SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

FY 2007/08
TRASH ASSESSMENTS IN URBAN CREEKS IN SAN MATEO COUNTY, CALIFORNIA

Prepared for the
San Mateo Countywide Water Pollution Prevention Program by
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1.0 INTRODUCTION

The San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) conducts Watershed Assessment and Monitoring (WAM) component activities in compliance with its municipal stormwater NPDES permit. A current emphasis is collecting screening-level biological, physical and chemical water quality data from creeks in representative urban watersheds in San Mateo County. These creeks are typically receiving waters for urban runoff discharges from municipal storm drain systems. SMCWPPP collects environmental indicator data from the creeks (e.g., via creek walks, trash assessments, bioassessments and water column toxicity testing) to help evaluate current creek health and water quality conditions. These data also help establish a baseline for future evaluations of long-term trends and thereby inform SMCWPPP's efforts to improve the effectiveness of its Best Management Practices (BMPs) to prevent or reduce stormwater runoff impacts.

As part of the WAM program, SMCWPPP conducted creek walks and trash assessments in urban creeks in San Mateo County during FY 2006/07 (SMCWPPP 2007) and FY 2007/08. This report documents the results of the FY 2007/08 trash assessments. The primary objectives were:

- Identifying sites in San Mateo County urban creeks where trash accumulates;
- Evaluating the status and condition of selected urban creek trash accumulation sites, including establishing a baseline against which to track future trends; and
- Collecting data that will help identify primary trash sources and transport pathways associated with the selected trash accumulation sites and inform development of BMPs to address trash in urban creeks.

2.0 BACKGROUND

SMCWPPP has initiated a program to begin identifying and addressing trash accumulation areas in urban waterways in San Mateo County. SMCWPPP (2008a) discusses typical trash management activities currently conducted by SMCWPPP's municipalities, SMCWPPP's efforts to characterize trash in urban waterways in the county, SMCWPPP's progress in beginning to identify new BMPs to address trash accumulation areas, and the proposed general future direction of SMCWPPP's trash program. It should be noted that staff of the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) is currently developing specific

trash-related provisions for a Bay Area stormwater NPDES Municipal Regional Permit (MRP). The MRP will replace existing countywide municipal stormwater NPDES permits held by SMCWPPP and other San Francisco Bay Area Phase I stormwater programs. It is anticipated that these provisions will require a variety of trash-related activities, including assessing trash in urban creeks using similar methods to those applied in this study.

3.0 METHODS

3.1 Identification of Trash Accumulation Sites in Urban Creeks

SMCWPPP (2008b) conducted creek walks during fall 2007 in seven San Mateo County watersheds using the Unified Stream Assessment (USA) creek walk protocol (CWP 2005). The USA was conducted within urban reaches of the Atherton, Redwood, Burlingame, Sanchez, Easton, Mills and Millbrae Creek watersheds. One component of the USA is to document creek sites where trash accumulates. General characteristics of each identified trash site were documented including major types of trash, readily apparent sources (i.e., littering,[1] illegal dumping,[2] and accumulation from upstream sources) and adjacent land uses. GPS coordinates of each site were recorded and digital photographs were taken.

3.2 Trash Assessments at Accumulation Sites

The Urban Rapid Trash Assessment (URTA)[3] protocol (Version 1.0) was used to further characterize trash conditions at a subset of the trash accumulation sites identified during the fall 2007 USA creek walks. URTAs were performed at a total of seven of the 27 trash accumulation sites identified during the creek walks - two sites in the Redwood Creek watershed, two sites in the Mills Creek watershed, two sites in the Millbrae Creek watershed and one site in the Burlingame Creek watershed. The URTA was conducted twice at each site, once during fall 2007 and a second time during spring 2008, for a total of 14 assessments. The remaining USA trash accumulation sites were not assessed using the URTA because only a relatively small quantity of trash was present, yard waste was the only type of trash observed, and/or site access was poor.

It is important to note that the sites selected for the more detailed URTA assessments were not intended to represent trash conditions throughout a watershed. Instead, relatively impacted and accessible sites were selected to begin identifying and prioritizing major trash sources and potential BMPs to reduce levels of trash.

The URTA was applied at defined 100-foot sections of creek. Where possible, the starting or end point of the assessment reach was marked by an easily identifiable landmark (e.g., bridge crossing, storm drain culvert). Each trash item at the site was categorized by type (e.g.,

[1]Littering refers to when individual(s) leave trash behind in the course of other activities at a creek site (e.g., walking, picnicking).
[2]Dumping refers to when individual(s) in a premeditated action dispose of a relatively large quantity of trash onto the creek bank or bed, often using a vehicle.
[3]During FY 2005/06, the SCVURPPP revised the Regional Water Board's Rapid Trash Assessment protocol (SFBRWQCB 2007) to increase its utility in evaluating trash conditions at typical impacted sites in urban watersheds. The revisions were intended to enhance the utility of this tool in assisting municipal staff to identify, prioritize and evaluate trash management activities in urban creeks. The revised protocol is referred to as the Urban Rapid Trash Assessment (URTA).

plastics, metals, biohazards, construction materials) and the total number of items found in each category was recorded. Also recorded was whether the trash was found above the high water line on the bank or below the high water line, either on the bank or in the creek channel. All of the trash observed at each site was removed to facilitate determination of trash accumulation rates during subsequent URTAs.

In addition to enumerating the total number of trash pieces, a score was assigned to each of six condition parameters that relate to a range of issues associated with trash and water quality:

1. Level of Trash - reflects a qualitative "first impression" of the site after observing the entire length of the reach. Sites scoring in the "poor" range are those where trash is one of the first things noticeable about the water body and where trash is evident in very large amounts. Sites that score in the "optimal" range appear to have little or no trash.

2. Actual Number of Trash Items Found - based on the tally of trash pieces found at the 100-foot creek site, a score within the appropriate condition category is selected based on the number of tallied items.

3. Transportable, Persistent, Buoyant Trash - based on the presence of trash items that are persistent in the environment, buoyant (floatable), and relatively small, can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. All of these factors are considered in this parameter.

4. Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use - based on the presence of trash items that are dangerous to people who wade or swim in the water and/or wildlife, including medical waste, diapers, human or pet waste and toxic substances. Site accessibility and use are also scored by this parameter.

5. Illegal Dumping and Littering - reflects the direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations.

6. Accumulation of Trash - reflects the accumulation of trash from upstream locations as distinguished from dumped trash by indications of age and transport.

Each parameter is scored from 0 to 20, with higher parameter scores indicating better conditions. The six parameter scores are summed for a total assessment score of 0 to 120. The Appendix contains further documentation on the URTA methodology and the field forms used to record the results of each assessment.

