Gore District Council

Water Supply Strategy

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Water Supply Strategy

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Contents

1 Introduction

This report provides a water supply strategy for the Gore District Council. The strategy itemises the progressive steps required in order for Gore District Council to meet its water supply obligations and it covers the risks associated with the steps, the potential costs, and the timing for each step.

The strategy is necessary in view of the lack of success with the drilling of new productive bores and the information contained in three reports on the water source catchments.

2 Background

During drought conditions the water supplied to the Gore District consumers has to be restricted because the available supply cannot meet the unrestricted demand. Future industrial demands and/or significant domestic growth demand will therefore create significant issues for the Gore District Council (GDC).

The GDC must also provide water complying with the New Zealand Drinking Water Standards, 2005, revised 2008 (DWS NZ). To date the upgrading of the existing water treatment process has been deferred awaiting decisions on the provision of additional water volumes.

The “Future Options” report [1] of 2008, costed options for supplies that allowed for the existing demand at that time with an allowance for moderate residential growth (in the case of Gore) and moderate residential decline (in the case for Mataura). The estimates did not include industrial development or significant domestic growth fuelled by industrial development in the district.

The report showed that the lowest cost options were those for bore supplied water which required lesser treatment than surface water. Drilling for productive water bores, however, has not been successful. It was therefore decided that an overall picture of the catchments should be obtained and three water reports from Opus International Consultants (Opus) were commissioned.

The first report “Hydrology of the Mataura River”, [2] showed that the last ten years have been characterised by lower that average flow conditions. This period coincides with a dramatic increase in the abstraction of water for irrigation. It also reported that climate change will have only a small impact on the Southland region with a slight reduction in drought frequency and severity.

The report concluded that because of the strong hydraulic connection between the river flow and the shallow groundwater in the vicinity of Gore then any abstraction from the Jacobstown and Coopers well-fields would likely be subject to the same restrictions on abstraction as surface water pursuits. Thus the Mataura Water Conservation Order is likely to act as a major constraint on any future development of the shallow groundwater resource in the vicinity of Gore.

The report “Coopers Well Field: Hydrology” [3] showed that there appears to be interaction between groundwater levels in the Coopers wells and the Mataura river. The Mataura Water Conservation Order is therefore likely to impact on any resource consent to abstract any increased volumes of water and additional abstraction would likely be restricted when additional water was in greatest demand. It is also possible that the total allocation in the Knapdale groundwater zone exceeds the limit set by Environment Southland. If that is the case then there is no allocation remaining which could be used to meet the future needs of the Gore community.

While new abstractions are constrained by the Water Conservation Order in the Mataura River these constraints do not apply to the existing consents. It is understood that current usage at the Coopers well-field is less than 50% of seasonal allocation. Thus optimising water use under the existing consents would be preferable to seeking new water permits. Increasing production by optimising existing well hydraulics and efficiency would be more effective than expanding the well-field.

Water quality may be an issue in the future. The Knapdale aquifer is predisposed to nitrate contamination and has the highest median nitrate concentration of any aquifer system in Southland. While the groundwater used for the water supply may not currently be affected by nitrate leaching, there is potential for nitrate levels to rise.

The report “Mataura – Hydrology and Hydrogeology” [4] covered factors affecting the Mataura community’s water supply. The study assessed various constraints on the current water supply system and provided information on drought susceptibility and the risk to the water resource of the Pleura catchment. If also assessed a potential groundwater resource from new bores on the east side of the river between Gore and Mataura.

The limited storage capacity behind the Pleura Dam, the need to maintain a residual flow downstream, and the highly variable flow regime act as major constraints on the abstraction of additional water from this source. Balancing water supply with demand is further complicated because flows tend to be lowest when demand is highest.

Shallow groundwater abstraction in this area leads to stream depletion effects because the aquifers are hydraulically connected to the rivers and streams. The Mataura Water Conservation Order thus limits further abstraction.

Deeper groundwater resources within the Mataura catchment appear limited and considerable expense would be incurred in locating a sustainable groundwater resource which was not hydraulically connected to a surface water resource. Consequently there are various constraints to using either shallow or deep groundwater. These constraints and the limitations of the existing supply system point to water storage as the means of meeting dry period demands. Water could then be taken at times of higher flows and used during periods of low flows.

