<table>
<thead>
<tr>
<th>Capital items</th>
<th>Details</th>
<th>KBR commercial rates ($)&lt;br&gt;20%+30%</th>
<th>DAWA/Shire rates ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase size of existing sports dam roaded catchment</td>
<td>Additional 4 ha, total 27 ha</td>
<td>24,000</td>
<td>52,400</td>
</tr>
<tr>
<td></td>
<td><em>(Cost of polymer excluded)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply and install pipe from existing sports dam to ovals</td>
<td>1550 m of DN100 mm with class 9 pressure rating</td>
<td>107,250</td>
<td>54,670</td>
</tr>
<tr>
<td>Supply pump from existing sports dam to ovals and enclosure</td>
<td>10 L/s @ 34 m head</td>
<td>30,520</td>
<td>26,980</td>
</tr>
<tr>
<td></td>
<td>(with level controls @ minimum depth of 0.5 m, timer @ 4 hours)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply and install storage tank at oval</td>
<td>Steel lined storage tank 390 L</td>
<td>75,593</td>
<td>35,600</td>
</tr>
<tr>
<td></td>
<td><strong>Sub-total capital costs</strong></td>
<td>369,363</td>
<td>169,650</td>
</tr>
<tr>
<td>Location allowance (20%)</td>
<td>Adjustment for regional location factor, e.g. transportation, etc. as costs are based on metro rates</td>
<td>47,473</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Sub-total location allowance costs</strong></td>
<td>47,473</td>
<td></td>
</tr>
<tr>
<td>Additional project costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General contractor’s prelims (20%)</td>
<td>For mobilisation/demobilisation, site set-up, site clean-up, etc.</td>
<td>56,967</td>
<td></td>
</tr>
<tr>
<td>EPCM fees (@10% of cost)</td>
<td>Engineering, Procurement, Construction and Management fees</td>
<td>34,180</td>
<td></td>
</tr>
<tr>
<td>Contingency (@10% of cost)</td>
<td></td>
<td>34,180</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Sub-total for additional project costs</strong></td>
<td>125,327</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total for capital investment</strong></td>
<td><strong>410,164</strong></td>
<td><strong>169,650</strong></td>
</tr>
<tr>
<td>Operation and Maintenance items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump operation (10 L/s @ 34 m head)</td>
<td>12 hrs/day, 3 days/week, 7 months/year of 5.1 kW pump and $0.17/kWh</td>
<td>874</td>
<td></td>
</tr>
<tr>
<td>Maintenance personnel and repairs</td>
<td>$80/hr 2 hrs/week 7 months/year</td>
<td>4,480</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total for operation and maintenance</strong></td>
<td><strong>5,354</strong></td>
<td></td>
</tr>
</tbody>
</table>
4.2 Option 2a: Town run-off to existing dam

4.2.1 Description of option
This reflects the capture of surface run-off from town and pumping it into the existing sports dam for storage.

- **Option 2a:** Surface run-off collection at a new sump
  Town surface run-off is to be collected at a new sump. Based on the existing town drainage plan, the best location for the new sump is on Martin Street south of the intersection of Aspendale Street. This is optimal as it is the confluence (as shown by grades on the existing drainage plan) for culvert structures intersecting Martin Street from north and south of town. It also has an existing overflow onto the diversion bank which can be utilised as an overflow point for the new sump.

  The requirements are:
  - Construction of a new sump; and
  - A drainage channel along Martin Street to ensure collection of surface run-off for the desired rainfall event.

Surface run-off collected at the new sump would then be pumped to and stored at the existing sports dam, which would have to be upgraded as described in Option 1.

The existing but leaky town dam, referred to locally as ‘bowling green dam’, also features in this option, to further augment irrigation demand. Run-off from the bowling green dam catchment will be pumped into the sports dam for storage. Bowling green dam will be used as a sump but current leaks prevent use as a storage facility.

All features discussed in each sub-option are shown in Figure 4.2.

4.1.2 Water yield
Based on the last 10 years of rainfall record the average annual surface run-off which can be collected from the townsit is 17.8 ML/year. The average yield from the leaky bowling green dam is 0.9 ML/year.

The town surface run-off, yield from the leaky bowling green dam and the existing sports dam produce a combined average annual yield of 29 ML/year. This volume of water would supply 71 per cent of the current water demand, which is 41 ML/year.

4.2.3 Capital requirements and costs
The capital requirements and costs for these options are shown in Table 4.3 for KBR commercial rates, and DAWA/Shire rates. The assumptions and cost details for these rates are supplied in Appendix J.
### Table 4.6. Capital requirements and costs, and operation and maintenance costs for Option 2a

<table>
<thead>
<tr>
<th>Capital items</th>
<th>Details</th>
<th>KBR commercial rates ($20%+30%)</th>
<th>DAWA/shire rates ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply and install pipe from existing sports dam to ovals</td>
<td>1550 m of DN100 mm with class 9 pressure rating</td>
<td>107,250</td>
<td>54,670</td>
</tr>
<tr>
<td>Supply pump from existing sports dam to ovals and enclosure</td>
<td>10 L/s @ 34 m head</td>
<td>30,520</td>
<td>26,980</td>
</tr>
<tr>
<td>Supply and install storage tank at oval</td>
<td>Steel lined storage tank 390 L</td>
<td>75,592</td>
<td>38,600</td>
</tr>
<tr>
<td>Upgrade drainage channel along Martin Street for I:10 year peak flow</td>
<td>250 m long, 2 m bottom width, 1:4 side slope, 2 m deep, 1 in 1000 longitudinal slope</td>
<td>32,500</td>
<td>625</td>
</tr>
<tr>
<td>Construct new sump</td>
<td>40 m x 20 m x 2.5 m fully lined</td>
<td>81,960</td>
<td>5,400</td>
</tr>
<tr>
<td>Pump from new sump to existing sports dam</td>
<td>1 x 10 L/s @ 44 m head</td>
<td>49,620</td>
<td>40,945</td>
</tr>
<tr>
<td>Pipe to connect from new sump to existing pipe route</td>
<td>550 m of DN100 mm with class 9 pressure rating</td>
<td>37,800</td>
<td>18,820</td>
</tr>
<tr>
<td>Upgrade leaky dam outlet structure</td>
<td></td>
<td>4,283</td>
<td>500</td>
</tr>
<tr>
<td>Pipe from leaky bowling green dam to existing pipe route to existing sports dam</td>
<td>360 m of DN100 mm with class 9 pressure rating</td>
<td>29,710</td>
<td>17,114</td>
</tr>
<tr>
<td>Pump from leaky bowling green dam to existing sports dam</td>
<td>10 L/s @ 35 m head</td>
<td>30,520</td>
<td>31,980</td>
</tr>
<tr>
<td><strong>Sub-total capital costs</strong></td>
<td></td>
<td><strong>479,757</strong></td>
<td><strong>235,634</strong></td>
</tr>
</tbody>
</table>

#### Location allowance (20%)
Adjustment for regional location factor, e.g. transportation, etc. as costs are based on metro rates | 95,951 |

#### Additional project costs
| Details | |
|---------||
| General contractor’s prelims (20%) | For mobilisation/demobilisation, site set-up, site clean-up, etc. | 115,142 |
| EPCM fees (@10% of cost) | Engineering, Procurement, Construction and Management fees | 69,085 |
| Contingency (@10% of cost) | | 69,085 |
| **Sub-total for additional project costs** | | **253,312** |

