NOVEMBER 2022 REPORT TO THE STATE WATER BOARD: IMPLEMENTATION OF GENERAL WASTE DISCHARGE REQUIREMENTS FOR COMMERCIAL COMPOSTING OPERATIONS

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1. EXECUTIVE SUMMARY

On August 4, 2015, the State Water Resources Control Board (State Water Board) adopted General Waste Discharge Requirements for Composting Operations, Order WQ 2015-0121-DWQ; a revision to Order WQ 2015-0121-DWQ was adopted on April 7, 2020. The revisions were incorporated into General Waste Discharge Requirements for Commercial Composting Operations, Order WQ 2020-0012-DWQ and are collectively referred to as the Composting General Order. Upon adoption of the Composting General Order in 2015, the State Water Board directed staff to work with stakeholders to develop performance measures and report on its implementation. The adoption of the 2020 revisions did not modify goals or performance measures developed for the Composting General Order. This report presents information on the performance measures and implementation of the Composting General Order through July 2022.

The Composting General Order was developed to efficiently support the diversion of organic material from landfills to composting operations while providing requirements to protect water quality. As of July 2022, there are 129 compost facilities enrolled or are in process of enrolling under the Composting General Order, operating pursuant to individual waste discharge requirements (WDRs), or identified as exempt.

The goals developed in collaboration with stakeholders are:

Assess water quality protection;

Provide effective and transparent communication of permit requirements and compliance information between regulators and stakeholders;

Support diversion of organic materials to composting and anaerobic digestion facilities and engage in the Healthy Soils Initiative; and

Assess implementation costs.

State Water Board staff continue to monitor the effectiveness of the Composting General Order through performance measures that include data collection and reporting. In addition, staff continue to conduct outreach and regularly participate in interagency work groups on organics management, the Healthy Soils Initiative, and engage in collaborative activities with other agencies and groups to promote sustainable organics management and remain receptive to industry stakeholders and emerging concerns.

2. INTRODUCTION

The State Water Board adopted the Composting General Order on August 4, 2015. Resolution No. 2015-0054 certified the Environmental Impact Report (EIR), State Clearinghouse No. 2015012021. Resolution No. 2015-0054 directed staff to report to the State Water Board on the development and progress of performance measures and the status of enrollment and compliance with the Composting General Order. The State Water Board adopted a Supplemental EIR and revisions to the Composting General Order on April 7, 2020. Resolution No. 2020-0007 certified the Supplemental EIR but did not modify the direction to report on the performance of the Composting General Order, nor did the revisions necessitate modification of the performance measures and goals. This is the fifth annual report presenting an update on performance measures, compliance with the Composting General Order, and education and outreach activities conducted for organic materials management.

Compost contains beneficial micro-organisms and can be useful as a humus-rich soil amendment. To create compost, organic substances are biologically decomposed in a controlled manner to produce a stabilized product. The process of generating compost can produce a leachate. Without adequate controls, leachate can pose a threat to water quality.

The Composting General Order was adopted to provide measures to protect water quality, streamline the permitting process, and support diversion of organic materials away from landfills to composting operations. Depending on the types of feedstocks used, volume of materials on site, and hydrogeologic site conditions, facilities enrolled under the Composting General Order may implement either Tier 1 or Tier 2 requirements. The requirements of the Composting General Order are not intended to be applied to all composting activities; rather, the tiered requirements are intended to apply to most commercial composting operations. Some composting operations are issued individual WDRs, are implementing requirements through other orders, and/or may be exempt from the Composting General Order. Owners of facilities with exempt activities may file a notice of non-applicability with the appropriate Regional Water Quality Control Board (Regional Water Board) detailing the reasons for exemption from the Composting General Order. Composting facilities operating pursuant to conditional waivers, individual WDRs, or other orders applicable to composting operations may be able to continue operations in accordance with those orders.

This report includes a discussion of performance measures associated with the Composting General Order, a description of composting operations enrolled under the Composting General Order, the permitting of composting operations statewide, and organic materials management.

3. GOALS AND PERFORMANCE MEASURES

Developing performance measures and providing subsequent reports is important for communicating to the public the effectiveness of the Water Boards in protecting California's waters. Establishing performance measures helps manage and evaluate our programs, activities, priorities, and efficiency. Performance measures are developed to improve communication and transparency between state regulators and the regulated community, to demonstrate the State Water Board's support for diversion of organic materials to composting and anaerobic digestion facilities, and to assess compliance with the Composting General Order.

State Water Board staff collaborated with stakeholders in 2016 to develop goals, performance measures, and deliverables for the implementation of the Composting General Order. Additional details on the development process for goals, performance measures, and deliverables are provided in previous annual reports. Because the goals and performance measures haven't changed, and the deliverables are either complete or continue to be implemented on an on-going basis, the focus of these annual reports will be on compliance with the Composting General Order. Below is a discussion of the actions taken by State Water Board staff in support of set goals and deliverables.

Goal 1: Assess Water Quality Protection

The Composting General Order was developed to streamline the implementation of requirements for the protection of water quality at most composting facilities. This report presents regulatory compliance information from facilities enrolled in the Composting General Order and an evaluation of water quality monitoring data from enrolled facilities, with identification of potential incidences of groundwater impacts when evident. Evaluating facility and monitoring information will aid in assessing the adequacy of Composting General Order requirements. Groundwater monitoring data is available for seven facilities. Three Tier 2 facilities had groundwater monitoring in place prior to enrollment. Two Tier 2 facilities and one Tier 1 facility began implementing groundwater monitoring programs after enrolling. One Tier 2 facility submitted groundwater monitoring data but monitoring was discontinued in 2018 because the site met working surface specifications and groundwater monitoring is no longer required. A summary of groundwater monitoring results is included in Appendix C. As groundwater monitoring data become available, information will be added to the annual report.

Most enrolled facilities are making structural improvements to protect water quality. Details of these structural improvements are discussed in Section 4.2.2, Compliance Approaches.

Goal 2: Effective and Transparent Communication of Permit Requirements and Compliance Information between Regulators and Stakeholders

Stakeholders expressed concern that requirements of the Composting General Order may be inconsistent with other regulations. State Water Board staff developed, in collaboration with CalRecycle staff, an online, interactive tool for the composting community. This tool guides users through a series of questions to give a user an idea of what permits may be needed for a composting operation from both CalRecycle and the Water Boards. The objectives of the tool are to 1) assist the composting community to navigate the requirements of both agencies, 2) help streamline the permitting process, and 3) increase transparency and consistency in staff's application of requirements. The tool is available this fall on the State Water Board compost website (http://www.waterboards.ca.gov/water_issues/programs/compost/).

To foster consistency and transparency, State Water Board staff meet frequently with state and local agencies to discuss composting-related regulations and associated interagency issues. State Water Board staff meet with smaller stakeholder groups, engage in communication with Regional Water Board staff and individual stakeholders about Composting General Order implementation and applicability, and engage in a variety of organics management-related conferences and training courses. The State Water Board compost website (http://www.waterboards.ca.gov/water_issues/programs/compost/) includes frequently asked questions and responses and a list and map of facilities fully enrolled under the Composting General Order.

Goal 3: Support Diversion of Organic Materials to Composting and Anaerobic Digestion Facilities and Engage in the Healthy Soils Initiative

Stakeholders expressed concern that costs of compliance with the Composting General Order may result in green waste materials currently received at composting facilities to be redirected to landfills or directly applied to land with no composting or pathogen reduction. Stakeholders were also concerned that the flow of organic materials was unknown and that the Composting General Order would not prove to be an efficient regulatory mechanism to meet the expected increase in organic materials to be diverted from landfills.

The Composting General Order was developed to support the diversion of organic materials from landfills to composting operations and provide streamlined requirements to protect water quality at composting facilities. Of the estimated statewide composting throughput (about 6 million tons), more than 50% is processed at 95 composting facilities operating pursuant to or in the process of enrolling under the Composting General Order. Approximately 30% of the statewide composting throughput is processed at 27 composting facilities operating pursuant to individual WDRs. These percentages are estimates as specific throughput data are not available during the

transition period of AB 901 regulation implementation (Assembly Bill No. 901; Gordon. Solid waste: reporting requirements: enforcement. 2015–2016 Reg. Sess., Stats. 2015, ch. 746). The Composting General Order requires reporting of maximum on-site volume while throughput metrics will be reported to CalRecycle following full implementation of AB 901. CalRecycle staff are coordinating with State Water Board staff on the implementation of AB 901 and Senate Bill No. 1383 (SB 1383; Lara. Short-lived climate pollutants: methane emissions: dairy and livestock: organic waste: landfills. 2015–2016 Reg. Sess., Stats. 2016, ch. 395) which support California's statewide diversion and recycling goals.

State Water Board staff continue to collaborate with CalRecycle and Local Enforcement Agency (LEA) staff, conduct education and outreach regarding proper land application practices and applicable regulations, encourage the responsible management of organic material through composting and anaerobic digestion, and communicate enforcement on illegal dumping. A discussion on land application and organics management is included in this report in Section 5, Organic Materials Management.

Staff are also engaged in the California Healthy Soils Initiative. Water Board staff meet with staff from the California Department of Food and Agriculture (CDFA), CalRecycle, California Environmental Protection Agency (CalEPA), California Air Resources Board (CARB), and the California Natural Resources Agency at numerous interagency meetings as composting operations are critical in supporting both diversion goals and the Healthy Soils Initiative. State Water Board staff serve on the CDFA Environmental Farming Act Science Advisory Panel, the CDFA On-Farm Composting Committee, the CDFA Manure Recycling and Innovative Products Task Force, and participate in groups such as the CARB SB 1383 Dairy and Livestock Subgroups discussing research needs and alternate manure management practices.

Goal 4: Assess Implementation Costs

Stakeholders expressed concern that the cost to comply with hydraulic conductivity requirements of the Composting General Order may negatively impact the composting industry and compost use by either making the cost to comply more than is economically viable or driving the price of compost higher than what consumers are willing to pay. State Water Board staff understand that compliance modifications come at a cost. To make financial assistance information more readily accessible, links to funding sources and financial aid available from multiple state agencies are posted on the State Water Board compost website (https://www.waterboards.ca.gov/water_issues/programs/compost/#resources). State Water Board staff received estimates for costs to modify two existing facilities and included this information in the 2018 report to the State Water Board. If more information becomes available, it will be included in the annual report.

