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# CEE 370 Environmental Engineering Principles

Lecture #1  
Introduction I

Reading: Chapter 1 in Mihelcic & Zimmerman

David Reckhow

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## Introduction to CEE 370

- Syllabus
- Book (Mihelcic & Zimmerman, 2<sup>nd</sup> edition)
- Website: <http://www.ecs.umass.edu/cee/reckhow/courses/370/>
  - Will also make some use of: Moodle, Gradescope and Piazza
- Labs: 5 in total
  - Streamflow is first
    - Location: Mill River on west edge of campus (adjacent to WET Center)
  - Teaching Assistants:
    - Soon-Mi Kim ([soonmi@umass.edu](mailto:soonmi@umass.edu)), Monday & Tuesday labs
    - Savannah Wunderlich ([swunderlich@umass.edu](mailto:swunderlich@umass.edu)), Wednesday & Thursday labs

## 370 Lab

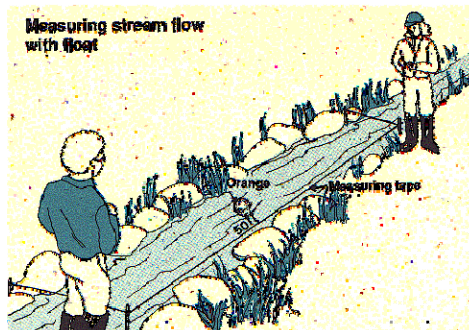
- This is our assigned lab room (Marston 24) as of this morning
- We may use an alternative lab room in Goessmann for labs #2-5

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## Lab #1 – measuring stream flow

- Measure **volumetric flow rate ( $Q$ )** and **mean velocity ( $v$ )** of a small stream
- How to do it?
  - Floating markers
  - Current meters
  - Chemical tracer dilution

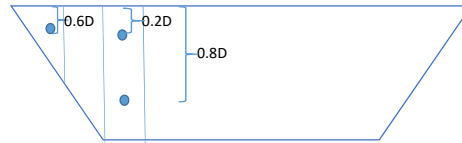
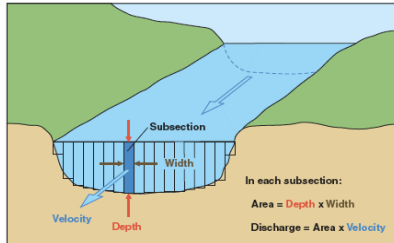


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## Electromagnetic Current Meter Method

- Hach meter: Based on stream velocity at a specific point (depth and width) for a specified time frame (in seconds).

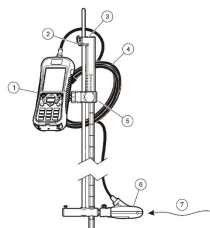


$$Q_{total} = (A_1 \times v_1) + (A_2 \times v_2) + (A_3 \times v_3) + \dots + (A_n \times v_n)$$

$$= Q_1 + Q_2 + Q_3 + \dots + Q_n$$

## Electromagnetic sensors

- Hach FH950 flow meter



1. Portable meter	5. Adjustable mount for portable meter
2. Sensor height lock/release device	6. Sensor assembly
3. Top entry/wading rod (optional accessory)	7. Flow direction
4. Sensor cable	



Images: [www.hach.com](http://www.hach.com)

## Mill River Field Site

- Teams of 3
- Use tape measure to define cross sections
- Metal rod supports meter and sensor at the right depth
- Need appropriate footwear



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## Lab #1, Stream flow

- Before:
  - Attend information sessions held during normal lab periods
  - Make groups of 3-4.
  - Read and understand the lab session handout for next week's lab exercise for all three methods.
- Day of:
  - Expect to step into the stream (knee-depth at most) so wear appropriate clothing (flip-flops, shorts).
  - Bring a notebook to record your data and take notes.
  - Leave on time to reach WET Center by 2:30 PM
  - If you don't know the directions and/or need a ride, talk to your TA.
- Write-up
  - Prepare a write up (1 per group) as per technical report handout and the lab handout (last couple of pages)
  - Turn in your write-up as directed by TAs (1-2 weeks after lab)