#### Total for capital investment
| Details | |
|---------||
| | **829,019** |
| | **235,634** |

<table>
<thead>
<tr>
<th>Operation and Maintenance items</th>
<th>Details</th>
<th>Cost ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of pump from existing sports dam to oval</td>
<td>12 hrs/session, 3 times/week, 7 months/year of 5.1 kW pump and $0.17/kWh</td>
<td>874</td>
</tr>
<tr>
<td>Operation of pumps from new sump to existing sports dam (2 duty/assist and duty/standby arrangement)</td>
<td>more intensive during winter months, 12 hrs/session, Nominal operations = 3 times/week, 7 months/year of 6.6 kW pump and $0.17/kWh and 1.5 times for 2 pumps</td>
<td>1131</td>
</tr>
<tr>
<td>Operation of pump from leaky bowling green dam to existing sports dam</td>
<td>12 hrs/session, 3 times/week, 4 months/year of 5.1 kW pump and $0.17/kWh</td>
<td>499</td>
</tr>
<tr>
<td>Maintenance personnel and repairs</td>
<td>$80/hr 2 hrs/week 7 months/year</td>
<td>7,680</td>
</tr>
</tbody>
</table>

**Total for operation and maintenance** | **10,184** |
4.3 Option 2b: Town run-off to new dam

4.3.1 Description of option

This is similar to Option 2a except the town surface run-off collected would be stored at a new dam instead of the existing sports dam.

- **Option 2b**: Construct a new dam at Crosby’s paddock, new sump and other upgrades are as outlined for Option 2a.

  All surface run-off will be stored in a new dam, at Crosby’s paddock.

  In this option the leaky bowling green dam also augments supply, however, water will be stored in the new dam instead of the existing sports dam. A schematic is shown in Figure 4.3.

4.3.2 Water yield

As for Option 2a, the average annual town surface run-off was estimated to be 17.8 ML/year and the average annual yield from the leaky town dam is 0.9 ML/year.

The size of the new dam required is 17 ML assuming a geometry of 30 x 30 x 6 m at a 1:3 side slope. The average yield from the new dam is 14 ML/year representing approximately 34 per cent of the existing water demand, which is 41 ML/year.

The yield from Option 2b is less than 2a, as augmentation of water from the existing sports dam is not included.

4.3.4 Capital requirements and costs

The capital requirements and costs for these options are shown in Table 4.4 at KBR commercial rates and DAWA/Shire rates. The assumptions and cost details for these rates is supplied in Appendix J.
Table 4.7. Capital requirements and costs, and operation and maintenance costs for Option 2b

<table>
<thead>
<tr>
<th>Capital items</th>
<th>Details</th>
<th>KBR commercial rates ($$) 20%+30%</th>
<th>DAWA/Shire rates ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade drainage channel along Martin Street for 1:10year peak flow</td>
<td>250 m long, 2 m bottom width, 1:4 side slope, 2 m deep, 1 in 1000 longitudinal slope</td>
<td>32,500</td>
<td>625</td>
</tr>
<tr>
<td>Construct new sump</td>
<td>40 m x 20 m x 2.5 m fully lined</td>
<td>81,960</td>
<td>5,400</td>
</tr>
<tr>
<td>Pump from new sump to new dam</td>
<td>2 x 30 L/s @ 10 m head</td>
<td>37,620</td>
<td>34,080</td>
</tr>
<tr>
<td>Pipe to connect from new sump to new dam</td>
<td>650 m of DN150 mm with 10 m pressure rating</td>
<td>43,400</td>
<td>21,060</td>
</tr>
<tr>
<td>Pipe from leaky bowling green dam to new dam</td>
<td>500 m of DN150 mm with 5 m pressure rating</td>
<td>37,950</td>
<td>20,650</td>
</tr>
<tr>
<td>Upgrade outlet structure for leaky bowling green dam</td>
<td></td>
<td>4,283</td>
<td>500</td>
</tr>
<tr>
<td>Pump from leaky bowling green dam to new dam</td>
<td>31 L/s at 5 m head</td>
<td>30,520</td>
<td>31,980</td>
</tr>
<tr>
<td>Construct new dam</td>
<td>17 ML capacity 30 m x 30 m x 6 m with 1:3 side slope</td>
<td>188,560 with liner</td>
<td>116,850 with liner</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>52,900 without liner</td>
</tr>
<tr>
<td>Reticulation line from new dam to oval</td>
<td>500 m of DN150 mm with 10 m pressure rating</td>
<td>17,250</td>
<td>15,080</td>
</tr>
<tr>
<td>Pump from new dam to oval</td>
<td>31 L/s at 10 m head</td>
<td>30,520</td>
<td>26,980</td>
</tr>
<tr>
<td>Supply and install storage tank at oval</td>
<td>Steel lined storage tank 390 L</td>
<td>75,593</td>
<td>35,600</td>
</tr>
</tbody>
</table>

**Sub-total capital costs** 580,157 with liner 308,805 with liner 244,855 without liner

Location allowance (20%) Adjustment for regional location factor, e.g. transportation, etc. as costs are based on metro rates 116,031

**Sub-total location allowance costs** 116,031

**Additional project costs**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>General contractor prelims</td>
<td>For mobilisation/demobilisation, site set-up, site clean-up, etc.</td>
</tr>
<tr>
<td>EPCM fees</td>
<td>Engineering, Procurement, Construction and Management fees</td>
</tr>
<tr>
<td>Contingencies</td>
<td></td>
</tr>
</tbody>
</table>

**Sub-total for additional project costs** 306,324

**Total for capital investment** 1,002,511 with liner 308,805 with liner 244,855 without liner
Table 4.7 continued ..... 

<table>
<thead>
<tr>
<th>Operation and maintenance items</th>
<th>Details</th>
<th>Cost ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of pump from new dam to oval</td>
<td>12 hrs/session, 3 times/week, 7 months/year of 2.6 kW pump and $0.17/kWh</td>
<td>446</td>
</tr>
<tr>
<td>Operation of pumps from new sump to existing sports dam (2 for duty/assist and duty/standby arrangement)</td>
<td>more intensive during winter months, 12 hrs/session, Nominal operations = 3 times/week, 7 months/year of 3.3 kW pump and $0.17/kWh and 1.5 times for 2 pumps</td>
<td>565</td>
</tr>
<tr>
<td>Operation of pump from leaky bowling green dam to new dam</td>
<td>12 hrs/session, 3 times/week, 4 months/year of 1.5 kW pump and $0.17/kWh</td>
<td>147</td>
</tr>
<tr>
<td>Maintenance personnel and repairs</td>
<td>$80/hr 4 hrs/week 7 months/year</td>
<td>7,680</td>
</tr>
</tbody>
</table>

Total for operation and maintenance 8,838

4.4 Summary of all options

Nyabing requires 41 ML of water per year. Water yield for all options is summarised in Table 4.8. Capital, operation and maintenance costs for all options is in Table 4.6 for comparison.

Table 4.8. Yield for all options

<table>
<thead>
<tr>
<th>Option</th>
<th>Average annual water yield (ML/year)</th>
<th>% of demand (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>current</td>
<td>15</td>
<td>37</td>
</tr>
<tr>
<td>1a</td>
<td>32</td>
<td>78</td>
</tr>
<tr>
<td>1b</td>
<td>30</td>
<td>73</td>
</tr>
<tr>
<td>2a</td>
<td>29¹</td>
<td>71</td>
</tr>
<tr>
<td>2b</td>
<td>14²</td>
<td>34</td>
</tr>
</tbody>
</table>

¹ Yield combines run-off of 17.8 ML/year town surface, 0.9 ML/year from leaky bowling green dam and 15 ML/year from existing sports dam with 4.7 ML unavailable for use.
² Yield combines run-off of 17.8 ML/year town surface and 0.9 ML/year from leaky bowling green dam with 4.7 ML unavailable for use.