4. COMPOSTING OPERATIONS

4.1 COMPOSTING STATEWIDE

Composting operations are typically regulated through WDRs. As shown in Table 1, Statewide Composting General Order Enrollees, 95 composting facilities are enrolled or are in the process of enrolling under the Composting General Order. Approximately 28% of the 64 enrolled facilities are in Tier 1 and 72% are in Tier 2. An interactive map and list of enrolled facilities is available on the compost website and includes links to facility information in both the GeoTracker and CIWQS databases (https://www.waterboards.ca.gov/water_issues/programs/compost/#map). Operations in the process of enrolling under the Composting General Order, facilities with a notice of non-applicability, and facilities with individual WDRs are not included in the list on the compost website. As shown in Table 2, Facilities Not Enrolled Under the Composting General Order, there are approximately 27 composting facilities operating pursuant to individual WDRs and 7 facilities with a notice of non-applicability submitted to the Regional Water Board and determined to be exempt from the Composting General Order.

Table 1. Statewide Composting General Order Enrollees

Regional Water Board	Tier 1 Enrollees	Tier 2 Enrollees	Enrollment in Process	General Order Total
1 – North Coast	0	0	5	**5**
2 – San Francisco	1	3	0	**4**
3 – Central Coast	2	7	2	**11**
4 – Los Angeles	1	2	2	**5**
5 – Central Valley	4	23	8	**35**
6 – Lahontan	0	2	1	**3**
7 – Colorado River	0	3	0	**3**
8 – Santa Ana	8	3	3	**14**
9 – San Diego	2	3	10	**15**
TOTAL	**18**	**46**	**31**	**95**

Tables 1 and 2 were compiled for the purpose of tracking Composting General Order enrollment and do not represent all composting facilities statewide. These tables include 129 compost facilities enrolled or are in the process of enrolling under the Composting General Order, operating pursuant to individual WDRs, or identified as exempt. Approximately 170 composting facilities are listed in CalRecycle and Water Board databases. Because of limitations inherent in database outputs, these numbers are not intended to be inclusive of all composting activities in the state. For example, a search for organics management related activities may include composting operations as well as chip-and-grind facilities.

Table 2. Facilities Not Enrolled Under the Composting General Order

Regional Water Board	Individual WDRs	Notice of Non-Applicability
1 – North Coast	0	0
2 – San Francisco	2	0
3 – Central Coast	1	0
4 – Los Angeles	3	0
5 – Central Valley	12	4
6 – Lahontan	3	0
7 – Colorado River	2	0
8 – Santa Ana	4	3
9 – San Diego	0	0
TOTAL	**27**	**7**

Unique conditions at composting operations may warrant coverage under different permits, making it difficult to define their permitting status using database searches. For example, Regional Water Board staff may determine that the requirements of the Composting General Order may not be applicable for some composting operations and coverage under an individual or other general order is more appropriate. One such general order is the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Industrial Activities, Order 2014-0057-DWQ, amended in 2015 and 2018 (Industrial General Permit). Facilities operating pursuant to other orders may not be identified as a composting operation in a database. Composting operations with notices of non-applicability do not always have database records and these notices are not required to be tracked in State Water Board databases. Although the total number of composting facilities from Tables 1 and 2 is not comprehensive, it represents more than 75% of the estimated number from available databases. State Water Board staff will continue to improve transparency, communication, and collaboration with other regulatory agencies and stakeholders to clarify apparent discrepancies.

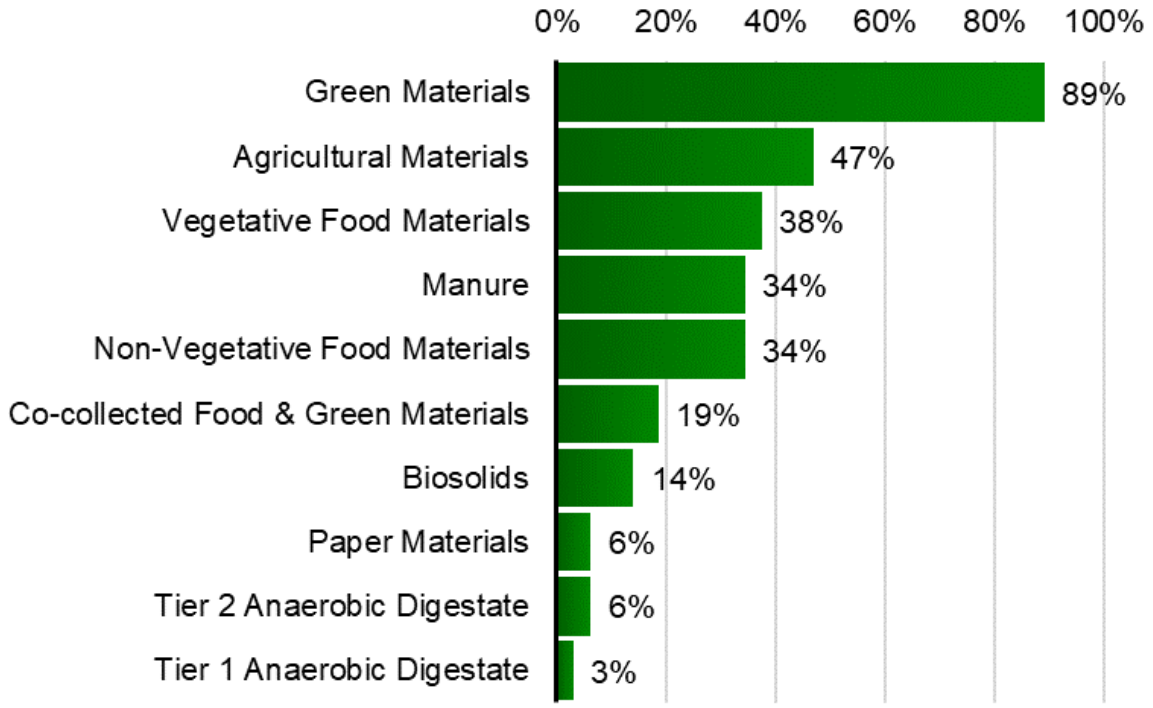
4.2 COMPOSTING FACILITIES ENROLLED UNDER THE COMPOSTING GENERAL ORDER

4.2.1. Feedstocks

A variety of feedstocks are allowed under the Composting General Order. Tier 1 facilities may accept agricultural materials, green materials, paper materials, vegetative food materials, residentially co-collected food and green materials, and anaerobic digestate derived from Tier 1 feedstocks. Manure may be accepted as a feedstock at a Tier 1 facility if a groundwater protection monitoring plan is also implemented. In addition to Tier 1 feedstocks, Tier 2 facilities may accept non-vegetative food materials, biosolids (Class A, B, and/or Exceptional Quality [EQ]), and anaerobic digestate derived

from Tier 2 feedstocks. As shown in Figure 1, Frequency of Allowable Feedstocks Used at Enrolled Facilities, most facilities compost green materials, including 11 that accept green materials as their only feedstock. Very few accept anaerobic digestate. Most enrolled facilities accept a combination of materials for composting.

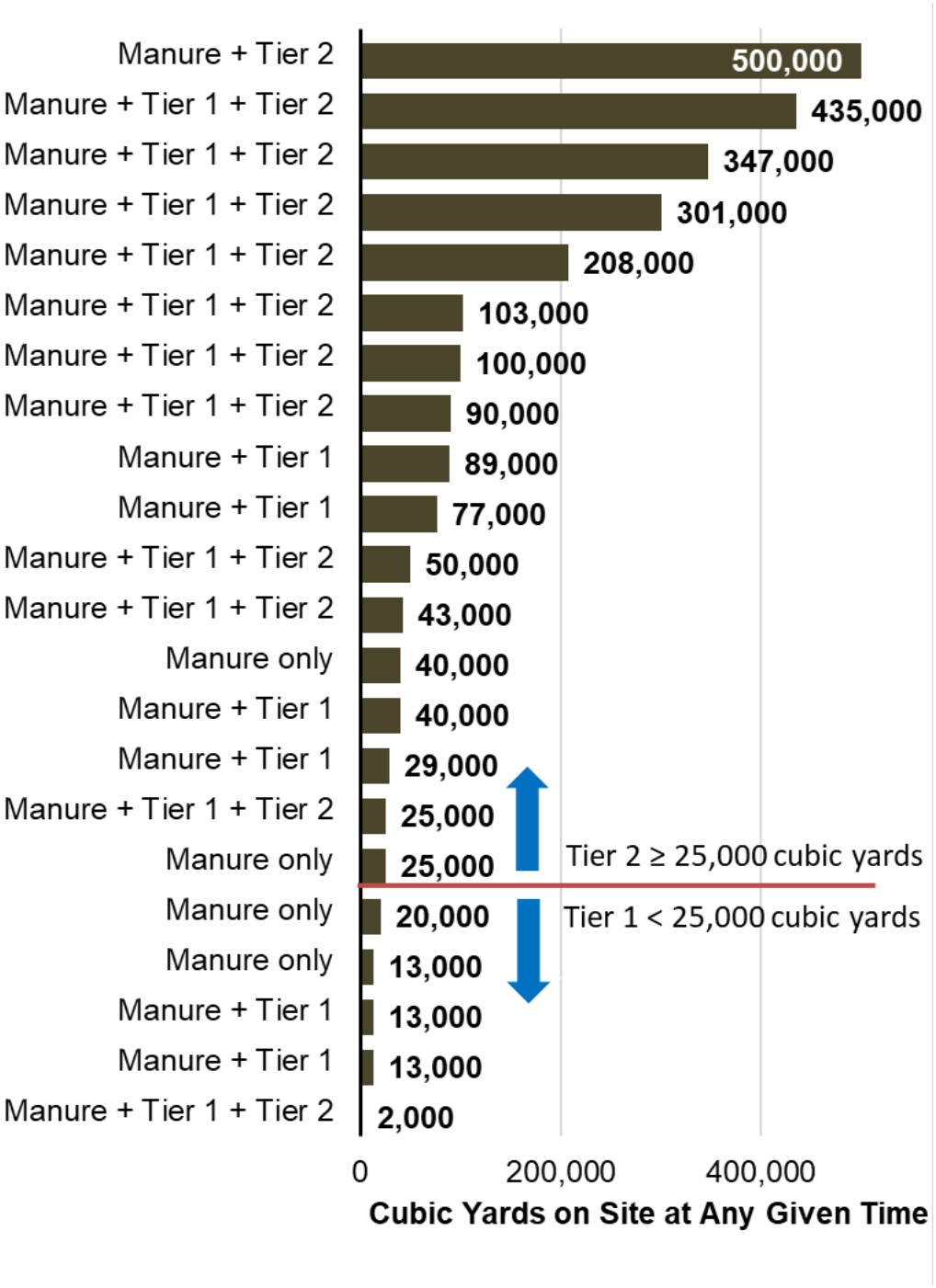
Figure 1. Frequency of Allowable Feedstocks Used at Enrolled Facilities