## How to dispose of Coke?

- To minimize environmental & human impact, I should
  - A. Pour it into the shrubs in front of Marston Hall during dry weather
  - B. Wait until there's a heavy rain and then pour it into the shrubs
  - C. Pour it down the sink
  - D. Pour it in the toilet
  - E. Throw the entire can's contents into the trash

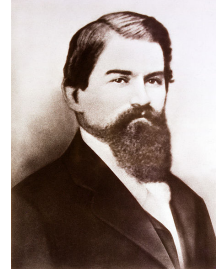
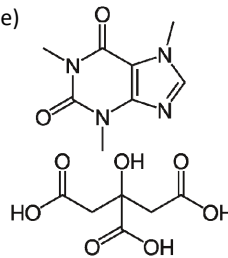
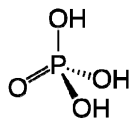
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## What's in it?

- John Stith Pemberton's original formulation
  - Cocoa leaves (37 g/L; including ~ 36 mg/L cocaine)
  - Cola nut (with Caffeine)
- Current formulation - largely unknown except:
  - Monosaccharides:
    - 84 g/L fructose
    - 68 g/L glucose
  - Caffeine: 89 mg/L (caffeine citrate)
  - Phosphoric acid (172 mg-P/L)
  - pH 2.3



### Nutrition Facts Valeur nutritive

Per 1 bottle (500 mL)  
pour 1 bouteille (500mL)

Amount Teneur	% Daily Value % valeur quotidienne
<b>Calories / Calories</b> 200	
<b>Fat / Lipides</b> 0 g	<b>0 %</b>
<b>Sodium / Sodium</b> 40 mg	<b>2 %</b>
<b>Carbohydrate / Glucides</b> 55 g	<b>18 %</b>
Sugars / Sucres 55 g	
<b>Protein / Protéines</b> 0 g	

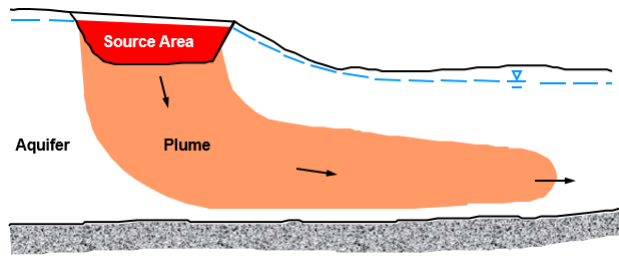
Not a significant source of other nutrients.  
Source négligeable d'autres éléments nutritifs.

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### A. Land disposal during “dry” weather

- plume



From Waterloo Hydrogeologic

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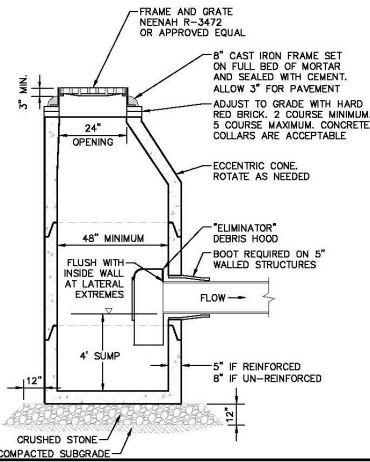
• Catch basin in front of Marston Hall

### B. In wet weather – to the storm drain system

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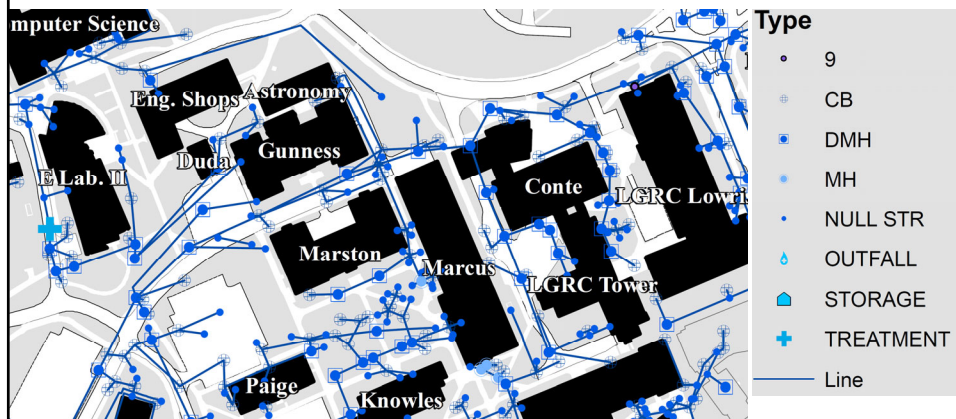
## Catch Basins

