DEMOCRACY IN ACTION

City of San Marcos
Storm Water Pollution Program

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City of San Marcos Storm Water

DEMOCRACY IN ACTION

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Tom Yamashita, GIS Research Assistant, provided expertise in GIS to design the mappings included in this report and for the data analysis, as well as directed a task group of ECON 421 students on GIS mapping fundamentals.

PROJECT DESCRIPTION

Trash discarded on urban lands frequently makes its way into streams, creeks, rivers, and eventually the ocean, as rainstorms wash it into gutters and storm drains. This trash pollutes California waters and adversely affects beneficial uses that support aquatic life, wildlife, recreation, water supplies, and public health.

In 2015, the State Water Resources Control Board adopted an Amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) to Control Trash emitted into waterways (Part 1 Trash Provision of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries or ISWEBE Plan). Collectively referred to as "the Trash Amendments," the policy objective is to provide statewide consistency for the regulatory approach to protect aquatic life and public health beneficial uses and reduce environmental issues associated with trash in state waters, while focusing limited resources on high trash generating areas. Put simply, the California Ocean Plan prohibits trash exceeding five millimeters in size from discharge into any waterway in California. The Trash Amendments of the Ocean Plan are implemented through National Pollutant Discharge Elimination System (NPDES) Permits (Phase I, Phase II, Industrial General Permit and Construction General Permit and individual Permits), and are not enforceable until incorporated into a Permit. The City of San Marcos (COSM) is a NPDES Phase I Permittee.

NPDES Permittees may select from one of two 'tracks' to comply with the NPDES. **Track 1** requires Permittees to install 'full capture devices' at Municipal Separate Storm Sewer System (MS4) outfalls or in MS4 systems that convey runoff from priority land uses. For Permittees choosing Track 1, these mitigation controls must be in place within 10 years from the date of the Trash Amendments' implementation via a NPDES Permit, or within 15 years of the effective date of the Trash Amendments. Permittees demonstrate compliance with Track 1 when they can "demonstrate installation, operation, and maintenance of full capture systems and provide mapped location and drainage area served by full capture systems." The Track 1 approach centers on high-cost investment and maintenance in mitigation technologies.

An alternative option, **Track 2,** allows a Permittee to "implement a plan with a combination of full capture systems, multi-benefit projects, institutional controls, [community outreach programs aimed to reduce trash emission,] and other treatment controls to achieve full capture system equivalency." Compliance with Track 2 is achieved when the Permittee has "develop[ed] and implement[ed a] set of monitoring objectives that demonstrate mandated performance results, effectiveness of the selected combination of treatment and institutional controls, and compliance with **full capture system equivalency**." COSM Storm Water staff has deemed Track 2 to be the feasible option for the COSM to satisfy the Trash Amendments.

In Spring 2017, Professor Robert Brown and students in ECON 421 (Public Economics) partnered with COSM Storm Water staff -- **Reed Thornberry** (COSM Storm Water Program Manager), **Douglas Dowden** (COSM Storm Water Program Specialist), and **Rafe Cesmat** (COSM Storm water Program Technician) -- to design a Trash TMDL Policy to satisfy the California Ocean Plan under the Track 2 option. Together, COSM Storm Water staff and Robert Brown outlined the following list of tasks (schedule) necessary to establish a Track 2 Plan:

1. **Develop an Implementation Assessment (Baseline Trash) Plan** for COSM to identify and prioritize high waste/litter areas, based on information gathered from various sources. Staff will:
   a. Identify high litter/discharge areas from field observations.
   b. Analyze existing street-sweeping data (e.g., trash loads).
   c. Identify and evaluate existing Municipal Separate Storm Sewer System (MS4) outfall trash data (high priority outfalls) collected by COSM public works crews.
   d. Identify High Priority Areas of COSM exhibiting significant trash levels (e.g., schools, convenience stores, industrial facilities, etc.).
   e. Spatially compile existing COSM trash data using GIS software to map trash levels across COSM, from which trash loads can be ranked and prioritized.

2. **Field Verification (Ground Truthing)**
   a. Conduct onsite visual assessments of high priority areas (photos, observations, field reporting data, mapping).
   b. Conduct/quantify field trash/debris counts in high priority areas.
   c. Prioritize areas in COSM based on waste loads (high to low).
   d. Identify/categorize specific sources of litter not represented in existing COSM data files (i.e., homeless encampments, pedestrian traffic at schools and convenience stores, socio-economic factors, commercial areas, and others).

