proposed tool for municipalities to use to estimate pollutant loads. This tool, a GIS-based model known as PLOAD, was developed by

CH2M HILL and is included in EPA's BASINS package. The workshop also included a discussion of the database to be used for the BMP effectiveness data management.

At this workshop, the issue of the actual measure of BMP effectiveness to be used in the project was discussed—specifically whether effectiveness should be expressed as % removal, or as effluent concentration. A sub-committee was formed to investigate this issue further, and make recommendation to the TAC.

Workshop 4: June 23, 2004

This workshop was with the sub-committee formed to investigate the effectiveness measure (percent removal or effluent concentration). The subcommittee recommended the use of effluent concentration.

Workshop 5: August 3, 2004

The developing *Access* database of BMP effectiveness data was reviewed at this workshop. The workshop also included a discussion of the options available for upgrading PLOAD to Arc GIS versions 8.3 or 9.0 (Current public domain version is in Arc View 3.2), and the options for modifying PLOAD to accommodate BMP effectiveness expressed as effluent concentration, and also include consideration of flow reduction in certain BMPs.

Workshop 6: September 3, 2004

This workshop, attended by agency GIS staff, presented additional information on PLOAD, designed to familiarize the GIS staff with PLAOD, and the work necessary to prepare to use PLOAD.

Workshop 7: September 30, 2004

This workshop included an update of the literature review, a discussion of QA/QC issues and data gaps, and a status report on PLOAD customization issues. The future training workshop on PLAOD was also discussed.

Workshop 8: December 14, 2004

This workshop consisted of a training session on PLOAD. The training session was conducted in a computer lab setting, and was split into two sessions—one focusing on GIS staff, and the second focused on water quality professionals.

Workshop 9: January 28, 2005

This workshop consisted of further discussion of PLOAD and the BMP Effectiveness Database, and evaluation of BMP effectiveness data gaps and TAC recommendations.

SECTION 3

References

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APPENDIX A
TAC Member Survey

Appendix A

TAC Member Survey

Survey Question	
1. Do you have suggestions and guidance for BMP studies from the Pacific Northwest and California to include in the review?	
Survey Participant Affiliation Phone Number Email	**Answer**
Andrew Swanson Clackamas County 503.353.4598 andrews@co.clackamas.or.us	a) ACWA UIC BMP Effectiveness Monitoring Study (to be published later in June 2004) b) The big ODOT-GeoSyntec study (Frank Wildensee, Janet "G" and many others know quite a bit about this one) c) ACWA UIC BMP Manual (published January 2003). While this isn't a "BMP study", it contains a very good selection of BMPs and BMP-related information. d) WERF report 97-IRM-2. It pertains to metals removal technologies for urban stormwater. I've pasted a screen print from the report into a separate Word file that's attached to this survey's email message. I have the full report, but it was too large (8.33 MB) and I couldn't email it to you.
Chuck Gottfried City of Springfield 541.736.1023 cgottfried@ci.springfield.or.us	Only that it should be broad. I know URS-Woodward-Clyde did a lot of this years ago, but don't know where the studies live now.
Ken Lanfear City of Florence 541.997.2141 ken.lanfear@ci.florence.or.us	King County or Puget Sound generally should be a hotbed of research, implementation.
Kim Peoples Multnomah County 503.988.3043 kim.e.peoples@co.multnomah.or.us	No.
Ollie Fick City of Bend 541.317.3000 ofick@ci.bend.or.us	I don't think we should limit the scope of our investigations to the West or PNW. A lot of good work has been done in other areas of the US as well as abroad. The challenge is to figure out which information is of acceptable quality and applicable to conditions in Western and Eastern Oregon. Caltrans has done a lot of work on BMPs and most of its studies are of pretty good quality. Same is true of the Washington State Dept of Transportation.
Steve Downs City of Salem 503.588.6211 sdowns@cityofsalem.net	ASCE, studies with effluent conc. Data
Theresa Walch City of Eugene 541.682.6839 Therese.Walch@ci.eugene.or.us	I assume that CH2MHill's literature review will include the International BMP Database, the Center for Watershed Protection BMP Database, and the EPA/ASCE BMP Database. For the Pac Northwest, I'm not aware of formal studies or databases, but check with the larger municipalities (e.g. Portland, Seattle) and those smaller ones with robust stormwater programs (e.g. Bellevue, Santa Barbara) for information on BMP effectiveness.
Jan Miller Clean Water Services 503.681.4493 millerj@cleanwaterservices.org	I will attach an annotated bibliography that the DMAs paid URS to do for us in preparation for the nonpoint source plans that some of the DMAs developed. There may be some useful information in the book that Gary Minton wrote titled: Stormwater Treatment Biological, Chemical & Engineering Principles by Gary Minton, I have a copy if you would like to borrow it. Stormwater Management Planning: A Guidebook for British Columbia may have information that will be helpful.

