

Optimal Well-Group Distribution of a Groundwater Source Heat Pump System¹

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Abstract: It is critical to determine how the well group arranges for application of the GWSHP system. Based on the fact that water movement is the most important factor influencing heat transfer in an aquifer, this paper presents a two-step analysis method and analyzes the inter-well thermal transfixion method as follows. First, we forecast the least influence radius through calculating the thermal diffusion function of aquifer. Then, we perform an analysis on the inter-well thermal transfixion, using the streamline analysis method and doing a quantitative analysis of the effects that inter-well distance and flux have on it. We discuss the well group arrangement and puts forward optimal scheme by means of the thermal diffusion and streamline simulation.

Key words: water/heat movement; well group arrangement; thermal transfixion; optimization

1 FOREWORD

The green technology GWSHP system is good for sustainable development. It makes use of groundwater as cold source or heat source, and its COP is higher than other air conditioning system, so it has higher environmental protection and economic value. Well group is an important part of GWSHP system, its operation performance is the linchpin which success or failure of the whole system depends on. At present, in the process of the

domestic well group design and construction of this kind project, the criterion of system scheme feasibility are the singer well water flow rate and the achievement of the favorable recharge. But in the process of well group distribution feasibility analysis and design, several problems must be taken into account:

(1) The local aquifer thermal energy storing and transfer process

While utilizing the GWSHP system, it needs to know the building cubage rate limitation that the system could burden. When the building annual cooling/heating load is not regularity, what perennial influence effect that the system makes on aquifer water temperature, whether brings about the aquifer

“background temperature” reduction or increase year by year and leads to the system operation fail. How to constitute the relative reply strategy?

(2) The avoidance of “thermal transfixion” effect

Because of the difference between recharge water temperature and initial aquifer water temperature, under the influence of conduction and convection, recharge water “temperature front” will induce the pumping well vicinity inlet water temperature increase or reduction, the phenomena always be called as “thermal transfixion”^[1]. How to ascertain the fitting well spacing and the well group distribution to avoid the “thermal transfixion” effect are the regardful problem to designer.

(3) The effect of ground unit and ductwork form

¹ Supported by the Scientific Research Project of Hunan Provincial Education Department(04C537).