

Non-Confidential

Milestone 5 / Final Report

Aquifer Storage and Recovery (ASR) of Stormwater at Kingswood Golf Club, 62M - 2047

Prepared by: Norm Seaton, Kingswood Golf Club

With the support of the Smart Water Fund

12 July 2012

Executive Summary

The Kingswood ASR scheme is now completed and licensed to operate for fifteen years.

The main points of this final milestone report are:

- The latest season of trials in 2010 –11 confirmed that about 60ML can be injected over a six month period. Irrigation requirements were low in the wet summer of 2011 so extraction was limited to 12ML. Recovery efficiency improved further to about 36%.
- An updated Management Plan included some changes suggested by Southern Rural Water.
- The remote monitoring and alarm system was commissioned.

The features of the ASR scheme which has emerged from this project can be summarised as follows:

The Silurian siltstone fractured rock aquifer exposed between 109m and 114m in Bore 9033830 is capable of accepting water under 60m of applied pressure at a rate of 6 to 6.5 L/s for an extended period. About 10ML can be injected in about seventeen days at an average rate of 7L/s. The average injection rate over the cycle, inclusive of the transfer and settling periods, is about 3.7L/s.

Injecting in batches of 9 to 10ML ensures the injected water complies with the quality criteria of the management plan.

Water can be recovered at a rate of 9 to 10L/s. The volume recoverable over a four month irrigation season is likely to be not less than 50ML. This provides an increase in irrigation supply of at least 35ML.

Recovery efficiency in the second trial season was about 36%, and is likely to improve further..

The addition of a 700kL tank to the original scope of the project allows higher salinity water to be directed to the more salt-tolerant couch fairways. This ensures that all of the water recovered from the aquifer can be used for irrigation.

Kingswood spent \$250,000 on the ASR project. \$75,000 was for a desktop study and a new bore. \$175,000 was needed to conduct the trials and complete the project. The Smart Water Fund's contribution of \$114,000 was of material assistance. Kingswood also spent \$170,000 to install the 700kL tank.

The operating cost of the 50ML from the ASR scheme is estimated to be about \$20,000 per year, or \$400/ML.

There are a number of reasons why this project was successful. The two most fundamental reasons are licensed access to a good supply of stormwater and the construction of a successful new bore in a suitable aquifer.

Kingswood also received excellent advice from Australian Groundwater Technologies and had the benefits of an existing storage dam and an irrigation pump system which is well suited to injection duty.

The project has been well publicised within the Victorian golf industry through magazine articles, site visits and presentations. The Western Australian division of Parks and Leisure Australia industry group has also received a presentation. Further site visits are being scheduled.

At least three water utilities in Victoria are actively investigating ASR. It is recommended that the Smart Water Fund should continue to encourage the application of the technology. It is suggested that facilitating a regular exchange of information between the participants could be considered.

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Background

Golf clubs are part of the sports and recreation industry. Regardless of whether the clubs operate with a membership base or with a green fee paying public clientele, all require the year-round presentation of a golf course which is well turfed and attractive to golfers. This requires regular irrigation in the summer months. Now that potable water from community supplies is rarely available in the quantities required, many clubs rely mainly on groundwater, stormwater or treated effluent for turf irrigation.

The quality of groundwater is variable and many bores produce water which is too salty to be continually used on all the grass types used on golf courses. The bent and poa grasses commonly used on the putting greens are particularly prone to salt damage. Obtaining a supply of high quality water to either mix with groundwater or to apply directly to putting surfaces usually requires stormwater to be collected and stored. Some clubs have elected to desalinate some of their groundwater or recycled effluent, which is a relatively expensive process.