Survey Question	
1. Do you have suggestions and guidance for BMP studies from the Pacific Northwest and California to include in the review?	
Survey Participant **Affiliation** **Phone Number** **Email**	**Answer**
Lynne Kennedy City of Gresham 503.618.2634 Lynne.Kennedy@ci.gresham.or.us	Info from Lynne & Eric (mostly Eric): You'll probably get the same info regarding the first two studies mentioned below from Jan Miller since the work I know of was done for Jan by URS. URS/Geosyntec did a report on TMDLs for Washington County/Clean Water Services that includes a chapter called "Analyses of the Expanded EPA/ASCE International BMP Database and Potential Implications for BMP Design." URS also put together some information for Washington County/Clean Water Services regarding the effectiveness of BMPs that treat pollutants that are 303(d) listed or have TMDLs in the Tualatin. The ACWA UIC BMP Effectiveness Study, just recently pulled together by Geosyntec. This data is somewhat limited due to the number of storm events collected to date. WashDOT has done some side to side comparison monitoring of different BMPs using highway runoff as influent. ODOT has been monitoring runoff from some of its BMPs. GeoSyntec has been assisting ODOT with this work. City of Portland Swale Study (at BES Lab). City of Eugene Bertleson Slough Monitoring Study (wetland treatment). This monitoring was completed as a part of the NPDES Phase I Characterization Monitoring (Stations I1 and I2, I think). City of Seattle has been monitoring their Green Streets project. We have not seen a report. Rich Horner might be the contact person for this data. He would also be good to interview regarding other BMP performance studies. The Port of Seattle may have some monitoring data for BMPs There is likely some performance data in Spokane for their "208" swales. Note from Krista and Eric: The report that we did for Washington County/CWS (mentioned above) has an annotated bibliography. This bibliography includes important BMP studies that we targeted, including a few from Portland, ODOT and WERF for example. It seems these would be good to include. Roger Bannerman from Wisconsin DNR (banner@dnr.state.wi.us) has completed a comprehensive street sweeping study that was actually able to see an observed statistical difference in end-of-pipe water quality due to street sweeping. We do not have a copy of the study, but Eric has seen the presentation of this work at a conference. Bob Pitt would be a good person to just call and ask about studies. I think he has done one on catch basin filters as well, and illicit discharge elimination programs. He also (long ago) assisted Bellevue with much of their BMP monitoring programs. I would ask Mark Jockers about public education studies. Caltrans is another huge source of BMP studies. For example, they have done a lot of looking at catch basin cleaning and street sweeping. Most of these studies have been entered into the International BMP Database.
Frank Wildensee City of Portland 503.823.2926 Frankw@bes.ci.portland.or.us	I know Gary Minton in Seattle has been compiling data from the Pacific NW for the past few years. I have seen some of it he presented in the newsletter "Stormwater NW". A far as I know he has most of the data from the City of Portland and Clean Water Services.
Charles Logue Clean Water Services 503.681.3604 loguec@cleanwaterservices.org	

Survey Question

2. What types of BMP information will be of most use to your stormwater management program? Please select the 5 most useful items form this list, and add any others.

	Effectiveness at reducing pollutants	Effectiveness at achieving desired effluent quality	Effectiveness at reducing discharge volumes	Importance of and description of relevant physical variables	Costs to implement, operate, and maintain	Lifecycle costs	Ease of maintenance	Constructability	Regulatory acceptability	Public perceptions	Side benefits/impacts	Applicability	Cost of measuring effectiveness	Anecdotal comments/ observations/ cautions with respect to design, construction, operation or maintenance	Relationship between sizing and effectiveness (Note: this was added by Frank Wildensee)
Votes	**8**	**8**	**6**	**6**	**10**	**2**	**5**	**1**	**5**	**2**	**0**	**2**	**2**	**2**	**1**
Andrew Swanson	X	X	X		X					X					
Chuck Gottfried	X			X	X		X		X			X			
Ken Lanfear	X			X	X				X	X					
Kim Peoples		X			X		X		X				X	Volume of discharges being effected	
Ollie Fick	X	X	X	X	X										
Steve Downs		X		X	X	X	X		X						
Theresa Walch	X		X	X	X						X				
Jan Miller	X	X	X	X -Does this mean soil types that work -Rainfall patterns that it is designed to capture -Slope -Size of facility -Frequency of application (like street sweeping)	X		X in magenta		X in magenta						

Survey Question

2. What types of BMP information will be of most use to your stormwater management program? Please select the 5 most useful items form this list, and add any others.

