

Aquarium of the Pacific: Literature Review

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Chapter 1: Landfilled Waste

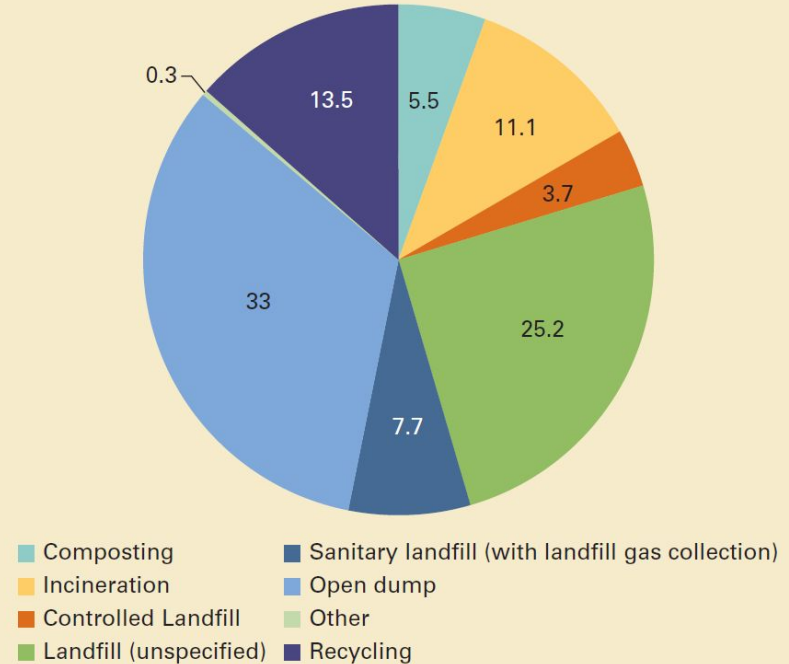
Ch. 1 — Landfilled Waste

By: Haley, Cora, and Abby

Global Waste Trends

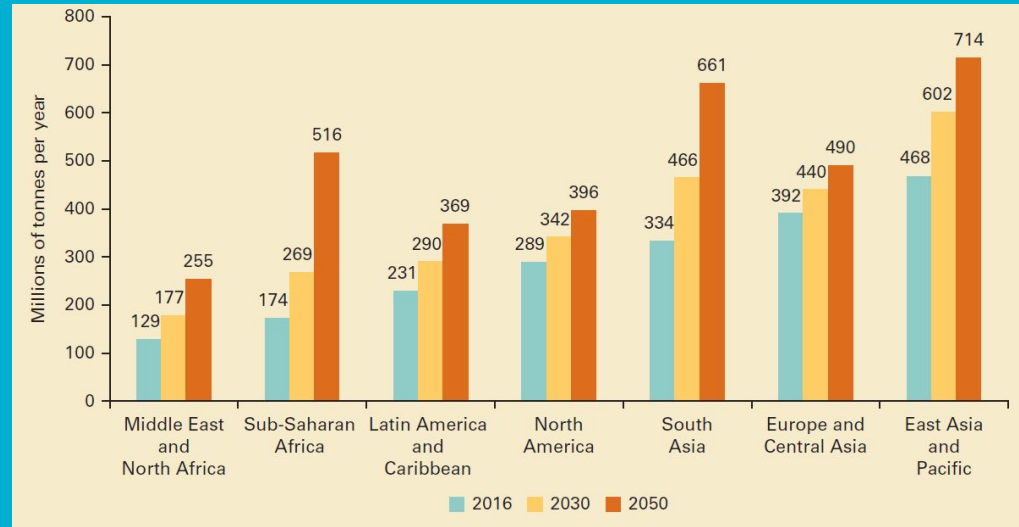
The world currently hosts **7.8 billion people**. As to be expected, this staggering amount of humans results in even more staggering amounts of waste.

According to The World Bank, humans generate **2.01 billion tons** of waste each year, averaged to be about **0.27 tons** of waste per capita. Unfortunately, a large majority of this waste is disposed of in landfills.



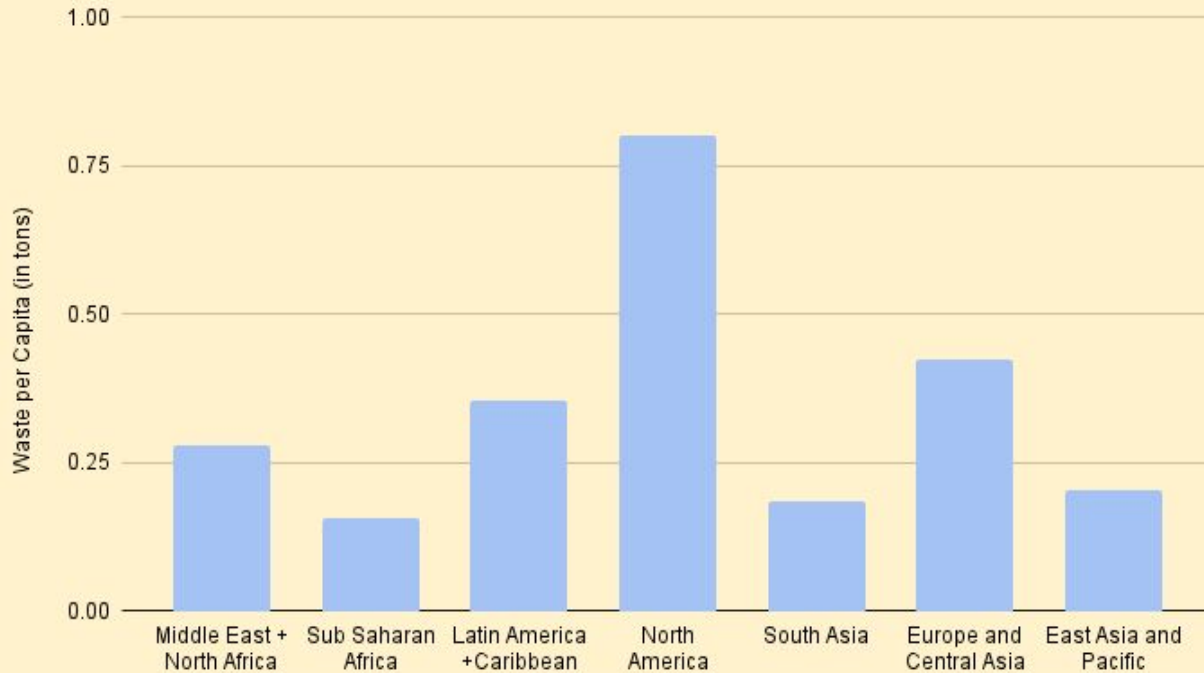
Predicted Future Global Waste Trends

However, approximately **34%** of this waste is accumulated by larger, more affluent countries like the United States, Canada and Sweden.



