Malory Osmond

From: Malory Osmond
Sent: Wednesday, 23 January 2013 4:36 p.m.
To: 'Nathan Baker'
Subject: RE: Draft conditions for Heretaunga Water Ltd

Hi Nathan,

Yes the Blockhouse Lane bore is available for monitoring. GWRC Water Supply have no plans for that bore at this stage.

Once we have a monitoring proposal agreed, I will go back to GWRC Water Supply to get final approval.

Regards

Malory

From: Nathan Baker [redacted]
Sent: Wednesday, 23 January 2013 10:47 a.m.
To: Malory Osmond
Subject: RE: Draft conditions for Heretaunga Water Ltd

Ok thanks

Nathan Baker
Manager - Wellington Planning
Beca
[redacted]
www.beca.com

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2) The "trigger level" of 44.06 MSL. It is too high and is based on GW's WL monitoring period and is unlikely to reflect what might naturally occur during a period drier than what occurred during this timeframe. Also there is no allowance for a nearby well going on line and causing interference drawdown. It is also based on our speculation about well loss of 0.3 m at 10 L/s and we have not measured this yet. If the trigger level remains one set for the pumped well, we suggest an additional metre be added because: a) well loss occurs only inside the well itself and does not affect anyone else b) natural variations will be greater than what has been measured and c) other new or periodic users could cause interference drawdowns. Further, we propose that the response to reaching the trigger level should be a requirement for reporting within 3 working days of observing the exceedance followed by an assessment of the cause of the drop below the trigger and not immediate cessation of pumping.
3) The 10 L/s test on demand. This would not be a problem after the permanent pump has been installed and it should therefore be stated that the test will is required following installation of the permanent pump.
4) The requirement for a CTV of the bore construction is unprecedented and does not alter the potential effects on any party. We ask that this requirement be removed.

We also wish to discuss an increased duration to 15 years if you are comfortable with the final conditions of consent. Look forward to discussing these points with you shortly.

Nathan Baker
Manager - Wellington Planning
Beca
[redacted]
www.beca.com

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From: Malory Osmond [mailto:Malory.Osmond@gw.govt.nz]
Sent: Thursday, 13 December 2012 6:03 p.m.
To: Nathan Baker
Cc: Jeremy Rusbatch; Jude Weggery
Subject: Draft conditions for Heretaunga Water Ltd

Hi Nathan,

Here are the draft consent conditions for the Heretaunga Water Ltd water permit.

A very quick run down….

The water meter and verification conditions are required by the water regulations. I discussed the water level monitoring conditions with Belinda. In short, these conditions has risen from the fact that the bore has not been tested at the applied for rate. As the effects of pumping the bore at a rate of 10 l/s has been based on modelling the results of the 4 l/s pumping test, we consider this monitoring is required to verify the conclusions drawn from that assessment, and to mitigate any adverse effect if it does occur.

I have not specified a date for installation of equipment etc, rather stated that they shall be installed prior to the commencement of the take. The consent holder will be required to notify us when they commence the take.

In regard to duration, our standard duration for water takes is 10 years. Given that the take has not been tested at a rate of 10 litres/second and that we have additional monitoring conditions to verify the modelled drawdown, I consider that a duration of 10 years is appropriate for this consent. If after 10 years, the monitoring has shown there to be no adverse effects, a longer duration may be warranted for a new consent.

If you wish to discuss these conditions, please contact Jeremy in the first instance on 04 830 4132 or jeremy.rusbatch@gw.govt.nz.

Regards

Malory Osmond | Senior Resource Advisor, Environmental Regulation
GREATER WELLINGTON REGIONAL COUNCIL
Te Pane Matua Taiao
142 Wakefield Street | PO Box 11646, Manners Street, Wellington 6142
T: 04 830 4015 | www.gw.govt.nz

Jude Weggery

From: Doug Mzila
Sent: Thursday, 17 January 2013 4:55 p.m.
To: Jude Weggery
Subject: RE: Stream depletion

Jude

I do think that the effects are less than minor taking into consideration the groundwater allocation status and the proposed conditions. I believe the applicant has done adequate work in assessing the stream depletion effects.