Of the 64 composting facilities enrolled under the Composting General Order, 22 facilities accept manure as a feedstock. Figure 2, Volume and Feedstocks Composted at Manure-Composting Facilities, compares the approximate volumes of materials on site and the types of feedstocks received at the 22 facilities. Manure is the only feedstock at four of these facilities. Facilities with greater than or equal to 25,000 cubic yards on site are required to meet Tier 2 specifications, regardless of the feedstocks. Facilities with less than 25,000 cubic yards on site and accepting only Tier 1 feedstocks may be eligible for Tier 1. The Composting General Order was revised on April 7, 2020, to allow manure to be composted at a Tier 1 facility if a groundwater protection monitoring plan is implemented and the facility has less than 25,000 cubic yards of material on site at any given time. Five facilities that compost manure and are enrolled in the Composting General Order have less than 25,000 cubic yards on site. One of these accepts Tier 2 materials and is therefore not eligible to enroll in the revised Tier 1. One facility, previously enrolled as Tier 2, enrolled under the new provisions of Tier 1 and is developing a groundwater monitoring program. The remaining three facilities, located near confined animal operations, may potentially be eligible for Tier 1. Each

facility is implementing a phased approach to compliance with Tier 2; the path to compliance may be modified to meet the revised Tier 1 if chosen and as appropriate.

Figure 2. Volume and Feedstocks Composted at Manure-Composting Facilities



Abbreviations Used in Figure 2:

Tier 1	Tier 1 feedstocks
Tier 2	Tier 2 feedstocks

4.2.2. Composting Methods

A variety of composting methods are chosen to suit specific operations, feedstocks, and local conditions. As shown in Table 3, Composting Methods at Enrolled Facilities, the most common composting methods are turned windrow and aerated static pile (covered or uncovered). Some facilities use a combination of methods.

Table 3. Composting Methods at Enrolled Facilities

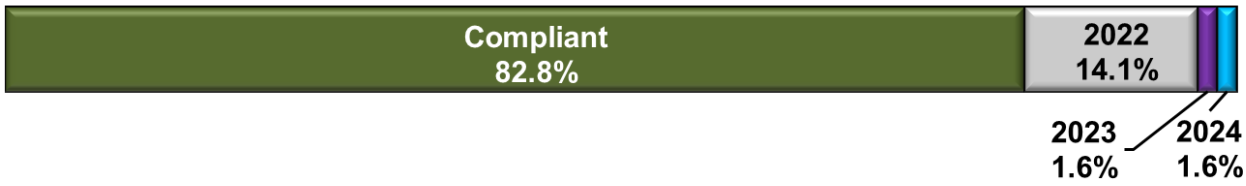
Composting Methods	Number of Facilities
Turned Windrow	44
Covered Aerated Static Pile	7
Aerated Static Pile	3
Turned Windrow + Covered Aerated Static Pile	3
Turned Windrow + Aerated Static Pile	2
Turned Windrow + Enclosed Aerated Static Pile	1
Turned Windrow + Static Pile	1
Compost-covered Windrow for Air Quality	1
Aerated Static Pile + Static Pile	1
Covered Aerated Static Pile, Engineered Compost System	1

4.2.3. Compliance Approaches

The Composting General Order allows composters to achieve compliance in a phased approach. If this option is pursued, a plan must be submitted with proposed schedules for implementation of planned collection, control, and monitoring practices. Compliance schedules must not exceed six years from the date the notice of intent was submitted to the Regional Water Board, be supported with appropriate technical or economic justification, and be as soon as practicable. The Regional Water Board Executive Officer may modify the schedules based on evidence that meeting the compliance date is technically or economically infeasible.

Most composting operations enrolled under the Composting General Order proposed compliance schedules within the six-year timeframe. Figure 3, Scheduled Year for the Completion of Compliance Modifications at Enrolled Facilities, presents a breakdown of the compliance schedules for the 64 enrolled composting facilities. About 83 percent of enrolled facilities are compliant with the infrastructure requirements of the Composting General Order. Compliant facilities are either new facilities constructed according to the design specifications of the Composting General Order, existing facilities compliant upon enrollment, or existing facilities that completed compliance modifications by 2021.

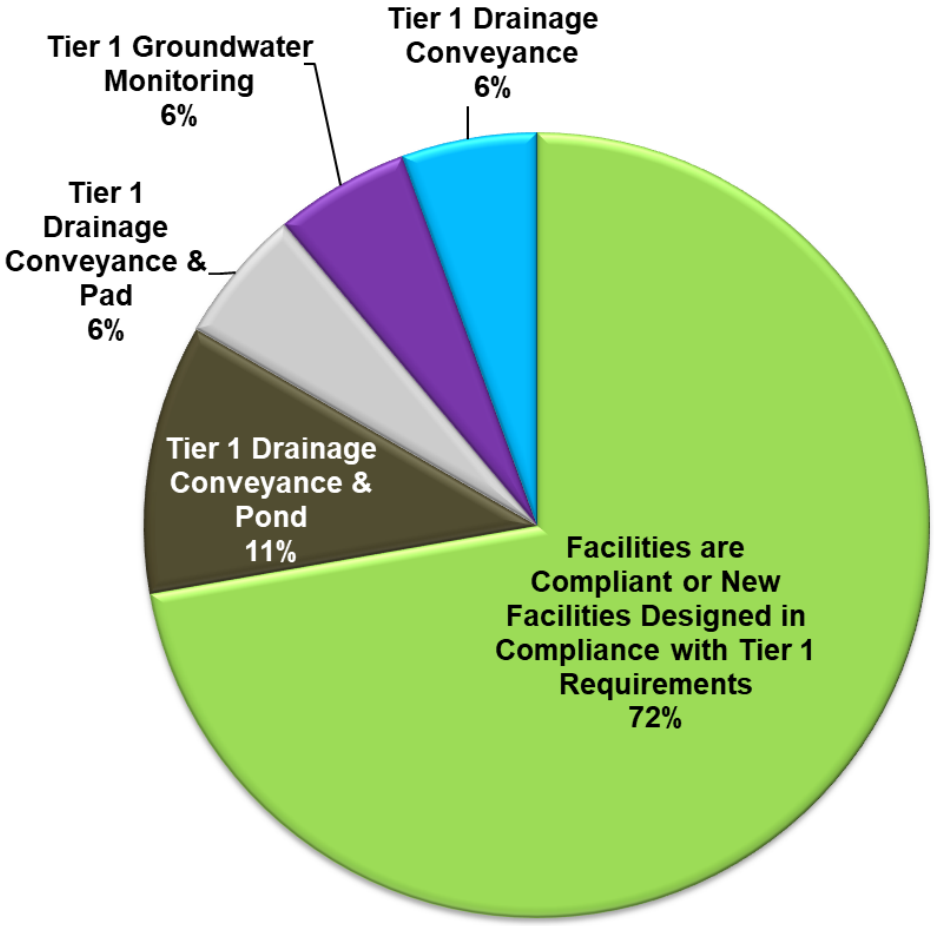
Figure 3. Scheduled Year for the Completion of Compliance Modifications at Enrolled Facilities



The following figures show the compliance modifications proposed by Tier 1 and Tier 2 facilities at the time of enrollment under the Composting General Order. Figures 4 and 5 show the combinations of modifications within each tier compared with the percentage of those compliant upon enrollment. Figures 6 and 7 show Tier 2 compliance approaches in further detail, divided by working surfaces and wastewater pond modifications. Dischargers may propose engineered alternatives for the design and construction of ponds, working surfaces, and drainage ditches to demonstrate compliance with the requirements of the Composting General Order.

As shown in Figure 4, Proposed Compliance Modifications at Tier 1 Facilities, most Tier 1 facilities were already in compliance with Tier 1 specifications upon enrollment or are new facilities being designed to comply. One Tier 1 facility that accepts manure as a feedstock will be installing a groundwater monitoring network to comply with the modified provisions of Tier 1. A greater percentage of Tier 2 facilities needed to make changes to meet Composting General Order specifications as shown in figures 5 through 7.

Figure 4. Proposed Compliance Modifications at Tier 1 Facilities



As shown in Figure 5, Proposed Compliance Modifications at Tier 2 Facilities, most Tier 2 facilities needed to make structural improvements. About 41% of Tier 2 facilities were compliant upon enrollment or were new facilities being designed to comply. Of the enrolled Tier 2 facilities, about 22% are modifying all three containment features (working surfaces, drainage conveyance, and wastewater pond) and 15% will make improvements to wastewater ponds alone.

