On-Land Visual Trash Assessment Protocol for Stormwater

PROTOCOL B - DRIVING SURVEY

Establishing baseline levels of trash generation and assessing changes in trash levels

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Version 2.0

1410 Jackson St.
Oakland, CA 94612

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Preface

The On-Land Visual Trash Assessment (OVTA) Protocol was originally developed by EOA, Inc. in 2015 to provide public agencies subject to the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (MRP) requirements with a mechanism to establish baseline trash levels on streets and sidewalks, and demonstrate trash load reductions from their stormwater conveyance systems due to trash prevention and reduction controls. The original protocol focused on conducting surveys of trash on streets and sidewalks, and was revised in 2017. The 2017 version of the protocol is now referred to as *Protocol A – Street and Sidewalk Survey*.

In response to the need to apply similar assessment concepts to areas that do not have sidewalks or safe pedestrian access, or are not associated with streets/sidewalk, EOA developed two additional OVTA protocols in 2017. *Protocol B – Driving Survey* should be used in situations where pedestrian access is not safe or available (e.g., highways). *Protocol C – Area-based Survey* should be used in situations where the area of interest is not associated with the adjacent roadway or sidewalk, such as parking lots. Protocols A, B and C may be updated/revised periodically by EOA, Inc.

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INTRODUCTION

The On-land Visual Trash Assessment Protocol for Stormwater is designed to provide qualitative estimates of the amount of trash that accumulates on specific street segments, sidewalks and adjacent land areas that may be transported to a municipal stormwater conveyance system. Trash accumulation is a term used to describe the level of trash deposited onto land areas and available for transport to the conveyance system prior to removal via street sweeping or other significant management actions that intercept trash before entering the stormwater conveyance system. Trash generation is a term used to describe the remaining level (i.e., volume) of trash transported by the stormwater conveyance system to receiving waters (e.g., creeks, rivers, lakes, estuaries, bays and oceans).

The On-land Visual Trash Assessment Protocol for Stormwater serves the following two purposes:

1) **Establishing Baseline Levels of Trash Generation -** to establish baseline levels of trash generation for specific land areas using four trash generation categories1, and;

2) **Assessing Changes in Levels of Trash Generation -** to provide a qualitative tool to assist in evaluating changes in the level of on-land trash that is transported by the stormwater conveyance system to receiving waters.

This protocol (B) focuses primarily on evaluating trash levels on streets that do not have sidewalks or are unsafe to walk. If streets of interest have sidewalks and can be walked safely, then please refer to *Protocol A – Street and Sidewalk Surveys*. For conducting area-based on-land visual assessments on the interiors of properties, such as parking lots of large commercial properties, please refer to *Protocol C – Area-based Surveys*. All three protocols are available at http://eoainc.com/ovta_fc/.

When using this methodology, the definition of trash or litter is generally consistent with the definition included in the California Code Section 68055.1(g)[1], but excludes sediments, sand, vegetation, oil and grease, exotic species, food waste (e.g., apple cores, banana peels), landscaping material that has been improperly disposed on the public right-of-way, and pet wastes. Additionally, mattresses, shopping carts, furniture, appliances, contained bags of trash, and all other illegally dumped large items not capable of fitting in a storm drain inlet opening; and trash that is less than 5mm in length are also excluded from the definition of trash.

PERSONNEL

This methodology requires at least two people, one driver and at least one passenger performing the assessments and managing the camera. An additional person in the office should be designated as a point-of-contact with cell phone numbers of both field personnel and their planned schedule (i.e., location and time).

[1] Defined as all improperly discarded waste material, including, but not limited to, convenience food, beverage, and other product packages or containers constructed of steel, aluminum, glass, paper, plastic, and other natural and synthetic materials, thrown or deposited on the lands and waters of the state, but not including the properly discarded waste of the primary processing of agriculture, mining, logging, sawmilling, or manufacturing.

EQUIPMENT

The following equipment is needed to properly apply the protocol:

- Digital camera (preferably with GPS capabilities)
- A car window mount to hold the camera steady
- Pencils and marker
- Field form and/or maps of the assessment area

ASSESSMENT AREA

When establishing baseline trash generation for the purposes of complying with the California State Water Resource Control Board's Trash Amendments, assessments should be conducted in areas associated with Priority Land Use (PLU) areas or equivalent alternative land areas. The width of the assessment area should extend from the center line of the road (or middle of the median) to the edge of the adjacent property, and include all portions of the public right-of-way (ROW) that convey stormwater to the stormwater conveyance system. The assessment area should include, but not be limited to the median, street, gutter, curb, sidewalk, backside of sidewalk, and vegetated areas (e.g., grass, bushes, and tree wells). The assessment area should also include any trash in visible areas that could theoretically reach the stormwater conveyance system, regardless if it is in the public right-of-way or private land area. If there are obstructions such as a building or fence that would prevent trash from moving to the stormwater drainage system, the area should *not* be included in the assessment area.