4.0 RESULTS AND DISCUSSION

4.1 Location and Characteristics of Trash Accumulation Sites in Creeks

Table 1 lists the 27 trash accumulation sites identified during the fall 2007 USA creek walks, including the seven sites further assessed using the URTA. Figures 1 and 2 show the locations of these trash sites.

Table 1. Location and general characteristics of 27 creek sites with trash accumulation documented during fall 2007 USA creek walks. The seven indicated sites were further assessed using the URTA.

Site ID	Water Body	Location	URTA Site	Trash Source	Adjacent Land Use
A1	Atherton Creek	Behind homes near Valley Rd.		TA	Residential
RW1	Redwood Creek	Downstream end of Menlo Country Club golf course	X	L	Golf Course
RW2	Redwood Creek	Upstream end of Menlo Country Club golf course		D	Golf Course
RW3	Redwood Creek	Behind homes at Woodside Rd.		TA	Residential
RW4	Redwood Creek	Below outfall from Woodside Rd.		TA	Open Space
RW5	Redwood Creek	Downstream of I-280 culvert	X	TA	Transportation
RW6	Redwood Creek	Upstream of I-280 culvert		TA	Transportation
OA1	Arroyo Ojo de Agua	Stulsaft Park trail along unnamed tributary		L	Urban Park
OA2	Arroyo Ojo de Agua	Stulsaft Park		TA	Urban Park
OA3	Arroyo Ojo de Agua	Upper end of Stulsaft Park below outfall		TA	Urban Park
T1	Terrace Creek	Upstream of El Camino Real	X	L	Institutional
T2	Terrace Creek	Downstream of Sharon Ave.		D	Residential
R1	Ralston Creek	Downstream of Eucalyptus Ave.		D	Residential
R2	Ralston Creek	Adjacent to Ralston Ave.		L	Residential
S1	Sanchez Creek	Upstream of Forest View Ave.		D	Residential
S2	Sanchez Creek	Upstream of Geri Ln.		D	Residential
S3	Sanchez Creek	Upstream of Geri Ln.		D	Residential
S4	Sanchez Creek	Downstream of Fern Ct.		D	Residential
E1	Easton Creek	At Benito Ave.		TA	Residential
E2	Easton Creek	Adjacent to Canyon Rd.		D	Residential
E3	Easton Creek	Below Canyon Rd. culvert		L	Residential
M1	Mills Creek	Upstream of El Camino Real	X	TA	Residential
M2	Mills Creek	At tributary confluence		D	Residential
M3	Tributary to Mills Cr.	Below outfall at Martinez Dr.	X	TA	Residential/school
MB1	Millbrae Creek	Palm and Millbrae Ave. at park	X	L	Park/school
MB2	Millbrae Creek	Above Ashton in vacant parcel	X	L	Vacant
MB3	Millbrae Creek	Downstream Minorca Way		L	Residential

Trash source categories identified during the USA: L - Littering, ID - Illegal Dumping, TA - Trash Accumulation.
URTA - Urban Rapid Trash Assessment.

The greatest number of trash accumulation sites occurred in the Redwood Creek watershed (n=9), followed by the Burlingame and Sanchez Creek watersheds (n=4), Mills, Millbrae and Easton Creek watersheds (n=3) and Atherton Creek watershed (n=1). The sites were distributed across a variety of land uses, including residential areas, transportation corridors, parks, schools and a golf course. Three general trash source categories identified during the USA were approximately equally represented: trash accumulation (n=10), litter (n=9) and illegal dumping (n=8). Trash accumulation sites were typically below large outfalls and/or areas with dense vegetation or other obstructions that capture trash as it moves downstream. Litter sites were generally in high traffic areas with good public access (i.e., schools and/or public parks). The illegal dumping sites observed were all in residential areas, with the exception of one site at a private golf course.

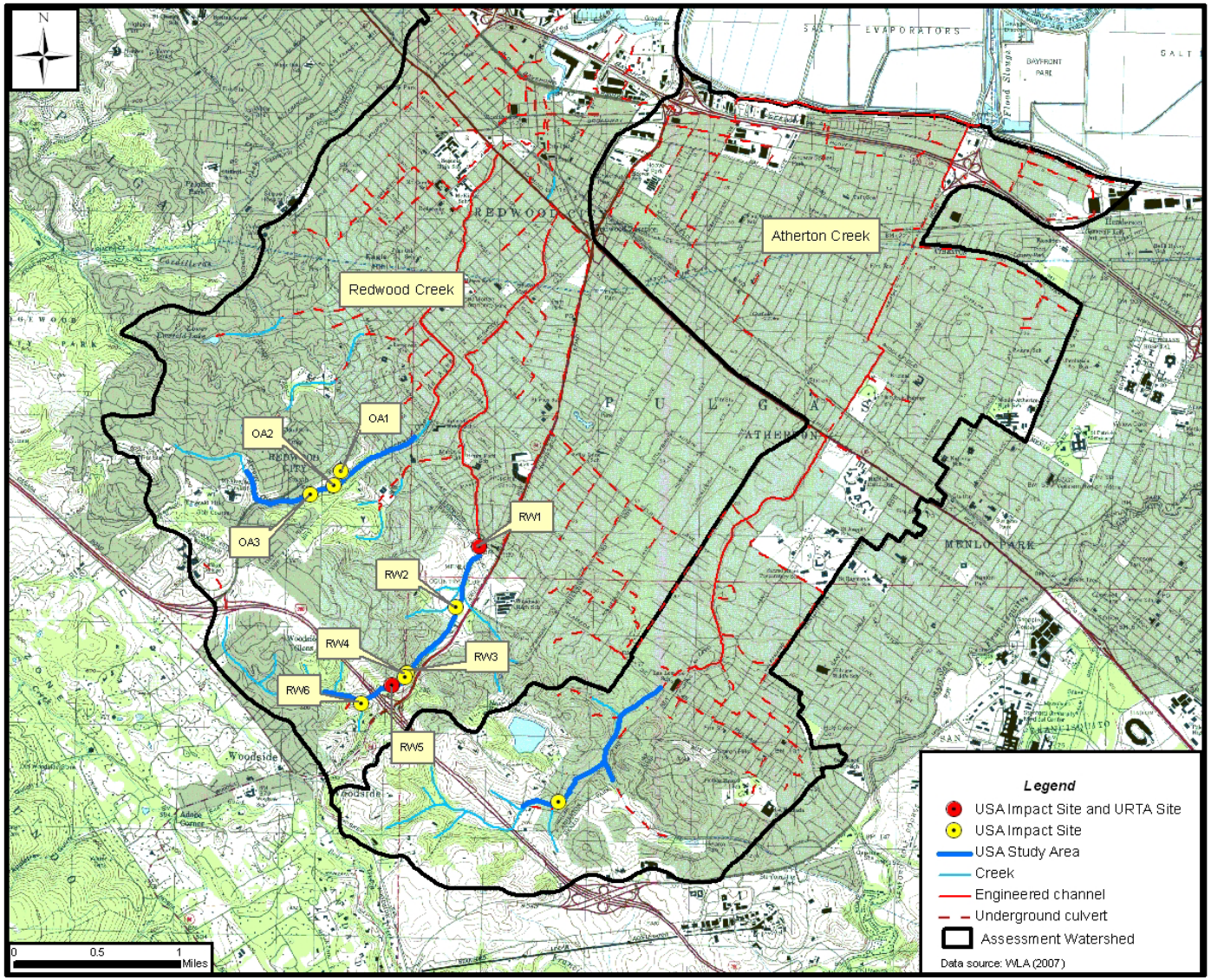

Figure 1. Location of USA and URTA trash sites in the Atherton and Redwood Creek watersheds.

