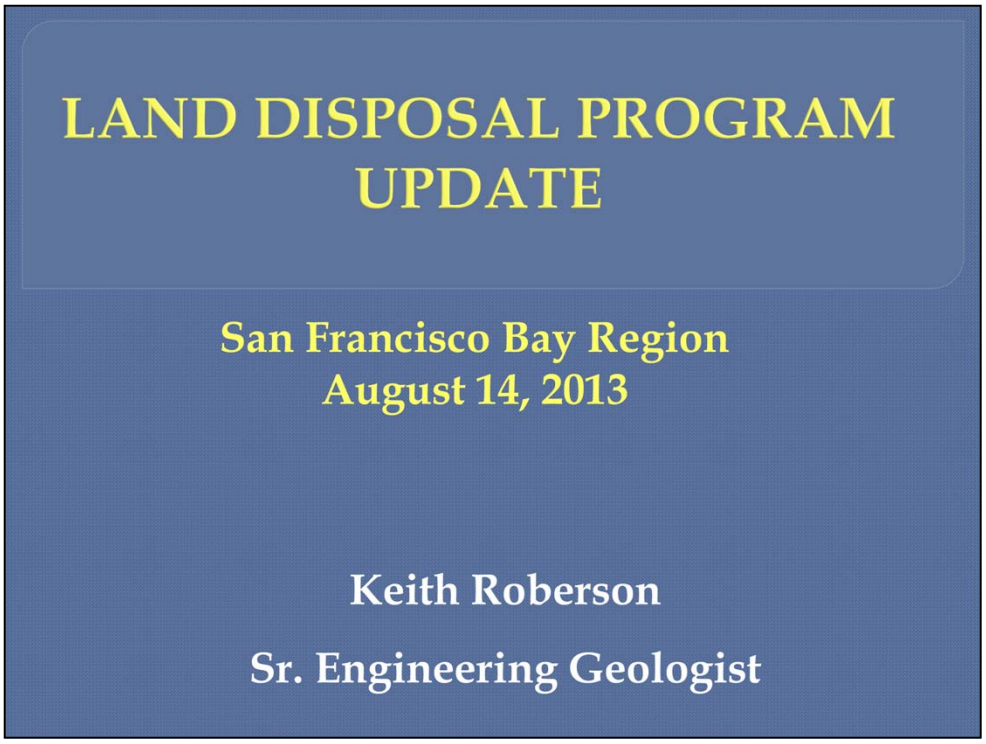
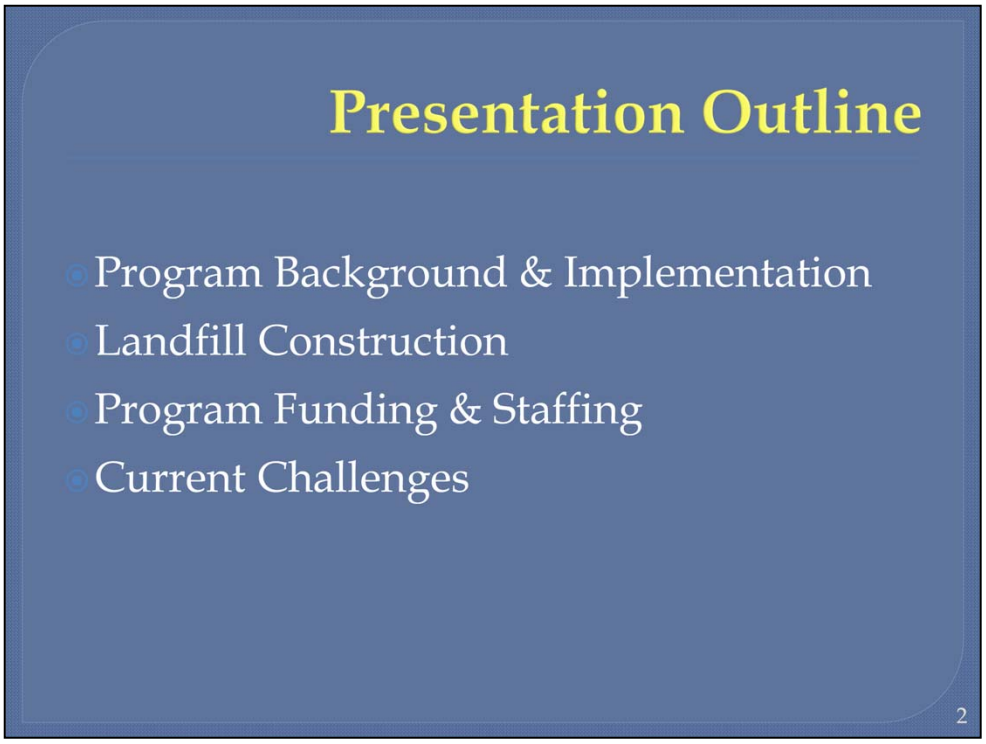


Chair, members of the Board My name is Keith Roberson & I am a Senior engineering geologist & Region 2's Land Disposal Program manager. Today I will be giving you a briefing on the status of the program, with a particular focus on how it has changed since the last program update in 2008.