TIMING OF ASSESSMENT

Establishing Baseline Trash Generation

When using this protocol to assess baseline trash levels, the timing of the assessment should be selected carefully in accordance with the following directions. To ensure that the level of baseline trash generation is not underestimated, assessments should be conducted prior to reoccurring trash control measure implementation events (e.g. street-sweeping). At a minimum,

the assessment should be performed sometime after the half-way point between sweeping events (or other reoccurring control measure implementation events). This will ensure that the trash conditions observed are most likely at or above typical levels for that location.

Assessing Changes in Trash Levels

When using this protocol to assess changes in trash levels over time, the timing of the assessment should be selected carefully in accordance with the following directions. To ensure that the level of observed is not under or overestimated, assessments should be conducted roughly half-way between reoccurring trash control measure implementation events (e.g. street-sweeping).

When to Conduct OVTAs

Establishing Baseline – So that baseline levels are not underestimated, conduct assessments **prior to** reoccurring trash control measure events, such as street-sweeping or on-land cleanup events.

Assessing Change/Progress – To obtain an average condition, conduct assessments roughly **half-way between** reoccurring control measure events.

Considerations of Rainfall (Transport) Events

To reduce the influence of recent rainfall-runoff events on the levels of trash accumulated at visible during assessments, assessments should not be conducted after a significant rainfall-runoff event. For the purposes of this protocol, a significant rainfall event is defined as at least 0.5 inches of rain in a 24-hour period occurring within a 48-hour period before the assessment. Rainfall volumes can be tracked at the following websites or other local rainfall data management systems:

http://cdec.water.ca.gov/cgi-progs/precip/DLYPCP
http://www.wrh.noaa.gov/mtr/versprod.php?pil=RR5&sid=RSA.

If more than one half-inch of rainfall has fallen within a 24-hour period prior to the assessment, then the assessment should be rescheduled.

TRASH LEVEL CATEGORIES

Trash levels established by using this protocol are based visual observations of the magnitude and extent of trash observed in a defined assessment area. There are four trash level categories (A, B, C and D). The definitions for each are provided in Table 1. Example images and links to videos illustrating trash levels are provided in **Appendix A**.

Table 1. Definitions of trash levels defined by the On-land Visual Trash Assessment protocol.

Trash Level	Definition
A **Not Littered**	• Effectively no trash is observed in the assessment area. • There may be some trash in the area, but it is not obvious at first glance. • One individual could easily clean up all the trash observed while walking at normal pace. • No additional trash reduction measures are needed in the assessment area.
B **Slightly Littered**	• Predominantly free of trash, except for a few littered areas. • Some trash is noticeable at first glance. • The trash observed could be collected by one or two individuals, but would require walking at a slower than normal pace. • Additional trash reduction measures are needed in the assessment area.
C **Littered**	• Predominantly littered, except for a few clean areas. • Trash is widely/evenly distributed and/or small accumulations are noticeable on the streets and sidewalks. • It would take multiple people to remove all trash from the area, frequently requiring individuals to stop walking to remove the trash. • Roughly 4 times as much trash as a "B" level.
D **Very Littered**	• Trash is continuously seen throughout the assessment area and there is a strong impression of lack of concern for litter. • Large piles of trash may be observed. • It would take a large number of people during an organized effort to remove all trash from the area, consistently requiring individuals to stop to remove the trash. • Roughly 3 times as much trash as a "C" level.

Important Note: Because the visual assessment protocol is intended to assess the level of trash greater than 5mm in length that is observed on-land and can reasonably be transported to the stormwater conveyance system, *only* trash that appears to be mobile or could be mobilized in a storm event should be considered in the assessment. Large items such as furniture, tires, and appliances that cannot fit into a storm drain inlet should not be included in this assessment. Additionally, graffiti on roads, buildings, or landscaping in disrepair should not affect the assessment grading.

