

This is the 1<sup>st</sup> problem of the semester for Solid Waste Containment Design. Throughout the semester, you will be completing different parts of the design of one particular solid waste containment facility. The first part involves some sizing and capacity calculations for a given landfill scenario.

**Basics of the Scenario:**

You have been hired to design a new landfill that meets the requirements of FAC 62-701. The design is challenging in that the County wants to construct the landfill over an existing unlined landfilled area. See Figure 1 for a description of the existing landfill area. The existing landfill area actually consists of 3 disposal units. You want to build one new unit on top of the three older units. The landfill will accept MSW from the county, as well as ash from a neighboring waste to energy facility that combust wood.

The old landfill units have 5:1 side slopes. The new landfill unit will have 4:1 side slopes. The boundary of the new landfill unit will be 25 ft outside the boundary of the existing units.

**Information Provided:**

In addition to the information provided in the figures, you have been provided with the following information about the county and its waste generation:

- Population in the county (2003) = 440,150
- MSW generation rate (lb/person/day, 2003) = 4.51
- Assumed annual population growth = 1.8 % per year
- The percentage of MSW that is landfilled (1998) = 70%
- Wood ash generation from neighboring WTE facility = 100 tons per day

Please provide answers to the following:

1. Assuming that the landfill operator must maintain a minimum distance of 100 ft on the top of the new landfill (so trucks can turn around), what is the maximum surface elevation of the landfill (X)? You will note from Figure 2 that the minimum distance will occur on top of the smaller landfill area.
2. How many cubic yards of volume are provided if the landfill were to be filled to this height?
3. If the cell begins operation on July 1, 2005, when will the landfill reach capacity? In addition to the information given above, assume the following:

- Density of compacted MSW in the landfill = 1,250 pcy
- Density of the cover soil = 120 pcf
- Density of compacted ash in the landfill = 95 pcf
- Cover content by volume = 0.125

Assume that the ash can contribute 20% of the volume needed for cover material. [DEP will allow them to use the ash for daily cover, but not intermediate cover.]

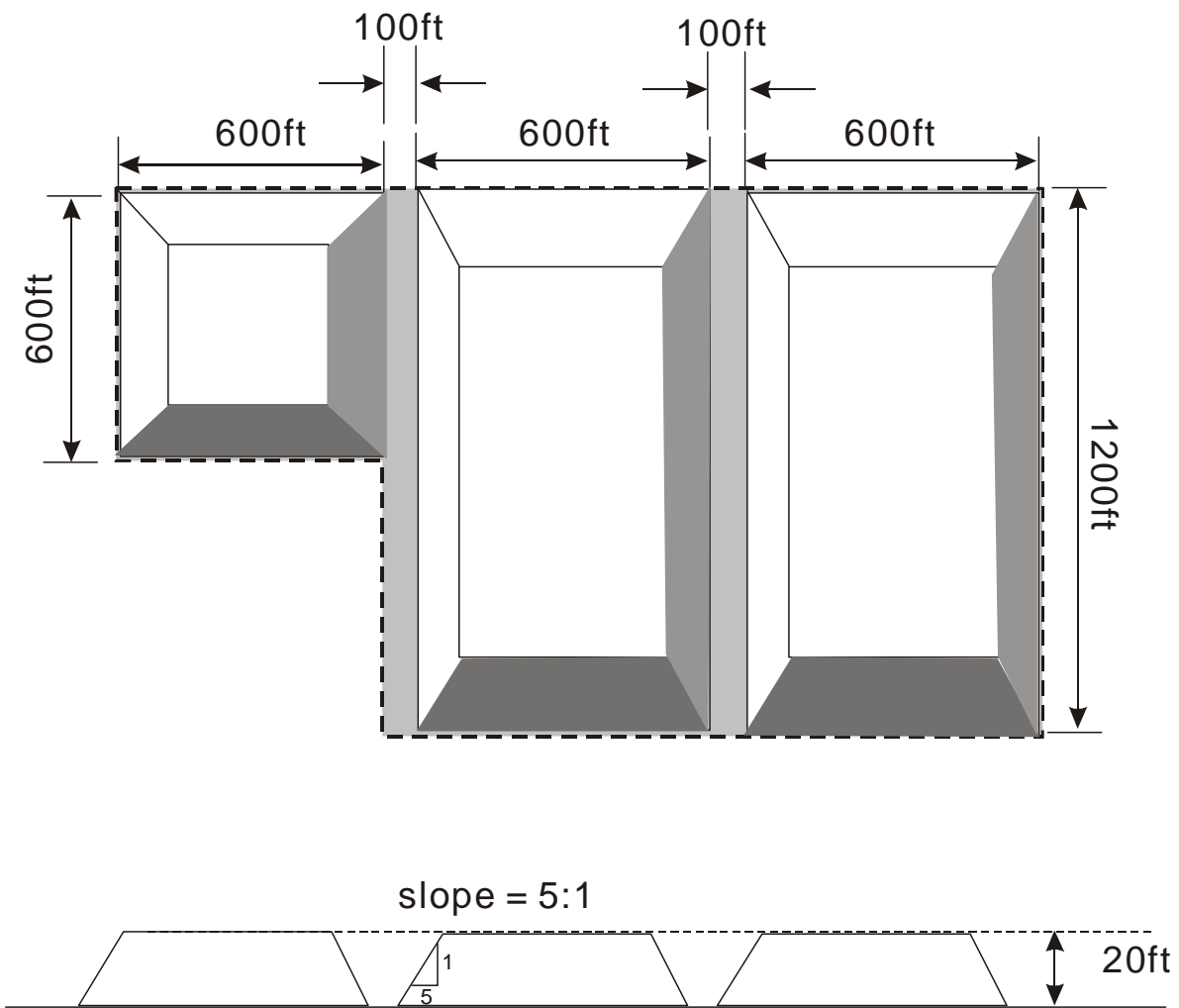
4. What would the landfill capacity be if the MSW density was increased to 1,500 pcy?
5. What would the landfill capacity be if the side slopes of the landfill were changed from 4:1 to 3:1? (using original assumptions)
6. What would the landfill capacity be if an alternative daily cover were used and it reduced the  $CC_v$  to 0.07? (using original assumptions)
7. You are considering operating this landfill as a bioreactor. An understanding of the moisture content is thus important. You determine the following:
  - a. MC of MSW is 20%;  $\theta_{fc} = 35\%$
  - b. MC of ash is 15%;  $\theta_{fc} = 25\%$
  - c. MC of cover soil is 8%;  $\theta_{fc} = 13\%$