Kingswood Golf Club (KGC) has access to stormwater, but when its storage dam and the retardation basin are both full, further run-off cannot be stored. KGC also has an operating bore, 131775, which produces brackish water with a salinity of about 2300 EC (conductivity of 2300 $\mu\text{S}/\text{cm}$). The output is mixed with stormwater to reduce the EC to about 1100 $\mu\text{S}/\text{cm}$ to allow it to be applied to the putting greens. The volume of the resultant supply is not sufficient in a dry summer to maintain the course in optimum condition. After evaluating options for increasing supply, KGC elected to pursue the capture of more of the winter/spring stormwater by using aquifer storage and recovery (ASR). ASR schemes are new to Victoria, so as well as addressing the technical risks of whether stormwater can be injected into a saline fractured rock aquifer at the required rate and in the required volume, and then recovered at a satisfactory quality, the project study must also satisfy the licensing authority Southern Rural Water (SRW) and the Environmental Protection Authority (EPA). These organisations need to be satisfied that the aquifer is not downgraded, human health is protected and the rights of other ground water users are not adversely affected. These assessments have little Victorian precedent and the Australian and Victorian guidelines have only been developed in 2009.

A pilot hole for a new bore, 9033830, was drilled and evaluated visually and geophysically by groundwater consultants. The recommendation was to target the fresh Silurian bedrock beneath the Tertiary sediments, looking for a fractured rock aquifer. The pilot hole was reamed out, cased to 109m and the casing grouted in. Deepening the hole to 114m yielded a strong flow of water which was air lifted to the surface. The flow was estimated to be more than 10 L/s and indicated the likelihood of establishing a viable ASR scheme. The native salinity of the water is similar to that of bore 131775, about 2380 $\mu\text{S}/\text{cm}$.

Introduction

The project aimed to undertake a staged series of trials and risk assessments to determine if a viable ASR scheme could be established at Kingswood using new bore 9033830, and if successful, to establish an operational ASR scheme.

The first stage involved a single injection and extraction trial of 1.9 ML using contractor's equipment and personnel, under the direct supervision of ground water consultant Australian Groundwater Technologies (AGT). AGT detailed the results in Report No. 2008/35 and recommended the scope and format of the second stage.

The second stage involved a season of trials in 2009-10 in which 27ML was injected and extracted. This stage was reported in the Milestone 3 report.

The third stage finalised the functional design of the operating system, completed the risk assessments and developed operating procedures. This work allowed KGC and AGT to prepare a management plan. KGC then applied to SRW for a long term operating permit to inject up to 70ML per year. This stage was reported in the Milestone 4 report.

The final stage comprised:

- a further season of injection and extraction trials in 2010-11 while the licence application was being assessed by SRW,

- revision of the management plan and receipt of approvals from SRW,
- installation and commissioning of a remote monitoring and alarm system.

Scheme Objectives

1. Inject and recover water at 2 to 3 L/s, inclusive of rest periods.
2. Store a minimum of 10 to 15 ML, preferably up to 25 ML, over 6 months in late autumn/winter/spring.
3. Achieve satisfactory recovery efficiency over time, namely 50 to 80% of injected volume recovered per cycle, at an average salinity of 1100 $\mu\text{S}/\text{cm}$ EC (electrical conductivity).
4. See better turf conditions as a result of increased irrigation water supply, particularly in January and February.

Milestone 5

- Milestone 5 Description

Install and commission the control systems necessary to meet the licence conditions.

- Methodology & Resources

Discussions about monitoring of injection water quality with SRW and AGT led to KGC adopting the practice of starting an injection batch only after laboratory analysis results were received, and the water shown to be compliant with the water quality criteria of the management plan. No additional site measuring equipment was required. KGC and AGT then prepared an updated management plan which was forwarded to SRW.

The two seasons of injection trials developed a favoured operating procedure comprising injection of batches of dam water of about 9 to 10ML each. This entailed injection runs of up to seventeen days, spanning one or two weekends. A monitoring and alarm system was designed to allow Terry Ford and Marcus Harber, the nominated Scheme Managers, to remotely monitor ASR operations. KGC established the goals for the system and developed the detailed scope in conjunction with EDAC, ABB and Hudson Electrical Services. The supply, installation and commissioning of the required equipment was carried out by the three contractors.

- Timing

The work was carried out between November 2010 and July 2011.

- Financial Summary

The funding agreement is for a contribution of up to \$114,000 from Smart Water Fund, being half of the \$228,000 cost to complete the project as estimated at the time of the grant application. The costs for Milestones 2 to 4 total \$155,520 of which Smart Water Fund has contributed \$77,760.