The report concluded that as the Gore supply has similar constraints then providing storage to meet the demand from both Gore and Mataura townships should be considered.

For some time issues with levels of manganese in water from the Jacobstown well-field have resulted in consumer complaints. It appears that the problem is confined to water from the deep well. This is used during dry periods when the river level is low. The report “Jacobstown Bores Manganese Issues” [5] covered possible treatment processes for removing the manganese. It recommended that manganese removal measures be undertaken concurrently with upgrading of the Hilbre Avenue WTP to meet protozoa requirements of DWSNZ and that bench testing of polyphosphate dosing be undertaken.

In view of the lack of success with the drilling of new productive bores and the information contained in the three reports on the water source catchments it was decided that a water supply strategy was needed. This strategy would itemise the progressive steps required for GDC to meet its water supply obligations and would cover the risks associated with the steps, the potential costs, and the timing for each step. The strategy is outlined below.

3 Water Supply Strategy

3.1 Outline

Undertaking work that reduces the water demands should be carried out first. This not only will reduce the treatment costs but will also defer the need to establish new sources of water to meet future demand increases. Meeting legislative requirements must also be a priority. There are five items of work which can be carried out concurrently and commenced now;

- Installation of zone metering (which is already under way)
- Updating of the Public Health Risk Management Plan,
- Leak detection work,
- An increase in water conservation measures, and
- Development of water demand scenarios covering a range of future populations.

Outcomes from this work will also provide information for the installation of a pressure management system.

Low cost methods of meeting demands during drought conditions should be investigated. GDC currently has consent for emergency pumping of river water to the surfaces of both well-fields during drought conditions. The provision of infiltration media for the water to pass though should be explored. It may prove to be a low cost treatment method of obtaining well-field quality water. Using the emergency pumping consent could be a lower cost alternative to providing additional volumes of water.

Improving the yields from the existing well-fields would be the next step. The well-fields currently only produce 50% of the consented water volumes. Additional step down pump tests and constant pumping tests would be undertaken following refurbishment or replacement of the existing screens.

Investigating possible raw water storage locations and volumes will give an indication of whether it will be possible to take river water at times of high flows to use when water takes are restricted during times of low river levels. This would enable higher demands to be met and would result in lower cost water treatment than if the water was taken directly from the river at all times, as the stored water would be cleaner.

3.2 Install Zone Metering

Zone metering is the provision of flow meters at various locations in the reticulation to measure and record flow throughout a 24 hour period. The information obtained is essential for calibrating the reticulation model that GDC have. The calibrated model can then be used to assess areas of possible leakage in the reticulation. The model will also show where there are areas with pressure problems (both high and low pressures).

The integration of zone metering information with a reticulation model has reduced leakage and resultant costs significantly in other areas throughout New Zealand.

The flow meters would be installed on the outlets of the Wentworth Street and Hilbre Avenue reservoirs, at the bridge over the Mataura River, and upstream of the southern part of the Hilbre Tower zone. Cost estimates have been prepared and tenders are about to be called for this work.

3.3 Update the Public Health Risk Management Plan (PHRMP) for Gore

Water Suppliers are required by legislation to have PHRMPs for their water supplies. For Gore, with a population of 7,500, the PHRMP is required to have been approved by the Drinking Water Assessor within the 12-month period starting 1 July 2013. This is the date at which GDC must legally comply with DWSNZ.

The PHRMP will show the Drinking Water Assessor (DWA) how DWSNZ compliance will be met by GDC during the investigation of, and upgrades resulting from the implementation of, this water supply strategy.

The PHRMP is to be updated by Opus and will include the improvements made by the GDC to the water supply since the draft PHRMP was prepared. Updating is estimated to cost $4,000 + GST. The risk with this step is that the DWA may not approve the PHRMP because the improvement programme is not sufficiently definitive or of too long a duration.

3.4 Continue Leak Detection Work

Reducing leakage from the reticulation system will reduce treatment costs and give a buffer against future demand increases. Leak detection work was carried out in 2005 (East Gore), 2011 (West Gore) and 2012 (Mataura) and has resulted in the detection of leaks not noticeable at the surface.