I will first provide you with background information on the land disposal program and how we implement it, then I'll describe how land disposal sites are currently constructed.

I'll provide some information about how the program is funded & staffed and what we do with our time, and end with a discussion of some of the current challenges we face.

Unlike many Board programs that are authorized by the Porter-Cologne Water Code, the Land Disposal Program gets its authority from Title 27 of the California Code of Regulations. Title 27 was issued in 1997, and is the primary set of regulations governing the disposal of non-hazardous waste sites. (click)

The three main goals of the program are to assure waste is contained and there is no leakage or discharge of waste material - and that the public and environment are protected .

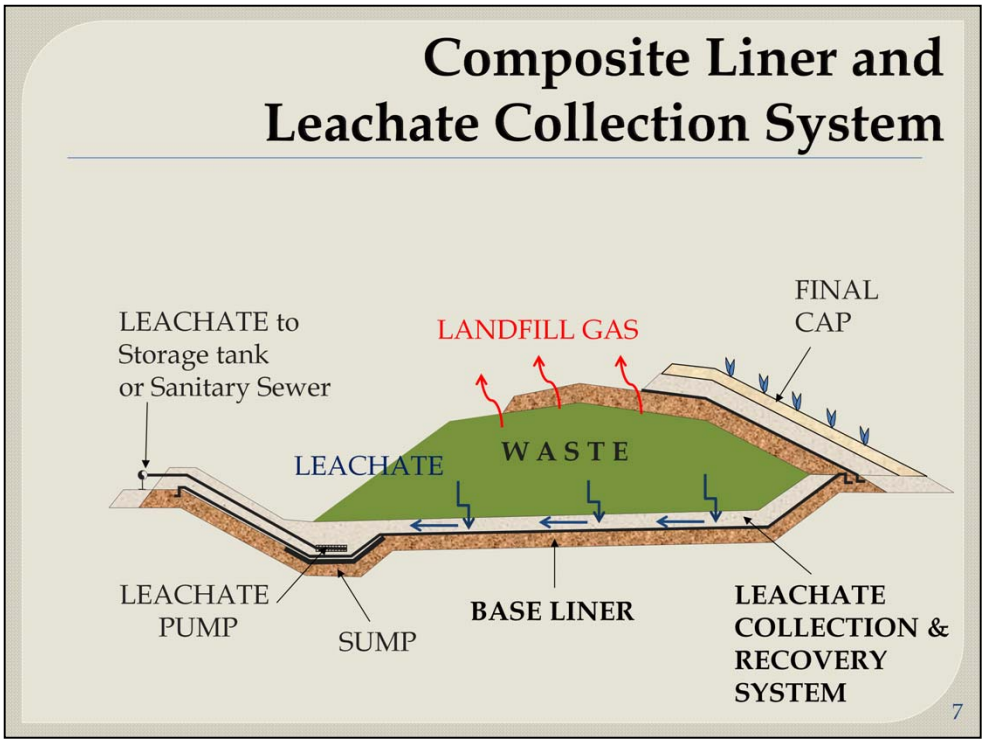
- The various aspects of Landfill operations are regulated by several agencies. In this talk, I will focus on our role in the regulation of disposal sites.
- In addition to the Regional Water Boards, another state agency, CalRecycle, is authorized by Title 27 to enforce land disposal regulations. CalRecycle's role is mainly focused on daily disposal operations, such as waste volumes, managing blowing trash, controlling seagull populations, daily cover, fire control. These responsibilities are typically delegated to a Local Enforcement Agency, or LEA, that is usually a County Dept of Health.
- The Bay Area Air Quality Management District regulates atmospheric emissions from landfills –primarily gases that emanate from the landfill, although they may also address dust and odor complaints.
- Resource agencies such as BCDC, Cal Fish and Wildlife, USFWS, and the Army Corps of Engineers get involved when landfill operations or a proposed expansion may have an impact on streams or wetlands.

