

Regional Waste Movement Study

2024

Task 6: Technical Memo: Forecasting Site/Facility Life Cycles and Anticipated Replacements/Expansions

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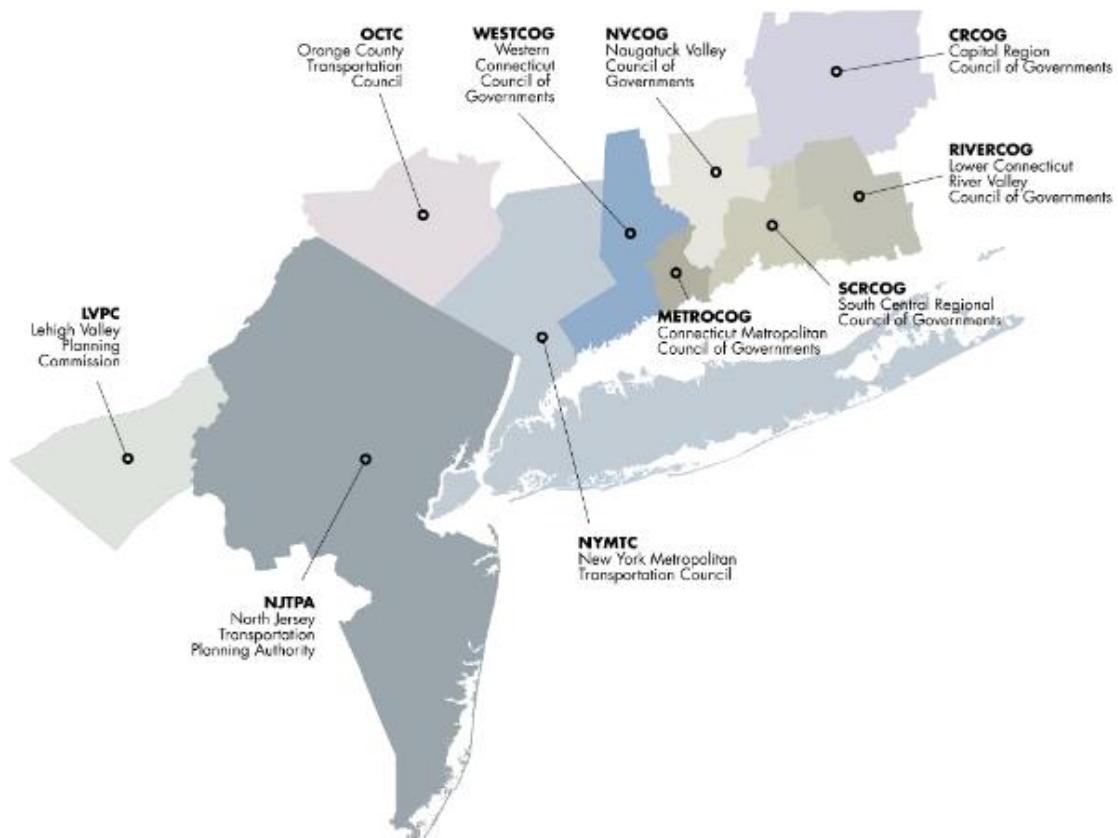
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1 Introduction

The Regional Waste Movement Study is focused on identifying the needs and opportunities associated with the movement of municipal solid waste (MSW) and construction and demolition (C&D) debris or waste in the Metropolitan Area Planning (MAP) Forum Study Area, which encompasses six councils of government (COGs) in Connecticut and four metropolitan planning organizations (MPOs) in New Jersey, New York, and Pennsylvania (refer to **Figure 1**).

Figure 1: Metropolitan Area Planning (MAP) Forum Study Area



2 Memorandum Introduction

The purpose of this memorandum is to estimate the lifecycle of the waste disposal facilities in the Study Area through 2050, with a focus on landfills. Understanding the lifecycles of these facilities is important for the long-term planning for moving waste within and through the region. By assessing landfill capacity at key milestones—2035 and 2050—this study provides insights into how regional disposal limitations will affect the flow of waste within and beyond the Study Area. These projections enable planners and policy makers to anticipate potential shifts in waste movement patterns and evaluate the economic, regulatory, and logistical challenges associated with maintaining sufficient disposal capacity or finding alternative solutions in the future.

The Study Area includes 20 landfills and 9 waste-to-energy (WTE) facilities which, combined, process more than 9.8 million tons of waste annually—4.5 million tons in landfills and 5.2 million tons in WTE facilities.¹ About 85 to 90 percent of this waste consists of MSW and C&D, depending on the state. MSW is primarily generated by households and businesses and tends to grow steadily over time as it is closely linked to population size and household behavior. In contrast, C&D waste generation is driven by construction activity and economic conditions, leading to more significant fluctuations. These differences shape waste movement and disposal patterns across the region, as well as the capacity needs of disposal facilities.

The landfills in the area have a combined storage capacity of 54.7 million cubic yards, which, at historic compression rates and waste fractions,² can hold approximately 38.1 million tons of waste.³ While much of the waste disposed of at these facilities originates within the Study Area, some is received from outside the region.

More waste is generated in the Study Area annually than its disposal facilities process. In 2022, approximately 44.1 million tons of waste were produced in the Study Area.⁴ The region's annual disposal rate—defined by the processing capacity of landfills and WTEs—could handle 22 percent of this waste, with 10 percent processed through landfills and 12 percent processed through WTEs.⁵ However, some of the waste processed by these facilities originates from outside the Study Area, reducing the share of locally generated waste they process. This highlights the complexity of regional waste flows, which are shaped by factors such as tipping fees, contracts, transportation costs, and infrastructure. These dynamics complicate efforts to evaluate the lifecycle of landfills in the region, as cross-boundary waste flows and limited transparency in disposal patterns affect projections of landfill lifespan and long-term capacity needs.

Landfills and WTE facilities have distinct considerations for long-term planning. Landfills are constrained by the physical characteristic of their sites. While operators often apply for permits to expand capacity, these expansions are finite and limited by site-specific factors. By contrast, WTE facilities burn waste to produce energy, greatly reducing the weight and volume of waste.

¹ Based on state and operator reports. Does not sum due to rounding.

² Waste fractions are the composition or categories of waste materials that make up the total waste stream.

³ Estimates for capacity account for required space for layers and caps

⁴ This figure is based on waste generation numbers reported by states in 2018, then projected forward linearly to 2022. It aligns with projections made in Task 7. More details regarding this calculation are included in Attachment A.

⁵ See section 4.3 for further discussion of these results.

Byproducts of incineration include ash⁶ and metal, which are transported to landfills or recycled [4].