Waste per Capita

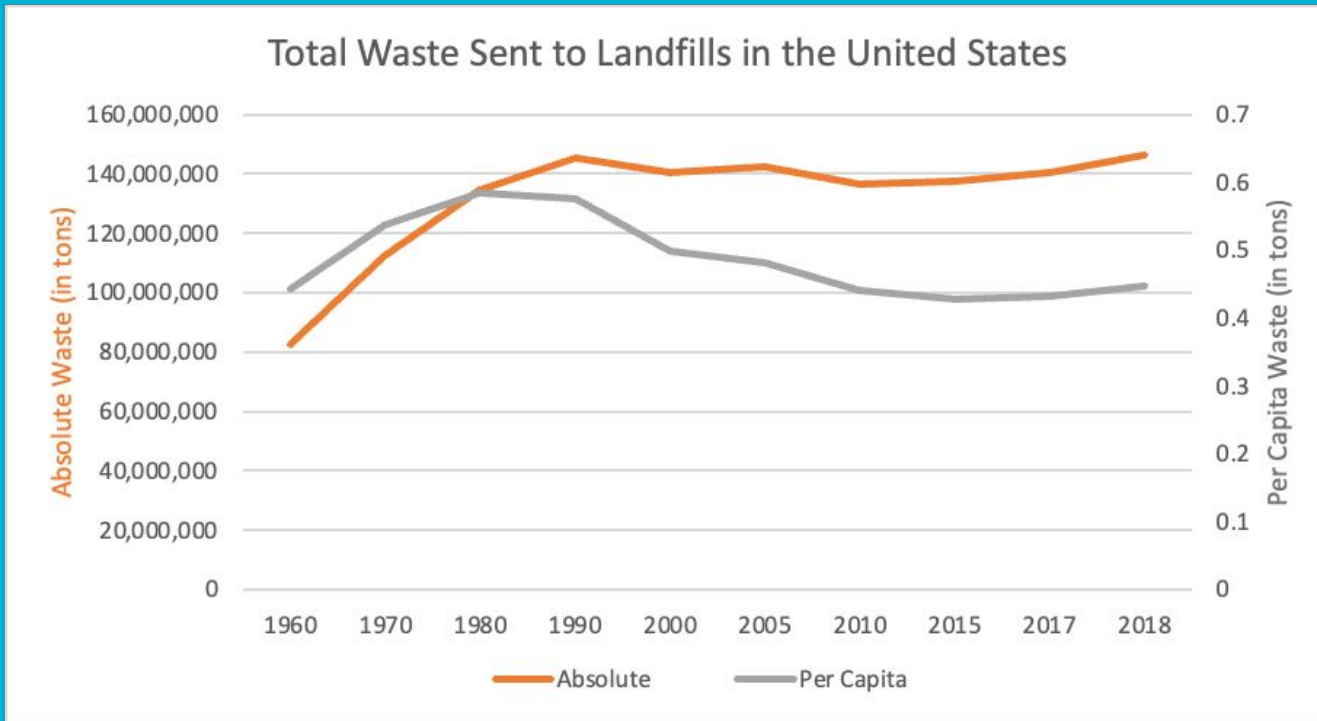
Regional Waste per capita in 2016



Landfill Waste and Population Data from 2016 and 2020 respectively

Source: [WorldBank.org](https://www.worldbank.org)

Landfilled Waste in the United States



Landfill Waste
data source:

[EPA](#)

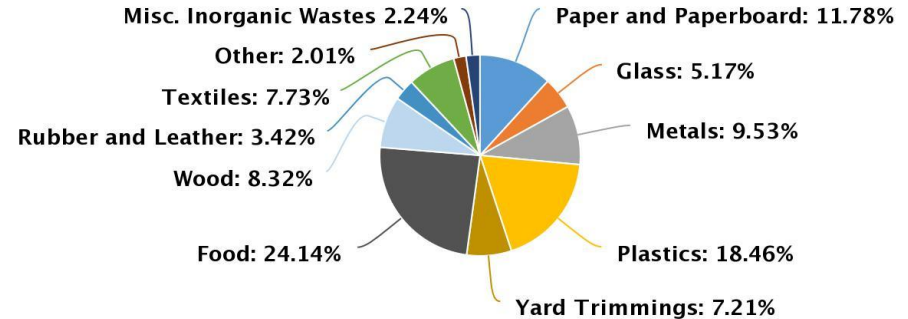
Population data
source:

[Macrotrends.net](#)

Composition of Landfill Waste in the United States

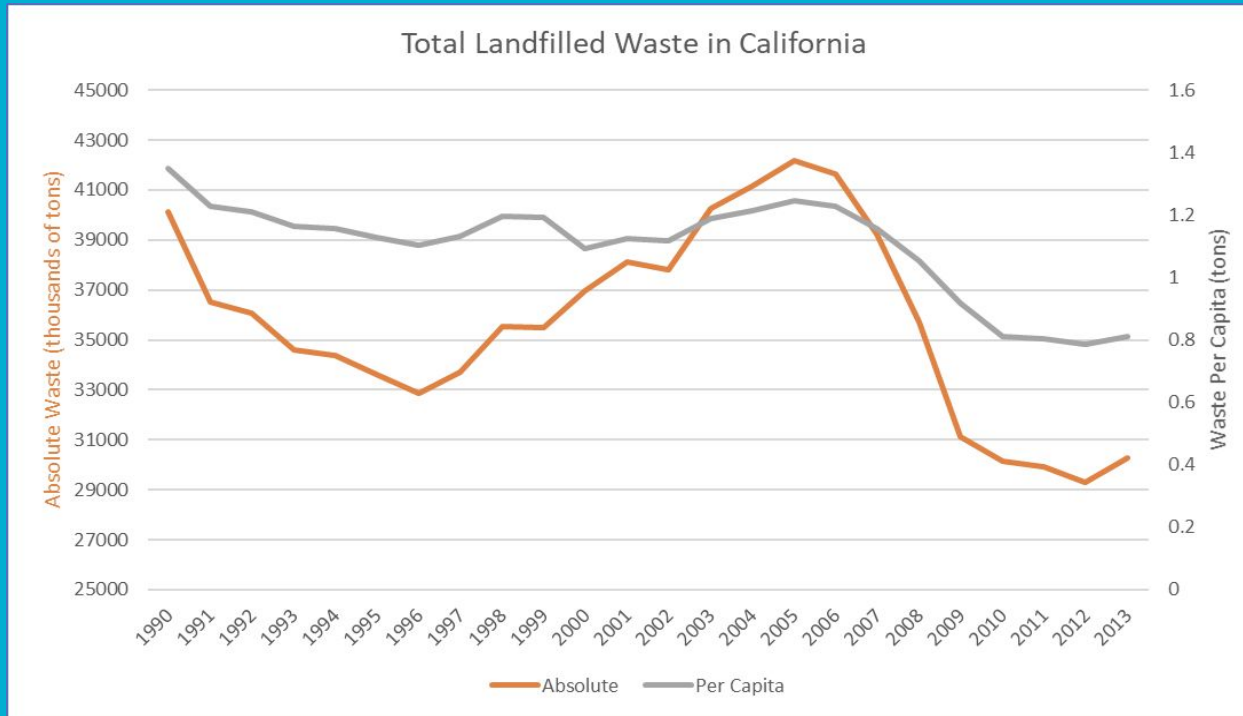
Total MSW Landfill by Material, 2018

146.1 million tons



Landfilled Waste in California

Trends in the Data



There is a large decrease in the total landfilled waste around the year 2007. This is due to several reasons:

- Curbside recycling programs ramped up
- Less consumption overall
- Collapse of the 2007 housing bubble, leading to less construction wastes

Landfill Waste data source:

CalRecycle

Population data source:

Census.gov

"Trends in the data" sources:

KPCC

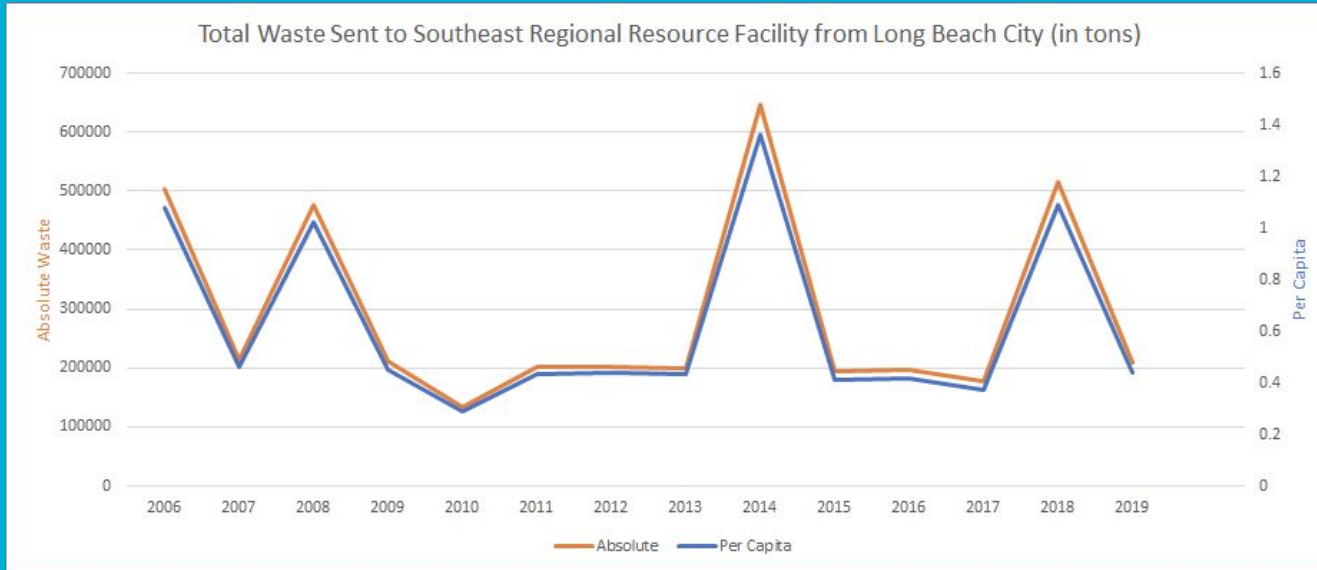
Solid Waste in Long Beach

-The city of Long Beach sends its generated waste to the Southeast Regional Resource Facility (SERRF) to undergo waste-to-energy incineration*

-Although this means that Long Beach does not contribute significantly to landfill waste, incineration still results in health and environmental issues, such as increased air pollution and exacerbation of environmental justice issues due to the location of the incinerator*



Solid Waste Trends in Long Beach



Graphing Data Source:

County of Los Angeles Countywide Integrated Waste Management Plan Annual Reports for available years

Trends in the Data:

- There was no online published data found as to why the waste data trends for Long Beach are so variable.
- The waste data for Long Beach was not available for each year, leading to erratic slope lines where there are gaps in the data
- If there were more data points available to plot, the trendline of the data would be a smoother line with less sudden increases and decreases.

Landfill Waste in Aquariums

*having trouble finding exact waste audit data for any aquariums (ie nothing more than “we have cut back our aquarium’s waste by 50% in the last two years...”)

- Found some data for zoo animals but otherwise have hit a dead end

Environmental Implications of Landfills : Greenhouse Gas Emissions

1



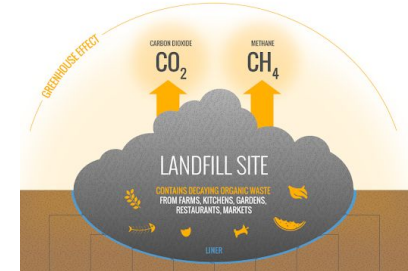
The majority of landfilled waste is organic wastes. Bacteria are responsible for breaking down landfilled organic material.

2



If the organic waste is exposed to oxygen, bacteria break down the food waste through aerobic digestion, leading to carbon dioxide production.

3



If the landfill is covered prior to the food waste being fully degraded, bacteria break down the organic waste through anaerobic processes, leading to methane.

Environmental Implications of Landfills : Greenhouse Gas Emissions

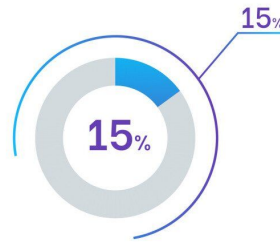
4



The release of methane has serious consequences of trapping of heat within the atmosphere- it is a highly potent greenhouse gas, 32x stronger than CO₂.

Data Sources: [EPA](#), [Washington Post](#)

5



Landfills are the third-highest source of human-related methane emissions in the US, accounting for 15% of all methane emissions in 2019.

6



Reducing the amount of food waste being sent to landfills would have a significant impact on climate change and air quality. Additionally, implementing LFG-to-energy technologies can help mitigate the impact of methane on the environment.

Landfill Waste Breakdown: Environmental Implications of Various Types of Waste

Plastics



Plastics can leach chemicals like phthalates and BPA into nearby soil and groundwater. These chemicals are endocrine disruptors and can also cause reproductive and developmental harm to those exposed.

Organic Waste



As stated before, if organic waste is exposed to oxygen, bacteria break down the food waste through aerobic digestion, leading to carbon dioxide production, which is a powerful greenhouse gas.

Electronic Waste



Electronic items like computers contain hazardous chemicals like mercury, arsenic, cadmium and lead. These toxins can leach into nearby soil and groundwater, contaminating the environment and risking human health.

Landfill Waste Breakdown: Environmental Implications of Various Types of Waste

Paper & Cardboard



Paper is bulky and biodegradable. It takes up large amounts of space in landfills, and its decomposition produces Methane, a powerful greenhouse gas. If not recycled, it increases natural resource consumption.