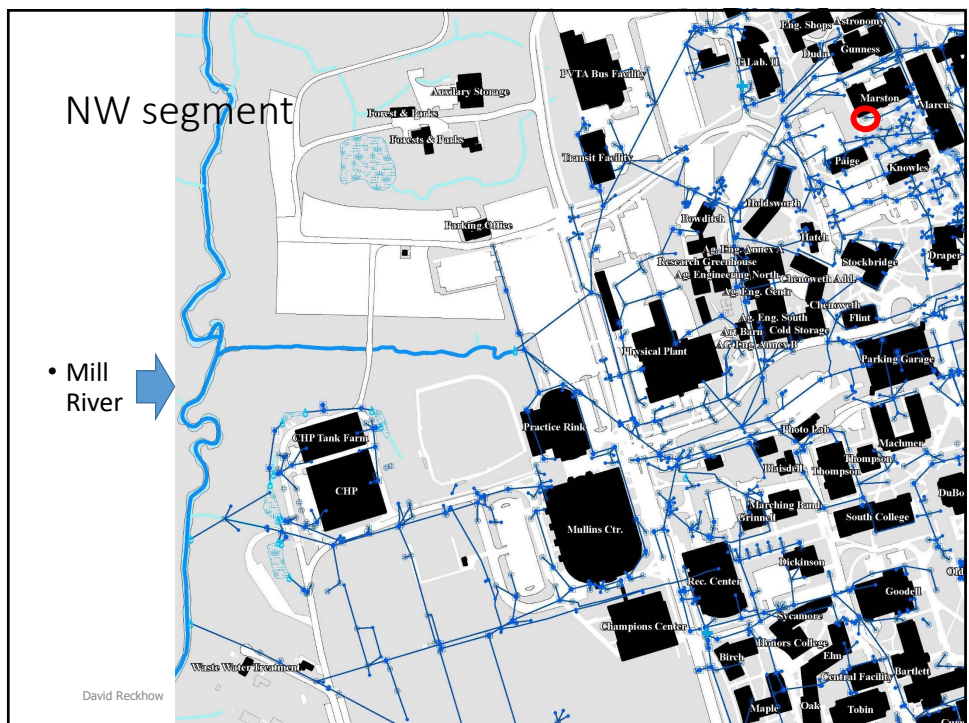
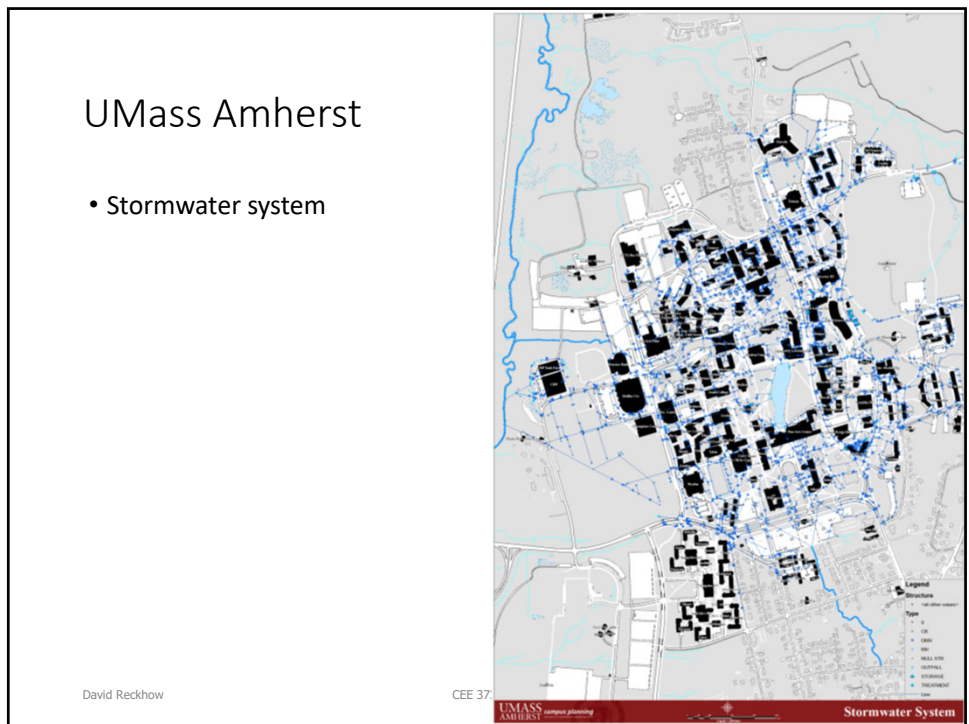
- UMass design