Figure 5. Proposed Compliance Modifications at Tier 2 Facilities

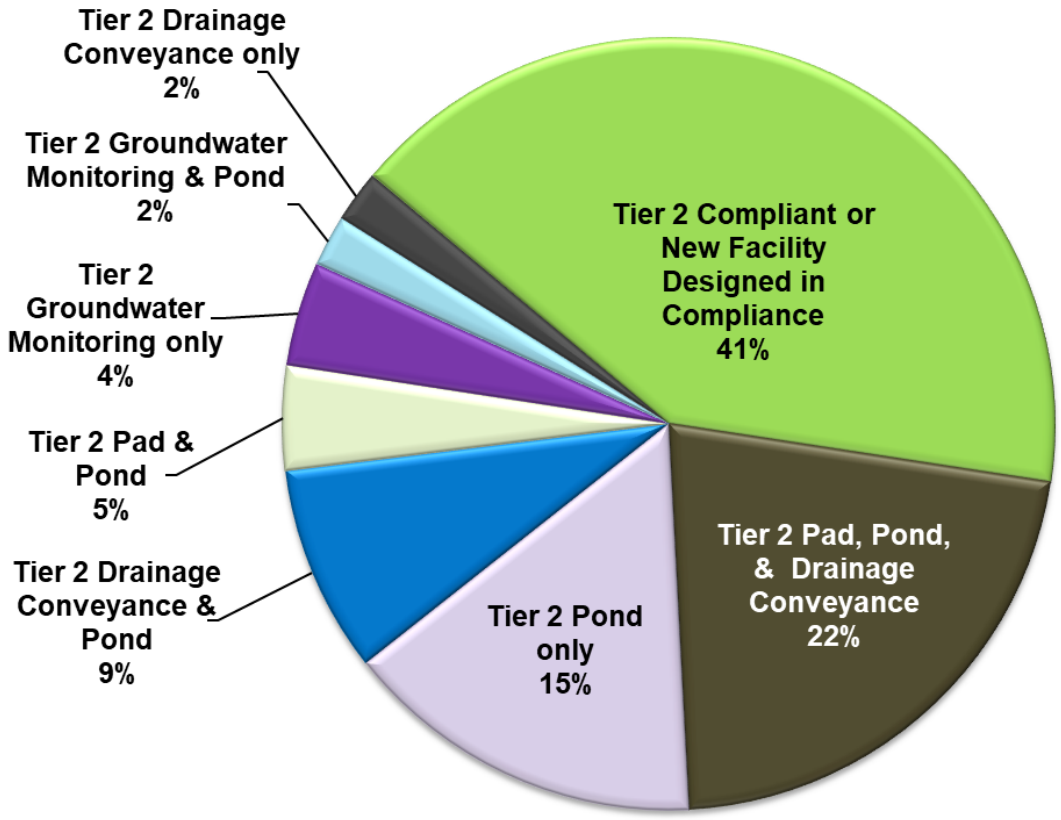
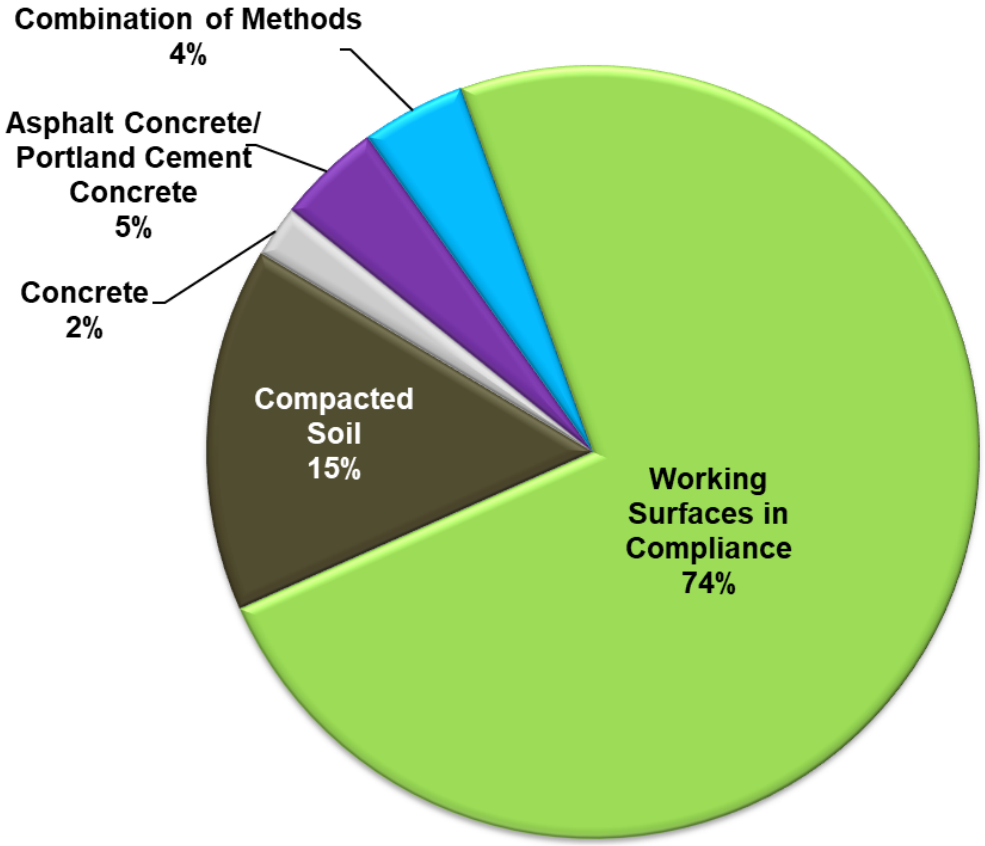


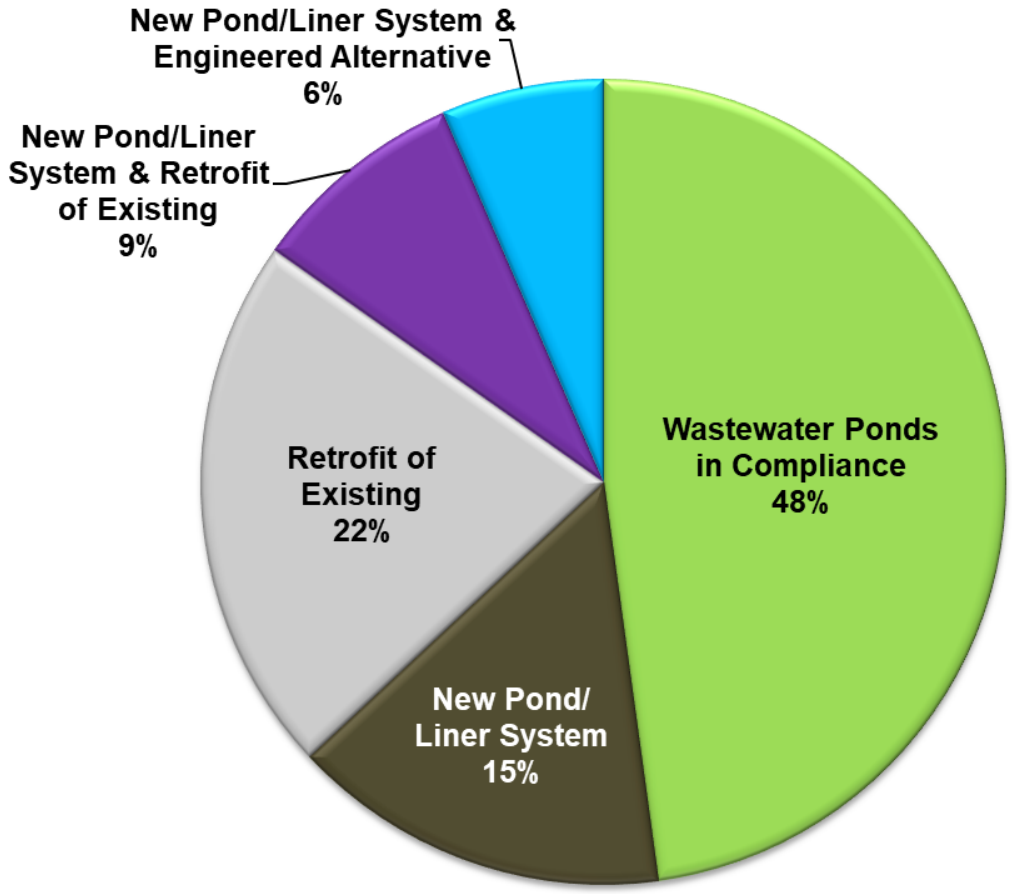
Figure 6, Proposed Working Surface Improvements at Tier 2 Facilities, shows that 74% had compliant working surfaces and 26% proposed modifications. Compacted soil is chosen by a little more than half of the Tier 2 facilities proposing working surface improvements.

Figure 6. Proposed Working Surface Improvements at Tier 2 Facilities



As shown in Figure 7, Proposed Wastewater Pond Improvements at Tier 2 Facilities, approximately 52% of Tier 2 facilities planned a modification to their wastewater containment systems when they enrolled. Including those with alternative methods of wastewater handling, 48% of Tier 2 facilities had wastewater containment systems which met the requirements of the Composting General Order upon enrollment. Approximately 22% will retrofit existing ponds, 9% will both install new containment systems and retrofit existing systems, and 6% will install new containment systems in conjunction with engineered alternative systems. Figures 5 and 7 show that pond modifications are a major factor for compliance at Tier 2 facilities.

Figure 7. Proposed Wastewater Pond Improvements at Tier 2 Facilities



4.3 COMPOSTING OPERATIONS WITH INDIVIDUAL OR OPERATION-SPECIFIC WDRs

There are at least 27 composting facilities operating pursuant to individual WDRs. Many of these individual WDRs require more protective measures due to siting considerations and/or the materials accepted, in accordance with California Code of Regulations, title 27. Eight are co-located at landfills and requirements for the composting operations are incorporated into the WDRs for the landfill. Composting activities may also take place at other facilities such as confined animal facilities or publicly owned treatment works where compostable materials handling is regulated through operation-specific WDRs.

5. ORGANIC MATERIALS MANAGEMENT

5.1 GENERAL OVERVIEW

Requirements in the Composting General Order are intended to protect against potential threats to water quality from discharges from composting operations. The Composting General Order was developed to streamline permitting of composting operations with similar materials and operations. Other operations, such as chip and grind facilities and land application activities, use similar materials as those used at composting facilities; however, these activities are regulated differently because the operations are different from the composting process operation. This section discusses management of organic materials not occurring at composting facilities.