The need for further leak detection work will be triggered by the reticulation model showing unusually large night time demands in certain locations and/or large volumes of unaccounted for water.

A leak detection firm would undertake the work based on area/locations determined from reticulation modelling. This is specialised work and some firms have more experience and greater success at locating the leaks than other firms. There is therefore the risk that leaks may go undetected if the most suitable firm is not used. There is also the risk that the leakage volume showing on the reticulation model comprises a far greater number of individual leaks than expected. This would result in greater detection costs if the full potential of leakage reduction measures was to be achieved.

Expenditure of $11,500 + GST per annum could be expected over a period of 5 to 10 years to make significant sustained improvements in leakage reduction.

3.5 Increase Water Conservation Measures

GDC currently encourages both domestic and commercial consumers to conserve water. These measures should be continued as any reduction in demand reduces treatment costs and provides a buffer against future source development to meet increased demand.

Should water demands increase despite the leakage reduction actions implemented in the steps above then By-Laws may need to be added to the management measures. As a condition of building consents new residences could be required to have rain water tanks connected. The same could apply to commercial buildings. Increased education measures could also be implemented. The costs incurred would be staff time and possibly $20,000 + GST for education measures.

The risks are that there could be resistance from developers and commercial firms to the imposed requirements and the costs of the education measures may not be covered by the lower demand savings.

Incentives to encourage installation of rain water tanks at existing residences could also be introduced but these have not been costed.

3.6 Develop Water Demands

Water demands for various population numbers in the Gore district will give an indication of likely volumes and treatment capacities required should the population increase (or decrease) significantly and the likely costs which would result. These water supply capital expenditure figures may be required for future Long Term Plan inputs.

Per person demand figures for water supplies throughout New Zealand will be reviewed and adjustments will be made for Gore conditions and industry. High, medium, and low per person demand figures will be determined and the resultant demands for various population figures calculated.

These will give direction for likely future source, treatment, and reticulation requirements. This work is estimated to cost $10,500 +GST. It should be noted that “wet” industry establishment or other large industry development in the region could outstrip the calculated demands.

3.7 Provide a Pressure Management System

Pressure management systems are used to regulate pressures in a reticulation system throughout each 24 hour period. In this way sufficient pressures are maintained during high demand periods to meet normal requirements and fire flows, while pressures can be reduced during low demands (during night hours) so that leakage from the system and pipe bursts are minimised. Treatment and pumping costs are therefore reduced.

The trigger for this step is when the reticulation modelling and leak detection work indicate that significant cost savings can be made by controlling the pressures throughout the system.

The pressures are adjusted by control valves positioned at various locations as predicted by the reticulation model. Various settings for the valves are input and the flows and pressures are then monitored.

The risk associated with this step is that the predicted cost savings are not achieved as a result of poor positioning of the valves or incorrect settings on the valves.

The cost of such a system depends on the number of pressure zones, whether there are ring mains or distribution mains and a good detailed knowledge of the whole reticulation system. At this stage the Gore District Council’s reticulation modelling is not sufficiently advanced to be able to provide the necessary information. It is therefore not possible at this time to give an estimated cost for this step of the strategy.

3.8 Investigate Infiltration Media Installation Feasibility

Following implementation of the water saving/lowering of water demand steps above, new lower peak demand figures will be established. If the anticipated water demand during drought conditions is likely to exceed the water available unless emergency pumping takes place, then it will be necessary to investigate the feasibility of using infiltration media.

Emergency pumping of river water onto the two well-fields is a consented activity during drought conditions when the river level is low. The water is pumped onto the surface well-field and drains down through the gravel to add to the supply being pumped out by the bore pumps. A suitably graded media of sufficient depth may reduce the river water turbidity to that of the water in the well-field. This could prove to be a low cost form of treatment during emergency pumping periods.

The investigation which would include checking for suitable materials, sampling and testing, design of mixes, and laboratory testing to confirm turbidity removal and water travel times through the media is estimated to cost $40,000 - $50,000 + GST.

The risks are: that there is an insufficient quantity of the required quality materials available, that they are too expensive, that the travel time through the available depth would be too short to achieve the required quality improvement, and that the media may clog over time.