A summary of the invoiced costs for Milestone 5 is shown below. Details are given in Appendix 1.

	\$ excl. GST
Professional services from AGT	2,761.00
Monitoring instrumentation	15,456.87
Analytical services	466.00
Printing & communications services	231.82
Total	18,915.69

The total invoiced costs to complete the project as originally scoped are thus \$174,436.

In addition KGC spent a further \$170,000 on a 700kL tank and piping to allow higher salinity water to be distributed to the more salt-tolerant couch fairways. This system was installed to ensure KGC would be able to use the full recovered volume from the ASR bore. This will be of particular value in the first few years when recovery efficiency is predicted to be low.

The funding summary below for Milestone 5 includes an “in kind” contribution from Kingswood of \$53,564 for manhours spent on design, procurement, pipework installation, project management, presentations, site visits and preparation of publicity articles.

Funding Summary for Milestone 5		
Source	Amount	
	\$	In kind
Smart Water Fund	36,240	
Grantee	9,458	53,564
Other (please name)		

Outcomes

Results of the 2010 –11 Season of Injection and Extraction Trials

A total of 56ML was injected over 26 weeks in six injection cycles. A range of injection times from fourteen to seventeen days was used.

Initial extracted water of low salinity was returned to the storage dam for general irrigation use. Some higher salinity water extracted later in the trial was diverted to the tank for distribution to the more salt-tolerant couch fairways. A total of 11.9ML was recovered over twelve weeks. The relatively low extraction total was due to regular rainfall, which reduced the need for course irrigation.

The 2010-11 season of trials has been fully reported in AGT Report No. 0904D, Aquifer Storage and Investigations – ASR Trial 2010-11, 20 May 2011. The main findings are:

The Silurian siltstone fractured rock aquifer exposed at the base of Bore 9033830 is capable of accepting water under 60m of applied pressure at a rate of 6 to 6.5 L/s for an extended period. About 10ML can be injected in about seventeen days at an average rate of 7L/s. The average injection rate over the cycle, inclusive of the transfer and settling periods, is about 3.7L/s;

The total volume which can be stored over a six month injecting season is likely to be not less than 60ML;

The six batches of injected water complied with the quality criteria of the management plan.

Water was recovered at a rate of 9 to 10L/s, slightly less than in 2010. The total volume recoverable over a four month irrigation season is likely to be not less than 50ML;

The recovery efficiency was projected to be about 36%, compared with 26% in 2009-10;

The peak pressure level recorded at the monitoring bore was 2m below the bore collar, compared with the control limit of 0.5m;

Following consultation with SRW, the injection procedure was modified to start injection only after analysis results confirmed water quality was compliant.

Approvals from Southern Rural Water

On 17th June 2011, SRW approved two documents under Section 76 of the Water Act 1989:

- Approval to Dispose of Matter Underground
- Licence to Operate Works

Both approvals have an expiry date of 30 June 2026, have general conditions attached which are operationally acceptable, and have a particular condition that injection must only occur in accordance with the approved monitoring program and updated management plan – AGT Report No. 2010/904C, Aquifer Storage and Recovery, Updated Management Plan, 1/03/2011.

The Monitoring and Alarm System

The day-to-day management of the process has been improved by providing a capability to remotely monitor the ASR instrumentation and receive alarm condition alerts. The features provided are:

1. Remote monitoring of the ASR system using VHF radio to transmit signals from the ABB videographic recorder in the pump shed to a module in the Course Superintendent's office. The module can be accessed from the office computer, or by a remote computer via the internet. The measurements available are injection flow rate, extraction flowrate, conductivity, turbidity and well-head pressure.
2. Transmission of a number of alarm conditions pertaining to the ASR process and the injection pumping system to nominated mobile phones:
 - high well-head pressure - to cover the event (unlikely, but with potentially serious consequences for the aquifer confining layer) that the pump station pressure control system fails and output pressure rises above 60m. This alarm uses the output of the down-hole pressure transmitter.
 - low well-head pressure during injection, again using the down-hole pressure transmitter. The purpose of the alarm is to alert to a blocked pump station screen or a screen cleaning malfunction.
 - irrigation system power outage, other than for short-lived faults.
 - high temperature of the water in the pump station outlet manifold. This needed a new temperature sensor to be supplied and fitted. This alarm will alert to a situation where pumps are running, the output flow is low and the low pressure cut-out has not been activated.
 - pump station low pressure. This will alert if the existing low pressure cut-out has been activated.