According to interviews conducted for this study, WTE facilities can operate indefinitely if properly maintained and periodically modernized. This study assumes that WTE facility operators will make the necessary investments to sustain operations through 2050 and that waste volumes processed will remain constant over the study period.⁷ However, while technically feasible, the conditions necessary for continued operation are not always met, as evidenced by recent closure of WTE facilities in the study area.

Like landfills, WTE facilities are susceptible to political, regulatory, or economic pressures that can force closure. Connecticut's experience with the 2022 closure of its second-largest WTE facility in Hartford illustrates these challenges. Operated by the quasi-governmental Materials Innovation and Recycling Authority (MIRA), the facility required hundreds of millions of dollars in refurbishment after three decades of operation but failed to secure state funding. Compounding financial pressures was a shift in the contracting environment—while municipalities readily signed 20- to 30-year waste disposal contracts in the 1980s, by the 2010s, they were more reluctant to commit long-term, increasing financial risk for operators.

Ultimately, MIRA closed, challenging Connecticut's goal of waste disposal self-sufficiency. While perpetual WTE operation is possible through repairs and upgrades, the MIRA case underscores the difficulty of securing the political will and economic conditions necessary to sustain these facilities.

Processing facilities for recycling and composting play an important role in diverting MSW and C&D away from landfills and WTE facilities for reuse. The Study Area has 586 processing facilities that collectively divert 22.3 million tons of waste annually.⁸ Like WTE facilities, these facilities are not constrained by physical limitations and are assumed to maintain their current diversion rates through 2050.

This memorandum focuses on estimating the long-term capacity of landfill facilities in the Study Area to continue receiving waste through 2035 and 2050. These milestone years are important for understanding how changes in disposal capacity may influence waste movement. By estimating landfill capacity at these intervals, this analysis identifies the timing and magnitude of potential constraints that will shape future waste flows within the Study Area. The evaluation relies on landfill data reported by state agencies and facility operators, including remaining capacity, historical acceptance rates, and proposed expansions.

⁶ The ash produced is about 15 to 25 percent of the total MSW processed by weight and 5 to 15 percent by volume, according to the United States Environmental Protection Agency.

⁷ Future research could consider the current state of each waste-to-energy facility in the region and estimate when investments will be required to continue operating them to capture a more nuanced picture of the long-term waste-to-energy capacity of the Study Area.

⁸ Based on data collection and analysis conducted for Task 5

3 Methods

This study estimates the lifespan of landfills in the Study area using data from state reports and landfill operators. The study incorporates current landfill capacities, historical waste acceptance rates, and proposed expansions to project the future availability and closure. Notably, most landfill expansions considered in this memorandum have not been approved and therefore, if they were all implemented, represent just one possible future for the Study Area landfills. These proposals are subject to change as the region's waste management needs and strategies evolve. Finally, this analysis includes only landfills that are currently operational, as no new facilities are proposed or under construction.

Comprehensive data were gathered for each landfill as detailed in Attachment 1. This data includes:

- remaining permitted capacity at the beginning of 2023,⁹
- current and projected annual waste intake,
- and proposed expansion plans where applicable.

Projections of remaining operational years were calculated by dividing each landfill's remaining capacity by its historic waste acceptance rates. These estimates assume that historical acceptance rates will remain unchanged. This approach provides a baseline understanding of the region's future waste disposal capacity, which will decrease as landfills reach their capacity and ultimately close.

3.1 Consideration of Future Waste Generation

Estimates of future waste generation, detailed in the Task 7 memorandum, were reviewed but not directly applied to the landfill lifespan calculations. These estimates from Task 7 indicate that waste generated in the Study Area far exceeds regional landfill capacity and is expected to increase over time. However, as landfills are already operating at or near their annual capacity, increases in waste generation will not affect acceptance rates or accelerate closure timelines.

3.2 Scenario Analysis

Two scenarios are evaluated in this study to establish the theoretical range of the Study Area's landfill capacity over time: an open-market scenario and a constant-stream scenario.

3.2.1 Open Market Scenario

This scenario assumes unrestricted waste movement within the Study Area. As individual facilities reach capacity, waste is redirected to other landfills in the Study Area, continuing until all landfill capacity in the region is exhausted. To estimate the collective lifespan of all landfills in the region, the combined landfill capacity is calculated by summing all landfills' remaining capacity at the start of the study period and the combined annual waste acceptance rate is subtractive iteratively. This scenario provides a regional perspective on the collective landfill capacity in the region and overall closure timelines for planners and policy makers.

⁹ Data was collected in February and March of 2023 for capacity and acceptance rates for the end of 2022.

3.2.2 Constant Stream Scenario

This scenario assumes that each landfill continues to accept waste at historical rates until it reaches capacity. Once a landfill is full, any additional waste that would have normally gone to that facility is assumed to leave the Study Area entirely. For each landfill, its current capacity is divided by its annual acceptance rate to estimate its operational lifespan. This scenario provides planners and policy makers with an estimated life of each facility within the region.

3.3 Key Assumptions and Limitations

Both scenarios assume that historical waste acceptance rates remain constant over the study period. This assumption is based on the limited availability of data and the economic incentives for landfill operators to maintain operations at or near their permitted or physical capacity. Tipping fees represent the primary revenue source for landfill facilities, and underutilization would result in lost income and inefficiencies. Therefore, it is reasonable to assume that operators will strive to maximize utilization of their facilities.

However, factors such as regulatory changes, infrastructure upgrades, evolving waste management strategies, or shifts in regional economic conditions could lead to deviations from historical acceptance rates. Without sufficient data to model these potential changes, this analysis assumes that the available data reflect trends that fall within historical norms and can serve as a reliable baseline for projections.

Additionally, cross-boundary waste flows—driven by private haulers seeking cost efficiencies—are assumed to occur as landfills close, but the specific dynamics of these flows are not analyzed in detail.

Finally, a key limitation of this study is the lack of granular data on the composition of waste (i.e., MSW versus C&D) at individual landfills in New Jersey and Connecticut. While MSW and C&D waste generation are driven by distinct factors—population size and economic activity, respectively—this analysis assumes that historical acceptance rates at each landfill capture the combined effects of these waste streams. Future analyses with more detailed data could refine projections by accounting for these differences more precisely.

The reality of waste movement is likely to fall between the open-market and constant-stream scenarios presented in this study. Private haulers will adjust waste flows in response to economic, regulatory, and logistical factors, potentially redirecting waste within and outside the Study Area. Future analyses may refine these projections by incorporating detailed hauler behavior, evolving waste management strategies, and broader trends in regional waste movement.

4 Results

This lifecycle analysis indicates that landfill expansions or siting of new landfills or WTE facilities will be necessary to maintain disposal rates within the Study Area given the short- and long-term demand for disposal capacity.

