Updated: 5 September 2019

Print version

CEE 370
Environmental Engineering Principles

Lecture #1

Introduction I

Reading: Chapter 1 in Mihelcic & Zimmerman

Introduction to CEE 370

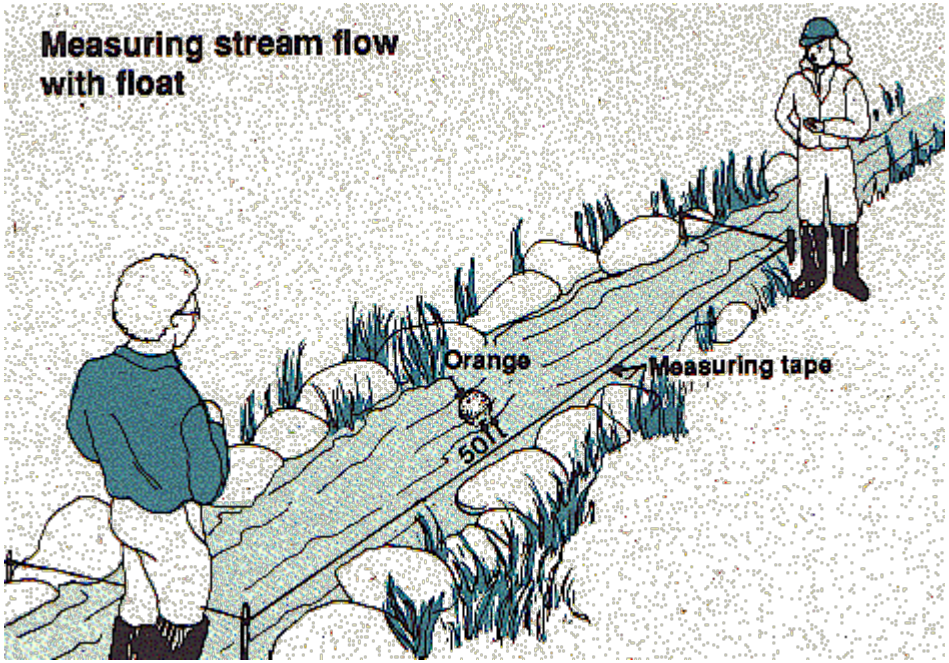
- Syllabus
- Book (Mihelcic & Zimmerman, 2nd edition)
- Website: http://www.ecs.umass.edu/cee/reckhow/courses/370/
  - Will also make some use of: Moodle, Gradescope and Piazza
- Labs: 5 in total
  - Streamflow is first
    - Location: Mill River on west edge of campus (adjacent to WET Center)
  - Teaching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

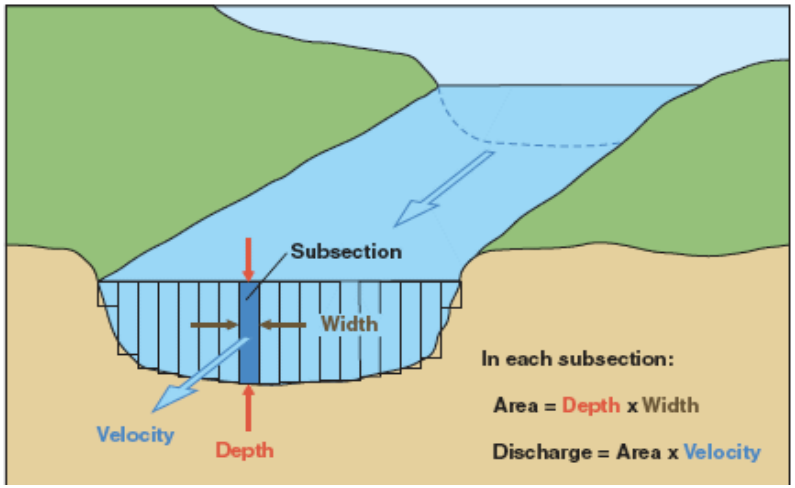
Lab #1 – measuring stream flow

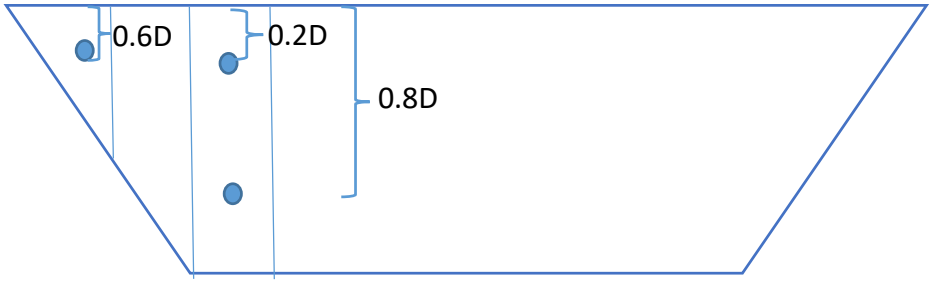
- Measure **volumetric flow rate (Q)** and **mean velocity (*v*)** of a small stream
- How to do it?
  - Floating markers
  - Current meters
  - Chemical tracer dilution



Electromagnetic Current Meter Method

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

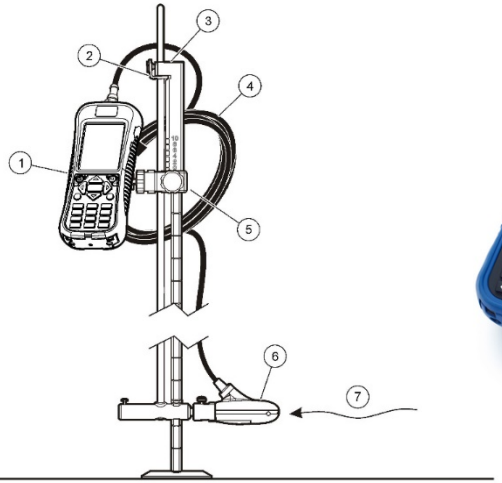




$$Q_{total} = (A_1 \times v_1) + (A_2 \times v_2) + (A_3 \times v_3) + \cdots + (A_n \times v_n)$$
$$= Q_1 + Q_2 + Q_3 + \cdots + Q_n$$