Metals



Most metals are mined from irreplaceable raw materials in the Earth. These finite resources can take up to 500 years to degrade, but are easily reusable if recycled.

Glass



Glass takes over one million years to degrade. It's bulky in nature and takes up lots of landfill space, which the US is projected to be full by 2035.

Chapter 2: Organic Waste Reduction Legislation in CA & Beyond

SB 1383

- Senate Bill 1383: Short-lived climate pollutants: methane emissions: dairy and livestock: organic waste: landfills.
- Effective January 1, 2022-January 1, 2024
- This bill aims to reduce emissions of short-lived climate pollutants (SLCP) and requires all California residences and businesses to separate organic waste from solid waste and recyclables and participate in an organics collection program
- Landfills & organic waste produce methane, a SLCP
 - Reduce organic waste disposal 50% by 2020 and 75% by 2025.
 - Rescue for people to eat at least 20% of currently disposed surplus food by 2025.
- CalRecycle is the state agency responsible for creating the regulatory standards for SB 1383
- Important dates:
 - Effective January 1st, 2022—CalRecycle’s regulations for organics reduction and food recovery, as well as state penalties for noncompliance.
 - Effective January 1st, 2024
 - Local jurisdictions may impose penalties for noncompliance
 - Tier Two must comply with edible food recovery requirements
 - Tier two includes:
 - Local education agencies (with an onsite food facility)
 - Large venues
 - Large events
- Business requirements:

1. Need to separate and recover the maximum amount of edible food that would otherwise be disposed (landfill or compost)
 - a. Staff or collected and recovered by a food recovery organisation or service
2. Need a contract with each food recovery organization that picks up edible food
3. Must track and maintain records of food recovered each month
 - a. Type, frequency and pounds of food

AB 1826

- Assembly Bill 1826 was signed in October 2014 and took effect in April of 2016.
- The bill requires businesses to recycle their organic waste, which includes food scraps, green waste and yard trimmings, non-hazardous, non- treated wood waste, food-soiled paper, and cardboard.
- It also requires that local California jurisdictions to implement an organic waste recycling program if there is not one already in place
- The bill applies to businesses and multifamily complexes that generate 2 or more cubic tons of solid waste, recycling, and organic waste total per week

Similar laws across the United States

- Several other states have implemented laws that currently restrict the amount of food and organic waste permitted in landfills, including Connecticut, Massachusetts, Rhode Island, and Vermont
 - Vermont
 - Vermont has a ban on disposal of food scraps in landfills, requiring that people dispose of organic waste by food donation, animal feed, composting, or anaerobic digestion
 - The bill was put into effect July 1, 2020

- Connecticut
 - Connecticut Commercial Organics Recycling Law (Public Act 11-217)
 - The Connecticut Commercial Organics Recycling Law requires that food wholesalers, food distributors, food manufacturers, supermarkets, resorts, and conference centers that create more than 1 ton of organic waste per week and are within 20 miles of an eligible facility must recycle their organic waste
 - This bill was put into effect in January 2017
 - Public Act (PA) No. 21-16
 - PA No. 21-16 requires that food wholesalers, food distributors, food manufacturers, supermarkets, resorts, and conference centers that is within 20 miles of an eligible facility and that produces an average of more than 26 tonnes of waste per year sort their organic waste and dispose of it accordingly
 - This bill will be put into effect in January 2022
- Massachusetts
 - Massachusetts banned landfill disposal of organic waste for businesses that generate more than 1 ton of organic waste per week
 - This bill was put into effect in October 2014,
- Rhode Island
 - Refuse Disposal Law Section 23-18.9-17
 - As a part of the Refuse Disposal Law, Rhode Island has a food waste ban requiring that businesses that produce more than 2 tons of organic waste per week divert it from landfill if they

located within 15 miles of an authorized composting or anaerobic digestion facility

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Vermont Official State Website. *Vermont Universal Recycling Law (Act 148)*.

<https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/Universal-Recycling/Food-Scrap-Ban-Guidance.pdf>

Chapter 3: Enforcement & Obstacles of CA Waste Laws

Discuss how each of the new California “reduce waste laws” will be enforced?

- California waste law SB 1383 will be enforced by requiring all businesses, schools, multi-family complexes, and single-family home residents to subscribe to an organics collection service. They must separate all of their green waste, food scraps and 100% fiber based food-soiled paper into their green organics container. This will begin on January 1st, 2022.
 - Businesses and multifamily complexes must provide easily accessible organic waste containers for employees, tenants, and customers. Their containers must be correctly labeled and signed for recycling, organics, and landfill waste. They also must educate employees, tenants, customers, and contractors how to correctly sort their waste every year.
 - Businesses must have containers for organics waste and recyclables in all areas where disposable containers are provided for customers, besides restrooms. They also must prohibit their employees from placing organics waste in a landfill or recyclables container. Employees must be informed if containers are wrongly contaminated and periodic inspection must occur.
 - Edible Food Generators must recover the maximum amount of food that would be disposed of. Food donation/collection must be arranged with contracts/written agreements with food recovery organizations/services and donation records must be kept.
 - Jurisdictions are required to implement an inspection/enforcement program to make sure waste generators are complying with requirements. They must also have evaluations of edible food recovery, CAL Green Building Standards and Water Efficient Landscape program requirements.

- California Waste Law AB 1862
 - Requires businesses that generate a specified amount of organic waste per week to arrange for recycling services for that waste,
 - Requires jurisdictions to implement a recycling program to divert organic waste from businesses subject to the law
 - Requires jurisdictions to report to CalRecycle on their progress in implementing an organic waste recycling program
 - Jurisdictions may implement enforcement provisions and other oversight methods that could assist in developing the jurisdiction's organic waste recycling program.
 - May include:
 - Enforcement provisions that are consistent with the jurisdiction's authority, including a structure for fines and penalties
 - Certification requirements for self-haulers
 - Exemptions on a case-by-case basis
 - Jurisdictions can choose to implement a local mandatory organic recycling commercial recycling program to enforce business compliance.
 - May include:
 - Implementing a mandatory commercial organic waste recycling policy or ordinance that addresses organic waste recycling,
 - Requiring a mandatory commercial organic waste recycling program through a franchise contract or agreement, or

- Requiring that organic waste go through a source-separated or mixed waste processing system that diverts material from disposal etc.
- The law does not require jurisdiction enforcement upon businesses
 - the law does allow for enforcement provisions and other oversight methods
- CalRecycle will evaluate the jurisdiction's implementation of its organic waste recycling program
- Jurisdictions can consider exemptions for individual businesses and or multifamily complexes
- This law does not specify or require the jurisdiction to conduct enforcement for container requirements against businesses.
- Enforcement basically completely relies on jurisdiction and what they want to do about it

What are the obstacles to compliance for each law?

