

August 5, 2026

Letter Report

Adam Link
California Association of Sanitation Agencies
925 L Street, Suite 200
Sacramento, CA 95814

204593

Subject: Biosolids Capacity Challenges from a Land Application Ban in California

Dear Mr. Link,

This report documents the current state of biosolids management in California and estimates the capacity and environmental implications in the event of a statewide ban or restrictions on land application. Based on an evaluation of data from the United States Environmental Protection Agency's (US EPA) Enforcement and Compliance History Online (ECHO) database, most of the state's wastewater utilities primarily manage biosolids through direct land application, composting, and landfill disposal with a few utilities utilizing drying, thermo-chemical hydrolysis (Lystek), pyrolysis, deep well injection, incineration, storage, and surface disposal.

Notably, approximately 15% of biosolids generated in California are transported to Arizona for beneficial use through direct land application or compost for agricultural production. Based on legislation that has been proposed in Arizona in recent years, this interstate biosolids management could be endangered in the immediate future through bans on land application of biosolids and biosolids-based products in that state. These legislative efforts have not yet been successful; however, our analysis conservatively assumes that biosolids currently managed in Arizona will ultimately need to be managed within California. Therefore, those biosolids would also be impacted by any future California-based restrictions or bans.

It is critical for legislators and policymakers to note that under California's Senate Bill 1383 (SB 1383, Short-Lived Climate Pollutants: Organic Waste Reduction) regulations, local jurisdictions are prohibited from enforcing ordinances or policies that ban or unreasonably restrict the lawful land application of biosolids. This is intended to ensure municipalities have the infrastructure needed to divert organic waste from landfills (to achieve SB 1383 mandates) and support beneficial soil amendments. As a result, implementation of a statewide ban or significant restriction on land application would likely require legislative or regulatory changes to SB 1383.

Our analysis indicates that banning the land application of biosolids and biosolids-based products in California would impact approximately **2,527,000 wet tons** of material annually. This shift would present immediate and significant challenges:

- **Insufficient Alternative In-State Capacity:** It is estimated that the available additional landfill capacity in California for managing this displaced tonnage falls short by at

least 1,456,000 wet tons and up to 2,178,000 wet tons, meaning over half of the previously land applied biosolids would have no clear outlet in the state (details of methodology and analysis begin on page 4). This capacity shortfall represents a significant and critical risk to California's wastewater treatment plants (WWTPs)—and ultimately ratepayers and public health.

- **Conflict with Other State Policies:** Several California state initiatives, including statewide organics diversions and methane reduction mandates under SB 1383 are designed to reduce the amount of organic material, including biosolids and food waste, sent to landfills. When organic matter breaks down in a landfill it generates methane, a potent greenhouse gas (GHG), which is not entirely captured by even modern landfill gas collection systems. Because biosolids are rich in organic matter and moisture, they rapidly break down in the oxygen-starved environment of a landfill. This significantly accelerates the production of landfill gas, which is composed of roughly 50% methane and 50% carbon dioxide. Diverting biosolids from landfills reduces GHG emissions and frees up landfill volume for municipal solid waste and other streams as landfill capacity dwindles and new facilities face difficulty in permitting and siting. In addition to conflicting with SB 1383, disposing of biosolids in landfills would also run counter to several other existing California policies intended to promote beneficial reuse of organic materials, reduce greenhouse gas emissions, divert organic waste from landfills, and improve soil health. These include CalRecycle's Zero Waste goals, the California Department of Food and Agriculture's (CDFA) Healthy Soils Initiative and Climate Resilience Strategy for California Agriculture, and the California Natural Resources Agency's Natural and Working Lands Climate Smart Strategy. Collectively, these initiatives encourage the beneficial use of organic materials and support carbon sequestration, soil health, and methane-emission reductions. Increased landfill disposal of biosolids would be inconsistent with these broader state policy objectives.
- **Constraints on Incineration, Pyrolysis, and Deep-well Injection:** While a few utilities in California process all or a portion of their plants' biosolids through incineration, pyrolysis, or deep well injection, these options currently represent only a small fraction of statewide capacity relative to the volume of biosolids generated in the state. California currently has only one operational biosolids incineration facility, which is 45 years old. The state's stringent air-quality standards, siting constraints, and public opposition makes the approval and construction of additional biosolids incineration capacity highly unlikely in the foreseeable future. Similarly, pyrolysis is deployed at only two facilities with one intermittently operational and the other not yet started. The systems at these facilities are currently operating at a scale far below what would be required to absorb volumes potentially displaced by a statewide land application restriction, and to date, have not proven reliable continuous operation. Even if proven at scale, these complex thermal processes would require permitting and significant capital and operational investments, often requiring capital expenditures on the order of hundreds of millions of dollars for medium- to large-sized facilities to expand throughout the state. Given current deployment levels, inconsistent operational performance, and scalability constraints, these pathways are not expected to provide near-term, statewide replacement capacity to offset a land-application ban should it occur. Similarly, other niche management practices, including deep well injection, currently manage only a small fraction of California biosolids. Expansion of deep well injection capacity is uncertain due to the need for

suitable geologic formations, seismic concerns, extensive permitting requirements, and potential geotechnical and environmental considerations, which can vary significantly by location. Deep well injection systems also generate substantial public concern and opposition, which has stopped such systems in other parts of the country. Consequently, deep-well injection is also not expected to provide significant statewide replacement capacity.

- **Negative Environmental Impact:** Land application of biosolids in the state sequesters carbon and avoids the emissions of an estimated 229,223 metric tons carbon dioxide-equivalent (MTCO₂e) annually, while landfilling this material would generate 169,919 MTCO₂e annually, a net increase of 399,142 MTCO₂e emissions. This increase results from the high emission intensity of landfilling combined with the loss of climate benefits currently achieved with land application and would directly contradict SB 1383 regulations that mandate reductions in GHG emissions through organics diversion from landfills.
- **Further Affordability Challenges for Wastewater Ratepayers:** Capacity for biosolids management options is already constrained; further restrictions will only escalate the cost burden to wastewater utilities and their ratepayers. Historically, the cost of biosolids management via landfill disposal (including transportation and tipping fees) averaged approximately \$50 per wet ton (WT) between 2009 and 2016, based on available regional survey data. However, between 2018 and 2023, those costs dramatically increased to an average of approximately \$130/WT based on available regional survey data. This increase in average costs is likely related to reduced landfill acceptance of biosolids as alternate daily cover (due to SB 1383 defining biosolids as organic waste and alternative daily cover as disposal), reduction in available landfill disposal capacity for biosolids, and an associated market-based increase in costs imposed for landfill disposal. The dramatically higher costs represent an approximate 160 percent increase relative to pre-2018. According to a 2025 report by Bluefield Research, current landfill disposal costs in California are anticipated to increase by 76 percent over the next 10 years under current trends alone. Redirecting biosolids that are currently land applied into landfills is apt to push prices up well beyond this level, comprising a significant portion of many utilities' annual expenditures, costs which are ultimately paid by ratepayers. Assuming a continued upward trend consistent with recent market conditions and limited landfill capacity, costs for biosolids management via landfill disposal could reach approximately \$150/WT within the next few years even without further management restrictions. Should additional restrictions on land application be imposed, pressure on landfilling will increase and costs could rise even more, potentially doubling from \$130/WT to \$260/WT as was experienced before with the effects of SB 1383. Applying these potential low (\$150/WT) and high (\$260/WT) landfill unit cost ranges to the 2,527,000 wet tons of biosolids currently being land applied annually, and using a baseline beneficial use cost of approximately \$95/WT (based on average land application and composting costs from 2018-2023 regional survey data), wastewater utilities and ultimately ratepayers would be facing a price increase of \$140M to \$420M per year.

- **Interstate Impacts:** Arizona accepts approximately 15 percent¹ of all biosolids generated in California for land application . If California enacts a land application ban, it increases the likelihood that neighboring states do the same, particularly Arizona. Arizona has already seen county-level short-term biosolids land application moratoria and is actively considering restrictions/legislation related to PFAS and land application of biosolids. Notably, House Bill (HB) 2669 (2023) would have established additional constraints on land application, including more stringent setback requirements from residential areas and some crops, and clarified that biosolids combined with solid waste are regulated under solid waste regulations. Furthermore, ongoing legislative efforts, including HB 2640 (2026, proposed) notes that Arizona could limit land application of biosolids or biosolids-based products by December 2027. Should this or other similar bills pass, either now or in the future, it would force even more California biosolids back into the state's already limited landfill capacity.