3. **Compare COSM compiled Data with Field Verification,** re-prioritizing areas as necessary.

4. **Identify/Define "Full Capture of Equivalence"**

5. **Propose a "Full Capture of Equivalence" Land Use System**

6. **Develop Plan (Strategies) to Address and Reduce Litter** – Track 2 approach requires developing and submitting implementation plan, including but not limited to:
   a. Identify "full capture systems" of agencies with locations in San Marcos that would most benefit the COSM compliance (determine high priority areas in San Marcos emitted from other agencies such as Caltrans, NCTD, CSUSM, Palomar College, SMSD, bordering cities and San Diego County lands, and Industrial General Permit Permittees).
   b. Assess effectiveness of locating Public Trash Containers placed at specified locations throughout COSM (e.g., high pedestrian traffic areas, schools, convenience stores.)
   c. Assess effectiveness of placing Trash Containers at homeless encampment locations.
   d. Public Education/Outreach Programs – targeting specific priority areas.
   e. Commercial/Industrial sites – Identify sites that currently require IGP Coverage that have high waste/litter generation issues. These sites will be targeted to comply with the new Trash TMDL Policy by installing and maintaining a full trash capture systems.

7. Develop an Implementation Schedule/Timeline (10 Year Plan) targeting high priority areas first, based on steps 1 to 6.

8. **Develop a Budget for all program strategies and timeline (10 Year Plan).**

9. **Develop a Plan to Assess Program Effectiveness and Iterative Plan.**

Class Tasks and Deliverables

After discussions with COSM staff early in the semester, we determined that the first step to design a TMDL Policy was to establish baseline trash level data assessment across COSM. To do so, our ECON 421 class would focus on Item 1 (Trash Baseline from existing data), Item 2 (Field Verification of Trash Baseline data), Item 3 (Compare Baseline Trash data with Field Verification), and, as time permits, begin Item 6 (Develop Strategic Plan). This section describes our accomplishments pertaining to these specific tasks.

Item 1 — Collecting Baseline Trash Data across COSM

Early in Spring 2017, COSM staff sent trash data files compiled for the City from four broad sources covering several years – Dry Weather Reporting Data from Field Screening Stations; Municipal Separate Storm Sewer System (MS4) Reports; Public Works (PW) Trash Removal Records; and Street Sweeping data. Essentially, these four sources of trash data comprise the portals by which trash flows (and is collected) throughout the COSM. City Storm Water staff provided descriptions of these data and collection methods so that students could evaluate each data source. Students in ECON 421 were

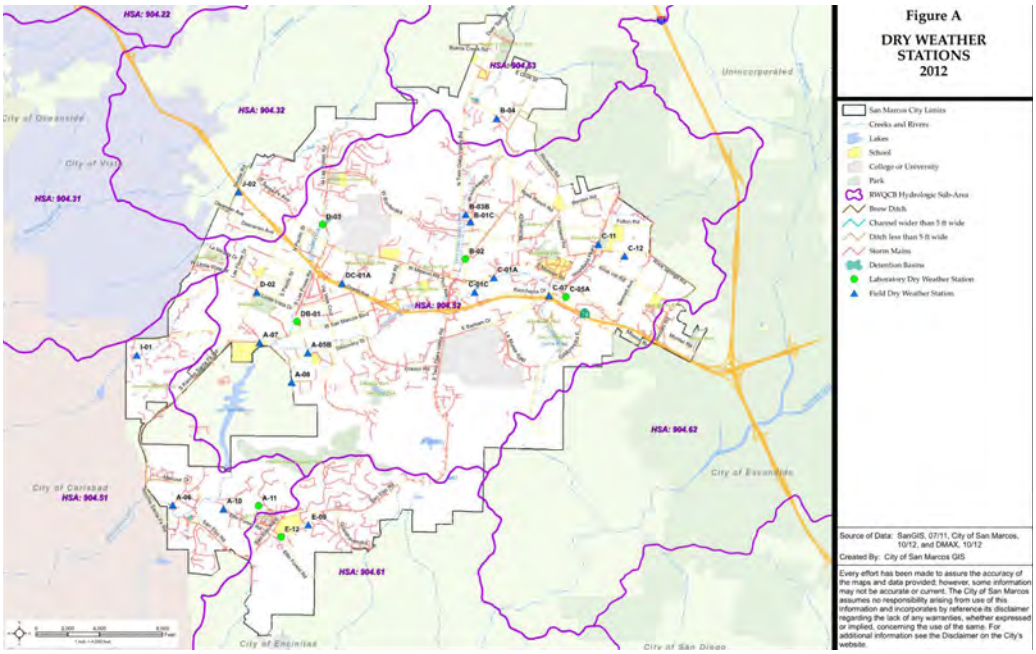
separated into four groups, each charged to analyze one of the four sources of trash data and report a description of the data files to the class. The purpose of this task was to become familiar with the existing data as well as to glean any strengths, weaknesses, or general tendencies in the data. It was clear from this exercise that these data would best be analyzed spatially using GIS software to map appropriate scales (rankings) of trash generation levels across locations and areas of COSM. Several students formed a GIS task group, under direction of Tom Yamashita, to work on the spatial mapping aspects of the project.