- Compliance for waste law SB 1383 is determined by how jurisdiction and non-local entities implement programs. Both jurisdictions and the State are required to conduct enforcement for the regulations.
 - CalRecycle also oversees and completes compliance evaluations of jurisdictions.
- Some businesses might not be able to implement these changes due to funding
- How well the enforcement system works
 - Will there be agents sent to every business to check that these changes have been implemented?
 - How often will these checks be done?

- The public not listening/following guidelines
 - How are public individuals going to be held accountable for following these guidelines (putting waste in correct bins, etc).
- Possible smell
 - A compost bin might generate a bad smell and every business might not want this in their space
- Small businesses
 - Small businesses might have a harder time complying to these guidelines due to costs or access to resources
 - Will businesses be helped to comply with these guidelines or is the responsibility completely their own?

What are the obstacles for implementation for the laws?

- AB 1826
 - Monitoring to figure out which businesses are not recycling
 - People needed to conduct the monitoring
 - Determining cutoff points for amount of organic waste per week (8 cubic yards, 4 cubic yards, 2 cubic yards) and letting businesses know when the law is changing for them specifically
- SB 1383
 - Collection and recycling: providing organic waste collection services
 - Food recovery: finding local food recovery organizations to donate to
 - Capacity planning: estimating recycling capacity of current facilities and future projections
 - Need people to do the studies and calculate capacity
 - Limited available data

- Enforcement: “Jurisdictions are required to implement an inspection and enforcement program to ensure organic waste generators comply with the requirements.”
 - Incredibly vague!
- Louis-Zenak, M.C. (2020): Top barriers to edible food recovery, based on survey: space (29%), communication (23%), lack of education on laws (16%)
- Waste collection services for households is much more developed than waste collection services for businesses, so implementation will be harder for businesses than households
- Long Beach Commercial Food Scraps Collection Pilot program
 - Every business must be given a 95-gallon green cart to dispose of food scraps
 - The business must the place to put this large bin
 - The city should must provide routine site visits, training materials, and signage to help businesses implement the program
 - Requires people to do the checks, as well as make and deliver the training materials and signage

Are the laws equitable?

- AB 1826
 - Small businesses lack the capital and resources, and also have less purchasing power to negotiate lower prices from sellers (Bailey et al.)
- SB 1383
 - Increasing costs for businesses and households for waste pick-up, unclear whether costs will be distributed equally
- Long Beach Commercial Food Scraps Collection Pilot program

- Seems equitable since there is no extra cost to the businesses, and everything is provided to them by the city

Will compliance with the laws cost businesses, homes, or institutions money?

- For SB 1383, yes. Many jurisdictions lack adequate services to comply with SB 1383. Therefore, city governments will need to increase waste collection rates for residents and businesses to fund additional organic waste collection. (CalRecycle, 2020)
- CalRecycle (2019) calculated direct costs to residents and businesses, based on the highest estimated costs for SB 1383. Two scenarios were used: 1) a 50/50 split in direct costs between commercial and residential sectors; and 2) a split in costs proportional to the amount of waste generated, or 60% to commercial and 40% to residential. Additional calculations were made for Southern California, as well as for businesses depending on their size.
 - Average monthly cost per resident: \$4.59 if 50%, \$3.65 if 40%
 - For SoCal: \$5.69 if 50%, \$4.55 if 40%
 - Average monthly cost per business: \$73.19 if 50%, \$87.82 if 60%
 - For SoCal, \$72.17 if 50%, \$86.63 if 60%
 - The cost for residents is significantly lower because many residential programs in California have yard waste collection and can easily include food waste. In contrast, a significant number of businesses are not subscribed to commercial recycling services (CalRecycle, 2020).
 - CalRecycle further calculates how costs would be distributed to businesses based on their size (or number of employees). Two tables were generated below: one including businesses with 0 to 4 employees and one excluding those businesses. This was done due to uncertainty regarding how many

businesses with 0 to 4 employees have accounts for organic waste collection.

Table 15-A: Estimated Business Cost Breakdown by Business Size

Business Size	Number of Businesses	Average Employee Number	Cost/month (2022)
0 to 4	1,112,836	1	\$3.78
5 to 9	172,689	7	\$20.64
10 to 19	125,695	14	\$41.29
20 to 49	94,916	30	\$88.48
50 to 99	34,403	69	\$203.50
100 to 249	17,923	149	\$439.44
250 to 499	4,428	343	\$1,011.59
500 to 999	1,667	683	\$2,014.33
1000+	1,055	2,394	\$7,060.47

Table 15-B: Estimated Business Cost Breakdown by Business Size (excluding businesses with 0-4 Employees)

Business Size	Number of Businesses	Average Employee Number	Cost/month (2022)
5 to 9	172,689	7	\$22.48
10 to 19	125,695	14	\$44.96
20 to 49	94,916	30	\$96.33
50 to 99	34,403	69	\$221.56
100 to 249	17,923	149	\$478.45
250 to 499	4,428	343	\$1,101.40
500 to 999	1,667	683	\$2,193.17
1000+	1,055	2,394	\$7,687.34

- These calculations are limited because SB 1383 implementation will vary by each jurisdiction. This means costs to households and businesses will depend on their local jurisdiction's fee structure, existing level of organic waste collection and recycling, and type of community. Additionally, despite a breakdown of costs by business size, costs may also vary considerably across different business sectors.
- Complying with AB 1826 by implementing food waste diversion has presented a challenge for food sector small businesses because it is costly and waste management companies won't provide adequate support.
- In June 2021, Long Beach's Environmental Service Bureau (ESB) initiated its Commercial Food Scraps Collection Pilot Program in line with SB 1383 and AB

1826, partnering with 115 local businesses. The program has been provided to them at no additional cost. According to the press release, businesses have initially received a 95-gallon green cart to dispose of food scraps. Additionally, the city should be providing routine site visits, training materials, and signage to help businesses implement a food scraps collection program. (Long Beach ESB, 2021)

- There isn't a lot of information about this program available online.

How can the cost of compliance be managed?

- If a jurisdiction mandates organic waste collection and the collection rate is bundled, costs for households and businesses can be reduced. This means solid waste, recycling, and organic waste collection would have one total rate, based on the solid waste service level. As a result, businesses and residents can reduce waste costs by reducing solid waste and increasing diversion of recyclables and yard waste. (CalRecycle, 2020)
- Businesses could potentially divert organic waste and reduce costs by working with other local organizations.
 - Louis-Zenak (2020) suggested that for restaurants, a collaborative edible food recovery program can reduce the cost of complying with AB 1826, as well as additional costs to safely recover edible food from the waste stream.
 - Bailey et al.'s (2021) program, Rubbish, aims to collect food waste from small food retailers to produce renewable energy and compost. These byproducts will lower the program's operational costs, and these savings can be passed on to participating small businesses.

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Chapter 4: Zero Waste Events and Waste Audit Methodology

How other institutions have sought to create zero waste events, what major steps they have taken and sustainable substitutes for existing wasteful practices.