## UMass Amherst

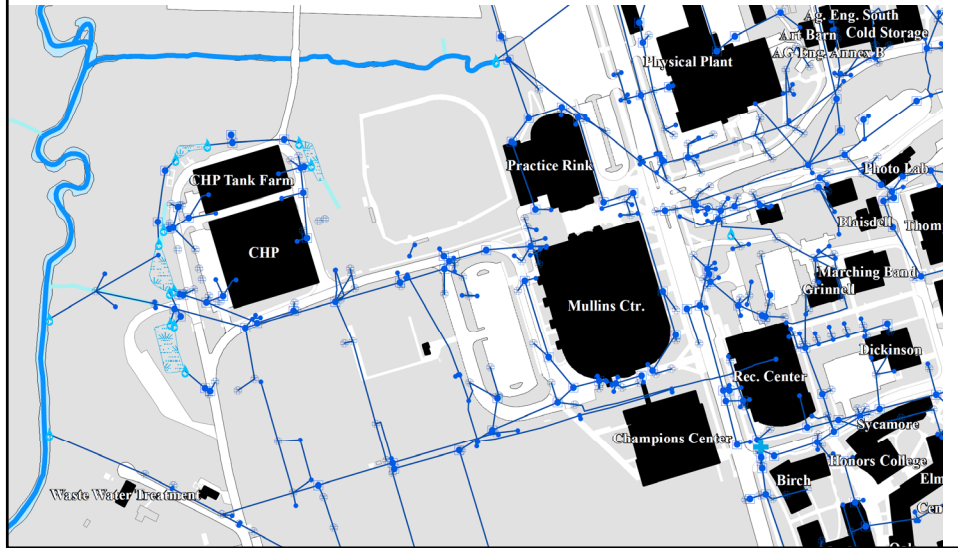
- Stormwater system