If a biosolids land application ban were enacted in California or Arizona, or if Arizona were to restrict or prohibit acceptance of California-generated biosolids, the disruption would be substantial. This will, likely lead to operational issues at California WWTPs and significant cost increases. This report details the underlying dynamics impacting biosolids management in California. The approach undertaken in this analysis, while specific to California, is likely to yield comparable results in states facing similar biosolids management issues.

Very truly yours,

Carollo Engineers/ Brown and Caldwell

Rashi Gupta, Task Lead
Carollo Engineers
Costa Mesa, CA

Natalie Sierra, Project Manager
Brown and Caldwell
Boston, MA

cc: Pooja Oberoi, Carollo Engineers
Bill Brower, Brown and Caldwell

¹ Percentage range for land application in Arizona was estimated based on 2024 US EPA ECHO biosolids annual reporting data and 2023 US EPA data (unpublished Excel dataset previously provided by US EPA Region 9 upon request).

Investigation Methodology

Biosolids data used in this study were primarily sourced from the United States Environmental Protection Agency's (US EPA) Enforcement and Compliance History Online (ECHO) database. Data for the 2024 calendar year were analyzed, representing the most recent year with complete and consistent reporting across data sources. The ECHO database provided information on biosolids quantities and management pathways, including land application, deep well injection, surface disposal, storage, hauling, and receipt at landfills, and composting, drying, incineration, thermo-chemical hydrolysis (Lystek), and pyrolysis facilities.

Landfill-related data including permitted capacity, remaining useful life, and total disposal tonnages for 2024 were obtained from CalRecycle's landfill tonnage report and the Solid Waste Information System (SWIS) database. The list of permitted landfills authorized to accept "sludge/biosolids" was derived from the California Water Boards' GeoTracker landfill permitted waste map. Quantities of biosolids beneficially reused at landfills as alternative daily cover (ADC) reported in the ECHO database were cross validated using CalRecycle's Recycling and Disposal Reporting System (RDRS), Public Report #4 (Beneficial Reuse for Landfills).

In addition, historical land application site information was reviewed to assess whether biosolids generated in California were applied within California or exported to Arizona. These assessments were based on data from the Bay Area Clean Water Agencies (BACWA) 2024 Biosolids Trends Survey Report (covering 2021–2022), the Clean Water SoCal Biosolids Biennial Trend Survey (2021–2023), and unpublished 2023 EPA datasets previously provided directly by the US EPA Region 9 biosolids manager.

In this document, "biosolids" is used to refer generally to the final solids residual generated at municipal wastewater treatment plants from treatment processes and products derived from this material, and in compliance with applicable requirements of US EPA 40 Code of Federal Regulations (CFR) Part 503.

The following assumptions were made when recording and analyzing data:

- When the percent solids of biosolids was not reported, it was assumed to be 20 percent. Specifically for the San Jose/Santa Clara RWF, a higher solids percent (95 percent) was applied to biosolids reported as landfilled, based on the known use of air drying beds in 2024.
- While some utilities may be planning to install equipment to raise this percent solids (e.g. improved dewatering, thermal drying), this is a typical industry assumption for performance. When the quantity of biosolids received was recorded in volume units, a conversion factor of 0.8 wet-tons/cubic-yard was used.
- All Class A/EQ biosolids produced through composting, drying, and thermo-chemical hydrolysis (Lystek) facilities, were assumed to be land applied in California or Arizona unless otherwise noted. The final beneficial use location of Class A/EQ materials produced from California-generated biosolids is not consistently tracked or reported in available data sources. Hence, all such material was assumed to be beneficially used through land application within California or Arizona. These land applied volumes have been grouped into one category as "California-generated Biosolids - Processed by California and Arizona Facilities (Composting, Drying, Lystek)".

- Similar to the land applied volumes from biosolids processing facilities as mentioned above, direct land application volumes have also been combined into one category as “California-generated Biosolids - Direct Land Application in California and Arizona”.
- A small fraction of California-generated biosolids transported to Nevada for land application and biosolids processing was documented separately but represents a negligible portion of overall statewide volumes (<1 percent).
- The landfill capacity-gap analysis assumes that Arizona land-application capacity becomes constrained on a similar timeframe as California (or earlier). This assumption reflects the fact that potential future restrictions implemented in Arizona could result in additional California-generated biosolids being redirected to in-state management. This means the full volume of California-generated biosolids must be managed with in-state disposal outlets. If management in Arizona remains viable, the magnitude of the in-state landfill capacity shortfall would be reduced, but interstate reliance would remain a serious risk.

Additionally, estimates of GHG emissions associated with an end-use were calculated for two scenarios: 1) actual 2024 biosolids management via land application, and 2) if all biosolids that were land applied were instead landfilled. (Emissions from incineration, thermal drying, and hauling were assumed to remain constant and so were not included in the analysis.)

Calculations were performed using the Biosolids Emissions Assessment Model (BEAM) version 3.1. Specifically, the “Alkaline Stabilization”, “Composting”, “Thermal Drying”, “Landfill Disposal CA Regulatory”, and “Land Application” calculation modules were used. Note that land application of thermo-chemically hydrolyzed (Lystek) biosolids were assumed to be similar to alkaline stabilization. The assumptions made for BEAM analysis are listed for each module in the Appendix in Table A-1.

California-Generated Biosolids Accepted at In-State and Out-of-State Facilities

The following subsections summarize California-generated biosolids data reported for 2024 by biosolids processing facilities, direct land application sites, and landfills in in-state and out-of-state facilities.

Biosolids Processing Facilities

Biosolids processing facilities perform additional (post-dewatering) treatment—composting, drying, thermo- chemical hydrolysis (Lystek), and pyrolysis— to produce biosolids products for beneficial use. In 2024, these facilities processed over 1,415,000 wet tons of biosolids generated in California. A few of these facilities, including the few drying and pyrolysis systems, only process biosolids from the host WWTP or local area, while the majority of composting operations and the thermo- chemical hydrolysis (Lystek) facility are large merchant facilities— i.e., those that accept biosolids from across the state.

Based on communications with two major merchant facility operators for composting, drying, and thermo-chemical hydrolysis facilities, Synagro and Lystek, it was confirmed that nearly all biosolids end-products produced at their California-based facilities are land applied within California, and Arizona-based facilities are land applied within Arizona. Therefore, it is assumed for the purposes of this analysis that biosolids processed in California or Arizona are land-applied within California or Arizona, respectively (and not in any other states). In evaluating the volume of material directly affected by a potential land-application prohibition, only biosolids currently land-applied within California and Arizona were included.

When considering the amount of material that would be directly impacted by a land application ban, only tonnage currently land applied in California and Arizona was considered (i.e., 1,443,000 wet

tons as listed in Table 1). Because 2024 US EPA ECHO data does not consistently identify whether California-generated biosolids applied to land were applied in California versus Arizona, land-applied tonnages are reported in this section as a combined category (“California-generated Biosolids - Processed by California and Arizona Facilities (Composting, Drying, Lystek”). Any land application policy change in Arizona that reduces land-application outlets would increase the likelihood that a larger portion of California-generated biosolids would need to be managed in California.