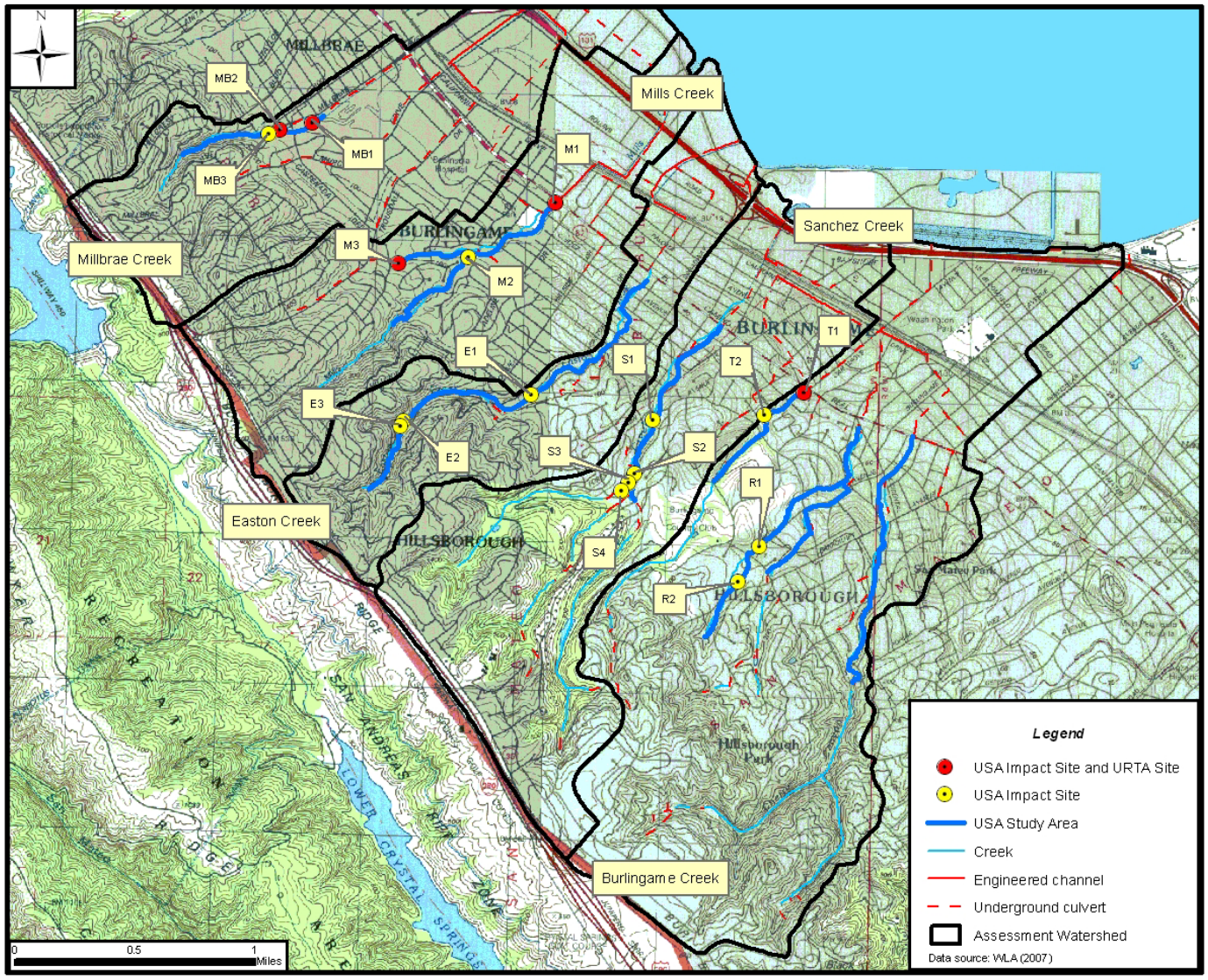

Figure 2. Location of USA and URTA trash sites in the Burlingame, Sanchez, Easton, Mills and Millbrae Creek watersheds.

4.2 Urban Rapid Trash Assessments

4.2.1 Overall Status and Condition of Trash Accumulation Sites

Total URTA scores ranged between 31 and 71 (higher scores indicate less trash impacts and better conditions) (Table 2). The three lowest scores occurred during fall season assessments at a site in the tributary to Mills Creek (31), a site in Redwood Creek (42) and a site in Millbrae Creek (45). These three sites also had the highest total number of trash items, 607, 1,278 and 542, respectively.

Figure 3 is a frequency histogram of the URTA scores for both fall and spring season assessments. Spring 2008 assessment scores were generally higher than fall 2007 scores.