ASSESSMENT PROTOCOL

Establishing Baseline Trash Generation

The following on-land visual assessment protocol should be used to establish baseline trash levels for a specific land area. The time to complete the protocol will depend on length of the assessment area and traffic on roadways.

The protocol consists of the following steps that should be conducted in sequential order:

1. **Identify Assessment Areas**. Assessment areas should be delineated on a map. Areas should be identified on the map using a unique ID or other label, which should also be used on the data collection form and/or tracking spreadsheet. Targeted roads should be split into segments varying from approximately 200 to 600 meters in length. It is best if segments are divided at intersections or other features that are easily recognizable while driving. These segments could be established in the office before the assessment, or in the field during the first assessment. This allows the assessor to split the road by trash generation level observed in addition to other features such as intersections.
2. **Confirm timing** falls directly before reoccurring control measure implementation and does not follow a significant rainfall event.
3. **Assemble equipment** needed to conduct the assessment including the data collection form and map(s) delineating the assessment area (see **Appendix B**).
4. **Review trash condition category definitions** presented in Table 1 (also included on the data collection form) and photo examples in Appendix A.
5. **Conduct Photography-Based Assessments.** Conduct assessments using a high definition digital camera and a window mount to hold the device steady. Camera specifications should include a wide field of view, fast shutter speed, and an internal GPS to geo-reference the photos taken. The camera should be mounted to the passenger-side window to maintain a steady shot and keep a consistent angle between photographs. The camera should be aimed perpendicular to the car or slightly forward to capture a wider area, if necessary. Photographs should be taken approximately every 100 meters (e.g., 16 photographs per mile) on each side of the road. The vehicle should be driven at no more than 65 mph, although less than 35 mph is preferred to reduce the blurriness of the photos.
6. **Evaluate Trash Deposited in the Assessment Area**. In parallel to the photography-based methods, the passenger in the car should also conduct an OVTA of each roadway segment and record the results. The width of the assessment area extends from the center line of the road (or middle of the median) to back of the sidewalk, and includes all portions of the public right-of-way that drain to the stormwater conveyance system, including but not limited to the median, street, gutter, curb, sidewalk, back of sidewalk, and vegetated areas (e.g., grass, bushes, and tree wells). Also, include any trash observed on lands adjacent to sidewalk/street that could theoretically reach the stormwater conveyance system if there are no obstructions such as a building or fence that would prevent trash from being transported to the system.
7. **Record the Trash Level on the Map.** The passenger should have a series of forms/maps that clearly designate the road segments, but do not illustrate baseline trash generation levels or OVTA scores from previous assessments. Using a permanent marker, the assessor should write an OVTA score directly on the form/map after assessing each segment. While recording information on the form/map, the assessor should take time to write legibly. Errors can arise due to handwriting being misread when the data are processed digitally. Additionally, the assessor should record the full names of each field crew member present

for the assessment along with the date of the assessment so that the field crew members may be consulted if discrepancies in the assessment data are found.

8. **At the end of each assessment, review the form/map** for accuracy, legibility, and completeness.
9. **Compile the Data and Determine Final Baseline Trash Level.** In the office after conducting the assessments, the OVTA score for each photograph should be determined and recorded. The combination of OVTA scores based on photographs and those observed during the driving assessments are then compared and the highest (worst) OVTA score observed is assigned to the segment.
10. **Conduct Quality Assurance.** 10% of the photographs should be evaluated for quality assurance. The photographs should be reviewed by a staff member other than the original assessor who has prior experience conducting OVTAs. Trash levels should be compared between the initial assessment and the reassessment of the photographs and adjustments should be made as needed.

Assessing Changes in Trash Levels (Over Time)

The following on-land visual assessment protocol should be used to assess changes in trash levels for a specific land area. The protocol consists of the following steps that should be conducted in sequential order:

1. **Identify Assessment Areas**. Assessment areas should be delineated on a map. Areas should be identified on the map using a unique ID or other label, which should also be used on the data collection form and/or tracking spreadsheet. Targeted roads should be split into segments varying from approximately 200 to 600 meters in length. It is best if segments are divided at intersections or other features that are easily recognizable while driving. These segments could be established in the office before the assessment, or in the field during the first assessment. This allows the assessor to split the road by trash generation level observed in addition to other features such as intersections.
2. **Identify timing** of the assessment so that it falls roughly half-way between reoccurring control measure implementation and does not follow a significant rainfall event.
3. **Assemble equipment** needed to conduct the assessment including the data collection form and map(s) delineating the assessment area (see **Appendix B**).
4. **Review trash condition category definitions** presented in Table 1 (also included on the data collection form) and photo examples in Appendix A.
5. **Conduct Photography-Based Assessments.** Conduct assessments using a high definition digital camera and a window mount to hold the device steady. Camera specifications should include a wide field of view, fast shutter speed, and an internal GPS to geo-reference the photos taken. The camera should be mounted to the passenger-side window to maintain a steady shot and keep a consistent angle between photographs. The camera should be aimed perpendicular to the car or slightly forward to capture a wider area, if necessary. Photographs should be taken approximately every 100 meters (e.g., 16 photographs per mile) on each side of the road. The vehicle should be driven at no more than 65 mph, although less than 35 mph is preferred to reduce the blurriness of the photos.
6. **Evaluate Trash Deposited in the Assessment Area**. In parallel to the photography-based methods, the passenger in the car should also conduct an OVTA of each roadway segment and record the results. The width of the assessment area extends from the center line of the road (or middle of the median) to back of the sidewalk, and includes all portions of the public right-of-way that drain to the stormwater conveyance system, including but not limited to the median, street, gutter, curb, sidewalk, back of sidewalk, and vegetated

areas (e.g., grass, bushes, and tree wells). Also, include any trash observed on lands adjacent to sidewalk/street that could theoretically reach the stormwater conveyance system if there are no obstructions such as a building or fence that would prevent trash from being transported to the system.

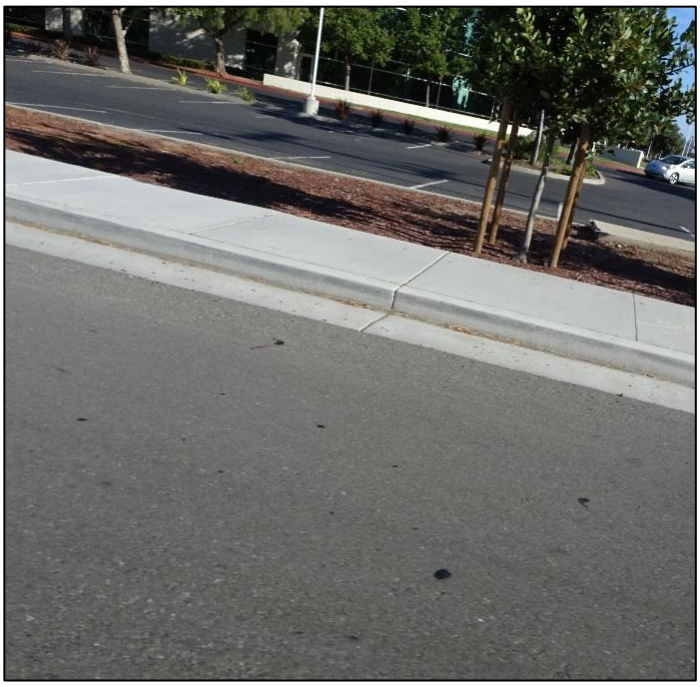
7. **Record the Trash Level on the Map.** The passenger should have a series of forms/maps that clearly designate the road segments, but do not illustrate baseline trash generation levels or OVTA scores from previous assessments. Using a permanent marker, the assessor should write an OVTA score directly on the form/map after assessing each segment. While recording information on the form/map, the assessor should take time to write legibly. Errors can arise due to handwriting being misread when the data are processed digitally. Additionally, the assessor should record the full names of each field crew member present for the assessment along with the date of the assessment so that the field crew members may be consulted if discrepancies in the assessment data are found.
8. **At the end of each assessment, review the form/map** for accuracy, legibility, and completeness.
9. **Compile the Data and Determine Final Baseline Trash Level.** In the office after conducting the assessments, the OVTA score for each photograph should be determined and recorded. The combination of OVTA scores based on photographs and those observed in during the driving assessments are then compared and the highest (worst) OVTA score observed is assigned to the segment.
10. **Conduct Quality Assurance.** 10% of the photographs should be evaluated for quality assurance. The photographs should be reviewed by a staff member other than the original assessor who has prior experience conducting OVTAs. Trash levels should be compared between the initial assessment and the reassessment of the photographs and adjustments should be made as needed.