The equipment installed also provides protection to the control panels from surges in the power supply or short term power failures.

Risk Management

The main risks to successful project completion have been both technical and regulatory.

Technical Issues

The minimum viable rate of injection (2 to 3L/s including rest periods) and minimum viable storage volume (10 to 15ML) have been comfortably exceeded.

The risk that a low recovery efficiency might seriously limit the proportion of recovered water that could be used for irrigation was covered by setting up a system with a 700kL tank to allow higher salinity water to be used on fairways.

The risk that management of injection water quality to the satisfaction of SRW might prove to carry excessively high costs has been dispelled. The water quality data accumulated during two seasons of trials and the development of an operating procedure which injects batches of known quality water has led to a management plan acceptable to both KGC and SRW.

The risk that injection performance may decline over time due to aquifer clogging seems to be low, at this time. The regular backflushing procedure after each injection cycle has been effective in maintaining the hydraulic characteristics of injection flowrate and pressure increase.

Regulatory Issues

The risk that the lack of precedents in Victoria for permitted ASR schemes might lead to lengthy delays and difficulties with testing and final permitting has not eventuated.

As with the Rosedale Golf Club demonstration project, SRW issued short term permits for trials. In KGC’s case, the permit allowed dam water to be used, which gave relevant data from all stages of testing.

During the trial period, national guidelines for ASR were developed. EPA Victoria and the Department of Sustainability and Environment developed complementary guidelines, initiated amendments to legislation and issued assessment procedures. This provided SRW with the framework to assess and approve KGC’s long term permit without undue delay.

Discussion

The project gives every indication of being very successful. The table below summarises the injections and extractions over the trial period. Volumes (and flowrates) have been very satisfactory and an improving trend in recovery efficiency is evident.

Summary of the ASR Trials					
	Injection		Extraction		
	ML	Av. EC mS/cm	ML	Av. EC mS/cm	Recovery Efficiency, %**
Oct 2008	1.9	537	1.9	1700	6
2009 -10	27	331	27	1440	26
2010 -11	56	333	12	650	36 (est.)
Total to date	85	337	41	1220	

** Recovery efficiency for this scheme is defined as the percentage of injected volume recovered when the spot conductivity (EC) reaches 1100 µS/cm.

Some of the main factors that have led to this successful result are:

- Licensed access to good quality stormwater from the retardation basin.
- Licensed access to groundwater.
- Existence of the water storage dam.
- KGC Board and management support for the program of staged investigations.
- Smart Water Fund provided financial and concept support,
- Southern Rural Water’s system of short term permits for trials allowed full scale testing using the proposed injection water,
- AGT provided practical and effective advice throughout. Two key decisions were to establish a new bore in the nominated location and to bypass the Tertiary sedimentary aquifer in favour of a fractured bedrock aquifer. The recommendation to proceed to a full season of trials, after the initial trial in October 2008 was inconclusive as to viability, meant that the scheme was largely established and operational by September 2009.
- The flowrate and storage capacity of the new bore comfortably exceeded minimum requirements.

- The happy coincidence that the existing irrigation pumps were suitable for injection flowrate and pressure duty. The normal operating irrigating pressure of 60m coincided with the recommended safe working pressure for aquifer injection.
- The decision to supplement the initial ASR project scope with a tank to segregate higher salinity water ensured the project would deliver good value even if recovery efficiency did not fully meet predictions.
- The development of a regime comprising a 9 to 10ML batch of water of known quality being injected each month simplified the management of the system.

Of the above factors the most important are the availability of stormwater and the construction of a successful new bore in a suitable aquifer.