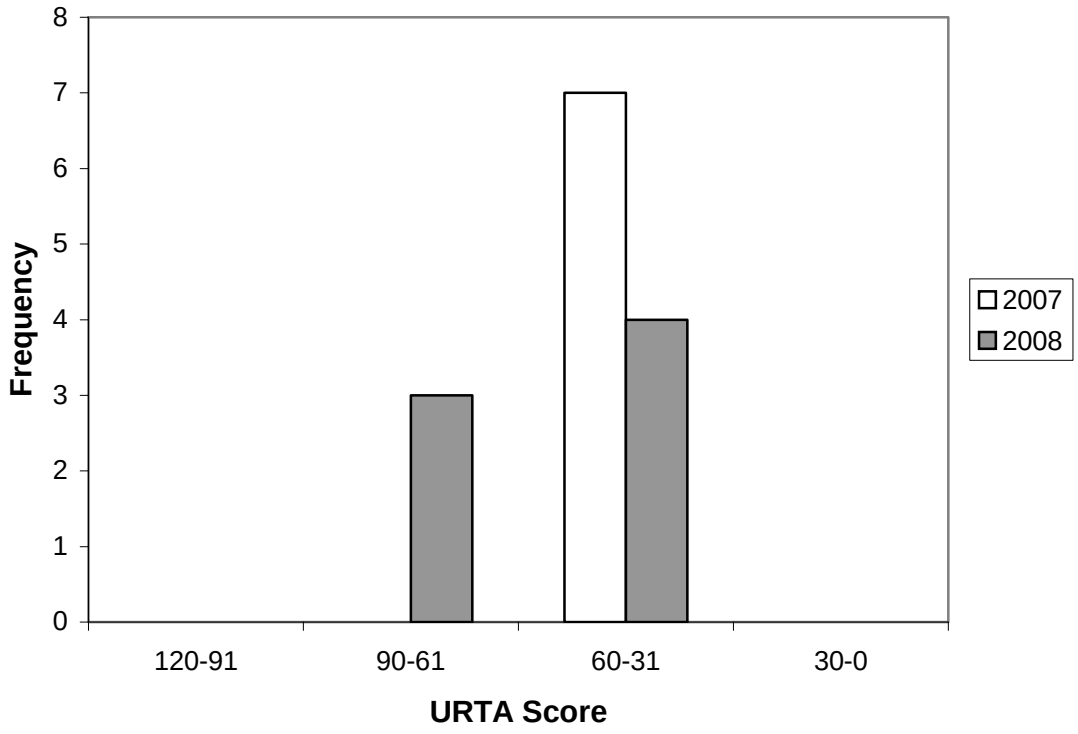

Figure 3. Distribution of Urban Rapid Trash Assessment (URTA) scores conducted during fall 2007 and spring 2008 at seven sites. Higher scores indicate less trash impacts and better conditions.

Table 2. Total and individual parameter scores and total number of trash items documented during URTAs conducted at seven creek locations in four watersheds during fall 2007 and spring 2008.

Water Body	Site ID	Site	Date	1	2	3	4a	4b	5a	5b	6	Total Score	Total Trash Items
				Qual-itative	Quant-itative	Trans-portable Items	Hazard-ous Items	Access	Dumping	Litter	Accum-ulation		
Mills Creek	M1	Upstream El Camino Real	Oct-07	6	7	4	6	6	10	8	0	47	383
			Mar-08	9	12	6	10	6	10	8	4	65	211
Tributary to Mills Creek	M3	Below outfall at Martinez Drive	Oct-07	4	4	3	2	9	1	6	2	31	607
			Mar-08	10	8	3	9	9	6	9	3	57	395
Redwood Creek	RW1	Menlo Country Club golf course	Nov-07	11	11	5	10	4	10	3	6	60	230
			Mar-08	12	14	8	9	4	10	6	8	71	133
Redwood Creek	RW5	Downstream end I-280 culvert	Nov-07	5	0	0	8	9	10	10	0	42	1,278
			Mar-08	9	6	2	7	9	10	9	5	57	461
Terrace Creek	T1	Upstream El Camino Real	Oct-07	10	10	7	4	5	10	6	7	59	259
			Mar-08	7	11	7	9	5	6	3	15	63	236
Millbrae Creek	MB1	Palm and Millbrae Avenue at park	Oct-07	10	9	5	2	1	4	4	14	49	329
			Mar-08	14	9	9	2	1	9	6	6	56	327
Millbrae Creek	MB2	Upstream Ashton in vacant land	Oct-07	7	5	5	0	1	10	1	16	45	542
			Mar-08	6	7	8	1	1	9	1	12	45	406

Note: higher scores indicate less trash impacts and better conditions. See the Appendix for more information.
URTA – Urban Rapid Trash Assessment.

4.2.2 Trash Characteristics

The total number of trash items per URTA ranged between 133 and 1,278, with a total of 5,797 pieces of trash observed and collected during the 14 assessments (Table 3). In general, a smaller number of trash items was found at each site in the spring compared to the fall. Plastic was the most common item found during the assessments, representing about 65% of all the trash observed. Miscellaneous, glass, biodegradable and metal items were the next most common trash items, collectively representing about 33% of the trash found (Figure 4).

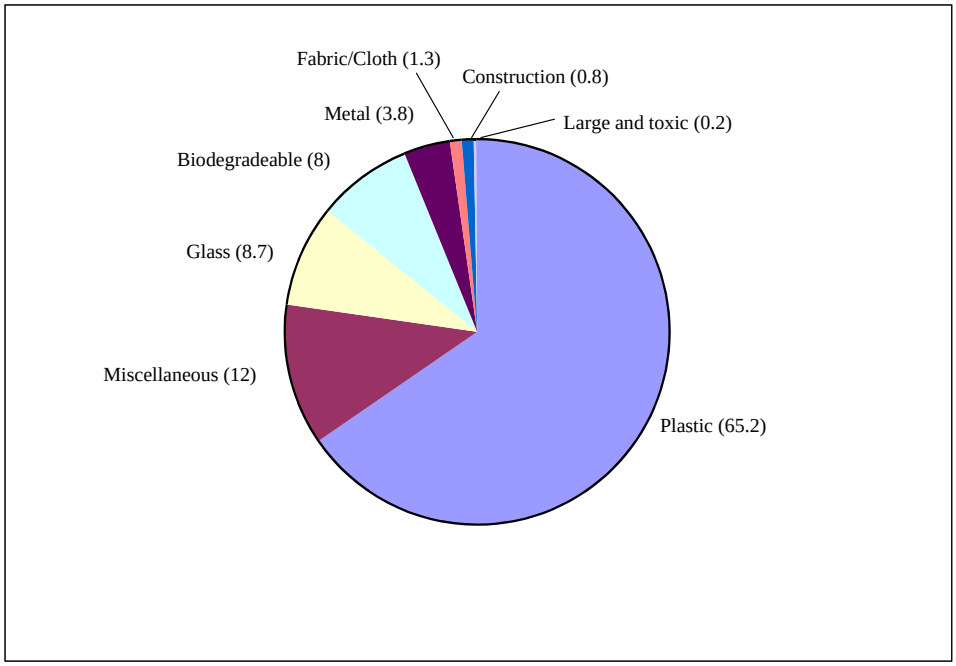

Figure 4. Relative proportions of trash types enumerated using the Urban Rapid Trash Assessment at seven creek sites over two seasons.

URTA Parameters 3 and 4 provide an indication of potential impacts that trash items at the site may have on water quality and beneficial uses. The Parameter 3 score reflects the amount of transportable, persistent, buoyant litter at the assessment site. Trash in this category can be transported over long distances and may impact wildlife through ingestion and entanglement (see Section 3.2 and the Appendix). The number of plastic items (e.g., bags, wrappers, bottles) and miscellaneous items (e.g., cigarette butts, rubber balls) found during an assessment was totaled to determine that assessment's Parameter 3 score (see the Appendix for more information). The average Parameter 3 score for the 14 URTAs conducted was 5 out of a total of 20 possible points (higher scores indicate less trash impacts and better conditions). Over 75% of the trash that was identified during the URTAs was categorized as transportable, persistent, buoyant litter.

Table 3. Total number and type of trash items documented at seven sites assessed using the URTA during fall 2007 and spring 2008.

