

# GROUNDWATER & ENVIRONMENT NEWSLETTER

**A PERIODIC NEWSLETTER  
COMPILED FOR  
HYDROGEOLOGICAL &  
ENVIRONMENTAL  
PROFESSIONALS WITHIN  
W.A. MINING & RESOURCE  
COMPANIES.**

## **Groundwater Hydraulic Modelling**

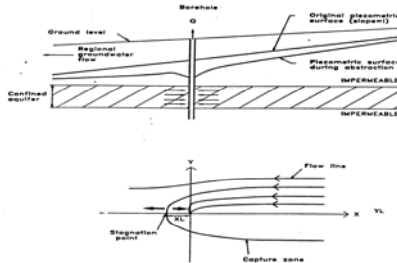
The process of quantifying & predicting groundwater levels & flow quantities to changing conditions.

## **ANALYTICAL MODELLING**

Equations for 2-3D groundwater flow may be used to provide a relatively simple/ inexpensive first-pass approximation. Steady state (non time variant) equations are available for water table (unconfined), leaky layer (semi-confined) & confined aquifers, for long term seepage & water levels. Typical applications include seepage estimates through dams, or interference of abstractions on neighbours/ wetlands etc.

Time varying solutions (eg the start of dewatering operations) are available. Commercially available software includes WHPA et al.

Although relatively easy to apply, analytical techniques are limited to simple extensive aquifers, uniform aquifer properties (usually) lacking any boundaries or recharge. They are however extremely useful in initial estimates of impact, & may be applied where little data on aquifer systems is available.



## **Water Balances**

Water balance quantifies water inputs, outputs or loss/gain to a

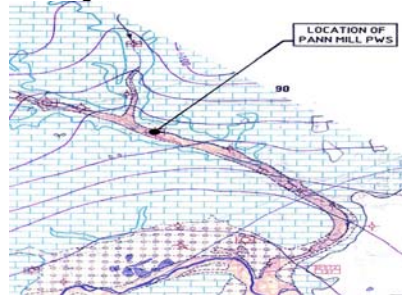


**HYDROSOLUTIONS**  
PTY LTD  
Hydrogeological & Environmental Consultants

groundwater system. It requires knowledge of the aquifer system & quantifiable flow estimates, & therefore may be reasonably demanding in effort. Typical applications include estimates of landfill leachate generation, seepage loss from tailings dams/ storage lagoons, evaporation, runoff & crop irrigation modelling etc.

## **NUMERICAL MODELLING**

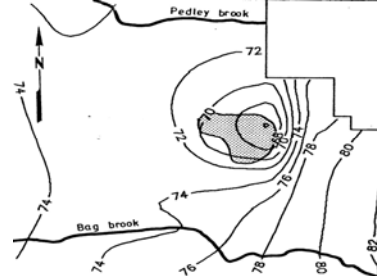
This uses software capable of describing complex & variable aquifer conditions, boundaries, time & spatially varying pumping & recharge conditions.



A background & site investigation defines conditions & properties. A conceptual hydrogeological model is then developed describing groundwater flow & aquifer geometry as the basis for the numerical model, using number arrays to describe the system. The model is then calibrated to reproduce observed data, by varying properties to improve the 'goodness' of data fit (expressed statistically), & an assessment of model sensitivity to parameters. The model is calibrated when an adequate fit is obtained, giving confidence that the model is capable of reproducing historical conditions, & therefore future impacts.

Investigation scenarios are then developed, & impact is predicted using the model. Typical applications include groundwater sustainable resource appraisals, dewatering assessments, & impacts on surface water features etc. Commercially available software includes (freeware) MODFLOW

requiring pre-processors eg VisualMODFLOW, & models such as FEFLOW, FLOWPATH et al.



The amount of data, time & effort required to develop a calibrated numerical model is related to the complexity & understanding of the system. While this may require considerable effort & expenditure, the predictions of impact from complex large-scale developments may only be adequately assessed using this technique. A regulatory review of such developments may require consideration of predictive output from numerical techniques.

## **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, remediation & risk assessment - qualitative/ quantitative, health, & ecological.*

## **Next issue - Contaminated Sites**



*What you need to do & why?*

Visit us at: [www.HydroSolutions.com.au](http://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](mailto:stuart.jeffries@HydroSolutions.com.au)

[www.HydroSolutions.com.au](http://www.HydroSolutions.com.au)