5.2 CHIP AND GRIND FACILITIES

The chip and grind process mechanically reduces the size of green materials including tree and yard trimmings, untreated wood wastes, and natural fiber products. Organic material from chip and grind facilities can be used as feedstock for biomass energy, composting, or anaerobic digester facilities; or may be applied directly to land as a soil amendment. CalRecycle requires that chip and grind material not be on site for more than 48 hours (or up to 7 days with LEA approval) and must not reach active composting temperatures. The material holding time and temperature restrictions reduce the potential for materials to decompose.

Although organic materials do not remain for long periods of time at chip and grind facilities, the materials may pose a threat to waters of the state unless managed appropriately. The material holding time and temperature restrictions at these facilities limit the biological decomposition of organic materials and the leachate generation potential which reduce the threat to groundwater quality. However, the operations may pose a threat to surface water from runoff of sediment and organic particulates. Generally, chip and grind facilities are more appropriately regulated under the Industrial General Permit or individual WDRs.

5.3 LAND APPLICATION OF UNCOMPOSTED ORGANIC MATERIALS

Land application is the spreading of uncomposted organic materials on land such as rangeland and cropland. These materials are often mechanically size-reduced prior to spreading and may include materials from curbside green waste collection or agricultural activities such as grass clippings, leaves, garden waste, plant trimmings, bark, agricultural plants, or food waste. Uncomposted organic materials may contain metals, pathogens, nutrients (e.g. nitrate), salts, or other waste constituents, and may harbor damaging insects. In addition, uncomposted organic materials from sources such as curbside waste collection may include contaminants such as trash, plastics,

glass, metals, pet waste, and other materials. If not conducted appropriately, the application of uncomposted organic materials to land may impact surface and groundwater. Land application of uncomposted organic materials may be considered a discharge of waste to land subject to regulation by the Water Boards. For example, the Regional Water Boards are adopting orders which include requirements for irrigation and nutrient application to agricultural land in the Irrigated Lands Regulatory Program. The application of green waste to agricultural lands must be accounted for in a grower's nutrient management plan. Additionally, the application of residual solids from winery processes are subject to the requirements of General Waste Discharge Requirements for Winery Process Water. Orders for land application of organic material require implementation of best management practices and include conditions requiring water quality monitoring of receiving waters and corrective action when impairment is found.

Stakeholders expressed concern that the increased costs of producing compost due to meeting the requirements in the Composting General Order would create an incentive to directly land apply organic materials. Preliminary investigations revealed that land application activities have occurred for over a decade, prior to the development of the Composting General Order. State Water Board staff conducted joint education and outreach with the State Water Board's Office of Enforcement and CalRecycle staff in response to stakeholder concerns. As a result of the outreach, Water Board staff were notified of land application locations with potential water quality issues. Since the initial adoption of the Composting General Order in 2015, about a dozen land application cases were reported and enforcement measures were taken as needed.

State Water Board staff are coordinating with CARB, CalRecycle, and LEA representatives on issues related to land application and organic materials management. State Water Board staff also published and distributed an informational pamphlet, available on the State Water Board compost website. A hyperlink to the CalEPA Environmental Complaint System was added to the State Water Board compost website.

Several sites were identified as potential illegal applications of uncomposted organic materials to land that may pose a threat to water quality and beneficial uses, as shown in Table 4, Summary of Land Application Enforcement Cases Since the Adoption of the Composting General Order (2015 to 2020). Sites include ongoing cases, sites discovered by Regional Water Board staff or the LEA, or sites identified and reported by the public. There continues to be active enforcement on sites statewide involving collaboration with the LEA. Some land application activities may be in violation of one agency's regulations/requirements but not the other. And at some sites, both agencies may determine that the land application of uncomposted organic material was conducted at a proper rate, meets CalRecycle's land application standards, and does not pose a threat to water quality or public health. Enforcement actions can take a long time to complete with some spanning multiple years; however, the lack of new

complaints received and new active cases may point to success in our collective education and outreach efforts.

Water Board enforcement staff investigate complaints as resources allow and will continue collaboration with CalRecycle and LEA staff on land application activities and enforcement issues. Water Board and CalRecycle staff recognize that enforcement is a necessary component of ensuring compliance; however, staff are focusing on education to prevent contamination and dumping in land application areas. CalRecycle developed protocols for determining levels of contaminants in compostable materials by weight as a method to determine compliance. The Composting General Order provides exemptions for on-site composting which may encourage responsible on-site management of organic waste and reduce off-site disposal.

Notes for Table 4 below:

Totals included in the “No. of Cases” column are active and inactive cases as recorded by the Regional Water Boards between 2015 and 2020. An individual case may include multiple enforcement actions.

Totals included in the "Active Cases" column are cases that are currently active or pending enforcement.

Totals included in the “Pending Inspection and Violation Determination” column are the number of cases the Regional Water Boards have been informed of and are pending inspection or the violation type is pending determination.

Totals included in the “Regional Water Board Determined No Threat to Water Quality” column are the number of sites the Regional Water Boards have inspected in coordination with other agencies (e.g. LEA) and determined there were no violations or threats to water quality.

Table 4. Summary of Land Application Enforcement Cases Since the Adoption of the Composting General Order (2015 to 2020)

Regional Water Board	No. of Cases	Notices of Violation (NOV)	Clean Water Code Section 13260 & 13267 Violation Letters	Cleanup and Abatement Orders (CAO)	Active Cases	Regional Water Board Determined No Threat to Water Quality
North Coast	–	–	–	–	–	–
San Francisco	–	–	–	–	–	–
Central Coast	2	–	2	–	–	–
Los Angeles	1	–	–	–	–	1
Central Valley	3	7	–	–	–	1
Lahontan	–	–	–	–	–	–
Colorado River Basin	–	–	–	–	–	–
Santa Ana	2	1	–	–	–	–
San Diego	3	2	–	1	1	–
TOTAL	**11**	**10**	**2**	**1**	**1**	**2**

5.4 MANURE MANAGEMENT

California's agriculture contributes significantly to the state economy and commodity export. The Central Valley is the largest agricultural region in California and is one of the world's most productive agricultural areas. In addition to crop production, agricultural operations include animals such as chickens, cows, sheep, goats, and pigs. Many of these operations are known as confined animal facilities, which are farms or ranches, including dairies, where livestock are held for a significant part of the time and are provided food, as opposed to grazing. These operations produce large quantities of manure that must be managed appropriately to prevent water quality impairment. Materials such as manure may pose a higher threat to water quality due to concentrations of pathogens, nitrates, and salts.

To reduce impacts to water quality from manure in the central valley, the Central Valley Regional Water Board adopted a Dairy General Order, Waste Discharge Requirements General Order No. R5-2013-0122 for Existing Milk Cow Dairies. The Dairy General Order includes requirements for corrals, production areas, ponds, and land application areas. Any new dairies, or dairies that expanded since 2005, may not be eligible for coverage under the Dairy General Order and may be subject to individual WDRs. The Central Valley Regional Water Board also adopted general WDRs applicable to feedlots in the Confined Bovine Feeding Operations General Order on June 8, 2017. The Dairy Representative Monitoring Program evaluated manure management at dairies and made recommendations for best management practices in the April 1, 2019 Summary Representative Monitoring Report. The goal of the Representative Monitoring Program is to identify on-farm management practices that are protective of groundwater quality. Data and analysis from the final report will aid in determining appropriate protective requirements for manure management at dairies. Those requirements are expected to be incorporated into the upcoming revised Dairy General Order.

At agricultural operations, a variety of methods are used to manage manure, including land spreading, anaerobic digestion, and composting. As shown in Figure 1 of Section 4.2.1, approximately 35% of enrolled composting facilities use manure as feedstock. Stakeholders are concerned that the requirements of the Composting General Order are cost-prohibitive to compost manure on farms. The Composting General Order was not intended to apply to composting conducted on farms to manage manure or create compost for on-farm use. The State Water Board revised the exemption in the Composting General Order to support on-farm composting practices. Waste discharge requirements for confined animal facility operations address manure handling and storage; therefore, additional coverage under the Composting General Order may not be necessary. There is a need to export surplus manure from farms. Water Board staff are participating in a Manure Recycling and Innovative Products task force led by CDFA with representatives from the dairy industry on innovative ways to create a market for excess manure generated on dairies.

Stakeholders also expressed concern with imposing the same requirements on herbivore manure composting as non-herbivore manure composting. The 2015 EIR analysis discussed that composting nutrient-rich feedstocks on coarse-textured soils where there are no barriers to soil-water movement has the potential to create elevated nitrate concentrations in groundwater. The State Water Board revised the Composting General Order to allow animal manure as a Tier 1 feedstock if a groundwater protection monitoring plan is implemented.

5.5 RESEARCH ON MANURE BEST MANAGEMENT PRACTICES

Through a contract with the State Water Board, the University of California at Davis (UCD) conducted research on the nitrate leaching potential of manure composting systems. UCD researchers also compared the chemical transformations and properties of a manure composting system and a static manure stockpiling system. The contract was initiated on August 19, 2019 in response to comments indicated above that manure should be permitted as a Tier 1 feedstock. The contract ended on January 31, 2022; the following is a summary of this research. The results of this research may inform future regulatory pathways for manure handling practices.

5.5.1. Overview of the Research and Experiment

The research provided a literature review focusing on dairies, manure handling practices, uncomposted manure properties, chemical transformations during the composting process, and composted manure properties. UCD researchers conducted an experiment at a well-established composting operation to compare the chemical transformations and properties of two different manure handling practices: dairy manure composted with wood mulch and uncomposted dairy manure managed in a static pile. The chemical transformations of carbon and nitrogen were specifically analyzed in both systems. To look for evidence of nitrate leaching and to explore nitrate fate and transport mechanisms through the underlying soil, UCD conducted soil-core sampling to about 30 feet below the composting operation and an adjacent hayfield where compost is applied. For background data, these results were compared to soil-core sampling taken beneath a neighboring hayfield that had not received organic amendments in the previous 20 years of management.