Now I'll discuss the five main types of disposal sites we regulate under Title 27. These include: (click)

- Municipal solid waste or municipal landfills, which are the landfills that receive household and commercial waste that is picked up curbside or from transfer stations; (click)
- Landfills that accept only inert wastes like soil and construction and demolition (C & D) debris; (click)
- Industrial landfills, which are located on industrial facilities like petroleum refineries & chemical plants, and receive industrial process wastes; (click)
- Surface impoundments, which are waste water storage ponds used to store sludges and other liquid wastes; and (click)
- Old mine sites, which often have piles of mine tailings that have been left behind after mining ended.
- All of these types of disposal sites have the potential to impact water quality, which of course is why we regulate them.
- Also, all of these sites can accept only non-hazardous wastes; the DTSC regulates hazardous wastes and hazardous waste disposal sites under a different set of regulations. (click)
- The C&D landfills, industrial landfills, & surface impoundments don't

require a great deal of staff time because there aren't many of them, most of them are closed, and most do not present significant threats to water quality. Mines & quarries are also regulated under the land disposal program, but these are a very different type of disposal site that I will not discuss in this presentation.

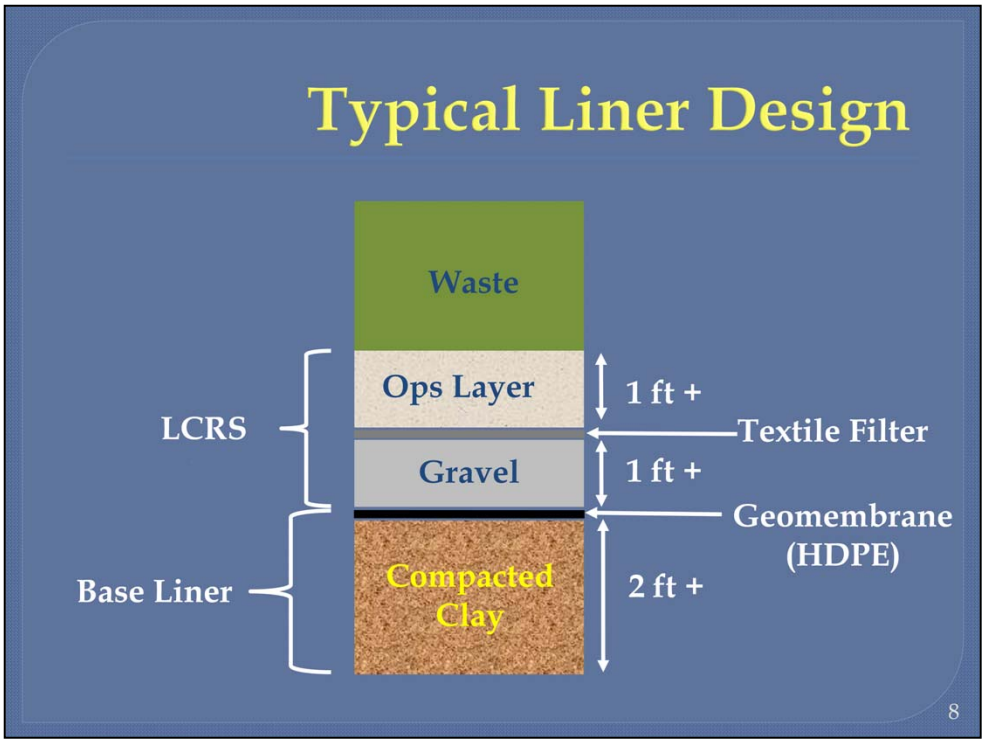
- Most of our focus in this Region is on active and closed municipal landfills There are quite a few of them, and active landfills have ongoing fill operations, active leachate management, and every few years, new disposal cell construction. For these reasons, the active MSW landfills generally require the bulk of LDP staff time.
- There are currently 10 active MSW landfills in this Region, but the number has been declining due to the rising cost of waste disposal. Typically, each Bay Area county has one MSW landfill, although Alameda has two & Santa Clara County has three. San Francisco and Sonoma Counties have no active MSW landfills within this region.
- In the old days, there were a lot of relatively small privately owned landfills. Now, for reasons I will explain, waste disposal has become very capital-intensive, and the number of landfills is smaller, but the remaining municipal landfills are a lot bigger, and all of them are owned and operated by very large corporations. There are no more “mom & pop” garbage dumps, and for water quality’s sake, that is a good thing.
- In addition to the 10 active municipal landfills, we regulate 56 closed landfills. Most of these are located on the Bay front and almost all of them are unlined. Providing regulatory oversight for closed landfills does take staff time & presents its own set of challenges.