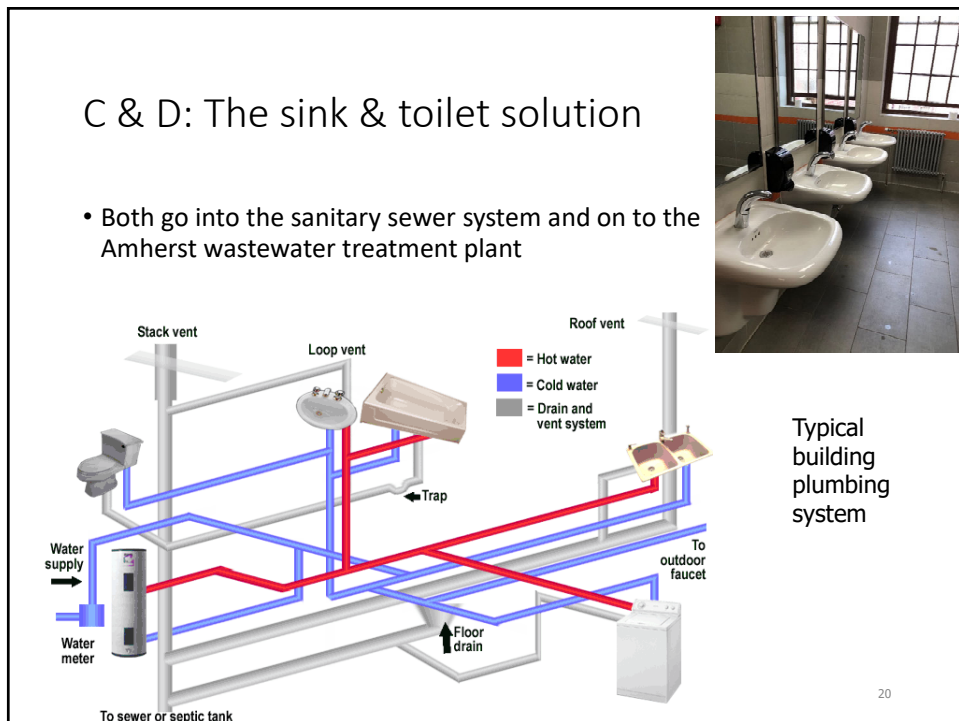
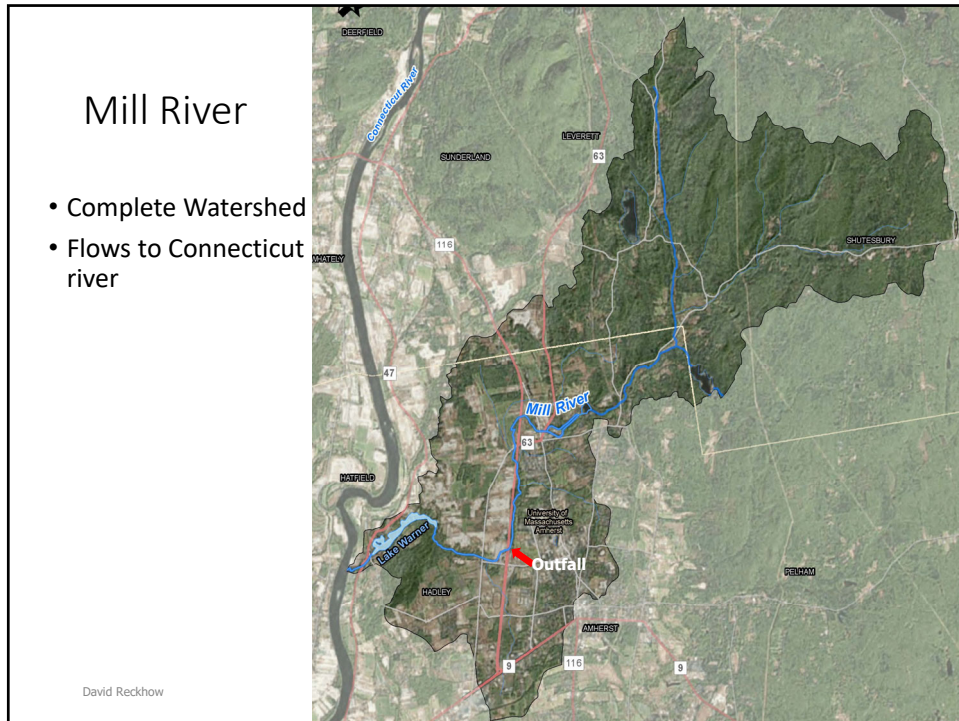