5.5.2. Measurements and Findings from the Experiment

In the composting system, nitrate concentrations within the pile fluctuated several times, with the highest levels measured at the end of the experiment. Elevated nitrate levels were found underneath the composting operation in this experiment but attenuated to background levels within 30 feet below ground surface. Soil-core sampling identified several clay layers beneath the composting site, the first being between 3 and 4 meters below ground surface. Above this layer was a thin layer of saturated soil.

Manure used in the uncomposted static system was mechanically separated manure solids and had a higher carbon-to-nitrogen ratio than whole manure (manure that includes a liquid fraction).

Tables 5, 6, and 7 summarize experimental data provided by UCD researchers. Table 5 compares the carbon-to-nitrogen ratios between the composting system and the uncomposted static system at the beginning and at the end of the 15-week experiment. Table 6 compares four parameters for the composting system and the uncomposted static system at the beginning and at the end of the 15-week experiment as extracted by deionized water experimentally. Table 6 shows results of soil-core sampling for nitrate below a composting system and an untreated hayfield as extracted by potassium chloride solution experimentally.

Table 5. Carbon to Nitrogen Ratios Compared Between Systems

Time Period	Composting System Results	Uncomposted Static System Results
Beginning	37:1 – 40:1	29:1 – 30:1
End	12:1 – 15:1	10:1 – 11:1

Table 6. Experimental Parameters Compared Between Systems

All values have been rounded to the nearest whole numbers except where noted. The units are milligrams per kilogram of dry material.

Parameter	Time Period	Composting System Results	Uncomposted Static System Results
Ammonium	Beginning	70 – 276	163 – 253
Ammonium	End	3 – 22	22 – 31
Dissolved organic carbon	Beginning	3452 – 5274	2047 – 3378
Dissolved organic carbon	End	2033 – 2688	5011 – 7499
Dissolved organic nitrogen	Beginning	392 – 758	685 – 1045
Dissolved organic nitrogen	End	278 – 307	555 – 710
Nitrate (rounded to tenths)	Beginning	2.6 – 17.7	1.4 – 2.5
Nitrate (rounded to tenths)	End	11.6 – 82.4	2.1 – 4.7

Table 7. Nitrate Levels in Soils Underlying a Compost Yard Compared to Background

The units of nitrate are milligrams per kilogram of dry soil. Values are rounded to the nearest hundredths.

Meters Below Ground Surface	Nitrate Levels Underlying Compost Yard	Nitrate Levels Underlying Untreated Hayfield
0.15	190.83	5.72
0.46	119.35	38.93
0.76	88.22	85.95
1.07	55.03	48.47
1.83	46.54	15.37
3.05	17.55	7.09
4.27	0.38	3.39
5.49	0.77	1.78
6.71	0.60	0.52
7.92	1.35	0.52
8.84	0.56	0.34

5.5.3. Comparisons and Conclusions

Both the composting system and the uncomposted static system experienced transformations and decomposition. In both systems, the carbon-to-nitrogen ratio decreased during the experiment. However, the composting system consistently had a higher carbon-to-nitrogen ratio than the uncomposted static system because high carbon bulking material was added. In the uncomposted static system, ammonium levels were higher than in the composting system because the addition of bulking material to the composting system diluted the manure with its ammonium content. Some of the ammonium can volatilize during turning in a composting system. Likewise, anaerobic conditions in a static system can lead to the formation of methane and some of the ammonium and methane can volatilize. The uncomposted static system also had higher dissolved nitrogen and carbon than the composting system.

The research conducted by UCD contributed to understanding the differences in the risks of nitrate leaching from dairy manure composting systems compared with the management of uncomposted dairy manure in a static pile. UCD researchers found the forms of nitrogen in each system are different. In the manure composting system, some of the nitrogen can be expected to be converted to nitrate during the final stages of composting. Results indicate that nitrate levels increased towards the end of the composting process when the compost is maturing, and the thermophilic and cooling

phases are completed. During this stage, nitrification resumes and nitrate content rises. Results of the study indicated that the risk of nitrate leaching to underlying soils increases towards the end of the composting process. Underlying soils at this site had several clay layers. These clay layers were hypothesized to create conditions where perched water saturated soil layers. Along with the availability of dissolved organic carbon, these clay layers likely contributed to microbial denitrification of nitrate to nitrogen gas in the shallow subsurface and nitrate levels were attenuated to background levels. The uncomposted static system had a greater potential for leaching dissolved organic nitrogen to soil than the composting system due to higher concentrations of dissolved organic nitrogen. Soil microorganisms can convert dissolved organic nitrogen into ammonium and nitrate. On the other hand, dissolved organic carbon in soil can become a substrate for the conversion of nitrate into nitrogen gas through denitrification which may attenuate nitrate leaching. Soil-core soil sampling was not conducted below the uncomposted static system, therefore, these conversions and nitrate leaching were not studied experimentally.

Findings in the research conducted by UCD supplement the discussion in the 2015 EIR that composting nutrient-rich feedstocks on coarse-textured soils where there are no barriers to soil-water movement has the potential to create elevated nitrate concentrations in underlying soils. Due to the variability of California soils and depths to groundwater, it is reasonable to deduce that there are some places where nitrate may leach to groundwater and other places where clay layers, perched water, and the availability of dissolved organic carbon allow microbial denitrification to attenuate nitrate to background levels before reaching groundwater. This research identifies fine-grained soils not only as physical barriers to leaching potential but also as acting to increase denitrification processes, therefore supporting the requirements in the Composting General Order for working surfaces at commercial composting operations.

5.6 CALIFORNIA HEALTHY SOILS INITIATIVE

CDFA is the agency responsible for leading California's Healthy Soils Initiative. In collaboration with other state agencies and departments, the goal of the Healthy Soils Initiative is to promote the development of healthy soils on California's natural and working lands. Health of agricultural soil relates to its ability to build and retain adequate soil organic matter through the activity of plants and soil organisms. Soils with adequate soil organic matter have the capacity to function as vital living ecosystems that sustain and produce food for plants, animals, and humans, and increase carbon sequestration and reduce overall greenhouse gas emissions. The proper application of compost can increase soil organic matter and contribute to soil health. The Composting General Order provides streamlined requirements for on-farm composting and permitting of commercial composting facilities and may contribute to more compost use.

State Water Board staff are engaged in the California Healthy Soils Initiative and meet regularly for interagency meetings with staff from CDFA, CalRecycle, CalEPA, CARB, Department of Pesticide Regulation, and the California Natural Resources Agency. Meetings include the Environmental Farming Act Science Advisory Panel, California Agriculture Partnership Forum, workgroups associated with Assembly Bill No. 1045 (Irwin; Organic waste: composting. 2015–2016 Reg. Sess.; Stats. 2015, ch. 596), the California Roundtable on Agriculture and the Environment, meetings for the Healthy Soils Initiative and Healthy Soils Week, and on-farm composting work groups, and CARB SB 1383 subgroup meetings regarding alternate manure management practices and dairy digester research needs.

6. SUMMARY

The application of compost is one of several sustainability practices promoted by California's Healthy Soils Initiative. Agronomically-applied compost helps retain soil moisture, provides nutrients, and may reduce irrigation and synthetic fertilizer needs and runoff potential. With several goals for diversion of organic materials from landfills, composting operations are critical in supporting both diversion efforts and soil health. Although compost is a beneficial product, composting operations may pose a threat to water quality through the discharge of leachate or wastewater with high concentrations of nitrogen, phosphorus, metals, and pathogens. The State Water Board adopted the Composting General Order to provide a streamlined mechanism to support the production of compost while providing minimum standards for water quality protection. On April 7, 2020, the State Water Board adopted revisions to the Composting General Order related to agricultural operations and manure management practices.

The Composting General Order was developed concurrently with CalRecycle's efforts to divert organic materials from landfills and in support of the Healthy Soils Initiative. To address stakeholder concerns, State Water Board staff met with industry stakeholders to develop performance measures. State Water Board staff continue to meet with other agencies and interested stakeholders on topics such as organics management, Healthy Soils, sustainable agriculture, and tracking of organic material through diversion efforts to ensure transparency and collaborative communication and continue supporting the goals and performance measures of the Composting General Order.

The Composting General Order appears to be a successful tool to streamline the permitting process and protect water quality. Ninety-five facilities are enrolled or in the process of enrolling in the Composting General Order. About 50% of the statewide composting throughput is processed at composting facilities operating pursuant to or in the process of enrolling under the Composting General Order. Preliminary groundwater monitoring results appear to indicate that the requirements of the Composting General Order are protective of water quality.

State Water Board staff intend to continue with annual updates to this report to reflect current activities related to organic materials management. State Water Board staff further intend to evaluate best management practices by reviewing data reported pursuant to the Composting General Order and the results of the research conducted by UCD.

APPENDIX A - GLOSSARY OF TERMS

Beneficial Uses – potential uses of waters of the state to be protected against quality degradation. Beneficial uses include but are not limited to domestic, municipal, agricultural and industrial supply, power generation, recreation, aesthetic enjoyment, navigation, and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. (Wat. Code, § 13050)

CIWQS – The California Integrated Water Quality System (CIWQS) is one of the Water Board's primary systems for tracking regulatory data for several programs including land disposal and WDR programs. It is also used to track municipal and regionally issued stormwater permit information, and some irrigated lands and timber harvest information. It also accepts certain types of electronically submitted data from the regulated community.

Composting – Composting is the biological decomposition of organic materials by microorganisms under controlled aerobic conditions to create a product (e.g., soil amendment or soil blend). Compostable materials comprise a wide range of material types: grass, leaves, branches, prunings, stumps, wood waste, agricultural materials, manure, food, and biosolids.