Table 1. California-generated Biosolids Processed by Composting, Drying, and Thermo-Chemical Hydrolysis Facilities Operating in 2024

Facility Name	Location	Total Biosolids Received		
		dry metric tons	dry tons	wet tons
Merchant Facilities				
Composters				
Bently Ranch Composting	Nevada (State)	1,269	1,399	6,994
Engel & Gray Compost Facility	Santa Maria	6,888	7,593	37,963
One Stop Landscape Supply Composting	Redlands	806	889	4,445
Recology Blossom Valley Organics	Lamont	16,053	17,695	88,477
Synagro Vicksburgh (Formerly Arizona Soils Composting)	Arizona	11,861	13,074	65,371
Synagro Tolleson (Formerly Arizona Soils Composting)	Arizona	2,383	2,627	13,135
Synagro (Formerly Liberty Composting)	Lost Hills	48,144	53,070	265,351
Synagro Central Valley Compost Facility	Dos Palos	11,668	12,862	64,308
Synagro Nursery Products Hawes Composting Facility	Helendale	65,647	72,363	361,815
Synagro South Kern Compost Manufacturing	Taft	19,046	20,994	104,972
Synagro Unknown Location	Assumed California or Arizona	2,878	3,173	15,863
Dryers				
Synagro Organic Fertilizer Co of Sacramento	Elk Grove	6,566	7,238	36,189
Thermo-Chemical Hydrolysis				
Lystek Fairfield Organic Material Recovery Center	Fairfield	20,006	22,053	110,266
Non-Merchant Facilities				
Composters				
City Of Fortuna Wastewater Treatment Facility – Biosolids Composting Facility	Fortuna	113	124	621
Inland Empire Regional Composting Facility	Chino Hills	32,559	35,890	179,451
Los Angeles Griffith Park Compost	Los Angeles	361	398	1,992
Rancho Las Virgenes Composting Facility	Calabasas	796	877	4,387
Tulare Lake Compost	Kettleman City	10,334	11,391	56,956
Dryers				
Encina Water Pollution Control Facility	Carlsbad	5,782	6,373	31,866

Table 1. California-generated Biosolids Processed by Composting, Drying, and Thermo-Chemical Hydrolysis Facilities Operating in 2024

Facility Name	Location	Total Biosolids Received		
		dry metric tons	dry tons	wet tons
Irvine Ranch Water District	Irvine	0.28	0.31	1.5
Pyrolysis				
Silicon Valley Clean Water (Bioforcetech)	Redwood City	38	42	212
Total Processed by Merchant Facilities		213,216	235,030	1,175,148
Total Processed by Non-Merchant Facilities		49,983	55,097	275,485
Total California-generated Biosolids - Processed by California and Arizona Facilities		261,930	288,728	1,443,639
Total California-generated Biosolids - Processed by Nevada (State) Facility		1,269	1,399	6,994
Total California-generated Biosolids - Land Applied in California and Arizona ^{(1),(2)}		261,891	288,685	1,443,427

Note:

(1) Pyrolysis tonnage (Silicon Valley Clean Water) is included in “Total In-State Biosolids Processed in California and Arizona Facilities” but excluded from “Total In-State Biosolids Land Applied in California and Arizona” because end-use disposition could not be confirmed as land application.

(2) End-use assumption: Biosolids processed in California/Arizona facilities are land-applied within California/Arizona.

Direct Land Application

Table 2 lists the California WWTPs biosolids tonnages that were directly land applied in 2024. This table is for Class B or Class A or Class A EQ which were air dried, dewatered or thickened biosolids, and hauled directly from WWTP to a land application site (as opposed to the tonnages shown in Table 1 for facilities that perform additional processing before beneficial use). In 2024, over 1,072,000 wet tons of biosolids were directly applied to land in California or Arizona.

Consistent with the biosolids processing facilities subsection above, direct land-application totals are reported as a combined “California-generated Biosolids - Direct Land Application in California and Arizona” category because of lack of consistency in available 2024 data delineating the exact split of application within California versus Arizona.

Table 2. California WWTPs Direct Land Application Tonnages in 2024

Facility Name	Location	Total Biosolids Applied		
		dry metric tons	dry tons	wet tons
Atwater, City Of	Atwater	400	441	2,206
Bakersfield WWTP 2	Bakersfield	5,900	6,504	32,518
Bakersfield WWTP 3	Bakersfield	3,383	3,729	18,646
Blythe RWRf	Blythe	300	331	1,653
Burlingame WWTP	Burlingame	589	650	3,249
Central Marin Sanitation Agency WWTP	San Rafael	4	4	22
Chico WQCP	Chico	1,036	1,141	5,707
Coachella Avenue 54 WWTP	Coachella	2,000	2,205	11,023
Colton WRF	Colton	210	232	1,159
Delano WWTP	Delano	119	131	655
Delta Diablo WWTP	Antioch	2,390	2,634	13,172
East Bay Mud WWTP	Oakland	10,510	11,585	57,927
El Dorado Deer Creek WWTP	Placerville	589	649	3,244
El Dorado Hills WWTP	Placerville	577	636	3,178
EMWD - Moreno Valley RWRf	Moreno Valley	2,080	2,293	11,464
EMWD - Perris Valley RWRf	Perris	4,108	4,528	22,639
EMWD - San Jacinto RWRf	San Jacinto	1,624	1,790	8,952
EMWD - Temecula Valley RWRf	Temecula	2,808	3,095	15,475
Escondido Hale Ave RWRf	Escondido	4,128	4,550	22,752
Eureka Elk River WWTP	Eureka	191	210	1,051
Fallbrook Public Utility District WRP	Fallbrook	240	265	1,325
Galt WWTP	Galt	152	168	838
Grass Valley WWTP	Grass Valley	333	367	1,835
Ironhouse Sanitary District WWTP	Oakley	565	623	3,114
LACSD - A.K. Warren Water Resource Facility	Whittier	3,043	3,354	16,772
Las Gallinas Valley STP	San Rafael	104	115	574
Las Virgenes Tapia WRF/Compost	Calabasas	828	913	4,564
Lodi White Slough WPCF	Lodi	1,149	1,267	6,333
Los Angeles Hyperion WWTP	Playa Del Rey	36,371	40,092	200,459
Manteca WQCF	Manteca	378	417	2,086
Merced WWTP	Merced	1,096	1,208	6,038
Millbrae WPCP	Millbrae	323	356	1,778
Modesto WQCF	Modesto	8,261	9,106	45,531
Napa SOSCOL WRF	Napa	978	1,078	5,388
North of River S. D. I WWTP	Bakersfield	932	1,027	5,137

Table 2. California WWTPs Direct Land Application Tonnages in 2024

Facility Name	Location	Total Biosolids Applied		
		dry metric tons	dry tons	wet tons
North San Mateo County WWTP	Daly City	815	898	4,490
Oceanside La Salina WWTP	Oceanside	59	65	325
Oceanside San Luis Rey WWTP	Oceanside	1,137	1,253	6,267
Orange County SD #1	Fountain Valley	6,445	7,104	35,522
Orange County SD #2	Fountain Valley	13,349	14,715	73,574
Oro Loma WWTP	San Lorenzo	3,080	3,396	16,978
Pacifica Calera Creek WRF	Pacifica	328	361	1,806
Patterson WQCF	Patterson	351	387	1,934
Petaluma Ellis Creek WRF	Petaluma	792	873	4,365
Placerville Hangtown Creek WRF	Placerville	186	205	1,025
Porterville WWTP	Porterville	1,398	1,541	7,705
Roseville Dry Creek WWTP	Roseville	1,669	1,840	9,198
Roseville Pleasant Grove WWTP	Roseville	2,054	2,264	11,321
Salida Sd WWTP	Salida	138	152	759
San Diego MBC	San Diego	32,145	35,434	177,170
San Elijo WRF	Cardiff by the Sea	753	830	4,150
San Francisco Oceanside WWTP	San Francisco	352	388	1,940
San Francisco Southeast WWTP	San Francisco	3,527	3,888	19,439
San Leandro WPCP	San Leandro	213	235	1,173
San Mateo WWTP	San Mateo	1,660	1,830	9,150
Santa Rosa Laguna WWTP	Santa Rosa	2,368	2,610	13,051
Silicon Valley Clean Water	Redwood City	1,449	1,597	7,987
Stockton RWCF	Stockton	4,286	4,724	23,621
Sunnyvale WPCP	Sunnyvale	1,882	2,075	10,373
Tahoe-Truckee WWTP	Truckee	830	915	4,575
Tracy WWTP	Tracy	2,790	3,075	15,377
Turlock WQCF	Turlock	2,996	3,303	16,513
Union Sanitary District WWTP	Union City	2,969	3,273	16,366
Vallejo SFCD	Vallejo	3,109	3,427	17,135
Victor Valley WRA WWTP	Hesperia	3,983	4,391	21,953
Willits WQCP	Willits	118	130	650
Windsor WWTP	Windsor	411	453	2,264
Total Direct Land Application in California and Arizona ⁽¹⁾		194,509	214,409	1,072,044
Total Direct Land Application in Nevada ⁽²⁾		830	915	4,575

Note:

Table 2. California WWTPs Direct Land Application Tonnages in 2024				
Facility Name	Location	Total Biosolids Applied		
		dry metric tons	dry tons	wet tons

(1) The combined land application tonnages for California and Arizona were informed based on reviewing datasets from 2024 EPA ECHO database, 2023 EPA datasets, regional trend surveys (BACWA and Clean- Water SoCal), and other applicable state permits for land application.