	Effectiveness at reducing pollutants	Effectiveness at achieving desired effluent quality	Effectiveness at reducing discharge volumes	Importance of and description of relevant physical variables	Costs to implement, operate, and maintain	Lifecycle costs	Ease of maintenance	Constructability	Regulatory acceptability	Public perceptions	Side benefits/impacts	Applicability	Cost of measuring effectiveness	Anecdotal comments/ observations/ cautions with respect to design, construction, operation or maintenance	Relationship between sizing and effectiveness (Note: this was added by Frank Wildensee)
Lynne Kennedy	3	1	2	5 One should at least get information on the size relative to the average size storm event and/or average rainfall intensity. Information on Bypass is also important.	4 Cost to install, implement, operate, and maintain (This really is the same as life-cycle costs.) Need to be very careful as costs can be tricky. For example, I would look for "additional" costs. Let's say that land-scaping was planned for an area anyway. The cost to implement would really be the difference between what the land-scaping would have cost and the swale con-struction cost. One has to be very careful about cost information.											
Frank Wildensee	X	X	X		X										X
Charles Logue	X	X	X	X	X	X	X	X				X	X	X	

APPENDIX B
Literature Review References

APPENDIX B

Literature Review References

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APPENDIX C

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LICENSE AGREEMENT

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RECITALS

Whereas, Licensor has developed PLOAD software, which is a GIS-based model to calculate pollutant loads for watersheds.

Whereas, ACWA desires to obtain a license to use Licensor's PLOAD software;

Whereas, ACWA desires to obtain a license for each ACWA Member (as defined below) to use Licensor's PLOAD software.

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option (a) repair or replace the non-conforming Licensed Software, or (b) refund the license fee paid under this Agreement and the service fees attributable to the Licensed Software paid under the Professional Services Agreement upon ACWA's return of the Licensed Software and Licensed Documentation and terminate this Agreement upon written notice.

6.3 In the event the PLOAD Modules fail to conform to the warranty set forth in Paragraph 6.1 and ACWA notifies Licensor of the noncompliance in writing, Licensor shall at its option (a) repair or replace the non-conforming PLOAD Modules, or (b) refund the service fees attributable to the PLOAD MODULE paid under the Professional Services Agreement..

6.4 DISCLAIMER OF WARRANTIES. THE REMEDIES SET FORTH IN PARAGRAPHS 6.2 AND 6.3 ARE THE EXCLUSIVE AND SOLE REMEDIES OF ACWA FOR ANY BREACHES OF THE WARRANTY OF PARAGRAPH 6.1.EXCEPT FOR THE EXPRESS WARRANTY IN PARAGRAPH 6.1, LICENSOR HEREBY DISCLAIMS, TO THE MAXIMUM EXTENT PERMITTED BY LAW, ALL WARRANTIES OF ANY KIND, EITHER EXPRESS, IMPLIED, ARISING BY LAW OR OTHERWISE, WITH RESPECT TO THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, PLOAD MODULES AND ANY OTHER ITEMS OR SERVICES FURNISHED UNDER THIS AGREEMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR USE OR ANY IMPLIED WARRANTY ARISING FROM COURSE OF PERFORMANCE, COURSE OF DEALING OR USAGE OF TRADE. LICENSEE ASSUMES THE ENTIRE RISK AS TO THE QUALITY, OPERATION, AND PERFORMANCE OF THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, AND PLOAD MODULES AND THE RESULTS OBTAINED FROM THE OPERATION OF THE SOFTWARE, AND WAIVES, DISCLAIMS AND RELEASES LICENSOR FROM ANY OBLIGATION, LIABILITY, RIGHT, REMEDY, OR CLAIM IN TORT, NOTWITHSTANDING ANY FAULT, NEGLIGENCE, STRICT LIABILITY OR PRODUCT LIABILITY OF LICENSOR (WHETHER ACTIVE, PASSIVE OR IMPUTED) WITH RESPECT TO ANY BUG, DEFECT, DEFICIENCY OR ERROR IN THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, PLOAD MODULES, SUPPORT, OR ANY OTHER ITEMS OR SERVICES FURNISHED HEREUNDER. LICENSOR DOES NOT REPRESENT ANY RESPONSE-TIME OR THAT THE OPERATION OF THE LICENSED SOFTWARE SHALL BE ERROR-FREE OR UNINTERRUPTED OR THAT THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, PLOAD MODULES, OR ANY OTHER ITEMS OR SERVICES FURNISHED HEREUNDER COMPLY WITH APPLICABLE ENVIRONMENTAL OR OTHER LAWS, RULES OR REGULATIONS.