Table 1 identifies the twenty (20) landfills located within the Study Area, the type of waste they accept, and the nearest freight route to reach them. Of the 20 landfills, 15 have significant remaining capacity to accommodate future waste flows.¹⁰ However, as presented in **Table 2**, seven (7) of the landfills—Town of Manchester Landfill, Town of Suffield Landfill, Bethlehem Landfill, Brookhaven Waste Management Facility, Port Jefferson Village Clean Fill, Middlesex County Landfill, and Monmouth County Regional Sanitary Landfill—do not have expansion plans that extend their lifespans until 2035. Only four (4) landfills—Grand Central Sanitary Landfill, 110 Sand Company Clean Fill Disposal Site, Sussex County Solid Waste Complex and Warren County District Landfill—have expansion plans that extend their lifespans through 2050.

Table 3 presents projections of the lifespan of each landfill, including remaining capacity, annual acceptance rates, and estimated years of operation under both current and proposed expanded capacities. These projections help inform how waste flows may shift as individual facilities reach capacity and close, affecting regional and cross-boundary waste movement.

These findings underscore the importance of considering transportation infrastructure, regulatory constraints, and economic factors in the Study Area's waste movement planning. As landfills close, waste flows are likely to become increasingly complex, with greater reliance on interregional transport and the capacity of alternative disposal facilities.

¹⁰ Based on conversations with Connecticut officials

Table 1: Landfill Location, Waste Type, and Access

State	Landfill Name	Waste Types Accepted			Nearest Freight Connection
		MSW	C&D	Ash	
<i>Connecticut*</i>	Town of Manchester Landfill		•		I-84 and I-384
	Town of Suffield Landfill		•		County 168
	Landfill – Avon		•		CT 79
	Landfill – Essex		•		CT 9
	Landfill – Glastonbury		•		CT 2, CT 66
	Landfill – Monroe		•		I-84
	Landfill - Thomaston		•		CT 8
<i>New York</i>	110 Sand Company Clean Fill Disposal Site		•		I-495
	Babylon Southern Ashfill			•	I-495
	Blydenburgh Road Landfill Complex		•		I-495
	Brookhaven Waste Management Facility		•	•	I-495
	Port Jefferson Village Clean Fill		•		Local roads, I-495
<i>New Jersey</i>	Middlesex County Landfill	•	•	•	I-95, NJ 18, and US 1
	Monmouth County Regional Sanitary Landfill	•	•	•	NJ 18 and Garden State Parkway
	Ocean County LF Corp	•	•	•	US 9
	Sussex County Solid Waste Complex	•	•	•	NJ 15 and NJ 94
	Warren County - PCFAWC	•	•	•	US 46 and NJ 31
<i>Pennsylvania</i>	Bethlehem Landfill	•	•		I-78
	Chrin Brothers Sanitary Landfill	•	•		I-78
	Grand Central Sanitary Landfill	•	•		PA 33
<i>*There are seven “active” landfills in the Connecticut portion of the Study Area. The CT Department of Energy and Environmental Protection defines “active” as “Landfills that have not completed closure in accordance with solid waste regulations.” Of these seven landfills, just two accept waste in any significant volume or with any regularity, Town of Manchester Landfill and Town of Suffield Landfill.</i>					

Table 2: Landfill Capacity, Acceptance Rate, and Lifespan

State	Landfill Name	Capacity* (tons)	Annual Acceptance Rate (tons)	Projected Lifespan without Expansion**		Projected Lifespan with Expansion***	
		End of 2022	2018-2022	Final Year	Remaining Years	Final Year	Remaining Years
Connecticut	Town of Manchester Landfill	1,505,354	180,643	2031	8	No reported expansion	
	Town of Suffield Landfill	44,575	650	2091	69	No reported expansion	
	Landfill – Avon	Low	Low	NA	NA	NA	NA
	Landfill – Essex	Low	Low	NA	NA	NA	NA
	Landfill – Glastonbury	Low	Low	NA	NA	NA	NA
	Landfill – Monroe	Low	Low	NA	NA	NA	NA
	Landfill - Thomaston	Low	Low	NA	NA	NA	NA
New Jersey	Middlesex County Landfill	4,874,427	537,711	2033	11	No reported expansion	
	Monmouth County Regional Sanitary Landfill	2,377,267	423,197	2029	6	No reported expansion	
	Ocean County LF Corp	7,725,537	587,763	2036	13	No reported expansion	
	Sussex County Solid Waste Complex	1,048,821	106,743	2032	10	2059	37
	Warren County -PCFAWC	5,301,627	108,235	2064	41	No reported expansion	
New York	110 Sand Company Clean Fill Disposal Site	4,989,970	424,276	2034	12	2090	68
	Babylon Southern Ashfill	774,656	49,866	2038	16	No reported expansion	
	Blydenburgh Road Landfill Complex	74,738	39,417	2024	2	2040	18
	Brookhaven Waste Management Facility	850,758	822,631	2024	1	2025	2
	Port Jefferson Village Clean Fill	8,547	808	2034	12	No reported expansion	
Pennsylvania	Bethlehem Landfill	2,179,971	392,327	2028	6	No reported expansion	
	Chrin Brothers Sanitary Landfill	4,091,617	182,251	2045	22	2045	22
	Grand Central Sanitary Landfill	2,241,366	682,802	2026	3	No reported expansion	

*Values account for estimated volume of final cover

** “NA” indicates not enough data available to indicate the year of closure. The acceptance rate of these facilities is low, and they are not a significant source of capacity for the region.

*** Includes permitted, under review, and proposed extensions

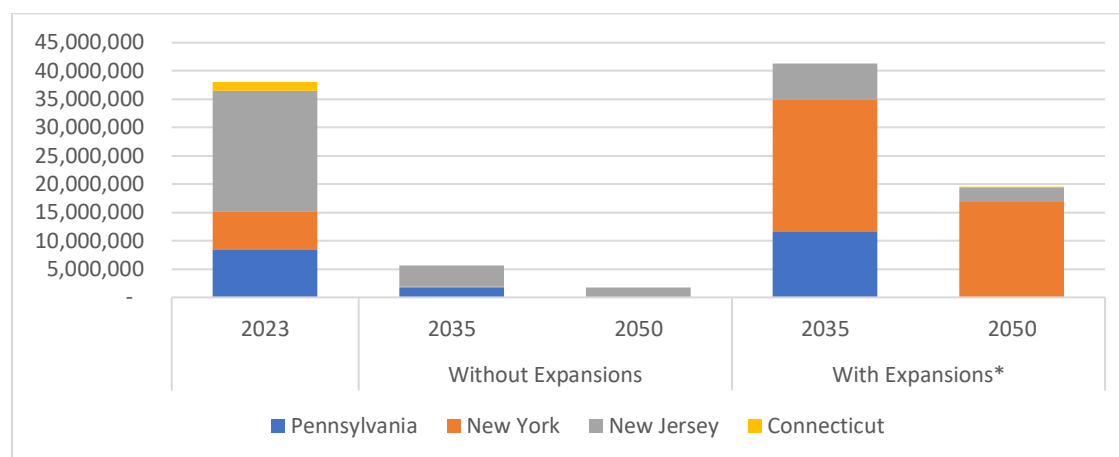
Table 3: Estimated Landfill Capacity with and without Expansions: 2035 and 2050