Table 4.9. Cost for all options

<table>
<thead>
<tr>
<th>Option</th>
<th>KBR commercial rates ($) (including location allowance) (-20%+30%)</th>
<th>Additional cost ($) (-20%+30%)</th>
<th>Total commercial rates¹ capital investment costs ($) (-20%+30%)</th>
<th>Total DAWA/Shire rates¹ capital investment costs ($)</th>
<th>O and M cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>414,436²</td>
<td>182,351</td>
<td>596,788</td>
<td>227,250</td>
<td>5,354</td>
</tr>
<tr>
<td>1b</td>
<td>284,836²</td>
<td>125,327</td>
<td>410,164</td>
<td>169,650</td>
<td>5,354</td>
</tr>
<tr>
<td>2a</td>
<td>575,708</td>
<td>253,312</td>
<td>829,019</td>
<td>235,634</td>
<td>10,184</td>
</tr>
<tr>
<td>2b</td>
<td>696,188</td>
<td>306,324</td>
<td>1,002,511</td>
<td>308,805</td>
<td>8,838</td>
</tr>
</tbody>
</table>

¹ See Capital Investment and Costs for calculation methodology and assumptions.
² Cost estimate does not include polymer application for dam.
Figure 4.1. Schematic for Nyabing Option 1: Existing sports dam to oval
Figure 4.2: Schematic for Nyabing Option 2a: Town surface run-off and dam catchment to existing dam
Figure 4.3. Schematic for Option 2b: Town surface run-off and town dam catchment to new dam
5. COST-BENEFIT ANALYSIS

5.1 Introduction

Costs and benefits associated with the proposed water management options, as identified in Section 4, and the current use of the existing sports dam form the basis of the cost-benefit analysis. Because there isn’t a market price for locally produced water, instead of documenting net benefits results are expressed in terms of the break-even water price that needed so that for a project, total costs are equivalent to total benefits (Appendix K).

5.2 Application

General base case assumptions are that surface water harvested in Nyabing in its current state, would be fit for irrigation only. It is also assumed that if necessary, scheme water will supplement that available from the sports dam (dependent on selected water management option outlined below) and all 41 ML that is assumed to be required annually will actually be used (despite the rainfall in any particular year). Based on Water Corporation (2005) data, the cost of scheme water provided by the Integrated Water Supply System to vacant non-residential land is assumed to be $1.20 per kilolitre. This cost-benefit analysis has been over a 20-year period with a 7 per cent discount rate. The discount rate is slightly higher than current bank interest so that long-term risk of an interest rate increase can be factored into the analysis. However, the rate is dropped to 4 per cent in a sensitivity analysis to determine if the discount rate has a bearing on the overall outcome. In other sensitivity analyses the costs are varied up by 30 per cent and down by 20 per cent and the quantity of water produced by any of the options is increased and decreased by 10 per cent. If the overall results do not change when these analyses are imposed then they can be considered robust.

For water produced by the sports dam in its current state, it is assumed that operating and maintenance costs are the same as for Option 1 (based on DAWA/Shire rates) and that there is a capital contingency of $5,000 in year 1. In addition, for each option all pumps are replaced in year 11. For the current option the cost of the pump is equivalent to that in Option 1 (based on DAWA/Shire rates). Details of the complete schedule of costs are presented in Section 4. It is assumed that 95 per cent of capital costs will be funded up front in the form of a grant and/or other such funding, while the remaining costs are annualised over the 20 year period.

5.3 Results and conclusions

The price of water required for an option to break-even given the base case assumptions as described is given in Table 5.1.

<table>
<thead>
<tr>
<th>Option</th>
<th>Water price based on KBR commercial rates ($/kL)</th>
<th>Water price based on DAWA/Shire rates ($/kL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>-</td>
<td>0.47</td>
</tr>
<tr>
<td>1a</td>
<td>1.97</td>
<td>0.88</td>
</tr>
<tr>
<td>1b</td>
<td>1.51</td>
<td>0.75</td>
</tr>
<tr>
<td>2a</td>
<td>3.22</td>
<td>1.27</td>
</tr>
<tr>
<td>2b (with liner)</td>
<td>7.70</td>
<td>3.01</td>
</tr>
</tbody>
</table>
Acknowledging the base case assumptions set for these analyses, use of the sports dam to produce water, as currently done, costs less per kilolitre of product water than any other option. However, the costs were assumed and there may be a significant risk of supply not being achieved over the 20-year period. Furthermore, the total annual yield from this dam is less than the current requirement of 41 ML per year. Hence, if annually, 15 ML of water was made available from the sports dam for the oval and park at $0.47/kL, and the remaining 26 ML of water required was purchased from the scheme at $1.20/kL, the average cost of water would increase to $0.93/kL.

Alternatively, when DAWA/Shire rates were used in analyses for Options 1a and 1b, the break-even price of water was found to be $0.88/kL and $0.75/kL respectively (Table 5.1). With the inclusion of scheme water in this scenario to make up the shortfall in supply of 9 ML for Option 1a and 11 ML for Option 1b, the average price would increase to $0.95/kL for Option 1a and $0.87/kL for Option 1b.

Using DAWA/Shire rates for Option 2a resulted in a break-even water price slightly above the assumed price of scheme water so that if costs are reduced by just 5.7 per cent from the base case value or product water increased by only 6 per cent, this would be a better option than using scheme water alone. Moreover, if Option 2 was implemented, additional benefits of up to $22,553 per year could be realised, due to a lower risk of salinity and water damage to infrastructure such as buildings and roads. By including the total value of these benefits in the analysis, the break-even price of water drops to $0.50/kL with the average price at $0.70/kL (derived from an annual demand of 29 ML of dam water and 12 ML of scheme water). Furthermore, only 9.3 per cent of the estimated damage benefits would need to be realised to produce a break-even water price of $1.20/kL. If it is difficult to achieve benefits from implementation of a strategy to reduce damage to infrastructure in the early years of the program, then it is more likely that the break-even price of water would be around $1.20/kL.

Water produced for all options that incur KBR commercial rates and for Option 2b (with DAWA/Shire rates) would need to be valued above the estimated scheme water price for these options to break-even.

For all options, decreasing the discount rate to 4 per cent from the base of 7 per cent did not change the overall outcome with Options 1a, 1b and Option 2a (all assuming DAWA/Shire costs) still being the only new systems showing potential net benefits in comparison to scheme water purchase.

It is assumed in the base case analysis that all of the water produced in Options 1 and 2a results from the improvements made to the sports dam, and if these alterations were not done the dam in its current state would yield nothing. Alternatively, if the costs for Options 1 and 2a are linked specifically to the additional water generated by the dam in its existing state (15 ML), then the break-even price for each option would increase and become greater than the scheme water price. However, if the structural integrity of the dam is dubious and therefore work is needed on the dam to reliably produce the water then the base case results as presented in Table 5.1 hold.

While total costs are included in the above analysis, the break-even water price can be divided into annual operating costs per kilolitre of water produced, and the combined capital and opportunity cost of investment\(^1\) per kilolitre of product water for each option (Table 5.2). Note that commercial costs and the DAWA/Shire estimation for operating and maintenance were assumed to be the same.