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 setting wading rod (optional accessory)	7 Flow direction
4 Sensor cable	

Images: 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

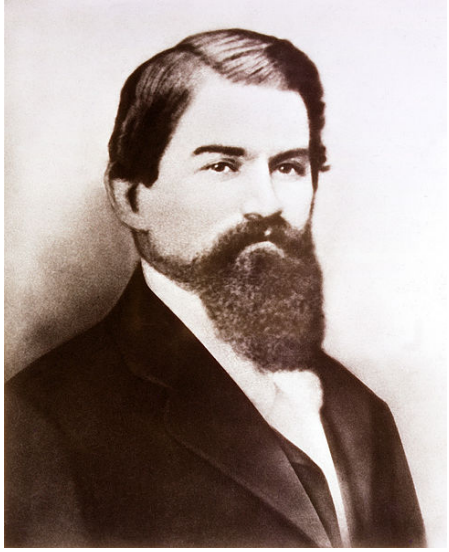
Lab #1, Stream flow

- 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)

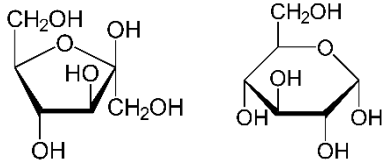
How to dispose of Coke?

- 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

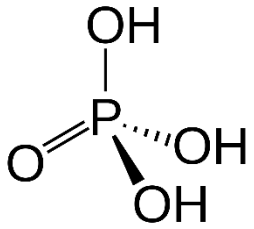
What's in it?

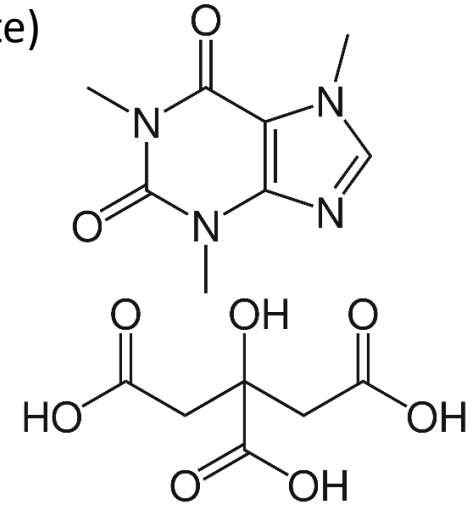


- John Stith Pemberton's original formulation
  - Cocoa leaves (37 g/L; including ~ 36 mg/L cocaine)
  - Cola nut (with Caffeine)
- Current formulation - largely unknown except:
  - Monosaccharides:
    - 84 g/L fructose
    - 68 g/L glucose



  - Caffeine: 89 mg/L (caffeine citrate)
  - Phosphoric acid (172 mg-P/L)
  - pH 2.3





Nutrition Facts
Valeur nutritive

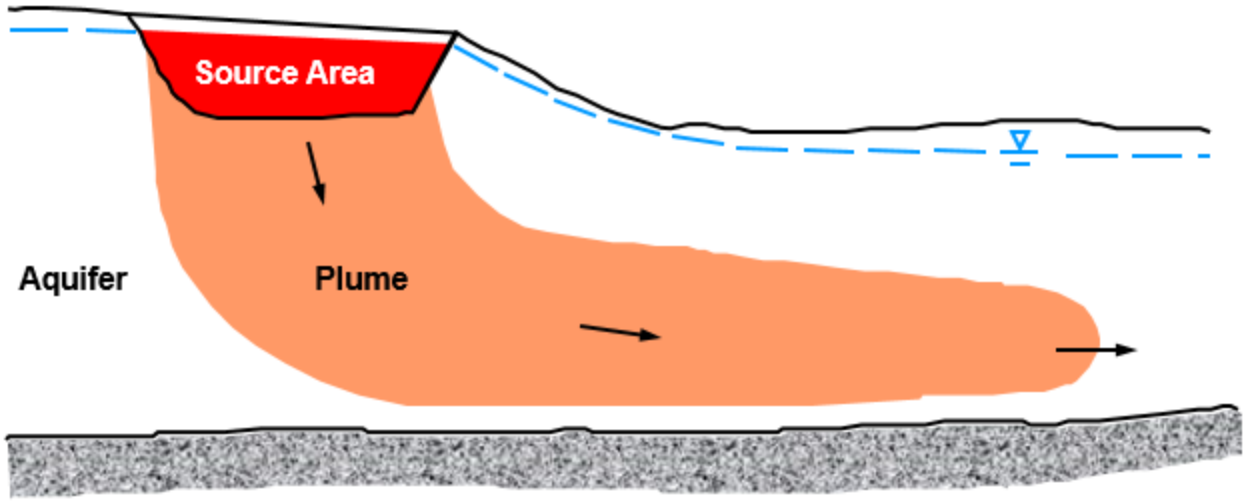
Per 1 bottle (500 mL)
pour 1 bouteille (500mL)