State	Landfill Name	Capacity* (tons)	Projected Capacity without Expansion (tons)		Projected Capacity with Expansion** (tons)	
		End of 2022	2035	2050	2035	2050
Connecticut	Town of Manchester Landfill	1,505,354	-	-	-	-
	Town of Suffield Landfill	44,575	36,125	26,375	36,125	26,375
Subtotal		1,549,929	36,125	26,375	36,125	26,375
New Jersey	Middlesex County Landfill	4,874,427	-	-	-	-
	Monmouth County Regional Sanitary Landfill	2,377,267	-	-	-	-
	Ocean County LF Corp	7,725,537	63,812	-	63,812	-
	Sussex County Solid Waste Complex	1,048,821	-	-	2,531,404	932,786
	Warren County -PCFAWC	5,301,627	3,632,467	1,706,513	3,632,467	1,706,513
Subtotal		21,327,679	3,696,279	1,706,513	6,227,682	2,639,299
New York	110 Sand Company Clean Fill Disposal Site	4,989,970	-	-	23,171,214	16,798,083
	Babylon Southern Ashfill	774,656	127,715	-	127,715	-
	Blydenburgh Road Landfill Complex	74,738	-	-	188,054	-
	Brookhaven Waste Management Facility	850,758	-	-	-	-
	Port Jefferson Village Clean Fill	8,547	-	-	-	-
Subtotal		6,698,669	127,715	-	23,486,984	16,798,083
Pennsylvania	Bethlehem Landfill	2,179,971	-	-	-	-
	Chrin Brothers Sanitary Landfill	4,091,617	1,722,349	-	1,722,349	-
	Grand Central Sanitary Landfill	2,241,366	-	-	9,801,429	-
Subtotal		8,512,955	1,722,349	-	11,523,778	-
GRANDTOTAL		36,539,303	5,546,343	1,706,513	41,238,444	19,437,382

*Values account for estimated volume of final cover

** Includes permitted, under review, and proposed extensions

Figure 2: Estimated Landfill Capacity (Tons) With and Without Expansions by State Study Area: 2035 and 2050



4.1 Open Market Scenario Results

In the open market scenario, waste moves freely throughout the Study Area without regulatory, infrastructure, or cost constraints. When a landfill's capacity is exhausted, this scenario assumes that waste previously disposed of at that landfill is redirected to another landfill within the Study Area. The analysis also assumes that landfills will continue to accept waste at their historical annual rates. As noted in Section 3.3, this assumption is based on the available data and the economic incentives for landfill operators to maximize utilization of their facilities. While deviations from historical acceptance rates are possible, the limited data available suggest that the rates used fall within a reasonable range of historical norms.

As shown in **Table 4**, if landfills across the Study Area collectively continue to accept waste at the same rate each year, all landfills across the area will run out of capacity by 2031 under current conditions. If all proposed expansions are implemented, the area's landfill capacity would be exhausted by 2041.

When analyzed by state, the results show differing timelines for landfill capacity exhaustion at current acceptance rates.

- **Connecticut:** Capacity would be exhausted by 2031 with no expansions.
- **New Jersey:** Capacity would be exhausted by 2035, extended to 2036 with proposed expansions.
- **New York:** Capacity would be exhausted by 2027, extended to 2046 with proposed expansions.
- **Pennsylvania:** Capacity would be exhausted by 2029, extended to 2043 with proposed expansions.

These projections highlight the uneven distribution of landfill capacity across the Study Area and the potential challenges associated with waste flows as facilities close. While proposed expansions provide additional capacity in some states, they do not address the broader imbalance, particularly in Connecticut, where no expansions are planned or in New Jersey where proposed expansions would extend the lifespan of the state's facilities by one year.

This scenario underscores the importance of regional collaboration in addressing waste movement challenges. Without new facilities or significant capacity expansions, landfills in the Study Area are likely to reach capacity in the near term, leading to increased reliance on cross-boundary waste flows and transport to facilities outside the region.

Table 4: Open Market Scenario Landfill Year of Closure as of End of 2022

Area	Without Proposed Expansions	With Proposed Expansions
Connecticut	2031	2031
New Jersey	2035	2036
New York	2027	2046
Pennsylvania	2029	2043
Study Area	2031	2041

4.2 Regionwide Constant-Stream Scenario Results

In the constant-stream scenario, waste continues to flow to existing landfills at their historical acceptance rates until the capacity of each landfill is exhausted. Unlike the open market scenario, when a landfill reaches capacity, waste is assumed to leave the Study Area entirely rather than being redistributed to another landfill within the region. This results in a progressively declining amount of waste disposed of in-region.

As shown in **Table 5** and **Figure 3**, under the constant-stream scenario:

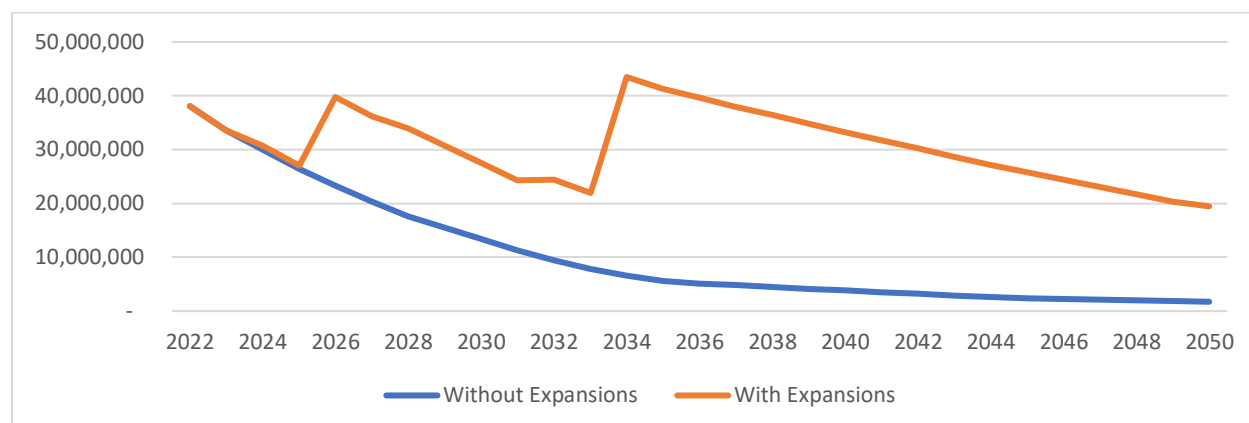
- Without proposed expansions, annual waste disposal capacity in the Study Area declines from 4.5 million tons in 2023 to 2.2 million tons by 2030, 290,000 tons by 2040, and 110,000 tons by 2050.
- With proposed expansions, annual waste disposal capacity decreases more gradually, falling to 3.3 million tons by 2030, 1.5 million tons by 2040, and 880,000 tons by 2050.

Table 5: Constant-Stream Scenario Annual Waste Disposal Rates in Study Area

Year	Without Expansions (Tons)	With Expansions (Tons)
2023	4,539,317	4,539,317
2025	3,677,269	4,539,317
2030	2,178,944	3,293,490
2035	928,764	2,182,002
2040	291,136	1,525,072
2045	190,971	1,404,791
2050	108,885	882,110

Figure 3 illustrates the graduate decline in landfill capacity under this scenario, with and without proposed expansions.

Figure 3: Combined Capacity (Tons) of Study Area Landfills under Constant-Stream Scenario: 2022-2050



Note: This analysis assumes that landfill expansions occur the year in which the landfill is expected to be exhausted. This timing is for illustrative purposes only and does not reflect planned or expected implementation timelines.

4.3 Regionwide Constant-Stream and Open Market Scenario Comparison

As projected waste generation increases over time (Task 7), in-region disposal capacity will decrease unless new facilities are built or existing facilities are expanded. **Table 6** compares the annual acceptance capacity under both scenarios.

- In the constant-stream scenario, capacity decreases steadily as landfills close, leaving a minimal amount of capacity by 2050.
- In the open market scenario, capacity is frontloaded as waste flows freely within the Study Area, leading to earlier exhaustion of landfill capacity but reducing short-term dependency on exporting waste outside the region.

Table 6: Study Area Projected Annual Landfill Acceptance Capacity

Base/Projection Year	Maximum Tonnage Disposed In-Region			
	Open Market (With Expansion)	Open Market (Without Expansion)	Constant-Stream (With Expansion)	Constant-Stream (Without Expansion)
Base Year (2022)	4,539,317	4,539,317	4,539,317	4,539,317
2035	4,539,317	0	2,182,002	928,764
2050	0	0	882,110	108,885

The percentage of waste disposed of in-region under both scenarios is shown in Table 7 and Table 8. Table 7 accounts for both landfill and WTE capacity (assumed to remain constant at 5.2 million tons per year as described in section 2) while Table 8 accounts for just landfill capacity.

Table 7: Percent of Waste Generated in the Study Area Disposed In-Region (Landfills and WTE Facilities)

Base / Projection Year	Waste Generated (Tons)	Maximum Percent Disposed In-Region			
		Open Market (With Expansion)	Open Market (Without Expansion)	Constant-Stream (With Expansion)	Constant-Stream (Without Expansion)
Base Year (2022)	24,247,574	22%	22%	22%	22%
2035	25,633,380	21%	11%	16%	13%
2050	26,967,800	10%	10%	12%	11%

Table 8: Percent of Waste Generated in the Study Area Disposed In-Region (Landfills Only)

Base/Projection Year	Waste Generated (Tons)	Maximum Percent Disposed In-Region			
		Open Market (With Expansion)	Open Market (Without Expansion)	Constant-Stream (With Expansion)	Constant-Stream (Without Expansion)
Base Year (2022)	24,247,574	10%	10%	10%	10%
2035	25,633,380	10%	0%	5%	2%
2050	26,967,800	0%	0%	2%	0%

4.4 State-Level Lifecycle Assessments Under Constant-Stream Scenario

The following sections describe state level landfill capacity and waste flows under constant-stream scenario. This analysis is limited to the reported data available for each landfill and does not account for potential changes in operations, expansions, or shifts in policies or regulations. Assumptions regarding historical acceptance rates and economic incentives are consistent with those described in Section 3.3. The data presented in this section refers to **Tables 1, 2 and 3**.

4.4.1 Connecticut

As presented in **Table 1**, there are seven landfills in the Connecticut portion of the Study Area. These landfills accept C&D waste only. MSW generated in Connecticut is handled by in-state WTE facilities or shipped out of state. Of the seven landfills, only the Town of Manchester Landfill and the Town of Suffield Landfill have significant capacity and regularly accept waste. Together, these two landfills account for about 4 percent of the Study Area's capacity and handle about 181,000 tons of waste annually.

Projected Capacity without Expansion

At current acceptance rates and without any expansions, Connecticut's landfill capacity will decline significantly by 2035. The Town of Manchester Landfill will be exhausted, and the Town of Suffield Landfill will have about 36,000 tons of capacity. By 2050, the Town of Suffield Landfill will have 26,000 tons of remaining capacity (see **Table 3**).

The Town of Manchester Landfill, which accepts the majority of Connecticut's C&D waste, is projected to reach capacity by 2031. The Town of Suffield Landfill is expected to reach capacity by 2091 at the current acceptance rate of 650 tons per year (see **Table 2**).

Projected Capacity with Expansions

Neither the Town of Manchester¹¹ nor the Town of Suffield landfills have planned expansions beyond their reported capacities.

4.4.2 New Jersey

As presented in **Table 1**, there are five landfills in the New Jersey portion of the Study Area. These landfills accept MSW, C&D, and ash, among other types of waste. These landfills account for about 56 percent of the disposal capacity in the Study Area, with a combined capacity of 34.0 million cubic yards, capable of holding about 21.3 million tons of waste. Of the total waste accepted by landfills in the Study Area, about 39 percent, or roughly 1.8 million tons annually, is disposed of in New Jersey landfills.

Projected Capacity Without Expansions

At current levels of acceptance rates and without any expansions, four of the five New Jersey landfills will have a combined capacity to hold about 3.7 million tons of waste in 2035. By 2050, all but the Warren County landfill will be exhausted, with a projected remaining capacity to hold 1.7 million tons of waste (see **Table 3**).

Flow control regulations in some counties, including Monmouth, Ocean and Sussex,¹² require some or all waste types generated in those to be disposed of either within the county or out of state, limiting the flexibility of intra-state waste movement. By contrast, Middlesex and Warren counties have open markets, allowing their landfills to accept waste from anywhere.[10] Additionally, all landfills in the New Jersey Study Area accept ash from WTE facilities.

As presented in **Table 2**, among the five landfills in New Jersey, the Monmouth County Regional Sanitary Landfill is projected to reach capacity first in 2029. Three of the landfills—Middlesex, Monmouth, and Ocean—have accepted more than 400,000 tons of waste annually in recent years. Sussex County Solid Waste Complex has a planned phased expansion that would extend its lifespan beyond 2050, according to projections. Even without expansion, Warren County landfill has over four decades of remaining capacity at the five-year average acceptance rate, the longest constructed lifespan in the region.

Projected Capacity with Expansions

The Sussex County Solid Waste Complex is the only landfill with a proposed expansion. If implemented, the New Jersey portion of the Study Area will have enough capacity to accept about 6.2 million tons of waste in 2035 (refer to **Table 3**). By 2050, both Warren and Sussex County landfills are projected to remain operational, with a combined capacity of 2.6 million tons of waste.¹³

¹¹ According to a conversation with a town official, a portion of the reported capacity of the Town of Manchester Landfill is not yet constructed. The current constructed capacity of the landfill was not available, so unconstructed capacity is treated as existing, not as an expansion, in this analysis.

¹² Flow control does not include an out-of-state provision, and requires all Sussex County generated waste to be disposed in county.

¹³ This assumes that the Sussex County Solid Waste Complex will expand one year prior to the expected exhaustion of the landfill's current capacity in 2032.

4.4.3 New York

As presented in **Table 1**, there are five landfills in the New York portion of the Study Area. All five of these landfills are on Long Island and, therefore, are subject to the Long Island Landfill Law, which prohibits the disposal of MSW, but allows the disposal of both C&D and ash.[8] Long Island also has four WTE facilities that process MSW.¹⁴ All landfills on Long Island but Babylon Southern Ashfill accept C&D, but only the Brookhaven Waste Management Facility and Babylon Southern Ashfill accept ash. Combined, these landfills account for about 18 percent of the disposal capacity in the Study Area, with an estimated combined capacity of 6.1 million cubic yards, capable of holding about 6.7 million tons of waste.¹⁵ Of the waste accepted by landfills in the Study Area annually, about 29 percent, or roughly 1.3 million tons, is disposed in New York landfills.

Projected Capacity without Expansion

As presented in **Table 3**, at current acceptance rates four of the five landfills are projected to reach capacity by 2035. By 2050, all five landfills are expected to be exhausted.

The Brookhaven Waste Management Facility is particularly significant, as it currently accepts more than 820,000 tons of waste annually, the highest acceptance rate in the Study Area. However, it is projected to stop accepting C&D waste by the end of 2024, with ash disposal continuing for a few more years.¹⁶

The Blydenburgh Road Landfill Complex, which accepts less than 40,000 tons annually, is also nearing the end of its lifespan, with capacity expected to be exhausted by 2024. Port Jefferson Village Clean Fill, with a much lower acceptance rate of under 1,000 tons per year, has capacity to remain operational until the 2030s but contributes minimally to regional capacity. By 2035, only Babylon Southern Ashfill will have remaining capacity, estimated at 128,000 tons.

Projected Capacity with Expansion

Several expansions have been proposed for Long Island landfills, which, if implemented, would significantly extend their operational lifespans. The operators of the Blydenburgh Road Landfill Complex have proposed an expansion that could extend its life until approximately 2040. Similarly, the 110 Sand Company Clean Fill Disposal Site has a large amount of permitted but unconstructed capacity that could allow operations to continue for over 50 years at current acceptance rates. If all proposed expansions are realized, the New York region of the Study Area will have sufficient capacity to accept approximately 23.5 million tons of waste by 2035. By

¹⁴ In addition to MSW, the Hempstead Resource Recovery Facility receives Industrial/Supplemental and APHIS regulated waste and MacArthur Renewable Energy accepts APHIS regulated waste. APHIS regulated waste is organic material generated outside the U.S., generally on ships and aircraft.

¹⁵ The absence of MSW, which on average is less dense than both C&D and ash waste, accounts for the relative density of material in the Long Island landfills.

¹⁶ To maintain consistency, this analysis projects the acceptance rate at Brookhaven as continuing at historic rates. However, conversations with professionals familiar with the landfill and reviews of landfill documents, indicate current proposals for Brookhaven would reduce annual acceptance rates to extend the landfill's lifespan for ash disposal beyond the end of 2025. The 2022 annual report filed by Brookhaven Landfill estimates the annual acceptance rate will drop from 1.1 million tons annually to 338,000 tons annually after the remaining 1.48 million cubic yards (as of Dec. 2022) capacity is consumed. This lower acceptance rate is associated with an additional permitted, but not yet constructed, 1.35 million cubic yard capacity, according to the annual report.

2050, the 110 Sand Company Clean Fill Disposal Site would remain the only operational landfill in the region, with capacity to accept an additional 16.8 million tons of waste.¹⁷

4.4.4 Pennsylvania

As presented in **Table 1**, there are three landfills in the Pennsylvania portion of the Study Area. These landfills accept both MSW and C&D waste. Collectively, they account for approximately 22% of the Study Area's total disposal capacity, with an estimated combined capacity of 11.9 million cubic yards, capable of holding about 8.5 million tons of waste. Annually, about 28% of the waste disposed of in the Study Area—roughly 1.3 million tons—is accepted at Pennsylvania landfills.

Projected Capacity without Expansion

At the current levels of acceptance rates and without any expansions of existing landfills, just one landfill, Chrin Brothers Sanitary Landfill, will have remaining capacity in 2035 and by 2050, all three landfills will be exhausted.

Grand Central Sanitary Landfill, the landfill with the second highest annual acceptance rate in the Study Area, receives nearly 700,000 tons of waste annually. Similarly, the Bethlehem Landfill, which accepts 520,000 tons per year, is projected to be filled by 2028. Chrin Brothers Sanitary Landfill, with a lower acceptance rate of 182,000 tons per year is expected to remain operational until 2045.

Projected Capacity with Expansion

Two of the three landfills in Pennsylvania have proposed expansions. Waste Management, the operator of the Grand Central Sanitary Landfill operator Waste Management is pursuing a large expansion that, if approved, could extend the site's lifespan by more than two decades.[5] [6] Similarly, the Pennsylvania Department of Environmental Protection recently approved an expansion for the Bethlehem Landfill that would extend its lifespan to about ten years.[7] There are no known expansion plans for the Chrin Brothers Sanitary Landfill.

With the approved expansion at the Bethlehem Landfill and the proposed expansion at the Grand Central Sanitary Landfill, the Pennsylvania region of the Study Area will have enough capacity to accept about 11.5 million tons of waste in 2035 (refer to **Table 3**). By 2050, even with the proposed expansions, all three landfills will be exhausted.

5 Conclusions

This memorandum evaluates the lifecycle of waste disposal facilities within the Study Area through 2050, focusing on landfills. By analyzing the current capacity, historical acceptance rates, and proposed expansions of these facilities, this study provides insights into the challenges and opportunities facing decision makers in the region. Key findings and their implications are summarized below:

¹⁷ This assumes that the operators of the 100 Sand Company Clean Fill Disposal Site will construct the permitted capacity of the site one year prior to the expected exhaustion of the landfill's current capacity in 2034.