I have also looked at the applicant's proposal for an allowance of an extra 1m of drawdown and their proposed wording, their proposed wording seems ok to me. I have downloaded the whole application for a fresh perusal. I will let you know my thoughts tomorrow morning.

Thanks, have a good evening

Doug

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rom: Jude Weggery
Sent: Thursday, 17 January 2013 4:29 p.m.
To: Doug Mzila
Subject: Stream depletion

Hi Doug

Just checking your thoughts on the following stream depletion assessment for the Heretaunga bore in upper hutt. See the excerpt from my report:

> *According to the GW document "Application of Proposed Framework for Conjunctive Water Management: Hutt Valley and Kapiti Coast (June 2011)" the proposed groundwater take is located in a Category A area. Category A areas are sites with direct hydraulic connection with surface water where stream depletion effects may be mitigated by application of minimum flow or level cut-offs.*
>
> *To assess potential stream depletion the applicant ran a model using three sets of assumed possible values for aquifer transmisivity, aquifer storativity, stream bed hydraulic conductivity and streambed thickness. The analysis showed that pumping the bore 2hrs/day at 10 L/s would cause a depletion of flow in the Hutt River and the Mawaihakona Stream. Depletion from the from Mawaihakona Stream was assessed at <1-5% of its recorded flow while the depletion of the Hutt River would be less than 0.2% of its 1-Day MALF.*

Do you consider these effects less than minor with the proposed conditions?

Thanks

Jude Weggery| Resource Advisor
GREATER WELLINGTON REGIONAL COUNCIL
Te Pane Matua Taiao
142 Wakefield St | PO Box 11646, Manners St, Wellington 6142
T: 04 830 4235
www.gw.govt.nz

Jude Weggery

From: Jude Weggery
Sent: Friday, 21 December 2012 3:53 p.m.
To: 'Nathan Baker'
Subject: RE: Heretaunga decision

Hi Nathan

I'm back on 14 Jan as well so ill be in touch soon after re Heretaunga.

Regarding the Kapiti water supply consent app, we have received 21 submissions and apparently there are half a dozen in the post from KCDC. I will compile a list and send any submissions you haven't received on to you in the new year.

Merry Christmas

Jude Weggery

From: Nathan Baker [redacted]
Sent: Friday, 21 December 2012 3:27 p.m.
To: Jude Weggery
Subject: Heretaunga decision

Hi Jude – I'll be back in the office week commencing 14th Jan – but checking my emails. Please send any decision to me as a draft firstly for comment prior to issuing a final.

Thanks

Nathan Baker
Manager - Wellington Planning
Beca
DDI +64-4-471-5508 Fax +64-4-473-7911
Mobile: 027 242 0764
nathan.baker@beca.com
www.beca.com

Jude Weggery

From: Nathan Baker [redacted]
Sent: Tuesday, 18 December 2012 2:59 p.m.
To: Jeremy Rusbatch; Jude Weggery
Cc: Malory Osmond
Subject: RE: Draft conditions for Heretaunga Water Ltd

Thank you for providing these conditions as draft for comment. We would like to discuss the following with you in no particular order:

ask Doug

1) Water level monitoring. We suggest both the electronic system and a dedicated tube for manual measurements with a dip meter. Otherwise there is often no way to know if the electronic device is accurate or precise enough. It is most unusual that a level is defined in a consent for the pumping well and we suggest a level to be defined in the nearby GW observation bore, such as the 'blockhouse' well, instead.

Based on real data coc if diff.

immediate action required

2) The "trigger level" of 44.06 MSL. It is too high and is based on GW's WL monitoring period and is unlikely to reflect what might naturally occur during a period drier than what occurred during this timeframe. Also there is no allowance for a nearby well going on line and causing interference drawdown. It is also based on our speculation about well loss of 0.3 m at 10 L/s and we have not measured this yet. If the trigger level remains one set for the pumped well, we suggest an additional metre be added because: a) well loss occurs only inside the well itself and does not affect anyone else b) natural variations will be greater than what has been measured and c) other new or periodic users could cause interference drawdowns. Further, we propose that the response to reaching the trigger level should be a requirement for reporting within 3 working days of observing the exceedance followed by an assessment of the cause of the drop below the trigger and not immediate cessation of pumping.

ok.