7. Limitations of Liability

7.1 Limitation of Consequential Damages. IN NO EVENT SHALL LICENSOR BE LIABLE TO ANY LICENSEE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES (INCLUDING, WITHOUT LIMITATION, LOST PROFITS, LOST SAVINGS, COSTS OF DELAYS, INTERRUPTION OF BUSINESS, LOSS OF GOODWILL, COSTS OF LOST OR DAMAGED DATA OR DOCUMENTATION, GOVERNMENTAL FINES OR

PENALTIES OR LIABILITIES TO THIRD PARTIES) ARISING OUT OF OR RELATED TO THIS AGREEMENT (INCLUDING, WITHOUT LIMITATION, PERFORMANCE, NONPERFORMANCE OR ANY USE OR INABILITY TO USE THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, OR ANY OTHER ITEMS OR SERVICES FURNISHED HEREUNDER), WHETHER ARISING IN BREACH OF CONTRACT OR WARRANTY, TORT (INCLUDING NEGLIGENCE), STRICT OR STATUTORY LIABILITY, OR ANY OTHER LEGAL THEORY OF LIABILITY, EVEN IF LICENSOR HAS BEEN ADVISED, KNEW, OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES OR CLAIMS.

7.2 Limitation of Monetary Damages. IN NO EVENT SHALL LICENSOR'S TOTAL AGGREGATE LIABILITY FOR ANY AND ALL CLAIMS OR CAUSES OF ACTION THAT ARISE OUT OF OR RELATE TO THIS AGREEMENT INCLUDING, WITHOUT LIMITATION, PERFORMANCE, NONPERFORMANCE OR ANY USE OR INABILITY TO USE OF THE LICENSED SOFTWARE, LICENSED DOCUMENTATION, OR ANY OTHER ITEMS OR SERVICES FURNISHED HEREUNDER, WHETHER BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, BREACH OF WARRANTY, OR ANY OTHER LEGAL THEORY OF LIABILITY, EXCEED FIFTY-THOUSAND DOLLARS ($50,000.00).

8. Term and Termination

8.1 Term. With respect to ACWA, the term of this Agreement shall commence on the Effective Date and shall remain in full force and effect until it is terminated in accordance with the terms of this Agreement. With respect to an ACWA Member, the term of this Agreement shall commence on the earlier of (a) the date of acceptance of this Agreement by the ACWA Member, or (b) the date the ACWA Member first receives a copy of any of the following: the Licensed Software, the Licensed Documentation, or any PLOAD Module.

8.2 Termination by Licensor. Licensor shall have the right to terminate this Agreement with a Licensee and the license rights granted herein:

(a) upon written notice in the event that the Licensee commits a material breach or default of this Agreement and fails to cure such breach or default within ten (10) days after written notice of such breach or default; or

(b) upon written notice in the event the Licensee (a) ceases to conduct its business in the ordinary course; (b) becomes subject to any bankruptcy or insolvency proceeding under federal or state statute; or (c) becomes insolvent or becomes subject to direct control by a trustee, receiver, or similar authority.

8.3 Termination by a Licensee. A Licensee shall have the right to terminate this Agreement by providing written notice to Licensor

8.4 Effect of Termination. Upon termination of this Agreement by Licensor or a Licensee for any reason, all license rights granted to the Licensee herein are immediately terminated. Additionally, Licensor shall have the right, at any time after termination of this Agreement, to take immediate possession of all copies of the Licensed Software and

Licensed Documentation created or in the possession of the Licensee. Without limiting the foregoing, within five (5) days after the termination of this Agreement by either party, the Licensee shall return and/or destroy all copies of the Licensed Software and Licensed Documentation and certify to Licensor in writing that all copies have been returned and/or destroyed.

8.5 Survival. The parties' respective rights and obligations under Sections 3, 5, 7, 8.4, and 12 shall survive termination of this Agreement.

9. Hardware, Third Party Software, and Cooperation

9.1 Third Party Hardware and Software. Licensee acknowledges that operation and use of the Licensed Software requires certain hardware, network connections, operating system software, and other Third Party Software. As between the parties, Licensee is solely responsible, at its expense, for acquiring and maintaining all such items.

9.2 Response Time. Licensee acknowledges that the response time of the Licensed Software is dependent on the platform provided by the Licensee and the use of the platform by other systems.

9.3 Cooperation. Licensee acknowledges and agrees that Licensor's performance hereunder is dependent upon Licensee's timely performance of its various obligations herein, including Licensee's timely decisions and approvals, upon which Licensor shall be entitled to rely. Licensee shall not impede, in whole or in part, Licensor from performing its duties and obligations hereunder and shall make available to Licensor, at no charge, all information facilities, personnel and services reasonably required by Licensor to perform its duties hereunder.