---

\(^1\) In cost-benefit analyses the time value of money is recognised. That is by investing in the proposed option the funds are not available for a second best option and hence incur an opportunity cost.
Table 5.2. Capital and opportunity cost of investment per kilolitre of product water produced from the dam in its current state, and for water produced as described for each option, using either KBR commercial or DAWA/Shire rates, and the operating and maintenance costs per kilolitre of product water.

<table>
<thead>
<tr>
<th>Option</th>
<th>KBR commercial rates</th>
<th>DAWA/Shire rates</th>
<th>Operating and maintenance cost ($/kL product water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>-</td>
<td>0.11</td>
<td>0.36</td>
</tr>
<tr>
<td>1a</td>
<td>1.80</td>
<td>0.71</td>
<td>0.17</td>
</tr>
<tr>
<td>1b</td>
<td>1.34</td>
<td>0.57</td>
<td>0.18</td>
</tr>
<tr>
<td>2a</td>
<td>2.87</td>
<td>0.92</td>
<td>0.35</td>
</tr>
<tr>
<td>2b (with liner)</td>
<td>7.07</td>
<td>2.38</td>
<td>0.63</td>
</tr>
</tbody>
</table>

In conclusion, Options 1a, 1b and 2a (analysed using DAWA/Shire rates) should all be considered as potential water management options for Nyabing. In particular, if considering the average cost of water derived from the sports dam and from scheme water, so that supply meets demand for water, then Option 1b should be carefully contemplated. Alternatively, Option 2a shows the greatest returns given that benefits from reduced salinity and improved water management could be achieved with implementation of this option. All other options considered are unlikely to be viable propositions given the assumptions and data used in this study.
6. CONCLUSION

DAWA and its project partners have undertaken scientific investigations, and in consultation with the Shire of Kent, devised solutions for water management at Nyabing. The outcomes of the scientific investigations suggest that:

- The town is at risk of salinity, however, anecdotal evidence of infrastructure damage has been reported as low, which suggests a full inventory of salinity impacts should be established;
- Salinity management should focus on surface water processes; abstraction of groundwater is not feasible;
- Total scheme water consumption is 27.4 ML/year, supplied by the local Water Corporation dam. There is potential to re-use treated wastewater from the Water Corporation treatment pond (approximately 15.6 ML/year). The modelled surface run-off which could be captured from the townsit is 107 ML/year;;
- Current demand for irrigation on parks and ovals is approximately 40.9 ML/year. Of this, 25 ML/year is reported to be supplied by the existing sports dam and catchment; and 10 ML/year from scheme water when the dam is dry.

The recommended water management options outlined below are a result of scientific outcomes and in consultation with the Shire:

- Option 1: Upgrade the existing sports dam to supply irrigation demand;
- Option 2a: Capture stormwater run-off from the townsit via a sump then pump it into the existing sports dam for storage. The supply is also to be augmented by run-off from the leaky bowling green dam; and
- Option 2b: Capture stormwater run-off from the townsit via a sump then pump it into a new dam for storage. The supply is also to be augmented by run-off from the leaky bowling green dam located in town.

Preliminary engineering analyses were undertaken to quantify water yield for each option and associated capital requirements and costs, as well as operation and maintenance costs. Two sets of costings are provided. ‘KBR commercial rates’ include comprehensive costs based on the assumption that the project would be completely out-sourced and use materials of the highest quality. Alternative costings are termed ‘DAWA/Shire rates’ and based on work being conducted by local operators using adequate materials. It is important to note that further engineering analysis would be required prior to implementation of any options.

The annual water yield from the current dam in its existing state is estimated to be 15 ML. With additional catchment and upgrading as documented for Option 1a, water yield would increase to 32 ML and for Option 1b to 30 ML/year. Upgrading the dam as for Option 1 plus capturing surface water from within the townsit as suggested for Option 2a, would increase annual water yield to 29 ML. With a new dam and capture of surface water within the townsit, as suggested in Option 2b, annual water yield would total 14 ML/year.

Cost-benefit analyses were completed for the existing sports dam in its current state and for Options 1a, 1b, 2a and 2b using KBR commercial and DAWA/Shire rates. The analyses indicated that Options 1a, 1b and 2a (analysed using DAWA/Shire rates) should be considered as potential water management options. In particular, if considering total water demand, where water is sourced from the sports dam and the integrated water management system, then Option 1b should be carefully contemplated by decision makers. Alternatively, if benefits from reduced salinity and improved water management could be achieved with implementation of Option 2a, then this may well be the best alternative for Nyabing. All other options considered in the cost benefit analyses are unlikely to be viable propositions given the assumptions and data used in this study.
7. REFERENCE

Preliminary Community Profile

Nyabing

by Kate Shearer
for the Rural Towns Liquid Assets Project

February 2005
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1. Executive Summary

Nyabing is a small town of around 115 people in the Great Southern Region, east of Katanning. The community is reliant on agriculture with 71% of workers employed in the industry. Population within the shire is declining as is typical of many small rural towns, and the townsite has remained fairly static.

Nyabing’s water supply comes from three dams within the townsite: one owned by the Shire for reticulation purpose; a water carting dam to supply farmers; a Water Corporation dam collects runoff from ten hectare bitumen catchment and can be supplemented with scheme water. As part of the shire’s building strategy all new houses are to be constructed with rainwater tanks.

The shire identified 5 dams in the local area that are of strategic importance to the town, however it was recommended that the Water Corporation retain ownership of these dams due to maintenance costs of these assets.

The Shire of Kent provides sewerage services and a non potable water supply to the town of Nyabing. Grey water is treated and pumped into evaporation ponds.

The shire would like to see any water available used to attract and support new industries leading to an increased population and community.

If any excess water was available in the shire the residents surveyed would like to see it being used to develop new industries in order to attract more people to the town. Greening the town and maintaining the town oval was also considered an important use of water. Some also regarded a water store in case of emergencies or fire to be valuable.

The general response to new industries was ‘anything to increase the shire’s population and create jobs.’ Specifically, aquaculture and salt tolerant plants were regarded positively across the board. People were positive yet wary towards intensive animals as the piggery has recently closed down, however its low viability may be specific to the pig industry. Tree farms, vineyards and horticulture are considered to be possibilities though water availability and climate were listed as concerns, as well as the distance to transport products to consumers. A mineral harvesting operation of gypsum is already in operation at Lake Chinocup.

Nearly all respondents to the questionnaire would like to see a community swimming pool constructed for social and community benefits. They admitted it would be an unlikely scenario due to the low population of the town and high maintenance costs. Travelling to Lake Yealering was one person’s answer to achieving similar benefits noted as swimming for relief from hot weather and a relaxed community atmosphere.
Respondents with rainwater tanks were unlikely to consider any other water sources for a potable supply such as recycled water, due to the high quality and inexpensive nature of rainwater. It must be noted that quantity of rainwater supply and its reliability throughout the year was not investigated. Residents surveyed from the townsite that used scheme water as a drinking supply generally filtered their water.

Residents were asked about the importance of biodiversity to the community. Several took this question to mean diversity of industry, especially as this question followed several questions about industry development. Others said that biodiversity was important, but for no specific reason – it was also mentioned that conservation of biodiversity is a problem but it is more of state level issue rather than the town’s.

Farmers interviewed did not consider salinity to be a problem in the townsite, but residents in the town say it is increasing, particularly across the railway around the CBH depot.

Overall, the Shire is looking at water as an incentive for new industries to attract more people and families into the town. It is not a main priority for the town to reduce its reliance on scheme water but wants to have enough water to maintain the town’s sporting oval.