Trash Category[1]	Redwood Cr. Golf Course		Redwood Cr. below I-280		Terrace Cr. El Camino		Mills Cr. El Camino		Mills Cr. Tributary Outfall		Millbrae Cr. Park		Millbrae Cr. Vacant Land		Total Items
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	
Biodegradable	0	1	20	11	62	49	2	4	9	39	32	27	117	90	463
Biohazard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	4	3	0	12	0	11	8	3	2	3	0	46
Fabric/Cloth	1	1	15	5	0	1	4	4	30	7	5	0	2	0	75
Glass	0	0	4	5	1	1	0	1	8	1	57	155	138	136	507
Large	0	0	1	1	0	0	0	0	3	1	0	1	0	0	7
Metal	2	4	19	14	33	10	8	4	43	10	6	12	26	30	221
Miscellaneous	187	74	102	52	15	24	47	16	44	28	19	25	40	22	695
Plastic	40	53	1,117	369	145	151	310	182	459	301	206	104	213	128	3,778
Toxic	0	0	0	0	0	0	0	0	0	0	1	1	3	0	5
Total Items	230	133	1,278	461	259	236	383	211	607	395	329	327	542	406	5,797

[1]See the Appendix for more information on the trash categories.
URTA – Urban Rapid Trash Assessment.

The Parameter 4a score reflects the amount of trash items at the assessment site that are a biohazard, toxic, or sharp, (e.g., broken glass, metal shards, medical waste, diapers, pet waste and batteries). Trash in this category is potentially dangerous to wildlife and to people who wade or swim in the water (see Section 3.2 and the Appendix). The number of trash items found in this category during an assessment was totaled to determine that assessment's Parameter 4a score (see the Appendix for more information). The average Parameter 4a score for the 14 URTAs conducted was 6 out of a total of 10 possible points (higher scores indicate less trash impacts and better conditions). About 13 percent of the trash that was identified during the URTAs was categorized as hazardous (biohazard, toxic, or sharp). Most items in this category were glass and metal objects; biohazardous items were not observed and toxic items were relatively uncommon.

The URTA Parameter 4b score (site accessibility/use) for five of the seven URTA sites averaged 6.6 out of 10 possible points (a score of 10 points indicates that a site is inaccessible to the public), indicating that on average these sites had limited access and use. This contrasted with the results for the other two URTA sites, which were both located in Millbrae Creek. Four URTAs were performed in Millbrae Creek (two assessments at each of the two sites). The Parameter 4b score for each of the four assessments was 1.0, indicating that these sites are readily accessible by people. In addition, the Millbrae Creek sites had relatively low scores (lower scores indicate more trash impacts and worse conditions) for URTA parameter 4a (biohazard, toxic, or sharp trash items), ranging from zero to two, mainly due to a high number of pieces of broken glass.[4]

4.2.3 Trash Sources and Pathways at URTA Sites

URTA Parameters 5 and 6 evaluate potential trash sources/pathways. On average, the most common trash pathway identified during the 14 URTAs was accumulation from upstream sources with an average score of seven out of 20 possible points (a score of 20 points indicates no accumulation). The lowest scores for trash accumulation (score 0.0) occurred in two locations: Redwood Creek downstream of the I-280 culvert and Mills Creek, upstream of an SFPUC pipeline below El Camino Real. Another site with high accumulation (score 2.0) was located in the upper end of a tributary to Mills Creek just below an outfall at Martinez Drive (Table 2).

The littering source/pathway was slightly less common than trash accumulation at URTA sites, with an average score of 5.7 (a score of 10 points indicates no littering at a site). The lowest score for littering (1.0) occurred in Millbrae Creek at an undeveloped vacant parcel near to a high school. Other sites where littering was important included a golf course in Redwood Creek (i.e., golf balls in the creek) and an overflowing dumpster in a parking lot adjacent to Terrace Creek.

Dumping was relatively uncommon at URTA sites, with an average score of 8.2 (a score of 10 points indicates no dumping at site). The lowest score (1.0) for dumping occurred below an outfall at the upper end of tributary to Mills Creek. It was unclear how large materials (e.g.,

[4]Sometimes items are broken into two or more pieces. Transportable, persistent, and buoyant fragments such as plastics are individually counted, while paper and broken glass, with lower persistence and/or mobility, are counted based on the parent item(s). Broken glass pieces that are scattered, with no recognizable original shape, are counted individually.

construction materials, shopping cart) entered this site as public access was limited by a fence. Dumping was also identified at the downstream site on Millbrae Creek, which had good public access along Millbrae Drive.

In general, high levels of trash in the creek channel generally originated from upstream sources and accumulated at the assessment sites due to dense vegetation or instream structures (e.g., a pipeline) that captured it during conveyance downstream. Littering from adjacent land uses was the predominant source of trash at sites that had larger proportions of trash on the banks compared to the creek channel. These sites usually had good public access. Larger trash items (construction materials, furniture) were found on both banks and in creek channels.

5.0 REFERENCES

CWP 2005. *Urban Subwatershed Restoration Manual Series, No. 10. Unified Stream Assessment: A User's Manual*. Version 2.0. Center for Watershed Protection. Ellicot City, Maryland. February 2005.

SMCWPPP 2007. *Trash Assessments in Six Watersheds in San Mateo County, California*. Prepared for the San Mateo Countywide Water Pollution Prevention Program by EOA, Inc. August 2007.

SMCWPPP 2008a. *Addressing Trash in Urban Waterways in San Mateo County, California.* Fact Sheet prepared for the San Mateo Countywide Water Pollution Prevention Program by EOA, Inc. August 2008.

SMCWPPP 2008b. *Unified Stream Assessment in Seven Watersheds in San Mateo County, California.* Prepared for the San Mateo Countywide Water Pollution Prevention Program by EOA, Inc. August 2008.

APPENDIX

URBAN RAPID TRASH ASSESSMENT PROTOCOL
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Adapted from the San Francisco Bay Regional Water Quality Control Board Rapid Trash Assessment Protocol, Version 8.

Monitoring Design:

The urban rapid trash assessment can be used for a number of purposes, such as ambient monitoring, evaluation of management actions, determination of trash accumulation rates, or comparing sites with and without public access. Ambient monitoring efforts should provide information at sites distributed throughout a waterbody, and may be conducted several times a year to characterize spatial and temporal variability. Additionally, the ambient sampling design should document the effects of episodes that affect trash levels such as storms or community cleanup events. Pre- and post-project assessments can assist in evaluating the effectiveness of management practices ranging from public outreach to structural controls, or to document the effects of public access on trash levels in waterbodies (e.g., upstream/downstream). Trash accumulation rates may be determined by conducting trash assessments before and after the summer or dry weather index (to capture rates of littering) and the winter or rainy index (to capture rates of accumulation from upstream sources). This method was developed for sections of wadeable streams, but can be adapted to shorelines of lakes, beaches, or estuaries. This adapted version of the San Francisco Bay Regional Water Quality Control Board Rapid Trash Assessment Protocol, Version 8 was developed by SCVURPPP to more effectively assess trash problem areas and to detect changes in trash conditions over time as a result of management actions.

