



Phytoremediation of a Chlorinated Solvent Plume Using Fast-Growing Cottonwood and Hybrid Poplar Trees

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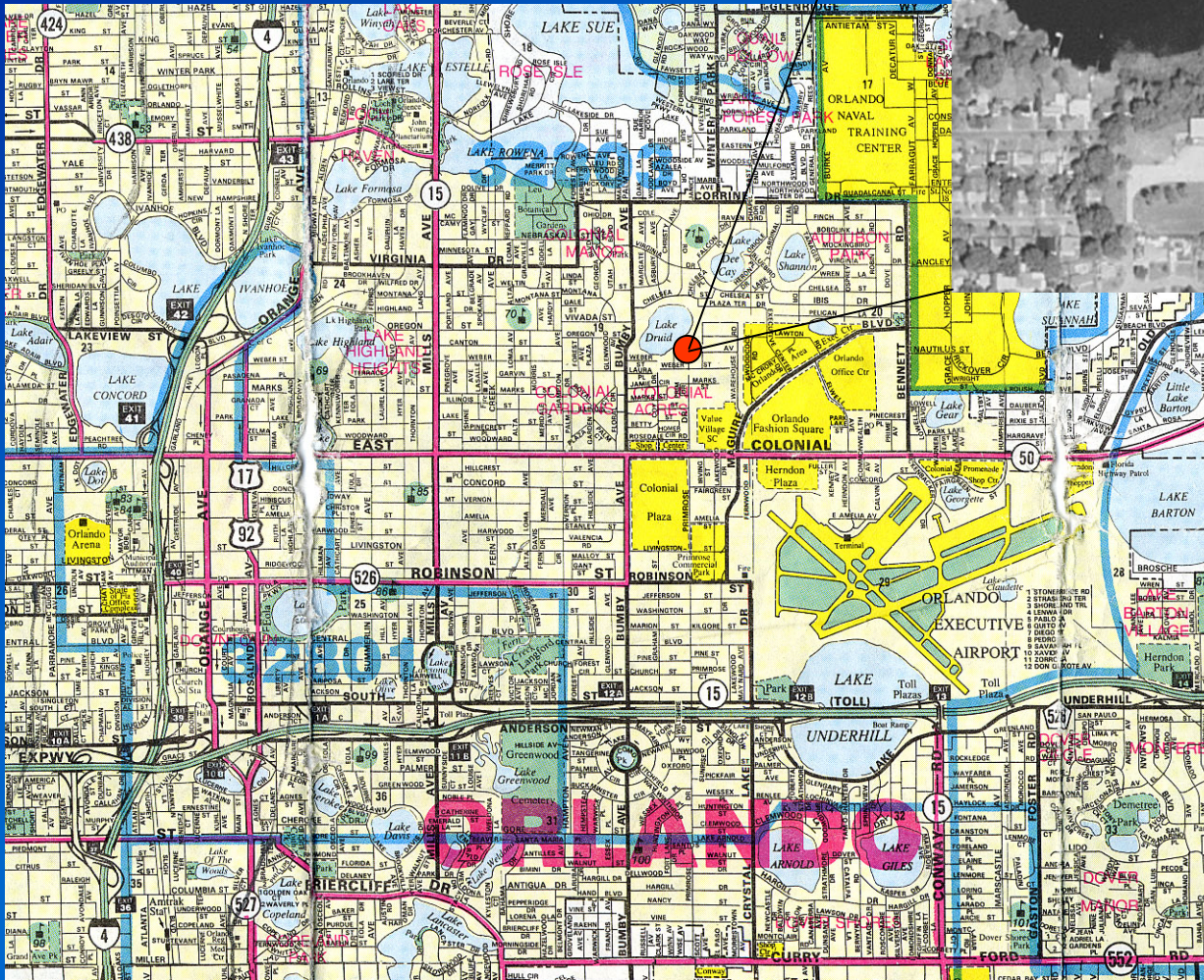


Discussion Topics of the Phytoremediation System

- Site location and history
- Latest tissue data and monitoring results
- Tree growth data over last 3 years
- Groundwater impacts under plantation
- Future operations & ecological risks



