Overview

- Introduction / Background
- The Problem
- The Solution - not just an engineering solution
- Gaining the community’s confidence
- The engineering solution
- Some innovative technology
Blackwater & Bluff – Location

- Central Highlands Regional Council

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Blackwater

- **Location**
  - 200 kms west of Rockhampton

- **Population**
  - 5,500 - 6,000 people

- **Mining town**
Bluff

- **Location**
  - 180 kms west of Rockhampton
- **Population**
  - ~380 people
- **Railway town**
Water Supply

- Water source is Sunwater’s Bedford Weir on the Mackenzie River
- Untreated water is pumped 25 kms - via 3 dams - to Raw Water Dam at WTP
Both towns are supplied from Blackwater WTP

Treated water is pumped 20 kms from WTP to Bluff
Blackwater Water Treatment Plant
Blackwater Water Treatment Plant

- The Plant is 40 years old
  - constructed mid-70’s
  - upgraded in late 80’s
- Capacity – 12 ML/day
- Conventional water treatment process
Water Treatment Process

Bedford Weir

Raw Water Dam

Chemical Dosing & Mixing

Storage

Filtration & Disinfection

Coagulation Flocculation & Settling

Distribution

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Blackwater’s Water Problem

- Taste and odour problems
  - organic matter / manganese
- Dirty brown / black water
  - manganese
- For quite a few years
Residents’ Problems

- Discoloured water
- Earthy taste and odour
- Stained washing
- Uncertainty about water quality
- Perceived health problems
Residents’ Problems

- Discolouration & earthy taste & odour were worse during summer
- Residents
  - bought bottled water - pallets of bottled water in the supermarket aisle
  - installed filters in their internal plumbing
Council’s Response

- Public meeting held in February 2013
- Council made a commitment to residents that a number of actions would be undertaken
  - investigate the depth of the raw water intake point at Bedford Weir - expensive to change
Previous Attempts to Rectify

- Council committed to
  - trialling granular activated carbon on top of filter to remove taste & odour - some success but loss of GAC in backwash
  - removing & replacing aged sand media in the filters
Previous Attempts to Rectify

» Council committed to

- a reticulation flushing program
  - both reservoirs were cleaned out
  - Blackwater & Bluff reticulation was air scoured .... with limited success
Council Commitments

- Council committed to
  - improving communications with residents
  - increased water sampling & testing regime
Water Testing

- Extensive water sampling & testing program
  - weekly sampling for standard water analysis
  - monthly sampling for heavy metals & pesticides
  - Qld Health was contacted for assistance to determine if there was a public health issue
  - all sampling complied with ADWG limits (other than aesthetics)
Council Response

- In January 2014 after little improvement
  - Council engaged specialist water treatment consultant *City Water Technology (CWT)*
  - CWT analysed water & reviewed the WTP performance - made recommendations for improvements
CWT Recommendations

- Increased monitoring for various parameters to better define the problems
- Destratification / aeration of the raw water dam at the WTP to increase dissolved oxygen in the water
CWT Recommendations

- Improved iron & manganese removal through additional treatment processes
  - pre-treatment oxidation, and
  - manganese oxide coated filter media
CWT Recommendations

- Removal of tastes, odours & potential algal toxins by dosing powdered activated carbon into a contact tank
- Council developed a comprehensive multi-faceted action plan to address the problems
# Plans for Improvement

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Planned Improvement</th>
<th>Desired Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source – CHRC</td>
<td>1. Aeration of storage</td>
<td>Destratification of dam to oxidise manganese</td>
</tr>
<tr>
<td>Raw Water Dam</td>
<td>2. Desilting of dam</td>
<td>Removal of settled manganese and iron prior to pre-treatment</td>
</tr>
</tbody>
</table>
## Plans for Improvement

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<tr>
<td>Pre-treatment</td>
<td>1. Construct <strong>potassium permanganate</strong> contact tank and dosing system</td>
<td>Oxidation of soluble manganese</td>
</tr>
<tr>
<td></td>
<td>2. Construct <strong>powdered activated carbon</strong> (PAC) contact tank and dosing</td>
<td>Removal of taste and odour</td>
</tr>
<tr>
<td></td>
<td>3. Pre-filter chlorination on manganese oxide coated media</td>
<td>Removal of any remaining soluble manganese</td>
</tr>
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## Plans for Improvement