10. Export Control

10.1 U.S. Export Control. This Agreement is subject to United States laws and regulations that control the export of technical data, computer software, and all other export controlled commodities. These laws and regulations include, but are not limited to, the Arms Export Control Act and the Export Administration Act. All rights granted by this Agreement are contingent upon strict compliance with all United States export control laws and regulations. Licensee shall not, directly or indirectly, export the Licensed Software or Licensed Documentation, or any portion thereof or any technical data related thereto, outside the United States unless Licensee has fully and strictly complied with all United States export control laws and regulations. Such compliance includes, but is not limited to, obtaining any necessary licenses or authorizations from the proper government agency(ies) prior to export at Licensee's sole expense.

11. U.S. Government Rights

11.1 Government End Users. By accepting or using the Licensed Software or the Licensed Documentation (the "Deliverables"), Licensee hereby agrees that: (a) the Deliverables qualify as "commercial computer software" or "commercial computer software

documentation" within the meaning of the acquisition regulation(s) applicable to the procurement, (b) to the maximum extent possible under federal law, Licensee shall be bound by the commercial terms and conditions contained in this Agreement, and (c) this license meets Licensee's minimum needs and is consistent with federal procurement law. U.S. Government Restricted Rights – If applicable, the Deliverables are provided with restricted rights and use, duplication or disclosure is subject to the restricted rights provisions set forth at FAR 52.227-19 and DFARS 227-7202-3, as applicable, and this Agreement.

12. Miscellaneous

12.1 Entire Agreement. Each party acknowledges that it has read this Agreement, understands it, and agrees to be bound by its terms, and further agrees that this Agreement (including all referenced or attached Exhibits) and the Professional Services Agreement are the complete and exclusive statement of the agreement between the parties, which supersedes and merges all prior proposals, understandings, and all other agreements, oral and written, between the parties relating to the subject matter of this Agreement. Except as otherwise provided herein, this Agreement may not be modified or altered except by written instrument executed by an authorized representative of each party. In the event of a conflict between the terms of this Agreement and the Professional Services Agreement, the terms of this Agreement shall govern.

12.2 Independent Contractors. Each party to this Agreement is an independent contractor and not a partner, franchisee, or agent of any other party. This Agreement shall not be interpreted or construed as creating or evidencing any partnership, franchise, or agency between the parties or as imposing any partnership, franchise, or agency obligation or liability upon any party.

12.3 Severability. If any provision of this Agreement is held by a court of competent jurisdiction to be invalid or unenforceable, such invalidity or unenforceability shall not affect the validity of remaining portions of this Agreement, and the parties shall substitute for the invalid provision a provision that most closely approximates the intent and economic effect of the invalid provision.

12.4 Waiver. In order to be effective, any waiver, by a party, of any right under this Agreement must be in writing by an authorized representative of the party making the waiver. No such waiver or failure of either party to enforce a right or strict performance under this Agreement shall be deemed to be a waiver or forbearance that would in any way prevent either party from subsequently asserting or exercising any such rights, making a claim not specifically waived, or requiring strict performance of this Agreement. No such waiver or failure to enforce shall affect the validity of this Agreement or be a continuing waiver excusing compliance with any provision of this Agreement in the future.

12.5 Notices. All notices, reports, requests, consents, demands, and other communications between Licensor and a Licensee under this Agreement, shall be in writing and shall be deemed duly given and effective (i) when actually delivered to the intended recipient, or (ii) three (3) days after being mailed by prepaid registered or certified U.S. mail to the receiving party to the address set forth below for Licensor and ACWA and set forth in the

written acknowledgement by any other Licensee, or to such other address as may be later designated by written notice from Licensor to a Licensee or from a Licensee to Licensor :

Licensor's Notification Address:

John Tully
13921 Park Center Road
Herndon, VA 20171

ACWA's Notification Address:

Janet Gillaspie, Executive Director
Oregon Association of Clean Water Agencies
537 SE Ash, Suite 12
Portland, Oregon 97214

During the term of this Agreement, Licensor shall promptly report to each Licensee any change in notification address, name, or company affiliation and each Licensee shall promptly report to Licensor any change in notification address, name, or company affiliation .

12.6 Force Majeure. Licensor shall not be liable for failure to fulfill the terms of this Agreement or considered in breach or default of this Agreement on account of any delay or failure to perform as a result of any cause or condition beyond its reasonable control, including, without limitation, fire, strike, war, government regulation, acts of God labor disturbances, or any act, delay or failure to act by Licensee or any third party.