(2) Direct land application tonnage in Nevada was reported by Tahoe-Truckee WWTP.

Landfills

Table 3 shows all the landfills in California that received biosolids generated at California WWTPs based on US EPA and CalRecycle records in 2024. This table summarizes permitted annual tonnage limit for all materials, the tonnage of all material received, the tonnage of California WWTP generated biosolids received as landfill-disposal excluding ADC, the tonnage of California WWTP generated biosolids received as landfill-ADC, the percent of the total material that was biosolids from landfill-disposed (excluding ADC), and the expected landfill closure dates. In 2024, landfills in California received more than 593,000 wet tons from WWTPs in California, out of which 303,000 wet tons were received for landfill-disposal excluding ADC, and 290,000 wet tons were received for landfill-ADC.

Biosolids used as ADC are reported separately because they are blended with other cover materials and are not counted as disposed biosolids in the “disposal excluding ADC” column. For the landfill capacity analysis presented in later sections, ADC tonnages were excluded because they are not used in the disposal area in the same way as direct disposed materials. It is assumed that the landfills will continue to use ADC material and will not take any additional material for ADC in the future. This approach avoids underestimating available landfill capacity in the future.

Table 3. Biosolids Received at California Landfills (2024)

Facility Name (1)	City	Permitted Limit/ Estimated Future Disposal (wet tons/year)	2024 Total Material Received (wet tons)	2024 Total Biosolids Landfill- disposed excl. ADC (wet tons)	2024 Total Biosolids Landfill-ADC only (wet tons) (2)	Biosolids (disposed excl. ADC) as % of total materials (2), (3)	Expected Closure Date
Altamont Landfill/Resource Recovery	Livermore	4,069,750	970,689		27,558	0%	2026
Antelope Valley Recycling & Disposal Facility	Palmdale	2,025,020	711,722		4,012	0%	2044
County Of Orange-Prima Deshacha Landfill	San Juan Capistrano	1,460,000	763,910	7,786		1%	2102
Fairmead SWDS	Madera	401,500	213,577	587		0%	2028
H.M. Holloway Landfill/Lost Hills Env Waste Facility	Lost Hills	730,000	383,164	154,395	79,400	40%	2030
Imperial Landfill Inc.	Imperial	620,500	133,809		1,378	0%	2051
John Smith Road Landfill	Hollister	365,000	81,138		15	0%	2025
L And D Landfill Limited Partnership	Sacramento	1,505,630	89,683		1,830	0%	2032
Lancaster Landfill & Recycling Center	Lancaster	1,861,500	145,786		4,134	0%	2044
Monterey Peninsula Landfill	Marina	1,277,500	626,410	38,377		6%	2107
Newby Island Sanitary Landfill	Milpitas	1,460,000	613,487		96,912	0%	2041
Ostrom Road Landfill/Recology	Marysville	109,500	321,605	4,279		1%	2066
Ox Mountain (Corinda Los Trancos) Landfill	Half Moon Bay	1,313,270	506,793		1,379	0%	2034
Paso Robles Landfill	Paso Robles	164,250	45,035		4,693	0%	2051
Potrero Hills Landfill	Fairfield	1,569,500	914,280		22,408	0%	2048
Recology Hay Road (Formerly NorCal Waste-Hay Road Landfill; Formerly B&J Landfill)	VACAVILLE	876,000	725,583	6,004		1%	2077

Table 3. Biosolids Received at California Landfills (2024)

Facility Name (1)	City	Permitted Limit/ Estimated Future Disposal (wet tons/year)	2024 Total Material Received (wet tons)	2024 Total Biosolids Landfill- disposed excl. ADC (wet tons)	2024 Total Biosolids Landfill-ADC only (wet tons) (2)	Biosolids (disposed excl. ADC) as % of total materials (2), (3)	Expected Closure Date
Redwood Landfill	Novato	839,500	182,975		6,345	0%	2036
Salton City Landfill	Salton City	2,190,000	222,151	53,594		24%	2038
Santa Maria Regional Waste Management Facility	Santa Maria	3,219,300	147,825		1,015	0%	2034
Simi Valley Landfill	Simi Valley	3,376,250	1,461,537	12,445		1%	2056
Tehama County- Red Bluff Landfill	Red Bluff	255,500	59,363		1,304	0%	2050
Vasco Rd Sanitary Landfill	Livermore	919,070	156,049	25,248	6,814	6%	2051
Visalia SWDS/Visalia Disposal Site	Visalia	730,000	344,876		26,523	0%	2045
Yolo County Central Landfill	Woodland	1,095,000	180,757	84	4,007	0%	2124
Total		32,433,540	10,002,204	302,799	289,727		

Note:

- (1) For cases where source records did not report landfill names, landfill identification was confirmed using prior regional records and applicable permits/records. Examples include Monterey Regional Waste Management District (Monterey Peninsula Landfill), San Jose/Santa Clara RWF (Newby Island), Sewer Authority Mid-Coastside (Ox Mountain), American Canyon, Vacaville, Simi Valley, and Rowntree/Recology.
- (2) Biosolids used as alternative daily cover (ADC) are reported separately because they are blended with other cover materials and are not counted as disposed biosolids in the "disposal excluding ADC" column.
- (3) It was assumed that all biosolids received at California landfills came from WWTPs in California.

As seen in Table 3, California landfills accepted varying amounts of biosolids when compared to the total amount of material they receive, ranging from 0 to 40 percent, with most landfills accepting less than 5 percent. Note that some landfills have reported higher biosolids acceptance percentages (over 10 percent of total landfilled) and this appears to be due to a combination factors including landfills role as a regional disposal site for biosolids thereby accepting more biosolids than typical, onsite operations such as composting, and other reasons which cannot be clearly identified based on the available data. Many factors can influence the amount of biosolids a landfill can accept annually, and acceptance rates can vary from year to year. In addition, approximately 17 percent of the landfills listed have closure dates within the next 5 years, signifying that an important portion of the available landfill capacity in the state is not available over the long term.

In addition to the biosolids received at California landfills, the US EPA ECHO database also reported biosolids sent to out-of-state and unknown landfill facilities, totaling 3,740 wet tons and 45,300 wet tons, respectively.

Other Management Pathways

Table 4 lists biosolids processed at California WWTPs in 2024 using other management practices including incineration, deep well injection, storage, and surface disposal based on the US EPA ECHO database. Biosolids processed and managed through these processes totaled to 318,000 wet tons.