- I want to spend some time here on the design & construction of a modern municipal landfill, because there is a common public misconception about landfills that they are simply “garbage dumps”- a hole in the ground where you toss waste and cover it up. That was basically true in the past, as you will see a bit later, but hopefully with the next few slides you will understand that this is no longer the case.
- This figure shows a cross section of landfill with all its major components labeled. The 3 main parts are the base liner system and the overlying leachate collection & recovery system or LCRS; the core consisting of the waste; and the cover or cap. This figure greatly exaggerates the thickness of the base and cap, each of which are generally 4 or 5 feet thick, whereas the internal waste pile can be 20 to 300 feet thick.
- As I mentioned earlier, the Water Board focuses its attention on the bottom of the landfill (click) and especially on the base liner & LCRS. CalRecycle & the LEAs focus on what goes into the waste pile, and the LEA & the air board regulate the upper surface. We also regulate the surface once the final cap is constructed.
- The waste pile produces a liquid called leachate that comes from three sources: 1) fluid that is buried with the solid waste, 2) rain that infiltrates into the waste, and 3) fluid that is squeezed out of the waste by compression. (click) Leachate drains downward into the LCRS and then

flows laterally at a slight grade into a collection sump, and from there is pumped out and stored in tanks, reinjected into the landfill, or sent to the local sanitary sewer.

- Decomposition of waste produces large volumes of gas, primarily methane, that migrates upward (click). Like the leachate, landfill gas has to be carefully monitored, collected, and managed. Landfill gas is collected with a vacuum system and is either flared off or, if a sufficient amount is produced, it can be burned for electricity production.



- Now we'll zoom in and take a closer look at the component parts of the landfill base. These parts are required by State & Federal regulations for all municipal waste disposal cells constructed since 1993.
- Starting at the bottom, you have at least 2 feet of compacted clay, which in itself will be virtually impermeable. Landfill cells built before 1993 typically had a compacted clay liner if they had any liner at all. The clay is overlain by an impermeable geomembrane composed of High Density Polyethylene or HDPE. (click) Together, the clay and the overlying HDPE layer form the **base liner** that is responsible for containing fluids and preventing them from leaking out of the landfill.
- On top of the base liner, you have the **LCRS** (click). The LCRS includes 3 components, starting with 1 foot of gravel, overlain by a textile filter fabric, which is covered by at least a foot of soil called the operations or ops layer. The gravel layer is intended to be very permeable. You want leachate to move easily through this material so that it can be collected and removed. The textile fabric allows fluids to pass through into the gravel but traps soil & fine sediment that would clog up the gravel layer and reduce its permeability. The "ops" layer simply cushions the gravel layer from being deformed or penetrated by large objects in the waste.
- Once this composite liner is in place across the disposal cell floor, waste is then placed in the cell on top of the operations layer.

Now I'll show you what this looks like in the real world. This photograph was taken at Potrero Hills Landfill during construction of a disposal cell on the landfill floor. From right to left you can clearly see each layer of the composite base liner and the Leachate Collection & Recovery System:

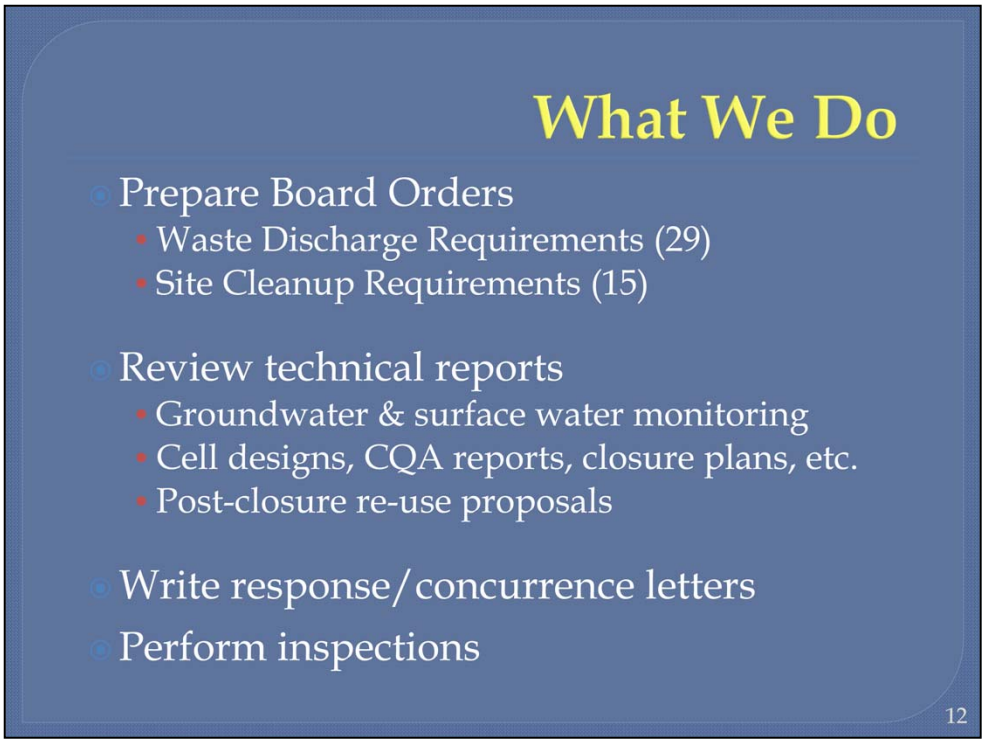
1) The upper surface of the two feet of compacted clay
2) The HDPE geomembrane
3) The foot-thick layer of pea gravel
4) The geotextile filter, and
5) The operations layer. The waste will be placed directly on top of this surface.

