Supplement of

Evaluating Long-Term Effectiveness of Managed Aquifer Recharge for Groundwater Recovery and Nitrate Mitigation in an Overexploited Aquifer System

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Table S1. Parameters of reactive transport

Half saturation of NO_3^- in $NO_3 \to NO_2$ (mole/L)	1.1e-5
Half saturation of CH_3COOH^- in $NO_3 \to NO_2$ (mole/L)	2e-4
Inhibition constant of $O2$ in $NO_3 \to NO_2$ (mole/L)	1e-5
Rate constant in $NO_3 \to NO_2$ (mole/L/s)	1e-9
Half saturation of NO_2^- in $NO_2 \to N_2$ (mole/L)	1.13e-5
Half saturation of CH_3COOH^- in $NO_2 \to N_2$ (mole/L)	2e-5
Inhibition of $O2$ in $NO_2 \to N_2$ (mole/L)	1e-5
Rate constant in $NO_2 \to N_2$ (mole/L/s)	2e-10

Table S2 Prameters of homogeneous fields

Zone	hydraulic conductivity (m/d)	Porsity
1	24	0.3
2	16	0.43
3	10	0.45
4	4	0.43

Table S3 Prameters of heterogeneous fields

Material	hydraulic conductivity (m/d)	Porsity
Clay	0.01	0.45
Silt	5	0.4
Fine sand	75	0.35
Medium sand	250	0.3

Table S4. Groundwater water-budget

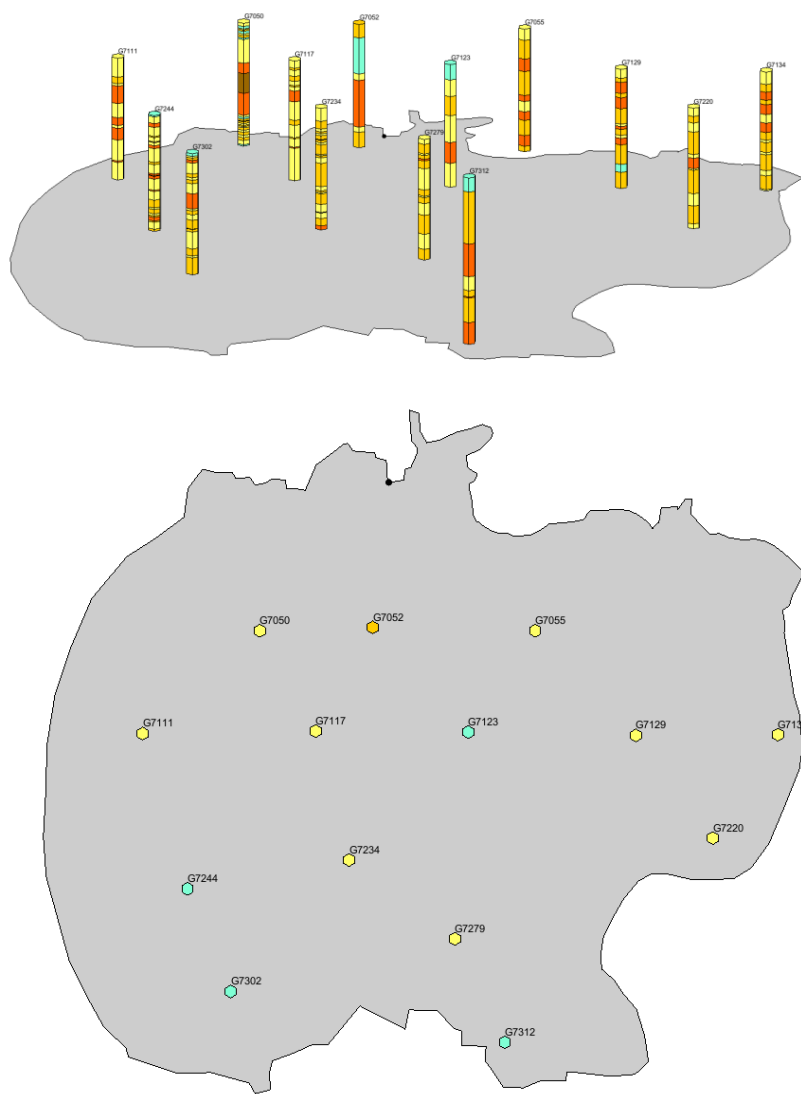| mass (kg)	Storage change	Pre	Irrigation	western	southern	eastern	Total pumping
$T_{end} - T_{initial}$	1.69×10^{11}	5.22×10^{11}	1.43×10^{11}	5.04×10^{11}	5.02×10^{11}	3.98×10^{11}	-1.9×10^{12}

