Present:

John Flannery – Chairman
Simon Fane – Hunter Community and Environment Centre
Bob Hawes – Property Council of Australia
Mark Richards – Businessman & local resident
Russell Pascoe – Hunter Water General Manager Assets & Operations
Deborah Sims – Hunter Water Manager Media and Corp Relations
Darren Cleary – Hunter Water Manager Wastewater & Environment
David Derkenne – Hunter Water Project Manager
Kathryn Stevenson – CRG Secretary
Mark Gebhard – Hunter Water Manager Treatment Operations
David Roser – University of NSW

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Item 1 – APOLOGIES

Apologies from Chris Tola, Neil Slater and Robert Dan.

Item 2 – MINUTES OF MEETING 6 HELD ON 11 MARCH 2008

The minutes were adopted.

Simon Fane (SF) asked for further explanation of the reasoning for the splitting of the project, whether the decision would restrict future upgrade options at the site, what approval processes were being adopted for each part, what options were being assessed for each part and whether each part would be open to public submissions.

Darren Cleary (DC) responded that options to upgrade the plant are being considered in two streams: liquid treatment and solids treatment. A large number of options for both streams were assessed as part of the upgrade strategy with a short list of viable options developed. The reliability works are the minimum works required to bring the plant up to capacity before the long term strategy for the plant is assessed for the completion of the Health Risk Assessment. The reliability upgrade is compatible with all viable future upgrade options for liquid and solids treatment (including improved effluent quality, the continuation of biosolids to ocean and on-site biosolids treatment) and does not bias other viable options, excluding the trickling filter option. However, the trickling filter option does not allow for future improvements to effluent quality or
nutrient removal and therefore the current ABF/activated sludge process is considered the preferred option to maintain the current operation and effluent quality whilst allowing for future upgrades.

Darren re-stated previous advice from the meeting held on 11 March 2008 that Hunter Water’s preferred upgrade strategy for the plant, pending the results of the Health Risk Assessment, is for the continuation of the current ABF/activated sludge process and disposal of biosolids to ocean.

The decision to split the project was endorsed by DECC.

The reliability works (the “stage 2 upgrade”) will be assessed under Part 5 of the EP&A Act with Hunter Water as the determining authority. However, DECC has a licensing role and the upgrade cannot be implemented without its approval. The REF for the reliability works will be put on exhibition in September 2008.

An EIA would be undertaken for the long term upgrade work (the “stage 3 upgrade”) irrespective of the preferred upgrade strategy due to the need for a variation to the plant’s licence. The EIA for the long term upgrade work will also be put on public exhibition. In the interim a summary document will be released to explain both the stage 2 & 3 upgrades at the time of the public exhibition of the REF for the reliability works.

Bob Hawes (BH) enquired whether concurrence from Department of Planning would be sought for the approval process.

DC responded that a decision on the approval pathway for the long term upgrade works will be made following the completion of the Health Risk Assessment and in consultation with Department of Planning. The trigger for assessment under Part 3A of the EPA&A Act will be if the proposed project involves the potential for significant environmental impact.

SF enquired whether the reliability upgrade would cater for future growth.

DC responded that the upgrade would bring the plant up to its original design capacity and licence limits and would not address long term issues. These issues would be addressed in the future upgrade.

**Item 3 – MATTERS ARISING FROM PREVIOUS MINUTES**

No matters arising.

**Item 4 – DESIGN OF HEALTH RISK ASSESSMENT**

Darren Cleary (DC) gave a presentation on the Screenings Level Health Risk Assessment and further work required as part of the Health Risk Assessment (slides attached).

David Roser (DR) gave a presentation on the design of the Health Risk Assessment (slides attached).

SF expressed concern that the illness index would create confusion when compared to the infection risk from index pathogens.

DR responded that the uncertainty contained in each methodology would be explained and that the illness index would be used as a check against the results for the index pathogens.

NSW Health and DECC have endorsed the design.
**Item 5 – PROGRAM**

DC provided an update on the program for the Health Risk Assessment, Stage 2 Upgrade and Odour Control Upgrade (slides attached).

DC proposed the CRG reconvene in Oct/Nov 2008 to discuss feedback on the REF (pending the level of response) and in Feb 2009 for presentation of the results of the Health Risk Assessment.

**Item 6 – ISSUES REGISTER**

All items have been completed.

