Appendix B
Forestry BMP Verification Guidance

Chesapeake Bay Program Forestry Workgroup's BMP Verification Guidance

This section describes guidance on how to verify the existence and performance of forestry BMPs in the Bay watershed. It has been revised to incorporate comments delivered by the Chesapeake Bay Program Partnership's BMP Verification Review Panel at their most recent meeting in April 2014. In addition, further comments submitted by June 30, 2014, from the CBP community are addressed. The organization is as follows:

I. Introduction

This guidance provides information on Forestry Best Management Practices (BMPs) and how best to verify that they have been correctly reported, installed, and maintained so they are deserving of the water quality benefits (nutrient and sediment load reductions) bestowed upon such Practices.

Forests cover the majority of the landscape in each Bay state. Protection of forested lands and restoration of trees in priority areas, such as riparian forest buffers (RFBs) along streams and shorelines, are vital for Bay watershed water quality and ecological health. The CBP Executive Council adopted an ambitious, science-based RFB goal in 2007 as part of the Forest Conservation Directive. Riparian forest buffers planted on agricultural land are one of the BMPs on which the states are most relying to achieve Bay water quality goals in their Phase II Watershed Implementation Plans. In addition to RFBs, other forestry BMPs play an increasingly important role, especially in the urban sector (see Section VI.).

Forests are not generally pollution sources. Instead, they absorb and use nutrients (greatly reducing nutrients from airborne sources, for example) and retain and use sediment, thus aiding pollution prevention. Four of the five Forestry BMPs covered by this guidance are types of tree planting designed to improve environmental and water quality conditions in currently non-forested areas, including tree planting in riparian areas. These tree planting practices apply to Agriculture and Urban landscapes. The Forest Harvesting BMPs are the only BMPs applied specifically to current Forest landscapes at this time.

Generally speaking, forest planting BMPs (riparian forest buffers and tree planting) are intended to last for a very long time. After verifying that buffer and tree planting projects have been installed and surviving according to plans, and after performing site inspection and maintenance

during the initial growth period or until considered established), forest BMPs will become easier to verify by aerial photography and inexpensive to maintain over the long term compared with other types of BMPs. Once the tree planting is established, the principal remaining concern is whether effectiveness of buffers will be undermined by concentrated flow or channelization circumventing the benefits of the buffer.

The five forestry BMPs for which verification guidance is presented are: a) agricultural riparian forest buffers; b) agricultural tree planting; c) expanded tree canopy; d) urban riparian forest buffers; and e) forest harvesting BMPs. Because of similarities in how the two agricultural BMPs are implemented, and how the urban forestry BMPs are implemented, they are grouped accordingly. This guidance is for use by the Chesapeake Bay states and, in general applies to federal installations as well, so they may use it to write Protocols for verification.

The Forestry Workgroup is mindful of the extensive resources needed to support BMP verification, and fully supports the "verification intensity" concept recommended by the CBP-VRP (2013). The intensity of verification efforts should be in direct proportion to contribution that a BMP makes to overall TMDL pollutant reduction in a state's Watershed Implementation Plan. The basic notion is to prioritize local and state verification resources on the BMPs that produce the greatest modeled load reduction in each state as reported in their annual progress runs to CBP. The converse also applies: less verification resources should be devoted to BMPs that make minor contributions to overall load reductions.

II. Role of the Forestry Workgroup in Verification

Since the late 1990s, the Forestry Workgroup has worked with Bay states to improve tracking and implementation of the oldest and most important BMP for water quality improvement: riparian forest buffers on agricultural lands. Bay watershed state forestry agencies are involved to varying degrees in inspecting newly-installed buffers and providing guidance and assistance for other forest restoration activities. When the Workgroup reviewed jurisdictions' tracking practices for all forestry BMPs in a December 2011 workshop, it saw a notable disparity in how and whether jurisdictions collected BMP implementation data. For example, regulation and oversight of forest harvesting vary considerably among states. Urban forestry BMPs (urban riparian buffers and expanded tree canopy) have only begun to be reported regularly by jurisdictions, despite having been defined Bay Program practices for over 10 years.

Seeing the disparities, the Forestry Workgroup was primed to work on BMP verification and more consistent BMP tracking in 2012. The Workgroup responded to the Water Quality Goal Implementation Team's request to develop guidance for verifying BMPs as part of the CBP's overall initiative to improve accountability of restoration practices. Multiple versions of the guidance were reviewed and discussed during Workgroup meetings in 2012 and 2013. The Expert Panels for Riparian Forest Buffers and Urban Tree Canopy provided input. In addition to BMP verification, the Forestry Workgroup tackled an even more difficult accounting issue: the extent to which agricultural riparian buffer planting has resulted in a net gain of forest buffers watershed-wide, given the loss of riparian forest to development and, in some areas, to crops. The Workgroup also looked at tools for assessing the net effect of urban tree planting.

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The process was aided by interactions with the Agriculture and Stormwater Workgroups, who are keenly interested in forestry practices taking place on agricultural and urban lands. These Workgroups have agreed that the Forestry Workgroup should develop technical verification definitions and guidance for forestry practices which supplement the general verification guidance they produce. In particular, the Forestry Workgroup guidance goes beyond that guidance to focus on net gain in riparian forest buffers and tree cover.

III. Background on Forestry BMPs Implemented on Agricultural Lands

Agricultural riparian forest buffers and tree planting are most often implemented in the Chesapeake Bay watershed through the USDA and state agricultural cost-sharing programs. In fact, a single project may be funded by multiple agencies. Cost-shared project design and implementation are guided by technical standards, and there are verification programs already being implemented by the funding agencies. In some states, state forestry departments provide additional monitoring for agriculture cost-share projects involving tree planting.

Riparian forest buffers and tree planting may also be carried out voluntarily by a farmer at his own expense. To date, such projects are a small fraction of the total projects credited in the Chesapeake Bay Program, but there is a current initiative under the 2010 Chesapeake Executive Order Strategy to develop a program for recognizing and giving credit to voluntary agricultural BMPs, including forestry BMPs. The voluntary riparian buffer plantings reported to date have generally been orchestrated by large non-governmental organizations that regularly do this type of work with volunteers.

Riparian Forest Buffer Description: Agricultural riparian forest buffers are linear wooded areas along rivers, streams, and shorelines with at least 2 types of woody vegetation. Forest buffers help filter nutrients, sediments and other pollutants from runoff as well as groundwater. The recommended buffer width for agricultural riparian forest buffers is 100 feet, with acceptable widths from 35-300 feet.

Tree Planting BMP Description: Agricultural tree planting includes any tree planting on agricultural land, except those used to establish riparian buffers. Lands that are highly erodible or identified as critical resource areas are good targets for tree planting.

Current Procedures:
The vast majority of forest practices on agriculture land are cost-shared conservation practices on agricultural land that are long-term in nature (once established, the practice often continues in perpetuity needing relatively little maintenance), and originate with a Conservation Reserve Enhancement Program (CREP) or Environmental Quality Improvement Practice (EQIP) contract. Procedures for approving contracted practices are established by USDA. Often, more than one agency has oversight of these agricultural tree planting practices, including the federal USDA's Farm Services Agency (FSA) and Natural Resources Conservation Service (NRCS), state forestry, Conservation Districts, etc. For simplicity, and because roles vary from state-to-state, all those providing oversight of tree planting activities are referred to as CREP partners. For instance, FSA will keep contracts for CREP, a forestry agency will write a planting plan and

check for compliance, and a technical service providing agency may make multiple site visits and have landowner contact. Sometimes multiple databases track the same practice.

Until now, agricultural tree planting has not been a commonly-reported practice to the Bay Program. However, there are new and expanding opportunities through agroforestry to plant trees on agricultural land. Agroforestry is the intentional mixing of trees and shrubs into crop and animal production systems for environmental, economic, and social benefits, and includes practices such as windbreaks, silvopasture, and alley cropping.

Procedures on how to establish a riparian forest successfully are well-documented (for example, MD DNR 2005). It starts with a conservation or planting plan designed by a ~~forester~~knowledgeable professional. Aspects of a good plan include: species selection, site preparation, and spacing of trees, among other factors. Forest buffer plantings almost always use tree shelters (e.g. 98% of the time in VA) to protect against herbivory. Shelters increase survival from 12% (no shelter) to 74% (with 4-foot shelter). Herbicide treatment is also highly recommended. Some of the trees planted are expected to perish but most must survive or be replanted to comply with contractual specifications. Repeated visits are made during establishment.

After establishment, a buffer planting may need additional maintenance to be fully functional. Adverse impacts include excessive traffic, livestock or wildlife damage, fire, pest or invasive plant infestations, and concentrated or channelized flows. The NRCS standard for this practice (Code 391) says the buffer will be inspected periodically and protected from these impacts. Maintenance is the responsibility of the landowner, and a portion of the public funding provided to the landowner is designated for maintenance expenses.