Site Location



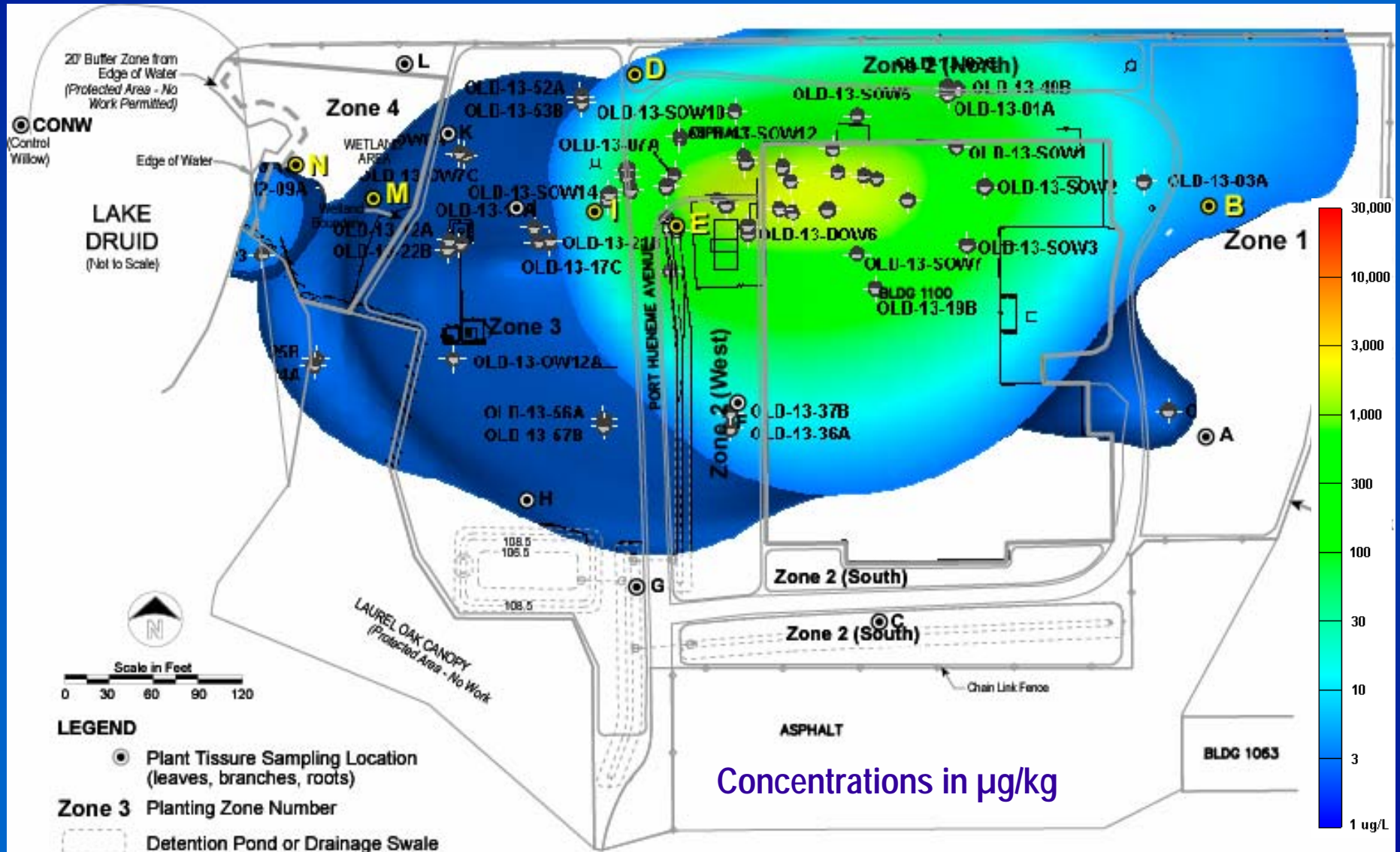


Site History

- Former Naval Training Center (Area C/OU4)
- GW contamination from dry cleaning fluids
 - Laundry facility in Bldg. 1100
 - Facility operated between 1943 and 1994
- COCs include PCE, TCE, DCE
- GW remediation goals (RGs) for the site:
 - Tetrachloroethene (PCE) 3 µg/L
 - Trichloroethene (TCE) 3 µg/L
 - cis-1,2-Dichloroethene (DCE) 70 µg/L