[Seven Generations Ahead, Zero Waste Event Planning Guide](#)

- Major Phases and steps
 - Pre-event
 - Minimize waste upstream
 - Prepare
 - Handle waste downstream
 - During event
 - Set up
 - Educate
 - Monitor sorting stations
 - Measure, record and showcase success
 - Tear down
 - Post-event
 - Clean up and haul resources to end sites
 - Gain feedback and evaluate
 - Publicize event successes
 - Plan next zero waste event
- Key components of waste reduction
 - Source reduction
 - Recycling
 - Composting

- Liquid diversion
- Single-use materials to replace with sustainable alternatives:
 - shopping bags, beverage bottles, take-away food packaging, beverage cups, tableware
- Choosing serving ware: reusable vs compostable vs disposable
 - Compostable: Made of biodegradable material (such as sugar cane bagasse, corn, and wheat straw)
 - Reusable: could purchase reusable silverware for more formal events where food is served like a restaurant
 - Higher up-front cost, but pays itself off after a few events
 - Requires large dishwashing facilities
 - Aquarium of the Pacific already has these
- Resource recovery stations (bins or bags where people dispose of things)
 - 1) Reusables
 - 2) Liquids
 - 3) Recyclables
 - 4) Compostables/Organics
 - 5) Landfill

[University of Illinois Chicago, Zero Waste Event Planning Guide](#)

- 90% of waste must be diverted from landfill
- Determine the size of your event beforehand, predict the amount of waste produced based on the size, and plan accordingly

- Ensure all vendors have reusable, certified compostable, or recyclable (recyclable material means #1-5) service ware. Determine whether you'd like to provide the service ware or if the vendors will be required to provide their own.
- Weight tracking after the event to determine if diversion goals were reached
- Onyx brand certified compostable service ware
 - [Onyx Company](#)

[Los Angeles County Public Works, Waste Free Event Guide](#)

- This guide is more of the same information as the two previous sources, but is more relevant to Long Beach because it is specific to LA County
- Includes a section with tips for specific event types
 - Conferences and Banquets are most likely the most relevant to events at the Aquarium

[A review of waste audit methodologies that could work well for Aquarium events.](#)

Overall guides to performing waste audits:

- [8 Steps to Improve Your Event With a Waste Audit](#)
- [A 5-Step Guide to Conducting a Waste Audit](#)
- [Waste Wise Events Waste Audit Procedures Manual](#)
- [How to do a waste audit](#)

The notes below are a culmination of the four sources above.

1. Pick an event to audit
 - a. Event size is important
 - i. May be best to start small and look at all waste from an event

- ii. Can use a sample of a large event as well
2. Define parameters & scope of audit
 - a. Material identification/define categories of waste
 - i. Plastic, cans, food waste, decorations, etc.
 - ii. Anticipate potential sources of waste/types of waste
 - b. Choose a sample of waste or analyze all waste
 - i. Depending on event size, as it may be feasible to analyze all waste of a small event
3. Plan sorting and gather tools
 - a. Where to perform waste audit—open area, well ventilated, outdoors
 - b. PPE—gloves, glasses, masks, tongs, etc
 - c. Labeled boxes for sorting categories
 - d. Scale for weighing waste
 - e. Trash bags for cleaning up waste
 - f. Have a method of recording findings—shared document, physical notes
4. Sort waste
 - a. Weigh all trash from event or the specific sample
 - b. Note recyclables mixed in trash
 - c. After sorting, weigh all categories
5. Collect and analyze waste data
 - a. Perform waste stream analysis
 - i. Calculate waste diversion rate
 1. $(\text{Weight of diverted waste})/(\text{all waste}) \times 100$
 - ii. Analyze individual categories
 1. Identify largest sources of waste

Specific audit methodology:

- [Waste Audit Methodology: A Common Approach](#)
 - Residential waste audit in Samoa
 - Their methodology is a much larger scale and more complex
 - Lessons from their methodology:
 - A standardized methodology allows for accurate comparison in future waste audits
 - Our methodology should be clear and replicable—guides and checklists for future use
 - Sample methodology
 - Identify timeframe of sample/when to collect waste
 - Auditing methodology
 - Maintain the integrity of the sample size
 - Ensure waste streams are not mixed
 - Reporting structure
 - Need a structure that can be replicated in future waste audits for ease of comparison

Event recommendations:

- [Rethink Waste and Make Your Event Earth-Friendly](#)
 - A study of waste audits found that the most common waste at special events are materials that can easily be recycled or replaced by reusable items
 - Highlights waste reduction recommendations, tailored to specific events

- This can be a useful reference when planning future events for zero-waste event planning and for waste audit ideas
- The recommendations that could be applicable for the aquarium may include: business seminars and meetings, concerts, flea markets and antique fairs
- Example of recommendations for business seminars and meetings:
 - Use electronic documents
 - Use post-consumer recycled paper, print on both sides of the page
 - Accurately predict the attendee count based on past event data to prevent waste from printed documents to food
 - Reusable name tag materials, collect after event
 - Reusable dishware
 - Do not offer single use items like drinks, purchase largest size package
 - Place recycling bins next to trash bins with clear signs

Tracking progress and variance in audit methodology based on event size.

Monterey Bay Aquarium Plastic Pollution Prevention:

- [Plastic pollution | What we do](#)
 - Have eliminated single-use plastic (bottles, straws and bags) from the cafe and sell affordable, reusable, stainless steel bottles
 - Souvenir shop minimizes use of plastic on retail packaging
 - Incorporate sustainability and pollution awareness in many of their exhibits

Publications about sustainability initiatives in Zoos and Aquariums:

- [Sustainability initiatives in zoos and aquariums: looking in to reach out](#)

- [Incorporating sustainable practices for zoos and aquariums: a Triple Bottom Line approach - TOWNSEND - 2009 - International Zoo Yearbook - Wiley Online Library](#)
- These studies need to be paid for for access but could be helpful tools down the road

Sample Design:

- [Waste Wise Events Waste Audit Procedures Manual](#)
- Events staged once a year should conduct ‘Waste audits ... at the end of the event using a sample (20%) of each of the waste and recycling streams.’
- Events that happen periodically, like markets, will be considered consistent and the initial 20% collection is sufficient. Repeat audit after strategy has been implemented
- The size of the containers required will depend on the waste type at each event. For a typical market event the following size containers are required;
- Large Containers: 1. Recyclable plastics 2. Compostable paper 3. Compostable food waste 4. Aluminum cans 5. Cardboard
- Medium Containers: 1. Glass 2. Plastic film 3. Composite plastic 4. Non-recyclable plastics
- Small Containers: 1. Inert 2. Pathogenic 3. Textiles 4. Liquid paper board 5. Steel

Large Event Planning Guide:

- [Rethink Waste and Make Your Event Earth-Friendly](#)
- Larger events require more planning ahead of time
- Also require more staff and coordination with the local waste management service
- Staff will need more training as a larger audience will entail more questions/need more knowledge

Carbon Offsets:

- [How-to Reduce Scope 3 Emissions](#)
 - Purchase materials with a lower CO2 content
 - Reduce quantity of inputs (less excess/leftovers)
 - Favor more sustainable suppliers
 - Encourage suppliers to improve their own Carbon footprint

- [Corporate Value Chain \(Scope 3\) Standard | Greenhouse Gas Protocol](#)
 - Methodology on tracking back Scope 3 emissions

- [Scope 3 Resources](#)
 - EPA'S guide to tracking scope 3 emissions

- [How General Mills, McDonalds and Kering are setting credible, courageous sustainability goals](#)

 - Large corporations are now establishing ranking systems and only partnering with providers who are setting carbon footprint goals themselves

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Chapter 5: Scope 3 Emissions

Introduction

Scope 3 emissions are incredibly complex, and therefore incredibly difficult to quantify.