Although the time from desktop study report in January 2007 to long term licence is nearly four and a half years, the time from drilling the new bore to having the basic ASR system established and effectively operational was only fourteen months.

Potential proponents of ASR schemes now have the benefit of national technical guidelines and established Victorian procedures. These should allow early identification of where the technical risks may lie and what level of investigation will be needed to adequately assess technical and financial viability. The elapsed time from conceptual study to fully licensed scheme will be likely to depend on particular circumstances.

Return on Investment

The Board of Kingswood Golf Club believes that the long term viability of the club depends upon attracting and retaining an adequate level of membership. One of the essential requirements for this to be achieved, given that KGC's immediate area contains four other private golf clubs and the availability of other "pay-for play" courses in the general area, is the presentation of an attractively grassed golf course year round. The shortfall in suitable water available for summer irrigation meant that this requirement could not be met in years where summer rainfall was well below average.

The ASR project has, in effect, increased the supply of groundwater from about 15ML to at least 50ML at much improved salinity. The enhanced supply will be sufficient to maintain the course in good condition for the hottest and driest summers experienced to date.

The net capital cost of the water project is about \$306,000 as detailed below.

	\$k
ASR project	
Preliminary study and new bore	75
Completion	175
Less, Smart Water Fund contribution	-114
Sub-total ASR project	136
Tank project	170
Total water project	306

The annual operating costs to inject and recover 50ML are estimated to be about \$20,000. Costs include power for pumping, maintenance, water analysis, technical oversight, reporting and an annual fee to SRW. The expected operating cost is thus about \$400/ML.

The combination of capital and operating costs gives a net present cost of \$650 /ML. The assumptions in this calculation are:

- 15 year operating time span
- All capital spent in year zero

- 7% discount rate
- 50ML per year injected and recovered.

The total project cost is considerably less than other options of buying recycled water or desalinating ground water. The option of providing 40ML of additional surface storage dams for stormwater was not practical due to the lack of suitable land area.

Conclusion

The final stage of the project has been completed. This has entailed the acceptance by SRW of a revised Management Plan, the issuing of a 15 year permit to inject, and the commissioning of a remote monitoring and alarm system.

The increase in water supply arising from the project has been at least 35ML, fully meeting KGC's most optimistic expectation.

The commitments made to progressively communicate the results of the project to people concerned with irrigating turf recreation facilities has been met by a series of magazine articles, site visits and presentations. Similar activities seem likely to continue for some time to come..

The original scope to complete the ASR scheme (Project 62M – 204) has cost less than planned – about \$175,000 compared with the estimate of \$228,000. The cost of adding a tank system to handle higher salinity recovered water has been partly offset by the contribution from the Smart Water Fund.

Recommendation

By supporting this project, and previous ASR projects, the Smart Water Fund has played a significant role in developing the use of ASR within Victoria. There are now a number of schemes being actively investigated, including those by East Gippsland Water, City West Water and Barwon Water. CSIRO remains active in the field. Other consultants are also entering the field eg Hydro Tasmania Consulting.

During the early days of the application of the technology in Victoria it would be helpful to proponents and potential proponents to have a way of updating the “state of play”. Information on aspects such as:

- results from operating schemes,
- objectives of proposed schemes,
- current stage of investigation,
- design and control of schemes,
- changes to regulations or assessment procedures,
- a contact list.

It is recommended that the Smart Water Fund consider ways it might facilitate a regular exchange of information between the operators, proponents, consultants and regulators. Such ways might include an annual update of results and investigations by a report, creation of a web site or through regular forums. It is envisaged that after five to ten years the need to facilitate such an exchange of information may have passed.

