MS4-###

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| Title | BMP Inventory Update for 2015 NPDES submittal |
| Category |  |
| Status |  |
| Reviewed By |  |
| Date | March 13, 2015 |
| Author | Daniel Ashney |

General Template Usage. This template uses numbered heading styles using the legal numbering style. Use “Insert, Cross-reference…” to insert references to sections that will automatically update. This template is used for internal documentation of explicit model as well as general collection modeling systems. Since these documents tend to change and are considered “living,” the revision history at the very beginning of this document should always be updated whenever modifications occur.

Categories. Use the following categories for each MS4:

*Application*: a user manual for a tool, program, or script used or developed in-house

*Architecture*: the MS4 describes a software-related issue

*Procedure*: the MS4 shows you how to approach a task. Since there can be many kinds of task, also provide a subcategory along the lines of “monitoring, model construction, data scrubbing, modeling, analysis, administration, or quality control.”

*Standards*: the MS4 describes a related standard that should be followed as closely as possible.

*Theory*: the MS4 justifies technical assumptions or provides technical background on how an element of explicit model behaves and attempts to mimic natural processes

Status. Indicate the following for status of document: *placeholder*, *rough*, *final draft*, or *obsolete*

# Revision History

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| --- | --- | --- |
| Revision Date | By | Description |
| 3/14/2015 | DCA | Established document |

# Background/ Overview

The BMP Snapshot is being used in the MS4 benchmark submittals. The utility of the snapshot is proportional to how recent it has been created. An update will be required prior to each new submittal.

There are many shortcomings in the current version of the BMP inventory which has been patched together from disparate inventories, some of which are still active and some not. The primary sources are the DME (Hansen), the MIP (private) and what have been deemed The Dead Inventories as they are no longer maintained. As the facilities from The Dead get reconciled with the DME that inventory source will become irrelevant.

This update to the inventory will involve as much script automation as possible. This will make the process self-documenting and repeatable.

MDAS has done a lot of work to improve the DME since Oct 2012 therefore we need to see how this effects the BMP result. We need to know how many of the Dead Inventory features still need to be reconciled. MDAS needs a list of the feature which we are claiming as BMPs that they do not have and a list of those features from Dead Inventories which may still need to be included. In the data from the previous submittal there were 126 records in the Deads.

# Restructure/ Requirement Specs

1. Schema – establish a finalized, official set of required fields that meet everyone’s needs (MS4 (both Kristi and Patrice), SWSP, etc)
2. Establish who, in total, the audience is for the BMPs. We will want to cast a wide net, identifying *all* facilities and then allowing for subset (MS4 ownership, etc).
3. Private facilities (primarily from MIP) will still be managed as a part of the overall inventory. Currently there is a not an updated, available source for private BMP facilities therefore a snapshot must be requested from Loren Shelley, et al.
4. Ditches will continue to be included in the inventory and as type 11 in the ACWA types.
5. Previous BMP inventories have represented all facilities as points regardless of their source geometry type. This will continue to be the case although the linear feature will be converted to downstream node instead of line centroid.

## Invested Parties

These groups are basically either data providers or data end users. Either way they have a vested interest in the result of the BMP update and will sign off on inventory data schema, pollutant loading (ACWA) designations and queries to select facilities from the larger data sources that are maintained. Member lists are current as of 3/14/15.