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

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

A. Land disposal during “dry” weather

- plume



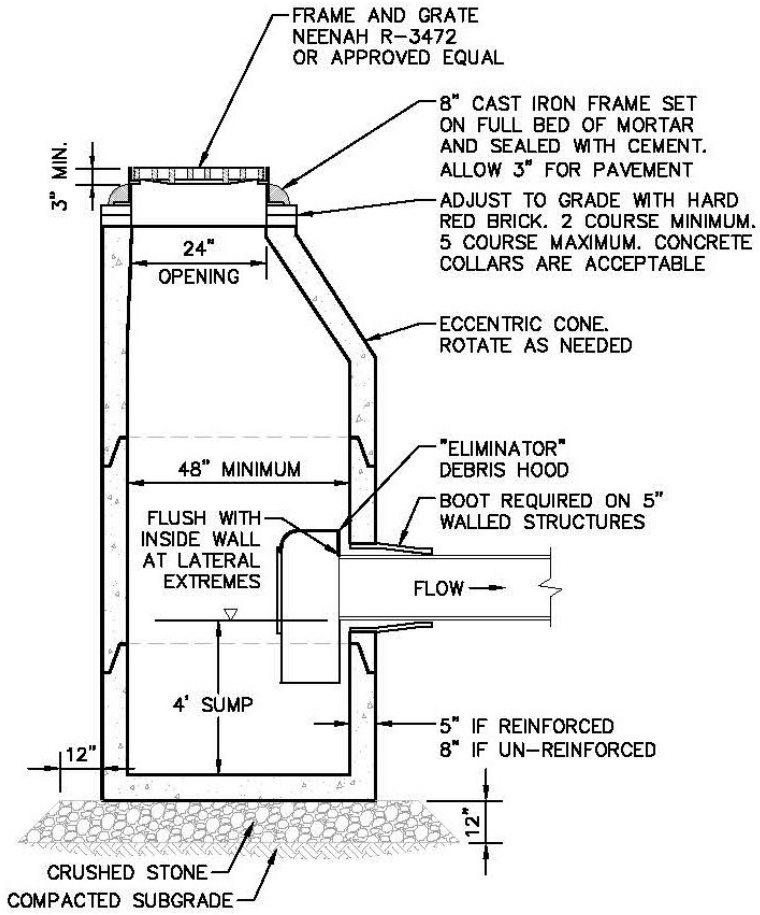
From Waterloo Hydrogeologic

B. In wet weather – to the storm drain system

David Reckhow

Catch Basins

