

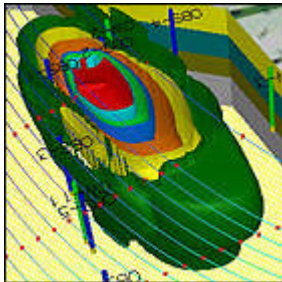
GROUNDWATER & ENVIRONMENT NEWSLETTER

A PERIODIC NEWSLETTER COMPILED
FOR HYDROGEOLOGICAL &
ENVIRONMENTAL PROFESSIONALS IN
W.A. INDUSTRY, MINING & RESOURCE
COMPANIES

Issue November 2009

Groundwater Pump and Treat

Pump and Treat (P&T) is a common groundwater remediation technology, where contaminants are extracted by pumping & treated either in-situ or at the surface, & either reinjecting treated water to the aquifer or disposing of it off site. It is an effective method to control LNAPL & remove dissolved contaminants from the subsurface, and hydraulically contain contaminated ground water to prevent migration. Contaminant removal is controlled by its behaviour in the subsurface, the site hydrogeology, and the efficiency of the extraction system design. The pumping system design and water treatment technologies are dependent on the site characteristics and the contaminant properties. Effective monitoring is needed to verify effectiveness & to adjust the system in response to potential changes in subsurface conditions.



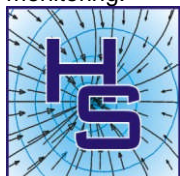
Data Requirements

The contaminant plume or mobile Non Aqueous Phase Liquids (NAPLs) needs to be delineated within a 3-D aquifer for which the hydraulic properties & contaminant characteristics/ behaviour have been determined, prior to designing a capture system. Specific data requirements include:

- Regulatory requirements
- Site-specific conceptual model
- Design objectives
- Quality/ characteristics of the water
- Flow rates
- Recovered water discharge options
- Effective monitoring system

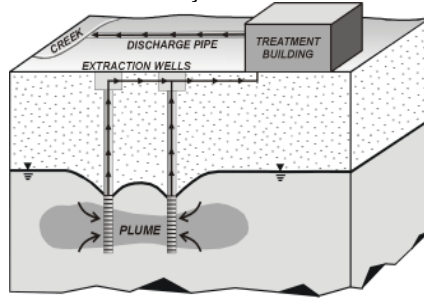
System

Basic components comprise an extraction system, in-situ OR above-ground treatment, disposal of treated water, subsurface groundwater & treatment process monitoring:



Groundwater extraction may comprise:

- Single/ multi-wells
- Vertical / inclined/ horizontal Wells
- Vertical Well Point Systems
- Trench drain Systems



Example Setting of a Pump and Treat System

Source - USEPA

Water treatment systems:

- In-situ treatment, e.g. in bore separation of e.g. oil & water, recirculation sparging wells etc
- Pre-treatment via solid or liquid separation/ stilling
- Above-ground treatment options et al:
- Organics:
 - Air stripping
 - Granular activated carbon
 - Chemical/UV oxidation
 - Aerobic biological reactors
- Metals et al:
 - Chemical precipitation
 - Ion exchange/adsorption
 - Electrochemical methods
- Vapour Phase Treatment et al:
 - Activated carbon filtration
 - Catalytic oxidation
 - Thermal incineration
 - Acid gas scrubbing
 - Condensation

Disposal systems:

Reinjection wells or infiltration galleries may be used to enhance the movement and capture of the plume towards the extraction system.

P&T System evaluation

Evaluation parameters include:

- Effective plume capture
- Treatment process monitoring
- Groundwater monitoring
- Extraction well performance
- Injection well performance

Advantages

- Effective and time-tested method
- Effective in removing dissolved materials including VOCs, SVOCs, fuels, UXO (i.e., explosive compounds) and dissolved metals.
- Treated water may be reused

Disadvantages

- Often prolonged operation needed to meet cleanup goals & associated expense.
- Nature of contaminants, subsurface geology, aquifer properties greatly influence its effectiveness. E.g. sorption/ retention on aquifer materials, entrapment within fractures, capillary effects etc
- "Rebound" effect may be seen after system turn-off. Pumping depresses the groundwater level, leaving residuals sorbed to the soil. After groundwater rebound, contaminants can desorb & continue to pollute.
- "Tailing" effect, where contaminant concentrations decline at slower rates as pumping continues, & may become asymptotic above target cleanup levels.

Indicative Costs

The main factors include:

- Contaminant behaviour/ properties
- System design and operation
- Source control
- Hydrogeological setting,
- Extent of contamination, and
- Remedial goals

Indicative average costs in \$Aus adjusted to 2009 (Source: USEPA):

- Total capital cost: - \$2.3M to \$8M
- Average operating cost per year: \$0.24M to \$1.05M

Next issue – Vacuum Enhanced Recovery



HydroSolutions Pty Ltd

We are a specialist hydrogeological consultancy providing expert services including investigation, potable & process resource development & dewatering. Our environmental capabilities include contaminated site investigation, auditing, remediation & risk assessment - qualitative/ quantitative, health, & ecological.

Visit us at: www.HydroSolutions.com.au
Broadband NetMeeting conferencing available for remote sites.

Tel: +61 8 9457 5448

Fax: +61 8 9457 4293

Mob: 0403 021533

stuart.jeffries@HydroSolutions.com.au

www.HydroSolutions.com.au

HYDRO SOLUTIONS
PTY LTD
Hydrogeological & Environmental Consultants