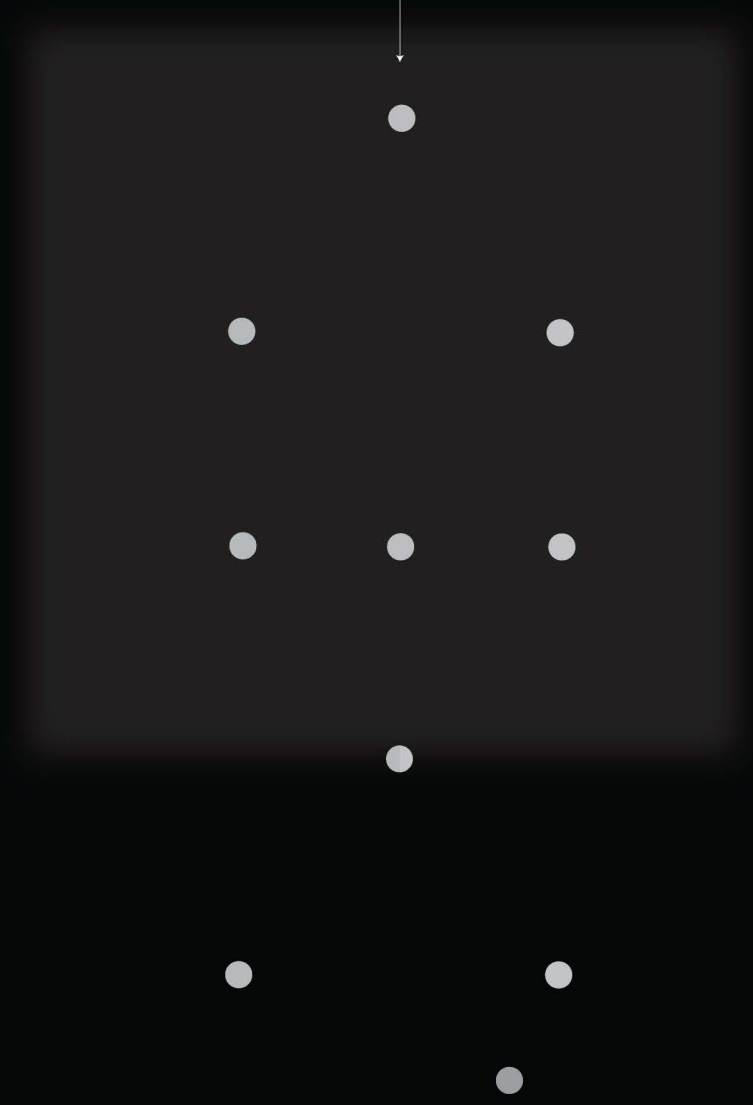
visualizing the waste system



BY CHLOE PROCK

visualizing the waste system

DESIGN, RESEARCH, AND CHARTS BY CHLOE PROCK

Project Statement

This project is a monograph study of the function of visualization as a tool for understanding the Massachusetts waste system. The topic of waste systems is broad and multifaceted. While there is no way that the full breadth of such a subject could all be covered within these few pages, the work proposes a series of methods for understanding a few facets of the system. While no individual method is sufficient for fully understanding the entire system, together they may begin to unveil some of the intricacies of the issue.

There are three sections in this monograph. The first contains introductory diagrams which frame the issue of data collection within the waste system, and charts which visualize some of this data.

The second and third portions of this monograph focus on exploration of Massachusetts waste data through spatial and temporal processes. This is done through mapping, charting, and a series of site case studies. As the information builds upon itself over the course of these pages, the hope is that so too will the viewers understanding of the data, and ultimately, of the system itself.

Broadly, this monograph underscores the importance of extensive data collection around waste management strategies, and in citizens' ability to engage with this information.

contents

what we know (and what we don't)

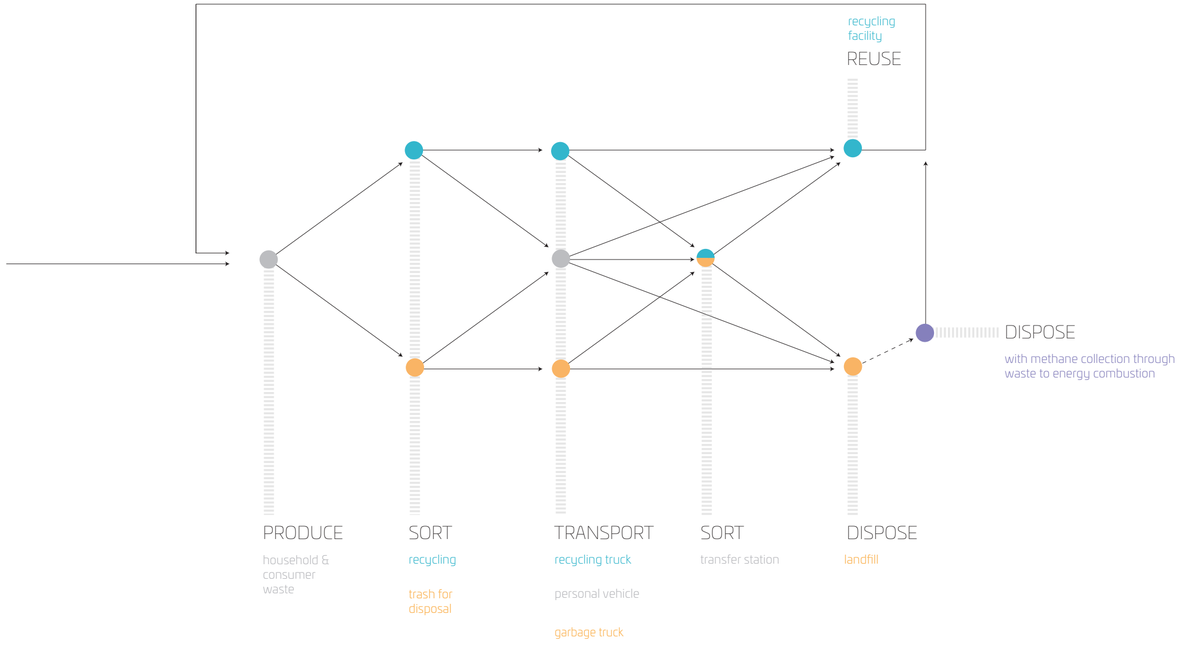
In this chapter, I propose a diagram of what we know is occuring in the waste disposal system, and then alter the same diagram to highlight the few elements of the system that we actually collect data on.

These diagrams are accompanied by visualizations of waste disposal data about the USA from 1960-2018, in order to make visible the process through which the diagrammatic proposal was formed.

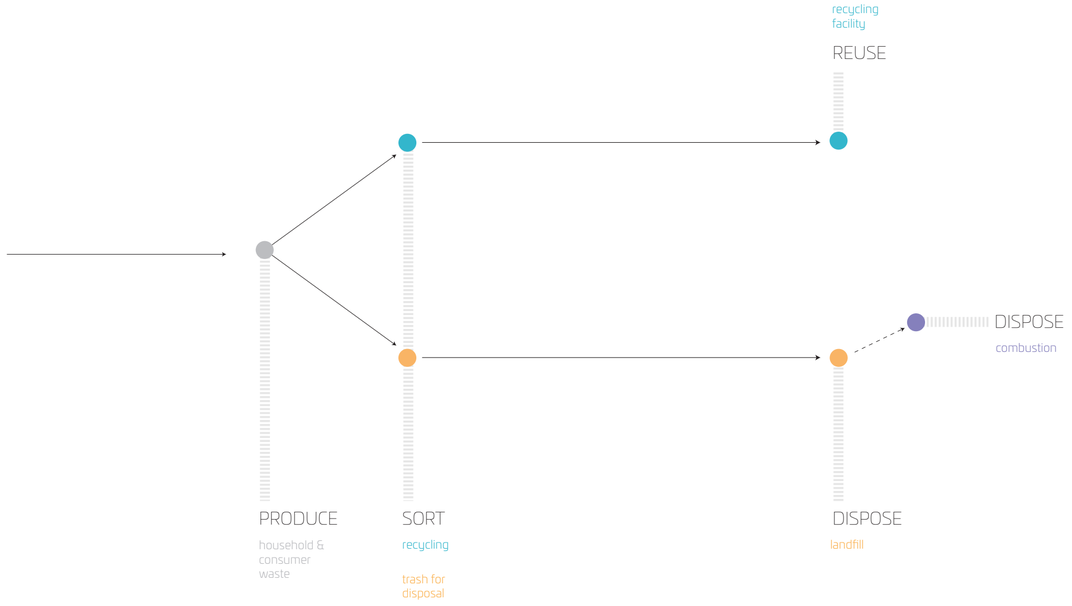
When tasked with attempting to create a visual representation of where our waste goes, it became clear that the gaps in the system are so pervasive that the somewhat basic question "where does this soda can go when I throw it away" is virtually impossible to answer succinctly.

While it is difficult to create simple representations of such a complex system, identifying key processes and features that we know to be occuring, and cross referencing these processes against the data that is collected, allows us to begin forming a picture not only of what we know about the system, but more importantly, what we don't.

what we know is happening

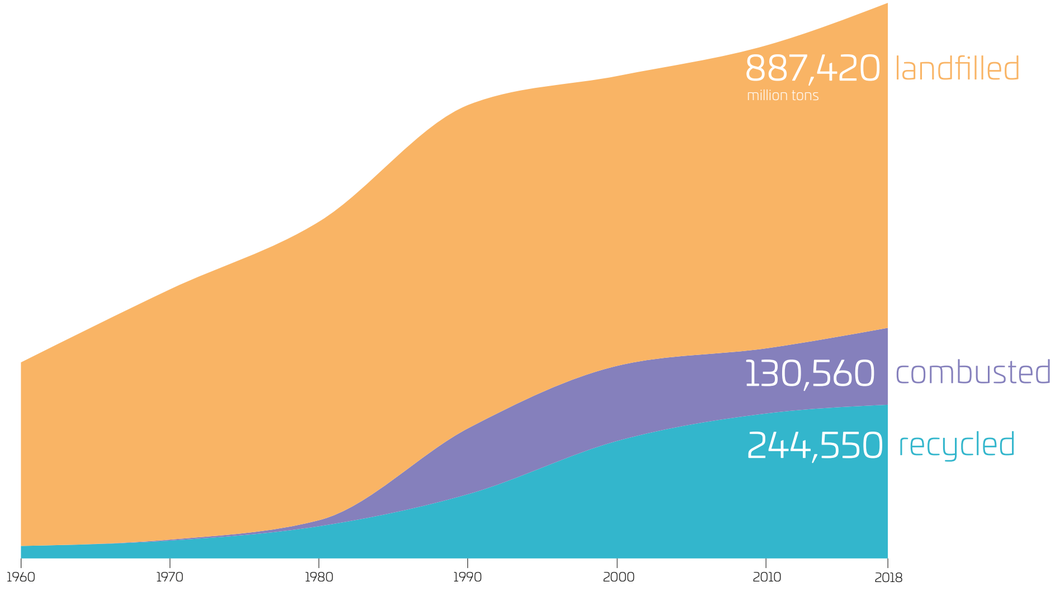


what we actually collect data on



THE DATA

streamgraph of disposal of municipal solid waste (MSW) in the USA, 1960 - 2018



matrix plot of disposal of municipal solid waste (MSW) in the USA, 1960 - 2018

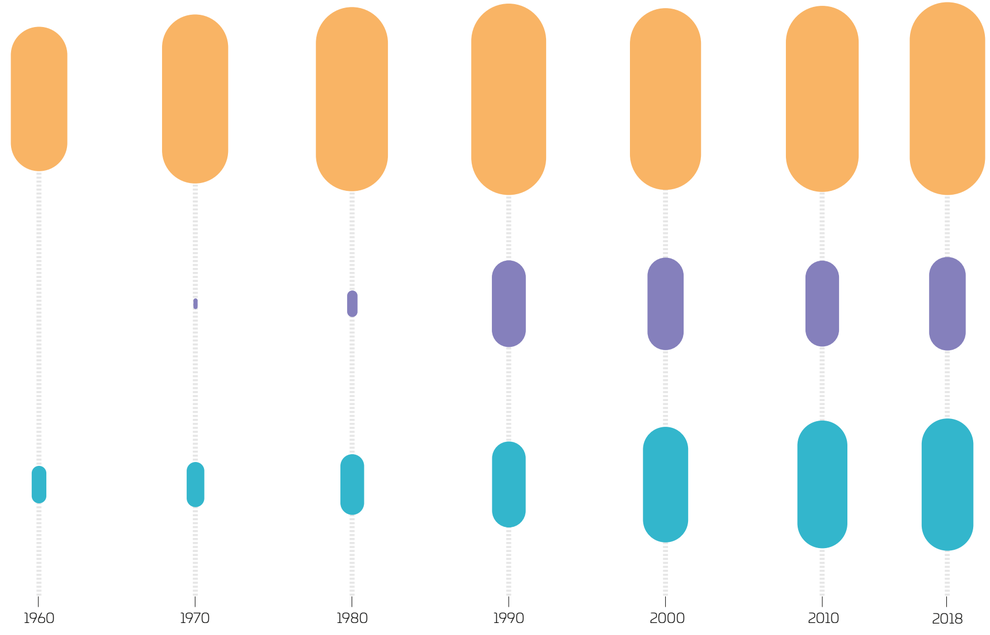
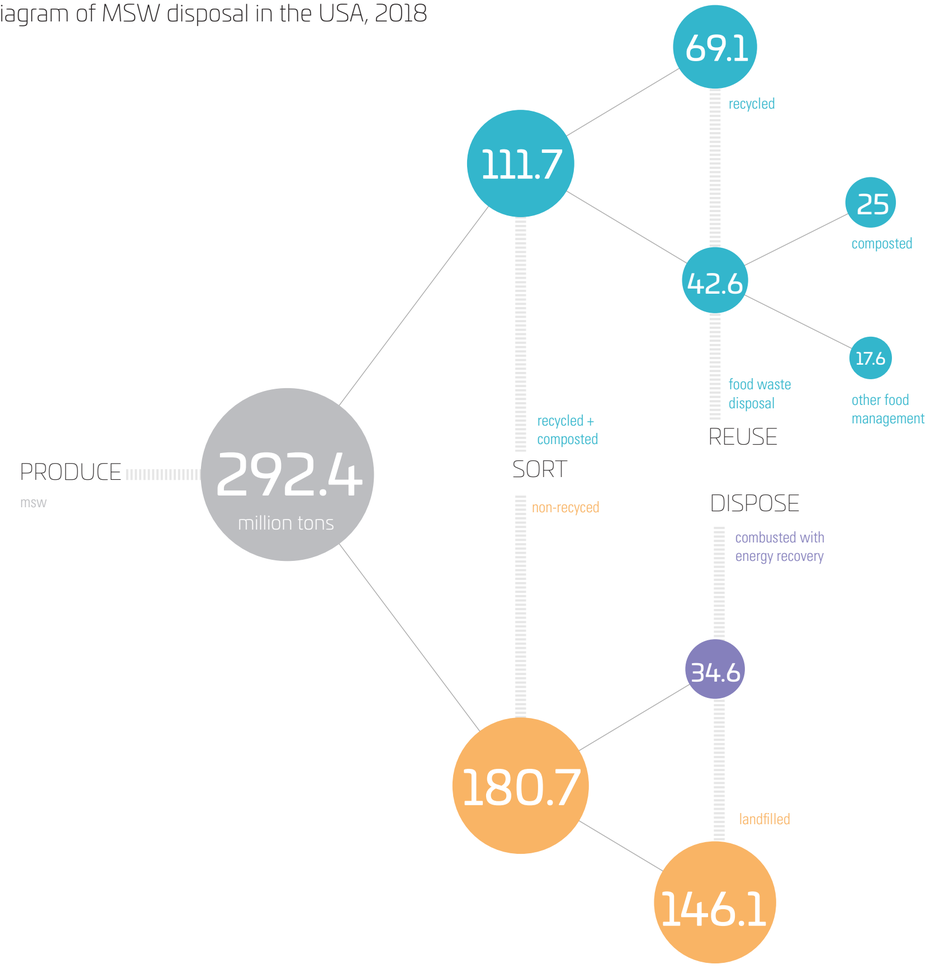
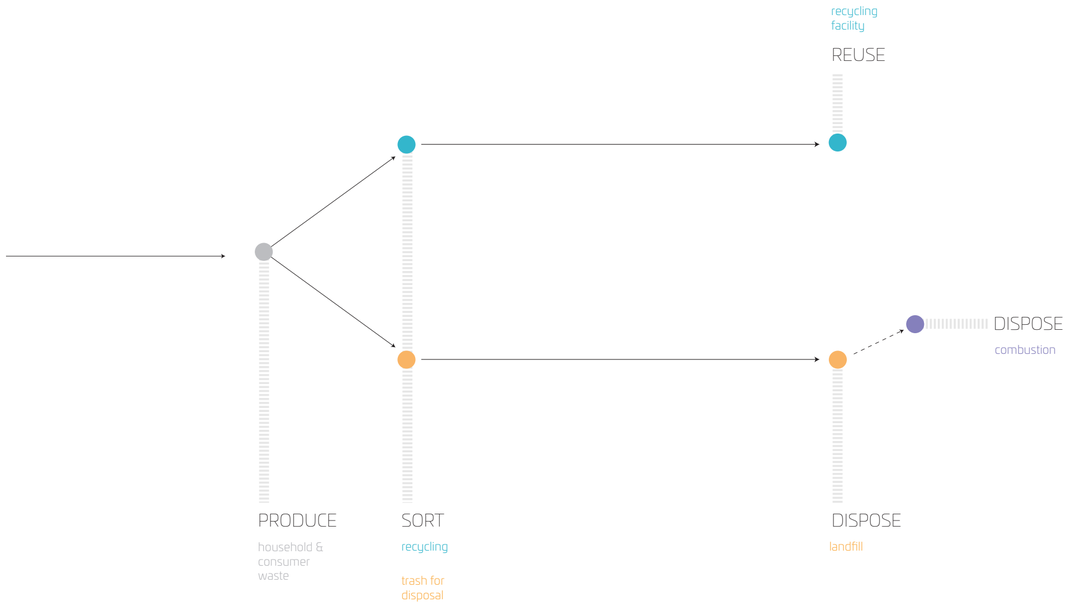


diagram of MSW disposal in the USA, 2018



The data on the left corresponds to the waste system diagram “what we actually have data on”



solid waste disposal in Massachusetts, 2014-2019

Millions of tons of MSW

- Produced
- Combusted
- Landfilled
- Net Exports

In recent years, net exports of waste in Massachusetts have increased, while the amount of waste landfilled in the state has decreased. Total amount of waste produced and combusted has remained somewhat steady. Data on recycling was not available.

Source: mass.gov

spatial understanding

Visualizing the geographic placement of active and legacy landfills is essential in understanding social and environmental impacts of waste disposal. Legacy landfills are defined as inactive and closed landfills. Legacy landfills still pose environmental risks to the surrounding area, and are consequentially monitered for 30 years after closure.

The following chapter conducts an exploration of where landfills are in Massachusetts, specifically in relationship to Environmental justice populations. It also covers more in depth case studies of legacy landfills that are registered as federal superfund sites. This is done in order to begin to visualize some of the environmental impacts of these sites, and the ongoing risks posed by legacy landfills.

SITE TYPES

Site types correspond to the variable of “activity status” in the mass.gov landfill data. The variable allows for differentiation between landfills by their status.

Type 1: Active

The active type indicates a landfill that is actively operating. In other words, it is currently open and accepting waste.

Type 2: Inactive

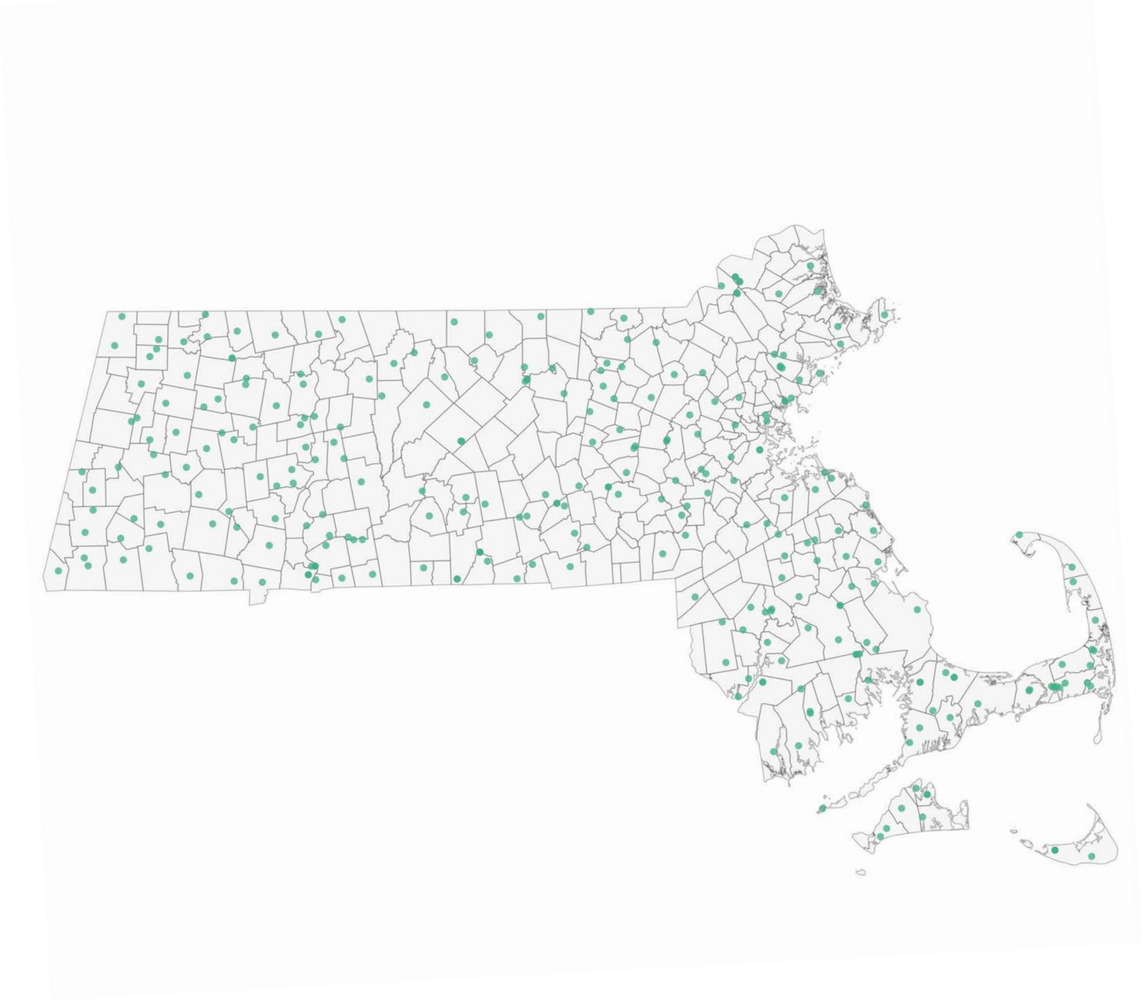
The inactive type indicates a landfill that is not actively operating, but also has not been officially closed. This means that the site is not accepting waste, but is still going through the process of closure.

Type 3: Closed

The closed type indiicates that a landfill is not accepting waste, and has gone through all of the necessary steps, such as capping, to be officially considered a closed site.

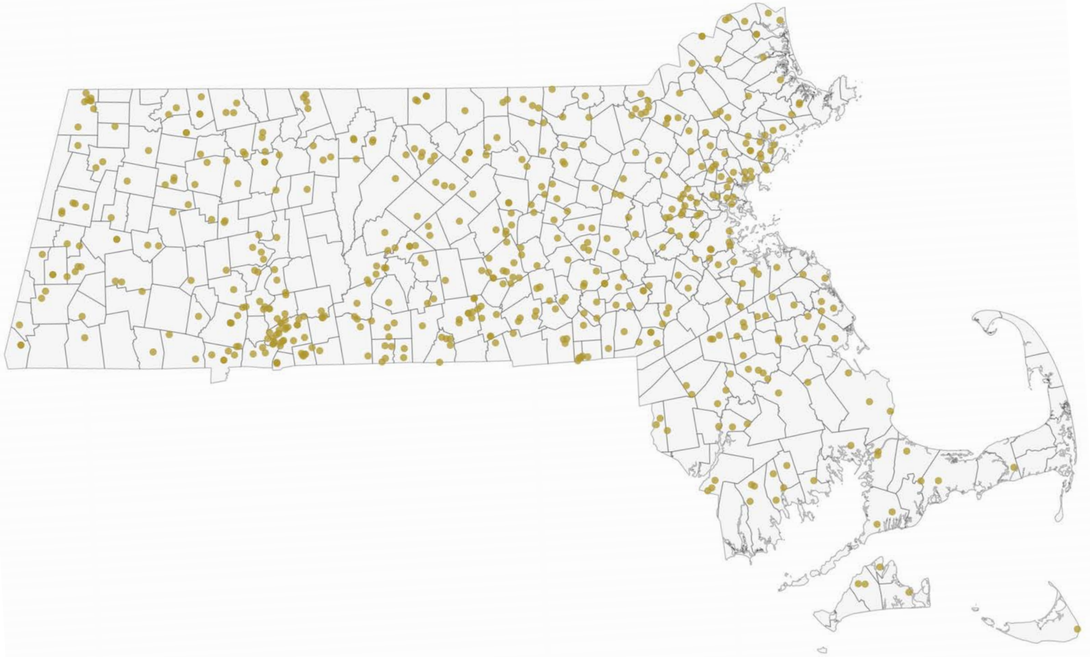
283 ACTIVE

solid waste facilities in Massachusetts



532 INACTIVE

solid waste facilities in Massachusetts

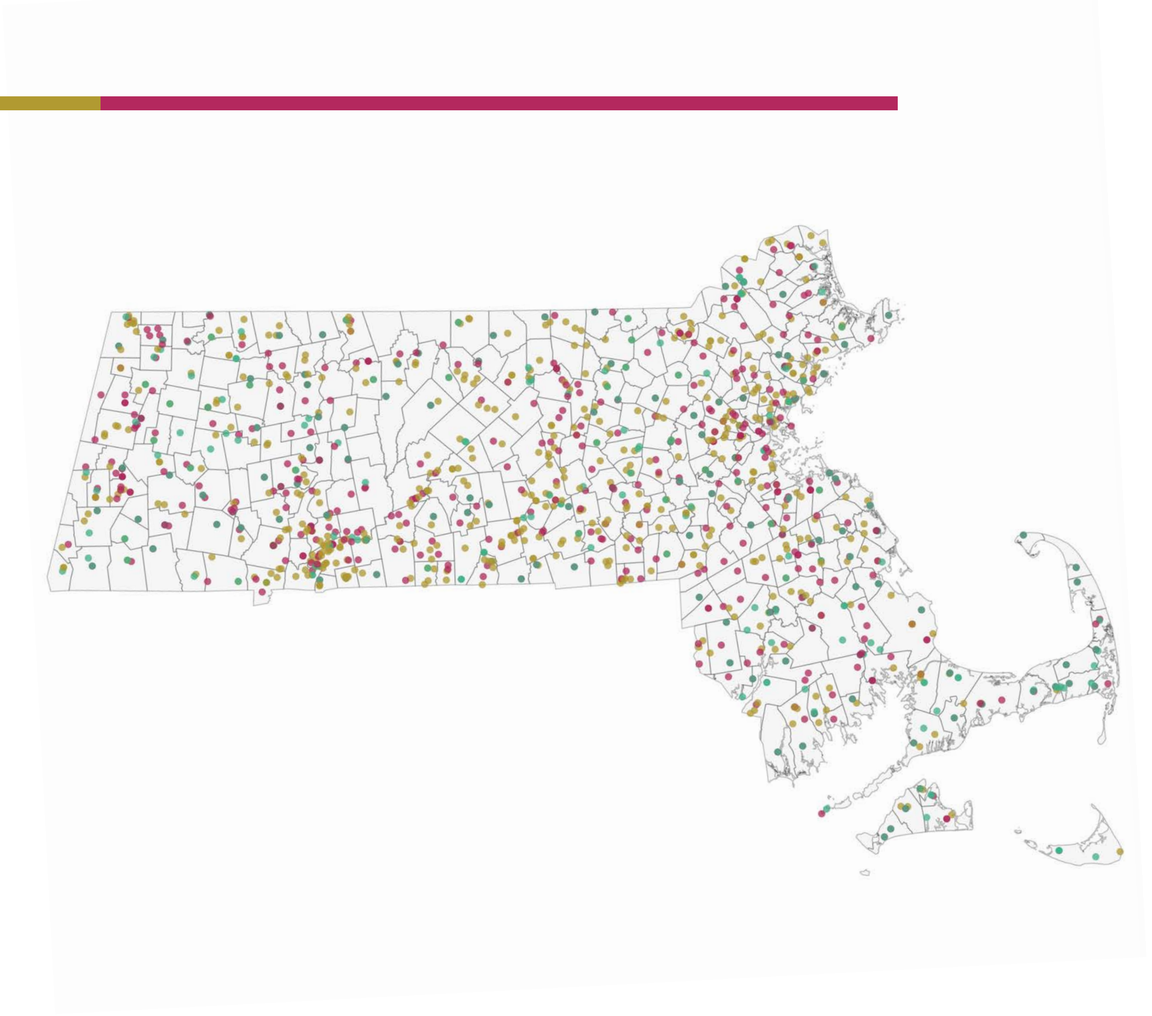


482 CLOSED

solid waste facilities in Massachusetts

1297 TOTAL

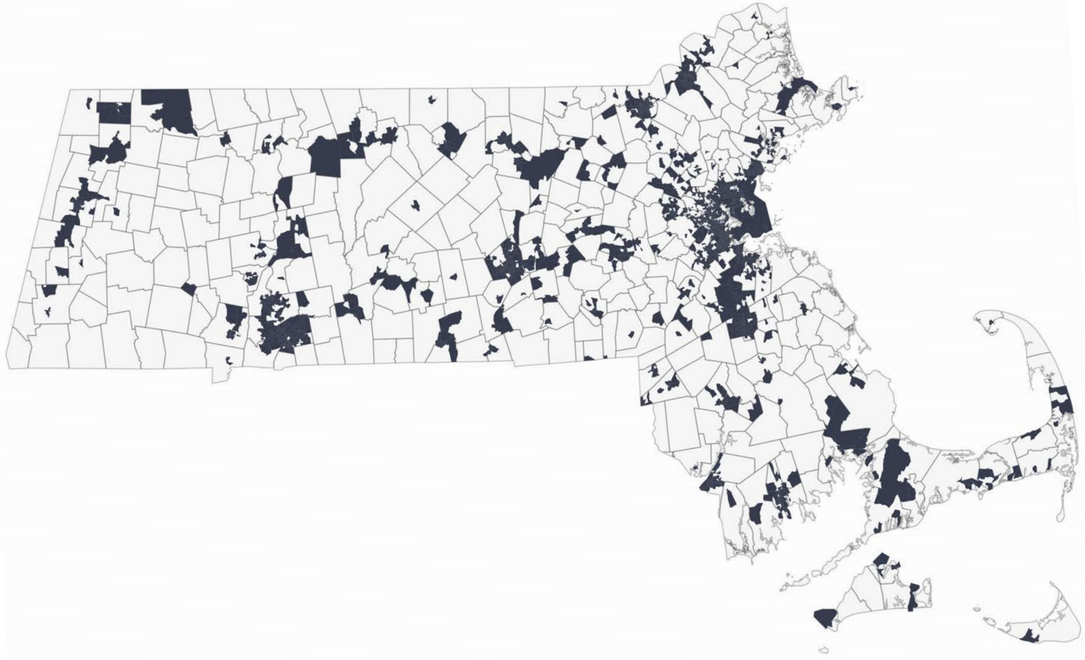
solid waste facilities in Massachusetts



What are environmental justice populations?

"In Massachusetts, a neighborhood is defined as an Environmental Justice population if one or more of the following four criteria are true:
1. the annual median household income is not more than 65 percent of the statewide annual median household income;
2. minorities comprise 40 percent or more of the population;
3. 25 percent or more of households lack English language proficiency; or
4. minorities comprise 25 per cent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 per cent of the statewide annual median household income."

Source: mass.gov



Where are landfills located in relation to environmental justice populations?

What is a Superfund Site?

"Thousands of contaminated sites exist nationally due to hazardous waste being dumped, left out in the open, or otherwise improperly managed. These sites include manufacturing facilities, processing plants, landfills and mining sites.

In the late 1970s, toxis waste dumps such as Love Canal and Valley of the Drums recieved national attention when the public learned about the risks to human health and the environment posed by contaminated sites.

In response, Congress established the Comprehensive Envrionmental Response, Compensation and Liability Act (CERLA) in 1980.

CERLA is informally called Superfund. It allows EPA to clean up contaminated sites. It also forces the parties responsible for the contamination to either perform cleanups or reimburse the government for EPA-led cleanup work. When there is no viable responsible party, Superfund gives the EPA the funds and authority to clean up contaminated sites.

Superfund's goals are to:

1.
Protect human health and the environment by cleaning up contaminated sites;

2.
Make responsible parties pay for cleanup work;

3.
Involve communities in the Superfund process;

4.
Return Superfund sites to productive use. "

Source: epa.gov/superfund

1950

Active year

Charles George Reclamation Trust Landfill

"The 70-acre Charles George Reclamation Trust Landfill in Tyngsborough, Massachusetts, started off as a small municipal dump, then expanded to accept household and industrial wastes, chemicals containing volatile organic compounds and metal sludge. The state ordered the site closed in 1983. EPA provided a pipeline supplying residents effected by contaminated groundwater with a permanent alternative water supply. EPA has capped the landfill and is collecting leachate and contaminated groundwater to eliminate immediate potential risks.

The site has been addressed through federal actions. EPA has addressed site risks by extending the City of Lowell's water supply system to the Cannongate Condominium complex. In addition, 24 residential well water users along Dunstable Road to Cannongate Road, and along Cannongate Road, were included in the waterline extension. EPA also provided a cap for the site consisting of a synthetic membrane and soil cover, a surface water management system, a passive landfill gas venting system, and a leachate collection system."

Source: epa.gov

1983

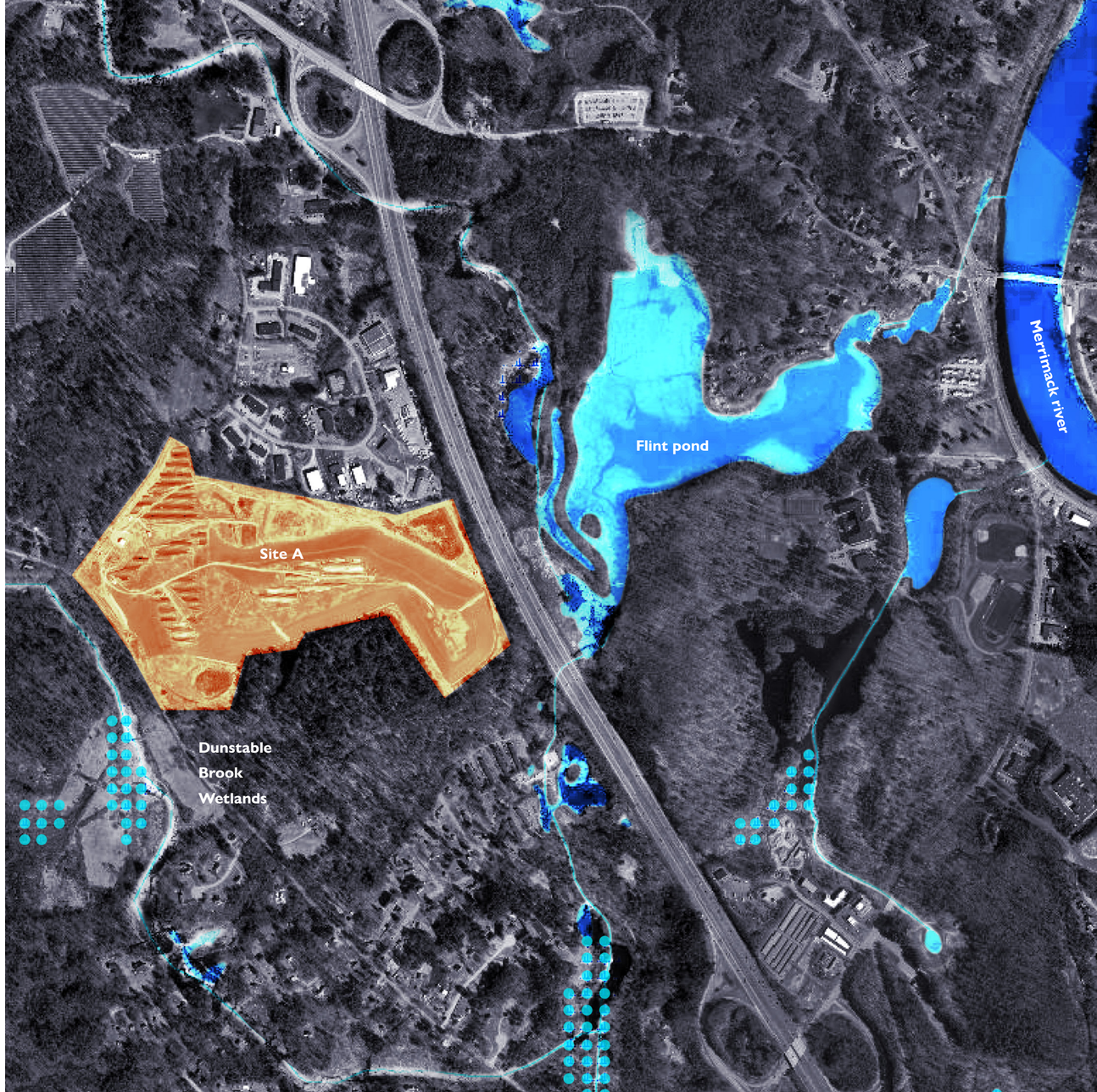
Inactive year

Waste category: MSW & Sludge

Class: Land Disposal

Closure status: Unknown

Location: Tynsborough, MA



Sutton Brook Disposal Area

1957

Active year

1988

Inactive year

Waste category: MSW

Class: Land Disposal

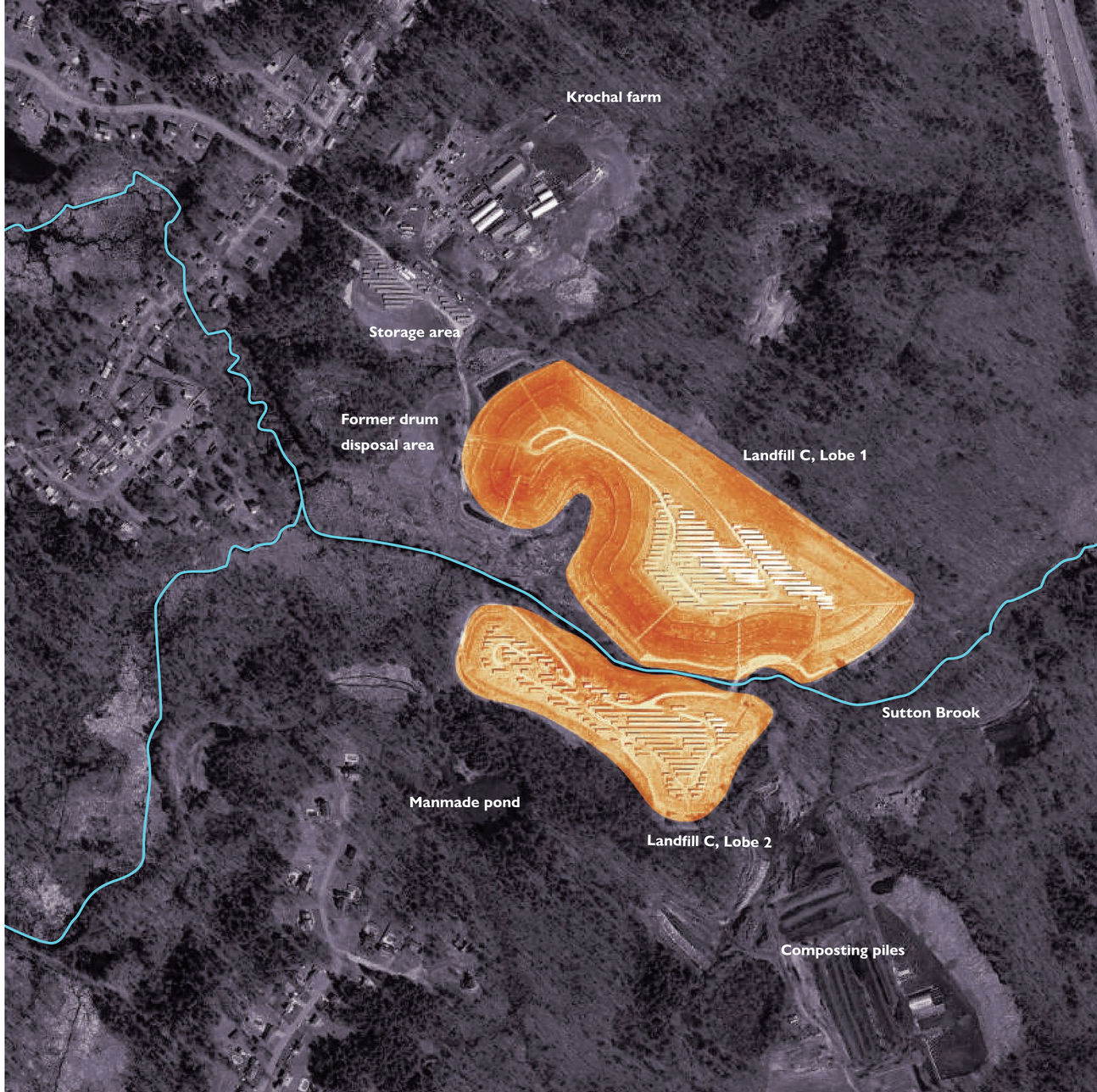
Closure status: Incomplete

Location: South St, Tewksbury

"The 50-acre Sutton Brook Disposal Area site is located in Tewksbury, Massachusetts. A small part of the site also extends into the town of Wilmington. The site includes three source areas – a 50-acre landfill, an area of buried drums (excavated in 2000) and contaminated soils associated with the drum disposal area (excavated in 2000 and 2007).

Waste disposal activities can be traced back to at least 1957, when an area of the site was used as a "burning dump". The Tewksbury Board of Health originally used this area as a temporary disposal area (landfill). In 1961, the temporary assignment was modified to require that the landfill on the site be operated as a sanitary landfill, accepting municipal refuse generated only in Tewksbury. The assignment was not complied with; the landfill accepted municipal, commercial and industrial wastes from both inside and outside Tewksbury. The owners of the landfill received numerous citations from state and local officials for violating Massachusetts Sanitary Landfill Regulations.

In 1966, the Commonwealth of Massachusetts Commissioner of Public Health ordered the Town of Tewksbury to operate the landfill using the sanitary landfill method. However, after 1966, there were documented occurrences of landfill burning, uncovered waste areas, the filling in of on-site wetlands, and wastes disposed of below the water table and landfill slopes that exceeded operation plans. Due to these violations, the Commonwealth ordered the closure of the landfill in 1979. At the time of its closure, the landfill was accepting in excess of 250 tons of waste per day. Despite the closure order, landfill



excess of 250 tons of waste per day. Despite the closure order, landfill operations continued until 1982, when official landfill operations were suspended, yet waste acceptance continued through 1988.

In 1983, a loam screening business began operation on the property. On August 11, 1983, during an inspection by the Massachusetts Department of Environmental Quality Engineering (MADEQE, now MassDEP), underground burning was observed through fissures in the ground in the southern landfill lobe. During a subsequent inspection by MADEQE personnel in August 1983, flames and smoke were no longer visible after heavy machinery had covered the fissures with soil. Subsequent investigations by Tewksbury Health Inspectors and MADEQE documented piles of demolition debris and soil on areas of the property, in some cases adjacent to and/or encroaching upon on-site wetland areas.

The site was placed on the National Priorities List (NPL) in June 2001."

Source: epa.gov

1938

Active year

1996

Inactive year

Waste category: MSW & Sludge

Class: Land Disposal

Closure status: Incomplete

Location: Old Groveland Rd, Haverhill

Haverhill Municipal Landfill

"The Haverhill Municipal Landfill is located adjacent to the Merrimack River in the City of Haverhill, Essex County, Massachusetts. The landfill consists of three tracts of land covering a total of about 73 acres. Prior to June 1981, two of the three tracts were reportedly used for disposal of municipal and commercial refuse, while the other reportedly received liquid wastes and sludges. In August 1981, the city contracted for a ground water study, and evaluation of the landfill's impact on the local environment, and development of closure and monitoring plans. The results of that study indicate that ground water in the vicinity of the landfill is contaminated with volatile organic chemicals such as benzene, toluene, and xylenes.
Two municipal wells, which had supplied drinking water to approximately 6,000 people until they were closed in 1979 due to volatile organic contamination, lie within 1 mile of the site. These wells are being investigated as part of work at the Groveland Wells Site, which was placed on the NPL in September 1983."

Source: epa.gov

out with the old; in with the new

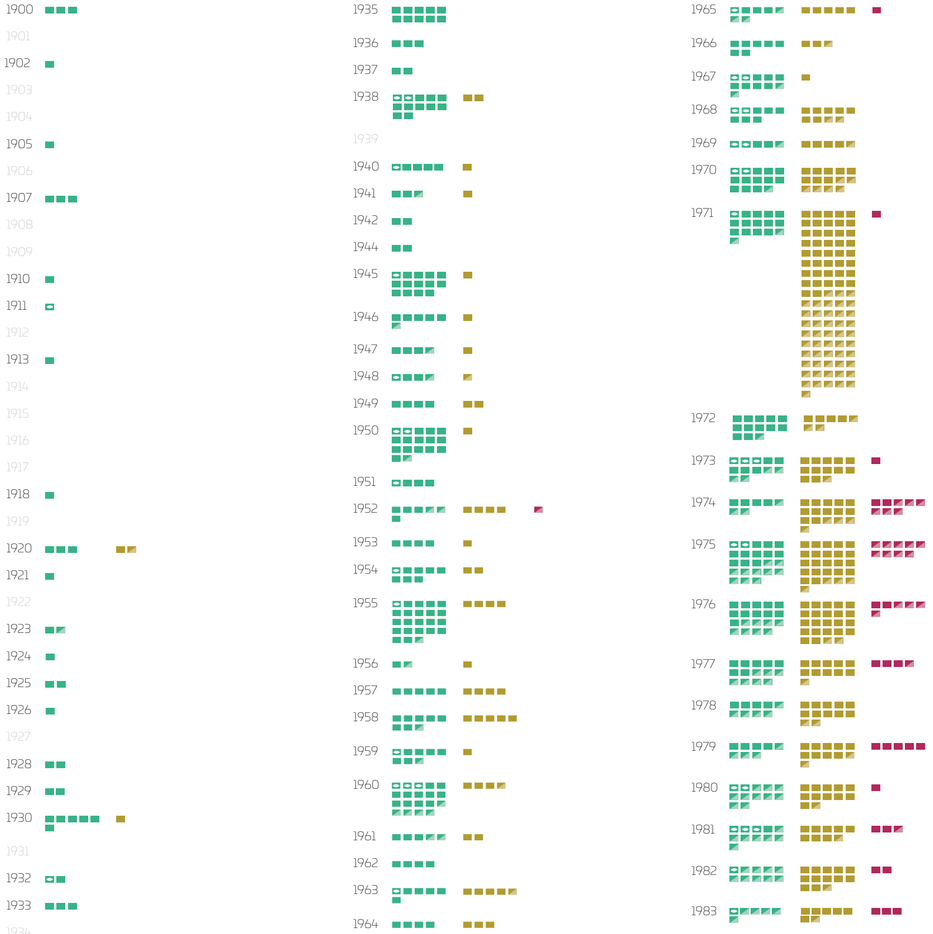
What do we learn from visualizing landfill site data, not only through a spatial lense at one point in time, but through a temporal lense? How have practices shifted over time, and what do these concrete shifts to physical points in space imply about the shifts to the waste system itself, and the impacts of governance? How do we implement new systems for research and analysis when we suspect that the data alone doesn't tell the whole story?

The process of answering these overarching questions is not easy; they unfold into a series of smaller questions, none of which have a simple answer. The focus of this chapter is to explore the new framework for analysis that arises when we think about landfills from a temporal perspective, and how we might apply this framework in a broader context to solve issues around public understanding of how the waste system works, and the impacts that it has on the land around people's own communities.

A series of case studies is presented in the section "landfill lifecycle". These case studies focus on landfills in the Boston area, and combine the mass.gov data with site photography. The goal of these case studies is to explore how site visits and more extensive site documentation emphasises the uniqueness of each site. The case studies underscore how much is lost if we consider "data" as consisting only of numbers in a spreadsheet.

LANDFILLS OPENING AND CLOSING OVER TIME (1900-2020)

CONTEXT

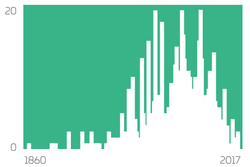


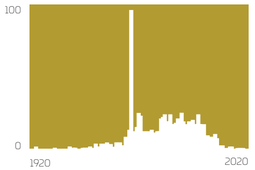
KEY

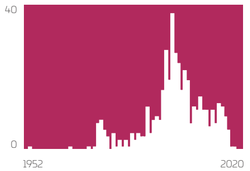
landfill
- opens
- goes inactive
- closes

landfill liner:
- unlined
- lined
- n/a

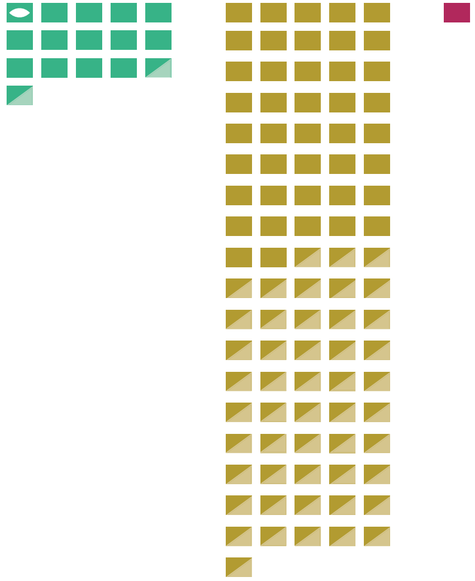
FOCUS







1971



In 1971, MassDEP promulgated its first solid waste regulations, establishing permit and operational requirements for solid waste facilities. (310 CMR 19.000)

Source: Massachusetts Solid Waste Laws

Is it a coincidence that there was a spike in landfills becoming inactive the same year that waste regulations were enacted? Why did so many landfills become inactive, but only one officially closed?

When we combine the temporal way of visualizing the data with an understanding of the history of waste governance laws, we can begin thinking about what causal relationships exist within the waste system: the measurable impacts of governance at the level of the sites.

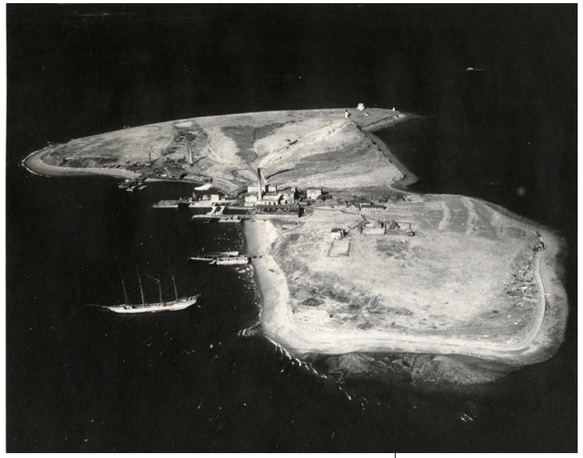
Spectacle Island

The history of Spectacle Island is long and well documented. An abundance of both archival and current images of the site exist, as well as information regarding its current usage and environmental monitoring information.

1918

Active year

Source: US National Archives



North View, circa 1939 - 1947

1959

Inactive year

Source: Land Use Database

Soil from the big dig (1990s) was used for capping.

2006

Closed year

Spectacle Island post-restoration. More than 2,400 trees and 26,000 shrubs were planted over the course of 15 years.

Waste category: MSW

Class: Land Disposal

Closure status: Capped

Location: Boston Harbour

Current use: Public park

Source: National Park Service

LANDFILL LIFECYCLE

Barry Quarry

Not all landfills have extensive records of documentation. In fact, in cases such as Barry Quarry, it is difficult to understand the full site narrative through data alone.

Site photography can greatly assist our understanding. These 3 images come from the author's archive, and were taken on a site visit in 2021.

1984

Active year

1990

Inactive year

Waste category: C & D

Class: Land Disposal

Closure status: Incomplete

Location: 403 Cummins Highway

Current use: Informal Dumping

Call to Action

It is only through the documentation of past and present practices around the waste disposal system that we can begin to unpack long term impacts. Landfills, waste treatement centers, and transfer centers are all around us. Yet they are often hidden from pubic view, and the information around them can be difficult to access. What are the long term impacts of living near these sites? What happens to each site when the active use of the area ends? How might the data collected differ from the information one can gather after the experience of a site visit?

One way to answer some of these questions is to center the conversation around community engagement with the information. There are too many sites in Massachusetts alone for one person to document. It is imperetive that more people engage with this topic, and become empowered to add to the existing information by reporting on the sites in their local area.

The ideal continuation of this project would be to create a full archive of the sites. The creation of this archive would include submissions from the public, as local residents could conduct site visits to the areas near them, and provide essential site context to situate the data within a braoder narrative. This archive would serve to expand our collective memory of land use as it relates to waste disposal practices.

Please direct any inquiries or submissions to visualizingwaste@gmail.com