3) The 10 L/s test on demand. This would not be a problem after the permanent pump has been installed and it should therefore be stated that the test will is required following installation of the permanent pump.

Remove

4) The requirement for a CTV of the bore construction is unprecedented and does not alter the potential effects on any party. We ask that this requirement be removed.

We also wish to discuss an increased duration to 15 years if you are comfortable with the final conditions of consent. Look forward to discussing these points with you shortly.

Nathan Baker
Manager - Wellington Planning
Beca
[redacted]
www.beca.com

From: Malory Osmond [mailto:Malory.Osmond@gw.govt.nz]
Sent: Thursday, 13 December 2012 6:03 p.m.
To: Nathan Baker
Cc: Jeremy Rusbatch; Jude Weggery
Subject: Draft conditions for Heretaunga Water Ltd

Hi Nathan,

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A very quick run down....

The water meter and verification conditions are required by the water regulations. I discussed the water level monitoring conditions with Belinda. In short, these conditions has risen from the fact that the bore has not been tested at the applied for rate. As the effects of pumping the bore at a rate of 10 l/s has been based on modelling the results of the 4 l/s pumping test, we consider this monitoring is required to verify the conclusions drawn from that assessment, and to mitigate any adverse effect if it does occur.

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If you wish to discuss these conditions, please contact Jeremy in the first instance on 04 830 4132 or jeremy.rusbatch@gw.govt.nz.

Regards

Malory Osmond | Senior Resource Advisor, Environmental Regulation
GREATER WELLINGTON REGIONAL COUNCIL
Te Pane Matua Taiao
142 Wakefield Street | PO Box 11646, Manners Street, Wellington 6142
T: 04 830 4015 | www.gw.govt.nz

Jude Weggery

From: Doug Mzila
Sent: Wednesday, 19 December 2012 9:42 a.m.
To: Jude Weggery
Subject: RE: Hetereunga Ltd

Jude

Thanks. This application relates to a Upper Hutt water take. I am satisfied with the stream depletion analysis that has been presented.

Thanks

Doug

Dr Doug Mzila | Senior Environmental Scientist-Groundwater
GREATER WELLINGTON REGIONAL COUNCIL
Te Pane Matua Taiao
142 Wakefield St | PO Box 11646, Manners St, Wellington 6142
T: 04 830 4019 | www.gw.govt.nz

stream depletion

Jude Weggery

From:	Nathan Baker [redacted]
Sent:	Tuesday, 18 December 2012 11:09 a.m.
To:	Jeremy Rusbatch; Jude Weggery
Cc:	Malory Osmond
Subject:	RE: Draft conditions for Heretaunga Water Ltd
Attachments:	NZ1-6789257-Section 92 Follow-Up River and Stream Depletion Analyses Heretaunga Well Consent[1].pdf; Attachment 1 Hutt River and Mawaihakona Stream Depletion Analysis.pdf; Attachment 2 Hutt River and Mawaihakona Stream Depletion Analysis.pdf

Please find attached the stream depletion analysis as requested by Doug – this follows discussions between Mark and Doug to confirm this approach and methodology. We trust this information is sufficient to show any stream depletion effects will be less than minor and to make a decision, however Mark is available should Doug or yourselves wish to discuss any of the detail attached.

We will provide a response to the draft conditions shortly under separate email.