Discharger – any person who discharges waste that could affect the quality of waters of the state and includes any person who owns a waste management unit or who is responsible for the operation of a unit. (Cal. Code Regs., tit. 27, § 20164)

General WDRs – a regulatory order that pertains to a group of waste management units that employ similar operations, waste types, and treatment standards. (Wat. Code, § 13263, subd. (i))

GeoTracker – an internet-accessible database system used by the Water Boards and local agencies to track and archive compliance data from authorized or unauthorized discharges of waste to land, or unauthorized releases of hazardous substances from underground storage tanks. GeoTracker consists of a relational database, on-line compliance reporting features, a geographic information system (GIS) interface, and other features utilized to input, manage, or access compliance and regulatory tracking data. (Cal. Code Regs., tit. 23, §§ 3891–3895)

Groundwater – water below the land surface that is at or above atmospheric pressure. (Cal. Code Regs., tit. 27, § 20164)

Leachate – any liquid formed by drainage of liquids from waste or the percolation of liquid through waste, including any dissolved or suspended constituents extracted from waste. (Cal. Code Regs., tit. 27, § 20164)

Liner – a continuous layer of natural or artificial material, a continuous membrane of flexible artificial material, or a continuous composite layer consisting of a membrane of flexible artificial material directly overlying a layer of engineered natural material. The liner is installed beneath or on the sides of a waste management unit and acts as a barrier to both vertical or lateral fluid movement (Cal. Code Regs., tit. 27, § 20164)

Operator – the person(s) responsible for the overall operation of a facility or part of a facility. (40 C.F.R., § 258 (1996))

Owner – the person(s) who owns a facility or part of a facility. (40 C.F.R. § 258 (1996))

Publicly Owned Treatment Works – i.e. wastewater treatment facilities

Threat to Water Quality – a rating used to determine the relative threat of discharges of waste that could cause the degradation, impairment, or long-term loss of a designated beneficial use of the receiving water. (Cal. Code Regs., tit. 23, § 2200)

Waiver – a regulatory order that may be issued in lieu of WDRs for a specific discharge or a specific type of discharge. Requirements for WDRs may be waived by the Regional Water Board if it determines that the waiver is consistent with any applicable water quality control plan and is in the public interest. (Wat. Code, § 13269)

Waste Discharge Requirements (WDRs) – a formal set of requirements prescribed and adopted by the Regional Water Boards as to the nature of any proposed discharge, existing discharge, or material change in an existing discharge, with relation to conditions existing in the disposal area or receiving waters upon, or into which, the discharge is made or proposed. The requirements implement any relevant water quality control plans that have been adopted and take into consideration the beneficial uses. (Wat. Code, § 13263; Cal. Code Regs., tit. 27, § 21720).

Waters of the State – any surface water or groundwater, including saline waters, within the boundaries of the state (Wat. Code, § 13050).

APPENDIX B - LIST OF ACRONYMS AND ABBREVIATIONS

AB 901	Assembly Bill No. 901 (Gordon)
CalEPA	California Environmental Protection Agency
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CDFA	California Department of Food and Agriculture
EIR	Environmental Impact Report
LEA	Local Enforcement Agency
NONA	Notice of Non-Applicability
Regional Water Board	Regional Water Quality Control Board
SB 1383	Senate Bill No. 1383 (Lara)
State Water Board	State Water Resources Control Board
Wat. Code	California Water Code
WDRs	Waste Discharge Requirements

APPENDIX C - GROUNDWATER MONITORING RESULTS SUMMARY

The following groundwater monitoring results include summary tables from one Tier 1 and five Tier 2 facilities showing data for 2017 through 2021. Analytical data was collected from groundwater monitoring wells on site. Each well was sampled for the parameters listed in Table B-3 of the Composting General Order Monitoring and Reporting Program. These parameters may be used to indicate a release from the facility and include pH, total dissolved solids, nitrate (as N), sodium, chloride, and total coliform organisms.

Some of the results were compared to recommended action levels found in Basin Plan Water Quality Objectives (WQOs) or primary and secondary maximum contaminant levels (MCLs) included in the California Code of Regulations, Title 22, for municipal drinking water. A discussion of the compiled data from each site is included below.

Summary of Groundwater Data by Facility

Site 1

For the 2017 through 2021 monitoring periods, total dissolved solids levels in each sample exceeded MCLs at Site 1. The discharger indicated in monitoring reports that high total dissolved solids levels are existing conditions not attributable to facility operations and do not indicate releases from the sites. Recommended action levels were not exceeded for any of the other parameters listed in Table B-3 of the Composting General Order.

Site 2

Site 2 was last included in the 2020 annual report but has since discontinued groundwater monitoring.

Site 3

Throughout the 2017 and 2018 monitoring periods, Site 3 was sampled semi-annually for pH, total dissolved solids, and nitrate but was not sampled for sodium, chloride, or total coliform organisms. In 2018, some samples exceeded primary MCLs for total dissolved solids. In 2019, more monitoring points were added, and samples were analyzed quarterly for each of the parameters listed in Table B-3 of the Composting General Order. In 2019 and 2020, some pH values were below the lower WQO, and some samples exceeded recommended action levels for total dissolved solids, nitrate, and total coliform organisms. In 2021, the pH value was above the upper WQO in some samples of the fourth quarter; some samples exceeded recommended action levels for total dissolved solids and nitrate in every quarter; and recommended action levels were

exceeded for total coliform organisms in every quarter except the first. Future sampling may determine if these concentrations are indicative of a release.

Site 4

Some pH values were below the lower WQO in the fourth testing quarter of 2018, in three testing quarters of 2019, and in two testing quarters of 2020. In 2021, the pH value was below the lower WQO in some samples of the second and third quarters. Total dissolved solids concentrations exceeded recommended action levels in about 70% of samples from 2017 through 2021. The MCL for Nitrate was exceeded in samples from one cross-gradient well between 2017 and 2019. Nitrate exceedances did not occur in samples from other wells or at all in 2020 or 2021. Chloride was detected above the secondary MCL twice; once in the 4th quarter of 2017 and once in the 4th quarter of 2019. From 2017 through 2021, total coliform organisms were detected in high concentrations in all wells except once in a downgradient well in the second quarter of 2021. Total coliform organisms frequently measured hundreds of most probable number per 100 milliliters in all wells except in one cross-gradient well. One downgradient well consistently measured greater than 1,600 most probable number total coliform organisms per 100 milliliters each year.

For each of the exceeded constituents, it appears there are generally higher concentrations in downgradient relative to upgradient wells. Additional sampling and trend evaluation are needed to determine if the concentrations detected in groundwater are indicative of a release from the facility.

Site 5

Site 5 began groundwater monitoring in the third quarter of 2019. Total dissolved solids were consistently detected at levels above the primary MCL in all upgradient and downgradient wells. Nitrate concentrations above the MCL were found in upgradient and downgradient wells and only downgradient wells had concentrations lower than the MCL. The MCL for chloride was exceeded in about 60% of both upgradient and downgradient samples. Throughout the sampling period, coliform organisms were detected in only three samples, twice in an upgradient well in very high concentrations and once in a downgradient well at lower concentrations. Preliminary data do not indicate an impact to groundwater related to the composting operations.

Site 6

Site 6 began groundwater monitoring in the second quarter of 2020. Data for 2021 is not yet available.

Site 7

Site 7 is a Tier 1 composting operation and began groundwater monitoring in the fourth quarter of 2021. There is insufficient data to discuss results at this time.

Groundwater Data Tables

Tables C-1 through C-6 include summarized data from one Tier 1 composting operation and five Tier 2 composting operations that implement groundwater monitoring programs. More data will be included as more composting operations begin implementing groundwater monitoring programs. Three of these six composting operations had groundwater monitoring programs in place prior to enrollment under the Composting General Order and three began implementing groundwater monitoring programs after enrolling. The high and low results for each parameter were included when available. To standardize the variety of ways data were reported, the data shown here have been rounded. Nitrate and total coliform organism data were rounded to the nearest whole number; pH values were rounded to the nearest tenths; and total dissolved solids, sodium, and chloride data were rounded to the nearest tens. Where "0" values are indicated, the measured value was below 0.45, rounded down for this summary. Data are summarized from upgradient, downgradient, and cross-gradient groundwater monitoring wells. When a parameter was not detected above detection limits, the term "ND" is used in the table cell. Where monitoring was not conducted or data were not available, a dash is used in the table cell

Table C-1. pH

pH is measured in pH units.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	7.5 – 7.5	7.4 – 8	6.9 – 8	–	–	–
Quarter 2, 2017	7.4 – 7.8	–	7.2 – 7.7	–	–	–
Quarter 3, 2017	7.5 – 7.8	7.7 – 7.8	7 – 7.4	–	–	–
Quarter 4, 2017	7.4 – 7.7	–	6.6 – 7.3	–	–	–
Quarter 1, 2018	7.2 – 7.5	7.4 – 7.6	6.7 – 7.3	–	–	–
Quarter 2, 2018	7.1 – 7.4	–	6.9 – 7.3	–	–	–
Quarter 3, 2018	7 – 7.5	7.2 – 7.9	6.5 – 6.7	–	–	–
Quarter 4, 2018	7.1 – 7.4	–	6.3 – 6.6	–	–	–
Quarter 1, 2019	7 – 7.4	7.3	6.4 – 7	–	–	–
Quarter 2, 2019	7.5 – 7.9	7.4 – 7.6	7.1 – 7.8	–	–	–
Quarter 3, 2019	7.2 – 7.5	6.3 – 7.9	6 – 6.4	7.2 – 7.4	–	–
Quarter 4, 2019	6.8 – 7.2	6.3 – 7.9	6.4 – 6.8	7.2 – 7.4	–	–
Quarter 1, 2020	7.4 – 7.9	6.2 – 7.8	6 – 6.5	7.3 – 7.6	–	–
Quarter 2, 2020	7.2 – 7.4	6.3 – 7.8	6.9 – 7.7	7.3 – 7.6	6.8 – 6.9	–
Quarter 3, 2020	7.1 – 8	6.2 – 7.5	6.6 – 7.6	7.3 – 7.7	6.9 – 7.1	–
Quarter 4, 2020	7.6 – 7.8	6.3 – 8	6.3 – 7.2	7.5 – 8	6.8	–
Quarter 1, 2021	7.0 – 7.3	6.8 – 7.9	6.6 – 7	7.5 – 7.8	–	–
Quarter 2, 2021	7.2 – 7.4	6.8 – 8	6.3 – 7.3	7.1 – 7.3	–	–
Quarter 3, 2021	7.2 – 7.5	7.1 – 8.4	6.4 – 7	6.8 – 7.2	–	–
Quarter 4, 2021	7.1 – 7.3	7.3 – 8.6	6.7 – 7.7	6.7 – 7.2	–	7.1 – 7.4

