

Table of contents

Preface	XI
Water in Europe <i>Th.G.Martijn</i>	XIII
The role of artificial recharge of groundwater for the water supply of Amsterdam <i>G.ter Horst</i>	XV
Organization	XVII
1 <i>Paper presentations</i>	
1.1 <i>Operation of basin recharge</i>	
Seawater intrusion reversed through artificial recharge beneath the Oxnard Plain, California <i>S.G.Berger & F.J.Gientke</i>	3
Sustainable groundwater management using artificial recharge in the Paris region <i>H.Haefner, M.Detay & J.L.Bersillon</i>	9
Dynamic simulation model for water management of a large-scale artificial recharge system <i>M.J.M.Mosch</i>	15
Maaskant Recharge Project: Monitoring and operation of the recharge system <i>M.W.J.Eck, S.M.L.Verheijden & A.J.Vogelaar</i>	21
1.2 <i>Water management in arid regions</i>	
Role of artificial recharge in the water resources management of Kuwait <i>M.N.Viswanathan & M.N.Al-Senafy</i>	29
The management of surface and groundwater resources in Lebanon <i>S.Sadek & M.El Fadel</i>	35
Successful operation of a large aquifer storage facility for a desert community <i>M.R.Lluria</i>	41
The role of artificial recharge in integrated water management in Egypt <i>F.Attia, M.Moustafa, T.Olsthorn & E.Smidt</i>	47

1.3 Clogging	
A conceptual and numerical model to characterize clogging <i>A. Pérez-Paricio & J. Carrera</i>	55
Well clogging effects determined from mass balances and hydraulic response at a stormwater ASR site <i>P. Pavelic, P.J. Dillon, K. E. Barry, A. L. Herczeg, K.J. Rattray, P. Hekmeijer & N.Z. Gerges</i>	61
Effects of natural channel bed filtration prior to deep well injection <i>S.W. van Duijvenbode & T.N. Olsthoorn</i>	67
Microbial growth and clogging in sand column experiments simulating artificial recharge of groundwater <i>H.-J. Albrechtsen, R. Boe-Hansen, M. Henze & P.S. Mikkelsen</i>	73
1.4 Recharge of treated waste water	
The San Gabriel Valley Recycled Water Demonstration Project <i>A.S. Hutchinson & G. Woodside</i>	81
Wastewater Aquifer Storage and Recovery (ASR) – Towards sustainable reuse in South Australia <i>C. B. Boshier, T.O. Simms & B. Kracman</i>	87
Column experiments to evaluate clogging and biogeochemical reactions in the vicinity of an effluent injection well <i>S.M. Rinck-Pfeiffer, S.R. Ragusa & T. Vandeveld</i>	93
Wastewater treatment and groundwater recharge for reuse in agriculture: Dan Region reclamation project, Shafdan <i>N. Ickson-Tal & R. Blanc</i>	99
1.5 Pollutants and bankfiltration	
Removal of organic matter during bank filtration <i>A.-L. Kivimäki, K. Lahti, T. Hatva, S.M. Tuominen & I.T. Miettinen</i>	107
Long-term sustainability in artificial groundwater recharge <i>C. Frycklund</i>	113
Fate of pollutants during artificial recharge and bank filtration in the Netherlands <i>P.J. Stuyfzand</i>	119
1.6 Microbiological aspects	
DNA-analysis to study the microbial diversity in recharged groundwater <i>B. Eschweiler, B. Kilb, B. Kuhlmann, G. Preuß & E. Ziemann</i>	129
Temporal and spatial distribution patterns of Crustaceans inhabiting a slow sand filter <i>P. Rumm, H. Schmidt & W. Hollwedel</i>	135
Fate of pathogens and consequences for the design of artificial recharge systems <i>J.H. Peters, J.F. Schijven, W. Hoogenboezem, M.J.C. van Baar, J. Bergsma, P.J. Nobel, A. Stakelbeek & A.J. Vogelaar</i>	141

1.7 Hydrological aspects

- Predicting infiltration and mounding, and managing problem soils 149
H. Bouwer
- Tracking the movement of recharge water after infiltration 155
Y. Fujita, J. Zhou, E. Orwin, M. Reinhard, M.L. Davissou & G.B. Hudson
- Optimisation of artificial groundwater recharge system with infiltration galleries 161
C.K. Vidanaarachchi, Y. Zhou, J.C. Nonner & S.E. Meijer
- Ground water management system in Vienna – An evaluation after three years of operation 167
J.E. Dreher & A. Gunatilaka