Thanks

Nathan Baker

Manager - Wellington Planning

Beca

[redacted]

www.beca.com

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From: Malory Osmond [mailto:Malory.Osmond@gw.govt.nz]
Sent: Thursday, 13 December 2012 6:03 p.m.
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132 Vincent Street
PO Box 6345, Auckland 1141, New Zealand
T: +64 9 300 9000 // F: +64 9 300 9300
E: info@beca.com // www.beca.com

Piccadilly Investments, Ltd
41 Edgecumbe Road
Tauranga

17 December 2012

Attention: John Cronin

Dear John

Section 92 Follow-Up River and Stream Depletion Analyses Heretaunga Well Consent R27/6978

1 Introduction

Piccadilly Investments, Limited (Piccadilly) contracted Beca Carter Hollings & Ferner (Beca) Ltd to prepare an analysis of a pumping test of the Heretaunga well (previously called the Refreshment Place or the Unibag well) as part of an application for consent to pump up to 10 L/s from the well. A report documenting the test, the analyses and assessment of effects, *Analysis and Assessment of Hydraulic Impacts – 72 Hour Constant Rate Pumping Test Refreshment Place Well R27/6978* was issued on 15 March 2012 and included with the application for consent submitted by Beca to the Greater Wellington Regional Council (GWRC). GWRC subsequently issued a Section 92 request for an analysis of stream depletion. Although GWRC July 2012 guidelines for conjunctive use management of the surface water and groundwater in the Upper Hutt Groundwater Management Zone places the Heretaunga well in Category A, whereby the aquifer is considered to be in direct continuity with the Hutt River, they were also interested in an assessment of the depletion effects on the Mawaihakona Stream. After discussions between Doug Mzila (GWRC) and Mark Utting (Beca) an approach was agreed upon and confirmed via emails on 10 December 2012.

In this approach we agreed to:

- Develop a range of stream depletion coefficients (lambda) by assuming (1) Good (direct) connection to the Hutt River and Mawaihakona stream, (2) No connection to the Hutt River.
- Calculate drawdown at the head waters of the Mawaihakona stream;
- Use calculated drawdown at the head of the Mawaihakona stream to calculate stream depletion from this stream.

This letter report presents the results of the agreed-upon stream depletion analysis.

2 Method and Input Data

2.1 Overview of Method

This report assesses the stream depletion effects on the Hutt River and Mawaihakona Stream using the analytical approach developed by Environment Canterbury Regional Council (ECan) and now used by GWRC. The location of the Heretaunga well, the Hutt River and its closest point from the Heretaunga well and the headwaters of the Mawaihakona Stream are shown in Figure 1.

Figure 1 – Location of Heretaunga Well, headwaters of Mawaihakona Stream and the closest point of the Hutt River

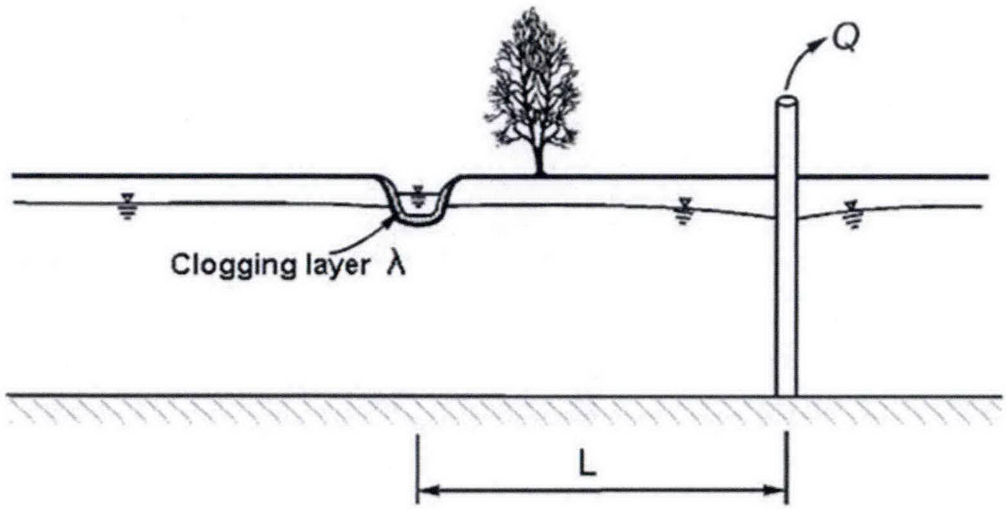
We used the Hunt (1999) portion of the ECan spreadsheet model "ECan stream-depletion-v3.xlsm" (ECan, 2012) to assess the depletion effects. The Hunt model assumes an unconfined, homogeneous aquifer, infinite in extent, with direct hydraulic continuity to a single stream or river that has a bed of known (or estimated) thickness, has a single value of known (or estimated) hydraulic conductivity and is of a known (or estimated) constant width. The effects of the stream depletion are simulated using a Theis (1935) drawdown model whereby the water abstracted by the well is derived from either removal of water stored within the aquifer or from the stream. The model calculates the amount of water depleted from the stream as a rate and a percentage of the total abstraction over time. The analysis conservatively assumes that pumping will take place at a rate of 10 L/s 24 hours per day, 365 days per year.