Table 4. California Biosolids Processed by Incineration, Deep-well Injection, Storage, and Surface Disposal in 2024					
Facility Name	Location	Management Type	Total Biosolids Received		
			dry metric tons	dry tons	wet tons
Central Contra Costa WWTP	Martinez	Incineration	14,026	15,461	77,305
Los Angeles Hyperion WWTP	Playa Del Rey	Deep-well Injection	8,036	8,859	44,293
Los Angeles Terminal Island WRP	San Pedro	Deep-well Injection	2,742	3,023	15,114
Calexico, City Of	Calexico	Storage- Unknown disposition	309	341	1,704
California City WTF	California City	Storage- Unknown disposition	38	42	209
Dinuba WRF	Dinuba	Storage- Unknown disposition	403	444	2,222
El Centro WWTP	El Centro	Storage- Unknown disposition	600	661	3,307
Rio Vista, City Of	Rio Vista	Storage- Unknown disposition	150	165	827
Tuolumne City Sanitary District	Tuolumne	Storage- Unknown disposition	13	14	72
Avalon WWTP	Avalon	Surface Disposal	145	160	799
California Men's Colony WWTP	San Luis Obispo	Surface Disposal	30	33	167
Corcoran WWTP	Corcoran	Surface Disposal	250	276	1,378
Dublin San Ramon RWTF	Dublin	Surface Disposal	1,590	1,753	8,765
Echewater Resource Recovery Facility	Sacramento	Surface Disposal	23,676	26,098	130,491
Las Gallinas Valley STP	San Rafael	Surface Disposal	148	163	816
Novato WWTP	Novato	Surface Disposal	793	874	4,368
Oceanside La Salina WWTP	Oceanside	Surface Disposal	278	306	1,530
Oroville Region, Sewerage Commission	Oroville	Surface Disposal	618	681	3,406
Oxnard WWTP	Oxnard	Surface Disposal	3,813	4,203	21,015
San Clemente Island WWTP	San Clemente	Surface Disposal	45	49	247
Total managed by Incineration			14,026	15,461	77,305
Total managed by Deep-well Injection			10,779	11,881	59,407
Total managed by Storage (unknown disposition)			1,513	1,668	8,341
Total managed by Surface Disposal			31,385	34,596	172,981
TOTAL of all Other Management Pathways			57,703	63,607	318,034

Overall Distribution of Biosolids Generated in California

The total quantity of biosolids generated and managed in California during 2024 is approximately 3.5 million wet tons, as summarized in Figure 1, and approximately 708,000 dry metric tons or 780,000 dry tons, as summarized in Figure 2. These totals are based on the biosolids management data presented in the preceding sections, with biosolids quantities that could not be identified with a management pathway due to incomplete data are included in the “Biosolids Tonnages Undetermined” category. Minor differences remain between the ECHO database and the compiled management pathway totals, primarily due to differences in landfill ADC quantities reported between the ECHO and CalRecycle databases.

Note that the biosolids management percentages presented on wet ton basis (Figure 1) differs from those presented on a dry metric ton and dry ton basis (Figure 2), because of the solids content. Specifically, biosolids landfilled by the San Jose/Santa Clara Regional Wastewater Facility were historically reported to contain approximately 95 percent solids, reflecting the facility's use of air-drying beds in 2024. As a result, landfill disposal represents a larger proportion of biosolids management when expressed on a dry mass basis than when expressed on a wet mass. Conversely, management pathways such as composting and direct land application represent a larger share on a wet ton basis because of the higher moisture content of the product used in those processes. Therefore, equivalent dry mass does not necessarily correspond to equivalent wet mass.

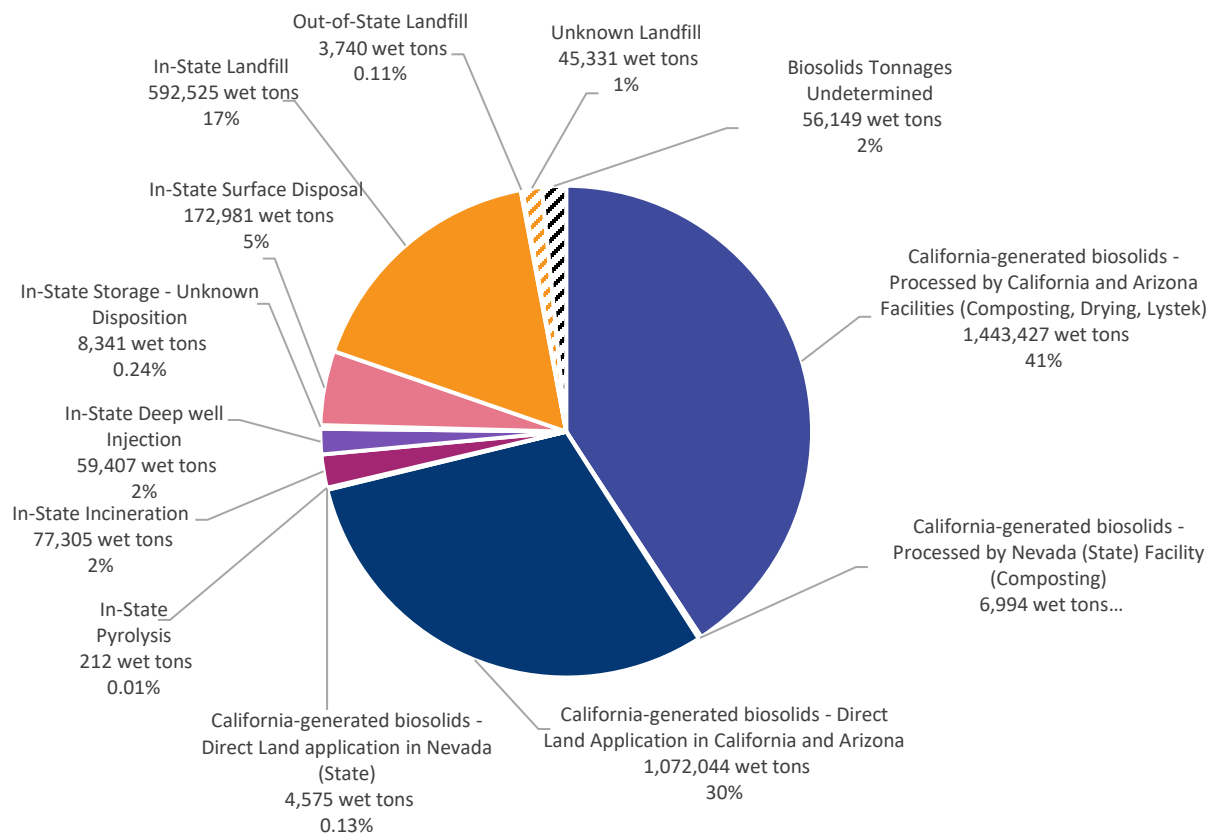


Figure 1. Overall Distribution of Biosolids Generated in California in 2024 (wet tons)

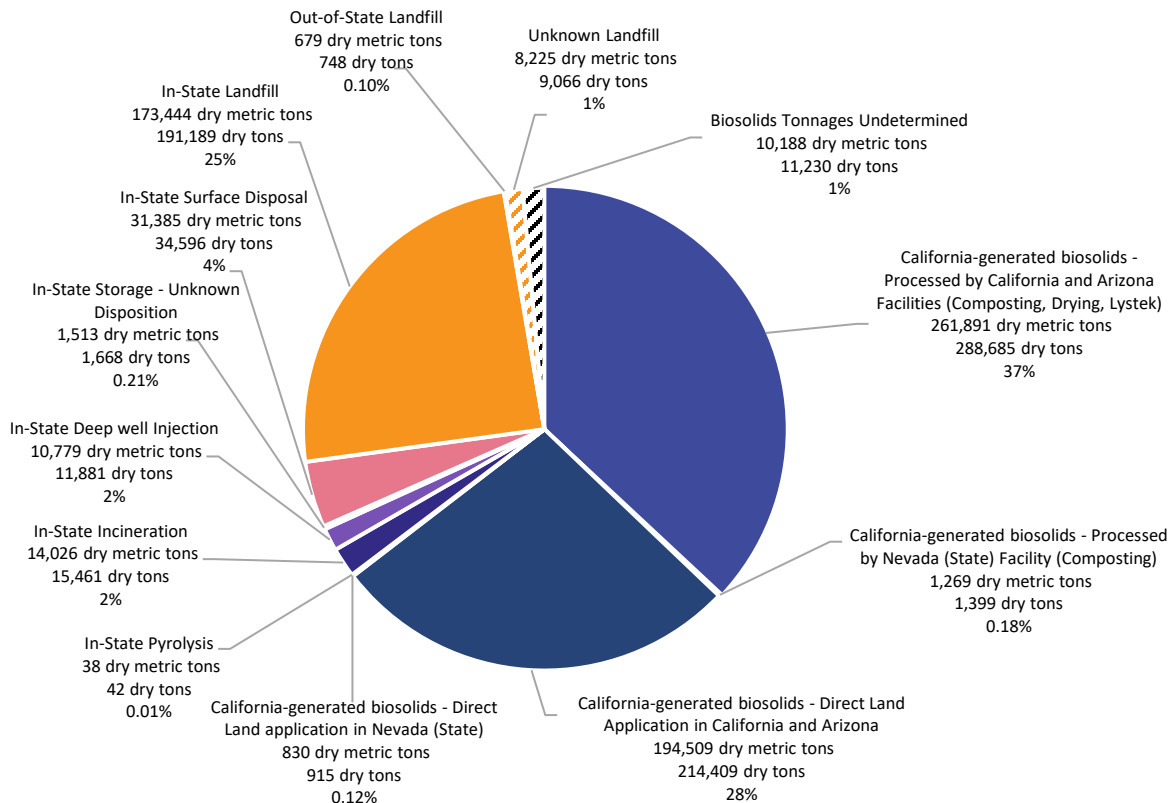


Figure 2. Overall Distribution of Biosolids Generated in California in 2024 (dry metric tons and dry tons)