1.8 Well recharge case studies

- Creation of potable water reserve in Kuwait through artificial recharge 175
A. Mukhopadhyay, J. Al-Sulaimi & A.A. Al-Sumait
- Deep well recharge in a polder area near the river Rhine 181
H. Timmer & P.J. Stuyfzand
- Simulation of the influence of recharged cold groundwater on temperature and level of surrounding groundwater 187
J. Akiyama, Y. Katsuragi, N. Goto, H. Abiko & T. Yokoyama
- ASR feasibility testing of the semi-confined Cretaceous Chalk aquifer of South Essex, England 193
M.C. Cook & S. Moncaster

1.9 Pollutants and basin recharge

- Microparticle facilitated transport of contaminants during artificial groundwater recharge 205
T. Hofmann & U. Schöttler
- Fate of cyanobacterial hepatotoxins in artificial recharge of groundwater and in bank filtration 211
K. Lahti, J. Vaitomaa, A.-L. Kivimäki & K. Sivonen
- Arrenæs artificial recharge trial plant, Denmark – Hydrological and chemical aspects 217
G. Brandt
- Fate and behaviour of atrazin in the Meijendel artificial recharge system 223
H.G. de Jonge & J.A. Ståb

1.10 Other types of recharge

- Artificial recharge schemes in water resources development in Oman 231
N.M. Al Battashi & S.R. Ali
- Artificial recharge of a lake excavated for gravel extraction 237
M.H.A. Juhász-Holterman, J.H. Peters & J.J.G.M. Geerts
- Sprinkling infiltration in Finland: Effects on forest soil, percolation water and vegetation 243
H.-S. Helmisaari, V. Kitunen, A.-J. Lindroos, I. Lumme, S. Monni, P. Nöjd, L. Paavolainen, E. Pesonen, M. Salemaa, A. Smolander & J. Derome

An innovative drinking water concept based on double aquifer passage <i>H.J.Roelofs</i>	249
1.11 <i>Storage and recovery efficiency</i>	
Aquifer storage recovery: Recent developments in the United States <i>R.D.G.Pyne</i>	257
The use of modelling to predict the behaviour of ASR systems <i>M.J.Streetly</i>	263
ASR, hydraulic and salinity response in unconfined/confined aquifers <i>N.Z.Gerges, S.R.Howles & K.J.Dennis</i>	269
Aquifer storage recovery – Wessex Water’s experience using the chalk aquifer <i>J.C.Eastwood, C.M.Bienfait & R.D.G.Pyne</i>	275
1.12 <i>Chemical reactions and well recharge</i>	
Quality changes upon injection into anoxic aquifers in the Netherlands: Evaluation of 11 experiments <i>P.J.Stuyfzand</i>	283
Well recharge in California: Water quantity and quality considerations <i>D.Wendell & D.Glanzman</i>	293
An experiment on well recharge of oxic water into an anoxic aquifer <i>H.de Ruiter & P.J.Stuyfzand</i>	299
Water quality modelling at the Langerak deep-well recharge site <i>A.Brun, F.D.Christensen, J.S.Christiansen, P.J.Stuyfzand & H.Timmer</i>	305
1.13 <i>Well recharge case studies</i>	
Environmental guidelines for aquifer storage and recovery: Australian experience <i>P.Dillon & P.Pavelic</i>	313
Berkheide well recharge system: Design, implementation and initial experience of operation <i>M.W.Kortleve</i>	319
Preliminary study for deep injection experiments at the Cornellà site, Barcelona <i>A.Pérez-Paricio & J.Carrera</i>	325
Well recharge pilot in the south-east Netherlands <i>R.Straatman, Y.Brekvoort & S.M.L.Verheijden</i>	331
2 <i>Poster presentations</i>	
2.1 <i>Water management in arid regions</i>	
Development of a simple tracer method to assess contribution of artificial recharge ponds to augment groundwater resources <i>B.S.Sukhija, D.V.Reddy & P.Nagabhusanam</i>	339

