Leachate Collection System Design and Cost Estimation

Part A:
You have been given the responsibility to design the bottom leachate collection system (LCS) for Cell 4 of an MSW landfill located in Detroit, MI. Design the leachate collection system such that:

1. maximum leachate head on the liner does not exceed 30cm when the thickness of the waste is greater than 15 ft and less than 200 ft and the landfill is active (not closed);
2. Spacing between adjacent leachate collection pipes is ≥ 75 ft;
3. LCS drainage material has a hydraulic conductivity of ≥ 0.1 cm/s; and
4. Use the peak monthly impingement rate using minimum 30 year climatic data when using HELP.

In addition, once your design is complete, estimate the capital cost for the construction of the LCS. Assume that the dimensions of the cell are 200 m by 200 m (area = 1 acre). Use the following unit rates for estimating the cost.

1. Geotextile cushion layer to be placed on the geomembrane to protect the drainage material from damaging the geomembrane = $0.15/ft²
2. LCS drainage material = $15/yd³ as placed
3. LCS pipe (4” dia HDPE) = $2/ft installed
4. Cut/Fill the liner to slope the LCS: $5/m² for LCS slope < 5°; $10/m² for LCS slope ≥ 5° and < 10°; $20/m² for LCS slope ≥ 10° and < 30°; and $25/m² for LCS slope ≥ 30°
5. Ignore the cost of leachate sumps, riser pipes, and leachate pumps.

Part B:
Assume the landfill is located in Los Angeles, CA. How will it impact the capital cost of the LCS construction?