Trash Level Data Descriptions

Below, we report a brief summary of our findings from our initial review of existing COSM trash data -- Dry Weather Station Reports, MS4 Outfall Field Screening, Public Works (PW) Trash Collection, and Street Sweeping tonnage.

Dry Weather Field Screening and Analytical Monitoring Reports

The 2007 Municipal Separate Storm Sewer System (MS4) Municipal Permit required COSM to monitor pollutants from waterways during October through September (e.g., current 2017 Monitoring Year, 10/1/16 – 9/30/17). Dry weather reporting stations were located at either major outfalls or other outfall points located throughout the City's MS4. The COSM has Dry weather reports/data from 2008 to 2013, but full reports are available only for 2008, 2010, 2011, and 2012. In our analysis, these Dry Weather Reporting data seem to be good quality with relatively few missing observations, and station GIS coordinates align with map layers provided from the COSM.

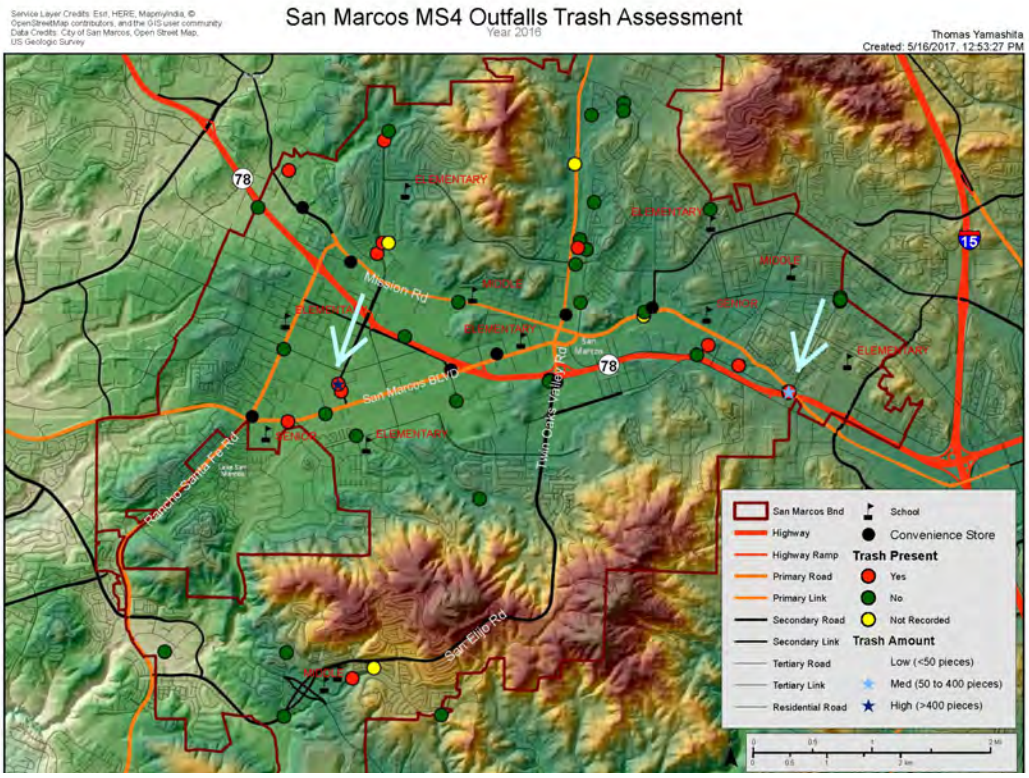


Map 1

MS4 Outfall Field Screening and Discharge Monitoring Program Data

The 2013 MS4 Permit requires the COSM to collect and monitor MS4 Outfall Field Screening and discharge trash data, replacing the Dry Weather Screening Program. A consultant for the COSM performed the last round of MS4 outfall observations and analytical monitoring.