- UMass design

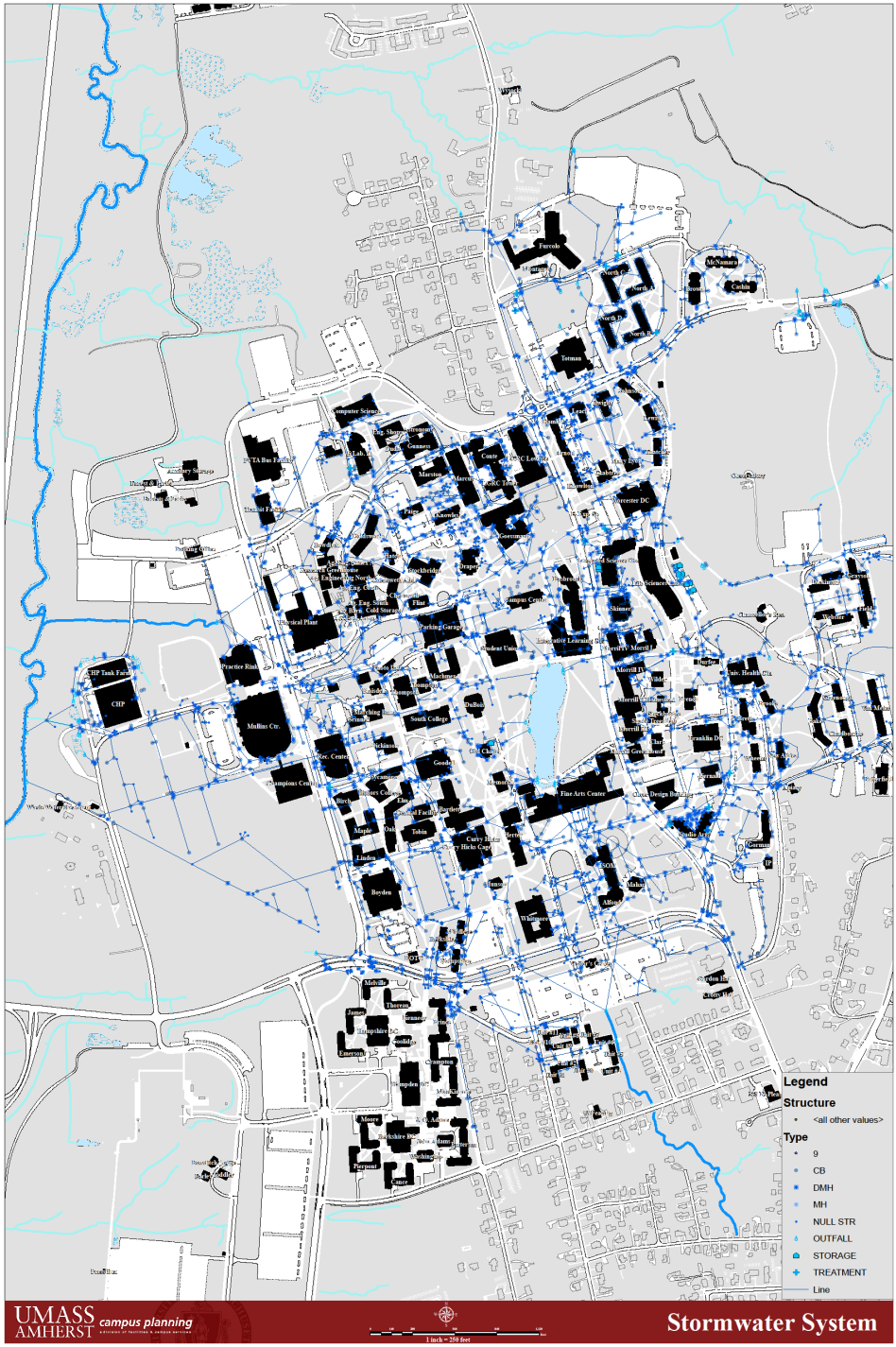


UMass Amherst

- Stormwater system

UMass Amherst

- Stormwater system



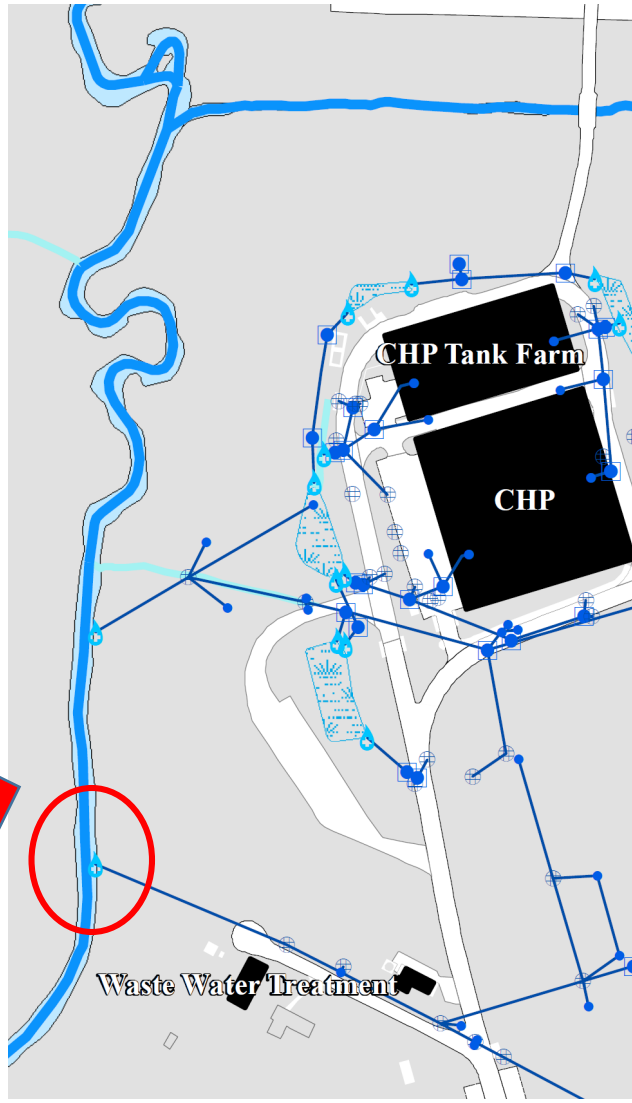
NW segment

- Mill River

UMass Amherst outfalls

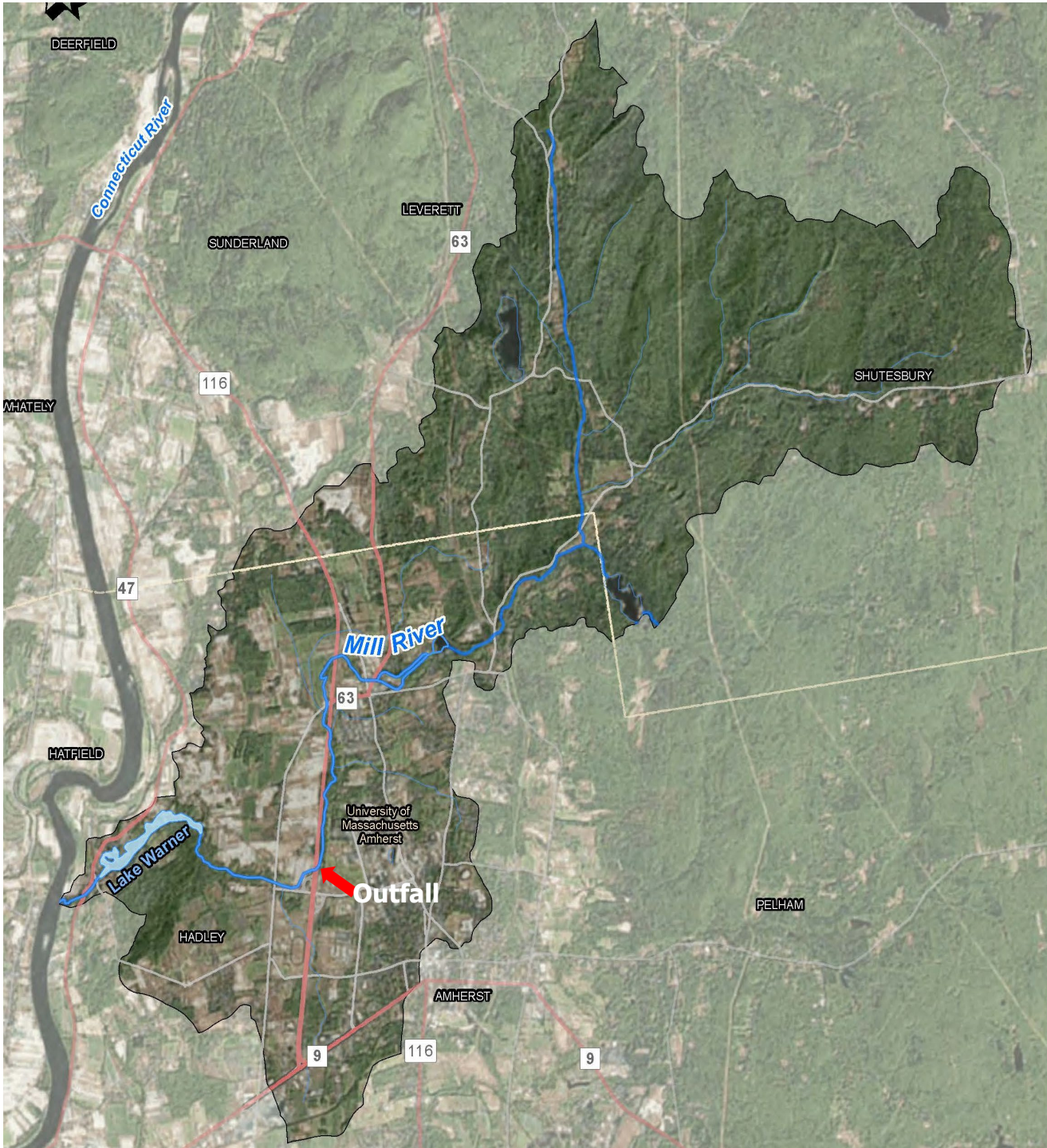
Outfall

- “Dry” weather (3 Sept 2019)