3.9 Improved Well-Fields Subsurface Information

If emergency pumping is likely to be required during drought conditions then it will be necessary to know the best locations for constructing the beds of filtration media. Knowledge of the composition of the existing well-fields will then be needed. Subsurface investigations would provide the ability to check for the location(s) of possible rock sills, variations in existing materials and possible locations for the infiltration media.

Methods such as ground radar and multi-electrode resistivity can be used. Southern Geographical Ltd provides such services and is skilled in this type of specialised work.

The estimated total cost for investigating the well-fields is in the range of $25,000 - $30,000 + GST.

The risks are that the investigation does not give the required amount of detailed information or that the area of investigation needs to be extended beyond the initial expectation with resultant increased costs.

3.10 Extend Knowledge of Well-Fields

If the water demand reductions from the steps above are not large enough it will be necessary to improve the water yields from each of the well-fields. Thus upgrading of the screens and performing pumping tests to determine the efficiencies of the well and characteristics of the well-fields will be required. The information gained will also give an insight to the manganese issues, which are creating consumer complaints of black/dirty water, and to increasing nitrate levels.

Knowledge of the well-fields is important as it appears that less than 50% of the consented water takes are being pumped out of the two well-fields.

Refurbishing or renewing the screens and re-developing the wells will be the first step. Then efficiency and yield testing can be carried out using step drawdown testing (including water quality testing) and constant rate pumping tests (also including water quality testing).

The testing should enable sustainable yield figures to be determined.

The cost of the screen renewal, well re-development, and efficiency/yields testing is estimated to be in the range $160,000 - $200,000 + GST.

The risks associated with this step are that yields are much smaller than expected and that interference between the wells may require the removal of turbidity from the wells' production water during the testing of the other well(s) in the well-field.

3.11 Possible Water Storage

Providing raw water storage has been advocated previously as a means of providing greater volumes of water to meet future increased demands. Raw water storage is not seen as an immediate need or solution and situations likely to trigger a desk-top study of possible storage locations are:

- Investigations have shown that infiltration media systems are either unsatisfactory or not possible
- Elevated manganese and/or nitrate levels occurring frequently
- Indications that the emergency pumping consents will not be renewed.

The study would show whether or not a location with sufficient storage volume was available at a convenient distance from Gore. The cost of the study is estimated to be $38,000 + GST

The risks associated with this work are that the results show:

- That there are no sites with a sufficient storage volume
- That a suitable volume site is found but the geology is unsuitable
- That the site(s) are too far from Gore and the pipeline costs are prohibitive

Failure to locate a suitable storage site would give a warning that expensive run-of-the-river water treatment would be required in the future.

3.12 Report on Water Treatment Plant Upgrades

Upgrading of the existing water treatment plants to DWSNZ compliance will be on the improvement programme of the revised updated PHRMP. It is also possible that the outcomes from the infiltration media and well-fields efficiency/characteristics work will show that run-of-the-river treatment will be required. In that case having just one treatment plant for Gore would be a consideration.

It would be preferable to meet any increased water demands from improving the efficiency of each well-field. Treatment is then likely to be simpler and lower cost. The upgrading of the existing water treatment plants would then take place rather than a new single water treatment plant to process run-of-the-river water. The decision on existing plant upgrades versus a new single plant can only be made once the above steps have been worked though. However, the improvement programme of the PHRMP may not be approved by the Drinking Water Assessor and plant upgrades may be required before all the investigation work has been carried out.

Suitable treatment processes can be assessed, costed, and reported on by Opus. The estimated cost for the process evaluation work is $27,500 + GST.

It should be noted that if manganese issues continue or nitrate levels rise to a level requiring treatment then treatment costs (both capital and operating) will be considerably greater than the UV disinfection costs required to achieve protozoa compliance.

3.13 Energy Use/Energy Costs

Throughout the investigation steps above, any capital works requiring large energy consumption will be carefully evaluated to check whether advantages can be taken of the low electricity rate for Gore District Council. The costs for this evaluation are included in the various steps above. However, it is possible that the location of a preferred option requiring large electricity use is outside the Gore low-tariff area.