12.7 Section Headings. The section titles and headings contained in this Agreement are for convenience and reference only. Such heading and titles do not form a part of this Agreement, shall not define or limit the scope of the sections, and shall not affect the construction of interpretation of any section.

12.8 Choice of Law/Venue. This Agreement and performance hereunder shall be governed by the laws of the State of Colorado, without reference to its choice of law principles to the contrary. The provisions of the United Nations Convention on Contracts for the International Sale of Goods shall not apply. Venue for any claims or disputes arising under or in connection with this Agreement shall be the federal and state courts located in Denver County, State of Colorado. All parties hereby consent to the exclusive jurisdiction and venue of such courts with respect to such claims or disputes.

12.9 Assignment. Licensee may not assign, without the prior written consent of Licensor, its rights, duties, or obligations under this Agreement to any person or entity, in whole or in part, by operation of law or otherwise. Subject to the foregoing restriction on assignment, this Agreement shall be fully binding upon, inure to the benefit of, and be enforceable by the parties and their respective successors and assigns.

12.10 Remedies. Because of the unique and proprietary nature of the Licensed Software and Licensed Documentation, Licensee acknowledges that any breach of this Agreement by Licensee shall cause Licensor to suffer irreparable harm and to have no adequate remedy at law. In the event of such breach, Licensor shall be entitled to equitable relief, including without limitation, injunctive relief, specific performance, or other equitable

remedies in addition to all other remedies provided or available to Licensor at law or equity, without the necessity of posting a bond or other security.

12.11 Nonencumberance. Licensee shall not take any action that might encumber or expose the Licensed Software or Licensed Software Documentation to any claims, liens, or other form of encumbrance.

12.12 Counterparts. This Agreement may be executed simultaneously if two or more counterparts, each of which shall be deemed to be an original and all of which together shall constitute but one and the same instrument.

IN WITNESS WHEREOF, the parties hereto by their duly authorized representatives have executed this Agreement as of the Effective Date.

LICENSEE: Oregon Association of Clean Water Agencies

By: Janet A. Gillespie

Name: JANET A. GILLESPIE

Title: EXECUTIVE DIRECTOR

Date: 12/23/04

(Authorized Customer Signature)

LICENSOR: CH2M HILL, Inc.

By: Linda Macpherson

Name: Linda Macpherson

Title: Vice President

Date: 12/23/04

PLOAD SOFTWARE
LICENSE AGREEMENT

EXHIBIT A

PLOAD Software:

PLOAD v5.0, an extension to ArcGIS v9.x, is a simplified, GIS-based model to calculate pollutant loads for watersheds. PLOAD estimates non-point sources (NPS) of pollution on an annual average basis, for any user-specified pollutant. The user may calculate the NPS loads using the EPA's Simple Method approach. Optionally, best management practices (BMPs), which serve to reduce NPS loads, and point source loads, may also be included in computing total watershed loads. Finally, there are several product alternatives that may be specified to show the NPS pollution results as maps and tabular lists, and to compare multiple sessions.

PLOAD Modules (Customized Products for ACWA):

Module 1 BMP Modifications related to pollutant removal: This module calculates BMP pollutant removal based upon effluent concentrations rather than on percent removal efficiencies as in the original version.

Module 2 BMP Modifications related to flow reduction: This module recognizes the flow reduction component of BMPs and makes allowances for it within the calculations.

PLOAD SOFTWARE
LICENSE AGREEMENT

EXHIBIT B

Sample Acknowledgement Agreement

In consideration of the license rights to PLOAD Software version 5.0 (hereinafter, "PLOAD Software") and its documentation granted by CH2M HILL to [insert name of ACWA Voting Member or Associate Member] (hereinafter, "Licensee") via the PLOAD Software License Agreement entered into by and between CH2M HILL, Inc. and Oregon Association of Clean Water Agencies on [insert Effective Date] (hereinafter, "License Agreement"), Licensee hereby acknowledges the following:

(a) it has received and read a copy of the License Agreement;

(b) it understands the terms and conditions of this License Agreement;

(c) its rights to install, access, use, and reproduce PLOAD Software and related documentation shall be exclusively governed by the terms and conditions of this License Agreement; and

(d) it agrees to accept and be bound by, without any modifications, exceptions, or other changes, all terms and conditions of this License Agreement.