Site Definition:

A team of two people or more defines or verifies a 100-foot section of the stream or shoreline to analyze. When a site is first established, it is recommended that the 100-foot distance be accurately measured. The length should be measured not as a straight line, but as 100 feet of the actual stream or shore length, including sinuous curves. Where possible, the starting and ending points of the stream section should be easily identified landmarks, such as an oak tree or boulder, and noted on the worksheet ("Upper/Lower Boundaries of Reach"), or documented using a global positioning system (GPS), so that future assessments are made at the same location. The team should confer and document the upper boundary of the banks to be surveyed, based on evaluation of whether trash can be carried to the waterbody by wind or water (e.g., an upper terrace in the stream bank). The team documents the location of the high water line based on site-specific physical indicators, such as a debris line found in the riparian vegetation along the stream channel. If the high water line cannot be determined, it is suggested that bankfull height be documented, noting that the high water line could not be determined. Trash located below the high water line can be expected to move into the streambed or to be swept downstream during the next winter season. Visually extend all boundaries in order to encompass the 100' section. Defining site characteristics will facilitate the comparison of trash assessments conducted at the same site at different times of the year.

Survey:

It is highly recommended that all trash items within an assessed site be picked up, so that the site can be re-assessed to evaluate usage patterns, trash return rates, and management actions. A survey, including notes and scoring, will take approximately one to two hours based on how trash-impacted the site is and how many people are working together. The first time a reach is assessed, the process will generally take longer than on subsequent visits. Begin the survey at the downstream end of the selected reach so that trash can be seen in the undisturbed stream channel. Tasks can be divided according to the number of team members. If there are two team members, one team member begins walking along the bank or in the water at the edge of the stream or shore, looking for trash on the bank up to the upper bank boundary, and above and below the high water line. This person picks up trash and tallies the items on the trash assessment worksheet as either above or below the high water line based on the previously determined boundary. The other person walks in the streambed and up and down the opposite bank, picking up and calling out specific trash items found in the water body and on the opposite bank both above and below the high water line, for the tally person to mark down appropriately on the

trash assessment sheet. All team members pick up the trash items as they are found. All team members should wear gloves to avoid injuries.

The person tallying the trash indicates on the sheet whether the trash was found above the high water line on the bank, or below the high water line either on the bank or in the stream (i.e., tally dots or circles (•) for above high water line, tally lines (|) for below). If it is evident that items have been littered, dumped, or accumulated via downstream transport, make a note in the designated rows near the bottom of the tally sheet - this will help when assessing scores. A trash grabber, metal kitchen tongs, or a similar tool should be used to help pick up trash. Be sure to look under bushes, logs, and other plant growth to see if trash has accumulated underneath. The ground and substrate should be inspected to ensure that small items such as cigarette butts and pieces of broken glass or Styrofoam are picked up and counted. The tally count is an important indicator of trash impairment and should be used in conjunction with the total score to assist in site comparisons.

Sometimes items are broken into many pieces. Transportable, persistent, and buoyant, fragments such as plastics should be individually counted, while paper and broken glass, with lower persistence and/or mobility, should be counted based on the parent item(s). Broken glass pieces that are scattered, with no recognizable original shape, should be counted individually. The judgment of whether to count all fragments or just one item also depends on the potential exposure to downstream fish and wildlife, or to waders and swimmers at a given site. Concrete is trash when it is dumped, but not when it is placed. Consider tallying only those items that would be removed in a restoration or cleanup effort.

Once the team is finished with the tallying, use the tally sheet margins to count up two totals for each trash item line: one total for items found above the high water line, and one total for items found below the high water line. Now sum the totals of above and below for each trash category, and write in next to each trash category. Complete the worksheets before leaving the site in order to remember pertinent details. The team should discuss each parameter and agree on a score based on a discussion of the condition categories. Discuss and document possible influential factors affecting trash levels at the site, such as a park, school, or nearby residences or businesses. Within each trash parameter, narrative language is provided to assist with choosing a condition category. The worksheet provides a range of numbers within some of the categories, allowing for a range of conditions encountered in the field. Note that trash located in the water leads to lower scores than trash above the high water line. Not all specific trash conditions mentioned in the narratives need to be present to fit into a specific condition category (e.g., “site frequently used by people”), nor do the narratives describe all possible conditions. Scores of “0” should be reserved for the most extreme conditions. Once the scores are assigned for the six categories, sum the final score and include specific notes about the site at the end of the sheet. To characterize the variability, persistence, and return rate of trash it is necessary to assess a site three to four times, bracketing different seasons.

Trash Assessment Parameters:

The rapid trash assessment includes a range of parameters that capture the breadth of issues associated with trash and water quality. The first two parameters focus on qualitative and quantitative levels of trash, the second two parameters characterize trash levels of certain types of trash that may affect water quality, and the last two parameters estimate sources of trash (adjacent land use-related littering, dumping or upstream sources).

1. **Level of Trash.** This assessment parameter is intended to reflect a qualitative “first impression” of the site, after observing the entire length of the reach. Sites scoring in the “poor” range are those where trash is one of the first things noticeable about the waterbody and where trash is evident in very large amounts. Sites that score in the “optimal” range appear to have little or no trash. This parameter should be assessed prior to the collection and enumeration of trash done for subsequent parameter.

2. **Actual Number of Trash Items Found.** Based on the tally of trash along the 100-foot stream reach, total the number of items both above and below the high water line, and choose a score within the appropriate condition category based on the number of tallied items. Where more than 500 items have been tallied, assign the following scores: 5: 501-600 items; 4: 601-700 items; 3: 701-800 items; 2: 801-

900 items; 1: 901-1000 items; 0: over 1000 items. Use similar guidelines to assign scores in other condition categories.

3. **Transportable, Persistent, Buoyant Trash.** As indicated in the technical notes, below, certain characteristics of trash make it more harmful to aquatic life. If trash items are persistent in the environment, buoyant (floatable), and relatively small, they can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. All of these factors are considered in the narrative descriptions in this assessment parameter.

4. **Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use.** This category is concerned with items that are dangerous to people who wade or swim in the water, and with pollutants that could accumulate in fish in the downstream environment. Medical waste, diapers, and human or pet waste could potentially adversely affect water quality. Site accessibility and site use is considered in the scoring of this condition category. Sites with very difficult or restricted human access and no evidence of recreational use will receive higher scores due to reduced risk of human exposure at the site.

5. **Illegal Dumping and Littering.** This assessment category relates to direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations based on adjacent land use practices or site accessibility.