APPENDIX A

PHOTOGRAPH EXAMPLES OF TRASH CONDITION CATEGORIES

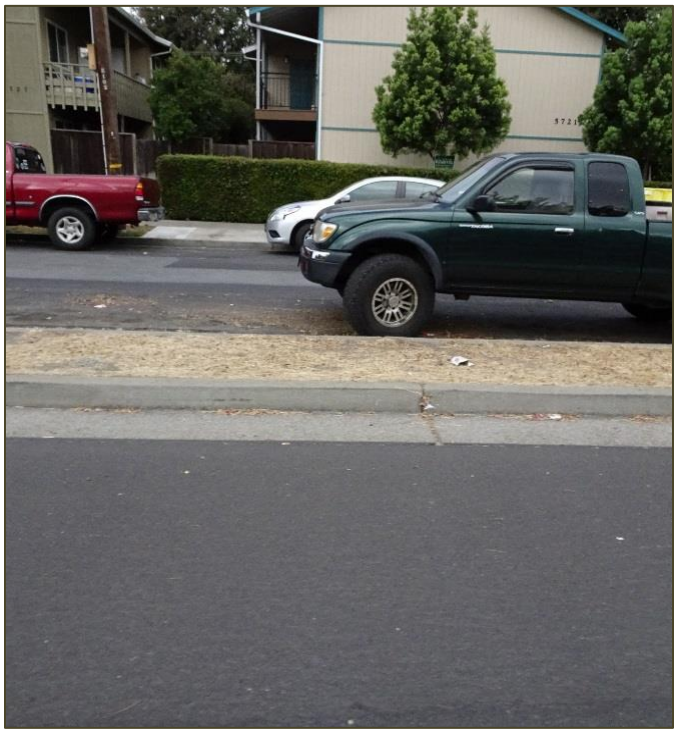
CATEGORY A - LOW TRASH LEVEL (NOT LITTERED)

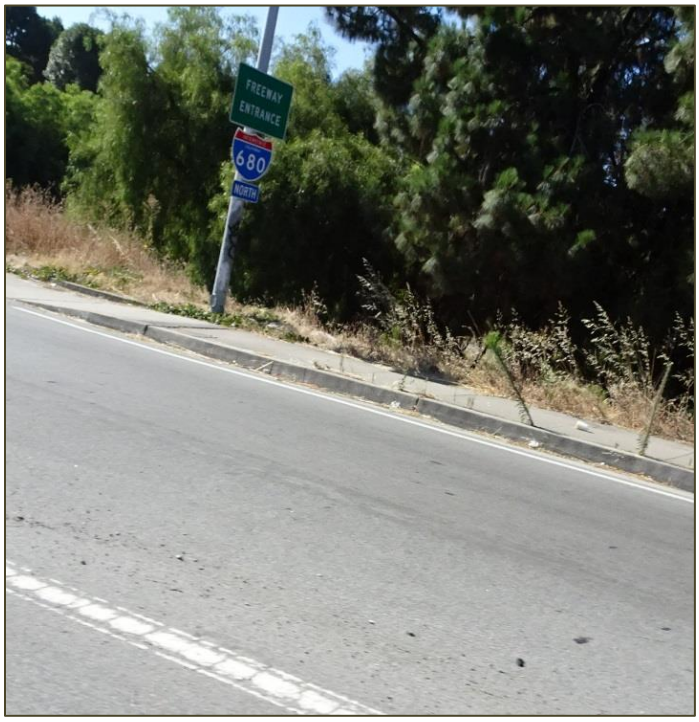
Effectively no trash is observed in the assessment area. There may be some trash in the area, but it is not obvious at first glance. One individual could easily clean up all the trash observed while walking at normal pace. No additional trash reduction measures are needed in the assessment area. To see videos of sites with Category "A" trash levels, click here.