**Item 7 – FEEDBACK FROM MEMBERS**

No additional feedback given.

**Item 8 – GENERAL BUSINESS**

Mark Richards (MR) asked whether sampling undertaken as part of the Health Risk Assessment would include a variety of conditions, including wet and dry weather and sunny and overcast conditions.

DC responded that all samples would be taken from within the plant and that the impact of sunny and overcast conditions on illness risk would be addressed as part of the inactivation experiment component of the study.

SF would like to be informed prior to the REF being exhibited. DC confirmed that all members would be notified prior to the REF going on public exhibition.

There was a discussion on the next meeting and it was agreed that the group would reconvene in October/November to discuss submissions on the REF and progress on the Health Risk Assessment.

**The meeting concluded at 6.30 pm**

John Flannery  
Chairman
Quantitative Microbial Risk Assessment (QMRA)

Application for Burwood Beach Situation

David Roser

UNSW Water Research Centre

What is QMRA

- Health Risk Assessment
  - Risk characterisation which captures the likelihood of infection & its consequence.
  - Characterised risk is used in management decisions (not strictly compliance)
- Focus - human populations & water borne pathogens.
- QMRA outputs (continuum + discrete statistics)
  - probability of infection (index pathogen) (.person⁻¹.exposure⁻¹)
  - probability of illness (.person⁻¹.exposure⁻¹ )
- Compare risk to Benchmarks
- Provide basis for decision making.

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ITEM 4 DESIGN OF HEALTH RISK ASSESSMENT - Presentation by David Roser

**Figure 3-1. Location of the present study**

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**Health Risk Assessment Tasks**

**Figure 3-2. Portion of Full Risk Assessment Process Undertaken in this Provisional Assessment**

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3 Core HRA Activities

- Hazard Assessment (e.g. loads of pathogens emitted by a sewage treatment plant),
- (Population) Dose Response Assessment (e.g. probability of infection following consumption of Rotavirus)
- Exposure Assessment (e.g. identification of rotavirus ingestion pathways).
The Barrier Concept

Emission from Contaminant Point Sources upstream of new outfalls and within outfalls

Barrier

Exposure (dose) and dose-response data

Infection/Toxic Effect

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Scenario Elements

- Hazard Choice for Modelling
  - Index pathogens (Cryptosporidium, Campylobacter, Rotavirus)
  - Illness Index (enterococci)
- ‘Barrier’ Elements
  - Secondary treatment (Main wastewater)
  - Initial Dilution at Diffusers
  - Local dispersion and surfacing
  - Subsequent dilution and travel
  - Dark and Light Inactivation
- Other modifiers
  - Points of exposure (Dudley, Burwood, Mereweather, Bar) (Beach & 200 m offshore)
  - Consumption volume per ‘exposure’
    - 10-50 mL for normal person
    - 200 mL for surfer
- Dose Response
  - Pathogens – literature values (EU Microrisk)
- Output
  - Estimates of Risk at Exposure Points
    - Selected risk statistics
    - Spectrum of risk estimates (consider Greenhouse warming concept)

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Building on Screening Assessment

- Measurement of Actual Pathogen and Indicator concentrations in waste streams
- Probabilistic rather than point estimation covers full spectrum of exposure
- Enhanced combination of hydrodynamic modeling and QMRA modeling
- Characterization of WAS and Assessment of Inactivation Rates in Microcosm System
- Consultation in Design of Assessment

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### Uncertainties

<table>
<thead>
<tr>
<th>Issue</th>
<th>How Addressed/Comments</th>
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<tbody>
<tr>
<td>Storm-water</td>
<td>Risk addressed by current management</td>
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<tr>
<td>WAS</td>
<td>Analysis of contents, study of inactivation following dilution</td>
</tr>
<tr>
<td>Exposure conditions</td>
<td>Use of different scenarios, probabilistic estimation</td>
</tr>
<tr>
<td>Other pathogens</td>
<td>Use of illness index dose response</td>
</tr>
<tr>
<td>Concerns identified by DOH/EPA/Community</td>
<td>Use of HIA process, collection of local data</td>
</tr>
<tr>
<td>Duration of program/seasonality</td>
<td>Summer + Winter Hydrodynamics</td>
</tr>
<tr>
<td>Management</td>
<td>Clearer characterisation of risk</td>
</tr>
<tr>
<td>Overcast days</td>
<td>Simulation of dark inactivation only</td>
</tr>
</tbody>
</table>

### What Does the Data Look Like?

What are Probability Density Functions (@Risk)?