Scope 3 emissions can be defined as every emission associated with a business's activities that aren't included within the definition of Scope 1 or Scope 2 emissions. Therefore, in order to properly understand what Scope 3 emissions actually are, it's important to first understand what activities are included within the definitions of both Scope 1 and Scope 2 emissions.

Scope 1 and Scope 2 Emissions

Scope 1 emissions are those which occur from sources that are controlled or owned by an organization. For example, the Scope 1 emissions of an ice cream truck would include CO₂ emitted from driving the truck from place to place. Scope 2 emissions are indirect emissions associated with the purchase of energy, such as electricity, heating, or cooling. Although Scope 2 emissions occur off-site, they are accounted for when calculating an organization's greenhouse gas footprint as they are a result of the organization's energy use.¹ Following the previous example, the Scope 2 emissions of an ice cream truck would include the CO₂ emitted through the generation of the electricity consumed to operate the truck while it is parked and being powered by the grid. Both Scope 1 and Scope 2 emissions are relatively simple for an organization to calculate since the necessary data is easily accessible given the proximity of that organization's activities to the emitting actions themselves. To calculate both Scope 1 and Scope 2 emissions of an ice cream truck one would simply track gas and electricity usage, and then perform a one-step calculation to determine the emissions from those activities.

¹ EPA. "Scope 1 and Scope 2 Inventory Guidance."

Scope 3 Emissions Definition and Categories

Scope 3 emissions, however, are “the result of activities that are not controlled by the reporting organization, but that the organization indirectly impacts in its value chain”.² The Scope 3 emissions for an organization includes the Scope 1 and Scope 2 emissions of all organizations along the reporting organization’s value chain, and therefore Scope 3 emissions are almost always the most significant category of emissions. Given how broadly encompassing the definition of Scope 3 emissions truly is, the EPA breaks this definition up into 15 distinct categories, outlined in the table below. The EPA has released guidance regarding the calculation of each of these categories, which will be utilized as a constant reference during the calculation of Scope 3 emissions from the Aquarium of the Pacific. Furthermore, organizations which perform a Scope 3 emissions audits are often incredibly transparent in regards to their calculation methodology, meaning these can be used as a secondary reference in order to fill any gaps in knowledge from the EPA’s guidance. Any calculation method used which goes beyond the EPA’s guidance should only come from credible environmental agencies, and must be communicated effectively when utilized.

Examples of Calculating Scope 3 Emissions

One example of calculating Scope 3 emissions is the calculation of employee travel and commuting. This is the transportation of employees between workplace and home and includes automobile, bus, rail, air and other travels such as subway, biking, and walking. This calculation includes scope 1 and scope 2 emissions of employees and third-party transportation providers in the scope 3 emissions calculation. There are three methods to calculate scope 3 emissions of employee travel and commuting. One method is fuel-based and uses determining the amount of fuel consumed during commuting and applying the

² EPA. “Scope 3 Inventory Guidance.”

appropriate emission factor for that fuel. Another method is distance-based and uses collecting data from employees on commuting patterns (distance travelled and mode used for commuting) and applying appropriate emission factors for the modes used. The last method is the average-data method and uses estimating emissions from employee commuting based on average (e.g., national) data on commuting patterns.³

Another example of calculating Scope 3 emissions is the calculation of contracted solid waste disposal and wastewater treatment. This includes disposal in a landfill with landfill-gas-to-energy (LFGTE - the burning of landfill gas to create energy), waste-to-energy (WTE - the burning of municipal solid waste to create energy), recovery for recycling, incineration, composting, and wastewater treatment. The calculation of these scope 3 emissions incorporate the scope 1 and scope 2 emissions of solid waste and wastewater management companies. Occasionally, the emissions from transportation of waste in vehicles that are operated by a third party are included in the calculation. There are three methods to calculate scope 3 emissions of contracted solid waste disposal and wastewater treatment. One method is supplier-specific and is done by collecting waste-specific scope 1 and scope 2 emissions data directly from waste treatment companies, such as for incineration and recovery for recycling. Another method is waste-type specific and uses emission factors for specific waste types and waste treatment methods. The last method is an average-data methods and is done by estimating emissions based on the total waste going to each disposal method, like a landfill, and averaging emission factors for each disposal method.⁴

Scope 3 Emissions Calculation Guidance

To aid with the calculation of such a complex category of emissions, EPA guidance states that Scope 3 emissions can be quantified using either primary data specific to an organization, or

³ GHG Protocol. "Category 7: Employee Commuting Methodology."

⁴ GHG Protocol. "Category 5: Waste Generated in Operations."

by using secondary data such as industry averages and proxies. The EPA even regularly updates a large quantity of default emissions factors to be used in organizational greenhouse gas calculations and reporting.⁵ Given the vast scope of the Aquarium of the Pacific’s activities, being able to use indirect data for this purpose is very convenient, however the data must be researched carefully before being integrated into a Scope 3 emissions audit.

Furthermore, a margin of error should be employed following a Scope 3 emissions audit in order to prevent greenwashing. Such margins of error generally range between 10-30 percent, and are up to the discretion of the reporting organization, so long as this margin is effectively communicated to the public.⁶

Scope 3 Category	Category Description	Relevant to the Aquarium of the Pacific?
1	Purchased goods and services	Y
2	Emissions from capital goods	Y
3	Emissions from fuel and energy	Y
4	Upstream transportation and distribution	Y
5	Waste generated in operations	Y
6	Business commuting	Y
7	Employee commuting	Y
8	Upstream leased assets	Only if the Aquarium leasing assets
9	Downstream transportation and distribution	Only if the Aquarium delivers goods
10	Processing of sold products	Y
11	Use of sold products	N
12	End of life treatment of sold products	Y, specifically food waste
13	Downstream leased assets	Only if the Aquarium leases assets
14	Franchises	N

⁵ EPA. “GHG Emissions Factors Hub.”

⁶ EPA. “Scope 3 Inventory Guidance.”