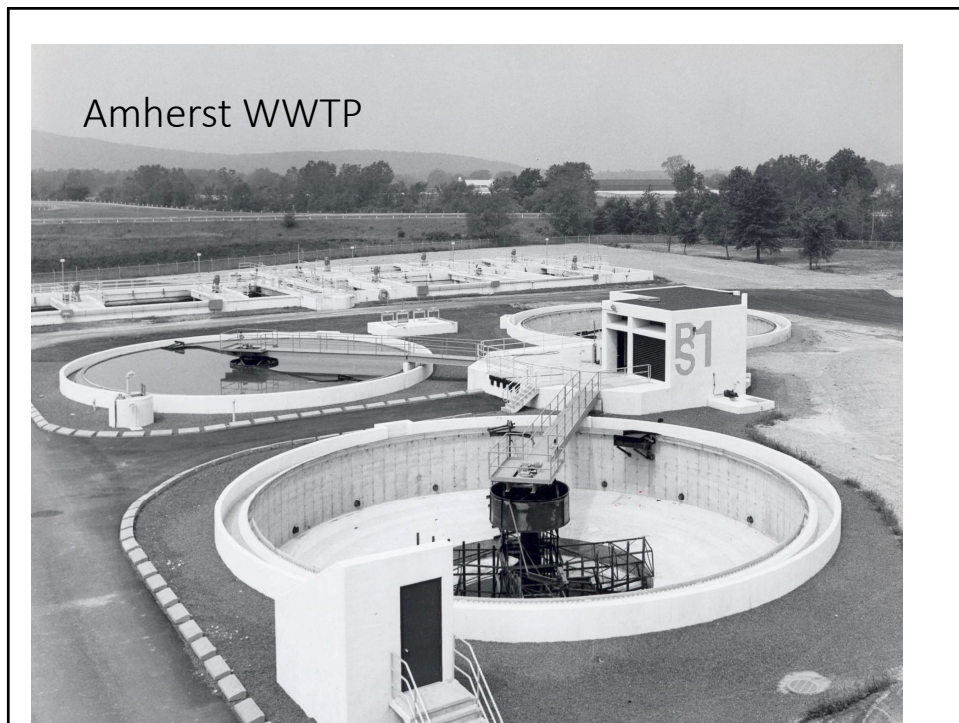
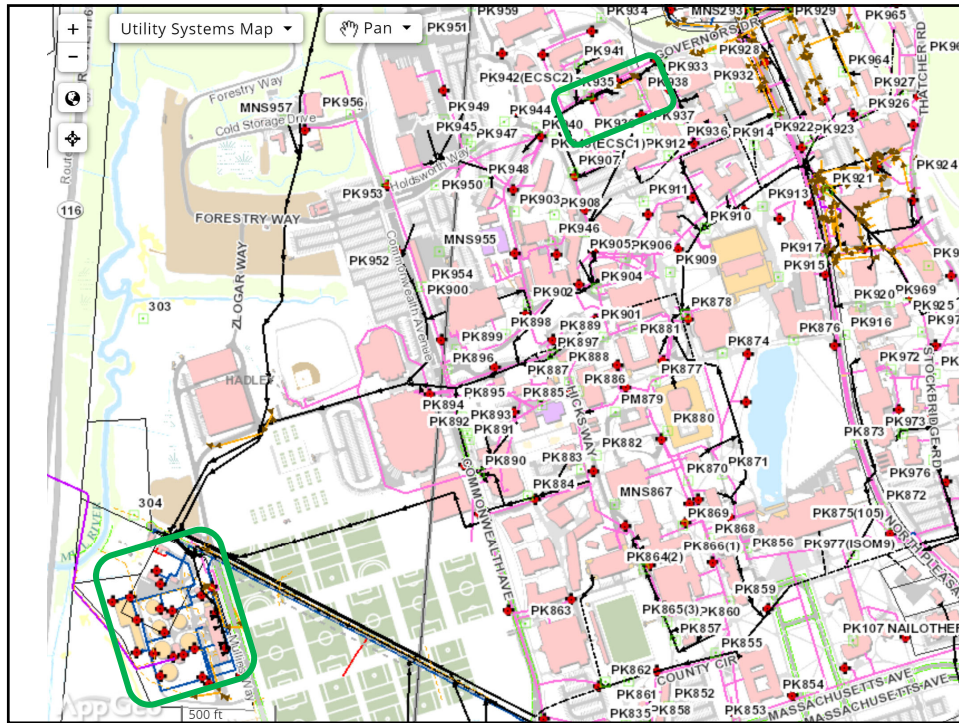