Licensee's Notification Address:

LICENSEE: [insert name of ACWA Voting Member or Associate Member]

By: _____

Name: _____

Title: _____

Date: _____

APPENDIX D
Data Gaps Supplemental Information

Aldrin

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found	X	X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found	X	X		X	X	X	X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found	X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X			X		X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	Y	Y	NA	Y	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	NA	N	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X		X	X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Total As

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X		X				X		X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	Y	NA	N	N	Y	NA	Y	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	N	NA	N	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X		X	X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

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		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X		X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X						X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	N	Y	Y	N	Y	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	Y	NA	NA	NA	N	Y	NA	Y	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X			X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	NA	Y	Y	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

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		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found				X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X			X	X						X	X
limited data (1 - 3 studies)	yes, or no	NA	Y	Y	NA	NA	Y	N	Y	Y	Y	NA	NA
data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	NA	NA	N	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found			X		X	X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	Y	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Total Cd

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found					X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X			X		X						
limited data (1 - 3 studies)	yes, or no	NA	Y	Y	NA	Y	NA	N	Y	N	N	Y	Y
data have a large range (high value is	yes, or no	NA	N	NA	NA	NA	NA	Y	Y	Y	N	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found			X			X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	N	NA	Y	Y	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	N	Y	NA	NA	NA	NA	NA	NA	NA

COD

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	N	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X								
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	Y	Y	Y	Y	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	N	Y	N	N	NA	Y

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X			X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	NA	Y	N	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	N	NA	N	N	NA	NA	NA	NA	NA	NA	NA

Dissolved Cr

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X			X	X	X					X	X
	limited data (1 - 3 studies)	yes, or no	NA	N	Y	NA	NA	NA	Y	Y	Y	Y	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	NA	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Cr

		BMP	Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues														
	no data found		X			X		X						
	limited data (1 - 3 studies)	yes, or no	NA	Y	Y	NA	Y	NA	N	Y	N	Y	Y	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	Y	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues													
	no data found			X			X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	Y	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Cu

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found					X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X		X	X	X							X
limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	Y	N	Y	N	N	Y	NA
data have a large range (high value is	yes, or no	NA	N	NA	NA	NA	NA	Y	N	Y	N	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found					X	X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	Y	Y	Y	NA	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Total Cu

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X		X						
	limited data (1 - 3 studies)	yes, or no	NA	N	NA	NA	Y	NA	N	N	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	N	Y	Y	Y	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found						X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	N	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	N	N	NA	NA	NA	NA	NA	NA	NA

Dieldrin

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	N	Y	Y	Y	Y	NA	NA	N	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	Y	Y	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dioxin

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

E. Coli

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found			X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X		X	X	X	X		X		X	X	X
limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	Y	NA	Y	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found		X	X		X	X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Fe

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found		X	X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X	X	X	X	X	X	X			X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	Y	Y	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found		X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Fe

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found			X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X	X	X	X	X	X				X		
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	N	Y	N	NA	Y	Y
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	NA	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found			X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Fecal Coliform

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found				X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X	X	X	X	X						X	
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	N	N	Y	N	Y	NA	Y
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	N	NA	NA	N	NA	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found			X		X	X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	N	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	N	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA

Flow

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X		X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	N	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Hg

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X		X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Hg

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X		X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X		X	X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

Metals

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X						X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	N	N	Y	N	Y	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X		X	X		X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	N	NA	NA	Y	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Mn

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found		X	X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X	X	X	X	X	X	X	X		X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA
data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found		X	X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Mn

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X		X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	N	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Ni

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X			X		X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	Y	Y	NA	Y	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	N	NA	NA	N	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Ni

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X		X						X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	Y	NA	Y	Y	N	N	Y	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Nitrate

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found				X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X			X	X							
	limited data (1 - 3 studies)	yes, or no	NA	Y	Y	NA	NA	N	N	N	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	N	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found						X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	Y	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	N	Y	NA	NA	NA	NA	NA	NA	NA

PAHs

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Pb

BMP

		Filters (sand / leaf / other media)	Catch Basin Type	Street Sweeping	Leaf / Needle Pick-Up	Catch Basin Cleaning	Sediment Manhole Cleaning	Line Maintenance	Pollution Reduction	Maintenance Procedures	Facilities Maintenance	Inspection and Enforcement	Illicit Discharge Prevention and Control (includes spills)
Existing Data Issues													
no data found				X	X	X	X	X	X	X	X	X	X
limited data (1 - 3 studies)	yes, or no	N	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
data have a large range (high value is	yes, or no	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Landscape Management	Centrifugal Separator	Sediment Manhole	Drain Inlet Devices	Oil/Water Separator	Soakage Trenches / Infiltration Basins	Vegetative Swales	Filter Strips	Wet Ponds	Dry Ponds - Vegetated	Dry Ponds - Non-Vegetated	Constructed Wetlands (subsurface flow)
Existing Data Issues													
no data found		X			X	X							X
limited data (1 - 3 studies)	yes, or no	NA	Y	Y	NA	NA	Y	N	Y	N	N	Y	NA
data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	Y	Y	Y	NA	NA