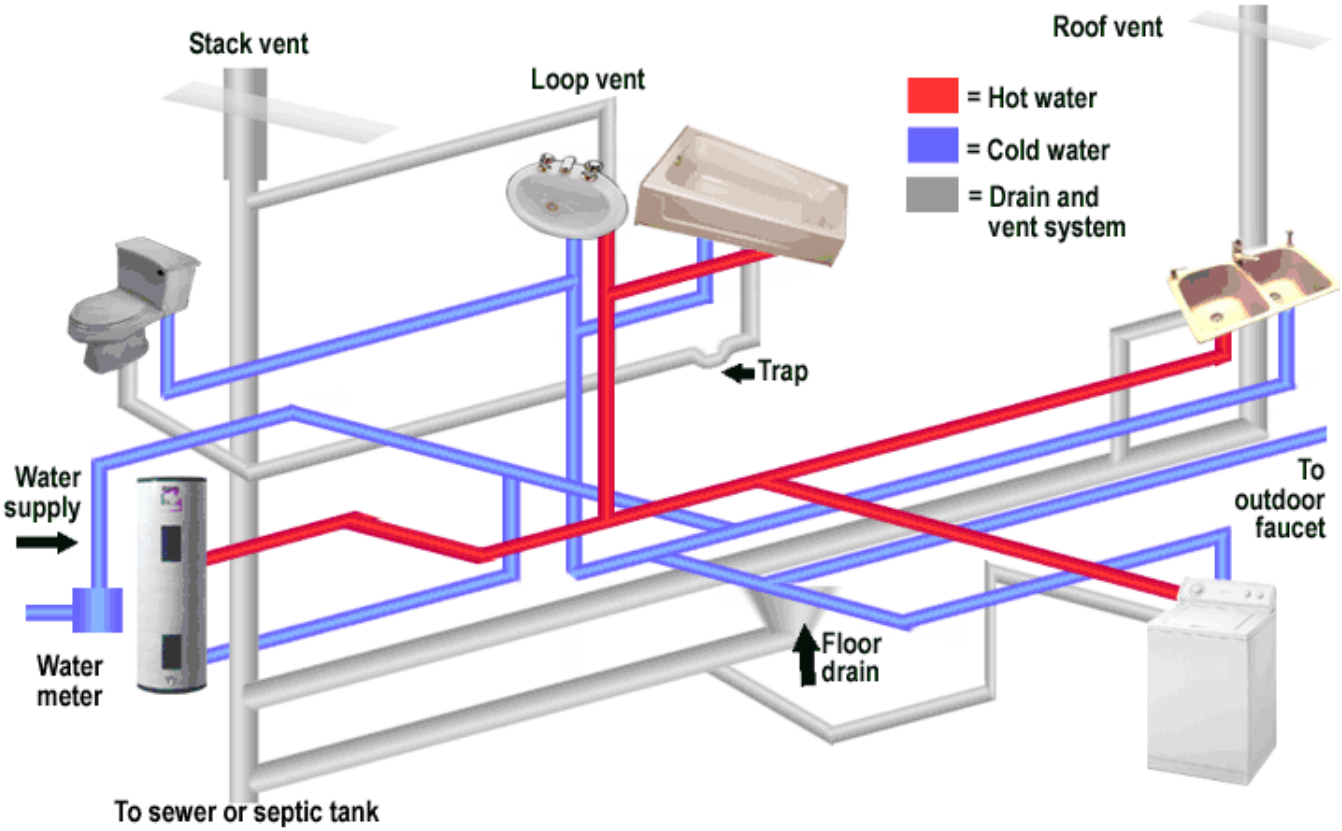
Mill River

- Complete Watershed
- Flows to Connecticut river

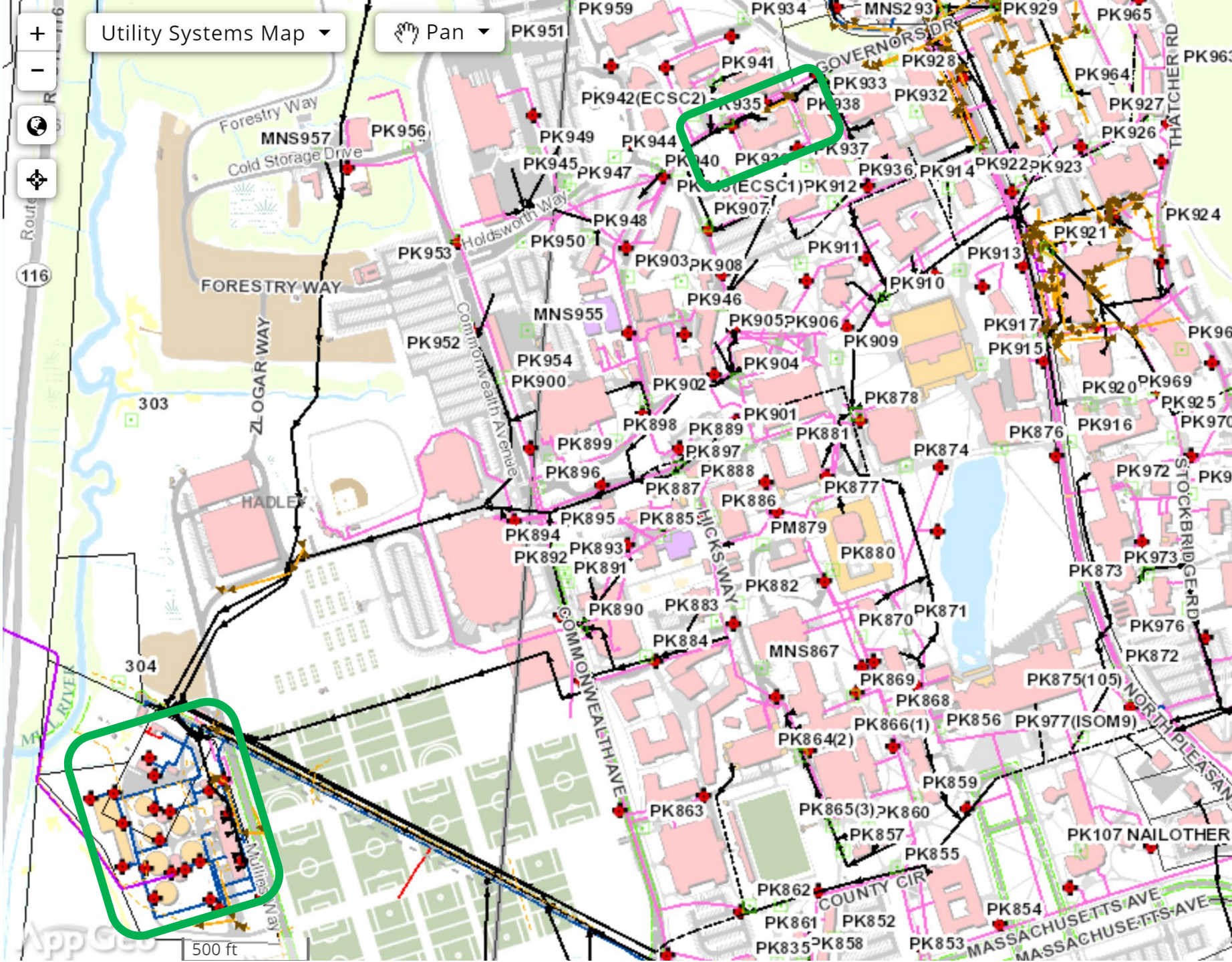