Map 2 shows the locations of MS4 outfall sites across the City and also ranks trash levels for the year 2016, the last available year of data. The green dots represent locations reporting no trash present; red dots represent locations reporting low levels of trash (under fifty pieces). In this particular year, there were only two MS4 outfall locations reporting trash above "low" levels (see arrows in Map 2) -- one MS4 reported trash "Medium" levels from 50 to 400 pieces of trash (located at the intersection of Mission Road and Highway 78), and another reporting "High" levels exceeding 400 pieces of trash (located at Las Posas Road, north side of San Marcos Boulevard). There were some missing data for MS4 Outfall Field and Lab test results for years 2013-2015. A similar analysis for years 2013 to 2015 would allow a more complete review of these MS4 outfall trash data.



Map 2

Public Works (PW) Activities and Reporting Data

COSM Public Works crews periodically remove trash and debris from various basins, conduits, and structures across the City. These data are available from 2010 through 2013. The COSM also has a litter abatement program that includes one part-time employee who collects trash using established routes. The City is communicating and researching more into this program and hopes to provide additional information.

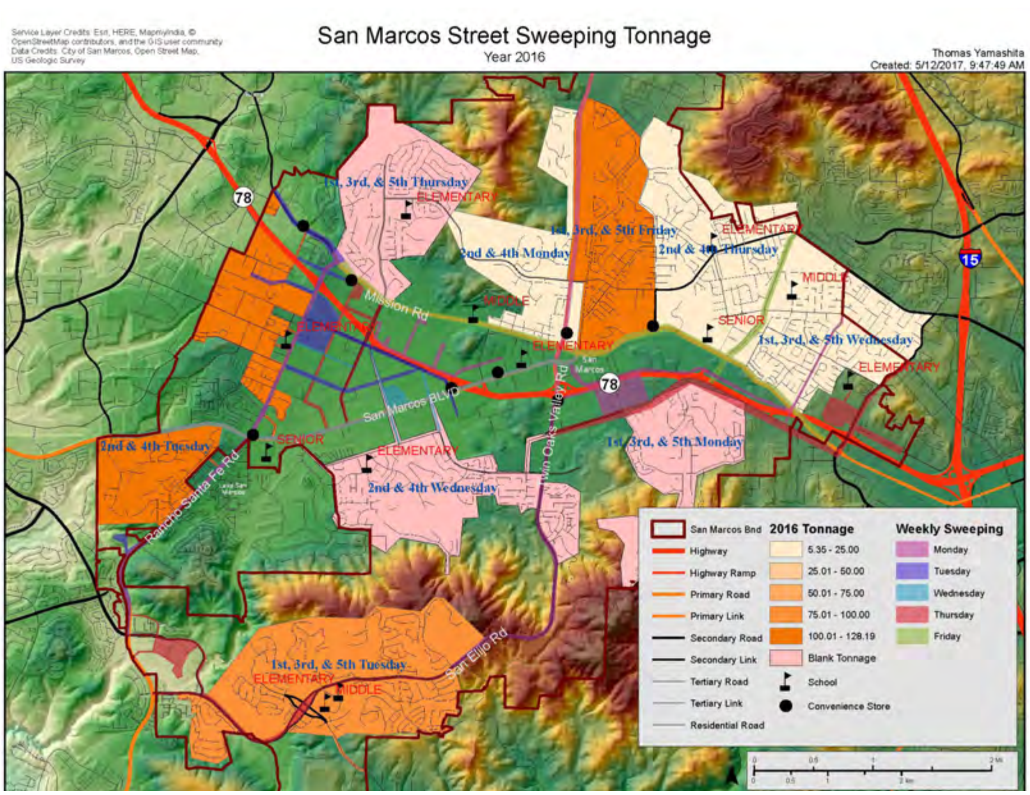
We identified some problems in these reports that limit the reliability of these data, all of which can be easily improved in the future. First, the PW data do not report GIS locations for most conduits and structures where crews collect trash throughout the City, but report only street locations; this limited our ability to spatially map PW trash collected across the City. However, these locations can be identified with field visits to mark the GPS coordinates. Second, the detention basins

listings report locations, but PW crews do not appear to collect (or report) trash at some basin locations. Third, the dates of PW cleanups are inconsistent and, thus, we were unable to construct time series trends.