6. **Accumulation of Trash.** Trash that accumulates from upstream locations is distinguished from dumped trash by indications of age and transport. Faded colors, silt marks, trash wrapped around roots, and signs of decay suggest downstream transport, indicating that the local drainage system facilitates conveyance of trash to water bodies, in violation of clean water laws and policies.

Technical Notes on Trash and Water Quality:
Trash is a water pollutant that has a large range of characteristics of concern. Not all litter and debris delivered to streams are of equal concern to water quality. Besides the obvious negative aesthetic effects, most of the harm of trash in surface waters is imparted to aquatic life in the form of ingestion or entanglement. Some elements of trash can negatively affect water quality such as discarded medical waste, and human or pet waste. Also, some household and industrial wastes may contain toxic substances that may influence water quality, such as batteries, pesticide containers, and fluorescent light bulbs that contain mercury. Sharp glass and metal objects are potential puncture and laceration hazards. Larger trash such as discarded appliances can present physical barriers to natural stream flow, causing physical impacts such as bank erosion. From a management perspective, the persistence and accumulation of trash in a waterbody are of particular concern and signify a priority area for prevention of trash discharges. Also of concern are trash "hotspots" where illegal dumping, littering, and/or accumulation of trash occur in very large amounts.

Rapid Trash Assessment. Trash assessment includes a visual survey of the waterbody (e.g., streambed and banks) and adjacent areas from which trash elements can be carried to the waterbody by wind, water, or gravity. The delineation of these adjacent areas is site-specific and requires some judgment and documentation. The rapid trash assessment worksheet is designed to represent the range of effects that trash has on the physical, biological, and chemical integrity of water bodies, in accordance with the goals of the Clean Water Act and the California Water Code. The worksheet also provides a record for evaluation of the management of trash discharges, by documenting sites that receive direct discharges (i.e., dumping or littering) and those that accumulate trash from upstream locations.

Trash Characteristics of Concern. Buoyant (floatable) elements tend to be more harmful to water quality than settleable elements, due to their ability to be transported throughout the waterbody and ultimately to the marine environment. Elements such as plastics, synthetic rubber and synthetic cloth, because of their persistence, have a more adverse effect on water quality than degradable elements such as paper or organic waste. Glass and metal are less persistent, even though they are not biodegradable, because wave action and rusting can cause them to break into smaller pieces. Natural rubber and cloth can degrade but not as quickly as paper (U.S. EPA, 2002).

Smaller elements such as plastic resin pellets (a by-product of plastic manufacturing) and cigarette butts are often more harmful to aquatic life than larger elements, since they can be ingested by a large number of small organisms which can then suffer malnutrition or internal injuries. Larger plastic elements such as plastic grocery bags are also harmful to larger aquatic life such as sea turtles, which can mistake the trash for floating prey and ingest it, leading to starvation or suffocation. Floating debris that is not trapped and removed will eventually end up on the beaches or in the ocean, repelling visitors and residents from the beaches and degrading coastal and open ocean waters.

Leaf litter is trash when there is evidence of intentional dumping. Leaves and pine needles in streams provide a natural source of food for organisms, but excessive levels due to human influence can cause nutrient imbalance and oxygen depletion in streams, to the detriment of the aquatic ecosystem. Clumps of leaf litter and yard waste from trash bags should be treated as trash in the water quality assessment, and not confused with natural inputs of leaves to streams. If there is a question in the field, check the type of leaf to confirm that it comes from a nearby riparian tree. In some instances, leaf litter may be trash if it originates from dense ornamental stands of nearby human planted trees that are overloading the stream's assimilative capacity for leaf inputs. Other biodegradable trash, such as food waste, also exerts a demand on dissolved oxygen, but aquatic life is unlikely to be adversely affected unless the dumping of food waste is substantial and persistent at a given location.

Wildlife impacts due to trash occur in creeks, lakes, estuaries, and ultimately the ocean. The two primary problems that trash poses to wildlife are entanglement and ingestion. Marine mammals, turtles, birds, fish, and crustaceans all have been affected by entanglement in or ingestion of floatable debris. Many of the species most vulnerable to the problems of floatable debris are endangered or threatened by extinction.

Entanglement results when an animal becomes encircled or ensnared by debris. It can occur accidentally, or when the animal is attracted to the debris as part of its normal behavior or out of curiosity. Entanglement is harmful to wildlife for several reasons. Not only can it cause wounds that can lead to infections or loss of limbs; it can also cause strangulation or suffocation. In addition, entanglement can impair an animal's ability to swim, which can result in drowning, or in difficulty in moving, finding food, or escaping predators (U.S. EPA, 2001).

Ingestion occurs when an animal swallows floatable debris. It sometimes occurs accidentally, but usually animals feed on debris because it looks like food (i.e., plastic bags look like jellyfish, a prey item of sea turtles). Ingestion can lead to starvation or malnutrition if the ingested items block the intestinal tract and prevent digestion, or accumulate in the digestive tract, making the animal feel "full" and lessening its desire to feed. Ingestion of sharp objects can damage the mouth, digestive tract and/or stomach lining and cause infection or pain. Ingested items can also block air passages and prevent breathing, thereby causing death (U.S. EPA, 2001).

Common settled debris includes glass, cigarettes, rubber, construction debris and more. Settleables are a problem for bottom feeders and dwellers and can contribute to sediment contamination. Larger settleable items such as automobiles, shopping carts, and furniture can redirect stream flow and destabilize the channel.

In conclusion, trash in water bodies can adversely affect humans, fish, and wildlife. Not all water quality effects of trash are equal in severity or duration, thus the trash assessment methodology was designed to reflect a range of trash impacts to aquatic life, public health, and aesthetic enjoyment. When considering the water quality effects of trash while conducting a trash assessment, remember to evaluate individual items and their buoyancy, degradability, size, potential health hazard, and potential hazards to fish and wildlife. Utilize the narratives in the worksheet, refer to the technical notes and trash parameter descriptions in the text as needed, and select your scores after careful consideration of actual conditions.

<u>References:</u>

U.S. Environmental Protection Agency, 2001. Draft Assessing and Monitoring Floatable Debris.

U.S. Environmental Protection Agency, 2002. The Definition, Characterization and Sources of Marine Debris. Unit 1 of Turning the Tide on Trash, a Learning Guide on Marine Debris.