C & D: The sink & toilet solution

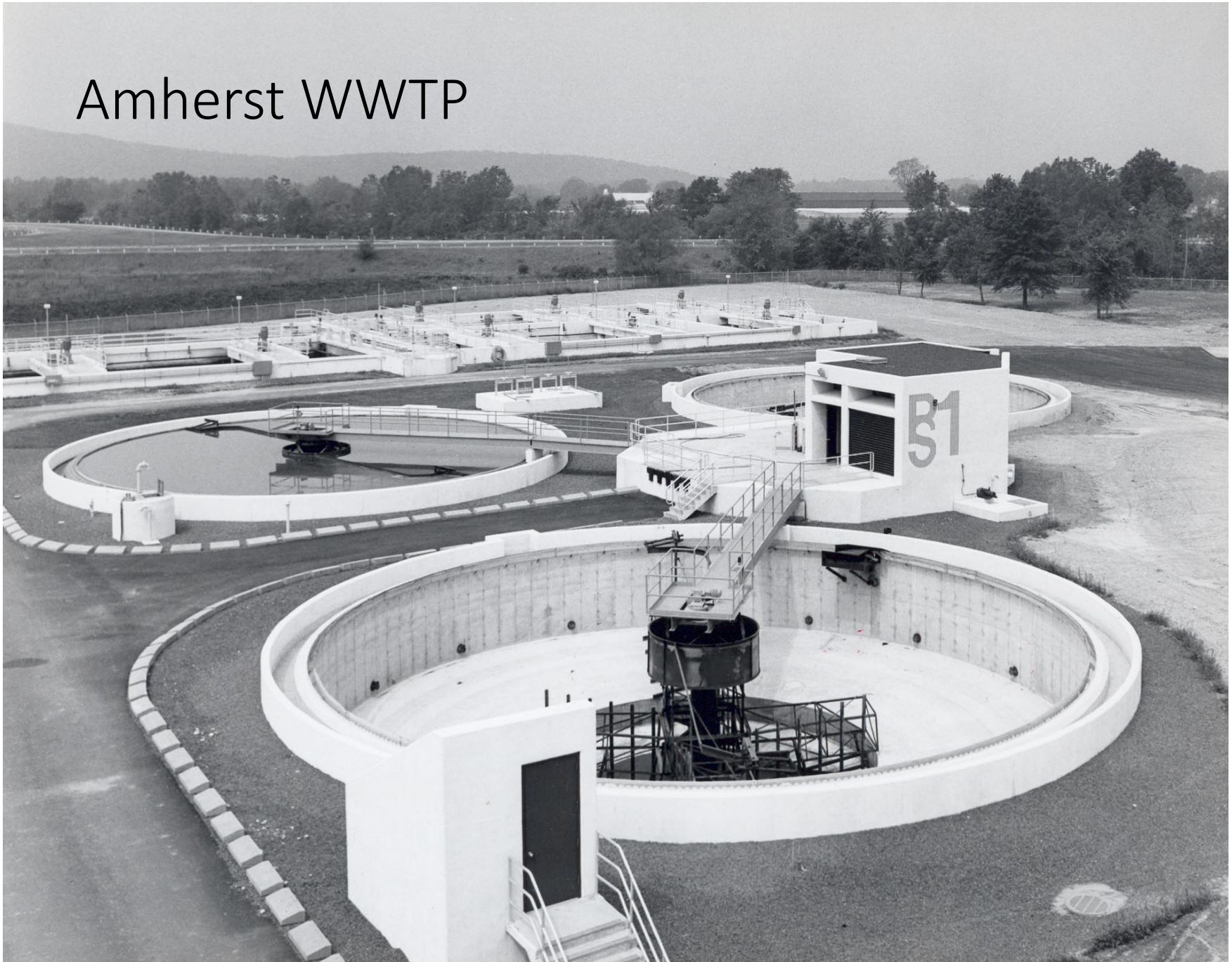
- Both go into the sanitary sewer system and on to the Amherst wastewater treatment plant