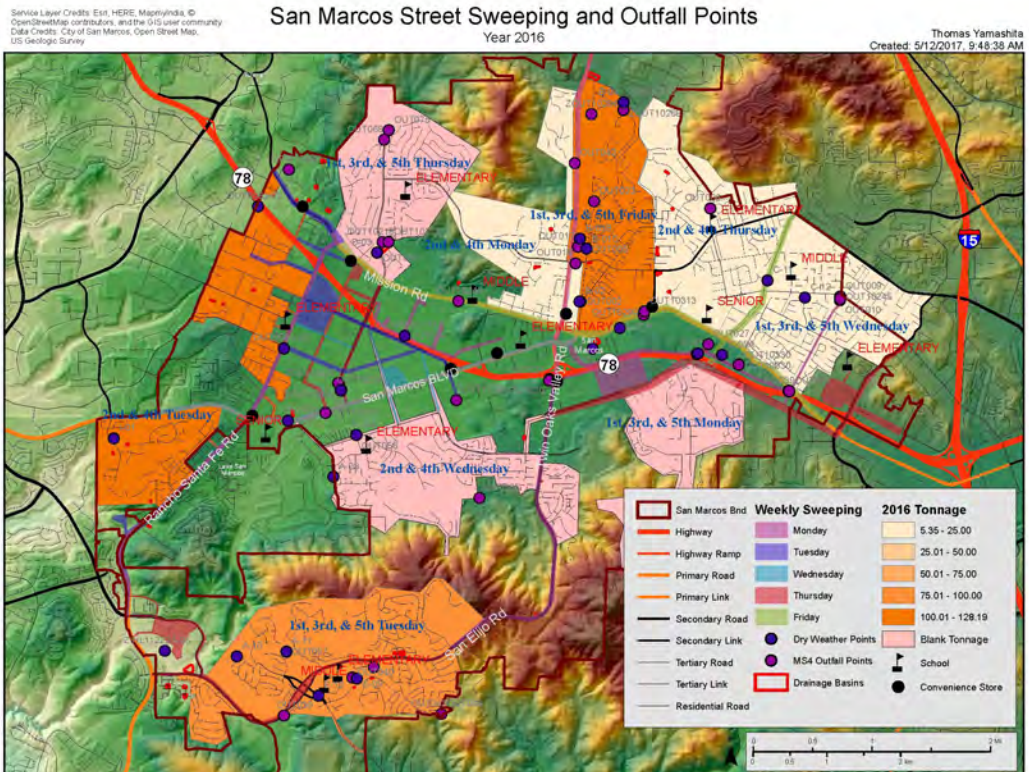
Street Sweeping Data

The COSM provided street sweeping data collected from 2008 through July 2016 reported as tonnage weighed from street sweeping trucks. Trash tonnage is weighed per day, but is not specific in precise locations; instead, the tonnage accumulates throughout the scheduled route on that particular day (or the day EDCO picks it up). Ideally, we wanted to spatially rank street sweeping tonnage across the City; to do so, required that our class manually plot the streets swept from the daily schedules and then create shape files in our GIS software. We then merged the trash tonnage data (Excel files) with the shape files created from the daily street sweeping schedules, from which we mapped and ranked these trash levels across the COSM using ArcMap GIS software.

Map 3 shows the boundaries of the nine scheduled street sweeping areas. Map 4 shows the street sweeping areas ranked by tonnage of trash collected (year 2016 shown here; a more complete spatial mapping should include all years of existing data.)