Estimating Capacity at In-State Biosolids Outlets

Landfills

The exact amount of additional available capacity for biosolids at California landfills is difficult to determine but can be estimated based on the proportion of biosolids currently accepted versus industry guidelines. Landfills will typically limit the amount of “high moisture content waste” or “wet waste”—typically defined as containing greater than 40 percent moisture (i.e., less than 60 percent total solids)—that is accepted as a percentage of the overall amount of material accepted. Wet wastes, such as dewatered biosolids, can contribute to stability, leachate generation, and reheating issues at landfills. Landfill operators have varying internal guidelines for the amount of wet waste accepted. Georgia, following a series of failures, enacted state guidance setting 5 percent as the maximum amount of wet waste accepted at landfills without enacting mitigation measures (GADNR, 2021). As previously noted, some landfills have reported higher biosolids acceptance percentages and this appears to be due to a combination of factors including landfills role as a regional disposal site for biosolids thereby accepting more biosolids than typical, onsite operations such as composting, and other reasons which cannot be clearly identified based on the available data.

To estimate potential additional landfill capacity available to accept biosolids in California, an assumed biosolids acceptance rate of 5 percent was applied to the landfills identified in Table 3. Landfills that already receive 5 percent of biosolids of the total landfilled materials were assumed to be at capacity for biosolids acceptance and therefore excluded. Additionally, landfills projected to close within the next five years (by 2031) were excluded from this analysis, as they do not represent

viable long-term options for biosolids management. For each qualifying landfill, the remaining excess biosolids acceptance capacity at landfills in California was estimated as the additional biosolids quantity that could be accepted until the landfills reach this 5-percent threshold. Hence, the biosolids tonnages for the landfills listed in Table 3 plus the quantity that could be accepted until this excess capacity value is met would be the total amount of biosolids that could be managed through landfilling. Based on this method, the estimated additional landfill capacity potentially available for biosolids acceptance is approximately 337,000 wet tons per year.

This value for additional biosolids acceptance capacity is likely unrealistically high for several reasons. First, the value does not account for other wet wastes accepted by these landfills that would also be counted toward the maximum proportion of wet wastes. Second, landfills need dry waste, such as construction and demolition debris, to reduce overall moisture content of the wet waste and mitigate stability risks. Because biosolids are semi-solid liquids, they must be mixed with solid bulky waste to prevent sloughing or shifting. Landfills often lack the required volume of bulky waste to accept large amounts of sludge, leading to capacity crises. The biosolids acceptance value noted assumes sufficient quantities of appropriate dry, bulky waste are available, but that may not be realistic; lack of sufficient dry material would further limit the amount of wet waste that could be accepted. In addition, many landfills have restricted hours of acceptance on weekends and holidays. This would create episodic shortfalls of capacity for the many WWTPs that do not possess sufficient on-site storage for biosolids. Lastly, municipal solid waste and construction waste volumes received at landfills are typically seasonal (less in winter, more in summer) so there may be potential seasonal shortfalls in biosolids acceptance capacity based on lack of sufficient dry material.

Landfills in California that currently accept biosolids represent only a small portion of overall landfills in the state. We estimated how much additional capacity might be available for biosolids if those landfills that are permitted to accept biosolids but have not historically done so, begin accepting them. This could be a possibility if biosolids land application is banned and the economic market makes this a favorable proposition for the landfill operators. Using the California Water Board tracker for permitted “sludge/biosolids” landfill facilities, we specifically identified landfills classified as designated, non-hazardous, or inert. Landfills classified as hazardous waste were excluded from this analysis. We then further filtered this list to include those that did not receive biosolids in 2024 (Table 3). To estimate potential additional landfill capacity under this hypothetical scenario, an assumed biosolids acceptance rate of 5 percent of total material received was applied to the identified landfills that do not currently accept biosolids. Under this hypothetical scenario, we estimate the potential to accept an additional 722,000 wet tons per year. Between those landfills that currently accept biosolids and those that may do so in this hypothetical scenario, we estimate a total additional capacity of 1,059,000 wet tons. However, this hypothetical scenario is risky and unlikely to be fully realized in practice, as many permitted landfills may choose not to accept biosolids due to the wet nature of the biosolids and their associated contribution to stability, leachate management, and reheating issues at landfills. In addition, increased landfill disposal of biosolids would directly conflict with the intent of California’s SB 1383 policy and mandates, which establish statewide targets to reduce organic waste disposal to landfills (75% reduction by 2025) to reduce methane emissions. A significant increase in landfill disposal of biosolids could therefore require legislative changes and policy/regulatory alignment to avoid conflicting directives.

Incineration

California currently has one biosolids incineration facility, owned and operated by the Central Contra Costa Sanitary District (Central San), which has been in continuous operation for approximately 45 years with a permitted incineration capacity of 20,000 dry tons per rolling 365 days, and does not currently accept biosolids from outside facilities. Central San is evaluating capital improvements to

extend the facility's useful life by an estimated 15 years. In parallel, Central San is assessing regionalization opportunities to provide an additional biosolids management option for other WWTPs in the Bay Area. Under the regionalization program, incineration capacity could potentially be expanded to accommodate a larger throughput, serving a portion of biosolids currently managed through land application (Central Contra Costa Sanitary District, 2026). However, the regionalization program remains in the feasibility evaluation phase, and the final capacity, service area, and implementation schedule have not yet been defined; making such a project, if implemented, a decade or more away. Therefore, the potential capacity available through incineration management pathway is not included as part of this analysis.

Estimated Capacity Shortfall

As previously mentioned, the landfill capacity-gap analysis assumes that Arizona land-application capacity becomes constrained on a similar timeframe as California (or earlier) representing an added risk that could shift additional California biosolids back to in-state disposal outlets. However, if Arizona remains viable, the magnitude of the in-state landfill capacity shortfall would be reduced, but interstate reliance would remain a material risk.

If California and Arizona enact a ban on land application of biosolids and biosolids-containing products, the tonnage that is received by biosolids processing facilities and land applied in California and Arizona (1,443,000 wet tons in 2024) and the tonnage that is directly land applied in California and Arizona (1,072,000 wet tons) would need to shift to alternative outlets (2,515,000 wet tons in total).

As shown in Figure 2, the estimated capacity at in-state landfills (1,059,000 wet tons), including both currently accepting biosolids and those assumed to newly accept biosolids in the future, is insufficient to meet this new demand. As noted above, this may be an optimistic estimate and does not address issues associated with daily and seasonal capacity shortages that are likely to happen throughout the year.