PCE, TCE Groundwater Concentrations





Phytoremediation Project Photos



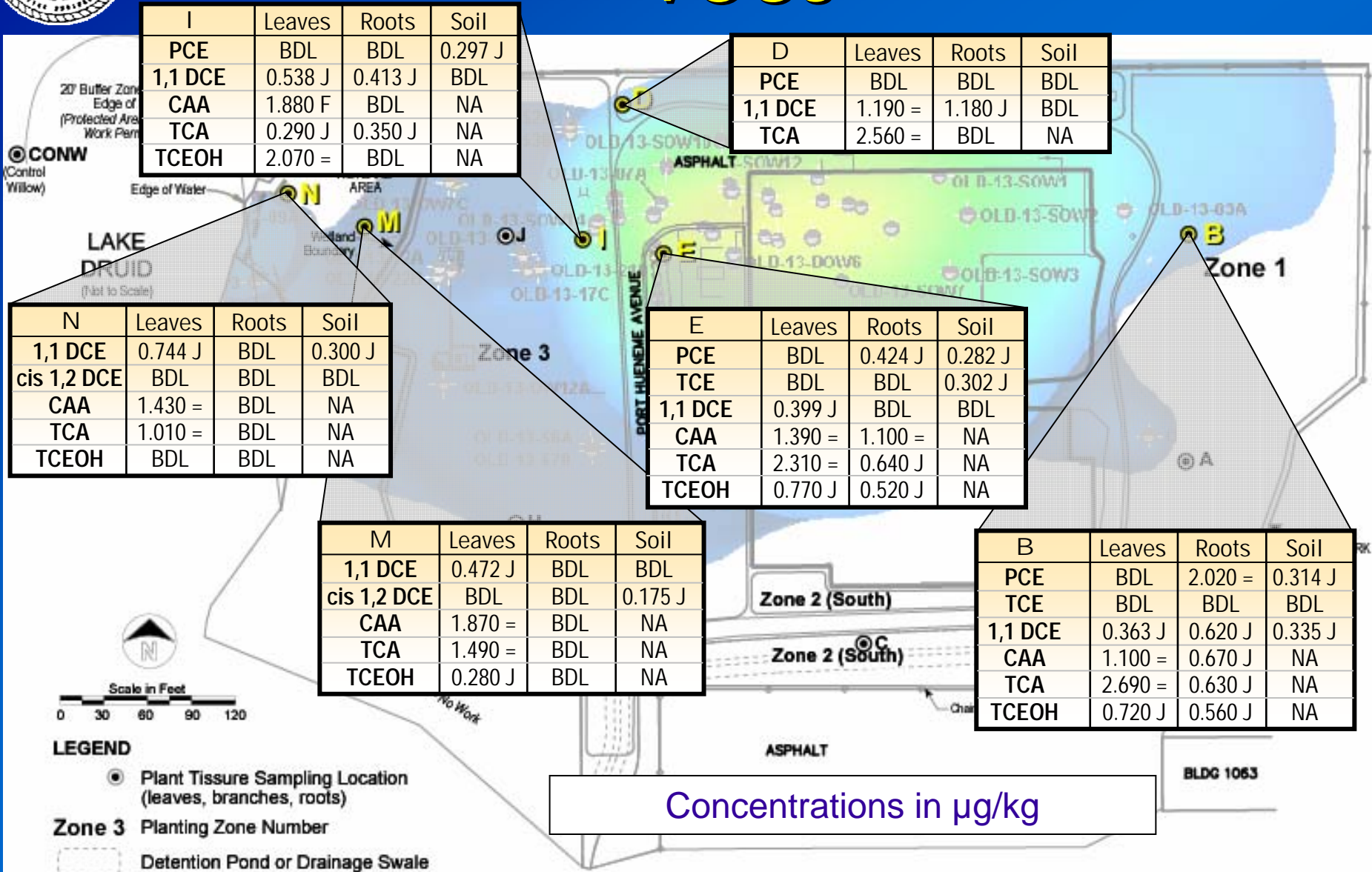


Phytoremediation Monitoring & Results

- Plant Tissue Analyses (VOCs & HAAs)
- Biomass Measurements (Ht, Trunk Diam.)
- Groundwater Level
- Groundwater Microbial Analyses
 - (Data Not Shown)

