

Pilot Field Study of Hot Water Distribution Systems

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Methods

- Record at 1 second intervals when water flowing
- at all hot water end uses
 - measure water flow
 - measure water temperature
- into & out of the water heater
 - measure water flow
 - measure water temperature
- Semi-intrusive
- Wireless data acquisition
- Automated data recovery & analysis

At Clothes Washer



At Showerhead

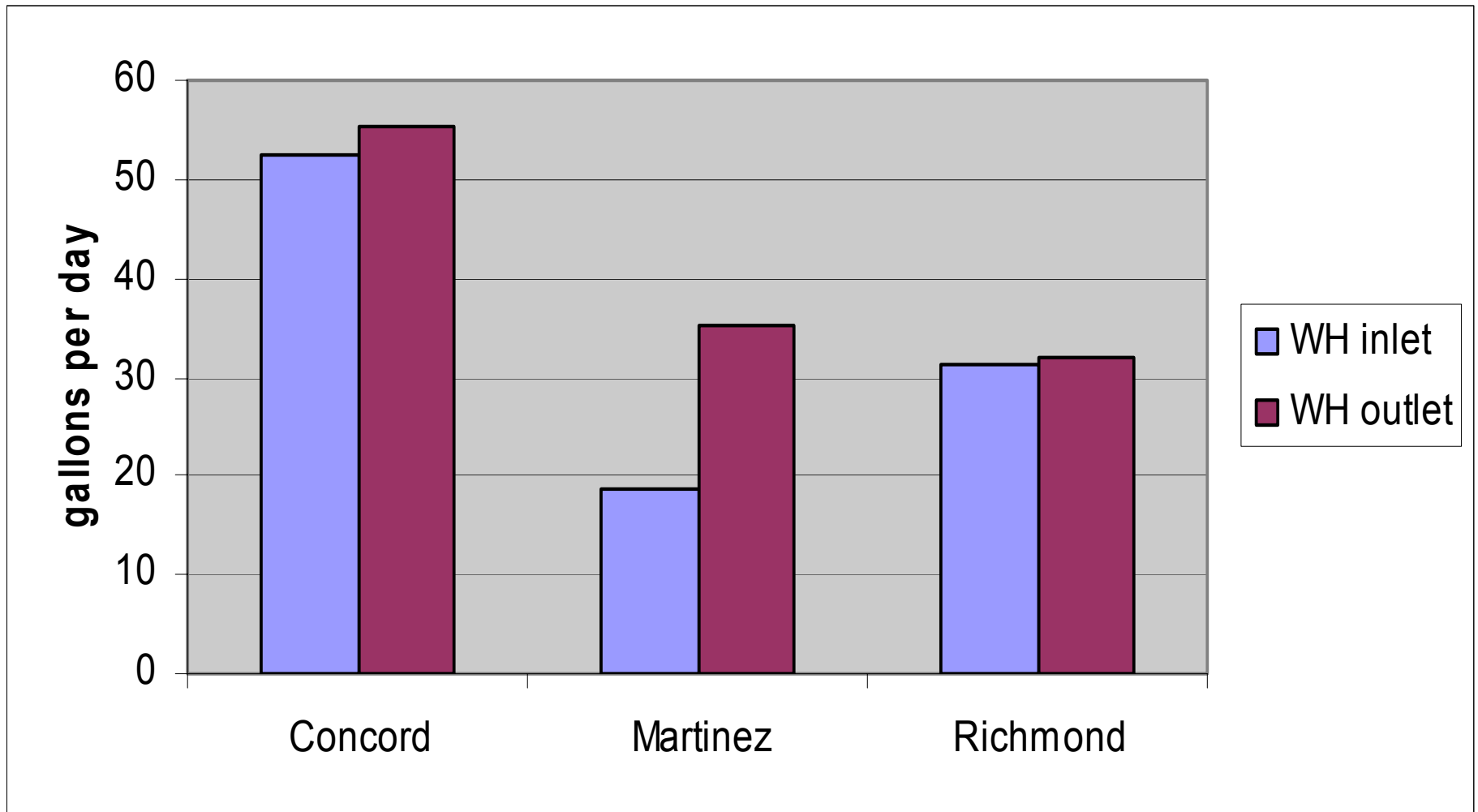


Monitoring Overview

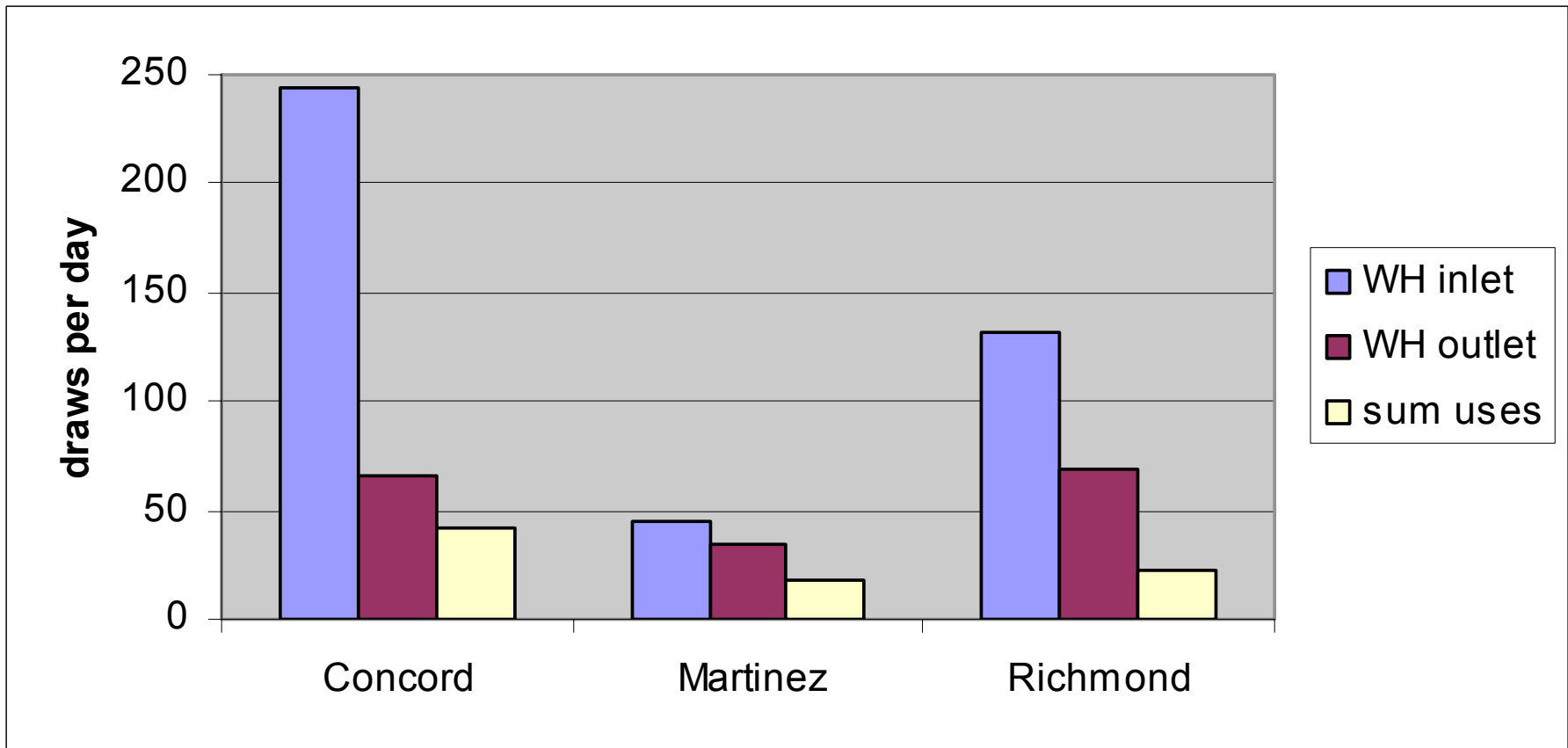
- 4 volunteer houses
- total 22 successful days
- 4,545 draws

| site | dates | days |
|----------|-----------------|------|
| Concord | 1/6 - 1/9, 1/13 | 5 |
| Martinez | 2/26 - 3/6 | 8 |
| Richmond | 3/19 - 3/26 | 9 |
| Moraga | not successful | 0 |