MDAS/Hansen (data providers) – Baron Howe, Gayle Bast, Grant Wright

* Supplemental: Sustainable Stormwater – Todd Gunter

MS4/NPDES (users) – Patrice Mango, Angie Tomlinson, Kristi Hedrick

## Schema

* Unique ID – calculate – unique to consolidated BMP inventory
* Original ID- difficult in the past because of the disparate nature of inventory sources; may want to use GlobalID from DME in case we need to join
* As Built – if possible, for general record keeping
* Install Date – valuable to MS4 (Patrice/ Angie) for tracking year to year changes in facilities
* *Field can change but likely best option; see email in doc* [*meeting\_11252014.docx*](file:///\\oberon\modeling\GridMaster\BMP\PRF\ARC\Working\2018_setup\docs\meetings\meeting_11252014.docx)
* MS4 – binary; am I in an MS4 area or not? – based on spatial location
* Source – DME, MIP, IC, Dead, etc
* Original Type – derived from source
* Gen\_Type – generalized type (since some sources call things different names, some use codes, etc)
* ACWA number – int; values 1 through 10 ultimately used to link facility to MS4 pollutant loading values
* ACWA type – string; text values associated with int values
* In Stream – binary; this is valuable to MS4 (Patrice) and is currently defined by proximity

## Other Assumptions

The selection of appropriate inputs is driven largely by the established general ACWA types which ultimately tie back to pollutant reduction figures.

1 - Centrifugal Separator Hydrodynamic devices

2 - Filters (Leaf/Sand/Other)

3 - Ponds, Dry Vegetated Detention Pond

4 - Ponds - Wet Retention Basin

5 - Swales - Vegetated Filter Strips

6 - Wetlands - Constructed Surface Flow

7 - Sediment Manhole

8 - Green Roofs (4" substrate)

9 - Porous Pavement

10 - Infiltration Facility

11 – Vegetated Ditch

*Note – an 11th type of Vegetated Ditch which had a reduced pollutant value was included for the 2014 submittal and also used in 2015 in order to reduce the effect of ditches counted as swales on the west side of the river*

## Inventory Input Sources

* DME - managed by MDAS

*EGH\_PUBLIC.ARCMAP\_ADMIN.collection\_points\_bes\_pdx*

*EGH\_PUBLIC.ARCMAP\_ADMIN.collection\_lines\_bes\_pdx*

* Ecoroofs – managed by Casey Cunningham in watershed group

*EGH\_PUBLIC.ARCMAP\_ADMIN.ecoroof\_pts\_bes\_pdx*

* MIP – managed by Loren Shelley/ Source Control

*EGH\_PUBLIC.ARCMAP\_ADMIN.priv\_mip\_strm\_facs\_bes\_pdx (a static copy provided by Loren was used for the 2015 work)*

* Dead Inventories (All [N,S,R], CAT, STM) – no longer managed – these will be phased out as the DME improves – not included as part of this process as they will be passed on to Hansen for input if they seem valid

### DME Selection

Collection Nodes - UNITTYPE in ( 'CNFLTR', 'DVT', 'PND', 'SBX', 'SED', 'SF', 'SST') AND SERVSTAT = 'IN'

Collection Segments - UNITTYPE in ( 'CHDTC', 'CHRTF', 'CHSWL', 'STINF','CHGRSTFA') AND SERVSTAT = 'IN'

Collection Polygons – suggested that we do not use

### MIP Selection

[FirstOfCode] in ( 'Constructed Treatment Wetland', 'Contained Planter Box', 'Detention Pond - Dry', 'Detention Pond - Wet', 'Drywell', 'Ecoroof', 'Flow Through Planter Box', 'Infiltration Basin', 'Infiltration Planter Box', 'Infiltration Trench', 'Porous Pavement', 'Sand Filter', 'Sedimentation Manhole', 'Silt Basin', 'Soakage Trench', 'Swale', 'Vegetated Filter')

### Ecoroof Selection

No query for subset required. Use all facilities.

### Inflow Control Selection

Although previously included, inflow controls have been removed as an input to the inventory as all currently installed inflow controls maintained by ASM modeling are also captured in Hansen.