How many gallons of water would be needed to bring the MSW in landfill up to field capacity? If the water were added as the waste was placed, how many gallons per day is this?

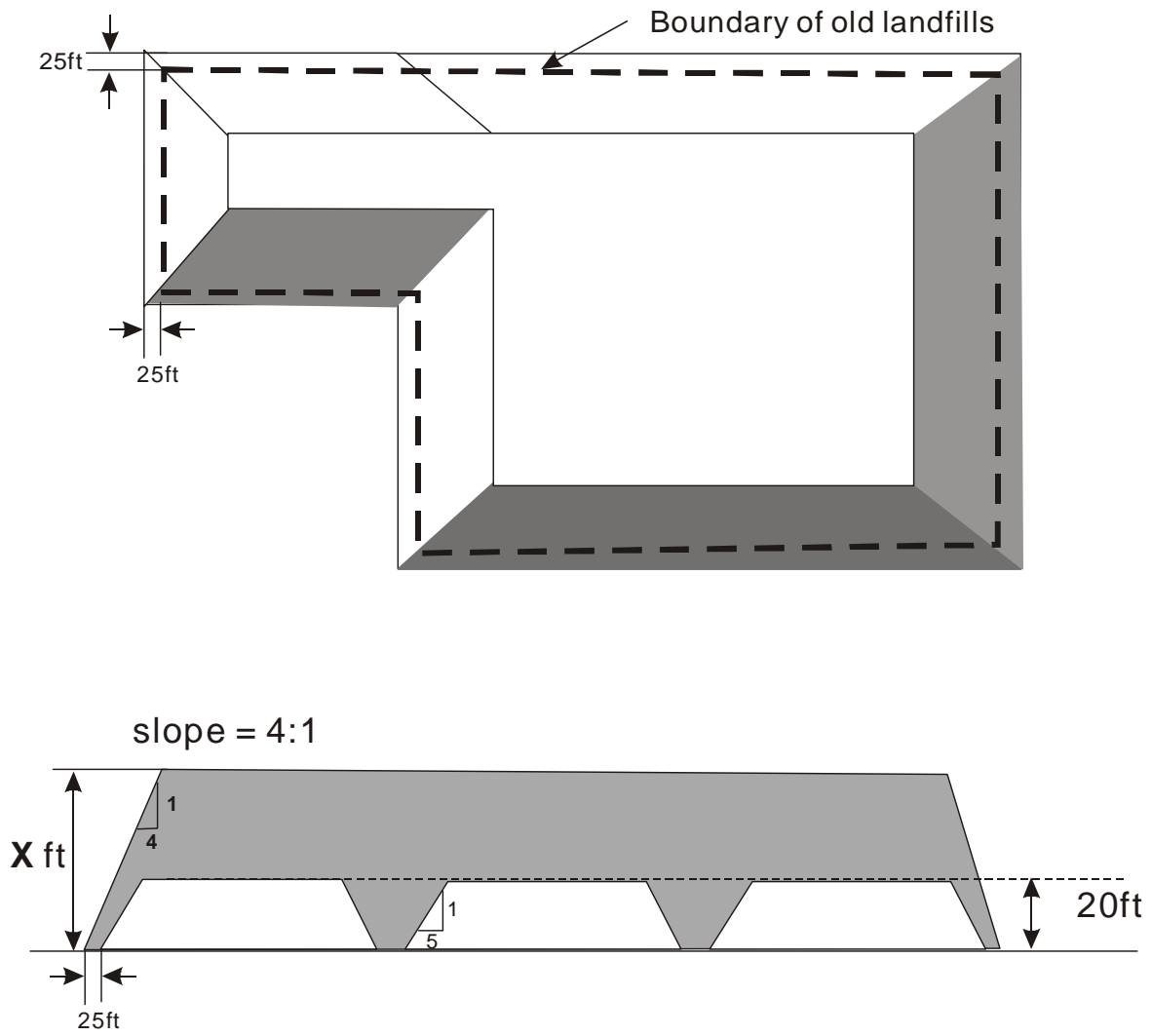
If you recirculated leachate after the waste was disposed, it would be unlikely that you could add water only to the MSW alone (and not the ash and soil). How many total gallons of water would be required to get all of the materials in the landfill to field capacity?