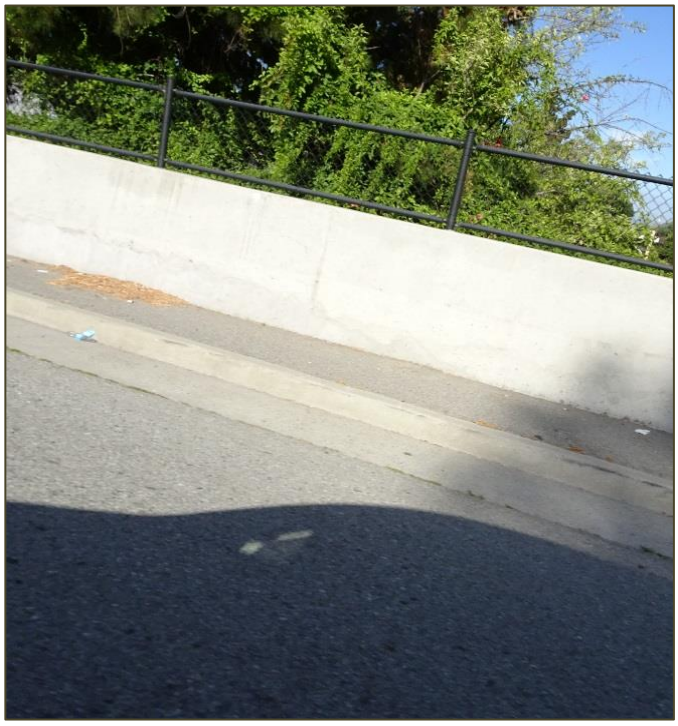


CATEGORY B – MODERATE TRASH LEVEL (SLIGHTLY LITTERED)

Predominantly free of trash, except for a few littered areas. Some trash is noticeable at first glance. The trash observed could be collected by one or two individuals, but would require walking at a slower than normal pace. Additional trash reduction measures are needed in the assessment area. To see videos of sites with Category "B" trash levels, click here.





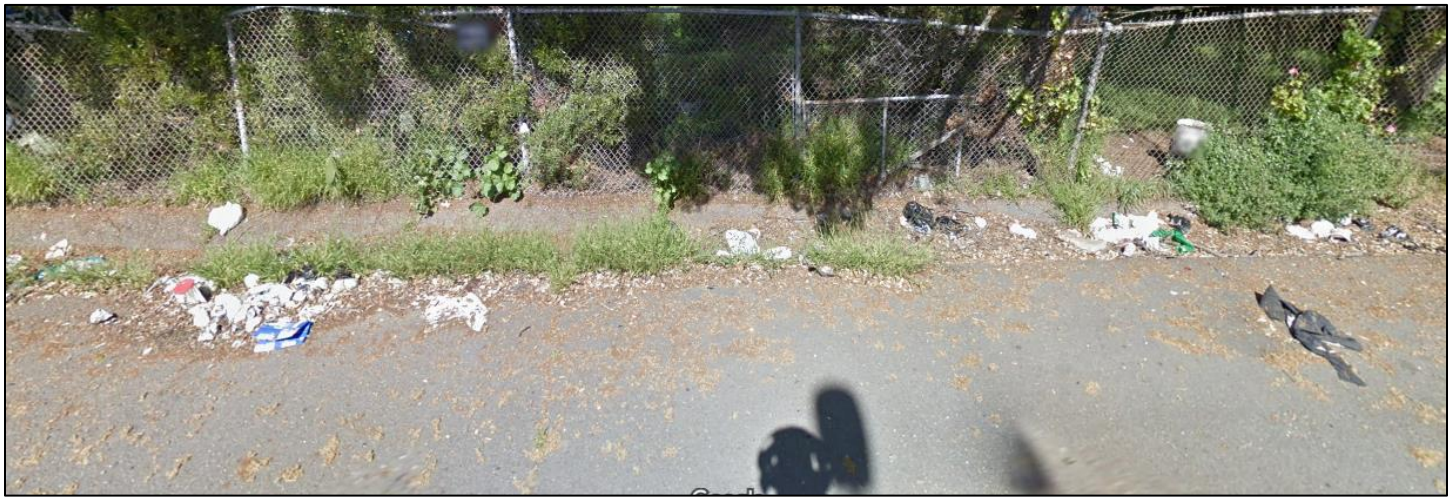


CATEGORY C: HIGH TRASH LEVEL (LITTERED)

Predominantly littered, except for a few clean areas. Trash is widely/evenly distributed and/or small accumulations are noticeable on the streets and sidewalks. It would take multiple people to remove all trash from the area, frequently requiring individuals to stop walking to remove the trash. Roughly 4 times as much trash as a "B" level. To see videos of sites with Category "C" trash levels, click here.

CATEGORY D: VERY HIGH TRASH LEVEL (VERY LITTERED)

Trash is continuously seen throughout the assessment area and there is a strong impression of lack of concern for litter. Large piles of trash may be observed. It would take a large number of people during an organized effort to remove all trash from the area, consistently requiring individuals to stop to remove the trash. Roughly 3 times as much trash as a "C" level. To see videos of sites with Category "D" trash levels, click here.



Appendix B

Example Map with Assessment Scores Observed

Completed Example Field Form