**NB.**
It must be noted that any responses from the surveys are opinions only. Also too few people were surveyed for any definitive conclusions to be made on these community opinions. Refer to Appendix 5 for transcripts of the questionnaire interviews.
2. The town of Nyabing

2.1 The Shire of Kent
Nyabing is a town in the low rainfall wheat/sheep zone of Western Australia with 100% of its population classified as remote (ABS, 2004). Most information available for the town encompasses the whole shire of Kent. This covers an area of about 6500km² in the Great Southern Region (Shire of Kent, 2004e) and includes another smaller town of Pingrup. It is an agricultural area dominated by grain production, specifically wheat and barley, as well as wool and livestock (Shire of Kent, 2003a).

The shire’s website (accessible online at www.kent.wa.gov.au) is a useful source of information as many council documents are available through the site, such as council minutes each month, annual reports, strategic plans and a policy manual.

2.2 Population
According to the Australian Bureau of Statistics (2004) the Shire of Kent had a population of 601 as of June 30, 2002. The shire’s population has been decreasing steadily since 1993, on average 4% a year, and has decreased by 29% over the nine years (Department of Local Government and Regional Development, 2003) (Figure 1). The population of the Nyabing townsite was 115 people and 65 in Pingrup for 2001 (Shire of Kent, 2003a)

Annual Population for Shire of Kent

Figure 1: Annual Population for the Shire of Kent. Source: (Department of Local Governments and Regional Development, 2003).
Table 1. Percent change in Shire of Kent’s population by sex for census years (ABS, 2003b)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>% change</th>
<th>Female</th>
<th>% change</th>
<th>Total</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>482</td>
<td>-</td>
<td>382</td>
<td>-</td>
<td>864</td>
<td>-</td>
</tr>
<tr>
<td>1996</td>
<td>426</td>
<td>-11.62</td>
<td>354</td>
<td>-7.34</td>
<td>780</td>
<td>-9.72</td>
</tr>
<tr>
<td>2001</td>
<td>338</td>
<td>-20.66</td>
<td>290</td>
<td>-18.08</td>
<td>628</td>
<td>-19.49</td>
</tr>
</tbody>
</table>

The population of the Shire of Kent has a low number of people in the 15-19 and 20-24 age groups however this is typical of many rural towns (see Figure 2) (Australian Bureau of Statistics, 2003a).

![Population profile - X01 Age by Sex](image)

Figure 2. Population profile by age and sex for Shire of Kent from the 2001 Census of Population and Housing (Australian Bureau of Statistics, 2003a).

Nyabing has an ageing population, with the median age increasing from 27 in 1991 to 35 in 2001 (Australian Bureau of Statistics, 2003b). The numbers of people in households that consist of couples with children are rapidly decreasing in the shire (Figure 3) (Australian Bureau of Statistics, 2003b). This trend is fairly typical to most rural towns. In the shire’s council minutes it was noted that housing suitable for families was lacking within the townsire causing one family to leave (Shire of Kent, 2003).
In the shire there is a primary school at both Nyabing and Pingrup. Bus services are available to take high school students from Nyabing to Katanning District High School and students from Pingrup to Lake Grace District High School (Shire of Kent, 2004).

The main birthplace countries other than Australia are the United Kingdom (6 males, 15 females) and New Zealand (7 males, 5 females), followed by Austria, Ireland and the Philippines at three people each (Australian Bureau of Statistics, 2003a).

Figure 3. Household and family type for the Shire of Kent time series from 1991 census year to 2001 (Australian Bureau of Statistics, 2003b)
2.3 Employment

In June 2002 the unemployment rate was estimated at 0.5% (3 people) for the shire of Kent (Australian Bureau of Statistics, 2004).

![Employment for Shire of Kent June 1999-2003](chart)

Figure 4. Employment for the Shire of Kent June 1999-2003 (Department of Local Government and Regional Development).

There were 479 people employed in for the June quarter in 2003 (see Figure 4) (Department of Local Government and Regional Development, 2003). In 2002 there was a 28.1% decline in employment from the September quarter (591 employed) to the December quarter (425) however the unemployment rate for the same period remained constant at three people (Department of Local Government and Regional Development, 2003).

For the year 2000-2001 there were 161 wage and salary earners with an average salary income of $21,620 and average total income of $22,524 (Australian Bureau of Statistics, 2004). At this time there were 596 employed people in the shire (Department of Local Government and Regional Development).

Major industries other than agriculture providing employment are Government work, Construction and Services to Agriculture (see Figure 5) (Australian Bureau of Statistics, 2003d).
Industries that have been increasing employment since 1991 are Education (40%), Retail Trade (35%), Construction (175%), and Health and Community Services and Hospitality both at 100% growth (Figure 6) (Australian Bureau of Statistics, 2003b).
Industries that have been decreasing employment since 1991 are Government Administration (-35%), Transport and Storage (-66.7%) and Communication Services (-100%) (Figure 7) (Australian Bureau of Statistics, 2003d).

T15 Decreasing Industry Timeseries for Shire of Kent

Figure 7 (Australian Bureau of Statistics, 2003b)

The majority of the work force for the Shire of Kent is mostly 45-49 years (Figure 7) Males work mostly fulltime at all ages and females work mostly part time (Australian Bureau of Statistics, 2003d).
Figure 8 (Australian Bureau of Statistics, 2003d)

Table 2: Selected averages for the Shire of Kent sourced 2001 Census time series (Australian Bureau of Statistics, 2003b)

<table>
<thead>
<tr>
<th></th>
<th>1991 Census</th>
<th>1996 Census</th>
<th>2001 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Weekly individual income</td>
<td>$200-$299</td>
<td>$400-$499</td>
<td>$200-$299</td>
</tr>
<tr>
<td>Median Weekly family income</td>
<td>$400-$499</td>
<td>$700-$799</td>
<td>$500-$599</td>
</tr>
<tr>
<td>Median Weekly household income</td>
<td>$400-$499</td>
<td>$700-$799</td>
<td>$500-$599</td>
</tr>
</tbody>
</table>

In 1999-2000 the Shire of Kent recorded the lowest average real taxable income of all the local government areas in Australia at $24,370 (Bureau of Transport and Regional Economics, 2003) and fourth lowest for 2000-2001 at $28,199, representing a 14.5% increase since 1990-1991 (Bureau of Transport and Regional Economics, 2004).

Also in 1999-2000 the shire experienced an 85.7% drop in average taxable income from $24,692 to $3,532 with similar drops in several surrounding shires such as Lake Grace, Jerramungup, Kulin, Kondinin, and Narembeen in the same year (Department of Local Government and Regional Development, 2003). The average taxable income for the shire of Kent increased back to $26,594 for the next year 2000-2001 (Australian Bureau of Statistics, 2004).
2.4 Industry
Agriculture is the main industry in terms of numbers of people, employing 71% of the shire’s working population in 2001 (Australian Bureau of Statistics, 2003d).

Annual Agricultural Production for Shire of Kent

Figure 9 Annual Agricultural Production for Shire of Kent (Department of Local Government and Regional Development, 2003).

Cropping
Nyabing is a receival point for wheat and barley from surrounding areas. It has a Type 4 bin so it is only resourced during harvest and therefore only requires short term staff (CBH, 2004c). Nyabing is classed into the Katanning district within the Albany zone so all grain collected is transported to Albany via Katanning (CBH 2004).