Input values include:

- Aquifer transmissivity
- Aquifer storativity (or more correctly, the specific yield as the model assumes an unconfined aquifer in continuity with the stream)
- Pumping rate of the well
- Distance from the well to the stream or river
- The effective width of the river or stream

- The thickness of the river or stream bed
- The hydraulic conductivity of the river or stream bed.

Combined, the last three terms are used to calculate the conductance parameter λ (equal to the hydraulic conductivity times the stream width divided by the bed thickness). The Hunt model set up is shown in Figure 2.



From: ECan stream-depletion-v3.xlsm

Figure 2 – Hunt (1999) Model Set-Up

2.2 Issues Affecting the Use of the Hunt Model

There are several factors that complicate the use of the Hunt method to assess the effects of pumping the Heretaunga well on the two surface water bodies of concern. These include:

- The Hunt model assumes the hydraulic effects of only one stream or river while the Upper Hutt groundwater management area pumped by the Heretaunga well includes the Mawaihakona Stream as well as the Hutt River.
- The hydraulic properties of the aquifer are variable as a result of the fluvial processes that caused high-permeability channels and lower-permeability over-bank deposits throughout the upper 35 m of the valley fill. Consequently the results of aquifer tests conducted on different wells in the valley indicate a range in transmissivity values.
- The river and stream bed parameter used to calculate depletion are not known and have to be estimated.

These issues are discussed below.

2.3 Modelling Two Surface water Bodies

The depletion effects on the Hutt River and the Mawaihakona Stream were modelled through a hybrid process using the Hunt model. Initially, the model was run for each of the surface water bodies. In each model run, the amount or water removed from the river (or stream) is calculated over time. Each model simulation assumes that water originates[1] from the river (or stream) or stored water in the aquifer. The total water removed cannot exceed the 10 L/s pumping rate used in each simulation. The results of a simulation for the Hutt River directly added to a simulation for the Mawaihakona Stream would result in a total withdrawal of 20 L/s, twice the actual withdrawal. To overcome this, our hybrid approach assumes that the initial surface water depletion would occur from the Hutt River and the Mawaihakona stream at the rate indicated by the single river (or stream) simulation up to a combined total of the 10 L/s pumped. The difference between the combined depletion and the pumping rate was assumed to be derived from aquifer storage. Once the total pumping of 10 L/s was reached we assumed that no additional water was being pumped from storage and that a steady state had been reached and the drawdown at each point of interest (Hutt River and Mawaihakona Stream) remains constant thereafter. Where the combined depletions upon reaching steady state exceeded 10 L/s, we reduced the depletion from each surface water body proportionally[2] to the depletions for the single-river or single-stream calculation. This proportionality is consistent with the approach outlined in the ECan guidance document ("guidelines") for evaluating stream depletion effects (Smith, 2009). Once steady state is reached, the rate of depletion from any of the three potential sources would remain unchanged no matter how long pumping continued.