References

AGT Report No. 2008/35 Aquifer Storage and Recovery (ASR) Investigations – Kingswood Golf Club – Field Testing

AGT Report No. 904A Extended ASR Trial Monitoring Plan

AGT Report No. 2010/904B Aquifer Storage and Recovery Investigations – Extended ASR Trial 2009-10

AGT Report No. KAA-10-904 Functional Design for Long Term ASR Operation

AGT Report No. 2010/904C Aquifer Storage and Recovery Updated Management Plan (01/03/11)

AGT Report No. 0904D_11_KAA Aquifer Storage and Recovery Investigations – ASR Trial 2010-11

CSIRO, Developing Aquifer Storage and Recovery (ASR) Opportunities in Melbourne – Rosedale ASR Demonstration Project, Final report, June 2010

Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Managed Aquifer Recharge, July 2009

EPA Victoria Publication 1290, Guidelines for Managed Aquifer Recharge (MAR) – Health and Environmental Risk Management, July 2009

Water Act 1989 - Policies for Managing Section 76 Approvals 21/09/2010

Department of Sustainability and Environment, Technical Advisory Notes to Delegates: Managed Aquifer Recharge, September 2010

Acknowledgements

The work of CSIRO Division of Land and Water, particularly that of Dr Peter Dillon, in promoting the concept of Aquifer Storage and Recovery and in developing the Australian Guidelines for Managed Aquifer Recharge (AGWR 2C) has been of great benefit to the development of the Kingswood ASR scheme.

The staff at Groundwater Technologies of Australia, particularly, Mr Zac Sibenaler, Dr Nabil Gerges and Mr Ralph Williams have been instrumental in guiding the project from concept to completion. They have shown skill, grace and patience in answering all of the numerous questions raised along the way.

The Smart Water Fund, by financially supporting a number of ASR projects in Victoria, including the Kingswood ASR scheme, is making a significant contribution to the application of this important technology.

The Board of Kingswood Golf Club particularly President Peter Shepard and Director Ken Brown, General Manager Heath Wilson, Course Superintendent Terry Ford, Assistant Course Superintendent Marcus Harber and their staff have all been active in the creation of this scheme, cognisant of the risks, and patient as these risks were investigated and managed. Terry Ford in particular has been tireless in his efforts to get a successful outcome.

Document Status

Version No.	Author	Date
1.0	Norm Seaton	29 July 2011

Appendix 1

List of Invoices for Milestone 5

Cost Area	Invoice No.	Date	Supplier	\$ excl. GST
Professional Services	1144	06.07.11	Australian Groundwater Technologies	2,761.00
Monitoring Instrumentation	1161903099	27.04.11	ABB Australia Pty Limited	1522.00
	1161903778	17.05.11		600.00
	1161905924	20.07.11		438.50
	10088	31.03.11	EDAC Pty Ltd	6723.00
	2738	13.05.11	Hudson Electrical Pty Ltd	4055.37
	09-0171b	24.06.11	HydroTerra	360.00
	02011211	07.06.11	Agmek of Ballarat Pty Ltd	1758.00
			Sub-total	15,456.87
Analytical Services	189277	03.02.11	MGT Labmark Environmental Laboratories	275.00
	195562	20.04.11		191.00
			Sub-total	466.00
Printing Services	335699	30.03.11	Eagle Stationers	40.91
	336311	31.05.11		81.82
			Sub-total	122.73
Communications	1012227	06.05.11	Kingswood Golf Club - catering	109.09
			Total for Milestone 5	18,915.69

Appendix 2

Approvals from Southern Rural Water

Permit approval no:

BEE052202

Printed on: 17 Jun 2011 3:36:27 pm

COPY OF RECORD IN THE VICTORIAN WATER REGISTER APPROVAL TO DISPOSE OF MATTER UNDERGROUND under Section 76 of the Water Act 1989

The information in this copy of record is as recorded at the time of printing. Current information should be obtained by a search of the register. The State of Victoria does not warrant the accuracy or completeness of this information and accepts no responsibility for any subsequent release, publication or reproduction of this information.

This Approval is not to be interpreted as an endorsement of the design and/or construction of existing works. Southern Rural Water does not accept any responsibility or liability for any suits or actions arising from injury, loss, damage or death to person or property which may arise from the maintenance, existence or use of works.

This approval relates only to the specified substance(s) to be used and in no way implies that the Authority has approved any associated groundwater characterisation, remediation design or management activities.

This approval in no way implies that the Authority assumes any responsibility for the quality of groundwater at or surrounding the specified location.