For the above calculations, use the original assumptions of the problem.

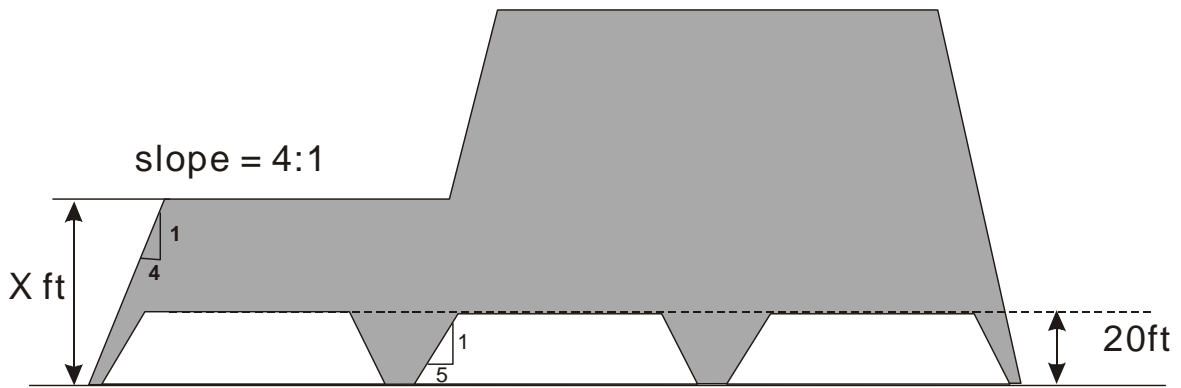
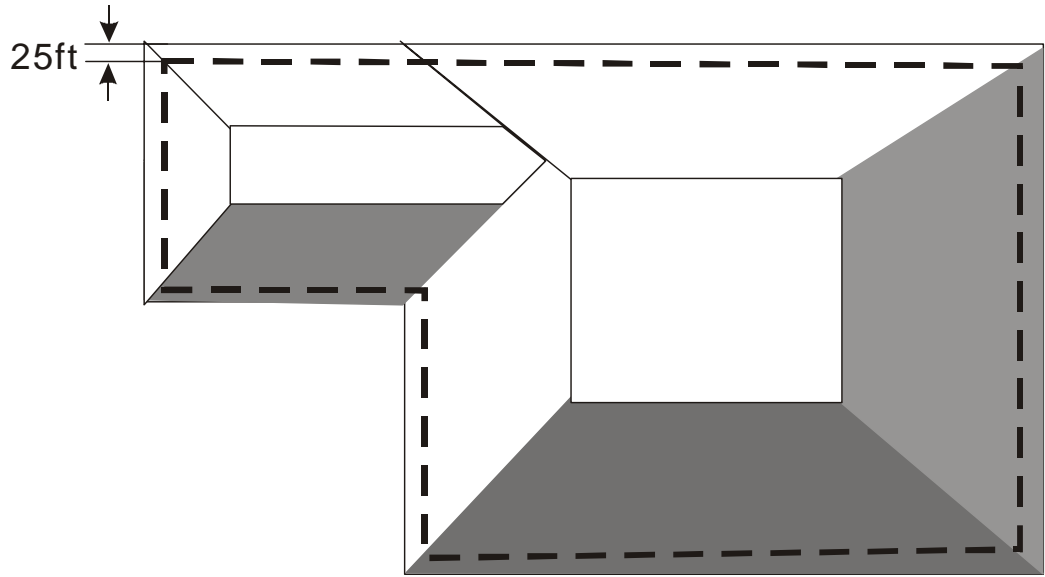
8. If you continued to high rise the area of the landfill on top of the two larger cells (see figure 3), how many years of capacity would you gain (using original assumptions).
9. Please provide a contour map of the final configuration of the landfill in question 8, at 10 ft contour spacings.



**Figure 1. Plan and Cross Section Views of the Existing Landfill Units**



**Figure 2. Plan and side view of a new landfill**



**Figure 3. Plan and side view of a new landfill**