5.1 Key Findings

- **Regional Capacity Constraints.** The Study Area produces far more waste than can be disposed within its borders and faces significant challenges in maintaining disposal capacity beyond the next two decades. Without expansions or the development of new facilities, landfills across the region will exhaust their capacity by 2031 under the open-market scenario and by 2050 under the constant-stream scenario. Additionally, although this study assumed that all WTE facilities would remain in operation until 2050, their continued operation depends on political as well as economic conditions.
- **Uneven Distribution of Capacity.** Capacity limitations vary significantly by state. Connecticut and New York face the most immediate challenges, with Connecticut relying entirely on construction and demolition (C&D) waste landfills and WTE facilities, and New York's Long Island landfills under significant political pressure. In contrast, New Jersey and Pennsylvania have larger capacities, but even these will be insufficient without significant expansions.
- **The Importance of Expansions.** Proposed expansions in New Jersey and Pennsylvania could extend regional landfill capacity, particularly at the Sussex County Solid Waste Complex, the Grand Central Sanitary Landfill, and the Bethlehem Landfill. However, these expansions, while essential, will not prevent capacity exhaustion across the Study Area, especially as waste generation continues to increase.
- **Waste Flow Complexity.** Waste movement within and beyond the Study Area is influenced by regulatory frameworks, economic considerations, and infrastructure. Flow control policies in New Jersey counties, the Long Island Landfill Law, and open-market dynamics in Pennsylvania and New Jersey shape the destinations of waste. The interplay of these factors complicates projections and necessitates a dynamic approach to planning.
- **Differences Between MSW and C&D Waste Drivers.** Waste generation is driven by distinct factors: municipal solid waste (MSW) aligns with population growth, while C&D waste fluctuates with economic activity. While this distinction is critical to understanding disposal trends, data limitations prevent precise tracking of these waste streams at individual facilities, which introduces uncertainty into capacity projections.

5.2 Implications for Waste Movement

The declining in-region disposal capacity highlighted in this analysis has several implications:

- **Increased Dependence on Waste Exports:** As landfills close, reliance on exporting waste beyond the Study Area will increase, particularly under the constant-stream scenario.
- **Regional Disparities:** States like Connecticut and New York will exhaust capacity much earlier than New Jersey and Pennsylvania, creating imbalances in waste movement.
- **Need for Adaptive Strategies:** Long-term waste movement planning must account for varying state capacities, waste generation patterns, and the timing of landfill closures.

6 References

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Attachment A: Methods

Data for each landfill in the region including the remaining volume of landfill capacity, annual tons of waste accepted annually, uncapped area, and any proposed expansions was collected to estimate the lifespan of landfills in the Study Area. This information was input into a spreadsheet model that estimated the remaining life of each landfill, as well as the region's overall capacity to continue to accept waste into landfills. The Constant-Stream and Open Market scenarios share the same data sources and inputs, though and are calculated using different methods.

Data Sources

This analysis primarily relies on data reported by landfills to the state (annual reports) and landfill permits. The study accessed this information via online state websites or information requests to the states' environmental agencies (New Jersey Department of Environmental Protection and Pennsylvania Department of Environmental Protection).

The following data was used for each state:

- Connecticut – Annual Topographic Report and Lifecycle Analysis for the Town of Manchester Landfill and the Town of Suffield Landfill. The remaining landfills in Connecticut accept limited amounts of waste and were not included in this analysis.
- New York – Annual Reports (2019-2022)¹⁸
- Pennsylvania – Solid Waste Disposal and/or Processing Permits, Annual Operation Reports (2022) and PADEP Bureau of Waste Management Disposal Information (2019-2023)
- New Jersey – Annual Topographic Surveys (2019-2023)¹⁹ and Solid Waste Facility Permits

These data sources were supplemented with questionnaires and interviews of state officials and industry representatives (see Task 3), which led to the following assumptions and actions:

- Based on interviews and conversations with state officials, it was determined most landfills in Connecticut within the Study Area are low capacity and not a major part of the waste system. Through these conversations two landfills within the area were identified as exceptions that manage significant capacity – the Town of Suffield and the Town of Manchester Landfill. The lifecycle analysis included these two landfills. The others are noted in the analysis, but their lifespan was not estimated.
- Data in annual reports and permits was supplemented with research from news reports and landfill owners/operators on expected expansions, either permitted, under review by state agency, or planned. News reports were used to understand context, but not as a source for figures.
- In some cases, the uncapped surface area of a landfill or expansion was unavailable. Review of publicly available aerial imagery were used in conjunction with site descriptions and maps, typically from annual reports or permits, to estimate the area

¹⁸ Port Jefferson Village Clean Fill annual reports were not available for all years.

¹⁹ The 2019 data year topographic report was not available for Monmouth County Regional Sanitary Fill. Sussex County Solid Waste Complex figures are from the 2022 data year topographic report, which included historic as well as current numbers.

requiring a final cap, as the volume of cap material needs to be discounted from the total landfill permitted capacity to define the available waste disposal capacity.

The reported percentages of waste generated in-region use data and projections developed in Task 7. Refer to Task 7 for the projection data sources and methodologies.

Data Inputs

The following data inputs were used in the capacity and available service life of landfills in the Study Area:

Waste Acceptance Rate (tons/year): reported waste tonnage accepted annually averaged over available years (2019-2023 where available) by landfill. This amount was used to estimate the tons of waste accepted by the landfills annually.

$$WAR_{Landfill} = \frac{\sum_{y \in Y} W_y}{|Y|}$$

where:

- W_y represents the tons of waste accepted in year y at a specific landfill.
- Y is the set of years for which waste acceptance data is available for each landfill.

Notes: Data for Port Jefferson Village Clean Fill in its annual reports was incomplete and did not include tonnage accepted annually; however, it reported waste acceptance in cubic yards. Thus, tonnage for this landfill was estimated using the waste volume to weight conversion factor described in the following section for landfills that accepted similar wastes (i.e., C&D). The Sussex County Solid Waste Complex reported historic acceptance rates in 11- to 13-month increments, which were used to develop a 12-month estimate.

The Town of Manchester Landfill reported one year of waste tonnage accepted (2023) and five years of data on the net airspace consumed (2019-2023). The tonnage acceptance rate for each of the previous four years was estimated using the 2023 ratio between tons accepted and net airspace consumed. The reported and estimated tonnage values were used input into the Waste Acceptance Rate (tons/year) equation.