		Constructed Wetlands (surface flow)	Planters (flow-through and infiltration)	Green Roofs	Porous Pavement	Tree Planting	Impervious Surface Reduction	Commercial Vehicle Washing / Fueling / Loading	Mobile Commercial Vehicle Washing Controls (vehicle / building)	Waterway Set-back / Riparian Protection	Public Education	Erosion Prevention and Sediment Control for Construction
Existing Data Issues												
no data found					X	X	X	X	X	X	X	
limited data (1 - 3 studies)	yes, or no	Y	Y	Y	NA	NA	NA	NA	NA	NA	NA	Y
data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA

Total Pb

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	N	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X			X								
	limited data (1 - 3 studies)	yes, or no	NA	N	Y	NA	Y	Y	N	N	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	Y	Y	Y	Y	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found						X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	N	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA

PCBs

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found		X	X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Temperature

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X	X		X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	NA	Y	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X		X	X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	N	NA	NA	NA	NA	NA	NA	NA	NA

TOC

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X		X		X				
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	Y	NA	N	NA	N	Y	Y	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total P

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X							X	X	
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	Y	Y	N	N	N	N	NA	NA	N
	data have a large range (high value is	yes, or no	NA	Y	NA	NA	NA	NA	Y	Y	Y	Y	Y	Y

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X			X	X	X	X	X		
	limited data (1 - 3 studies)	yes, or no	N	NA	Y	N	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA

TPH

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X		X		X	X	
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	Y	NA	NA	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TPH Diesel

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X		X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	Y	NA	NA	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TPH Gasoline

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X		X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	Y	NA	NA	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TPH Oil

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X		X	X	X		X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	N	Y	NA	NA	Y	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found		X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TSS

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X											
	limited data (1 - 3 studies)	yes, or no	NA	N	Y	Y	Y	N	N	N	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	Y	Y	Y	Y	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X			X	X		X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	NA	Y	N	NA	NA	Y	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA

Turbidity

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found			X	X	X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X	X	X	X	X	X		X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	NA	NA	NA	NA	NA	NA	Y	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found			X	X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	Y	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is 10x greater than low value)	yes, or no	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Dissolved Zn

		BMP											
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X	X	X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X	X							X
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	NA	Y	N	Y	N	N	Y	NA
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	Y	Y	Y	NA	NA

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found					X	X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	NA	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Zn

		BMP												
			Filters (sand / leaf / other media)	**Catch Basin Type**	**Street Sweeping**	**Leaf / Needle Pick-Up**	**Catch Basin Cleaning**	**Sediment Manhole Cleaning**	**Line Maintenance**	**Pollution Reduction**	**Maintenance Procedures**	**Facilities Maintenance**	**Inspection and Enforcement**	**Illicit Discharge Prevention and Control (includes spills)**
Existing Data Issues														
	no data found					X		X	X	X	X	X	X	X
	limited data (1 - 3 studies)	yes, or no	N	Y	N	NA	Y	NA	NA	NA	NA	NA	NA	NA
	data have a large range (high value is	yes, or no	Y	N	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Landscape Management	**Centrifugal Separator**	**Sediment Manhole**	**Drain Inlet Devices**	**Oil/Water Separator**	**Soakage Trenches / Infiltration Basins**	**Vegetative Swales**	**Filter Strips**	**Wet Ponds**	**Dry Ponds - Vegetated**	**Dry Ponds - Non-Vegetated**	**Constructed Wetlands (subsurface flow)**
Existing Data Issues														
	no data found		X		X	X								
	limited data (1 - 3 studies)	yes, or no	NA	Y	NA	NA	Y	Y	N	N	N	N	Y	Y
	data have a large range (high value is	yes, or no	NA	NA	NA	NA	NA	NA	Y	Y	Y	Y	NA	Y

			Constructed Wetlands (surface flow)	**Planters (flow-through and infiltration)**	**Green Roofs**	**Porous Pavement**	**Tree Planting**	**Impervious Surface Reduction**	**Commercial Vehicle Washing / Fueling / Loading**	**Mobile Commercial Vehicle Washing Controls (vehicle / building)**	**Waterway Set-back / Riparian Protection**	**Public Education**	**Erosion Prevention and Sediment Control for Construction**
Existing Data Issues													
	no data found						X	X	X	X	X	X	
	limited data (1 - 3 studies)	yes, or no	N	Y	Y	N	NA	NA	NA	NA	NA	NA	Y
	data have a large range (high value is 10x greater than low value)	yes, or no	Y	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA