Environmental and Public Health Engineering

TECHNICAL MEMORANDUM

TO: **BASMAA Phase II Cities, Counties and Other Public Agencies**

FROM: **Chris Sommers (EOA Project Manager)**

DATE: **May 19, 2017**

SUBJECT: **Technical Memo #2 (Final Draft) – Trash Reduction Framework and Full Capture Equivalency Approach**

I. Purpose

This is the second in a series of memoranda developed by EOA, Inc. to assist the 23 Bay Area Stormwater Management Agencies Association (BASMAA) Phase II communities[1] with their preparation for addressing the State Water Resource Control Board's (State Board) forthcoming trash reduction requirements. This memorandum presents the proposed **trash reduction framework** that BASMAA Phase II cities, counties and other public agencies plan to implement to demonstrate compliance with the State of California's Trash Amendments. The memo also includes the methods that municipalities will use to demonstrate **full capture system equivalency** and substitute Priority Land Use (PLU) areas with **equivalent alternative land areas**. Consistent with the Trash Amendments, Phase II municipalities will likely need to submit the methods for determining full capture equivalency and equivalent alternative land areas to the State Board in response to requests for information (i.e., 13383 letters) that are currently under development by the State Board staff and will be received by municipalities no later than June 2, 2017.

II. Background

On April 7, 2015, the State Board adopted Trash Amendments[2] that amend two statewide water quality control plans to include trash control requirements for owners/operators of municipal separate storm sewer systems (MS4s), including Phase II Permittees in the Northern portion of the San Francisco Bay Area. The Amendments are not self-implementing, and therefore the State Water Board plans to: 1) Issue letters to Permittees under California Water Code section 13383 in May or early June 2017 requesting that they choose their compliance strategy for addressing the Trash Amendments; and 2) Include trash reduction requirements consistent with the Amendments in the Phase II Statewide NDPES Permit when it is reissued in the next few years

[1] The 23 Permittees are: from the Marin County Stormwater Pollution Prevention Program (County of Marin, Cities of Belvedere, Larkspur, Mill Valley, Novato, San Rafael and Sausalito and Towns of Corte Madera, Fairfax, Ross, San Anselmo, and Tiburon), from the Napa Countywide Stormwater Pollution Prevention Program (County of Napa, City of American Canyon, City of Calistoga, City of Napa, City of St. Helena, Town of Yountville), County of Sonoma, City of Sonoma, City of Petaluma, Sonoma County Water Agency, and City of Benicia.

[2] The Trash Amendments include six elements: (1) narrative water quality objectives, (2) applicability, (3) prohibition of discharge, (4) implementation provisions, (5) time schedule, and (6) monitoring and reporting requirements. The Trash Amendments apply to all surface waters of the State, with the exception of those waters within the jurisdiction of the Los Angeles Water Board with trash or debris Total Maximum Daily Load (TMDLs) that are in effect prior to the effective date of the Trash Amendments. The narrative water quality objectives state that trash shall not be present in receiving water bodies or adjacent areas in amounts that adversely affect beneficial uses or cause nuisance.

(reissuance schedule to be determined). Based on the compliance schedule outlined in the Trash Amendments, beginning in mid-2017 and continuing through the next decade, Phase II Permittees will be required to significantly reduce the amount of trash discharged from their MS4 to local water bodies. On average, municipalities will need to demonstrate a 10% reduction per year in the amount of trash discharged from MS4s. The Amendments define trash as follows:

> *All improperly discarded solid material from any production, manufacturing, or processing operation including, but not limited to, products, product packaging, or containers constructed of plastic, steel, aluminum, glass, paper, or other synthetic or natural materials.*

Non-compliance with the requirements could result in monetary fines from the State or litigation from third-parties, which is allowed under the Federal Clean Water Act.

Applicable Land Areas (PLUs and Alternative Land Uses)

A central element of the statewide Trash Amendments is the designation of land areas where cities, counties and other applicable public agencies will need to implement new stormwater trash controls. Applicable land areas are based on land uses currently developed (i.e., not simply zoned) and presumed to generate high levels of trash. These areas are referred to as "Priority Land Uses, or PLUs" in the Trash Amendments. PLUs include all land areas currently developed as high density residential, industrial, commercial, mixed urban, and public transportation stations.[3]

Because not all PLUs generate significant levels of trash and not all trash is generated solely from PLUs, the Amendments allow Permittees to propose alternative equivalent land uses that better represent high trash generation in their jurisdictional areas. With the approval of the State, Permittees can substitute one or more PLUs with alternate land uses that generate trash at rates equivalent to or greater than, the PLU being substituted. Substituting PLUs for land areas that generate trash allows Permittees the flexibility to focus enhanced controls on trash-prone areas within their communities, as opposed to treating areas just because they fall into one of the PLUs. A description of the process that BASMAA Phase II municipalities will follow, should they choose to propose the substitution of PLU areas for equivalent alternative land areas, is included at the end of this memorandum.

Compliance Options and Related Considerations

The Trash Amendments provide two options (i.e., tracks) to demonstrate compliance with trash reduction requirements in PLUs of equivalent land areas:

- **Track 1 – Full Capture Systems**: Install, operate and maintain State Water Board certified/approved trash full capture systems in the storm drain system that drains <u>all</u> PLUs or equivalent alternative land areas. Full Capture Systems are those that trap all

[3] Priority land uses are defined as those developed sites, facilities, or land uses (i.e., not simply zoned land uses) within the MS4 permittee's jurisdiction from which discharges of trash are regulated by these trash provisions as follows: (1) **High-Density Residential**: all land uses with at least ten (10) developed dwelling units/acre; (2) **Industrial:** land uses where the primary activities on the developed parcels involve product manufacture, storage, or distribution (e.g., manufacturing businesses, warehouses, equipment storage lots, junkyards, wholesale businesses, distribution centers, or building material sales yards); (3) **Commercial**: land uses where the primary activities on the developed parcels involve the sale or transfer of goods or services to consumers (e.g., business or professional buildings, shops, restaurants, theaters, vehicle repair shops, etc.); (4) **Mixed Urban:** land uses where high-density residential, industrial, and/or commercial land uses predominate collectively (i.e., are intermixed). (5) **Public Transportation Stations**: facilities or sites where public transit agencies' vehicles load or unload passengers or goods (e.g., bus stations and stops).

particles that are 5 millimeter (mm) or greater, and have a design treatment capacity that is either: a) not less than the peak flow rate resulting from a one-year, one-hour storm in the subdrainage area[4], or b) appropriately sized and designed to carry at least the same flows as the corresponding storm drain. The 5 mm size limit corresponds with the diameter of a cigarette butt. Roughly 25 types of full capture systems have been approved by the Los Angeles and/or San Francisco Bay Regional Water Boards over the past 10+ years. Permittees will need to not only address trash from PLUs draining the public right-of-way, but PLUs draining to storm drain inlets located on private property and are connected to the Permittee's MS4.

- **Track 2 - Full Capture System Equivalent**: Implement a combination of full capture systems, multi-benefit projects, institutional controls, and/or other treatment controls to achieve full capture system equivalency, or the same performance results as Track 1. Example controls mentioned in the Trash Amendments include partial capture devices, street sweeping, and green infrastructure and Low Impact Development (LID) controls. If choosing Track 2, cities/counties will need to show equivalency to Track 1 performance using an approach that is acceptable by the State and the purpose of this memo is to describe the approach the listed 23 BASMAA Phase II Permittees will take to demonstrate that equivalency. Additionally, cities, towns and counties that opt to comply with the requirements via Track 2 will be required to submit an implementation plan and map illustrating: (a) the combination of trash controls selected and the rationale for the selection, (b) how the combination of selected controls is designed to achieve Track 1 equivalency, and (c) how Track 1 equivalency will be demonstrated.

III. Trash Reduction Framework

Overview

The following trash reduction framework was developed to assist BASMAA Phase II municipalities with planning for and complying with, the State's forthcoming trash reduction requirements. The framework is consistent with the approach developed, accepted, and currently in place in the San Francisco Bay Area for Phase I municipalities. The framework outlines the process that Phase II municipalities will use to develop baseline trash generation levels that will serve as the starting point for evaluating trash reductions from stormwater over time. The Framework also describes the recommended process for tracking and reporting trash control measure implementation and load reductions. The steps included in the framework are summarized below and fully described later in this section.

1. **Identify PLUs and Establish Baseline Trash Generation Levels** - Identify and map PLUs and establish baseline levels of trash generating from PLU areas based on the application of the Bay Area Trash Generation Model and field verification assessments.
2. **Evaluate and Select Compliance Approach (Track 1 or 2)** - Identify and evaluate existing and potential new/enhanced control measures for specific PLU areas or equivalent alternative areas. Select compliance approach based on the anticipated costs and benefits of the Track 1 versus Track 2.

[4] For the North Bay the one-year, one-hour storm is between 0.4 and 0.7 inches of rainfall, depending on the location of the subdrainage area. Additional information can be found at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca.

3.a If Selecting Track 2 – Develop and Submit an Implementation Plan and Map, and Full Capture Equivalency Approach to the State Board; Implement Control Measures – If choosing Track 2, develop and submit an implementation plan and map illustrating the control measures that will be implemented to address trash requirements, and the method that will be used to demonstrate full capture equivalency.

3.b If Selecting Track 1 – Develop and Submit an Operation and Maintenance Plan; Install, Map and Maintain Full Capture Systems – If choosing Track 1, identify and map the locations of trash capture systems and their treatment areas as they are installed. Develop and implement an Operation and Maintenance (O&M) plan for all full capture systems used to address trash reduction requirements.

4. Track and Report on Progress towards Trash Reductions Goals – Compare baseline and current trash generation levels and report annually on the stormwater trash reductions achieved via full capture systems and other types of control measures.

Step #1 – Identify PLUs and Baseline Trash Generation for PLU and Non-PLU Areas

Each BASMAA Phase II municipality will determine baseline levels (volumes) of trash generated from PLU areas within their jurisdictions. Baseline generation is defined as the estimated amount of trash generated from a land area in 2016/17 (or 2017/18 when current maps are refined) that would be captured by a well-maintained full capture system, if installed. Baseline levels of trash generated in PLU areas will serve as the starting point for demonstrating compliance with trash reductions mandated by the statewide Trash Amendments. In parallel, baseline levels of trash generated from Non-PLU areas will be determined to identify potential Equivalent Alternative Land Use areas. Figure 1 illustrates the process that North SF Bay Phase II municipalities have begun following to establish baseline levels of trash generation.

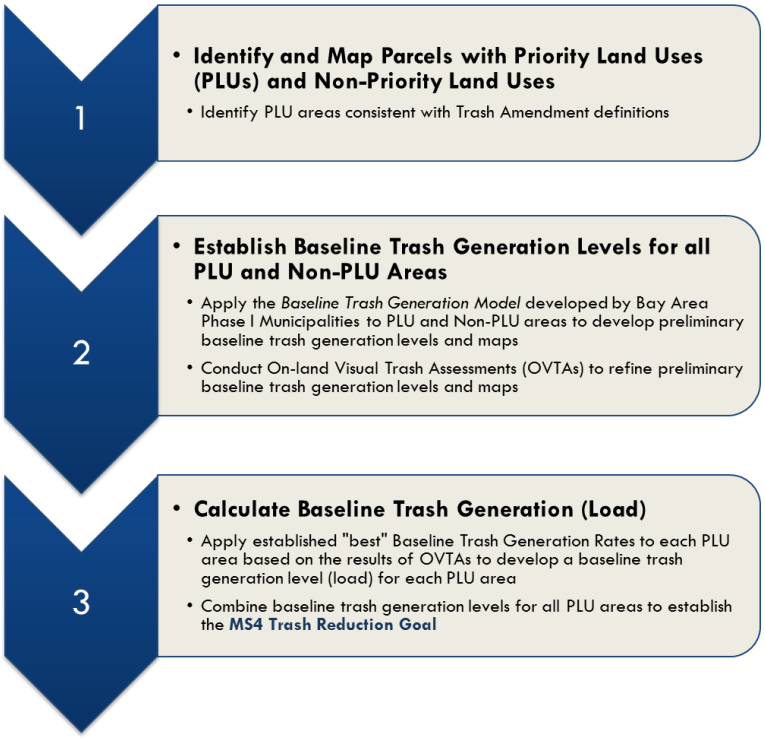

Figure 1. BASMAA Phase II MS4 process to establish baseline levels of trash generation.

Identifying Priority Land Use (PLU) Areas

As a first step toward developing baseline trash levels, BASMAA Phase II cities and counties identified and mapped land parcels that are currently developed PLUs. The five general PLU categories included in the Trash Amendments are listed and defined in Table 1. These categories are very broad and at times are inconsistent with the GIS land use data layers available for North Bay municipalities. In an attempt to reconcile the definitions of PLUs included in the Trash Amendments and the land use classes included in available GIS data layers, land use classes that that appear to meet the PLU definitions were identified and are presented in Table 1.

Municipal staff familiar with the local jurisdiction's land uses reviewed the land use classes included on preliminary PLU maps and identified parcels that are incorrectly categorized as PLUs and parcels that should be PLUs, but are not identified on the map. The resulting revised PLU maps identified all parcels within a city, town or unincorporated county that are PLUs. These parcels become the land area subject to the requirements associated with the Trash Amendments.

Table 1: Priority land use categories and the classes included in each.

Land Use Categories	Definition in Trash Amendments	Land Use Classes Included in Each Category
Priority Land Uses (PLUs)		
High-Density Residential	Residential land uses with at least ten (10) developed dwelling units (DU) per acre	• Single family residential parcels < 0.1 acre in size • Multi-family residential parcels identified as >10 DUs per acre or < 0.1 acre, including applicable apartments, townhomes, condominiums and trailer parks
Industrial	Land uses where the primary activities on the developed parcels involve product manufacture, storage, or distribution	• Heavy industrial buildings/facilities • Warehouses and equipment storage lots • Junkyards, landfills and waste recycling centers and transfer stations • Wholesale businesses and distribution centers • Building material sales yards • Other light industrial facilities
Commercial	Land uses where the primary activities on the developed parcels involve the sale or transfer of goods or services to consumers	• Retail establishments, including restaurants, theaters, shops, convenience stores, gas stations and grocery stores • Business or professional buildings • Community centers • Vehicle repair shops • Motels and hotels • Government buildings • Parking lots
Mixed Urban	Land uses where high-density residential, industrial, and/or commercial land uses predominate collectively	• Mixed use land areas that have a combination of two or more classes above
Public Transportation Stations	Facilities or sites where public transit agencies' vehicles load or unload passengers or goods	• Bus stations and stops • Park and ride lots • Rail stations and ferry terminals • Associated parking lots

Trash Generation Mapping

Maps illustrating PLU areas were transformed into preliminary baseline trash generation maps by applying the **Baseline Trash Generation Model** developed by BASMAA for Bay Area Phase I municipalities to PLU areas, and then verifying trash generation levels by conducting **On-land Visual Trash Assessments (OVTAs)**. An example baseline trash generation map is included as Figure 2. The Bay Area model was developed for the *BASMAA Trash Generation Rates for San Francisco Bay Area* project (BASMAA 2014) and uses a combination of land use and household median income levels to categorize different land areas based on predicted levels of trash generation. The Bay Area model was applied to PLUs in 23 North Bay Phase II communities as a first step toward developing baseline trash generation maps. The model was also applied to Non-PLU parcels to identify potential equivalent alternative land use areas.

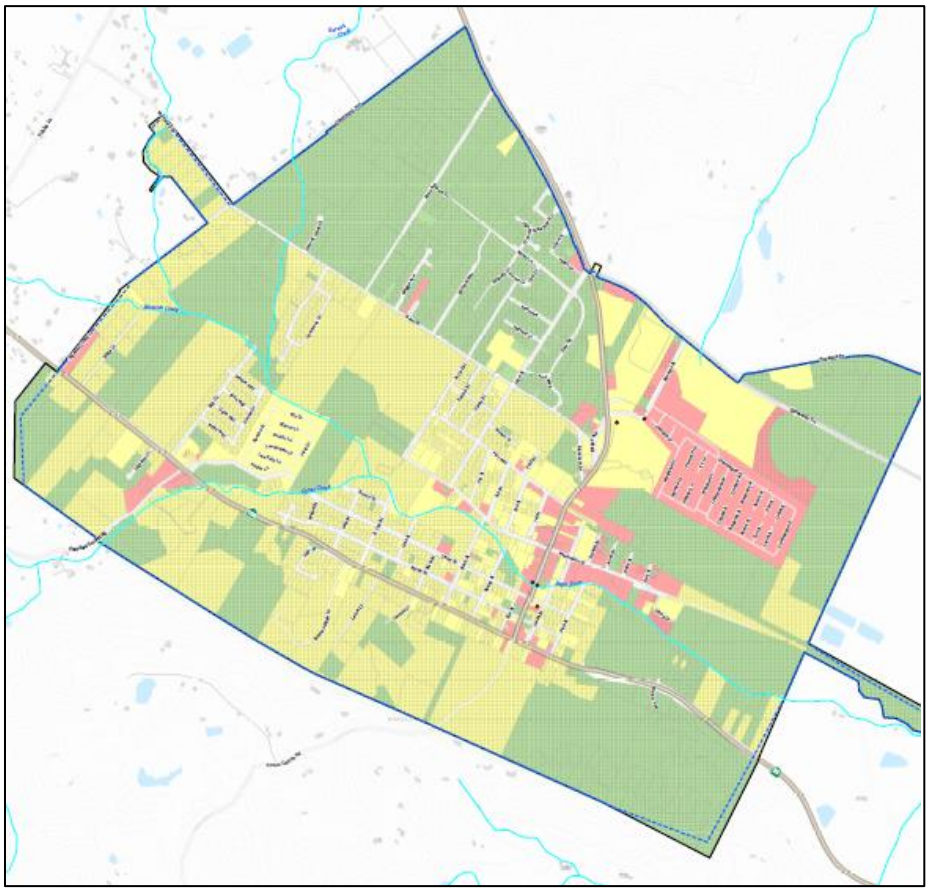

Figure 2. Example baseline trash generation map illustrating trash generation levels in priority land use (PLU) areas (solid colors) and Non-PLU areas (dotted colors).

Preliminary draft trash generation maps were developed in fall 2016. City, town and county staff are now refining their maps using the methods listed and described below, and consistent with the State Board's 13383 letter:

- On-land visual trash assessments (OVTAs); and
- Querying knowledgeable municipal staff or members of the public; and/or
- Reviewing municipal operations data (e.g., street sweeping or storm drain inlet cleaning); and/or,

- Viewing trash conditions within assessment areas via Google Maps – Street View.

On-land Visual Assessments

The *On-land Visual Trash Assessment* (OVTA) protocol (EOA 2015) is a qualitative protocol that results in observations of trash levels on streets and sidewalks at specific sites. Trash levels recorded as part of the OVTA fall into one of four scoring categories - Low (A), Moderate (B), High (C) and Very High (D). Narrative descriptions for each OVTA scoring category are provided in Table 2. Example photos illustrating each OVTA score are provided in Figure 3. The protocol is currently used by Phase I municipalities in the San Francisco Bay Area to establish baseline trash generation levels and to evaluate reductions in trash entering the stormwater conveyance system over time. The protocol assumes that the level of trash that is observed on streets and sidewalks is consistent with the level of trash discharged by stormwater conveyance systems.

Based on the recent findings of the Tracking California's Trash (TCT) project (BASMAA 2017), it is recommended that OVTAs be conducted at least 2 times at sites when establishing baseline. Additionally, it is recommended that municipalities attempt to conduct baseline assessments during both the wet and dry seasons to better depict the average levels of trash present on streets throughout the year. Assessments should not be conducted within 48 hours after a significant rainfall event (> 0.25 inches in 24 hours), or no sooner than half-way between street sweeping events. Conducting assessments earlier in a street sweeping cycle could underestimate baseline levels of trash on streets and sidewalks that may be available for transport to storm drain inlets.

Table 2. On-land visual trash assessment (OVTA) scoring categories and associated trash generation rates.

Trash Generation Category	OVTA Score	Description
Low	A	Effectively no trash can be observed on a city block or the equivalent. There may be some small pieces in the area, but they are not obvious at first glance and one individual could quickly pick them up.
Moderate	B	Predominantly free of trash except for a few pieces that are easily observed along a city block, or the equivalent. The trash could be collected by one or two individuals in a short period of time.
High	C	Trash is widely/evenly distributed and/or small accumulations are visible on the street, sidewalks, or inlets. It would take a more organized effort to remove the litter.
Very High	D	Trash is continuously seen throughout the area, with large piles and a strong impression of lack of concern for litter in the area. There is often significant litter even along gutters that are swept.

Figure 3. Example photos of On-land Visual Trash Assessment scores.

Querying Municipal Staff or Members of the Public

To the extent possible, municipal staff knowledgeable about the level of trash generated within an identified assessment area may also be able to provide information to confirm/refine preliminary maps. Information obtained by staff as a result of querying staff may supplement OVTAs. All information collected will be documented in tracking tables.

Reviewing Municipal Operations Data

Municipalities may have data on the amount of debris/trash removed via street sweeping and storm drain inlet maintenance. If available, these data may supplement OVTAs by providing information on whether specific areas are producing trash that enters the stormwater conveyance system. Information obtained by staff as a result of evaluating municipal operations data will be documented in tracking tables.

Viewing Trash Conditions via Google Maps™ – Street View

Municipalities may choose to identify the levels of trash associated with site via Google Maps - Street View to supplement OVTAs. This tool may provide valuable information to confirm or refine the level of trash in an assessment area. It is important to understand, however, that there are limitations to the use of this tool that may compromise accurate level of trash determination within an assessment area. For example, if vehicles or other large items present in the Street View

image may obstruct the view of trash in the area. Additionally, trash is typically only visible if located on streets or sidewalk and generally cannot be seen in Street View if located on adjacent parcels. Lastly, the date the Street View image was taken is unknown and may not fully represent the current level of trash generated in the assessment area. Given these challenges, Google Maps™ – Street View will only be used in combination with another confirmation method described above, as opposed to a single line of evidence for confirming/refining trash generation. Information obtained by municipal staff about the level of trash generation as a result of using Street View will be documented in tracking tables.

As a result of the data collection efforts described above, cities and counties will be able to accurately depict baseline levels of trash generation on maps within an acceptable level of confidence. Baseline trash generation maps will serve as the starting point for demonstrating compliance with trash reductions mandated by the statewide Trash Amendments. The process by which trash generation maps will be used to calculate the baseline volumes of trash from an MS4 is further described in Step #3 (Track and Report on Progress towards Trash Reductions Goals) of the trash reduction framework.

Step #2 - Evaluating and Selecting a Compliance Approach

Once baseline trash generation maps have been established, each municipality will begin to evaluate control measure options. The Trash Amendments require that by June 2017 the State Board formally designates cities, towns, counties and other Permittees that are subject to trash reduction requirements. In response, designated Phase II Permittees are required to communicate in writing to the State Board within three months of the designation as to whether it has elected to comply with the Trash Amendment requirements using a Track 1 or Track 2 approach. Examples of control measures that are included in Track 1 and 2 categories are included in Figure 4. When responding to the State Board on the approach selected, municipalities will submit the current version of their baseline trash generation maps as a demonstration of the city/county's current understanding of baseline trash levels in PLUs within their municipality.

Figure 4. Examples of Track1 and Track 2 control measures.

Step #3.a – Track 2 (Other Controls) Compliance Approach

The Trash Amendments require that Permittees that select the Track 2 compliance approach develop and submit a **Trash Full Capture System Equivalency (FCE) Approach** and a **Track 2 Implementation Plan and Final Jurisdictional Map** to the State Board within 18 months of the date of the information request from the state (i.e. 13383 letter). The implementation plan will describe the combination of controls selected by the Permittee to achieve FCE, and the rationale for the selection of the controls, including a discussion of costs and feasibility where appropriate or where required.[5] Plans will also include the latest version of the agency's baseline trash generation rate map.

For Track 2, a combination of both full capture systems and other control measures can be selected and implemented by Permittees. The implementation plan should identify the geographical extent and magnitude to which each type of control measure will be implemented. An implementation schedule for all planned control measures will also be included. If full capture systems are installed or planned for installation, cities, agencies will develop and submit a **Full Capture System Operation and Maintenance Plan (O&M Plan)** with their Track 2 implementation Plan. The O&M Plan will include the types and locations of all systems installed to-date, the O&M procedures that will be followed, and the frequencies at which each type of system will be inspected and maintained. As new systems are installed or maintenance procedures are revised, the O&M Plan will be revised accordingly and resubmitted to the State Board via annual compliance reports. All trash full capture systems should be maintained consistent with the definition of a full capture system.

The implementation plan will also include a summary describing how the combination of controls included in the plan are designed to achieve FCE and how FCE will be demonstrated. To the extent possible, North Bay Phase II cities/counties will develop, submit and implement a consistent FCE approach/method. A draft proposed methodology for determining and tracking FCE and demonstrating an average of 10% trash reduction per year is discussed later in this memorandum. Track 2 implementation plans and FCE approaches are subject to approval by the State Board.

Step #3.b – Track 1 (Full Capture) Compliance Approach

Those cities/counties choosing the Track 1 compliance option will develop and submit a **Track 1 Implementation Plan** to the State Board within 18 months after the designation of their municipality. The Track 1 Implementation Plan will be a Full Capture System Operation and Maintenance Plan (O&M Plan) and include the types and locations of all systems installed to-date, the O&M procedures that will be followed, and the frequencies at which each type of system will be inspected and maintained. As new systems are installed or maintenance procedures are revised, the Track 1 Plan should be revised accordingly and resubmitted to the State Board via annual compliance reports. All trash full capture systems will be maintained consistent with the definition of a full capture system.

The locations of all full capture systems installed and used to demonstrate compliance with Trash Amendment requirements will be mapped using Geographical Information Systems (GIS). Additionally, the land areas treated by full capture systems will be delineated and mapped onto baseline trash generation maps to illustrate the geographical extent of full capture

[5] It is the State Board's expectation that the Permittees will elect to install full capture systems where such installation is not cost-prohibitive.

implementation. The most current versions of baseline trash generation maps that include trash full capture locations and treatment areas will be submitted to the State Board via annual compliance reports.

Step #4 - Track and Report on Progress towards Trash Reduction Goals

Starting with the second annual compliance report due after the designation of a municipality (i.e., the FY 2019-20 Annual Report), trash control measure implementation and associated trash reductions will be reported to the State Board by Phase II cities and counties. Information on control measure implementation that cities/counties will track and report is described in this section. Methods that will be used by municipalities to track and report on trash reductions achieved to-date via full capture systems and control measures other than full capture systems are also summarized. Reductions will be calculated by comparing "baseline" and "current" trash generation levels. Reductions via control measures other than full capture systems will be accounted for by using the agreed upon FCE approach/method described below.

Trash Full Capture Equivalency Approach/Method

Due to hydraulic constraints or configurations of stormwater conveyance systems, the installation of trash full capture systems may not be feasible in some instances. Additionally, municipalities may choose to implement alternative (Track 2) control measures due to community needs that are not aligned with full capture systems and/or unique situations regarding trash generation. The statewide Trash Amendments allow for the implementation of alternative control measures, so long as the trash reduction can be quantified with an acceptable level of scientific rigor and the load reduced is equivalent to trash load that would be reduced if full capture systems were installed, operated, and maintained for all storm drains that capture runoff from PLUs or equivalent alternate land areas.

The Trash Amendments provide two examples of FCE approaches/methods:

- Trash Capture Rate Approach - Directly measure or otherwise determine the amount of trash captured by full capture systems for representative samples of all similar types of land uses, facilities, or areas within the relevant areas of land over time to identify specific trash capture rates. Apply each specific trash capture rate across all similar types of land uses, facilities, or areas to determine full capture system equivalency. Trash capture rates may be determined either through a pilot study or literature review. Full capture systems selected to evaluate trash capture rates may cover entire types of land uses, facilities, or areas, or a representative subset of types of land uses, facilities, or areas. With this approach, full capture system equivalency is the sum of the products of each type of land use, facility, or area multiplied by trash capture rates for that type of land use, facility, or area.
- Reference Approach - Determine the amount of trash in a reference receiving water in a reference watershed where full capture systems have been installed for all storm drains that capture runoff from all relevant areas of land. The reference watershed must be comprised of similar types and extent of sources of trash and land uses (including priority land uses and all other land uses), facilities, or areas as the Permittee's watershed. With this approach, full capture system equivalency would be demonstrated when the amount of trash in the receiving water is equivalent to the amount of trash in the reference receiving water.

In addition to the approaches described above, the San Francisco Bay Area regional municipal Phase I stormwater NPDES permit includes an accepted, scientifically rigorous, and practical approach to defining and demonstrating FCE. The SF Bay Area approach is based on technically acceptable and defensible assumptions and methods, and establishes a trash load reduction target for PLU areas. Given its acceptance by the SF Bay Water Board and practical application by municipalities, the Bay Area approach is the FCE method proposed by North SF Bay Area Phase II municipalities to establish FCE and demonstrate that FCE has been achieved via the implementation of control measures other than trash full capture systems (i.e., Track 2 controls).

Proposed Definition of Full Capture Equivalency

The following definition of Full Capture Equivalency (FCE) is proposed by BASMAA Phase II municipalities:

> *"The consistent achievement of **Low Trash Generation** in a PLU or equivalent alternative land area, as demonstrated via on-land visual assessments."*

This definition is consistent with the definition that is accepted and used in the San Francisco Bay Area by Phase II MS4s (SFBRWQCB 2015). Areas with low levels of trash generation typically include single family residential parcels or other areas where trash accumulation on streets, sidewalks and other land areas draining to MS4s is very minimal. There is effectively no trash present on streets and sidewalks in low trash generating areas. Although a very few small pieces of trash may be present in an area with low trash generation, trash items are not obvious at first glance and one individual could quickly pick them up in a very short period of time.

Low trash generating areas pose a very minor risk to water quality because they annually generate a very small volume of trash into storm drains (i.e., ~2.5 gallons of trash per acre on average). Because full capture systems are designed to only intercept trash that is transported via stormwater runoff from relatively moderate-sized storms (i.e., 1-year, 1-hour), trash that is mobilized into the stormwater system during larger storm events is typically not intercepted by the device (i.e., trash bypasses or overflows the system). Based on the results of trash full capture system performance studies (Allison et al. 1998; Caltrans 2004; DeCarlo 2004; Lee et al. 2006; City of Los Angeles 2006; City of San Diego 2012) the volume of trash that annually bypasses or overflows a full capture system is at least equal to (likely far greater than) the volume of trash generated from a low trash generating area. Trash full capture devices that treat moderate, high or very high trash generating areas and are well maintained, annually bypass and/or overflow greater than 2.5 gallons of trash per acre of land treated. Land areas that consistently generate low levels of trash are therefore equivalent to (if not better than) full capture systems designed to treat trash in runoff that occurs as a result of a 1-year, 1-hour storm event.

Method to Demonstrate Trash Reductions and Achievement of Full Capture/FCE in all PLUs

To demonstrate trash reductions from MS4s via full capture systems and/or trash controls that are equivalent to full capture systems, a combination of the following will be used:

1) Baseline trash generation levels in PLU areas, as illustrated on baseline maps;
2) The extent of PLU areas treated by full capture systems;
3) On-land Visual Trash Assessment (OVTAs) results collected through a monitoring program that is designed to detect improvements in levels of trash generated from PLU areas; and

4) Trash reduction offsets based on the volume of trash removed via cleanup events conducted in receiving waters.

The processes that Phase II cities/counties will create, use and report trash reductions and the achievement of full capture or FCE in all PLU (or equivalent alternative) areas are described in this section.

1. Calculate Baseline Trash Generation Levels

The estimated baseline level (volume) of trash generated from PLU areas in each municipality will be calculated using: 1) final baseline trash generation maps depicting areas (acres) generating levels of trash greater than FCE; and 2) annual trash generation rates developed for the Bay Area via the *Baseline Trash Generation Rates for the San Francisco Bay Area* project (BASMAA 2014) and incorporated into the San Francisco Bay municipal regional NPDES permit for stormwater discharges (SFBRWQCB 2015).[6] Annual trash generation rates are expressed as the volume (gallons) of trash generated per acre of land. Best/mid-point rates developed by BASMAA for very high, high and moderate trash generation categories are listed in Table 3. As described previously, rates associated with the low trash generating category are equivalent to full capture systems and therefore for the purposes of calculating trash reductions, are assumed to be zero.

Table 3. Trash generation categories and associated best/mid-point rates and On-land Visual Trash Assessment (OVTA) scores.

Trash Generation Category	**Low**	**Moderate**	**High**	**Very High**
Best/Mid-point Trash Generation Rates (gallons/acres yr^{-1})	**NA**	**7.5**	**30**	**100**
On-land Visual Assessment Score	**A**	**B**	**C**	**D**

The recent evaluation of OVTAs conducted by BASMAA (2017a) as part of the *Tracking California's Trash* (TCT) project concluded that best/mid-point trash generation rates correspond well to OVTA scoring categories (A/B/C/D). Based on these findings, best/mid-point rates will be assigned to all PLU areas assessed via OVTAs and depicted on baseline trash generation maps. By multiplying these rates by the corresponding acres within each PLU area, the "**Baseline Trash Levels**" (i.e., volumes of trash generated) will be calculated for very high, high and moderate PLU areas. An example calculation for baseline trash levels in included in Table 4.

The total baseline volume of trash generated from all PLU areas represents the amount of trash that is discharged to a receiving water body prior to the implementation of full capture or

[6] For a number of non-technical reasons, weighting factors (i.e., 0 - Low, 1 - Moderate, 4 - High, 12 - Very High) were preferred by the SF Bay Water Board over the use of mid-point/best trash generation rates. If the low trash generation category is assumed to achieve full capture equivalency, these weighting factors are roughly equivalent to applying the mid-point/best trash generation rates.

equivalent controls. This baseline volume will be compare against "current" trash levels calculated in future years to evaluate improvements in the levels of trash in stormwater.

Table 4. Example table depicting acreage in PLU areas within each trash generation category and the estimated baseline level of trash generated (gallons) from PLU area annually.

Category	Low	Moderate	High	Very High	Totals
Best/Mid-Point Trash Generation Rate *(gallons/acre yr^{-1})*	*NA*	*7.5*	*30*	*100*	**-**
PLU Area (Acres)	100	200	50	0	**350**
Estimated Annual Trash Generation Level (gallons)	**NA**	**1,500**	**1,500**	**0**	**3,000**

2. Establish Current Trash Generation Levels

Areas Treated by Full Capture Systems

Approved/certified full capture systems include devices installed in storm drain inlets, lines and outfalls. Depending on the location and type of full capture system installed, the land areas treated by these systems can range from less than one acre to hundreds of acres. Areas treated by these systems can be delineated using different methods (e.g., desktop or field), each with varying levels of accuracy. Areas treated by inlet-based devices are typically delineated in the field using storm drainage maps and elevations. Areas treated by larger systems (e.g., hydrodynamic separators and netting devices) are generally delineated as part of the design/sizing process.

To demonstrate trash reductions associated with full capture systems, BASMAA Phase II municipalities will delineate and map all land areas (PLU and Non-PLU) treated by full capture systems. Each treatment area may represent one or more systems. The location of each system will also be mapped. GIS will be used for all full capture system and treatment area mapping.

Annually, Phase II municipalities will calculate "**Current Trash Levels**" for PLU areas treated by full capture systems (i.e., Track 1 controls). The PLUs treated by full capture systems will have fully complied with the trash reduction goals outlined in the statewide Trash Amendments. Current trash levels for these PLU areas will therefore be calculated as zero (0).

Areas Addressed by Other Types of Control Measures

Trash control measures other than full capture systems (e.g., street sweeping, curb inlet screens and on-land cleanups) can significantly reduce trash in stormwater (Allison et al. 1998; SCVURPPP 2007; BASMAA 2017b). These "Track 2" control measures will be implemented by Phase II

municipalities in PLU areas that have moderate, high or very high baseline trash generation levels, and are not treated by full capture systems. For PLU areas identified on final baseline trash generation maps as having demonstrable low trash generation levels, no new or enhanced trash controls will be implemented since these areas will have achieved FCE.

Trash reductions in PLUs where new or enhanced Track 2 controls are implemented (i.e., PLUs that have moderate, high or very high baseline trash generation levels, and are not treated by full capture systems) will be evaluated using OVTAs conducted as part of a trash assessment program that is designed to depict "current" levels of trash generation. The OVTA protocol (EOA 2015) is relatively straightforward and practical to implement. As concluded in the OVTA evaluation that was recently completed by BASMAA, the OVTA protocol provides the level of accuracy and precision needed for documenting current levels of trash in stormwater and demonstrating stormwater trash reductions over time (BASMAA 2017a). Consistent with the findings and recommendations outlined by BASMAA (2017a), Phase II municipalities will conduct OVTAs as part of their trash assessment program using the following guidelines:

- **Number of Sites** - At a minimum, assess a set of sites that represent 10% of all street miles associated with PLU areas where Track 2 controls are currently implemented and trash reductions are being claimed. To the extent possible, randomly select assessment sites to ensure that OVTA results are representative of the areas where the Track 2 controls are being implemented.
- **Assessment Area** – The assessment area is defined in the OVTA protocol. Include both streets and sidewalks.
- **Frequency of Assessments** - Conduct a minimum of three OVTAs per year (on average) at each assessment site.
- **Timing of Assessments** – Conduct assessments during both the wet (Oct-Apr) and dry (May-Sept) seasons to depict the average levels of trash present on streets/sidewalks throughout the year. Conduct assessments no sooner than half-way between reoccurring street sweeping events and no sooner than 48 hours following a significant rainfall event (>0.25 inches in 24 hrs).
- **Number of Assessors** – Conduct assessments using a minimum of two trained assessors, working together to score sites to reach consensus on the assessment score.
- **Averaging Period** - Decisions on whether "current" trash generation should be based on data collected from one or more years should be based on an evaluation of assessment results. Averaging periods should be informed by the State Board required reporting cycles, the variability in scores observed at the set of OVTA sites, and the timing of the anticipated improvement in trash generation levels within PLU areas.

All OVTA sites will be mapped in GIS and included on baseline trash generation maps. Annually, "current" trash generation levels will be calculated for PLU areas where Track 2 controls are implemented, using OVTA results from all sites and assessment events that were conducted during the selected averaging period that is representative of the current level of trash generation. The process that will be used by each Phase II municipality to calculate the current level of trash generated by Track 2 PLU areas is as follows:

1. For each assesment site, calculate the "average linear street feet" that was observed in each OVTA category during all assessment events conducted during the selected averaging period.
2. Calculate the "total average linear street feet" in each scoring category for all sites combined by summing the average linear street feet for all sites.
3. Calculate the "% total average linear street feet" in each scoring category by dividing the total average linear street feet in the category, by the total average linear street feet for all categories combined. These percentages represent the "current" proportions of the total Track 2 PLU area in each trash generation category.
4. To calculate the "current acreage in each category", multiply the % of average linear street feet (calculated in Step #3) by the total PLU area (acreage) in the municipality assocaited with Track 2 controls.
5. To derive "**Current Trash Levels**" for Track 2 PLU areas, multiply the current acreage in each category (calculated in Step #4) by the associated best/mid-point trash generation rate (see Table 3); then sum the current trash levels for each category. The current trash levels represent the estimated volume (gallons) of trash currently generated in PLUs that are associated with Track 2 controls.

3. Account for Trash Reduction Offset (Cleanups in Receiving Waters)

Trash that is observed in creeks, rivers, lakes, lagoons and Bay shorelines can originate from MS4s and other pathways (i.e., direct dumping, wind and homeless encampments). Cleanup events conducted in these receiving waters to remove trash, improve water quality at the site, prevent trash from moving to downstream water bodies (e.g., SF Bay), and can create additional public outreach and participation benefits. Cleanup events are conducted by municipalities, volunteer groups, or other entities/individuals.

One way to recognize the value of these cleanups and to account for their short-term benefits is to provide a reduction offset that can be applied towards stormwater trash reduction goals. Consistent with the SF Bay Area regional municipal stormwater NPDES permit, an offset at a three (trash removed) to one (trash reduction) ratio is proposed for trash cleanups that occur during a given fiscal year within receiving waters within or directly downstream o the municipality boundaries. The volume of trash that would need to be removed via receiving water cleanup events to receive a 1% reduction offset is as follows:

1% Reduction Offset = Baseline Trash Level (gallons) x OF

where:

Baseline Trash Level	*= baseline volume (gallons) of trash generated via all PLU areas*
OF	*= 3:1 offset factor equal to 0.033*

A maximum of 10% trash reduction offset will be claimed by Phase II municipalities per fiscal year for receiving water trash cleanups. Each cleanup event should be documented via photographs (before and after), and the volume of trash removed during each event should be recorded to assist with calculating the load reduction offset.

4. Calculate Trash Reductions and Progress towards Trash Amendment Goals

The Trash Amendments set trash reduction goals of 10% per year (on average) and compliance with the stormwater trash discharge prohibition within 10 years after the designation of a Phase II municipality by the State Board. On an annual basis, each BASMAA Phase II municipality will calculate and report on trash reductions achieved to-date by comparing "Baseline Trash Levels" to "Current Trash Level" in all PLU areas. Current and baseline levels will be calculated using the methods previously described in this memo. Reductions, as well as information on control measure implementation (see below), will be reported in compliance reports submitted annually to the State Board. Trash reductions achieved to-date will be calculated by using the following formula:

$$\%\ \textbf{Trash Reduced} = \left(\frac{\text{Baseline Trash Level} - \text{Current Trash Level}}{\text{Baseline Trash Level}} \times 100\right) + \%\ \text{Reduction via Offset}$$

where: *Baseline Trash Level* = *baseline volume (gallons) of trash generated via all PLU areas*

Current Trash Level = *current volume (gallons) of trash generated via all PLU areas*

% Reduction via Offset = *trash reduction offset (%) associated with trash cleanup events conducted in receiving waters during the reporting year.*

Reporting on Control Measure Implementation

In addition to reporting on trash reductions achieved to-date and progress towards overall reductions outlined in Trash Amendments, BASMAA Phase II municipalities will also report annually on the status of existing and planned trash control measures. For those municipalities addressing the trash requirements via full capture systems, the following information on the will be included in annual compliance reports submitted to the State Board:

- Number and type of systems installed to-date;
- Trash generating areas (i.e., PLU acres in very high, high or moderate generation categories) treated by full capture to-date;
- Percent of baseline trash from all PLU areas reduced via full capture systems;
- Summary of full capture operation and maintenance activities conducted during the reporting year, including average frequencies of inspection and maintenance for all systems; and
- Any special problems observed such as flooding, screen blinding or plugging from leaves, or other negative conditions.

It is recommended that Phase II municipalities use a geospatial database format to map full trash capture device locations and drainage areas. Municipalities should also track maintenance frequencies and issues using spreadsheets or databases. Field forms documenting maintenance events should also be retained by municipalities.

For Phase II municipalities implementing Track 2 controls to address trash reduction requirements, the following information should be tracked and reported to the State Board on an annual basis:

- Summary of "Track 2" trash control actions implemented to-date, including the types of actions, levels of implementation, areal extent of implementation, and whether the actions are ongoing or new; and
- Summary of OVTAs conducted during the selecting averaging period, including the locations and extent of assessment areas, the dates assessments were conducted, and the results of OVTAs used to calculate "current trash levels."

Substituting PLU Areas with Equivalent Alternative Land Areas

The Trash Amendments allow municipalities to substitute alternative equivalent land areas for PLU areas, given that the alternate area generates trash at rates equivalent to or greater than the PLU being substituted. Municipalities may choose to exercise the option of choosing an alternative land area from trash controls for a number of reasons, including the lack of jurisdiction over a PLU area, the identification of higher priority areas for trash controls, and the lack of feasibility in installing trash full capture systems. Should a municipality choose to substitute a PLU area for an alternative equivalent land area, the city or county should generally following the process outlined below and summarized in Figure 5.

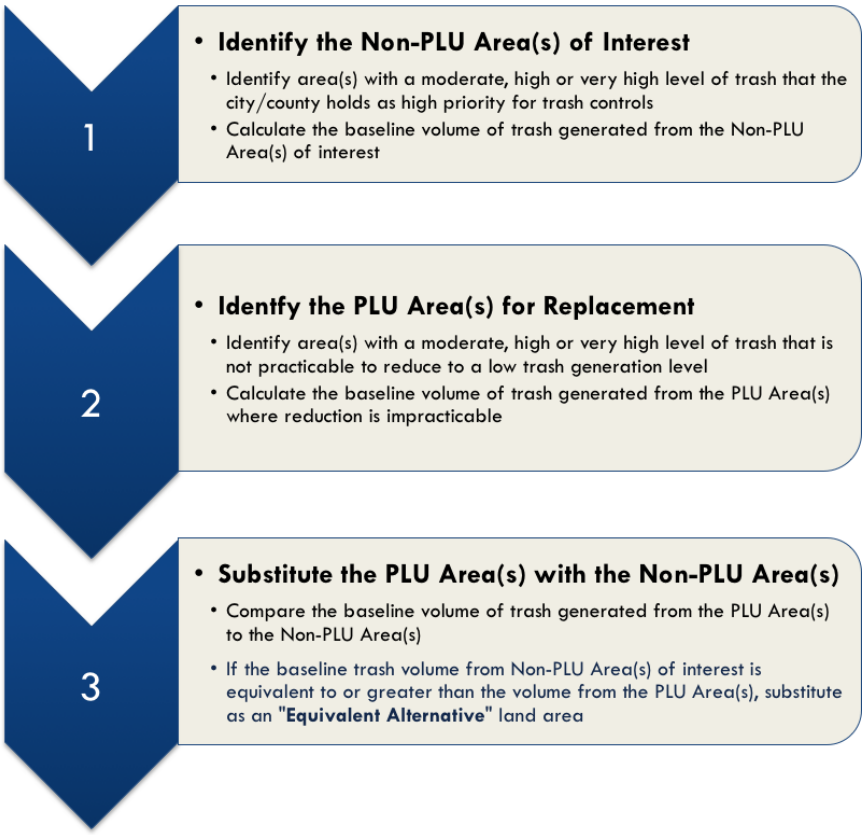

Figure 5. BASMAA Phase II MS4 process to identify and substitute PLU areas for equivalent alternate land areas.

Cities and counties interested in substituting areas should first identify on a map the non-PLU area(s) that the city/county holds as high priority for trash controls. Only non-PLU areas with either moderate, high or very high baseline trash generation levels can be used as an alternative land area. Non-PLU areas with low baseline trash generation should not be included in this process. Once an area(s) has been identified, the baseline volume of trash generated from this area should be calculated using the acreage of the area and the applicable best/mid-point trash generation rate. The baseline volume of trash generated from this area will be used to compare against the PLU area(s) being considered for substitution.

Once the trash volume generated from the Non-PLU area of interest has been calculated, a similar process will be conducted for the PLU area(s) identified for substitution. Again, only PLU areas with either a moderate, high or very high baseline trash generation level should be considered for substitution. Additionally, only PLU areas where control measures cannot practicably and cost-effectively be treated by a full capture system or the trash level reduced to a low trash generation level should be considered for substitution. If PLU areas meet these criteria and a municipality is interested in substituting a PLU area with an equivalent alternative land area, a request will be submitted in writing to the State Board staff as part of the municipality's annual reporting process. In the submittal, the areas being substituted will be identified on the city/county's revised trash generation map. Additionally, municipalities will include the levels of trash generation in each PLU or Non-PLU area of interest and justification for the substitution. The State Board shall grant or deny the request within 60 days or the request for substitution shall be granted as requested.

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