Table 3. Prices and buyers of the barley received for Nyabing 2004-05 (CBH, 2004b)

<table>
<thead>
<tr>
<th>Grain</th>
<th>Type</th>
<th>Buyer</th>
<th>Price ($/tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>Feed</td>
<td>AgraCorp</td>
<td>132.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brooks Grain Pty Ltd</td>
<td>129.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elders</td>
<td>131.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emerald Group Australia</td>
<td>125.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamma Grains</td>
<td>132.82</td>
</tr>
<tr>
<td></td>
<td>GRM1</td>
<td>Brooks Grain Pty Ltd</td>
<td>165.65</td>
</tr>
<tr>
<td></td>
<td>GRMT</td>
<td>AgraCorp</td>
<td>188.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emerald Group Australia</td>
<td>156.22</td>
</tr>
<tr>
<td></td>
<td>Hamelin</td>
<td>AgraCorp</td>
<td>183.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emerald Group Australia</td>
<td>156.22</td>
</tr>
<tr>
<td></td>
<td>Malt</td>
<td>AgraCorp</td>
<td>187.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emerald Group Australia</td>
<td>153.22</td>
</tr>
</tbody>
</table>
Livestock
In the 2001 census Nyabing was assessed as having 700 pigs, 347,200 sheep and a wool clip of 1,961,000kg (Shire of Kent, 2004e). The Nyabing piggery 18 kilometres out of the townsite reopened in 2002 (ABC News Online, 2002), (Pritchard, 2003). It opened with a workforce of 15, which was anticipated to increase by at least three a year to 2005 and have about 2300 sows (Pritchard, 2003). The company had plans to contract local farmers to produce feed grains for the pigs (Pritchard, 2003). This also prompted the Great Southern Development Commission (2004) to consider Nyabing a priority for an occasional child care centre due to the families that the piggery would attract. However from November 2004 the piggery was up for sale (Elders Real Estate, 2004). In the advertisement it promotes an “excellent water supply” (Elders Real Estate, 2004).

Mining
In 2001/2002 the total mining activity in the Shire of Kent was valued at $0.3 million, an increase of 36.9% on the previous year’s value of $0.2 million (Department of Local Government and Regional Development, 2003). In 2001 there were three males employed in metal ore mining (Australian Bureau of Statistics, 2003d) and six males employed for 1996 (Australian Bureau of Statistics, 2003b). According to Dominion Mining Limited (2001) an exploration project discovered gold anomalies at Nanicup bridge and Nampup Soak near Nyabing. The Nanicup bridge was determined to be of low risk and high potential to the company (Dominion Mining Limited, 2004).

Gypsum
Gypsum is mined from the shores of Lake Chinocup in the A-Class Nature Reserve between Nyabing and Pingrup (Environmental Protection Agency, 1994). To do so a Native Title agreement had to made with the Noongar Land Council (Native Title Research Unit, 1999).

2.5 Tourism
The Shire website lists historical buildings, nature reserves, wildflowers, salt lakes and Holland’s Track as the tourist attractions (Shire of Kent, 2004f). Holland’s Track is a four wheel drive track that runs from Broomehill to Coolgardie and passes through several towns such as Nyabing for food and fuel supplies (4wd Australia, 2004). The accommodation choices available are the Nyabing Inn and the Nyabing Caravan Park (Shire of Kent, 2004f). In a market performance of Australia’s south west for tourism, the Shire of Kent was assessed to have ten caravan bays and five other rooms for a total of 15 units available to let (Tourism Western Australia, 2004a).

The tourism initiative ‘Wake Up Broomehill’ involves encouraging bus tour operators to consider the area around Broomehill for tours (Council minutes December 2003 Shire of Kent, 2004a)
2.6 Recreation

Events Calendar (Shire of Kent, 2004b)
- February – Nyabing town beach party
- March – annual Pingrup races
- December – annual Country Women’s Association (CWA) market day, first Wednesday of December every year

Recreational facilities: football, cricket pitch, tennis, netball, hockey oval, sand golf course (iseekgolf.com, 2004) bowling club (Shire of Kent, 2004c). The shire has received funding from the Ministry of Sport and Recreation, receiving $17 000 for installing reticulation to football and hockey ovals (Department of Sport and Recreation, 2001) and $2900 to install flood lighting to the hockey oval (Department of Sport and Recreation, 2002).

2.7 Future Direction

Future directions for the shire of Kent were outlined by the community in areas that were perceived to require the most development (Shire of Kent, 2003e). These included town beautification in order to provide better facilities for residents and improve the visual impact of the town to tourists; residential development in the townsites; increased support and development for local businesses (Shire of Kent, 2003e).

Table 4. Expected expenditure ($ values in thousands) (Shire of Kent, 2003e)

<table>
<thead>
<tr>
<th></th>
<th>03/04</th>
<th>04/05</th>
<th>05/06</th>
<th>06/07</th>
<th>07/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town beautification</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Recreation</td>
<td>245</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Housing</td>
<td>960</td>
<td>285</td>
<td>130</td>
<td>145</td>
<td>170</td>
</tr>
<tr>
<td>Road Asset Management</td>
<td>1100</td>
<td>1100</td>
<td>955</td>
<td>885</td>
<td>910</td>
</tr>
<tr>
<td>Asset acquisition/replacement</td>
<td>110</td>
<td>165</td>
<td>390</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>Economic services</td>
<td>80</td>
<td>110</td>
<td>70</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Waste disposal / sewerage</td>
<td>50</td>
<td>100</td>
<td>90</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>2555</td>
<td>2020</td>
<td>1895</td>
<td>1590</td>
<td>1640</td>
</tr>
</tbody>
</table>
3. Water

3.1 Introduction

Nyabing is within a low rainfall area and therefore needs drought prevention plans to minimise the impact of drought on local industries and businesses. The shire has a Water Resources Committee as part of the council’s provision of economic services. Their main role is to secure water supplies to avoid drought (Shire of Kent, 2003c). Salinity has been identified as an increasing problem within the townsite (Hopgood, 2003).

3.2 Climate

There is no climate data specific to Nyabing so data for Katanning is used (Figure 10). This is available from the Bureau of Meteorology (2004). Average monthly rainfall and evaporation for Nyabing was sourced from Hopgood (2003) (see Figure 11).

Table 5. Selected climate statistics for the Shire of Kent (Shire of Kent, 2004e).

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average annual rainfall</td>
<td>383mm</td>
</tr>
<tr>
<td>Average evaporation*</td>
<td>1612mm</td>
</tr>
<tr>
<td>Average maximum temperature</td>
<td>29.9 C</td>
</tr>
<tr>
<td>Average minimum temperature</td>
<td>4.5 C</td>
</tr>
<tr>
<td></td>
<td>(Hopgood, 2003).</td>
</tr>
</tbody>
</table>

Figure 10: Mean monthly rainfall and mean daily maximum temperature for Katanning (Bureau of Meteorology, 2004)
Figure 11. Average monthly rainfall and evaporation rates for Nyabing. 

3.3 Water Cost

The Shire of Kent’s water supply is supplemented by scheme water from the 
Water Corporation through the Great Southern Towns Water Supply Scheme. 
This is charged to residential and commercial users as follows. Nyabing is 
classified as a Class 4 town.