2.4 Variations in Aquifer and Stream Bed Properties

Differences in the reported properties of the aquifer and stream beds were addressed by conducting three analyses using a range of properties: high-end, mid-value and low-end depletion. The properties that varied in the analyses were: aquifer transmissivity, aquifer storativity (or specific yield), river and stream bed hydraulic conductivities and river and stream bed thickness. In the high-end analysis we used the upper-end values for aquifer transmissivity, the lower-end value for aquifer storativity, the upper-end value for river and stream bed hydraulic conductivity and the lower-end value for stream bed thickness. This combination of parameter values produces the highest river and stream depletion. In the low-end analysis we used the lower-end values for aquifer transmissivity, the upper-end value for aquifer storativity, the lower-end value for river and stream

---

[1] In this case "originates" does not mean that the water pumped from the Heretaunga well came from these surface water bodies, only that the pumping caused more surface water to be "lost" from the Hutt River (an increase in groundwater recharge at the expense of river flow) and/or less groundwater to be "gained" by the Hutt River or the Mawaihakona Stream. The pumped water would likely have come from a combination of precipitation recharge and upstream seepage loss from the Hutt River.

[2] The head waters of Mawaihakona Stream and the Hutt River are approximately the same distance from the Heretaunga well. The guidelines call for a linearly proportioned distribution of the effects to each stream based on distance from the pumped well.

bed hydraulic conductivity and the upper-end value for stream bed thickness. This combination of parameter values produces the lowest river and stream depletion. The mid-value depletion analyses used the mid-values for the input parameters.

Aquifer transmissivity and storativity values came from the MWH (2008) report prepared for GWRC and the pumping test of the Heretaunga well. River and stream bed parameters came from the MWH report, either directly or as back calculations from the model calibration results for stream bed conductance. The distances to the Hutt River and the headwaters of Mawaihakona Stream were measured using Google Earth as were the representative channel widths. The values used in the analyses and their sources are listed in Attachment 1.

3 Results of the Depletion Analysis

The results of the depletion analyses are presented in Attachment 2. The upper half of the attachment presents the separate analyses (high-end, mid-value and low-end) for the Hutt River and the Mawaihakona Stream. The analyses indicate that under the assumed values for high-end depletion, much of the water pumped from the Heretaunga well would cause depletion from the river or stream within the first week of pumping. Under the assumed values for the low-end depletion analyses, a relatively large amount (5.8 L/s) of the abstraction would deplete the Hutt River within 150 days of pumping. Depletion from Mawaihakona Stream would be much smaller under the low-end assumed values with 0.5 L/s of reduced flow in the stream after one year of continuous pumping. The mid-value depletion analyses indicate a large depletion (5.4 L/s) from the Hutt River after one week of pumping with smaller depletions from Mawaihakona Stream (3.7 L/s) after one year. All of the analyses indicate that even after one year of pumping transient conditions still prevail with a slight increase in depletion rates continuing after year one.

The combined analyses (the lower half of Attachment 2) show that under the assumed values used for the high-end depletion analysis, steady state is reached within one week of pumping with 63 % of the water depleted from the Hutt River, 37 % of the water depleted from the Mawaihakona Stream and none from aquifer storage. Using the low-end depletion assumed parameter values, the rate of depletion continues beyond one year with an indicated 72 % originating from the Hutt River, 5 % from the Mawaihakona Stream and the remainder 23 % from aquifer storage. The mid-value analysis indicates that steady state is reached within 150 days with 78 % of the water originating from the Hutt River and 22 % from the Mawaihakona Stream.

These analyses give a wide range of possible effects (although all are small) to the two surface water bodies. Because the values of key parameters must be estimated owing to of a lack of hard data, the analyses cannot be refined further at this time.

4 Effects on Mawaihakona Stream

The combined analyses indicate that pumping the Heretaunga well could reduce the flow in the Mawaihakona Stream during drought conditions by <1 to about 5 %, based on an assumed base flow of 70 L/s, as indicated by stream gauging data supplied by GWRC (Mzila, 2012). The largest depletion is indicated by the analysis using all of the parameter values that would lead to the highest depletion rate, a situation that is not likely. In order for this to occur, the Heretaunga well would have to be directly connected to a high permeability buried channel deposit that linked directly to the headwater springs that feed the head waters of the Mawaihakona Stream and the hydraulic conductivity of the stream bed would also have to be at the high end of the range with the stream bed at its likely thinnest. The low-end value for transmissivity (1500 m^2/day) indicated in our analysis of the pumping test mean this is an unlikely situation.