This photograph to a large degree shows why the cost of landfilling waste has skyrocketed. These materials are expensive, as anyone who has done any backyard landscaping knows. It now takes a major capital investment to construct a single disposal cell, let alone an entire landfill. Constructing this type of composite liner across the floor of a disposal cell, which can occupy an area of 10 acres or so, is typically several million dollars just in materials cost alone. But this requirement has resulted in significantly better landfill performance in terms of waste isolation and leachate control. You should take some comfort in knowing that your higher garbage bills are paying for better water quality.

- Despite all the engineering, effort, and expense that goes into landfill design and construction, landfills continue to pose threats to water quality. The four main threats to water quality from landfills are: (click) releases of leachate to groundwater; (click) runoff of stormwater that has come in contact with waste; (click) releases of landfill gas and gas condensate; and (click) catastrophic failure of landfill slopes or liners.
- While landfills are designed to contain leachate, occasionally some does escape through rips or tears in the liner. Leachate can contain various contaminants that can impair water quality, including chlorides, metals, petroleum hydrocarbons, volatile organic compounds, and ammonia. Leachate loss is generally detected through the groundwater monitoring program.
- Similarly, storm water runoff that has come in contact with waste or leachate can impact groundwater or nearby surface water.
- Landfill gas consists primarily of methane and carbon dioxide that are collected by a vacuum vapor collection system, but some of the vapor condenses within the collection lines and is collected as a fluid. Condensate can impact groundwater in the same ways that leachate can.
- Also, slope stability is very important in waste containment. Slope failures are infrequent, but when they occur, usually in response to earthquakes or intense rain events, large amounts of waste can be released. Earthquake

damage could include failed slopes along with liner and cover damage. Our WDRs require prompt landfill inspections after any significant earthquake activity within a certain radius of the site.

- Now I will say a bit about how the land disposal program is staffed & funded. The LDP in Region 2 is currently managed by a full-time Section Leader (that would be me) and 5 staff members, four full-time and one currently transitioning from half-time to full-time in this section. So we have 6 staff assigned to the program. (click)
- However, LDP funding for this Region is only 3.2 staff positions per year, thus, there is not enough money in the LDP budget to cover all staff full-time. For this reason, each LDP staff member also works on several cleanup sites that are in the Site Cleanup Program's cost recovery arrangement.
- Program funding comes largely from two sources, both administered in Sacramento. One are the landfill tipping fees, so named because they are charged each time a garbage truck tips a load of trash into a landfill. The other source are the permit fees charged to all sites regulated under Waste Discharge Requirements.



Here is a brief summary of what the Land Disposal Staff do with our time: (click)

- The part of our work that you see are the Board Orders that we bring to you for adoption. Over the past 10 years, the Board has adopted 29 WDRs & 15 SCRs, for an average of about 4 to 5 orders per year. These numbers are not new orders, because we don't have any new landfills, but also include updates, revisions, and amendments. (click)
- In addition to preparing orders, we spend a large amount of our time reviewing various technical reports, including groundwater monitoring reports, disposal cell design plans, construction quality assurance, or CQA reports, which document that a disposal cell was constructed in accordance with the approved plan, closure proposals, etc. (click)
- We also write a lot of letters responding to the reports we review. (click)
- We also perform inspections, typically about 40-50 per year. (click)

In addition to the chronic problems of underfunding & understaffing,the Land Disposal Program faces several new challenges that were not on the horizon a decade ago. These include: (click)