Map 3

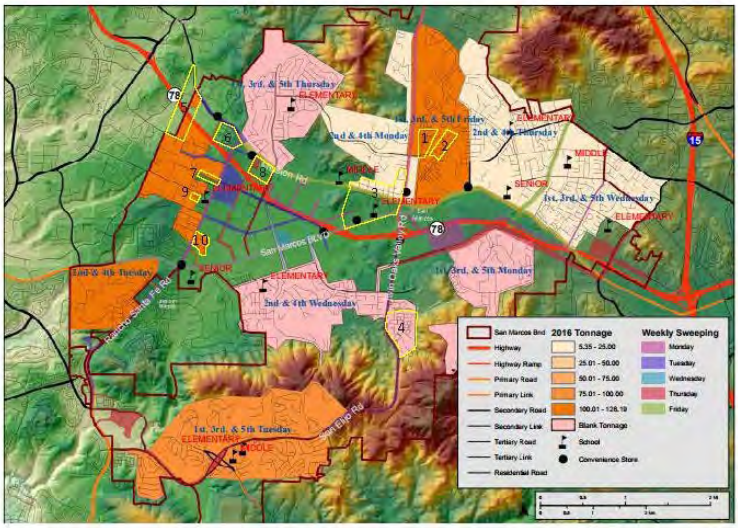


Map 4

There were some limitations in the tonnage trash data reported. First, the spreadsheets do not always connect the tonnage data with the street sweeping schedule dates. Therefore, we do not know whether the Street Sweeping schedule has changed since 2008 (the first year tonnage data were reported). Second, there appears to be missing data (tonnage), either because some areas were not swept on certain dates or the data were not reported. A closer review of all schedules published since the first Street Sweeping day (9/16/2008) to the last day data were collected (7/26/2016) should improve the accuracy of the report. Third, the tonnage reports do not distinguish between residential areas (swept every other week) and commercial areas (swept weekly). Therefore, on any given day, we cannot determine whether the trash comes from commercial or residential areas. A more accurate reporting would include additional map layers to adjust for zoning areas (residential, commercial) as well as population density, age of development, parked vehicles on streets (and citations), and the like.

COSM staff identified several high-congested areas where parked vehicles block sweeping trucks from accessing the curbside where trash deposits, thereby reducing the amount of trash swept from the streets (thus, trash enters the waterways). Map 5 below shows these high-congested areas within the trash level rankings. The COSM implemented a pilot program to cite vehicles illegally parked along streets on scheduled sweeping days, and City staff reports anecdotal data indicating that the program was successful.

STREET SWEEPING DATA AND CONGESTED STREET AREAS



List of congested streets for street sweeping:

1. Woodward from Borden to Kentfield
2. Vineyard from North Alda to Borden
3. Richmar Neighborhood
4. Village Drive from TOVR to TOVR
5. Smilax from Oleander to South Santa Fe
6. San Marcos Manor Neighborhood
7. Descanso from RSF to Las Flores
8. Descanso from Las Posas to North Pacific
9. Starstone and Via De Anza
10. Grandon from Rancho Santa Fe to Beverly Place

Map 5

The following diagram (Diagram 1) plots the time trend of the trash tonnage reports, providing a visual inspection of variation in trash tonnage across seasons.

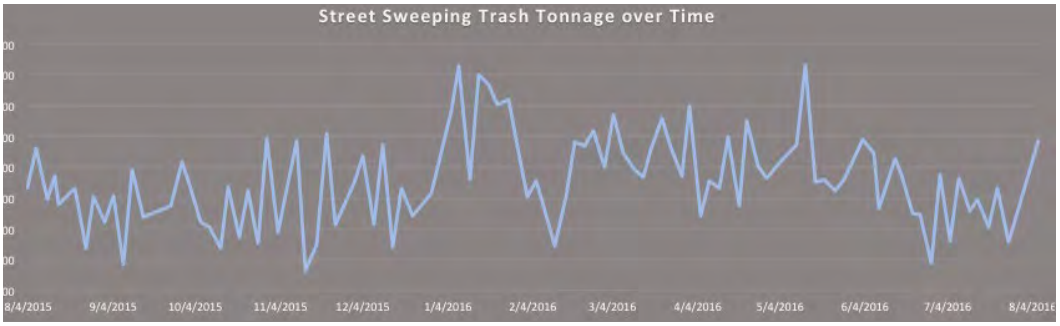


Diagram 1

Item 2—Field Verification, and Item 3—Comparing COSM-compiled Data with Field Verification

A comprehensive trash level baseline requires comparing existing trash data (Dry Weather Reports, MS4 Outfall Reports, Public Work crew collections, and Street Sweeping data) with field verification (ground truthing) from observations of trash in high-priority areas. Ideally, we would like to implement a systematic sampling method to report field

observations at identified locations. A systematic reporting method would include identifying locations from which to sample as well as designing a method to consistently quantify trash types and levels. The short timeframe of the semester limited our ability to design a systematic reporting method; however, COSM Storm Water staff hosted four field trips so that students could gain some insight into field methods. At a general level, the field observations gave students a "hands on" experience in data collection, connecting our data files with the actual trash deposited across the COSM urban environment. Typically, quantitative analysis in Economics uses data previously compiled by an agency (e.g., BLS, Census, etc.) placed into a spreadsheet, with little understanding of the collection methods or measurement error. Moreover, trash data observed at locations, such as homeless encampments, are examples of data that are excluded from the existing trash reports.