The low-end depletion amount may also be unlikely as the analysis assumes the lower transmissivity zone pumped by the Heretaunga well is relatively isolated from the springs that start the flow of Mawaihakona Stream. Therefore, the mid-value analysis appears to be the more likely scenario. As such, the 2.2 L/s indicated in the analysis represents about 3 % of the lowest flow of 70 L/s reported from the gauging data.

The analysis based on Mawaihakona Stream only (no connection to the Hutt River) indicates a depletion of < 1 % to 13 % after one year of pumping. The upper end depletion analysis results (13 % depletion) are most unlikely because the Hutt River *is* in continuity with the pumped aquifer (Gyopari, 2012) and the Heretaunga well's low transmissivity suggests it does not directly connect to a high-permeability buried channel.

5 Effects on the Hutt River

Depletion of the Hutt River would be much smaller percentage-wise as the flow in the Hutt is much greater than that in the Mawaihakona Stream. Compared to the 1-Day MALF of 3,400 L/s for the Hutt River (lower reach) listed in Keenan et al (2012), the 7.8 L/s depleted from the Hutt River (the highest amount listed in our analysis considering both surface water bodies) is about 0.2 %.

6 Summary and Conclusions

Simplified depletion analyses were conducted to assess the possible effects of pumping the Heretaunga well at 10 L/s. The method and approach were agreed upon by GWRC. The Hunt (1999) analytical model developed by ECan was run under three sets of assumed possible values for aquifer transmissivity, aquifer storativity, stream bed hydraulic conductivity and streambed thickness. The model was developed for a single stream in an infinite aquifer and does not fit the actual situation of a bounded system with multiple surface water bodies within a heterogeneous aquifer. None the less the approach was used to calculate a possible range of effects, as per agreement with GWRC.

The analyses indicated that pumping the Heretaunga well 2h hrs per day and 365 days per year at 10 L/s would cause a depletion of flow in the Hutt River and the Mawaihakona Stream. The high-end depletion analysis indicates that within one week all of the 10 L/s pumped by the Heretaunga well would be produced by stream depletion with 63 % of the depletion occurring from the Hutt River and 37 % from the Mawaihakona Stream. The low-end depletion analysis indicates that after one year of pumping 72 % would be supplied from Hutt river depletion, 22 % from Mawaihakona Stream depletion and the remainder from aquifer storage.

The combined analysis assuming hydraulic connection to both the Hutt River and Mawaihakona Stream indicates that the depletion from the Mawaihakona Stream represents from <1 to about 5 %

of its recorded lowest flow while the depletion of the Hutt River would be less than 0.2 % of its 1-Day MALF.

7 References

ECan, 2012. ECan stream-depletion-v3.xlsm, spreadsheet model downloaded from ECan website: http://ecan.govt.nz/services/online-services/tools-calculators/Pages/groundwater-tools.aspx

Keenan L., Thompson, M., and D. Mzila, 2012. *Freshwater allocation and availability in the Wellington regio*n, Stat and trends. GWRC technical report .

Gyopari, M., 2012 *Application of Proposed Framework for Conjunctive Water Management,* report by Liquid Earth report for GRWR issued July 2012.

MWH, 2008. *Sustainable Yield Study, Upper Hutt Aquifer, Stage Two.* Consultant's report prepared February 2008.