Typical building plumbing system

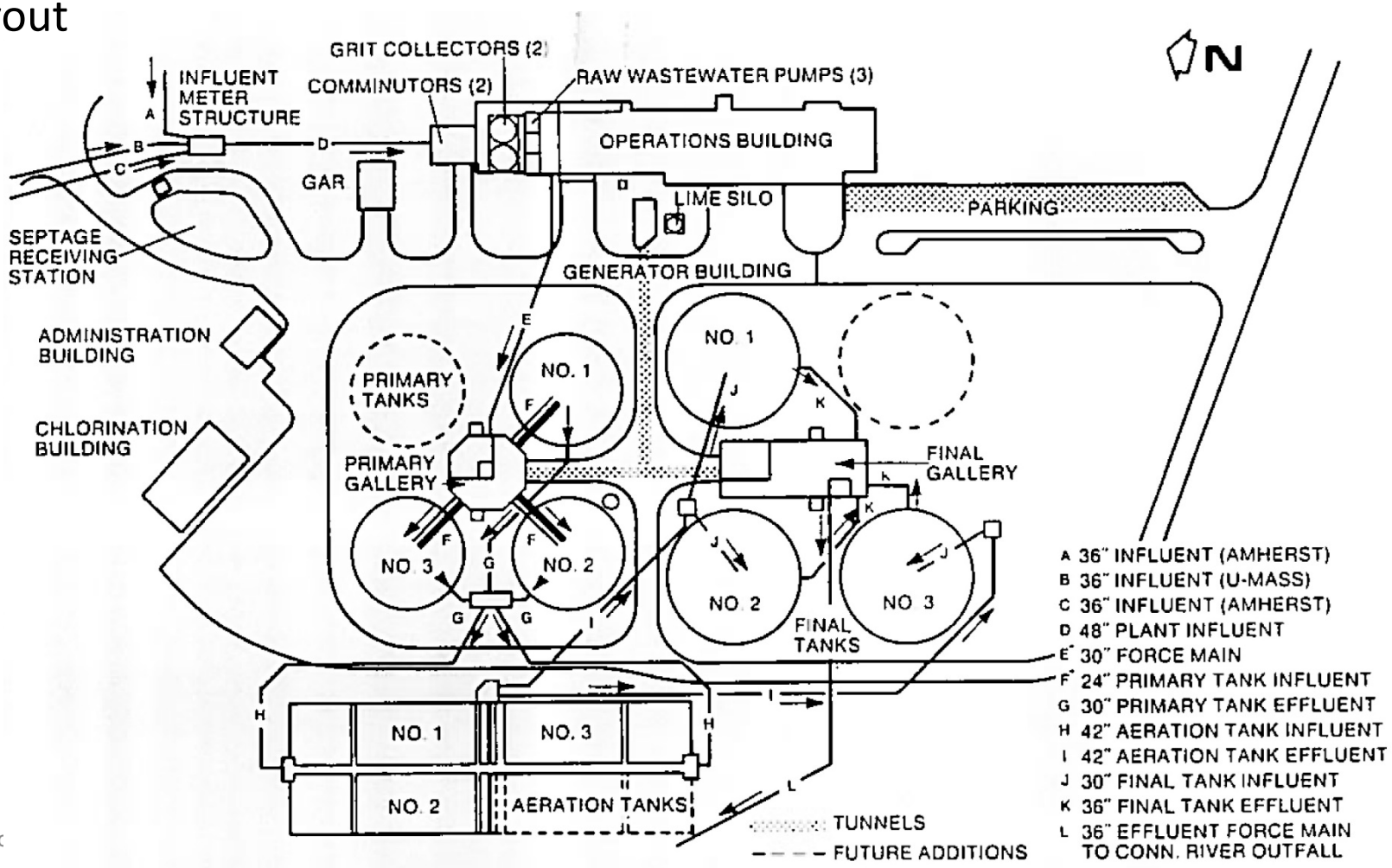

Utility Systems Map
Pan
Forestry Way
Cold Storage Drive
MNS957
PK956
PK949
PK944
PK945
PK947
PK948
PK950
PK953
Holdsworth Way
FORESTRY WAY
ZLOGAR WAY
Commonwealth Avenue
MNS955
PK952
PK954
PK900
PK902
303
PK898
PK889
PK899
PK897
PK896
PK888
PK887
HADLEY
PK895
PK885
PK894
PK892
PK893
PK891
PK890
PK883
PK884
HICKS WAY
COMMONWEALTH AVE
304
PK959
PK934
MNS293
PK929
PK965
PK951
PK941
GOVERNORS DR
PK928
PK964
PK942(ECSC2)
PK933
PK935
PK938
PK932
PK927
PK926
PK937
PK936
PK914
PK922
PK923
PK912
PK907
PK924
PK921
PK911
PK913
PK908
PK910
PK946
PK905
PK906
PK917
PK909
PK915
PK904
PK878
PK920
PK969
PK925
PK901
PK881
PK876
PK916
PK874
PK877
PK886
PM879
PK880
PK882
PK870
PK871
PK973
PK873
PK976
PK872
MNS867
PK869
PK875(105)
PK868
PK866(1)
PK856
PK977(ISOM9)
PK864(2)
PK859
PK865(3)
PK860
PK863
PK857
PK855
PK107 NAILOTHER
PK862
COUNTY CIR
PK854
PK861
PK852
PK835
PK858
PK853
MASSACHUSETTS AVE
THATCHER RD
STOCKBRIDGE RD
NORTH PLEASANT
116
500 ft