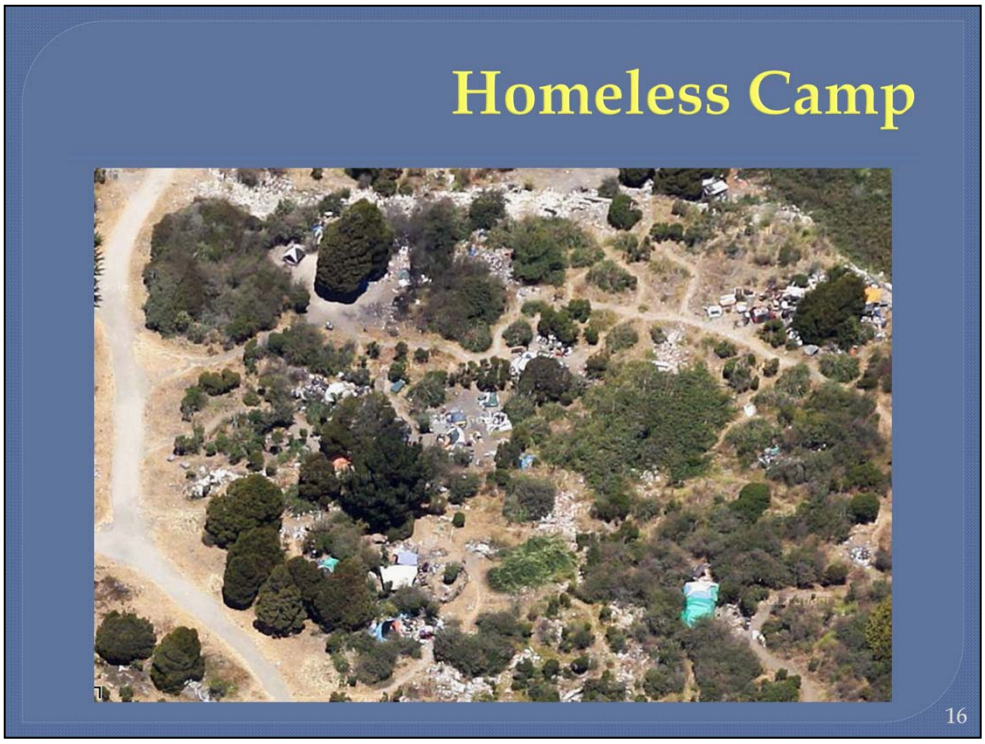
- Dealing with proposals for not only commercial redevelopment on closed landfills, but now residential development (click)
- Unauthorized full-time occupancy of landfills by the homeless (click)
- Vehement public opposition to landfill expansions, and (click)
- Rapid changes in the waste management industry, including a strong recent trend towards waste diversion & reuse rather than disposal. (click) and
- Preparing for the effects of Sea Level Rise on low-elevation landfills

For almost two decades we have been allowing old closed landfills to be redeveloped for beneficial purposes. Initially, landfills were set aside as open space or parks with public access for hiking, bird watching, etc. In the 90's more landfills began being used for commercial purposes such as golf courses, business parks, retail stores, and even hotels.

This modified photograph looking south over the city of Santa Clara shows two adjacent landfills that are in the process of being developed or planning for development. This is Highway 237 & Great America Parkway, with the closed Santa Clara All-Purpose Landfill in the center, and the closed Highway 237 landfill in the foreground. These buildings in this image are conceptual, but the two buildings on the west have been built and plans for these others are moving forward.

Because of issues with structural stability and landfill gas emissions, we always considered long-term human residency completely inappropriate as a land use for old landfills. However, in the past four months we have received our first two proposals for mixed commercial & residential development over landfills, both in Santa Clara County. As part of the proposed development associated with the new 49ers stadium here (click), Santa Clara is considering a mixed-use development that would include residential apartments. We have not decided how to respond to this proposal.

Another new problem is that of people choosing to live, without permission, on old landfills. Here on the Albany Bulb, which is an old C&D landfill extending out into the Bay west of Highway 880, a group of 60- 70 homeless people are now calling this site their home.



This aerial photo shows a closer view of the homeless camp at the Albany Bulb. We aren't sure about the extent of water quality impacts due to this unauthorized occupancy, but we do know that the people are disturbing the landfill cap by excavating and removing debris for art projects. The city is trying to figure out what they can do about it.

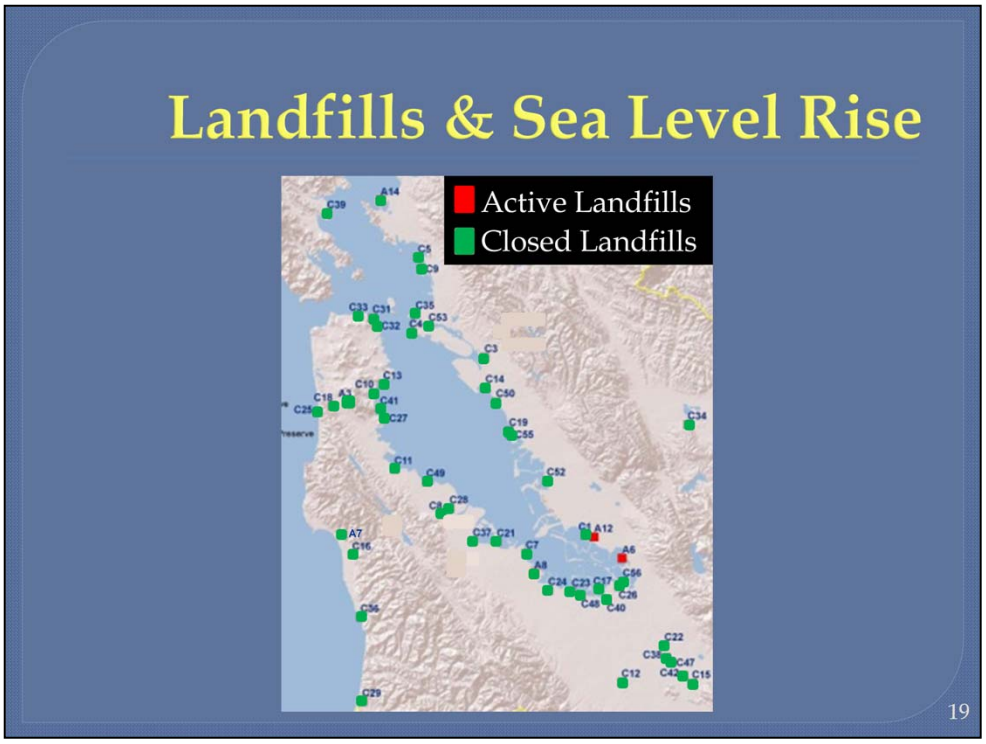
Another challenge is getting landfill expansions approved. Due to intense local opposition, a new landfill hasn't opened in California since 1995; the youngest landfill in Region 2 is Keller Canyon, which was permitted in 1992 and began accepting waste in 1994. Even with increased recycling, some municipal waste still has to be buried. But as the old landfills reach capacity and close, some of our existing landfills will have to be expanded.

Lateral expansions have been recently approved for the Redwood Landfill in Marin County and Potrero Hills Landfill in Solano County, shown here. Those expansions were strongly contested each step of the way, and each took about 10 years. Each also took a huge amount of staff time to oversee. We fully expect similar opposition to any proposed expansion in the future.

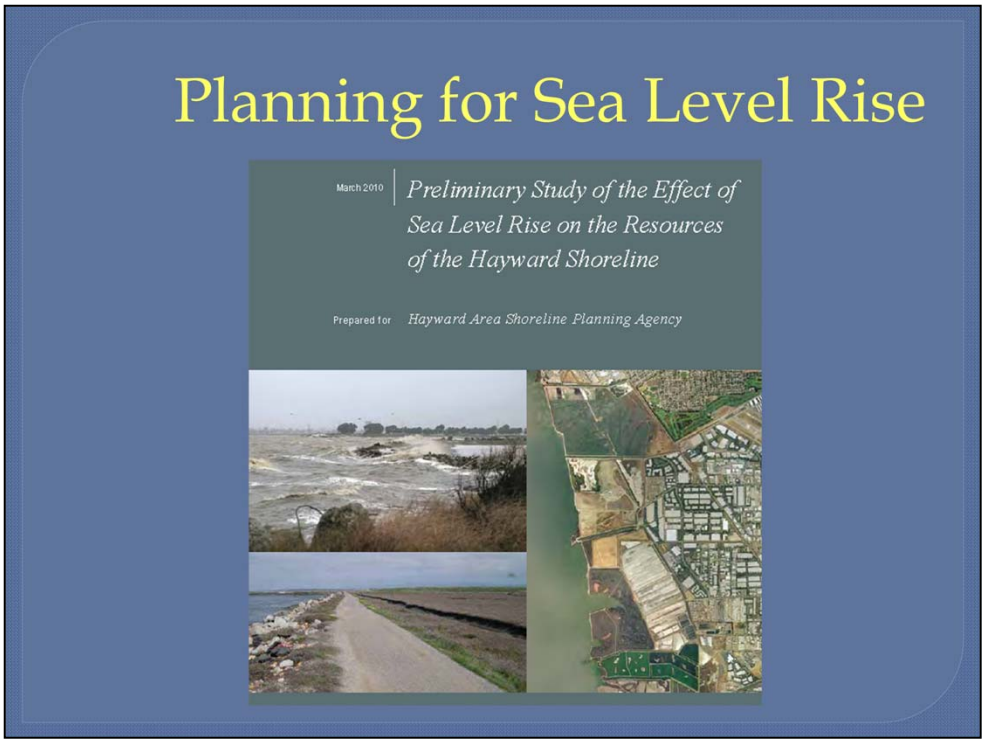
Another challenge I want to mention is the rapidly changing nature of the waste management industry. One change that is overwhelmingly positive is a vast increase over the past decade in the percentage of waste that is no longer buried but diverted for recycling and composting.