Mzila, D., 2012. Daily stream flow records for Mawaihakona Stream supplied in MS Excel format

Smith, M., 2009. *Techniques for evaluating stream depletion effects, A supplement to the guidelines for the assessment of groundwater abstraction effects on stream flow (2000)*, Report No. R09/53 ISBN 978-1-86937-992-6

Yours sincerely

Mark Utting
Senior Hydrogeologist

on behalf of
Beca Carter Hollings & Ferner Ltd
[redacted]

Attachments

Hutt River and Mawaihakona Stream Depletion Analyses Input Data

			Comment
Heretaunga Well and Aquifer			
Pumping Rate, Q	10	L/s	Consent
Transmissivity Upper-end	1500	m2/day	Aquifer Test Report
Transmissivity Mid-Value	15000	m2/day	Rounded Mean
Transmissivity Lower-end	28000	m2/day	Aquifer Test Report
S at well	0.02	-	Aquifer Test
S Upper-end	0.04	-	MWH Report
S Mid-value	0.03	-	Rounded Mean
S Lower-end	0.02	-	Heretaunga Test
Hutt River			
Distance L, Well to River	1400	m	Google Earth
Effective Width	25	m	Google Earth
Kv	25	m/d	back-calculated from MWH report
Kv Upper-end	250	m/d	10x MWH value
Kv Mid-Value	25	m/d	back-calculated from MWH report
Kv Lower-end	2.5	m/d	1/10 MWH value
Bed thickness	0.5	m	MWH Report
Bed thickness Upper-end	1	m	2x MWH Report
Bed thickness Mid-Value	0.5	m	MWH Report
Bed thickness Lower-end	0.25	m	1/2x MWH Report
Mawaihakona Stream			
Distance Well to Stream	1450	m	Google Earth
Upper Reach Effective Width	2	m	Google Earth
Kv	1	m/d	From MWH report
Kv Upper-end	10	m/d	10x MWH value
Kv Mid-Value	1	m/d	back-calculated from MWH report
Kv Lower-end	0.1	m/d	1/10 MWH value
Bed thickness	1.67	m	back-calculated from MWH report
Bed thickness Upper-end	3.33	m	2x MWH Report
Bed thickness Mid-Value	1.67	m	back-calculated from MWH report
Bed thickness Lower-end	0.83	m	1/2x MWH Report

λ =Kv *stream width / bed thickness

Hunt (1999) Results for a Separate River and Stream with each Surface Water Depletion and Withdrawal from Storage Limited to 10 L/s

	Hutt River			Mawaihakona Stream		
Time (days)	Depletion from River q (L/s)	Depletion from Aquifer Storage q (L/s)	Condition	Depletion from Stream q (L/s)	Depletion from Aquifer Storage q (L/s)	Condition
High-end Depletion						
7	7.5	2.5	Transient	4.5	5.5	Transient
30	8.8	1.2	Transient	6.9	3.1	Transient
150	9.5	0.5	Transient	8.6	1.4	Transient
365	9.7	0.3	Transient	9.1	0.9	Transient
Mid-Value Depletion						
7	5.4	4.6	Transient	0.4	9.6	Transient
30	7.6	2.4	Transient	1.1	8.9	Transient
150	8.9	1.1	Transient	2.6	7.4	Transient
365	9.3	0.7	Transient	3.7	6.3	Transient
Low-end Depletion						
7	0.2	9.8	Transient	0.0	10.0	Transient
30	2.3	7.7	Transient	0.1	9.9	Transient
150	5.8	4.2	Transient	0.3	9.7	Transient
365	7.2	2.8	Transient	0.5	9.5	Transient

Hunt (1999) Results for a Combined River and Stream with combined Surface Water Depletion and Withdrawal from Storage Limited to 10 L/s

	Hutt River	Mawaihakona Stream		
Pumping Time (days)	Depletion from River q (L/s)	Depletion from Stream q (L/s)	Depletion from Aquifer Storage q (L/s)	Condition
High-end Depletion				
7	6.3	3.7	0.0	Steady State
30	6.3	3.7	0.0	Steady State
150	6.3	3.7	0.0	Steady State
365	6.3	3.7	0.0	Steady State
Mid-Value Depletion				
7	5.4	0.4	4.3	Transient
30	7.6	1.1	1.3	Transient
150	7.8	2.2	0.0	Steady State
365	7.8	2.2	0.0	Steady State
Low-end Depletion				
7	0.2	0.0	9.8	Transient
30	2.3	0.1	7.6	Transient
150	5.8	0.3	3.9	Transient
365	7.2	0.5	2.2	Transient