Amherst WWTP



Amherst WWTP

- layout

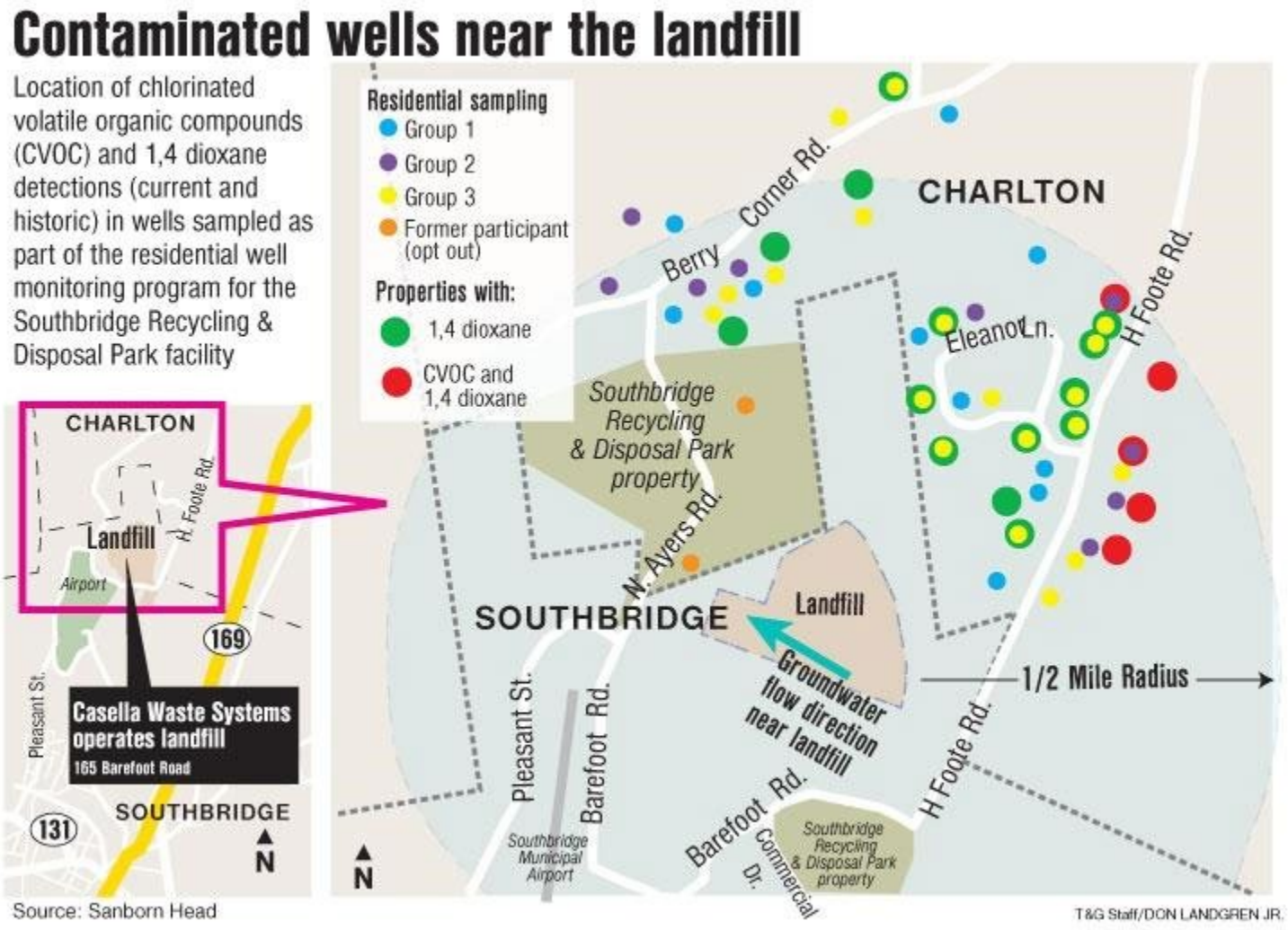


E: The trash can solution

- 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

Southbridge landfill – the final resting place?

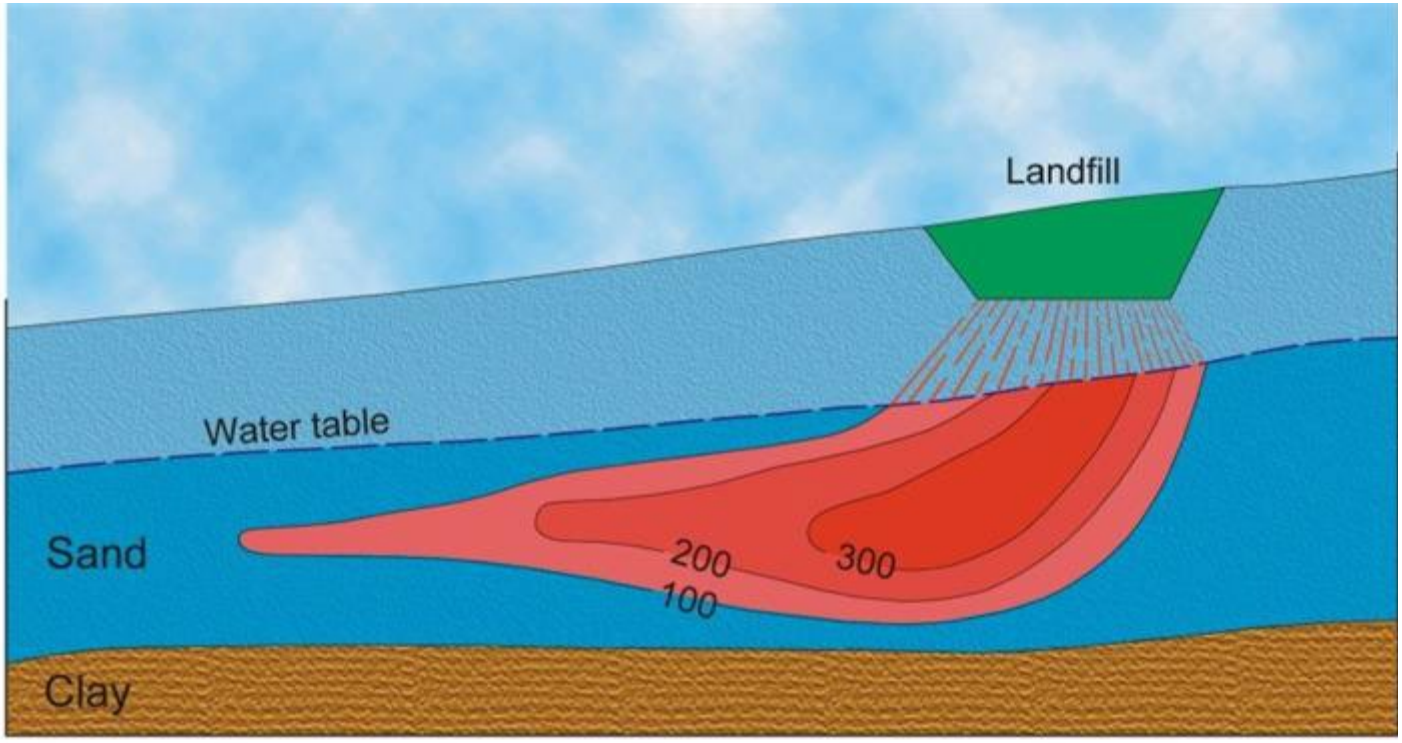
- Capacity and contamination problems?



From: Worcester Telegram, Nov 5, 2015

Landfills and groundwater

- They all leak to some extent, especially unlined landfills



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