![Probability Density Functions Diagram](image-url)
Benchmarks against which to assess risks

- 1% illness risk (Based on NMHRC 2008)
- 0.1% infection risk for any given pathogen (Derived from NHMRC 2008)
Optional Support
Illustration of how it works using the replacement flows project work

**Exposure Pathway – Replacement Flows**

- **Exposure Assessment Point** – Reticulated Drinking Water
- **Pathogen Source** – STP effluent treated via MF/RO
- **Proposed Mixing Zone**
- **Primary Risk Assessment Zones**
Selected Scenario Assumptions

- 20th, 50th, 80th percentile flows
- MF and/or RO breakdown (1 in 67 days)
- MF – 3 to 7 log reductions
- RO – 6.5 log reductions
- Malfunction (1-2 logs reduction)

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Scenario Modelling Stations

- Penrith Weir
- Winmalee
- North Richmond
- Windsor D/S South Ck
- Sackville
- Wisemans Ferry

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**Exposure Assessment drinking/swimming Example**

**Enterococci/L – Penrith After Dilution**

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<tbody>
<tr>
<td>Average</td>
<td>1.89E-08</td>
<td>5.42E-09</td>
<td>3.03E-08</td>
<td>1.53E-06</td>
<td>9.92E-04</td>
<td>4.85E-02</td>
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<td>95th %ile</td>
<td>4.26E-09</td>
<td>3.35E-10</td>
<td>6.53E-09</td>
<td>3.04E-06</td>
<td>2.20E-04</td>
<td>9.61E-02</td>
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<tr>
<td>median</td>
<td>3.17E-12</td>
<td>2.44E-13</td>
<td>4.93E-12</td>
<td>1.41E-06</td>
<td>1.53E-07</td>
<td>4.47E-02</td>
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Software

- Databases (Risk Assessment) – Risk Ratings, Point estimation for large numbers of systems
- Spreadsheets (Point Estimation) - Excel
- Probabilistic (Monte Carlo)
  - Excel Add-ins - @Risk, Crystal Ball
- System Analysis – Object Oriented
  - Winbugs, Analytica
- Full mathematical
  - Mathematica, Matlab

Better data and more detailed analysis allows higher 'Tiers' of risk assessment

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EXCEL Scenario MetaModel

1. @Risk Add in for Monte Carlo Simulations
2. Create Scenario by Selecting Input Functions from PDF Model library
3. Run Simulations
4. Estimate concentration after each barrier
5. Output risk probability statistics and pathogen numbers

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## Dose Response

(Traditional minimum dose)

- **Models** - Exponential & beta Poisson
- **Probability of Infection from Varying Doses**
- **microDALYs account for different severity of disease**

**Ref:** Haas and Eisenberg Ch 8 in *Water quality - Guidelines, standards and health: Assessment of risk and risk management for water-related infectious disease* Edited by Lorna Fewtrell and Jamie Bartram WHO 2001

### Model Code

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Model details</th>
<th>Model coefficients</th>
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</tbody>
</table>

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Health Risk Assessment (EnHealth 2002)

Quantification >

- Use scheme to systematise work
- Data mining + gap filling (CWWT work)
- Requires:
  - Hazard assessment (research lit review)
  - Dose response (literature)
  - Exposure Pathway Assessment (Initial provides basis for research program)

Geographical Solar Radiation Variance

- 21-24 MJ.m⁻²
- 3-6 MJ.m⁻²
- Average daily solar exposure July
HACCP & drinking water framework Correlation