Below is the current protocol for verifying contractual agreements in CREP:

A. Verify Planting Establishment

~~i.~~ ~~In practice~~According to program rules, NRCS or ~~an~~other ~~technical assistance partner (e.g.,~~ CREP partner~~)~~ confirms establishment on ~~every~~ 100% of sites between 0.5-4 years after planting. ~~at the 1 or 2 year point, and every year thereafter until the planting is determined to be established~~. ~~"Established" means that the buffer meets the NRCS forest buffer practice standards and any additional state requirements (required stocking/survival rates vary by state).~~

~~ii.~~i. If the site visit determines that the practice has not yet been established, replanting is usually required to get the buffer up to standard, and further site visits may be needed until the replanting is established. If the buffer never becomes established, it is taken out of contract.

~~iii.~~ii. Some states include detailed monitoring of plantings ~~as well~~. Virginia CREP partners - VA Department of Forestry is the primary forestry technical expert - visit every planting site 3 times and have routine documentation about species planted, survival rate, and other issues. This is a recommended practice that not only ensures survival but contributes valuable information for future plantings (adaptive management).

B. Spot Check Plantings

i. After the practice has been reported as established, USDA has a standard program of compliance checks on a portion of all contracts; the requirement is ~~for a minimum of 5~~for 10% of ~~the buffer contracts~~practices be ~~to be~~ spot-checked each year.

ii. State agriculture conservation programs that provide a portion of CREP cost-share may have additional verification requirements, for example, VA DCR ~~also~~ requires spot checks on 5% of practices under contract each year throughout their lifespan.

C. Tracking

Currently, USDA data are used by most states to report accomplishments to the CBP model. These data include acres of practice, but do not currently include width of practice. Because of the CBP agreements and directives emphasizing the need for riparian forest buffer restoration, and to assure consistent, good reporting by jurisdictions, a second complimentary process was developed by the Forestry Workgroup. Since 1997, the Workgroup has been tracking buffers installed on agricultural lands. Each fall, the Workgroup requests geo-spatial data from the Bay states. The following 10 fields are requested from the state contacts and every year CBP maps the point data for analysis:

Field 1: Unique identifier (parcel ID, etc.)
Field 2: State
Field 3: Latitude
Field 4: Longitude
Field 5: Miles of forest buffer
Field 6: Width of forest buffer
Field 7: Planting date
Field 8: Ownership type (public/private: Federal, state, other public, private)
Field 9: Notes/Comments field
Field 10: Watershed name or HUC

The Forestry Workgroup's specialized tracking has been a means of cross-checking what is reported to the National Environmental Information Exchange Network (NEIEN)/Chesapeake Bay (CB) model--- it helps prevent double-counting and it establishes an average width of practice. As improvements are made to riparian forest buffer information coming through the USDA agreement with EPA and USGS, and confidence in the information improves, the Forestry Workgroup will evaluate whether to continue its complementary tracking procedures.

IV. Verification Guidance for Agricultural Riparian Buffers

1. *Verification methods for cost-shared agricultural riparian forest buffers will utilize and build upon the verification programs already implemented for cost-share contracts.*

- Confirm with CREP partners the protocol currently in place for verifying establishment of newly-planted buffers are consistent with rules for the practice.
- Continue ~~following the current~~established protocol ~~for verifying contractual agreements in CREP and verifying the buffer has been installed according to plan~~that includes

visiting each site to develop the conservation/planting plan . In ~~the~~ this plan~~, it is suggested to note~~any ~~likely~~ potential problems on or near the site ~~impacts that need to be~~ should be documented. ~~addressed with maintenance.~~ After ~~installation~~establishment, ~~a~~ each buffer site should be visited ~~at least twice prior to becoming established (within the first 1-4 years)~~a 2nd time to ~~assure the buffer will meet practice standards and~~address any problems~~ are corrected~~. The minority of buffers that are cost-shared using other programs (e.g., EQIP) should follow the same protocol used for CREP buffers.

- A buffer can be credited (reported) when its installation according to plan is confirmed. When reporting the buffer for CBP credit, the reporting agency should capture width of the buffer in ~~the~~ NEIEN in addition to acres of practice.

2. Inspection and maintenance are critical: a) to insure riparian forest buffers become established effectively; and b) to verify that the buffer is being maintained throughout the contract and channelization is not occurring.

- After establishment is verified per contractual procedures, proceed with periodic inspections (spot checks) to see how well maintenance issues are being addressed by the landowner. Currently, a minimum of 10~~5~~% of contracted practices are spot-checked. But additional spot checks are needed to ensure that impacts do not threaten the performance of the buffer.

- States should be at least 80% confident that water quality impacts are being avoided in the most likely places. Statistical sampling is recommended as a targeted and cost-effective means to have confidence that maintenance is happening effectively. Sampling design should focus on common and specific maintenance issues that have the most potential to impact water quality, such as channelization/concentrated flows. For instance, to protect from concentrated flows, a stratified sampling design could look at all buffer sites that are on slopes of 7% or greater –i.e., where the impact is most likely to occur.

- States should describe in detail how they plan to conduct follow-up checks that go beyond the ~~5~~10% spot-checking that is the current practice.

- Plantings to be spot-checked for maintenance should be between 5 and 10 years old because this is the period between establishment and re-enrollment when the least number of inspections occur. Most maintenance issues are easily detected, and state protocols should describe typical maintenance violations that need to be checked. If statistical sampling design help is not available, states can recommend other means of spot-checking to reach an 80% confidence level.

3. Special attention is needed at the end of contract life (10 or 15 years), to determine if a new contract will ensure continuation of the buffer or if the buffer will be maintained voluntarily without a contract. If there is no confirmation that the buffer will be maintained on the landscape, it must be removed from NEIEN.~~In lieu of confirmation that the buffer will still be on the landscape, it will need to be removed from NEIEN after the contract expires~~.

- This action is recommended to encourage the conservation of existing buffers. CREP contracts expire after 10 or 15 years, and a record amount of sign-ups in 2001-2007 are due to expire in the next few years. There are three likely scenarios when a contract is ending: 1) the landowner re-enrolls the buffer into another 10 or 15-year contract; 2) the landowner does not re-enroll, but plans to keep the buffer; or 3) the landowner does not re-enroll and plans to get rid of the buffer. Actions taken now by CREP partners can lead to more landowners being in the re-enrollment category (#1), and to knowing what to expect for those lands coming out of contract (#2 or #3). To re-enroll, CREP partners must determine that the buffer still meets the practice standards (survival/stocking rate). To facilitate the re-enrollment process (and thus retain functioning buffers), the following actions are recommended:
    a. CREP partners conduct outreach/technical assistance to all landowners with expiring contracts.
    b. CREP partners field check buffer sites in the last 2-3 years of contract to assess whether buffers meet standards and will be continuing after contract expiration, either through re-enrollment in CREP or voluntary retention of buffer.
    c. Acres of buffer that do not meet the practice standard or will not be retained should be removed from NEIEN/CB model. FSA will assign a unique identifier to each project in the future so it can be tracked better and doesn't become double-counted when re-enrollment occurs.

4. Implementation strategies should include approaches to conserve existing forest buffers so that newly planted buffers represent a net gain in overall buffers for a county or watershed segment. The following examples support this point:

- *Laws or ordinances that encourage conservation of existing buffers are in place.*
- *Monitoring and maintenance occurs on both newly planted buffers and also on existing buffers.*
- *Periodic sampling of total buffer area ~~to indicate that overall riparian buffer canopy in the county or watershed segment is increasing (Part 3 below)~~. In 2015, the Chesapeake Bay Program agreed to create a high-resolution land-cover map that will be updated periodically (e.g., every 3-5 years) to indicate a gain or loss in total forested riparian area. The gain or loss will be reflected in the regularly-updated land-use portion of the CB Model. This information will be used to cross-check what has been reported to the Model.*

- ~~CREP partners should develop a plan to establish a baseline for total riparian forest buffer acreage in a given county and to assess change in total buffer acreage. A sampling of counties experiencing the most land conversion (especially conversion from agriculture to developed) should be taken periodically to determine whether there has been a loss or gain in riparian forest cover. A number of software tools and geospatial programs are available to help with this. For example, every 5 years, the reporting agency will sample the three counties in each state that have experienced the most development or increase in agriculture (per agriculture census) to show there has not been a loss in total buffer cover – this is not information that is "entered" in the model, but a way of assuring that what is reported is a net gain. If a loss in overall riparian forest buffer coverage in these counties is detected, it would result in county-wide removal of buffers reported as a "net~~

~~gain" for those years. The theory is that if a state can show that it is maintaining buffers in the counties with the most threat, then it is assumed that buffers are being protected in less critical counties.~~

5. *Where agricultural riparian forest buffers are being planted voluntarily and without a contract, jurisdictions may give them credit for an initial four years without inspection, only if such plantings represent a small portion (5% or less) of the total acreage of buffer plantings reported in a given year.*

- To credit riparian forest buffers installed voluntarily by a landowner or non-governmental organization, the reporting agency must obtain information (e.g., description of the project plan and photographs) to verify that the buffer has been installed, and has the characteristics of an effective buffer (at least two tree species and a minimum width of 35 feet). In addition, credit requires the same tracking information as described for cost-shared practices.
- When voluntary riparian forest buffers account for 5% or less of a state's reported buffer acreage, initial verification does not require a site inspection. Practices that are inspected at the 4-5 year mark can remain in the NEIEN record if a site visit is made and shows that the buffers are established, and they are included in the spot check protocol (similar to cost-share practice) outlined in Part 2.

V. Verification Guidance for Agricultural Tree Planting

1. *Verification methods for cost-shared agricultural tree planting will utilize the verification programs already implemented for cost-share contracts.*

    - For purposes of verification, this practice will follow the BMP Verification Guidance put forth by the Agriculture Workgroup.
    - For tracking and crediting purposes, 100 trees planted equals one acre of practice (the same as for expanded urban canopy).
    - For plantings over an acre, a forester-developed planting plan is recommended.

VI. Background on Forestry Practices on Urban Lands

Bay jurisdictions have had urban forestry programs for the past ~30 years, having been established after the 1978 Cooperative Forestry Assistance Act and other means. These programs provide assistance to improve the health of urban trees including tree planting and maintenance to ultimately expand the urban tree canopy. There are multiple grant opportunities in the Bay watershed to encourage the development of urban forestry programs and urban tree canopy expansion. In many cases, grassroots urban forest programs have developed because individuals and organizations realize the many benefits (water quality being one) that urban trees bring people and because the investment by the programs in planning and maintenance of trees has been shown to pay back in multiples.

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Increasing tree cover in communities is one of the most sustainable and cost-effective practices to improve both societal well-being and the environment.

Tree planting can be a cost-effective way to meet regional air quality goals and is increasingly included in air quality improvement plans as a voluntary measure. In 2007, the Chesapeake Bay Executive Council committed to having 120 communities develop urban tree canopy expansion goals by 2020. The Chesapeake Bay Agreement of 2014 has a goal to plant 2,400 acres of urban forest by 2025. Urban forest buffer restoration is another practice that is increasing in importance: i.e., it has not been reported regularly in the past, but is expected to be a significant part of certain states WIPs.

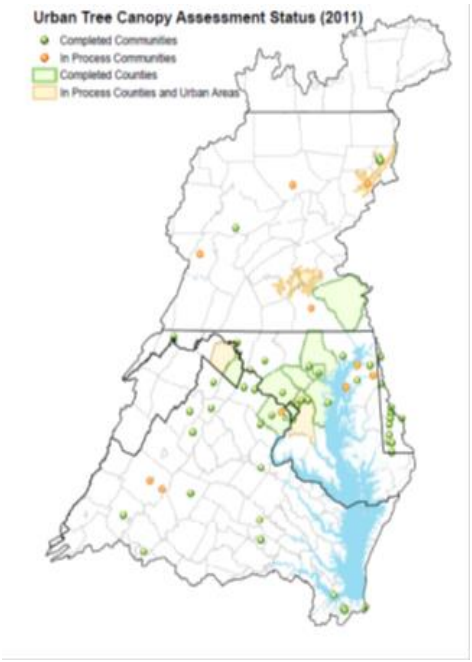

Figure 11. Urban tree canopy assessment status (2011) in the Chesapeake watershed.

Many localities in the watershed have had assessments done of their tree canopy and set goals to increase their urban tree canopy (Figure B-1). In recent years, the number of tools available for assessing and monitoring an urban canopy has soared, especially those using aerial imagery and software technology. In 2004, the Science and Technology Advisory Committee (STAC) held a workshop introducing these tools (STAC 2004). One leading program, the iTree suite of tools, is a free, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools (www.itree.com). Even more basic is the use of Google Earth® imagery to view tree canopy.

The two urban forestry practices, Urban Tree Planting/Expanded Tree Canopy and Urban Riparian Forest Buffers, overlap with practices covered by the BMP Verification Guidance of the Urban Stormwater Workgroup. As noted in that guidance, the practices may be implemented as part of a program to meet regulatory requirements, such as Clean Water Act MS4 permits. Tree planting has received a boost as federal, state and local stormwater requirements have strengthened provisions for maintaining and restoring natural hydrologic conditions in developed and developing areas.

Urban Tree Planting/Expanded Tree Canopy BMP - Urban tree planting is planting trees in an urban or residential environment. The intent of the planting is to have a living tree in that site or nearby in perpetuity and to expand the tree canopy. Tree replacement does not count. Planting 100 trees is equivalent to converting one acre of urban land to forest.

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Note that the definition and credit for this practice is currently under review by an Expert Panel and may be adapted somewhat in the future.

~~**Expanded Tree Canopy Description**: Expanding tree canopy is the overall percent of tree cover in a geographically defined locality on developed land. Credit is applied according to the number of new acres (net gain) of tree cover, i.e., amount of canopy expansion. If trees are not planted in a contiguous area, such as for street trees, then number of trees can be converted to acres using the following conversion factor:~~

~~100 trees = 1 acre of new tree cover~~

All tree planting data is aggregated and submitted to the state by a locality ~~,~~ for further aggregation to the CB model per land-river segment.

Urban Forest Buffer Description: An area of newly-established trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. An urban riparian forest buffer is any riparian buffer not in an agriculture or forest setting-- it is on developed land.

Current Procedures: At present, reporting of urban forestry practices by jurisdictions is not well-established, and procedures have been limited. In particular, there are questions about follow-up inspections and maintenance after initial planting. Also, there has been no means of assessing that tree planting projects are resulting in a net gain of tree cover.

VII. Verification Guidance for Urban Tree Planting/Expanded Tree Canopy

The Urban Stormwater Workgroup BMP verification guidance outlines a number of general principles that apply to Expanded Tree Canopy when used by a locality for stormwater management. Those that pertain to Tree Canopy include: 1) verification methods will be appropriate for the level of enforcement (e.g., consent decree or voluntary homeowner practice; 2) maintenance is essential to performance; and 3) BMP reporting must be consistent with the CBP standards.

The Forestry Workgroup adds the following forestry-specific guidance:

1. Establish urban forestry partner and support mechanisms

- For a decentralized practice, primarily on private land, a local urban forestry partner would improve confidence in tree survival/health and accuracy in tree reporting in a defined locality. An urban forestry partner may be a local government entity, or a non-governmental organization with necessary expertise who works cooperatively with the locality. The partner would be endorsed by the state forestry agency, which provides oversight and support with training, tools, etc. In turn, urban forestry partners can provide outreach and technical assistance on urban tree planting, tree care, and other issues that arise.

2. Urban forestry partner tracks and reports new acres of tree canopy in locality

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- For new plantings, the following information should be collected: 1) acres of planting, 2) dates of planting, and 3) anticipated stature of trees at maturity (e.g. large or small). Urban tree canopy plantings can be credited once planting is confirmed~~. All plantings over ½ acre should be site-checked by the urban forestry partner.~~.
- For natural regeneration acres, two similar pieces of data should be recorded: 1) acres of treatment, and 2) date started. But because of the difficulty to establish tree canopy in this way, this information should be reported for credit only after a 4-year maintenance period. Regeneration areas can be mowed, fenced or signed as deemed necessary.
- To receive credit, plantings should be site-checked. To credit ~~new acres~~plantings voluntarily- reported ~~voluntarily~~ by a landowner or other partner~~,~~ and not overseen by the forestry partner, the states or localities should develop a spot-checking/sampling strategy similar to approaches for some other voluntarily-reported urban practices. A 20% spot check is recommended. Protocols should indicate how the BMP acreage credit will be discounted based on ~~much total acreage is pro-rated by~~ survival rate, ~~by~~ information source, or other measures ~~means~~ of uncertainty.

3. Urban forestry partner should maintain new areas of canopy

- New urban plantings can have a high rate of mortality, succumbing to weed competition, dehydration, physical damage, or other injury. Removing competing vegetation is often necessary. A planted tree (e.g., one in a tree pit or open-planted, i.e., non-contiguous) that dies should be replaced, or removed from the NEIEN database.
- For natural regeneration areas, maintain desirable tree growth until a density of 100 trees per acre is reached and the trees are of a height where they can grow unhampered (above competing vegetation and deer browsing level of 4 feet). Area of intended tree canopy via natural regeneration should be a minimum of 1/4 acre (or adjoin to existing forest).

4. Reported practice should represent a net gain

- ~~Every 5 years, a locality should re-assess the tree canopy in its defined boundaries to show that there has not been a decrease in overall canopy. This is important especially since tree canopy losses may occur despite good policies and practices for urban forestry. Ongoing problems for tree canopy are the expansion of invasive pests such as emerald ash borer, required tree trimming for electrical reliability standards, and natural aging of trees.~~

- ~~If the tree canopy decreases, the acres of progress credited during the prior period (5 year max) should decrease by the same amount (e.g., 50 new acres planted over 5 years, 5% decrease found, 47.5 acres remain credited).~~In 2015, the Chesapeake Bay Program agreed to create a high-resolution land-cover map that will be updated periodically to indicate a gain or loss in urban tree canopy. The gain or loss will be reflected in the regularly-updated land-use portion of the CB Model. The high resolution tree canopy data will serve as a periodic cross-check on urban tree planting BMP data, to help ensure that what is credited in the model reflects actual tree canopy progress on the ground.
- ~~High-resolution imagery (1 or 2 meter/pixel) is becoming more common and can help a locality discern changes in tree canopy. There are experts available to help interpret the imagery and non-expert tools such as iTree Canopy () and the Land Image Analyst can be used as a cost-effective means of sampling and doing a quick assessment of canopy cover.~~

~~Example Canopy Assessment from iTree Canopy~~

~~To illustrate how to use iTree Canopy to estimate canopy cover, let us assume 1,000 points have been interpreted and classified within a city as either "tree" or "non-tree" as a means to ascertain the tree cover within that city, and 330 points were classified as "tree".~~

~~To calculate the percent tree cover and Standard Error (SE), let:~~

~~N = total number of sampled points (i.e., 1,000)~~

~~n = total number of points classified as tree (i.e., 330), and~~

~~p = n/N (i.e., 330/1,000 = 0.33)~~

~~q = 1 – p (i.e., 1 - 0.33 = 0.67)~~

~~SE = √ (pq/N) (i.e., √ (0.33 x 0.67 / 1,000) = 0.0149)~~

~~Thus in this example, tree cover in the city is estimated at 33% with a SE of 1.5%.~~

~~This process should take an average user several hours to complete and is requested once every five years.~~

~~iTree Canopy is designed to allow users to easily and accurately estimate tree cover within identified localities. This tool randomly lays points (number determined by the user) onto Google Earth imagery and the user then classifies what cover class each point falls upon. The user can define any cover classes that they like and the program will show estimation results throughout the interpretation process. The more points completed per size of the area to be sampled, the better the cover estimate. From this classification of points, a statistical estimate of the amount or percent tree canopy can be calculated along with an estimate of uncertainty of the estimate (standard error (SE)). A confidence interval of 95% should be reached to show no loss of canopy in the 5-year period.~~

5. ~~–~~ ~~–~~State oversight of reporting localities

To provide accountability, state forestry agencies regularly spot-check a subset of a locality/urban forest partner BMP project files and/or 5-year assessments of net gain for accuracy and thoroughness. This may also entail site visits to tree planting sites on record. The state oversight process needs to be transparent and publicly accessible so that NGOs, watershed groups and other stakeholders can be confident that BMP implementation is real. Improvements

on reporting are suggested. The state forestry agency should coordinate with the state MS4 oversight program, where local partners are implementing tree planting BMPs regulated by that program.

VIII. Verification Guidance for Urban Riparian Forest Buffers

- Partner should maintain information at local level of each new urban riparian forest buffer.
- For new plantings, data to be recorded should include: location (lat/long) and name of property, 2) acres planted (if appropriate, or length) and width, and date(s) planted.
- For natural regeneration acres, data to be recorded should include: location, acres of treatment, width, and date started. Naturally regenerating urban buffers are reported after 4 years of establishment if there are 100 or more live native trees per acre.
- All new buffer areas will be visited by the local urban forestry partner to confirm successful establishment.~~.~~

1. *Urban forestry partner ensures maintenance of urban riparian buffer*
   - New buffer plantings can have a high rate of mortality, succumbing to weed suppression, dehydration, physical damage, or other injury. Competing vegetation should be removed.
   - Reporting localities should be 80% confident that maintenance is occurring to avoid impacts to water quality pollution reduction efficiencies. Spot checking and/or statistical sampling is recommended. The sampling design should focus on specific maintenance issues that have the biggest potential impact on water quality such as concentrated flow. See guidance for maintenance of Agricultural Riparian Forest Buffers for more direction.

2. *Reported practice represents a net gain*
   - ~~Assessment of total urban forest buffer cover in a locality should be done every 5 years to ascertain that there is not a net loss of urban buffer. A procedure like the one described for Expanded Tree Canopy (using iTree Canopy) is recommended. For this practice, iTree Canopy data points would be located in the riparian area of a given locality. Other software may be equally useful in demonstrating there has not been a loss of buffer. If a loss of urban buffer in a locality is detected, the credits received over that 5-year period will be deducted by the same amount.~~A gain or loss in urban riparian forest buffers will be reflected in the regularly-updated land-use portion of the CB Model. This information will be used to cross-check what has been reported to the Model.

3. *State oversight of reporting localities*
   - To provide accountability, state forestry agencies should regularly spot-check a locality/urban forest partner BMP project files on urban forest buffer establishment ~~and/or 5-year assessments of net gain in~~ for accuracy and

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thoroughness. This may also entail site visits to buffer sites on record. The state oversight process needs to be transparent and publicly accessible so that NGOs, watershed groups and other stakeholders can be confident that BMP implementation is real. An oversight report should be communicated with the locality/urban forest partner to underscore what is being done well and what needs improvement.

IX. Background on Forest Harvesting BMPs

Forest Harvest BMPs Description: Forest harvesting practices are a suite of BMPs that minimize the environmental impacts of logging, including road building and site preparation. These practices can greatly reduce the suspended sediments and other pollutants that can enter waterways as a result of timber operations. The CB model currently assumes an average of 1% of forest is harvested in any given year, unless more accurate data are supplied by the state. The modeled pollution load from forest harvesting is reduced based on the annual number of acres of forest harvesting BMPs reported.

Current procedure: All States have adopted recommended BMPs for timber harvesting and forest management activities (also called Silvicultural BMPs) that have the potential to impact water quality. These water quality BMPs have common elements although they may vary from state-to-state and their use is site dependent. For the purposes of monitoring, BMPs are grouped by area of concern such as:

- Roads and timber loading areas
- Stream crossings
- Stream Management Zones or Riparian areas
- Wetlands
- Use of chemicals

Consistent and reliable data on the use and effectiveness of forest harvest BMPs are the most important evidence of a state's compliance with the Clean Water Act during timber harvest, and extensive protocols are available for monitoring (Welsh et al. 2006, Southern Group of State Foresters 2008). Such monitoring may be part of a state's nonpoint source management program, Sec. 319 of the Clean Water Act. EPA approves state harvesting guidelines which considers forest harvest BMP compliance to be voluntary when coupled with education and monitoring (West Virginia, where BMP compliance is mandatory, is an exception).

On-site visits of harvesting operations are routinely made by state agency foresters in most parts of the Bay watershed. If the forestry agency does not receive permission to access harvest sites and is not the authorized agency, request certification from the authorized agency. BMPs are widely implemented in practice and crediting should have every opportunity to be verified and credited.

Some forest harvesting BMPs are designed to have a short life—only for the duration of the harvest operation (e.g., temporary stream crossings), while others are intended to last several years-- until the forest grows back (e.g., erosion control plantings).

Appendix B
Forestry BMP Verification Guidance

Public Land vs. Private Land: In some states, forest harvesting is closely controlled and monitored on both public and private land. Other states control harvesting on public lands and can thus monitor BMP implementation there, but have no accessible record of where private forests are being harvested or what BMPs are used during those harvests. Public forests in all states are typically models in following BMPs, and many in the watershed comply with third-party certification programs such as Forest Stewardship Council to minimize impact. Only a small percentage (~4-8%) of private forest lands ascribe to third-party certification (through American Tree Farm membership or on their own).

As roughly 95% of harvesting is on private lands, it is important to apply the following verification guidelines to those lands. In some states, there is no authority for state forestry agents to access private lands after harvest. If states are not able to obtain permission to check enough randomly selected privately-owned harvesting sites, no forest harvesting BMP credit can be sought for those lands.

X. Verification Guidance for Forest Harvesting BMPs

1. *Track total acres of forest harvest BMP implementation, or rate of implementation, on private land, and conduct site visits after harvest to ensure proper installation. There are several options for tracking BMP implementation:*
    - State forestry agency documents that the project sites were visited and evaluated for forest harvest BMP establishment within 6 months of site preparation (or long enough to see results) and submits actual acres to NEIEN annually.

OR

- State forestry agency determines average rate of BMP implementation by on-site sampling (spot-checking) private land harvest sites within 6 months of harvest activity. A rate of implementation is determined and can be used for up to 5 years. Derived, assumed, or anecdotal information on implementation is insufficient. A good source of information on designing a statistically valid sampling procedure for implementation monitoring and analyzing the results can be found in "*Sampling and Estimating Compliance with BMPs*" produced by the Southern Group of State Foresters.

OR

- State forestry agency will determine an average rate of implementation by conducting a review of forest harvest records every 5 years. If using a sampling regime to determine rate of BMP implementation, use a confidence level of 80% (+/-5%).
    - Forestry staff or Cooperative Extension Offices can assess the overall rate of BMP implementation by using data collected from local forest district offices or county environmental protection offices. Harvest plan reviews and harvest permits are examples. BMP implementation rates can be credited after the first such review has been completed.
    - To complement a review of forest harvesting records, it is also recommended to interview local timber operators and forestry field staff to document consistency of practice implementation. Photographs of BMPs and some site visits are highly encouraged to further complement the

analysis of harvest records. This will help with BMP implementation improvement (#3 below).

2. *States should describe their existing and planned inspection programs for Forest Harvest BMPs in Verification Protocols.*

3. *Monitor use of forest harvest BMPs for Process Improvement*
Assessing forest harvesting BMP implementation and function, and looking at specific categories of BMP practices, will address issues such as training needs for forestry personnel and forestry practitioners. It can also provide insights about whether BMPs themselves are adequate or need improvement. States should describe how they plan to analyze their verification of forest harvest BMPs—e.g., how inspections and data records could more accurately capture what is happening with forest harvest BMP's during the most vulnerable periods (i.e., during a storm event soon after harvest).