"SMART" WELLFIELD™ DESIGN TO OPTIMIZE GROUNDWATER SUPPLY

Components of an optimal wellfield design include:

- Wells that yield the most available water given the aquifer characteristics
- Wells that insert water from the shallowest depth possible
- Wells that are in close proximity that can be monitored from existing and future verification sources
- Wells that provide continuous feedback to managers with which to assess their operational status and efficiency

The smart wellfield concept begins with equipping wells with continuous water level measurement sensors for compilation in the SCADA system along with flow rates and other information. Innovative computer technologies are then used for sophisticated trend analysis essential to understanding the dynamic operation of the system. Kriging algorithms and other visualization tools enhance this understanding, highlighting the need for basic well maintenance, and focus on traditional areas for working and preparing wells. Examples of these uses are shown below.

SMART WELLFIELD CHARACTERISTICS

1. Visualize Current Conditions
   - Delineate Accurate Well Head Protection Areas
   - Graphs of Wellfield Data Tell an Interesting Story
   - Power demand continues to go up
   - Use sophisticated kriging algorithms
   - Use transmissivity, storativity, specific yield, and hydraulic conductivity to be calculated using previous hydrographs or mathematical solutions
   - Methods can be used to increase the accuracy of Hydrologic models
   - Water level data is facilitated

2. Determine Well Hydraulics
   - Use transmissivity, storativity, specific yield, and hydraulic conductivity to be calculated using previous hydrographs or mathematical solutions
   - Methods can be used to increase the accuracy of Hydrologic models
   - Water level data is facilitated

3. Evaluate Well Interference
   - Wells that interfere with the same water
   - Interference is monitored continuously
   - “Close” optimal flow rates
   - Interference drainage

4. Perform Hydrologic Evaluation
   - At “Smart” locations performs continuous water level monitoring
   - Peak periods are calculated on the fly
   - Transmissivity, storativity, specific yield, and hydraulic conductivity is calculated
   - Water level data is facilitated

SMART WELLFIELD ECONOMIC IMPACT

1. Delicate Accurate Well Head Protetion Areas
   - Estimates capture zones under varying time of travel
   - Use site specific SCADA data
   - Provides an efficient, accurate, and defensible delineation of well head protection areas
   - Access SCADA water level and flow rate data
   - Observe aquifer response to actual pumping changes
   - Estimate capture zones under varying time of travel

2. Minimize Well Efficiency and Schedule Maintenance
   - Trends in specific capacity are an indicator of the health of a well
   - Maintain efficient wells to reduce electricity costs
   - Avoid well damage by early identification of excessive pumping
   - Calculate specific capacity in pumping wells
   - Evaluate well efficiency
   - Maintain efficient wells to reduce electricity costs
   - Avoid well damage by early identification of excessive pumping

Conclusions:

- “Smart” Wellfields (US Patent 8,244,499):
  - Decrease energy consumption, reporting, and compliance costs
  - Decrease well rehabilitation and water treatment costs
  - Decrease well interference costs and drawdown issues
  - Implement aquifer resource management tools that are based on real data

For more information, contact Bill Gregg at 651.262.4236 or visit www.summitenviro.com

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