<table>
<thead>
<tr>
<th>HACCP</th>
<th>Framework for Management of Drinking Water Quality</th>
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<tbody>
<tr>
<td>1. Hazard identification and preventive measures</td>
<td>Water supply system analysis, hazard identification and risk assessment (element 2)</td>
</tr>
<tr>
<td></td>
<td>Preventive measures and multiple barriers (element 3)</td>
</tr>
<tr>
<td>2. Critical control points</td>
<td>Critical control points (element 3)</td>
</tr>
<tr>
<td>3. Critical limits</td>
<td>Operational monitoring (element 4)</td>
</tr>
<tr>
<td>4. Monitoring system for each critical control point</td>
<td>Operational monitoring (element 4)</td>
</tr>
<tr>
<td>5. Corrective actions</td>
<td>Corrective action (elements 4 and 5)</td>
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<td>6. Verification / validation</td>
<td>Equipment capability and maintenance (element 4)</td>
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<tr>
<td></td>
<td>Drinking water quality monitoring, consumer satisfaction (element 5)</td>
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<td></td>
<td>Validation of processes, design of equipment (element 9)</td>
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<tr>
<td></td>
<td>Audit of drinking water quality management (element 11)</td>
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<tr>
<td>7. Documentation and record keeping</td>
<td>Management of documentation and records (element 10)</td>
</tr>
</tbody>
</table>

Integration/Risk Characterisation

**Hazard**
- River Water: [Pathogen] = 5 x 10^{-2}.L^{-1}
- Reservoir Outlet: [Pathogen] = 6 x 10^{-4}.L^{-1}
- Post Coagulation + Flocculation + Sedimentation [Pathogen] = 1 x 10^{-4}.L^{-1}
- Post GAC Filtration [Pathogen] = 6 x 10^{-3}.L^{-1}
- Post ClO₂ + Storage [Pathogen] = 7.9 x 10^{-5}.L^{-1}
- Median pathogens consumed 1 per 1.4 x 10^{8} persons per day
- Prob. of infection 5.7 x 10^{-7}.person^{-1}.d^{-1}
- Annual risk 0.002 x 10^{-4}.person^{-1}.y^{-1}

**Exposure Pathway**
- Reservoir Barrier Protection (Decimal Reduction) = 1.9
- Treatment Barrier Protection (Decimal Reduction) = 0.7
- Filtration Protection (Decimal Reduction) = 0.3
- Disinfection Protection (Decimal Reduction) = 3.9
- Drinking Consumption = 0.92 L.person^{-1}.d^{-1}
- Dose response – prob. of infection for n=1 is 0.05
- Annual risk prob. = (1-(1-P_{inf.})^{365} days).10^4 persons.
Rumsfeld’s? Postulates

- Known knowns
  - Contaminants we know we know (e.g. Cryptosporidium)
- Known unknowns
  - Contaminants we know we don’t know (e.g. Prions)
- Unknown unknowns
  - Contaminants we don’t know we don’t know (SARS, Legionella before discovery)

- Unknown knowns?
  - Contaminants we know about but we didn’t know of in context (antibiotic resistance)
Screening Level Health Risk Assessment

- Purpose of the study is to assess pathogen risk posed by discharges to ocean from the Burwood Beach WWTP
- Initial desktop assessment
  - Methodology was endorsed by Department of Health
  - Relied heavily on literature values
- Study was undertaken by CH2M Hill and peer reviewed by Dr David Roser from UNSW
Risk Assessment Methodology

Screening Level Risk Assessment – Hazard Assessment

- Selection of reference pathogens
  - Cryptosporidium
  - Giardia
  - Campylobacter
  - Rotavirus

- Hazardous events
  - Low dilution events (95%ile dilution)
  - Decrease in UV inactivation
Screening Level Risk Assessment
Exposure Assessment

- **Exposure pathway**
  - Swimming at the shoreline
  - Assume swallow 100 mL of seawater

- **Dose Response**
  - Mathematical models used to calculate the probability of infection for a given pathogen concentration
  - Risk of illness is then calculated (i.e., not all infections result in illness)

Further Investigations Required

- **Undertake field measurements**
  - Concentration of reference pathogens in raw sewage and biosolids
  - Decay rates of pathogens within biosolids in seawater

- **Include other exposure pathways in assessment**

- **Hydrodynamic modelling of reference pathogens**
Program Update

★ Health Risk Assessment
  • Stakeholder liaison: August 2008
  • Commence field work: September 2008
  • Preliminary results: February 2009
  • Complete study: April 2009

Program Update

★ Stage 2 Upgrade
  • Exhibit REF: September 2008
  • Commence detail design: October 2008
  • Award contract: February 2009
  • Construction & commissioning: 2009 – 2010
Program Update

Odour Control Upgrade

- Call tenders: September 2008
- Award contract: January 2009
- Commissioning: June 2009