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<tr>
<td>Water Treatment Plant</td>
<td>1. Additional monitoring &amp; control equipment to automate the plant</td>
<td>The plant will run continuously without manual operator control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuous in-line monitoring of manganese in raw &amp; treated water streams</td>
</tr>
<tr>
<td></td>
<td>2. Refurbish Sand Filters</td>
<td>Improved filtering of treated water</td>
</tr>
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<tr>
<td>Reticulation</td>
<td>1. Ice pigging of all reticulation mains &lt;300 mm diam</td>
<td>Removal of biofilm &amp; sedimentation from inside of mains &amp; reservoirs</td>
</tr>
<tr>
<td></td>
<td>2. Swabbing of mains &gt;300 mm diam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Cleaning of reservoirs</td>
<td></td>
</tr>
</tbody>
</table>
Proposed Improvements

- Investigate source of manganese at Bedford Weir
- De-silt RW Dam & aerate to remove manganese
- Refurbish filters & replace media
- Clean reservoirs
- Pre-treatment with KMnO4 to remove manganese & PAC to remove taste & odour
- Upgrade & automate the WTP
- Scour reticulation mains
Immediate Actions

- Chlorine (strong oxidising agent) was dosed into flash mixer to reduce manganese
- Successful manganese reduction – BUT increased THMs
- Chlorine dosing was discontinued
Council applied to the State Government for funding assistance under the *Royalties for Regions* program

Successful in attracting a $360K grant
Council’s communication strategy was as important as the engineering solution.
Communication

- Equally a technical and community relations / communication response
- Problems persisted after previous Council investigations and interventions
- Community sought greater accountability through activism, social media, strong public meeting attendance
Re-establishing confidence

- Council delegated CEO to lead response
- CEO and Council publicly stated that the situation was unacceptable & committed to finally resolve issue
- Set technical response, as described – stuck to the messaging – tested strongly by the community
- Set communication platform (2014/2015)
Communication

- Project Manager & Communication Manager appointed
- Monthly public meetings – attended by CEO, Councillors and senior officers
- Project webpage, with social media posts on CHRC landing page
Communication

- Reporting of water quality outcomes
- In-field meetings and consultation
- Participation in resident’s social media
Accountability & demonstrating progress

- **CEO & Councillors personally involved**
- **Very detailed minutes and issues registered (pictured)**
- **Issues reported and closed out with the agreement of community**
3 mini case studies

- Responding to elevated THMs
- ‘Ice pigging’ mains cleaning
- Management of resident petition
3 mini case studies

- Responding to elevated THMs
  - Sought advice from QH
  - Full, proactive disclosure – explained readings, implications and our efforts
  - Issued THM fact sheet
  - Briefed community – public meeting
  - Continued reporting on levels
  - No community concern or complaint
3 mini case studies

- Ice pigging’ mains cleaning
- Full, proactive communications suite
- Communication partnership with community
- Close liaison with Contractor
- Field liaison role
- Prompt complaints management
- Media coverage/management

- Low complaint & high recognition of Council investment
Further sections of Blackwater mains are scheduled for cleaning by ice pigging today Wednesday 27 May. Cleaning is scheduled for areas east of Mackenzie St, including Doon, Bluff, Taurus and Arthur Streets.

This schedule may vary depending on our progress. There may be some reduction of pressure, or short water closures as we test the water system in advance of the cleaning. Through the ice pigging process, a semi-solid ice slurry is pumped into a section of water main and...

See More
3 mini case studies

- Petition to Queensland Health
  - Petition circulated – seeking QH investigation and independent water quality testing
  - Response to petition included on issues register – regular updates
  - Individual interviews with petitioners
  - Ongoing water testing and public reporting
  - Satisfaction with sincerity of effort and quality of advice from QH
Key findings

- Communication & transparency is just as important as a technical response
- Accountability and demonstration of commitment is critical
- Explanation of response needs to be clear and consistent
Key findings

- Ongoing progress updates are essential to maintain confidence
- Seek community involvement as part of the solution
Public Meetings

- December – 65 annoyed residents
- January – 45 annoyed residents
- February – 12 residents
- March – 5 residents
- April – 0 residents (2 turned up ½ hr late)
- May – 2 residents
De-silting of RW Dam

- Council purchased a Sludge Rat
  - small dredge on pontoons
  - has a remotely adjustable suction head
  - self-propelled on ropes
Sludge Rat
Ice Pigging

- Removal of biofilm from mains
- Ice pigging was done by *Suez Environnement*
- Sole licensee for the technology in Australia
- Relatively new technology developed at Bristol University in the UK
Ice Pigging

Process involves

- Isolating the section of main to be pigged
- Pumping in the ice slurry through a hydrant
- Opening the upstream valve & pushing the ‘pig’ through the main using mains pressure
- Collecting the pig & scoured material
- Flushing the main & returning it to service
Benefits of Ice Pigging