Table 6. Residential costs (Water Corporation, 2004b)

<table>
<thead>
<tr>
<th>Usage (kL)</th>
<th>c/kL</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 150kL</td>
<td>41.6</td>
</tr>
<tr>
<td>next 200kL (350)</td>
<td>67.4</td>
</tr>
<tr>
<td>next 100kL (450)</td>
<td>85.7</td>
</tr>
<tr>
<td>next 100kL (550)</td>
<td>132.8</td>
</tr>
<tr>
<td>next 200kL (750)</td>
<td>159.5</td>
</tr>
<tr>
<td>next 400kL (1150)</td>
<td>262.4</td>
</tr>
<tr>
<td>next 400kL (1550)</td>
<td>477.1</td>
</tr>
<tr>
<td>next 400kL (1950)</td>
<td>572.5</td>
</tr>
<tr>
<td>Over 1950kL</td>
<td>667.7</td>
</tr>
</tbody>
</table>

Table 7. Commercial costs (Water Corporation, 2004a)

<table>
<thead>
<tr>
<th>Usage (kL)</th>
<th>c/kL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-300 kL</td>
<td>132.2</td>
</tr>
<tr>
<td>Over 300kL</td>
<td>249.1</td>
</tr>
</tbody>
</table>
3.4 Water Supply

The Shire has three dams for water supply within the townsite.

- Nyabing Dam
  The Nyabing Dam is the Water Corporation dam within the townsite (Hopgood, 2003) with a storage capacity of 29ML (Water Corporation, 2004c). It collects water from a 10 hectare bitumen catchment area (Hopgood, 2003). Since July 1999 the lowest storage was May 2001 at 2846kL and the highest at 28800kL in December 2001 (Figure 12). This water supply can be supplemented by water from the Harris Dam, Collie, as part of the Great Southern Towns Water Supply Scheme (Water Corporation 2004). During times of low rainfall the proportion of scheme water used increases as local dams cannot meet the towns water demand (Hopgood, 2003).

  Storage Data for Nyabing dam
  July 1999 to November 2004

  ![Storage data for Nyabing Dam](image)

  Figure 12 Storage data for Nyabing Dam (Water Corporation, 2004c)

- The Shire Dam
  The Shire Dam collects water along a spillway for reticulating town ovals and gardens (Hopgood, 2003).

- The Water Carting Dam
  The Water Carting dam collects a water supply for farmers from a seven hectare roaded catchment (Hopgood, 2003).
- **Infrastructure development: The North Nyabing Pipeline 2002**
  Council cost: $91,482

- **Rainwater tanks 2002 (Shire of Kent Council Minutes, June 2002)**
  Council cost: $as part of the building program (Shire of Kent, 2002)

The installation of up to three rainwater tanks on each property was included in the 10 year Building Program, with new houses requiring rainwater tanks as part of their construction.

- **Rationalisation of Agricultural Area Dams 2004 (Shire of Kent Council Minutes February, April and August 2004).**

The Water Resources Committee has undertaken an assessment of ten agricultural area dams within the shire currently vested by the Water Corporation. Although five of which were considered to be of strategic importance, it was considered that the expense and resources required to maintain these dams would be too great. It was recommended that the corporation retain ownership of the strategic dams, and that four other dams not required by the shire be acquired by landowners or other agencies (Shire of Kent, 2004a).
Plate 1 Nyabing bore location map. (Map sourced Hopgood, 2003.)
3.5 Water Demand
The demand of scheme water increases when other water sources are being fully utilised. Most of the water supply for Nyabing is collected rainwater so the highest demand for purchasing scheme water would be in low rainfall times (see Figure 13).

![Figure 13 Demand for scheme water](image)

3.6 Wastewater
The Shire of Kent is licensed by the Economic Regulation Authority to provide sewerage services and non potable water supply to the towns of Nyabing and Pingrup (Economic Regulation Authority, 2004). After treatment grey water is evaporated off in an evaporation pond west of town near the Nyabing creek. A sewerage audit was performed in 2003 however the relevant council minutes of January through to May 2003 are currently no longer accessible.

3.7 Water management and salinity
According to Hopgood (2003) in the Nyabing Groundwater Study the townsite has a high salinity risk. Recommendations were as follows;

- Reserve 9219 2002
  Transfer vesting of the reserve from the Waters and Rivers Commission to the Shire of Kent – improvement of drainage, ties in to work done as the Nyabing Creek Project

- Nyabing Creek 2002
  drainage west of the town

Would allow planned underground drainage of Richmond Street to proceed as it could use the drain to move the stormwater away from the townsite
- Rural towns Liquid Assets program
  Council cost: $30 000 (10 000 per year over three years)
  Funding gained: $90 000

Refer to Shire of Kent Council Minutes, July and October 2004 (Shire of Kent, 2004a).

3.8 Catchment area information

Blackwood River Catchment
The Katanning Zone of the Blackwood Catchment includes the towns of Katanning, Broomehill and Nyabing, covering an area of 307,000 hectares (Brockman, 2001). 17% of the Nyabing townsite is at risk of rising water tables (Brockman, 2001). Current infrastructure costs for the Katanning Zone total $300,000 annually, estimated to increase to $591,000 a year for townsites and $450,000 for roads (Brockman, 2001). The approximate loss of agricultural production is $8.4 million a year (Brockman, 2001).

Table 8 Risk of shallow watertables for Nyabing and estimated annual cost (Brockman, 2001)

<table>
<thead>
<tr>
<th>Area</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area not at risk of shallow watertables</td>
<td>229ha 83%</td>
</tr>
<tr>
<td>Total area at risk of shallow watertables (0-2m)</td>
<td>49ha 17%</td>
</tr>
<tr>
<td>Total town area</td>
<td>278ha 100%</td>
</tr>
<tr>
<td>Calculated annual cost of shallow watertables</td>
<td>$13,824</td>
</tr>
<tr>
<td>Estimated current annual cost of shallow water tables</td>
<td>$19,044</td>
</tr>
</tbody>
</table>

Farming practices
Farmers in the Lake Chincocup catchment are adopting more environmental and sustainable methods of farming and tillage practices (Anonymous, 2002). Investments in drainage, fencing remnant vegetation and planting more trees on farmland have also increased (Anonymous, 2002). In this salt lake catchment farmers have shown a good response to increased salinity and waterlogging on what was productive land (Anonymous, 2002).
4. Questionnaire Summary

If any excess water was available in the shire the residents would like to see it being used to develop new industries in order to attract more people to the town. Greening the town and maintaining the town oval was also considered an important use of water. Some also regarded a water store in case of emergencies or fire to be valuable.

The general response to new industries was ‘anything to increase the shire’s population and create jobs.’ Specifically, aquaculture and salt tolerant plants were regarded positively across the board. People were positive yet wary towards intensive animals as the piggery has recently closed down, however its low viability may be specific to the pig industry. Tree farms, vineyards and horticulture are considered to be possibilities though water availability and climate were listed as concerns, as well as the distance to transport products to consumers. A mineral harvesting operation of gypsum is already in operation at Lake Chinocup.

Nearly all respondents to the questionnaire would like to see a community swimming pool constructed for social and community benefits. They admitted it would be an unlikely scenario due to the low population of the town and high maintenance costs. Travelling to Lake Yealering was one person’s answer to achieving similar benefits noted as swimming for relief from hot weather and a relaxed community atmosphere.

Respondents with rainwater tanks were unlikely to consider any other water sources for a potable supply such as recycled water, due to the high quality and inexpensive nature of rainwater. It must be noted that quantity of rainwater supply and its reliability throughout the year was not investigated. Residents surveyed from the townsite that used scheme water as a drinking supply generally filtered their water.