Urban Rapid Trash Assessment Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

WATERSHED/STREAM: _____ DATE/TIME: _____
MONITORING GROUP, STAFF: _____ STATION ID_____
STATION NAME /LOCATION:_____

	CONDITION CATEGORY			
Trash Assessment Parameter	**Least Disturbed (Optimal Urban)**	**Sub optimal Urban**	**Marginal Urban**	**Poor**
1. Level of Trash	On first glance, little or no trash visible. Little or no trash evident when streambed and stream banks are closely examined for litter and debris, for instance by looking under leaves.	On first glance, trash is evident in low levels. After close inspection small levels of trash evident in stream bank and streambed.	Trash is evident in medium on first glance. Stream, bank surfaces, and riparian zone contain litter and debris. Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, clothing.	Trash distracts the eye on first glance. Stream, bank surfaces, and immediate riparian zone contain substantial levels of litter and debris Evidence of site being used frequently by people: many cans, bottles, and food wrappers, blankets, clothing.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Actual Number of Trash Items Found	0 to 100 trash items found based on a trash assessment of a 100-foot stream reach.	101 to 250 trash items found based on a trash assessment of a 100-foot stream reach.	251 to 500 trash items found based on a trash assessment of a 100-foot stream reach.	Over 500 trash items found based on a trash assessment of a 100-foot stream reach.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Transportable, Persistent, Buoyant Litter	Little or no (< 25 pieces) transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Low to medium presence (26-75 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Medium prevalence (76-200 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Large amount (>200 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, balloons, styrofoam, cigarette butts;
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Biohazard, Toxic and Sharp Objects	B: Trash contains no medical waste, diapers, pet or human waste. No evidence of toxic substances such as chemical containers or batteries. Only 1 piece of broken glass or metal debris, if any, is present.	B: No toxic substances, but small presence (2-10 pieces) of sharp objects such as broken glass and metal debris.	Presence of **any one** of the following: hypodermic needles or other medical waste; used diaper, pet waste, or human feces; any toxic substance such as chemical containers, batteries, or fluorescent light bulbs. Medium to high prevalence (11-50 pieces) sharp objects.	Presence of **more than one** of the items described in the marginal condition category, and/or high prevalence of (> 50) sharp objects.
Site Accessibility	A: Access is difficult, restricted by locked gate or some other physical barrier like steep banks or thick riparian veg. Site reach does not appear to be used by people. Might be private property or protected watershed.	A: Access is limited and site reach does not appear to be used by people. No trails down to creek.	A: Public access to reach is fair to good but site does not appear to be used frequently, **or** private access is good without any public access.	A: Excellent reach access including trails down to and adjacent creek and creekside space for sitting down. Some evidence that reach is used frequently by the public (e.g. rope swings, many beer/soda cans and food wrappers left on the banks, etc.).
B SCORE	10 9	8 7 6	5 4 3	2 1 0
A SCORE	10 9	8 7 6	5 4 3	2 1 0

Urban Rapid Trash Assessment Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

	CONDITION CATEGORY			
Trash Assessment Parameter	**Least Disturbed (Optimal Urban)**	**Sub optimal Urban**	**Marginal Urban**	**Poor**
5. Illegal Dumping	D: No evidence of illegal dumping. No bags of trash, no yard waste, no household items placed at site to avoid proper disposal, no shopping carts.	D: Some evidence of illegal dumping. Limited vehicular access limits the amount of potential dumping, or material dumped is diffuse paper-based debris.	D: Presence of **one** of the following: furniture, appliances, shopping carts, bags of garbage or yard waste, coupled with vehicular access that facilitates in-and-out dumping of materials to avoid landfill costs.	D: Evidence of chronic dumping, with **more than one** of the following items: furniture, appliances, shopping carts, bags of garbage, or yard waste. Easy vehicular access for in-and-out dumping of materials to avoid landfill costs.
Illegal Littering	L: Any trash is incidental litter or carried downstream from another location.	L: Some evidence of litter within creek and banks originating from adjacent land uses	L: Prevalent in-stream or shoreline littering that appears to originate from adjacent land uses.	L: Large amountof litter within creek and on banks that appears to originate from adjacent land uses.
D-SCORE	10 9	8 7 6	5 4 3	2 1 0
L-SCORE	10 9	8 7 6	5 4 3	2 1 0
6. Accum-ulation of Trash	There does not appear to be a problem with trash accumulation from downstream transport. Trash, if any, appears to have been directly deposited at the stream location.	Some evidence that litter and debris have been transported from upstream areas to the location, based on evidence such as silt marks, faded colors or location near high water line.	Evidence that trash is carried to the location from upstream, as evidenced by its location near high water line, siltation marks on the debris, or faded colors.	Trash appears to have accumulated in substantial quantities at the location based on delivery from upstream areas, and is in various states of degradation based on its persistence in the waterbody. A large percentage of trash items have been carried to the location from upstream.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total Score _____

SITE DEFINITION:

UPPER/LOWER BOUNDARIES OF REACH: _____

HIGH WATER LINE: _____

UPPER EXTENT OF BANKS OR SHORE: _____

_____

NOTES:

_____

_____

_____

_____

_____

_____

_____

Trash Item Talley Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

TRASH ITEM TALLY (Tally with (•) if found above high water line, and (|) if below)

PLASTIC # Above___ # Below____	**METAL** # Above___ # Below____
Plastic Bags	Aluminum Foil
Plastic Bottles	Aluminum or Steel Cans
Plastic Bottle Caps	Bottle Caps
Plastic Cup Lid/Straw	Metal Pipe Segments
Plastic Pipe Segments	Auto Parts (specify below)
Plastic Six-Pack Rings	Wire (barb, chicken wire etc.)
Plastic Wrapper	Metal Object
Soft Plastic Pieces	**LARGE (specify below)** # Above___ # Below____
Hard Plastic Pieces	Appliances
Styrofoam cups pieces	Furniture
Styrofoam Pellets	Garbage Bags of Trash
Fishing Line	Tires
Tarp	Shopping Carts
Other (write-in)	Other (write-in)
BIOHAZARD # Above___ # Below____	**TOXIC** # Above___ # Below____
Human Waste/Diapers	Chemical Containers
Pet Waste	Oil/Surfactant on Water
Syringes or Pipettes	Spray Paint Cans
Dead Animals	Lighters
Other (write-in)	Small Batteries
CONSTRUCTION DEBRIS#Above___#Below__	Vehicle Batteries
Concrete (not placed)	Other (write-in)
Rebar	**BIODEGRADABLE** # Above___ # Below____
Bricks	Paper
Wood Debris	Cardboard
Other (write-in)	Food Waste
MISCELLANEOUS # Above___ # Below____	Yard Waste (incl. trees)
Synthetic Rubber	Leaf Litter Piles
Foam Rubber	Other (write-in)
Balloons	**GLASS** # Above___ # Below____
Ceramic pots/shards	Glass bottles
Hose Pieces	Glass pieces
Cigarette Butts	**FABRIC AND CLOTH** # Above___# Below____
Golf Balls	Synthetic Fabric
Tennis Balls	Natural Fabric (cotton, wool)
Other (write-in)	Other (write-in)
Total pieces Above: **Below:**	**Grand total:**
Tally all trash in above rows; make notes below as needed to facilitate scoring.	
Littered:	
Dumped:	
Downstream Accumulation:	

SPECIFIC DESCRIPTION OF ITEMS FOUND:_____

_____