- No chemicals other than salt
- Nothing to get ‘stuck’ in the main
- Uses minimal water – minor flushing
- Very portable / mobile operation
- Relatively quick
- No high pressures in pipeline
Blackwater / Bluff

- Undertaken in May & June
- 28 days – generally between 8 am & 5 pm
- Some night work done to minimize impact on critical businesses (hospital)
- Very few complaints
- Major issue was isolation of sections of mains
# Ice Pigging Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of completed operations</td>
<td>126</td>
</tr>
<tr>
<td>Length of main cleaned</td>
<td>73 kms</td>
</tr>
<tr>
<td>Average distance cleaned per operation</td>
<td>580 m</td>
</tr>
<tr>
<td>Water used</td>
<td>~2,710 Kl</td>
</tr>
<tr>
<td>Estimated water saved cf swabbing</td>
<td>~6,250 Kl #</td>
</tr>
<tr>
<td>Average disruption time per operation</td>
<td>&lt; 2 hrs</td>
</tr>
</tbody>
</table>

# Estimated by Suez Env
Ice Pigging Results

- **Biofilm mass removed**

<table>
<thead>
<tr>
<th>Operation Number</th>
<th>Location</th>
<th>Town</th>
<th>Length (m)</th>
<th>Diameter (mm)</th>
<th>Mass of Sediment (kg)</th>
<th>Concentration (kg/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mackenzie St</td>
<td>Blackwater</td>
<td>500</td>
<td>375-250</td>
<td>33.4</td>
<td>66.8</td>
</tr>
<tr>
<td>5A</td>
<td>Colliery St</td>
<td>Bluff</td>
<td>800</td>
<td>100</td>
<td>5.1</td>
<td>6.4</td>
</tr>
<tr>
<td>31</td>
<td>Rufus St</td>
<td>Blackwater</td>
<td>795</td>
<td>100</td>
<td>6.0</td>
<td>7.6</td>
</tr>
<tr>
<td>39</td>
<td>Wattle St</td>
<td>Blackwater</td>
<td>620</td>
<td>225</td>
<td>43.1</td>
<td>69.5</td>
</tr>
<tr>
<td>61</td>
<td>Manna St</td>
<td>Blackwater</td>
<td>1320</td>
<td>300-150</td>
<td>6.3</td>
<td>4.8</td>
</tr>
<tr>
<td>113</td>
<td>Stower St</td>
<td>Blackwater</td>
<td>950</td>
<td>225-100</td>
<td>9.4</td>
<td>9.8</td>
</tr>
</tbody>
</table>

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Ice Pigging Scheduling
Ice Pigging Photos
Ice Pigging Photos

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Ice Pigging Photos
Ice Pigging Photos
Ice Pigging Photos
Water Treatment Plant Upgrade

- Scope of work & tender documents prepared by CWT
- Tender – design & construct contract - broad preliminary design provided in tender
- Tender advertised in December 2014
- Closed 2\textsuperscript{nd} February 2015
WTP Upgrade Scope of Work

- Oxidation / PAC Contact Tank (540 Kl)
- Filter refurbishment
  - filter media replacement & refurbishment of underdrains
  - valve & instrument upgrades
WTP Upgrade Scope

- New / upgraded chemical systems & associated works
  - Potassium Permanganate system
  - PAC system
  - Polyacrylamide system
  - All Clear 325 (Liquid Coagulant) system
WTP Upgrade Scope

- New / upgraded chemical systems & associated works
  - Sodium Hypochlorite pre-filtration dosing system
  - New chemical systems building
WTP Upgrade Scope

- WTP automation upgrades
  - Online manganese measurement
  - PLC / SCADA-based automation of clarifier, filter & backwash systems
  - Plant control air system improvements
Four tenders received

Legal delays to award

preferred Tenderer (*Water Infrastructure Group*) was sold by *Pentair* to *Monadelphous* during tender assessment period
WTP Upgrade Tender

- *Deed of Novation* required to assign contract
- Tender awarded on 16\(^{th}\) April
- Date for PC was 21\(^{st}\) August
WTP Upgrade Contract

- CWT was appointed as Superintendent
- Local Superintendent’s Rep appointed from Rockhampton
WTP Upgrade Contract

- Contractor was slow to gain momentum
- Weekly project & design meetings
- Progressing reasonably well, but behind time
WTP Upgrade Contract

- Refurbishment of filters is a major task
  - Filters are in poor condition
  - Concrete floor & underdrains removed
  - New underdrains and nozzles
WTP Upgrade Photos
WTP Upgrade Photos
WTP Upgrade

- Contract is due for completion in late October
BLACKWATER WATER PROJECT

✨ QUESTIONS?