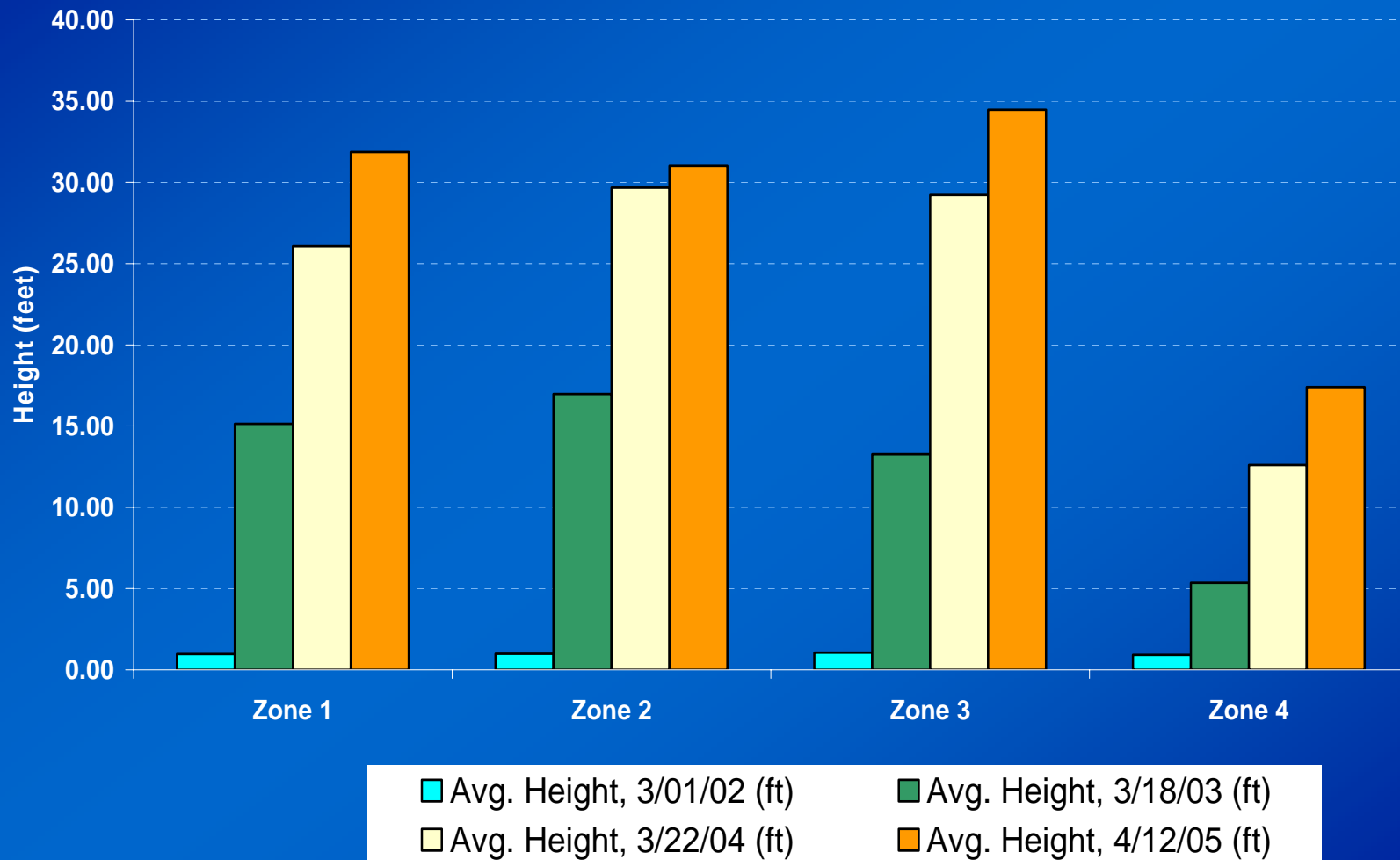


Year 3 (Summer): Plant Tissue & Soil VOCs





Tree Growth Data





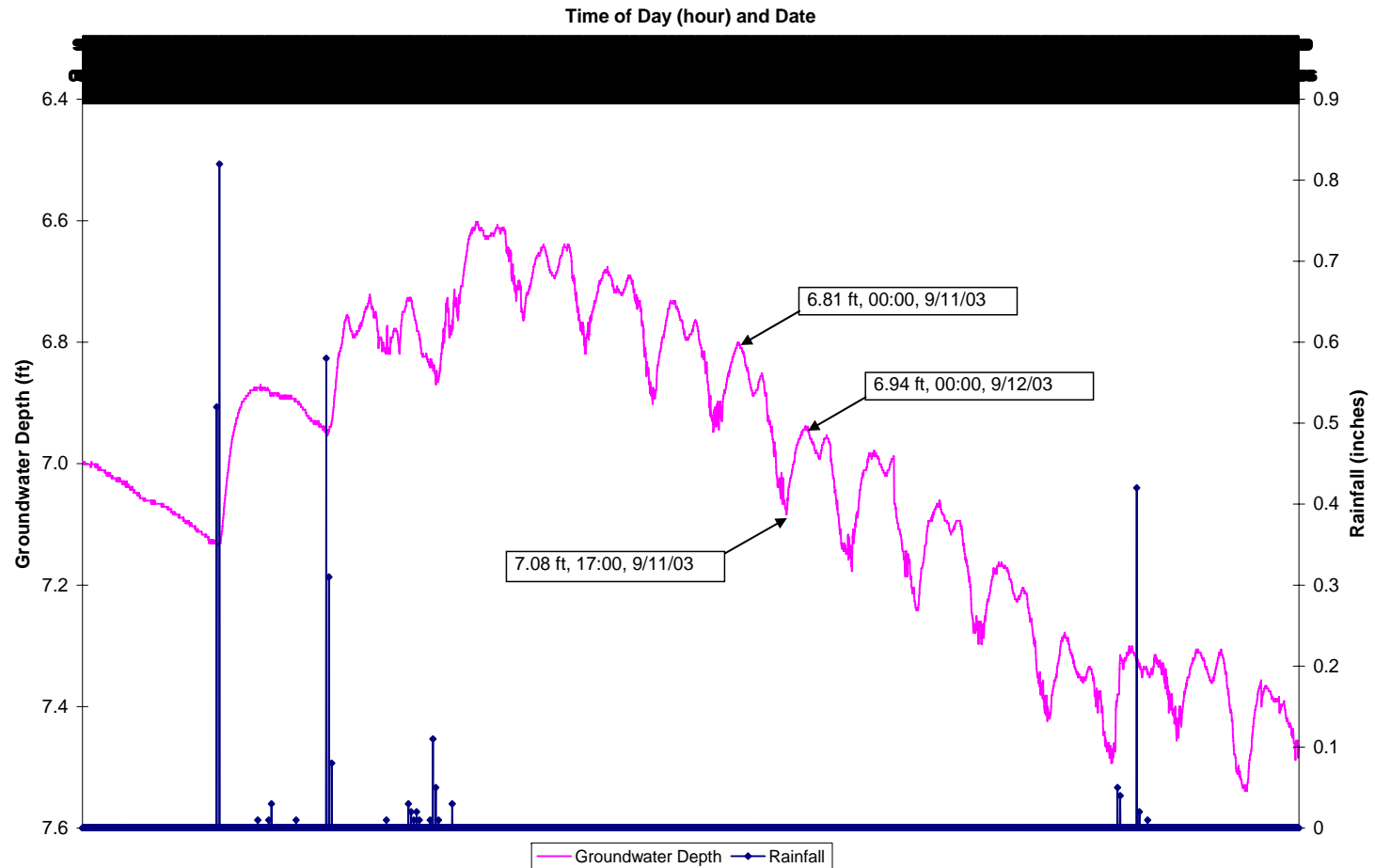
Impact of Phytoremediation on the Shallow GW Table

- Groundwater Table Monitoring
 - 11 shallow wells in Zone 1
 - Data Trolls monitor water level every 30 minutes
 - Data point from August 8, 2004 showed 1.09 ft depression in plot's center
- Long-term Impact
 - Verify trees remain engaged in water removal
 - Deeper root movement will encourage continued exudate deposition into shallow groundwater