15	Investments	Only if the Aquarium invests
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Chapter 6: Team Management Plan

Accountability

We will keep each other accountable by making sure all team members know what tasks they are responsible for and the deadlines for each task throughout the project. This will be accomplished by sending message reminders in our group chat when an assignment deadline is about to pass. This will also include weekly check-ins to see how everyone is doing.

Additionally, we will have a spreadsheet indicating who is responsible for each task and when tasks are due to ensure every group member is aware of their specific responsibilities.

One column of this spreadsheet will let team members note anything about their ability to complete a task, such as how available or busy they are. We may use the Basecamp To-Dos section as another place to track upcoming tasks and who will do each task. If a group member fails to meet deadline requirements, consistently turns in inadequate work, has communication issues with the team, or any other issue that needs to be addressed, one team member will have a conversation with that person in order to better understand how the team can support that individual.

Flexibility

We will be flexible and recognize each member's availability by creating a group calendar spreadsheet. On the calendar we will note meetings, deadlines, and any schedule conflicts or events that may come up over the course of the year. We will be sure to communicate as far ahead as possible if we are going to be busy or unable to work at any time. We also must be sure to be compassionate and understanding in regards to each member's schedule as sometimes there may be conflicts, difficult times or emergencies. To make sure the calendar is up to date, we will perform weekly member check-ins to see how everyone is doing, ask if there are any schedule updates, check in to see if work is being accomplished on time and to

see if anyone needs help. If conflicts occur and a member is not going to complete their work on time, the member will first communicate this to the group, and the group in turn will be understanding and equipped to help pick up the extra slack. Active and frequent communication is necessary to ensure all members and their schedules are respected and that work is completed on time.

Behavior

Everyone in the group is expected to be respectful to one another. We want to encourage active communication, transparency and compassion when communicating and working with one another. Everyone should feel safe voicing their ideas, opinions or suggestions to the rest of the group in relation to this project or things going on in their lives. We want to encourage members to listen to each other attentively and respectfully work together to find solutions or compromise. We want to discourage members from concealing information about their lives or work that may be useful to other members. The more we know about each other's schedules and conflicts, the more other members can help if work is falling behind. We want to discourage talking down to team members and their ideas, thoughts or suggestions. No idea is a "dumb idea" so we discourage unnecessary criticisms. We encourage members to practice constructive criticism so that discrepancies can be resolved in a smooth and effective manner. We are a team, so we want everyone to feel like a crucial part of the operation.

Data Management and Reference Management System

All of our files will be stored on a shared Google Drive. These files will be organized into respective folders (ex. folders for each component of this project). Data for this project will be entered into spreadsheets and organized respectively. Important files that need to be shared with PK, Fahria, and other Aquarium of the Pacific staff will be uploaded to Basecamp.

Events and deadlines are currently presented on a team Google Calendar, though they may be moved to the Basecamp calendar in the future; this calendar will also include each member's individual significant dates (such as midterms or projects) to track people's availability.

Meetings

We will host weekly group meetings to check progress, plan future steps and check in with members. To make meetings accessible for everyone, we will host them on Zoom and record them in case members cannot attend and so that we can readily review any information covered. Each meeting will start by checking in with members to see how they are doing and feeling. This allows us to keep up with each other and find out if there are any upcoming schedule or life conflicts that may interfere with a member's ability to complete their work on the project that week. It also makes sure that members know their situation and feelings matter to the rest of the group, creating a more cooperative team as a whole.

Every meeting will have a pre-planned agenda and we will begin within the first five minutes of the meeting, even if not everyone is there, to ensure the meeting runs smoothly and effectively. We want to make sure the meetings begin on time to respect everyone's schedule and so all necessary topics can be addressed. We will also have an outline of what we will cover each meeting and a work space prepared so that these things are actually accomplished as we go over them. Meeting notes will also be taken to take account of any updates, changes, questions or deadlines approaching. The meeting agenda will be presented by whoever is leading the meeting. Meetings will be led by whatever member or group of members has an urgent topic or deadline approaching that needs to be addressed or reviewed by the rest of the group.

Expectations for Internal Communications

Currently, most communication between members is done on a group chat, with separate smaller group chats for different components of the project (such as these chapters). This has allowed for quick messaging and response. Additional notes can be added to our task spreadsheet and team Google Calendar. Communication with Peter and other Aquarium of the Pacific staff will be done through email or Basecamp.

For the team, everyone should communicate with the best intentions in mind. This means messages should be sent and read considering where peers are coming from, without any negative assumptions of them. Additionally, we encourage communicating as much as possible so that everyone knows what's going on and how everyone else is doing. For instance, if someone faces issues completing a task, they should bring it up as soon as possible.

Identifying Priorities

Before January of 2022 our goal is to have our literature reviews thoroughly finalized. We will incorporate feedback from stakeholders and edit our literature reviews as needed in order to have the most up-to-date, accurate information. This is a priority to accomplish early in the year because we will use these literature reviews moving forward in our projects, and therefore we need the information to be in its peak form. Additionally, our team will complete the Team Management worksheet (which will be sent out by Professor Garrison early next quarter) by January 2022. Similar to the literature review, this Team Management worksheet will be essential for every aspect of our project- it is therefore a priority to have this worksheet be one of the first deliverables we address in Winter Quarter.

By March 2022, our team would like to have completed all aspects of data collection. This includes data collection from waste audits of the aquarium, scope 3 emissions, cost-analysis numbers, and literature review for sb1383 strategies and sustainable foodware catering options. Ensuring that all of our data is collected by the end of winter quarter will give our team enough time to perform analyses of our findings and translate our results into a final report, executive summary, infographics, presentations, and more.

Envisioning the Final Report

For our team's final report, we aim to create a document that is easy to read, yet still packed with useful information. We want to make it visually appealing, with an emphasis on pictures and graphics. We would like to minimize the word count on each page or slide, so that those reading the report can easily spot the important statistics, calculations, and recommendations that our team has provided based on our findings. Through following these tactics, our report will be a simple yet sleek, aesthetically pleasing, and effective tool to relate our findings to stakeholders, the executive team, and the general public.

Timeline of the Project

Although our team plan for the timeline of the project will likely evolve more over time, we have put together a rough outline of when certain deliverables will be due. The table is distinguished by color to represent the Fall 2021, Winter 2022, and Spring 2022 quarters.

Date	Deliverable
11/23/21	Complete website introduction paragraph
12/7/21	Turn in literature review
1/20/22	Team management worksheet

1/30/22	Incorporate feedback edits on literature review
2/1/22	Upload team introduction and bios to the IoES website
2/5/22	Social media post- Introduction
3/10/22	Presentation on data collection methods and preliminary findings
3/15/22	Social media update- methods and data collection
5/15/22	Results write up
5/17/22	Social media post- results
5/20/22	Presentation- Intro, methods, results, conclusions
5/25/22	Create software for Scope 3 emission calculations
5/27/22	Create infographics/templates
5/29/22	Completed final report
5/31/22	Completed executive report
6/3/22	Pitch to Executive team