Residents were asked about the importance of biodiversity to the community. Several took this question to mean diversity of industry, especially as this question followed several questions about industry development. Others said that biodiversity was important, but for no specific reason – it was also mentioned that conservation of biodiversity is a problem but it is more of state level issue rather than the town’s.

Farmers interviewed did not consider salinity to be a problem in the townsite, but residents in the town say it is increasing, particularly across the railway around the CBH depot.

NB.
It must be noted that any responses from the surveys are opinions only. Also too few people were surveyed for any definitive conclusions to be made on these community opinions. Refer to Appendix 5 for transcripts of the questionnaire interviews.
5. Conclusion

Nyabing is a small country town based on agricultural production with a declining shire population.

The Shire is looking at water as an incentive for new industries to attract more people and families into the town.

It is not a main priority for the town to reduce its reliance on scheme water but for town purposes want enough water to maintain the town’s sporting oval.
6. References


Rural Towns Liquid Assets Project

Nyabing


7. List of Appendices Available

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  3.3 Industry design  page 12
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Appendix 7: Anticipated Outcomes  page 33
WORKSHOP OUTCOMES, KENT SHIRE (NYABING) - 30/6/2005

PRIORITIES (must do)

1. Upgrade sportsground dam to increase runoff reliability by improving the catchment.
2. Improve townsite stormwater drainage, capture and storage. ‘Roof to road’ water management.

STAGE 1 – Harvest and store town stormwater
STAGE 2 – Undertake town drainage improvements.

PREFERENCES (recommended)

3. Initiate a cooperative project with Water Corp to (expand and?) utilise overflow from the town evaporation pond. The town is currently serviced by a communal waste water overflow collection system that discharges into an evaporation pond. However the pond is too small and overflows continuously contaminating the creekline downstream of the town.

4. Initiate a cooperative project with CBH to capture, store and utilise runoff from CBH site; roof area and hardstand.

ISSUES

- Despite presence of shallow watertables there is very little evidence of obvious salinity damage around the townsite.
- There are / will be increased demands from recreational facilities around the town which are difficult to meet due to high water costs and Water Corporation restrictions.
- RT-LA to investigate use of runoff improvement techniques, including polymers, as part of the improvements to rooded catchments.
- Modelled town stormwater yields are theoretically high enough to satisfy demand, but capture and reticulation systems (drains) need to be improved. Eg 107mL /yr was the modelled yield excluding contributions from CBH (J. Turner).
- Some options require infrastructure placement in Cathy Crosby’s paddocks and their support would be needed.
- Waterwise=Saltwise options. Currently there are not a lot of rainwater tanks fitted to houses in towns and this could be improved. If promoted by the Shire, health requirements would need to be considered. Potential roof-runoff yields can be tested by the urban runoff model.
- Production bore yields are low (0.2-0.3l/s).
- Hydrographs and ECs measured since 1997 are reasonably flat.
SUMMARY OF RT-LA MEETING WITH KENT SHIRE, 15 November 2005
(Mark Pridham notes)

Present: David Burt (CEO), David Long (Works Manager), Cathy Crosby (Councillor and landholder), Jeff Turner (RT-LA, CSIRO), Travis Cattlin (RT-LA, DAWA), Richard George (DAWA), Mark Pridham (RT-LA, DAWA).

Proposed Works

1. A new dam was the priority. John Skippsey is a local CLT who will look at potential damsites in Shire controlled reserve and Crosby’s paddock.
   - the reserve is the preferred site
   - a new 17 ML dam has been specified
   - John Davis is a drilling contractor based in Gnowangerup

   ACTION: RT-LA team to investigate a new damsite with J. Skippsey.
   ACTION: M. Pridham to check clearing NOI requirements with DoE.

- General agreement was that catchments and dams should be designed for the lowest rainfall/runoff year experienced in the preceding 10 years.

- There is a new enzyme product the project team will be assessing for roaded catchment improvement (lowering runoff thresholds), dam sealing, and waste water treatment.

   ACTION: D. Stanton to provide enzyme costs. To include:
   - Material supply
   - Installation (earthworks, site preparation)
   - Soil laboratory testing
   - Maintenance and upkeep

   ACTION: D. Long and D. Stanton to select 5 ha of sports dam RC for initial treatment.
   ALSO – verify dam inlet / outlet is OK.

2. Increase yield and reliability of sports dam.

   2.1 Option 1: Increase roaded catchment area by 21 ha. At $5,000 / ha = $105,000.
   2.2 Option 2 (preferred): Use polymer on existing RC, starting with 5 ha. D. Long and D. Stanton to select 5 Ha.

Water balance

DEMAND
Football ground and hockey field: 25 ML / yr
Bowling green: 6 ML / yr
Shire parks and gardens: 10 ML / yr
TOTAL: 41 ML / yr

POTENTIAL SUPPLY
Sports dam (modelled, previous 10 years): 15 ML / yr
Townsite stormwater runoff: 18 ML / yr
Leach drain collection system (waste black water to pond): 16 ML / yr
TOTAL: 49 ML / yr
• Wastewater appears to be an unutilised resource. Additional storage and chlorination facilities would have to be incorporated due to health concerns

**ACTION.** D. Burt to investigate provide chlorination details and costs to J Turner to include in benefit:cost assessment.

• Astra-turf was considered as an alternative for the bowling green. Quick estimate from a supplier was that 0.4 ha bowling green would cost $150,000 to $180,000 (vs $60,000 for a new dam).

**ACTION:** D. Burt → Bowling Club to obtain a firm quote for Astra-turf:

• High water losses from dams due to evaporation was a severe limitation. RT-LA should investigate options.

**ACTION:** J. Turner to look into potential evaporation control solutions.

Evaporation, rainfall and runoff figures had been prepared by KBR consultants.

**ACTION:** M. Pridham to obtain original spreadsheets from KBR.

3. **New Sump / Pump system** to collect town stormwater runoff and pipe to new dam.

4. **Reticulation system** to deliver water to irrigation points.

Low pressure pumping and piping system using 1 x 180 KL + 1 x 90 KL?? tanks. Westebyings; an irrigation supplier based in Albany would supply equipment and some reticulation design.

**ACTION:** T. Cattlin to scope out reticulation design to forward to reticulation supplier.
SUMMARY OF RT-LA MEETING WITH KENT SHIRE, 15 November 2005
(Richard George notes)

Existing Sports Dam

1. Geotech test for clay – for 5 ha trial area (To be decided by Shire).
2. Supply price and methodology ex Perth (enzyme or binder) (T Cattlin/D. Stanton)
3. Shire to quote (D Long may watch Merredin –T Cattlin, Shire)

Bowling green

1. Quote for Astroturf– 4 rinks $150,000-180,000 (Shire).
2. KBR Jo Pluske $5,000 ml to support case for Astroturf/or not (recBA)
3. Output = context for application – youth, sport and recreation.

Genesis Issue – evaporation suppression

RT-LA needs to consider program response – off desktop (J Turner).

Option 26

1. Yield analysis of low years vs average (17.6 ML= 14 ML) (T Cattlin).
2. Site analysis – 2 cleared, 1 bush site* (M Pridham)
3. RT-LA to supervise John Skipsey to site dam (M Pridham) and report (MR).
4. M Pridham to check NOIC.
5. Optimisation – tank size and irrigation demand (T Cattlin).

Technical question

- Sports Dam = available supply + (10 years)
- 10% town run-off = .....+ ..... (T Cattlin)
  - (now) target = 31 (25)
  - (town future) = 36.

Today’s output

1. A five page version of the WMP.
2. Dam siting – competed – 2 pm.
3. 5 ha trial – implemented.