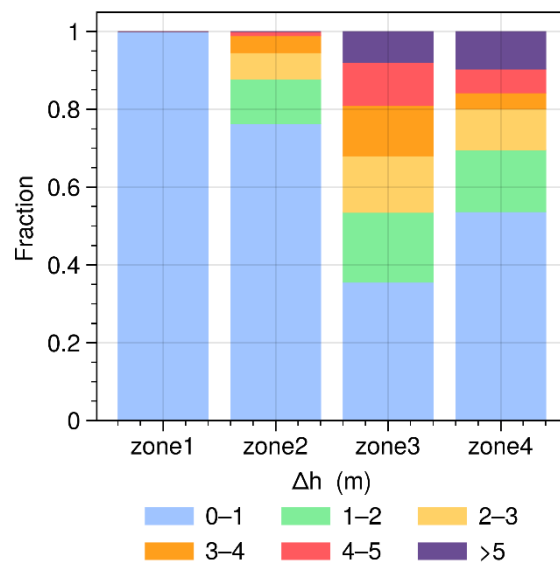15 **Figure.S1 Locations of the 14 boreholes within the study area.**

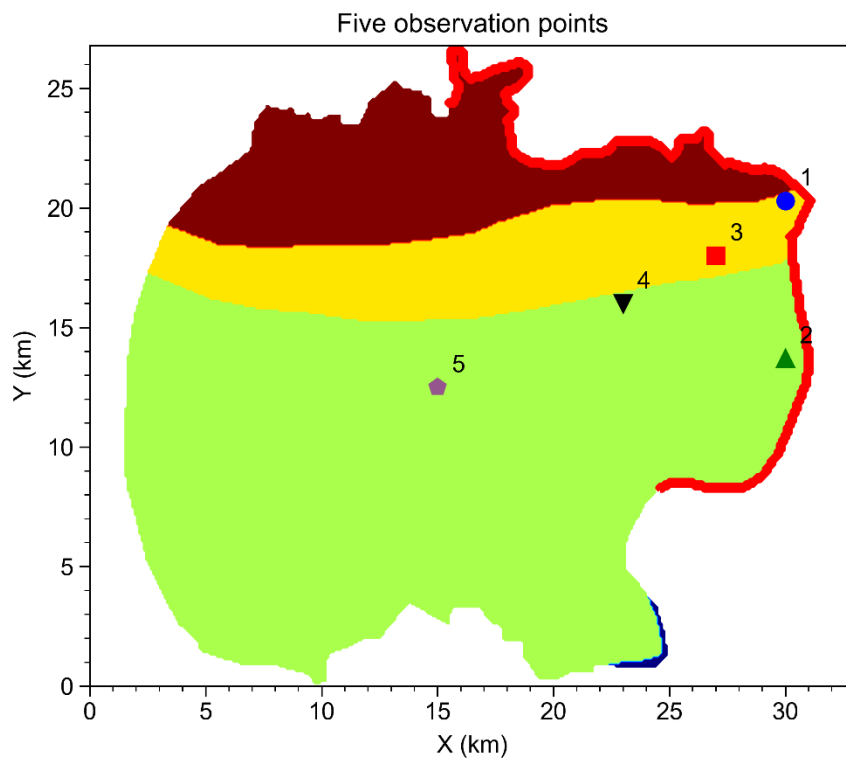**Figure S2. Distribution of Groundwater Head Recovery (Δh) Across Zones by 2035**

Figure S3. Spatial Distribution of Zones and Observation Wells

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