

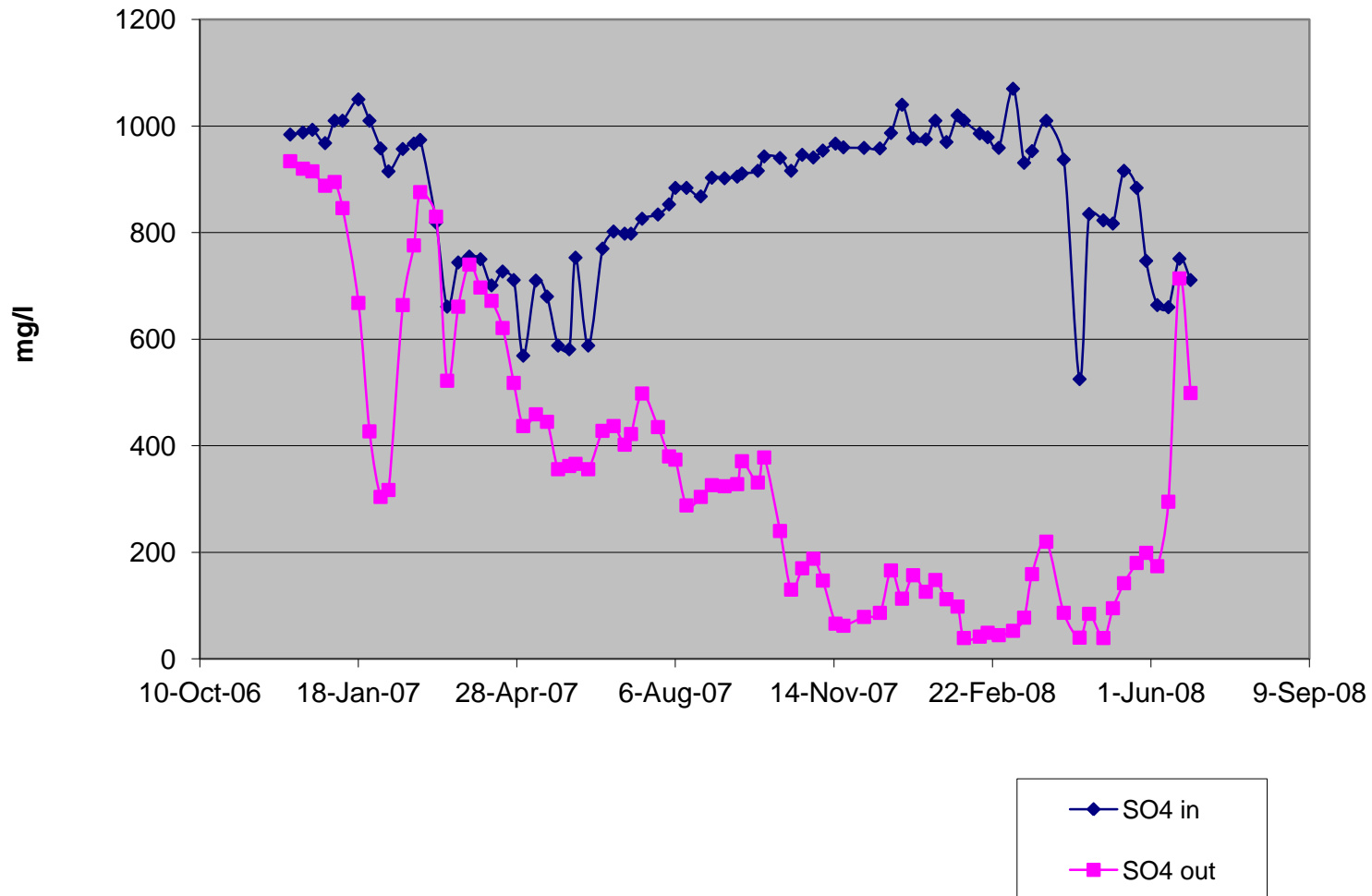
# Sulfate Treatment: Kinross Underdrain



- Removal of  $\text{SO}_4$  and  $\text{NO}_3$
- Initial  $[\text{SO}_4] = 100\text{-}120$  mg/L
- Final  $[\text{SO}_4]$  as low as 20 mg/L
- Methanol and phosphate feed

# Sulfate Treatment: Key Mine

## Sulfate Levels at the Key Biotreatment System



# Sulfate Treatment: Jerritt Canyon



- One system so far (Marlboro Canyon)
- Two more planned
- Flow = 10 gpm
- 1000 ft long
- Wood chips, sawdust, straw, limestone, manure
- [SO<sub>4</sub>]: 2800 → < 250

# Sulfate Treatment: PolyMet Mining

- *In situ* system (10 gpm) for pit lake in Northern Minnesota
- Uses plastic media for biofilm growth
- 1200 mg/L SO<sub>4</sub>
- Treatment goal is < 10 mg/L
- Achieving 100-200 mg/L so far
- Ethanol, nitrate and phosphate feed

# Lessons Learned

- Despite varying flows and concentrations, sulfate loads are often relatively constant.
- Regulators are more concerned with results than with process (which is a good thing).
- Biological systems need time to populate and acclimate.
- Bacteria are still active at low temperatures.