These changes are visible not just at the disposal sites we regulate, but everywhere. A decade ago, you used to simply toss your trash in one of these (click). Now we're confronted with all these options (click) that even confuse me, and I'm the land disposal program manager. Sometimes, you don't even get the trash option (click) and your refuse either gets recycled or composted.

You're probably wondering why we consider recycling & composting to be a challenge. But recycling & composting facilities are popping up all over the place, and like landfills, these facilities also present nuisances to the community through odors & noise, and they have the potential to create water quality impacts that are not specifically regulated under Title 27. The State Water Board is currently developing regulations that properly address the potential impacts from recycling & composting facilities. Also, because recycling & composting facilities don't pay tipping fees or WDR fees, the State is deprived of one of its primary sources of funding for the land disposal program.



- To see the challenge we face from sea level rise, all you need is a quick look at this map of the San Francisco Bay. As I mentioned earlier, the vast majority of our older landfills were built on the Bay margin, as shown by the grey squares.
- We have three active municipal landfills and 37 closed landfills located along the bayfront and essentially all of these, as well as some on the Pacific coast, lie within a few feet of sea level. So with just a few feet of sea level rise all of these landfills will be inundated and exposed to wave erosion.
- We have already begun addressing this issue by including new requirements in our WDRs for Bayfront landfills. For example, the WDRs for the Redwood Landfill that were updated in 2009 required the landfill to raise the elevation of their levees and to consider other actions to prepare for the effects of sea level rise. We will continue to use our authority under Title 27 to ensure waste containment at these facilities.



Several Bayfront communities are already planning for sea level rise, as shown by this document released by the Hayward Area Shoreline Planning Agency. This document does consider the effects of sea level rise on landfills as you can see from this table (click).

Planning for Sea Level Rise

Function	Land Fills
Location	Land fills are located in the center of the planning area directly behind the Bayshore levee.
Types of Hazard	Tidal inundation, sea level elevation, wind wave erosion, ground water elevation.
Proximity to Hazard	Land fills are located directly behind the Bayshore levee.
Mode of Failure	There are five main modes of failure: • Erosion and breaching of outboard levees by wind waves may allow erosion of the land fill itself. • Overtopping of levees by wind waves will erode levee crests and back slopes. • Overtopping and erosion of levees may impact integrity of the the land fill drainage system. • The land fill drainage system will become more difficult to drain as Mean Low Low Water rises. • Groundwater elevations are likely to rise which may change the flow paths of any contaminated water from the land fill.
Severity of Damage	Failure of the levees may result in erosion of the land fill itself. Rising base and groundwater elevations will make the correct operation of the land fill drainage more difficult over time.
Risk of Damage	The risk of damage will increase overtime as both sea level and groundwater rises and damage to the channel levees accumulates.
Adaptation Measures	The levees that protect the land fills may have to be raised and improved with additional armor. Cutoff walls could be constructed to prevent groundwater intrusion from the Bay. Pumping may be necessary as base levels rise.

I won’t spend any time here other than to mention that Hayward has already outlined adaptive measures that could be implemented to protect landfills from a rising bay.

I'll close with this aerial photograph of the Oyster Point Landfill in south San Francisco in 1958. This provides an example of how the early Bayfront landfills were built. This early type of landfill was formed by creating a dike with soil or construction debris and simply filling in the Bay behind it with trash. Waste was placed on top of the Bay mud with no liner and few features other than the dike to contain the waste.

The older, poorly constructed landfills like this will be particularly vulnerable to sea level rise. And keep in mind, there are 36 more just like one this ringing our Bay. So the Land Disposal Program will continue to have its hands full moving forward.

Hopefully this presentation gives you all a better understanding of how this agency regulates disposal of solid waste, and the challenges we can expect to see in the coming years.

That concludes my talk- I will be happy to answer any questions.