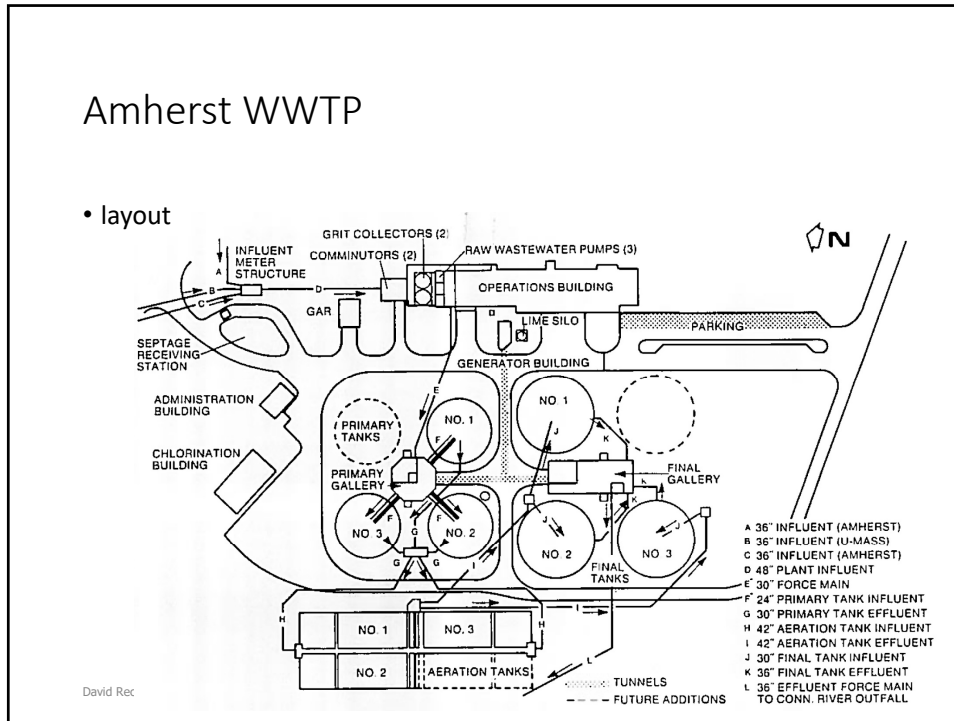


### UMass Amherst outfalls









## E: The trash can solution

- UMass office of waste management (<https://www.umass.edu/wastemanagement/>)
  - Integrated solid waste management approach
- The path
  - OWM trash packer truck to WRTF => transfer trailers to Holyoke transfer station => via rail to Southbridge MA landfill



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## Southbridge landfill – the final resting place?

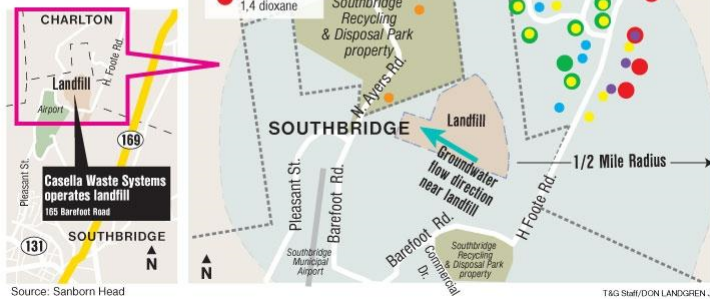
- Capacity and contamination problems?

### Contaminated wells near the landfill

Location of chlorinated volatile organic compounds (CVOC) and 1,4 dioxane detections (current and historic) in wells sampled as part of the residential well monitoring program for the Southbridge Recycling and Disposal Park facility

From: Worcester Telegram, Nov 5, 2015

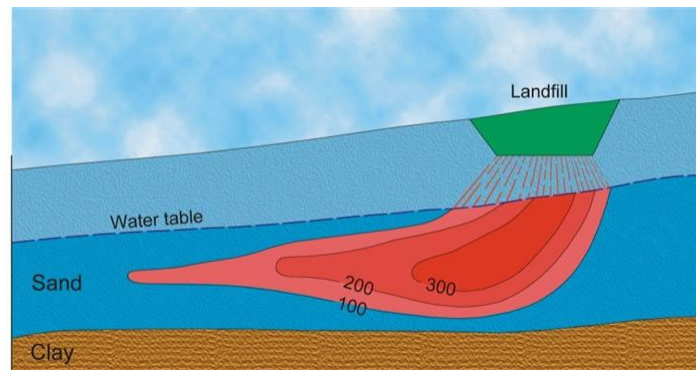
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T&G Staff/DON LANGREN JR.

## Landfills and groundwater

- They all leak to some extent, especially unlined landfills



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Next

- [To next lecture](#)

# Handout

- Reading for next class:

- M&Z: Chapter 1
- [Hardin's "Tragedy of the Commons" Science, 13 Dec 1968](#) (pg 1243)

[Also on website](#)