Artificial recharge experiments in Bustan Extension Area, Egypt <i>M.M.Darwish</i>	343
Scoping process to determine pilot sites for artificial recharge with wastewater <i>A.A.Fadlelmawla</i>	347
Need to increase recharge to the aquifer in Sri Lankan hard rock terrain <i>C.Shanthi de Silva</i>	349
<i>2.2 Field and desk studies, plans and cases</i>	
Epe artificial recharge project <i>B.D.Volkers & G.Roelofs</i>	355
Hydrogeological potential for Aquifer Storage and Recovery (ASR) in England and Wales <i>H.K.Jones, I.N.Gale & D.M.J.Macdonald</i>	359
Groundwater management and water quality assessment in the City of Vienna <i>H.H.Hauck</i>	363
Use of tracer tests in artificial recharge <i>L.Maxe, L.Tilly & P.-O.Johansson</i>	365
New-style open recharge in the Oostduinen: An ecological engineering approach <i>J.H.Peters, J.S.Rijk, C.Lafort & M.Annema</i>	369
Possibilities of enlarging groundwater exploitation reserves of Peć town, Yugoslavia <i>M.Komatina</i>	373
<i>2.3 Artificial groundwater recharge in Stockholm, Sweden</i>	
Artificial groundwater recharge in Stockholm – I. The project and its general aim <i>J.O.Hjort & P.Ericsson</i>	379
Artificial groundwater recharge in Stockholm – II. Column test design and tracer tests <i>P.-O.Johansson, B.Espeby, B.Nilsson & G.Allestam</i>	383
Artificial groundwater recharge in Stockholm – III. An experimental study of chemical processes in the unsaturated zone <i>D.Berggren, S.I.Nilsson, J.I.Blomberg & U.Larsson</i>	387
Artificial groundwater as the future water supply of greater Stockholm – IV. Phylogenetic diversity of the unsaturated zones of experimental sand filter columns <i>U.Szewzyk, S.Kalmbach, W.Manz, J.Långmark & T.-A.Stenström</i>	391
Artificial groundwater recharge in Stockholm – V. Strategic environmental impact assessment <i>J.I.Blomberg, U.Larsson, M.Andersson, H.Djurberg & M.Westerdahl</i>	395
<i>2.4 Behaviour of contaminants</i>	
Experimental and numerical analysis of atrazine behaviour in an artificial recharge site <i>M.Van Hoorick, L.Pussemier & J.Feyen</i>	401

Your daily 'drugs' in drinking water? State of the art for artificial groundwater recharge <i>N.Zullei-Seibert</i>	405
Pesticide monitoring: Measuring the right substances at the right place and time <i>B.Kuhlmann & N.Zullei-Seibert</i>	409
The behaviour of fluorine in a lake-water recharge plant in Southeastern Finland <i>A.Vuorinen</i>	413
<i>2.5 Predicting and modelling groundwater quality</i>	
An integrated model for predicting and assessing the development of groundwater quality <i>J.Griffioen, A.L.Lourens, P.Venema, C.B.M.te Stroet, B.Minnema, M.P.Laeven, P.J.Stuyfzand, C.G.E.M.van Beek & W.Beekman</i>	419
Modelling the effects of deep artificial recharge on groundwater quality <i>M.W.Saaltink, C.Ayora, P.J.Stuyfzand & H.Timmer</i>	423
Simple models for reactive transport of pollutants and main constituents during artificial recharge and bank filtration <i>P.J.Stuyfzand</i>	427
<i>2.6 Clogging of recharge systems</i>	
Determining the clogging potential of water used for artificial recharge in deep sandy aquifers <i>W.A.M.Hijnen, J.Bunnik, J.C.Schippers, R.Straatman & H.C.Folmer</i>	437
Operational guidelines regarding clogging <i>A.Pérez-Paricio & J.Carrera</i>	441
Analysis of a well recharge experiment <i>P.H.Giao, N.Phien-wej & P.Nutalaya</i>	447
<i>2.7 Biological treatment and removal of organic matter</i>	
Biological treatment and re-infiltration for denitrification of groundwater <i>J.Lindberg & P.-O.Johansson</i>	453
Biological purification of recharge water by forested soils <i>D.Rüetschi, U.Geissbühler, M.Schmid & Ch.Wüthrich</i>	457
Impact of drinking water sources on refractory DOC in water reuse systems <i>J.E.Drewes, P.Fox & D.Ziegler</i>	461
Artificial recharge of ground water, organic carbon and microbes <i>I.T.Miettinen, M.J.Lehtola, T.Vartiainen & P.J.Martikainen</i>	465
Current research into removal of natural organic matter at Baltezers artificial groundwater recharge plant, Latvia <i>T.Juhna & J.Sprogis</i>	469
Author index	473