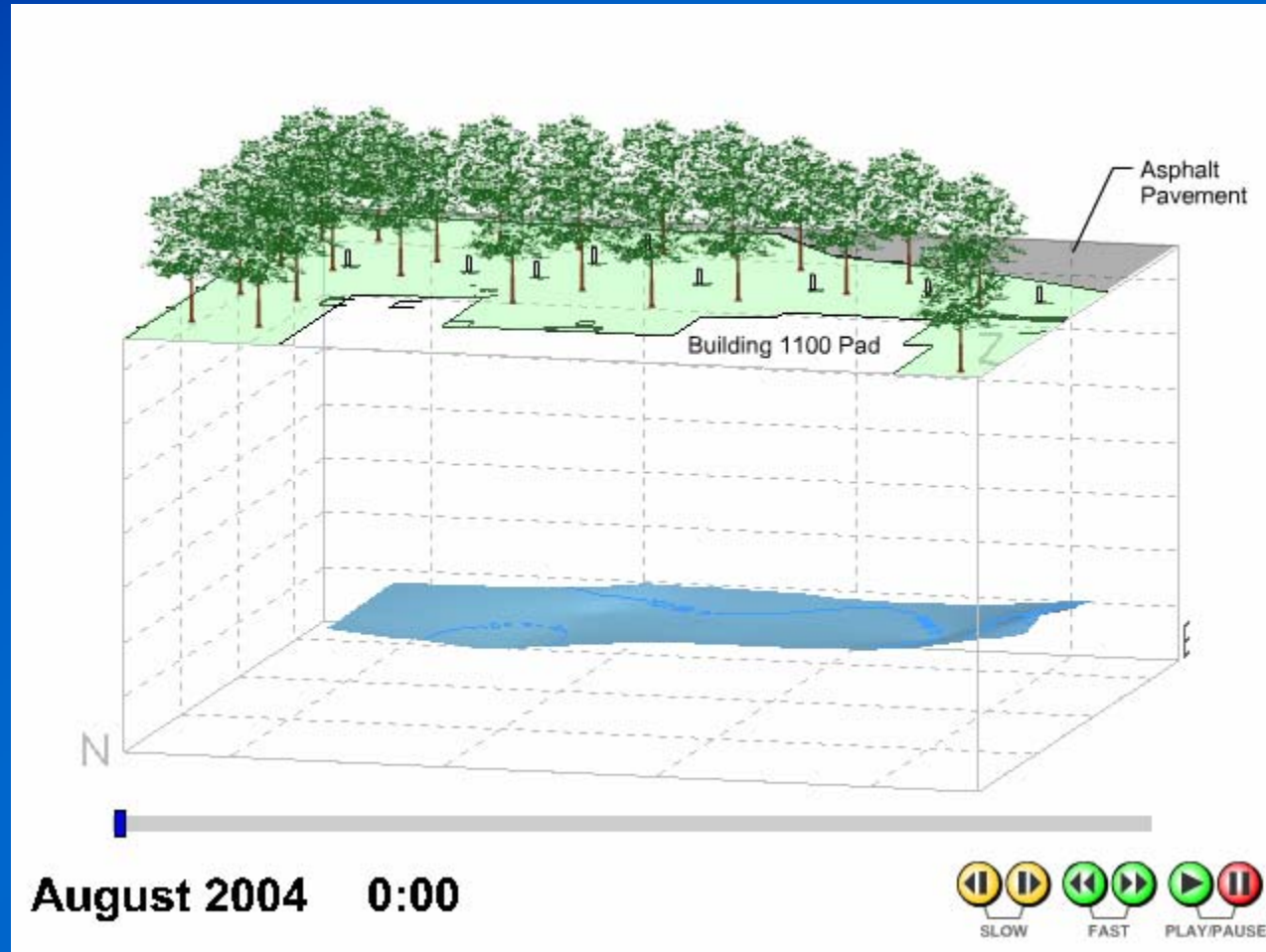
Groundwater Table Daily Fluctuation Under Active Plantation

Diel Groundwater Table Fluctuations under the Phytoremediation Plantation
Zone 1, Piezometer #7





Groundwater Table Monitoring Under Active Plantation (Aug. '04)





Long-Term Phytoremediation Outlook

- Monitoring Parameters (Annually)
 - Long term plant tissue uptake
 - Evaluate COCs & HAAs in plant tissue and soil
 - Microbial populations from PLFA data
 - Groundwater levels under plantation
- Plantation Health
 - Tree thinning
 - Soil fertility
 - Pest control (cottonwood beetle)



Long-Term Phytoremediation Outlook

● Future Operations

- Mature trees remove larger volumes of water with increasing age
- Track the depletion of plant-available contaminants in soil or shallow groundwater
- Expect productive life of 5 - 10 years

● Ecological Risk

- Leaves have minimal residual COCs (1.93 $\mu\text{g}/\text{kg}$ 1,2-DCE) and are below 6 ppm direct exposure std.
- Whole trees to be chipped onsite, used as mulch