3.14 Construct New Treatment Plant

If the above steps do not produce a sufficient volume of water meeting DWSNZ then it will be necessary to construct a new water treatment plant. This will treat water for both Gore and Mataura. The plant will be a "run-of-the-river" facility taking water directly from the Mataura River. Consequently a river intake will be required and pipelines will be required to convey the water to Gore and Mataura. Additional treated water storage will also be required.

The plant will need to be located above the flood levels but low enough to reduce pumping costs. It will comprise numerous process components in order to be able to deal with the range of the surface water characteristics. As a result it will be considerably more complex to operate than the existing plants and will incur significant operating costs.

The estimated cost of the plant including intake, pipelines and treated water storage is $13.0 million to $15.0 million plus GST.

A risk is that a suitable location close to Gore may not be available for the plant and this would result in longer pipelines and increased pumping costs.

4 Conclusion

This report gives the progressive steps that should be taken by Gore District Council to avoid the cost of having to provide expensive run-of-the-river water treatment in order to meet its water supply obligations. It should be noted that the order of work given above may change depending on changing circumstances and on the outcomes of the various investigations.

5 References:

[1] "Gore and Mataura, Water Sources and Treatment: Future Options Report", Opus International Consultants, November 2008

[2] "Hydrology of the Mataura River: A constraint on water abstraction at Gore", Opus International Consultants, July 2012

[3] "Coopers Well-field: Hydrology", Opus International Consultants, July 2012

[4] "Mataura – Hydrology and Hydrogeology: Mataura Community Water Supply", Opus International Consultants, July 2012

[5] "Jacobstown Bores Manganese Issues", Opus International Consultants, January 2012

Appendix 1: Table – Gore Water Supply Strategy: Order of Work

Gore Water Supply Strategy – Order of Work

The table below gives a suggested order for the work to be undertaken.

	Item	Details	Comments	Triggers	Risks
1A	Install zone metering. (Estimated $70,000 - $80,000).	On reservoir outlets, at bridge over Mataura River, and upstream of the southern part of the Hilbre Tower zone.	• Knowledge of flows allows model to be calibrated – • Leakage can then be assessed and monitored, • Location of demands determined • Pressure problem areas eliminated.	Needed to calibrate the reticulation model.	May not give all the information required – more meters may be required.
1B	Update PHRMP for Gore. (Estimated $4,000).	Update to include improvements made since draft PHRMP produced.	Shows Drinking Water Assessor how DWSNZ compliance will be met during investigations & upgrades.	Required by legislation.	DWA may not approve the improvement programme if not sufficiently definitive or too long a duration.
1C	Continue leak detection work. (Estimated $11,500 per annum – for 5 to 10 years).	Employ leak detection firm to undertake work based on areas/locations determined from reticulation modelling.	Reduction in leakage will reduce treatment costs and give buffer against future demand increases.	Reticulation model shows unusually large night-time demands in particular areas and/or large volumes of unaccounted water.	Firm employed may not be the most experienced – unusual leaks not detected. Number of leaks may be greater than expected – greater detection costs.

	Item	Details	Comments	Triggers	Risks
1D	Increase water conservation measures – domestic & commercial. (Staff time plus estimated $20,000 for education)	• Continue with existing measures. • By law for new dwellings and commercial developments. • Increase education.	Reduction in demand reduces treatment costs and provides a buffer against future source development to meet increased demand.	Water demands increase despite leakage reduction actions.	Resistance from developers and commercial firms to imposed requirements. Costs of education not covered by lower demand savings.
1E	Develop water demands for various population numbers. (Estimated $10,500)	Review per person demand figures for water supplies throughout NZ. Adjust for Gore conditions/industry and determine high, medium and low figures. Calculate demands for population bands.	Will indicate likely future source and treatment requirements.	Water supply capital expenditure figures required for Long Term Plan.	"Wet" industry or other development in the region could skew the results.
2	Provide a pressure management system.	Provide control valves at locations determined by consideration of reticulation modelling results.	Will assist in reducing leakage and pumping costs.	Reticulation modelling and leak detection work indicate significant cost savings.	Cost savings not achieved as a result of poor positioning of valves or incorrect settings on valves.