This approval authorises the holder(s) to dispose of matter underground, by means of the bore(s) described in any licences to operate bores identified below.

Approval Holder(s)

KINGSWOOD GOLF CLUB of C/- TERRY FORD
CENTRE DANDENONG RD DINGLEY VIC 3172

Contact Details

KINGSWOOD GOLF CLUB C/- TERRY FORD
CENTRE DANDENONG RD
DINGLEY VIC 3172

Approval Description

Status	Active
Expiry date	30 Jun 2026
Authority	Southern Rural Water
Approved aquifer	Unincorporated (GMU)
Maximum annual disposal volume	70.0

Related Licences

Licences to operate bores	WLE044701
Take and use licences	Nil

Copy of Record

Printed on: 17 Jun 2011 3:36:27 pm

Permit approval no: BEE052202

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Land on which Disposal is Approved

Land description

Volume 9000 Folio 342
Lot 1 of Plan TP156129L

Property address

CENTRE DANDENONG ROAD DINGLEY VILLAGE 3172

Application History

<i>Reference</i>	<i>Type</i>	<i>Status</i>	<i>Lodged date</i>	<i>Approved date</i>	<i>Recorded date</i>
BER006848	Modify	Approved	17 Jun 2011	17 Jun 2011	
BEI018190	Issue	Approved	24 May 2011	24 May 2011	

Copy of Record

Printed on: 17 Jun 2011 3:36:27 pm

Permit approval no: BEE052202

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Conditions

This approval for underground disposal is subject to the following conditions:

Metering of matter disposed

- 1 Disposal of matter under this approval may only occur if it is passed through a meter approved by the Authority

Protecting other water users

- 2 The approval holder must, if required by the Authority, monitor and record water levels in the bore(s) before and after pumping; the approval holder must also provide this information in writing as directed by the Authority.

Operation and maintenance

- 3 The maximum volume of matter disposed of under this approval in any twelve-month period, from 1 July to 30 June, must not exceed 70.0 megalitres.
- 4 The maximum volume of matter that may be disposed of under this approval in any one day is 1.0 megalitres.

Protecting biodiversity

- 5 The approval holder must maintain an accurate record of the quantity of matter disposed of under this approval, and allow the Water Authority to inspect this record at all reasonable times.

Particular conditions

- 6 Unless otherwise directed by the Authority aquifer injection must only occur in accordance with the approved monitoring program and management plan ("Aquifer Storage & Recovery Updated Management Plan, dated 1/03/2011")

END OF COPY OF RECORD

COPY OF RECORD IN THE VICTORIAN WATER REGISTER**LICENCE TO OPERATE WORKS***under Section 76 of the Water Act 1989*

The information in this copy of record is as recorded at the time of printing. Current information should be obtained by a search of the register. The State of Victoria does not warrant the accuracy or completeness of this information and accepts no responsibility for any subsequent release, publication or reproduction of this information.

This licence does not remove the need to apply for any authorisation or permission necessary under any other Act of Parliament with respect to anything authorised by the works licence.

Water used under this licence is not fit for any use that may involve human consumption, directly or indirectly, without first being properly treated.

This licence is not to be interpreted as an endorsement of the design and/or construction of any works (including dams). The Authority does not accept any responsibility or liability for any suits or actions arising from injury, loss, damage or death to person or property which may arise from the maintenance, existence or use of the works.

This licence authorises its holders to operate the described works, subject to the conditions.

Licence Holder(s)

KINGSWOOD GOLF CLUB of C/- TERRY FORD
CENTRE DANDENONG RD DINGLEY VIC 3172

Licence Contact Details

KINGSWOOD GOLF CLUB C/- TERRY FORD
CENTRE DANDENONG RD
DINGLEY VIC 3172

Licence Details

Expiry date	30 Jun 2026
Status	Active
Authority	Southern Rural Water
Name of waterway or aquifer	UNC-Unincorporated-Disposal
Water system	Unincorporated (GMU)

Summary of Licensed Works

The details in this section are a summary only. They are subject to the conditions specified in this licence.