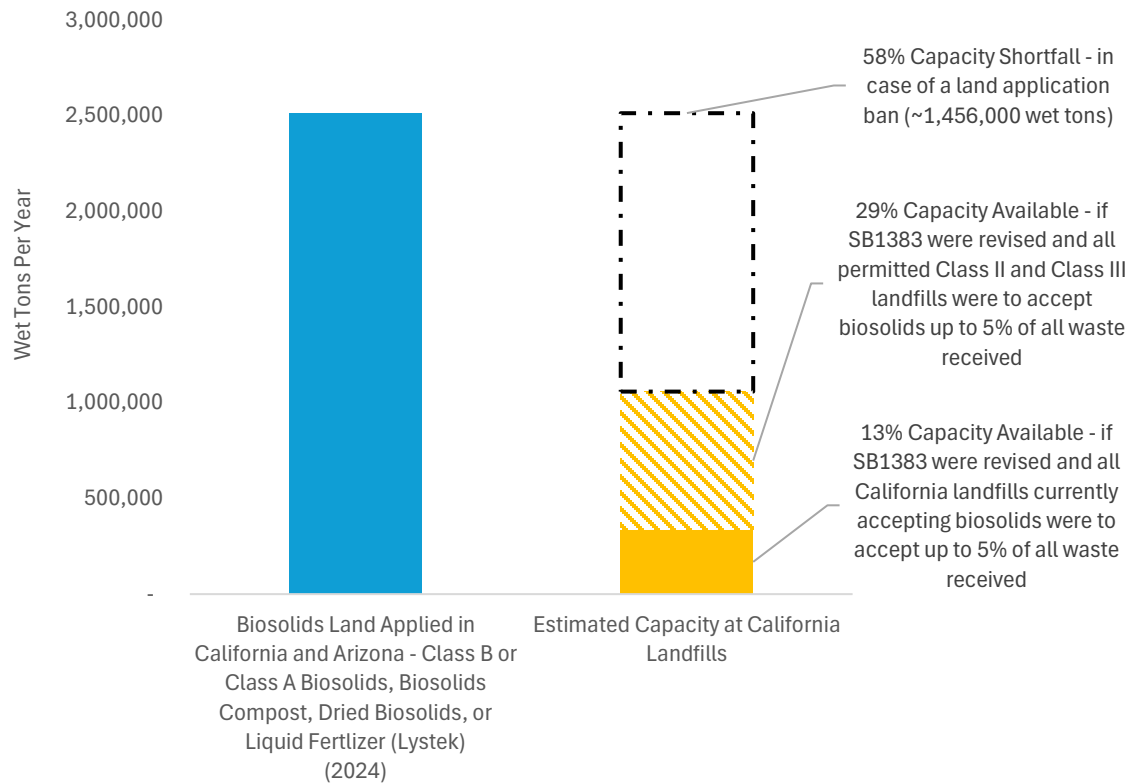


Figure 3. Biosolids Land Applied in California and Arizona (2024) vs. Capacity at Landfills in California

Climate Impact of Diversion to Landfill

In addition to these challenges, if all biosolids in California that are currently land applied were instead landfilled, there would be significant increases in the amount of GHG emissions associated with alternative biosolids management options (not to mention the need to produce and apply synthetic fertilizer to land application sites that no longer receive biosolids as their source of nutrients). Estimates of GHG emissions associated with end-use were calculated for two scenarios: 1) actual 2024 biosolids management via land application (existing practice), and 2) if all biosolids that were land applied were instead landfilled.

With the assumptions described in Table A-1 and the data from Tables 1-3, GHG emissions were estimated and summarized in Figure 3.

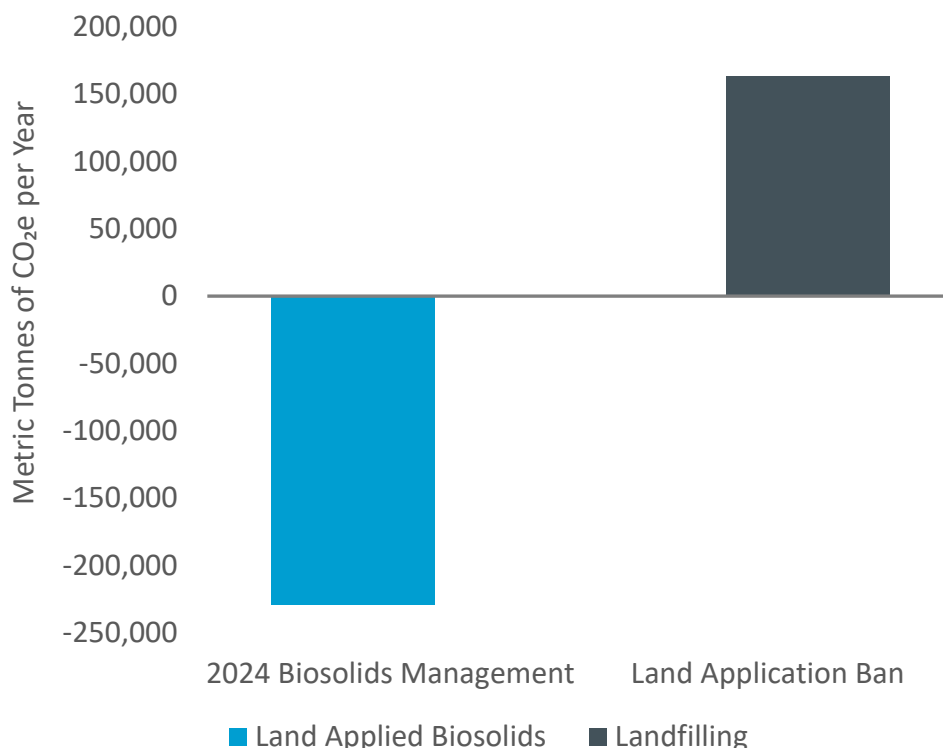


Figure 4. Estimated GHG Emissions from Land Application of Biosolids vs Landfilling Biosolids (2024)

These results illustrate the high emission intensity of landfilling biosolids, and the climate benefits provided by land application. While, in 2024, land applied biosolids constituted a significant carbon sink, sequestering or avoiding 229,223 MTCO₂e emissions, if they were landfilled (due to a land application ban), these displaced biosolids would generate 169,919 MTCO₂e emissions. Overall, when accounting for the loss of carbon benefits provided by land applying and the emissions generated by degradation at a landfill, a land application ban would generate a net total of 399,142 MTCO₂e emissions annually, or the equivalent of adding roughly 86,770 passenger cars to California roads. When comparing this net total to the baseline of 229,223 MTCO₂e sequestered, the result is a 174 percent increase in emissions if a land application ban were to go into effect in California. These results highlight that a land application ban could increase reliance on landfill disposal for an organic material stream that SB 1383 is designed to divert from landfills to reduce methane and achieve statewide climate objectives, as well as establish a circular economy.

Cost Impacts of Shifting Away from Land Application

If a biosolids land application ban were enacted in California, it would disrupt WWTP operations and result in significant cost increases (Maine DEP, 2023). When Maine (one of two states to ban land application and the only one with significant levels of land application) restricted and eventually banned land application, biosolids management prices for many utilities more than doubled (MeWEA, 2022). When subsequent legislation that impacted the ability of landfills to accept biosolids went into effect, many WWTPs were left with no option to manage their biosolids. The wastewater flows from homes, businesses and industries do not stop, so solids built up at WWTPs during this “sludge crisis”. Eventually alternative outlets were identified but hundreds of miles away

in Canada and at a greatly increased overall price. The situation for WWTPs in Maine remains precarious even now, years later.

The commissioner of Maine's Department of Environmental Protection, Melanie Loyzim, who experienced this firsthand, offered this advice to other states: "[A]ny state that is considering a prohibition [on the land-application of biosolids] should plan for where those materials are going to go first" (InsideEPA, 2025). That has not been done in California. California can learn from the experience in Maine and avoid the disruption and costs (paid by ratepayers) of enacting legislation without proper planning.