	Item	Details	Comments	Triggers	Risks
3A	Investigate installation of infiltration media (for river water pumped on to surface of the well fields to flow through to well pumps). (Estimated $40,000 - $50,000).	• Check availability of materials from local suppliers. • Sample and undertake sieve analyses. • Design suitable mixes. • Lab test mixes for travel times and turbidity reductions. • Determine volumes, and costs.	Emergency pumping from the river during drought conditions is consented. Improving river water quality to wellfield quality during these periods would provide low cost treatment.	Anticipated water demands during drought conditions likely to exceed water available unless emergency pumping undertaken.	Insufficient quantity of the required quality materials available or too expensive. Retention period too short to achieve required quality improvement.
3B	Improve subsurface information on Jacobstown & Coopers well fields. (Estimated $25,000 - $30,000).	Undertake subsurface investigation (eg. ground radar/ multi-electrode resistivity....)	Locate rock sill, provide possible locations for infiltration media.	Emergency pumping likely during droughts. Best locations for infiltration media required.	The investigation does not give the required information. Area of investigation needs to be extended beyond initial expectation (increased costs).
4	Extend knowledge of well fields efficiencies and characteristics. (Estimated $160,000 - $200,000)	Refurbish / Replace screens. Undertake additional step down pump tests and constant pumping tests. Check whether research additional to that already reported is needed.	Currently take only 50% of consented water volumes. Check efficiencies to determine reliable yields. Will provide information on manganese occurrence and levels, nitrate levels increase, etc.	Demand reductions achieved not significant. Consumer complaints of black/dirty water continue or increase. Water tests show increasing nitrate levels.	Long duration pump tests may require turbidity treatment of production water. (Short duration pump tests will not allow sufficient knowledge to be gained).

	Item	Details	Comments	Triggers	Risks
5	Undertake desk-top study of possible locations for raw water storage. (Estimated $38,000)	• Check for LIDAR survey information for Gore/Mataura area. • Broad brush assessment of possible sites using LIDAR or Topo. maps. • For three best possibilities determine volumes available -Dam height? -Geology? • Calculate earthworks quantities. • Determine pipeline requirements. • Determine pumping requirements/pump station/electrical supply. • Prepare cost estimates.	Indication of possible storage volume(s) will give warning of likelihood of requirement for expensive run-of-the-river water treatment in future.	Infiltration media systems not possible or not satisfactory. Elevated manganese and/or nitrate levels occurring frequently. Indications that emergency pumping consent will not be renewed.	No sites with sufficient volume. Geology unsuitable. Sites too far from Gore and pipeline costs prohibitive.

	Item	Details	Comments	Triggers	Risks
6	Report on necessary water treatment plant upgrades & programme. (Estimated $27,500)	Determine required treatment processes and costs to produce DWSNZ compliant water. Outcomes of above investigations will indicate source water quality. Prepare programme based on upgrade work required.	Information from the investigations above will provide the information for a decision on upgrading existing plants/providing one large plant/ reticulation reservoir locations.	Revised PHRMP programme of improvements. Outcomes from infiltration media and well fields characteristics work.	Upgrade programme may not meet requirements of the Drinking Water Assessor. Lower cost UV disinfection may not be sufficient treatment all the time.
7	Throughout above items consider energy use / energy costs. (Included in above steps)	Determine electricity costs component of the various options above.	Take advantage of low electricity rate for Gore DC.	When operation of any option involves large electricity consumption.	Location of preferred option requiring large electricity use is outside Gore low tariff area.
8	Construct new treatment plant. (Estimated $13.0 million. - $15.0 million.)	Plant to treat water for both Gore and Mataura. “Run-of-the-river” plant treating surface water (Mataura River). River intake and trunk pipelines required. Additional treated water storage required.	Location of plant to be above flood levels but low enough to reduce pumping costs. Plant will comprise numerous process components – considerably more complex to operate than existing plants. Significant operating costs.	Above steps do not produce sufficient volume of water meeting DWSNZ.	Suitable location close to Gore may not be available – would result in longer pipeline(s) and increased pumping costs.

All costs exclude GST

Gore District Council

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