## Process

### Creation of facility point inventory

1. Snapshot data – subset (using verified type values) data from DME, MIP, inflow controls, ecoroofs
2. Convert DME links to **downstream** node
3. Add necessary fields that do not exist (ACWA type, MS4, etc) to each fc
4. Populate fields in each fc– need crosswalk table pointing feature types to ACWA types
5. Rename useable fields in each fc, remove all others
6. Merge sources into one fc
7. Re order fields to match above schema

This process has been automated. See python code at [\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018\_setup\automation](file:///\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018_setup\automation):

BMP\_update.py

Compiled point inventory result for 2015 located at: [\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018\_setup\data\BMP\_update\_2018.gdb\BMP\_inventory](file:///\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018_setup\data\BMP_update_2018.gdb\BMP_inventory)

### Delineation – Creation of facility associated polygons

* *DME points and points converted from lines* – tie to network node id and trace up pipe/ delineate from there. Because of the types of some of these features some of them will not match to the Delineator network nodes. Those that do not match will need to be run from the surface (mostly ditches). Another thing that will cause delineations to drop out is when two linear features from the DME flow together (mostly ditches) which will result in two point features with the same DS ID once the lines are converted to point.
* *Ecoroofs* – use associated taxlot; each facility has an associated taxlot polygon including lots with multiple facilities (decision to use this method made in standup by Patrice 2/26/2015)
* *Private* – use associated taxlot; each facility has an associated taxlot polygon including lots with multiple facilities (decision to use this method made in standup by Patrice 2/26/2015)

#### Delineation Specifics

For source collection nodes and links:

1. Subset BMP points to collection nodes and links (SourceData); subset to a new feature class is required since the Delineator tool does not enforce definition queries
2. **Delineating from within the network** – use GLOBALID to join and select network nodes that match with BMP facility GLOBALID; run trace on these
3. **Delineating from the surface** - For BMPs that did not find the GLOBALID match (find by joining resulting polygons from step 2 to the BMP points selecting all, removing the join and then flipping the selection) make a feature class copy. Add field “DelinID”(text) and fill it using UID. Feed this into the delineator and delineate from the surface.

For sources MIP and ecoroof:

1. Subset BMP points to private and ecoroof
2. Run spatial join (taxlot = target, one to many, intersect) on the taxlots and BMPs
3. Select and delete records where Join Count =0.
4. For BMPs that did not find a spatial join match (find by joining resulting polygons from step 2 to the BMP points selecting all, removing the join and then flipping the selection):

Run a second spatial join on this subset (same criteria as above) but find those within 10’.

1. Select and delete records where Join Count = 0.
2. Look for records where, because of lots that were close to one another, multiple lots were selected for one BMP. Remove lots that were incorrectly selected.

Combine Results:

1. For the results of these steps: join back to source BMP and attach all associated attribution. Merge all into one, final, combined BMP delineation.
2. For MS4 purposes create a version which is clipped to the extents of the MS4 outfall boundaries and where MS4 = Y.

#### Delineation Exceptions

There are exceptions to the automated process where the data and/ or process were not appropriate for all records. These outliers can be caused by:

* facilities where the node identified is maintained as a point not connected to a piped network (eg many ponds)
* locations where inlets have not been categorized as inlets in the geometric network
* linear facilities that have been converted to the DS node which “disconnects” them from the network OR which move them outside of the MS4 area therefore excluding them
* facilities which were previously considered BMPs (based on the list from Hansen – see section 2.4.1) but which were changed to a different type in the DME source
* others, etc

Records were identified for review based on outstanding differences between 2015 and previous delineation. Those listed below are not a comprehensive list. These are meant as a representative sample of the situations that were encountered.

For the facilities that are artificially added as exceptions to our input: some of these (eg Ramsey Lakes) are excluded because they do not meet the criteria for inclusion by facility type but likely should be included – refer these to MDAS/Hansen.