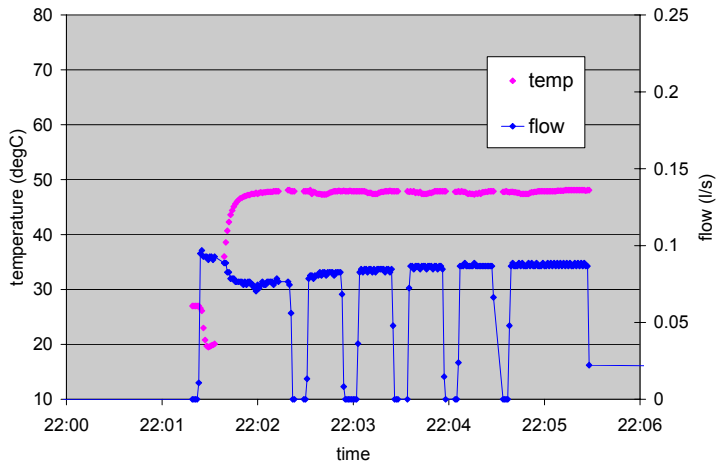
Daily Flow at Water Heater



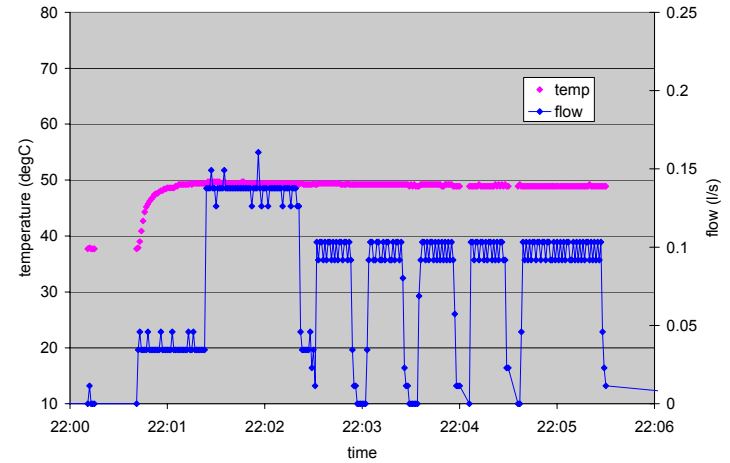
Draws per Day



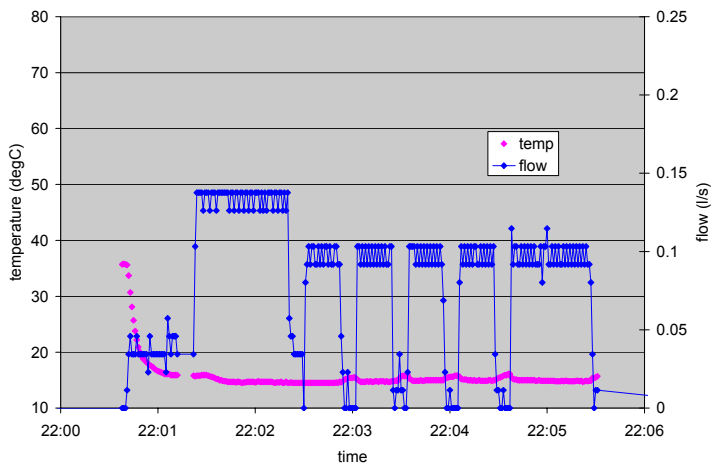
Sample Draw



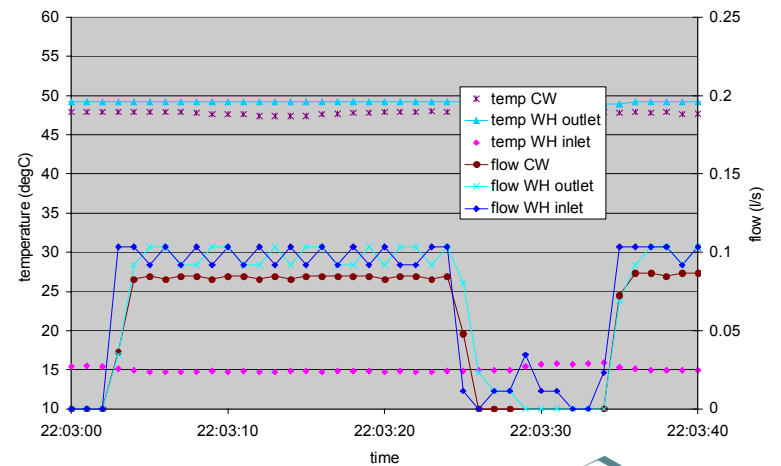
clothes washer



water heater outlet



water heater inlet



sample draw details

Sample Draw Analysis

| | WH inlet | WH outlet | CW |
|---------------------------|----------------------|-----------|------|
| volume (l) | 2.28 | 2.21 | 1.85 |
| % | 103% | 100% | 83% |
| temp (°C) | 14.8 | 49.2 | 47.7 |
| energy efficiency of pipe | | | |
| | temperature and flow | | 81% |
| | temperature only | | 97% |

Lessons Learned

□ Shortcomings

- Not all end uses
- Showerhead mixed flow
- Did not attempt Bath tub spout
- No master meter

□ Unpleasant Findings

- Programming notes was difficult
- Measurement inconsistencies
- Processing data
 - Dealing with quantity of data
 - Connecting draws

Recommendations

- Calibrate flow meters
- Pressure sensors at water heater
- Specifications for future motes
- Installation diagnostics
- Automate analysis
- Include indoor cold water
- Hire mote designer & programmer