<i>Works ID</i>	<i>Works type</i>	<i>Use of water</i>
WRK043761	Bore	Underground disposal

Description of Licensed Works

WORKS ID WRK043761
Works type Bore

Copy of Record

Printed on: 17 Jun 2011 3:36:23 pm

Works Licence ID: WLE044701

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Extraction Details

Service point/s SP087580 UnMetered

Maximum extraction rate	1.000 megalitres per day (The physical capacity of the works)
Maximum daily volume	1.000 megalitres (The volume authorised to be extracted via the works)
Maximum annual volume	70.000 megalitres
Use of water	Underground disposal

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
Nil		

Land description

Volume 9000 Folio 342
 Lot 1 of Plan TP156129L

Property address

CENTRE DANDENONG ROAD DINGLEY VILLAGE 3172

Related Instruments

Related entitlements	BEE052202
Related water-use entities	Nil

Application History

<i>Reference</i>	<i>Type</i>	<i>Status</i>	<i>Lodged date</i>	<i>Approved date</i>	<i>Recorded date</i>
WLV036156	Modify	Approved	17 Jun 2011	17 Jun 2011	
WLV036173	Modify	Approved	24 May 2011	24 May 2011	
WLV513088	Modify	Approved	23 Jun 2010	23 Jun 2010	
WLV510502	Modify	Approved	04 Feb 2010	15 Feb 2010	
WLI504497	Issue	Approved	17 Nov 2009	17 Nov 2009	

Conditions

Licence WLE044701 is subject to the following conditions:

Preventing pollution

- 1 The licence holder must, construct and maintain bund walls around any hydrocarbon fuel driven engine, motor, fuel storage, or chemical storage used in connection with works and appliances associated with this licence, in accordance with the timeframe, specifications, guidelines or standards set down by the Authority.

Metering of matter disposed

- 2 Disposal of matter under this licence may need to be passed through a meter, if requested by the Authority.
- 3 The licence holder must not, without the consent of the Authority, interfere with, disconnect or remove any meter used for the purposes of the licence.

Protecting water resources

- 4 Water must not be taken and used from the bore without specific written permission of the Water Authority, except for samples taken solely for the purpose of sampling, testing and analysis.

Protecting other water users

- 5 The licence holder must, if required by the Authority, monitor and record water levels in the bore(s) before and after pumping; the licence holder must also provide this information in writing as directed by the Authority.
- 6 The licence holder must, at the licence-holder's expense, if required by the Authority, conduct a pumping test and obtain a hydrogeological report, to the Authority's specification, on the potential for bore operation to interfere with any bore, aquifer, groundwater dependent ecosystem or waterway.
- 7 The licence holder must, if required by the Authority, provide the Authority with the results of water quality tests on samples of water pumped from the bore.
- 8 The licence holder must provide the Authority with safe access to the licensed bore and works for the purposes of obtaining water level measurements, water samples and any other information or data pertaining to the operation of the bore, the works and the aquifer.
- 9 The bore(s) must not be altered or decommissioned without a works licence that authorises alteration, or decommissioning.

Operation and maintenance

- 10 The licence holder must keep all works, appliances and dams associated with this licence, including outlet pipes and valves, in a safe and operable condition, and free from obstacles and vegetation that might hinder access to works.
- 11 The maximum volume of matter disposed of under this licence in any twelve-month period, from 1 July to 30 June, must not exceed 70.0 megalitres.

Protecting biodiversity

- 12 The licence holder must, if required by the Authority, remedy any damage to the environment that in the opinion of the Authority is a result of the installation, operation or maintenance of the works.
- 13 The licence holder must maintain an accurate record of the quantity of matter disposed of under this licence and allow the Water Authority to inspect this record at all reasonable times.
- 14 Matter must not be disposed of through the works if the Authority reasonably believes that such disposal will have a detrimental impact on the beneficial use of surrounding groundwater, land and surface water.

Particular conditions

- 15 Unless otherwise directed by the Authority aquifer injection must only occur in accordance with the approved monitoring program and management plan ("Aquifer Storage & Recovery

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