Airspace Consumption Rate (cubic yards/year): reported net cubic yards of airspace consumed annually averaged over available years (2019-2023 where available) for each landfill. This rate defines the total capacity consumed each year, considering the amount of waste placed, the placement of daily and interim covers, and waste compaction during placement. This rate does not account for the airspace gain that results from waste degradation and consolidation, which over long time periods and for large landfill could be significant.

$$ACR_{Landfill} = \frac{\sum_{y \in Y} A_y}{|Y|}$$

where:

- A_y represents the airspace consumed in cubic yards in year y at a specific landfill.

- Y is the set of years for which airspace consumption data is available for each landfill.

Notes: The remaining airspace is recorded for most landfills via an aerial survey conducted within two months of the end of the year (2022). The Monmouth County Regional Sanitary Landfill did not directly report the airspace consumption rate in its annual reports, so it was calculated using the difference between reported remaining capacity across consecutive annual reports. The Sussex County Solid Waste Complex reported the number of cubic yards consumed annually in 11- to 13-month increments, which were used to develop a 12-month estimate. For Suffield Landfill, the remaining capacity was measured in June 2023. To estimate the Dec. 31, 2022 capacity, half the annual landfill acceptance rate was subtracted from the total remaining capacity.

Airspace Available (AA) (cubic yards): reported volume available in each landfill in cubic yards available as of December 31, 2022.

Notes: For the Port Jefferson Village Clean Fill, the available airspace was derived from the landfill's reported projections for acceptance rate and cubic yards accepted annually.

Expansion Volume (EV) (cubic yards): Volume of landfill resulting from expansion(s). Includes expansions that are permitted, under review by state agencies, or proposed as of June 1, 2024, and is defined from volumes reported in permits, annual reports, state, or landfill operator websites. Not all expansions are constructed and the specifics of these expansions may be modified over time.

Notes: In the case of the Grand Central Sanitary Landfill, which is in the early proposal stages, only the acreage was available. This study estimated the number of cubic yards by assuming the height or final elevation of the proposed extension will be the same as that of the existing permitted landfill.

Expansion Area (EA) (acres): surface area, in acres, of the proposed expansion. For example, if the volume of the landfill increased by expanding the landfill's capacity upwards, then the overall acreage would remain the same. Plans and quantities defined in permits, annual reports, state agencies, and landfill operators were reviewed to determine the proposed increase of the landfill's footprint. In some instances, publicly available aerial imagery was used to supplement other materials to determine expansion areas.

Notes: For 110 Sand Company Clean Fill, the expansion area was assumed to increase by the same ratio of cubic yards to acres as the existing landfill.

Uncapped Area (UA) (acres): surface area, in acres, that had not received final capping or cover as of Q4 of 2022. This was defined from annual reports, permits, or landfill operator websites. If this information was incomplete, it was supplemented by information in site plans and publicly available aerial imagery was used to estimate the uncapped area.

Final Cap Thickness (CT) (feet). Landfills reported final cap thicknesses between two and three feet. For landfills that did not report a final cap thickness, it was assumed to be 2.5 feet.

Calculations

Calculations to estimate the lifespan and capacity of landfills in the Study Area were conducted for each landfill in order to provide inputs for the Constant-Stream and Open Market scenarios.

Waste Volume to Weight Conversion Factor (VtW): ratio of the annual waste accepted rate (WAR) and the airspace consumption rate (ACR) annually. This conversion factor accounts for the amount of waste, daily and interim covers, and waste compaction and is used to estimate the amount of air space consumed using the tons of waste placed for each landfill.

$$VtW_{Landfill} = \frac{WAR_{Landfill}}{ACR_{Landfill}}$$

Final Cap Volume (FCV): volume of the final cap that is used to cover areas not previously capped when a landfill ceases operations. At two to three feet in thickness over the entire surface area of the landfill, this cap can amount to several hundred thousand cubic yards of capacity not available for waste disposal [11] for several landfills²⁰, the final cap volume is accounted for in the reported remaining waste disposal capacity estimates. However, for most landfills, the final cap volume is not accounted for or reported in permits or annual reports. Thus, for this analysis it was conservatively assumed that the final cap volume for these landfills was not accounted for. Final cap volumes for each of these landfills were developed for both constructed capacity and expansions by converting the expansion area (acres) into feet, then multiplying by the thickness of the final cap to determine the volume consumed by the final cap.

$$FCV(yd^3) = \frac{Uncovered Area (ft^2) * Thickness of Final Cap (ft)}{27}$$

Available Capacity: available landfill capacity for waste disposal in cubic yards. Determined by subtracting the volume of the final cap from the remaining landfill capacity as of Q4 of 2022.

$$Available Capacity (yd^3) = Airspace Available (yd^3) - Final Cap Volume (yd^3)$$

The available capacity was also defined in terms of tonnage by multiplying the volumetric landfill capacity by the waste volume to weight conversion factor.

$$Available Capacity (tons) = Available Capacity (yd^3) * VtW$$

Annual Capacity Consumed: Tonnage that fills the landfill each year—accounting for waste placed, the placement of daily and interim covers, and waste compaction during placement. It is distinct from the tonnage accepted annually, which does not account for placement of cover or waste compaction. The following calculation is used to find the tons of annual capacity consumption:

$$Capacity Consumed (tons) = \frac{Available Capacity (tons) * ACR(yd^3)}{Available Capacity (yd^3)}$$

²⁰ Chrin Brothers Sanitary Landfill, Middlesex County Landfill, and Ocean County Landfill

Expanded Capacity Metrics

Following the methodology described in previous steps, the same metrics are developed for each landfill undergoing an expansion. Instead of existing capacity, these calculations use landfill capacity plus the increase to capacity due to expansion.

Study Area Waste Generation and Disposal Capacity

Calculations to estimate generated waste as a percentage of current and projected disposal capacity used waste generation figures from Task 7. The base year in Task 7 projections is 2018, while the base year in disposal capacity projections is 2022. To align these bases, we used the 2018 generation estimate and 2035 generation projection to calculate the slope, assuming a linear increase in waste generation over time.

$$\text{Slope} = \frac{\text{Projected Waste Generation 2035 (tons)} - \text{Waste Generation 2018 (tons)}}{2035 - 2018}$$

This slope was applied to the 2018 estimate and used to generate a 2022 waste generation figure.

$$\begin{aligned} \text{Projected Waste Generation 2022 (tons)} \\ = \text{Waste Generation 2018 (tons)} + [(2022 - 2018) * \text{Slope}] \end{aligned}$$

To find the maximum possible percentage of waste disposed in the region existing or projected capacity was divided by existing or projected waste generation. Several variations of this calculation were conducted based on capacity scenario, inclusion or exclusion of expansions, and inclusion or exclusion of WTE facilities.

$$\begin{aligned} \text{Maximum Percentage of Waste Disposed In Region} \\ = \frac{\text{Study Area Annual Disposal Capacity (tons)}}{\text{Study Area Annual Waste Generation (tons)}} \end{aligned}$$