Table C-2. Total Dissolved Solids

Total Dissolved Solids are measured in milligrams per liter (mg/L). The MCL is 500 mg/L.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	700 – 1240	440 – 450	380 – 2200	–	–	–
Quarter 2, 2017	680 – 1230	–	260 – 2000	–	–	–
Quarter 3, 2017	680 – 1220	470 – 480	440 – 2400	–	–	–
Quarter 4, 2017	710 – 1240	–	290 – 1600	–	–	–
Quarter 1, 2018	690 – 1130	490 – 510	430 – 1600	–	–	–
Quarter 2, 2018	720 – 1200	–	340 – 1900	–	–	–
Quarter 3, 2018	670 – 1120	440 – 520	420 – 1900	–	–	–
Quarter 4, 2018	710 – 1240	–	380 – 1700	–	–	–
Quarter 1, 2019	710 – 1100	390 – 460	310 – 2100	–	–	–
Quarter 2, 2019	720 – 1100	430 – 540	270 – 1900	–	–	–
Quarter 3, 2019	730 – 1050	390 – 1300	450 – 2000	940 – 1600	–	–
Quarter 4, 2019	560 – 980	420 – 1400	480 – 2500	1000 – 1600	–	–
Quarter 1, 2020	750 – 1100	430 – 1200	300 – 1700	900 – 1900	–	–
Quarter 2, 2020	765 – 1300	380 – 1200	400 – 2000	730 – 1800	1400 – 2300	–
Quarter 3, 2020	700 – 1200	460 – 1200	210 – 1900	780 – 1800	1900	–
Quarter 4, 2020	680 – 1170	390 – 1300	430 – 1400	830 – 2000	1700 – 2000	–
Quarter 1, 2021	690 – 1180	370 – 1300	670 – 2000	620 – 1500	–	–
Quarter 2, 2021	740 – 1170	400 – 1100	460 – 1500	780 – 1800	–	–
Quarter 3, 2021	730 – 1230	430 – 1300	200 – 1500	860 – 1800	–	–
Quarter 4, 2021	690 – 1150	420 – 1500	310 – 1600	900 – 2000	–	820 – 1300

Table C-3. Nitrate (as N)

Nitrate (as N) is measured in milligrams per liter (mg/L). The MCL is 10 mg/L. ND means not detected.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	0 – 1	2	0 – 20	–	–	–
Quarter 2, 2017	1 – 2	–	ND – 21	–	–	–
Quarter 3, 2017	0 – 1	1	ND – 12	–	–	–
Quarter 4, 2017	0 – 1	–	0 – 12	–	–	–
Quarter 1, 2018	0 – 1	1	ND – 6	–	–	–
Quarter 2, 2018	0 – 1	–	ND – 15	–	–	–
Quarter 3, 2018	0 – 1	1	ND – 14	–	–	–
Quarter 4, 2018	0 – 2	–	ND – 9	–	–	–
Quarter 1, 2019	0 – 2	2 – 7	ND – 7	–	–	–
Quarter 2, 2019	0 – 2	1 – 6	ND – 21	–	–	–
Quarter 3, 2019	0 – 1	0 – 49	ND – 13	4 – 27	–	–
Quarter 4, 2019	0 – 1	0 – 45	ND – 7	5 – 30	–	–
Quarter 1, 2020	0 – 1	ND – 54	ND – 9	5 – 35	–	–
Quarter 2, 2020	0 – 1	ND – 56	ND – 8	6 – 36	8 – 52	–
Quarter 3, 2020	ND – 1	0 – 53	ND – 9	6 – 37	13 – 21	–
Quarter 4, 2020	0 – 1	0 – 71	ND – 0	8 – 47	14 – 18	–
Quarter 1, 2021	0 – 2	0 – 77	ND – 3	8 – 52	–	–
Quarter 2, 2021	0 – 1	0 – 58	ND – 2	9 – 41	–	–
Quarter 3, 2021	0 – 1	1 – 67	ND – 1	10 – 36	–	–
Quarter 4, 2021	0 – 1	0 – 110	ND – 6	10 – 49	–	7 – 25

Table C-4. Sodium

Sodium is measured in milligrams per liter (mg/L). The MCL is not established.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	220 – 550	–	0 – 70	–	–	–
Quarter 2, 2017	220 – 410	–	10 – 70	–	–	–
Quarter 3, 2017	220 – 420	–	10 – 70	–	–	–
Quarter 4, 2017	230 – 420	–	10 – 150	–	–	–
Quarter 1, 2018	240 – 420	–	10 – 80	–	–	–
Quarter 2, 2018	230 – 380	–	10 – 70	–	–	–
Quarter 3, 2018	210 – 380	–	10 – 50	–	–	–
Quarter 4, 2018	220 – 390	–	20 – 60	–	–	–
Quarter 1, 2019	210 – 380	70 – 90	10 – 60	–	–	–
Quarter 2, 2019	210 – 370	100 – 140	10 – 60	–	–	–
Quarter 3, 2019	210 – 350	30 – 380	10 – 50	200 – 390	–	–
Quarter 4, 2019	240 – 410	40 – 430	10 – 270	200 – 390	–	–
Quarter 1, 2020	200 – 330	40 – 350	10 – 110	170 – 410	–	–
Quarter 2, 2020	220 – 370	40 – 280	10 – 80	140 – 420	220 – 290	–
Quarter 3, 2020	200 – 340	10 – 270	10 – 80	180 – 450	230 – 250	–
Quarter 4, 2020	200 – 440	50 – 260	20 – 80	140 – 430	240 – 250	–
Quarter 1, 2021	190 – 310	50 – 260	20 – 90	100 – 420	–	–
Quarter 2, 2021	190 – 320	60 – 280	10 – 100	140 – 400	–	–
Quarter 3, 2021	220 – 380	50 – 240	10 – 80	150 – 370	–	–
Quarter 4, 2021	210 – 360	50 – 270	10 – 90	160 – 420	–	60 – 80

Table C-5. Chloride

Chloride is measured in milligrams per liter (mg/L). The MCL is 250 mg/L.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	130 – 170	–	10 – 140	–	–	–
Quarter 2, 2017	130 – 190	–	20 – 170	–	–	–
Quarter 3, 2017	130 – 170	–	20 – 250	–	–	–
Quarter 4, 2017	130 – 170	–	10 – 600	–	–	–
Quarter 1, 2018	130 – 170	–	20 – 190	–	–	–
Quarter 2, 2018	130 – 160	–	20 – 150	–	–	–
Quarter 3, 2018	140 – 170	–	20 – 160	–	–	–
Quarter 4, 2018	140 – 170	–	20 – 180	–	–	–
Quarter 1, 2019	130 – 160	20 – 30	10 – 200	–	–	–
Quarter 2, 2019	130 – 160	20 – 30	20 – 170	–	–	–
Quarter 3, 2019	130 – 160	10 – 200	20 – 250	190 – 510	–	–
Quarter 4, 2019	140 – 160	10 – 220	30 – 1100	180 – 510	–	–
Quarter 1, 2020	130 – 160	10 – 140	20 – 230	180 – 500	–	–
Quarter 2, 2020	130 – 160	10 – 110	40 – 210	150 – 490	370 – 490	–
Quarter 3, 2020	130 – 160	10 – 100	10 – 260	180 – 500	350 – 420	–
Quarter 4, 2020	130 – 160	10 – 110	30 – 280	170 – 520	320 – 410	–
Quarter 1, 2021	130 – 160	10 – 120	40 – 330	130 – 490	–	–
Quarter 2, 2021	130 – 160	10 – 120	30 – 280	170 – 480	–	–
Quarter 3, 2021	140 – 160	10 – 130	10 – 220	180 – 470	–	–
Quarter 4, 2021	130 – 160	10 – 130	30 – 300	200 – 530	–	150 – 330

Table C-6. Total Coliform Organisms

Total coliform organisms are measured in most probable number per 100 milliliters (MPN/100 mL). The MCL level is 1.1 MPN/100 mL. ND means not detected.

Quarter, Year	Site 1	Site 3	Site 4	Site 5	Site 6	Site 7
Quarter 1, 2017	ND	–	13 – 920	–	–	–
Quarter 2, 2017	ND	–	2 – 240	–	–	–
Quarter 3, 2017	ND	–	2 – 49	–	–	–
Quarter 4, 2017	ND	–	2 – >1600	–	–	–
Quarter 1, 2018	ND	–	2 – 920	–	–	–
Quarter 2, 2018	ND	–	2 – 33	–	–	–
Quarter 3, 2018	ND	–	2 – 540	–	–	–
Quarter 4, 2018	ND	–	8 – >1600	–	–	–
Quarter 1, 2019	ND	ND – 130	13 – 350	–	–	–
Quarter 2, 2019	ND	ND – 23	ND – 33	–	–	–
Quarter 3, 2019	ND	ND – 240	ND – 130	ND – >1600	–	–
Quarter 4, 2019	ND	ND – 13	23 – >1600	ND	–	–
Quarter 1, 2020	ND	ND – >1600	ND – 49	ND – 23	–	–
Quarter 2, 2020	ND – 1	ND – 920	ND – 540	ND	ND	–
Quarter 3, 2020	ND	ND	ND – 27	ND – >1600	ND – 8	–
Quarter 4, 2020	ND	ND – 70	23 – >1600	ND	5 – 240	–
Quarter 1, 2021	ND	ND	5 – 1600	ND	–	–
Quarter 2, 2021	ND	ND – 5	ND – 79	ND	–	–
Quarter 3, 2021	ND	ND – 920	2 – 540	ND – 68	–	–
Quarter 4, 2021	ND	ND – 5	23 – >1600	ND	–	ND