1. ACT072 – Stephens Creek Headwaters – incorrectly included in 2013; Nearest Hansen field populated with link to DS node which created a delineation for most of Stephens Creek. Solution – *go with current 2015 delineation ie don’t change anything*.
2. ACR305 - Nearest Hansen field populated with link to DS node which created a delineation not representative of actual facility location. Solution – *go with current 2015 delineation.*
3. AMU863 - Nearest Hansen field populated with link to DS node which created a delineation not representative of actual facility location; resulted in delineation of entire Vermont (?) basin. Also, the nearest Hansen would be considered instream although the actual facility location was not. Solution – *go with current 2015 delineation*.
4. Ramsey Lake – DME types not in current list of BMP types therefore excluded although it drains half of St Johns. Should be a swale/pond/ect. Solution – *artificially add AAA285 and (ANC517 OR AAA284) – refer area to MDAS/Hansen.*
5. AAG637: E end of St Johns – BMP excluded in 2015 because the way in which it was mapped changed since 2013 (CHSWL/CHPRF to pond connector). Solution – *artificially add point at AAG637 and find out if we can query for pond connectors – refer to MDAS/ Hansen.*
6. AAS908 and AAS906: in 2015 mapped at actual node instead of nearest DS node; for AAS908 this changed the delineation significantly – *run delineation from nearby node ANJ885 to include the area that was excluded*
7. AAG212 – facility change from ditch to transition channel - *go with current 2015 delineation*
8. AAG249, AAG260, etc –location changed due to DS end being used – *use US end to select and run*
9. AAG260, etc – no longer ditches, now transition channels – *go with current 2015 delineation*
10. APE833 - location changed due to DS end being used – *use AAD958 as delineation point*
11. AAD941, AAD945 – moved due to DS end being used – *instead use AAD942, AAD938 and AAD936 as delin points.*
12. AAG289 – not connected to delineation network although should be – *use AAG288 as artificial delin point*
13. AAG293 – not connected to delineation network although should be – *use AAG292 as artificial delin point*
14. ANS785 – multiple inlets to pond – *artificially use ANS789 and ANS786 as delin points*
15. AAG420 – for some reason (?) ditch was excluded from 2015 BMP – *artificially use AAG420 as delin point*
16. AAD845, AQN979: location changed due to DS end being used – *artificially use AQN978, AAD872, AAD878 as artificial delin points*
17. AQP000, AAD800 – ditch configuration changed – *use 2015 delineations*
18. AAL540 - location changed due to DS end being used - *artificially use node with GlobalID 634841*
19. AMX562, AMV752 - location changed due to DS end being used – *artificially use AMV723 and AMX564*
20. **Etc…**

NOTE – the standard method of adding facility attribution to the associated delineation (join through ID field and add fields from nodes to delineations) will not work for these exceptions as they are generally created by artificially selecting network nodes not the actual BMP node. Attribution is carried over to the delineation manually using the Attribute Transfer tool.

## Caveats/ Usage/ Other

* As the Original ID is a combination of IDs from the various sources it is almost certainly not unique. To join the polygon back to its source inventory facility first subset using the Data\_Source field.
* The delineation run in March 2015 resulted in ~97% (22182 of 23051) delineation match. This is the percent of BMP facilities that had an associated drainage polygon successfully created. The remaining 3% were excluded as a result of incomplete data, variations in the data and imperfect tools. According to the MS4 NPDES group which manages the submittal this is more than adequate. However, we have also included some manual cleanup which should lower that 3% (2.5.2.2 above). All large (~20 acres or more) discrepancies should be resolved. ***If at all possible this should* be *addressed in the next round as we should avoid manual fixes whenever possible.*** *For example, would it actually work better from a Delineator input standpoint to convert linear features to the upstream end? Many of the issues ID’ed above seem to stem from this.*
* Current BMP facility and delineation outputs can be found at: [\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\Drainage\_Delineation\DelineationFinal\_results.gdb](file:///\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\Drainage_Delineation\DelineationFinal_results.gdb)
* Further documentation regarding the establishment of this process can be found at: [\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018\_setup\docs](file:///\\cassio\modeling\GridMaster\BMP\PRF\ARC\Working\2018_setup\docs)