Biosolids management costs often comprise a significant portion (30% or greater) of a wastewater utility's annual operating budget, which in turn, impacts sewer rates across the utility's service area. According to a 2025 report by Bluefield Research, "the slow development of additional landfilling and incineration capacity, coupled with growing concerns over contaminants that impeded land spreading, wastewater utilities in the West are projected to account for \$US6.0 billion, or 17 percent, of national spending during the forecast period [2025-2035]." California-specific data provided by Bluefield Research indicated a 76 percent increase in landfill tip fees within the next ten years. Utilities cannot easily pivot to or create new biosolids management outlets, and the costs of accessing more expensive landfills are likely to result in increased sewer rates. While drying biosolids could theoretically help address future landfill capacity shortfalls, such projects require substantial capital investment (on the order of approximately \$55M to \$400M for WWTPs with capacities of 10 mgd or greater, based on recent project references). In addition, only three utilities in California currently process all or a portion of their plants' biosolids through other thermal processes such as incineration and pyrolysis. Together, these options currently represent very limited statewide capacity relative to the volume of biosolids generated in the state. California currently has only one operational biosolids incineration facility, which is 45 years old. The state's stringent air-quality standards, siting constraints, and public opposition makes the approval and construction of additional biosolids incineration capacity highly unlikely in the foreseeable future. Similarly, pyrolysis is currently deployed at only two facilities with one intermittently operational and the other not yet fully started. The systems at these facilities are extremely capacity-limited and, to-date, have not shown reliable long-term operation. Beyond currently limited deployment, these advanced thermal technologies (including thermal drying) require extensive permitting and are subject to extensive air quality regulations which present a significant implementation barrier in California. Furthermore, these systems require significant capital and operational investments, and long implementation timelines that can exceed a decade from planning to commissioning. Given these constraints, advanced thermal pathways (including thermal drying) cannot be relied upon to provide near term, statewide replacement capacity to offset a land application ban should it occur.

Conclusion

In summary, there is insufficient alternative in-state capacity at landfills or through niche processing technologies to accommodate the biosolids currently land-applied in California and Arizona in the event of a land application ban. Out-of-state outlets have limited capacity and are coming under increasing regulatory pressure and may not be available in the future. Wastewater utilities and ratepayers could face an estimated \$140M to \$420M in additional biosolids management costs annually if they have to dispose of their biosolids rather than beneficially using them. In addition to the substantial rate increases this would require, the lack of landfill and other processing capacity and current state policies like SB 1383 make this an unrealistic scenario regardless. A land application ban is also estimated to increase GHG emissions by 174 percent by eliminating the carbon sequestration benefits of beneficial use and increasing emissions from landfilling. In short, a ban on biosolids land application in California would result in significant biosolids management

disruptions and economic and environmental costs.

Limitations:

This document was prepared solely for the Mid-Atlantic Biosolids Association (MABA) in accordance with professional standards at the time the services were performed and in accordance with the contract between MABA and Brown and Caldwell dated December 15, 2025, and a contract between Brown and Caldwell and Carollo Engineers. This document is governed by the specific scope of work authorized by MABA; it is not intended to be relied upon by any other party. We have relied on information or instructions provided by MABA and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

References

- Bay Area Clean Water Agencies (BACWA). (2010). *Bay Area Biosolids Management: Challenges, Opportunities and Policies*.
- Bay Area Clean Water Agencies (BACWA). (2021). *Biosolids Trends Survey Report (2020 Data)*.
- Bay Area Clean Water Agencies (BACWA). (2024). *Biosolids Trends Survey Report: Results from 2021–2023 Biosolids Management Survey*.
- Bluefield Research. (2025). *U.S. Municipal Biosolids Management: Drivers, Trends, and Forecasts, 2025-2035*.
- California State Water Resources Control Board. (No Date). *GeoTracker Database: Landfill Map (Waste Discharge Requirement and permitted landfill sites)*.
- California Department of Resources Recycling and Recovery (CalRecycle). (No Date). *Solid Waste Information System (SWIS): Facility/Site Search Database*.
- California Department of Resources Recycling and Recovery (CalRecycle). (2024). *Landfill Tip Fee and Tonnage Reporting System*.
- California Department of Resources Recycling and Recovery (CalRecycle). (2024). *Recycling and Disposal Reporting System (RDRS) Report No. 4: Beneficial Reuse Tonnage by Material Type*.
- Central Contra Costa Sanitation District. (2026). *CASA Winter Conference, Central San Regionalization Evaluation*. <https://casaweb.org/wp-content/uploads/2026/01/3B-N-Goel-BABC-Central-San-Regionalization.pdf>
- Clean Water SoCal (formerly Southern California Alliance of Publicly Owned Treatment Works [SCAP]). (2012). *SCAP Biosolids Trends Survey*.
- Clean Water SoCal (formerly Southern California Alliance of Publicly Owned Treatment Works [SCAP]). (2014). *SCAP Annual Report*.
- Clean Water SoCal (SCAP). (2016). *SCAP Biosolids Trends Update (Second Version)*.
- Clean Water SoCal (SCAP). (2020). *SCAP Biosolids Biennial Trends Survey (2016–2018)*.
- Clean Water SoCal (SCAP). (2022). *Biosolids Trends Update (2019–2021)*.
- Clean Water SoCal (SCAP). (2024). *Biosolids Biennial Trends Survey Report (2021–2023)*.
- GADNR. (2021). *High Moisture Content Waste Management Plans at Solid Waste Facilities Guidance Document*. Georgia Department of Natural Resources.
- InsideEPA. (2025). *Maine Official Urges States to Weigh Biosolids Disposal Options Before Ban*. InsideEPA.
- Maine Department of Environmental Protection (Maine DEP). (2023). *An Evaluation of Biosolids Management in Maine and Recommendations for the Future*. Andover.
- Maine Water Environment Association (MeWEA). (2022). *Biosolids Disposal Costs Compiled Data from Selected Utilities*. Maine Water Environment Association.
- United States Environmental Protection Agency (U.S. EPA). (2023). *Biosolids Annual Reporting Excel Workbook (unpublished dataset, provided upon request)*.
- United States Environmental Protection Agency (U.S. EPA). (2024). *ECHO Database (Enforcement and Compliance History Online). Biosolids Annual Reporting*.

Appendix

Table A 1. Assumptions for Greenhouse Gas Calculations

Composting			
Compost technology		ASP	
Biomass density (kg/m³)		950	
Has the biomass been digested prior to composting?		Yes	
Level of aeration		Well Aerated	
Solids Content to Composting (%-dry weight)		20%	
Total nitrogen (%-dry weight)		5.0%	
Total phosphorus (%-dry weight)		1.9%	
Total volatile solids - TVS (%-dry weight)		65%	
Organic carbon (%-dry weight)		36.4%	
Density of amendment (kg/m³)		250	
Material replacing commercial nitrogen fertilizer		Yes	
Material replacing commercial phosphorus fertilizer		Yes	
Carbon sequestration as result of land application		Mid-Range	
Thermal Drying			
Solids Content to Dryer (%-dry weight)		20%	
Solids Content from Dryer (%-dry weight)		92%	
Land Application			Alk Stabilized (assumed for Thermo- chemical Hydrolysis)
	Directly Land Applied	Thermal Dried	
Density of treated biosolids (kg/ m3)	950	741	950
Solids Content going to Land Application (%-dry weight)	20%	92%	20%
Total nitrogen (%-dry weight)	5%	5%	3.2%
Total phosphorus (%-dry weight)	1.9%	1.9%	1.2%
Total volatile solids (TVS) (%-dry weight)	65%	65%	52%
Organic carbon (%-dry weight)	36.4%	36.4%	29.1%
CaCO3 equivalence (%-dry weight)	0%	0%	0%
Average number of days biosolids are stored prior to land application	14	14	14
Climate at land application sites	Arid	Arid	Arid
Is lime in biosolids derived from a waste product?	No	No	No
Will the lime in biosolids replace purchased lime where it is applied?	Yes	Yes	Yes
Material replacing commercial nitrogen fertilizer	Yes	Yes	Yes
Material replacing commercial phosphorus fertilizer	Yes	Yes	Yes
Fine-textured/ Coarse-textured soil (% of land application area)	50%	50%	50%
Carbon sequestration as result of land application	Mid-Range	Mid-Range	Mid-Range

Table A 1. Assumptions for Greenhouse Gas Calculations

Landfilling	
Solids Content to Landfill (%-dry weight)	20%
Total nitrogen (%-dry weight)	5.0%
Total volatile solids (TVS) of solids going to landfill (%-dry weight)	65.0%
Organic carbon in solids going to landfill (%-dry weight)	36.4%
Methane correction factor for landfill (DOCf that will decompose in landfill)	1.0
Percent of captured methane used to generate electricity	100%
Level of Digestion/Processing	Partial Digestion
Landfill climate zone	cool dry