Photo 1 – COSM Storm Water staff and CSUSM students prepare for Field Verification Trip. Reporting sheets are used to quantify types and levels of trash.

Photo 2 – Sample of typical trash contents (e.g., plastics, paper products) collected by Public Works crews.

Photo 3 – Inspecting Outfall
COSM Staff and CSUSM students observe trash content in field verification at MS4 site located at South Las Posas Road, across from the San Marco movie theatres and Restaurant Row.

Photo 4 – Closer inspection of MS4 outfall, which collects three separate drainages from north. This field trip took place two days after a significant rain event; note the brush flattened from storm water rushing from outfall, thus, pushing trash farther down the creek.

Photo 5 – Open space adjacent to South Las Posas Road, on the north side of San Marcos Boulevard.

Photo 6

Photo 7

Photo 8 – A homeless encampment located along San Marcos Boulevard, west of Las Posas Road. Homeless encampments can generate significant trash levels in watershed areas.

Photo 9 – Staff and students find an abandoned vehicle, near CSUSM campus, in open space area along Discovery Street and Craven Road.

Moving Forward:
Suggestions on Designing a Full Capture Equivalency for Track 2 Approach

The main objective of the Democracy in Action Program for ECON 421 was to establish a trash level baseline – a starting point from which the COSM can develop a Full Capture Equivalency Track 2 Option over the next 18 months. The previous sections summarized our work over the 15-week Spring 2017 semester. In this final section, we propose a list of suggestions and ideas for the COSM staff to consider as they forge a detailed plan during the coming months.

- The previous section describes existing data collected for the COSM, along with evaluations of strengths and weaknesses of these data. Our data analysis was limited by the 15-week timeframe of the semester. With more time, we suggest a complete analysis to include (1) further analysis and mapping across all years for which data are available (Dry Weather Reports, MS4 Outfalls, Public Works Collections, Street Sweeping); (2) tracking trash level across time, from which any seasonal or weather related relationships can be identified; (3) descriptive tests for statistical and spatial correlations; (4) map trash levels in correlation with development patterns and demographic characteristics across COSM (population densities, types of development, proximity of schools or convenience stores, pedestrian and vehicle traffic patterns/volumes, income levels, etc.)
- The COSM has a long-standing problem with trash accumulating in areas with high street parking, restricting the street sweeper from the curb line where trash and debris accumulate. A COSM pilot study installed signs that restrict parking on a certain days/times in two areas of COSM, and Parking Enforcement ticketed vehicles not moved. Staff observed the pilot program to be successful in reducing parked vehicles and the City is modifying the municipal code to expand enforcement areas. We suggest that data from the citations (location, date, etc.) may be used to statistically correlate citations with street sweeping data to test the program effectiveness.
- In some congested urban areas it can be difficult to find available parking to move a vehicle on street sweeping days, resulting in more vehicles (and trash) on the street. One idea proposed in class was to develop an App to remind COSM residents to move their vehicles and locations of available parking. The App can also be used for community outreach, such as informing residents about the COSM program as well as messaging residents on positive land stewardship behaviors.
- We suggest the COSM expand their efforts to organize and sponsor group cleanup events, similar to ones organized by I Love a Clean San Diego "Creek to Bay Cleanup Event", which occurred in April. Previous cleanup events in the COSM organized by Storm Water staff appear to have been successful. Perhaps the COSM can identify schools and other organizations that require volunteer hours and schedule events throughout the year in high priority trash areas.
- We suggest that the COSM develop a systematic method for field observation (ground truthing) to sample (e.g., identify list of sites from which to randomly collect trash levels) and quantify (grid reporting sheet) trash levels at locations that existing measures (MS4 Outfalls, PW collections, Street Sweeping) fail to capture trash.
- City staff indicated that youth traffic around schools and convenience stores creates excessive trash, however, no systematic data have been collected. We propose a sampling method be developed to calibrate pedestrian traffic entering/existing schools and quantifying trash levels. Public trash containers may be set along areas deemed to be high-trash pedestrian corridors.
- Identify and quantity problem areas with trash from homeless encampments, and experiment with locating public containers in close proximity to reduce trash.