Contaminated Land - Sustainable Treatment

...ensure we don't bring new legacies for future generations to deal with, changing tomorrow today.

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EIANZ CONFERENCE 1-2 NOVEMBER 2018 | SYDNEY AUSTRALIA

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Introducing

Graham Smith is a principal level environmental professional providing specialist remediation advice to various large multidisciplinary projects across Australia. A recognised industry leader in the field, Graham manages and delivers complex environmental projects covering a wide range of environmental regulatory issues and remediation cleanup programs.

Overview

- What is a sustainable treatment?
- Pressure and Process
- Case Study
- Which treatment approach?
- Treatment Success
- Learnings and Resources

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Sustainability

What is a sustainable treatment? and why pursue this?

Is it a…

- balanced environmental outcome for the community?
- commercial business arrangement?
- waste of time?
- logical approach?
- subjective approach?

Green and Sustainable Remediation (ITRC 2011)

The balance of sustainability (Theory)

- Environmental
- Social
- Economic

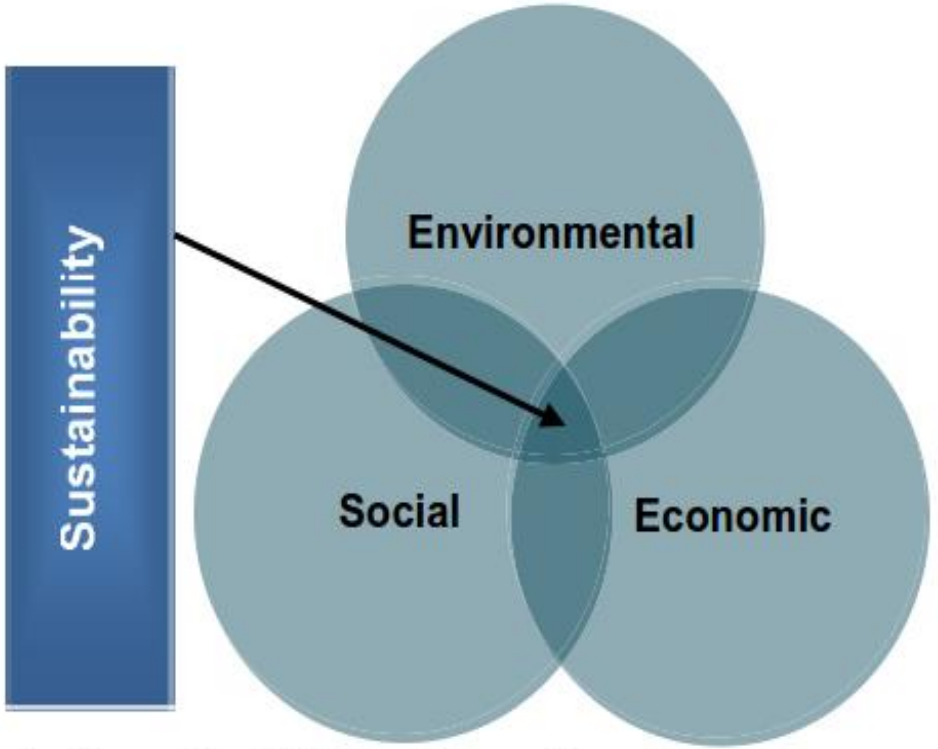
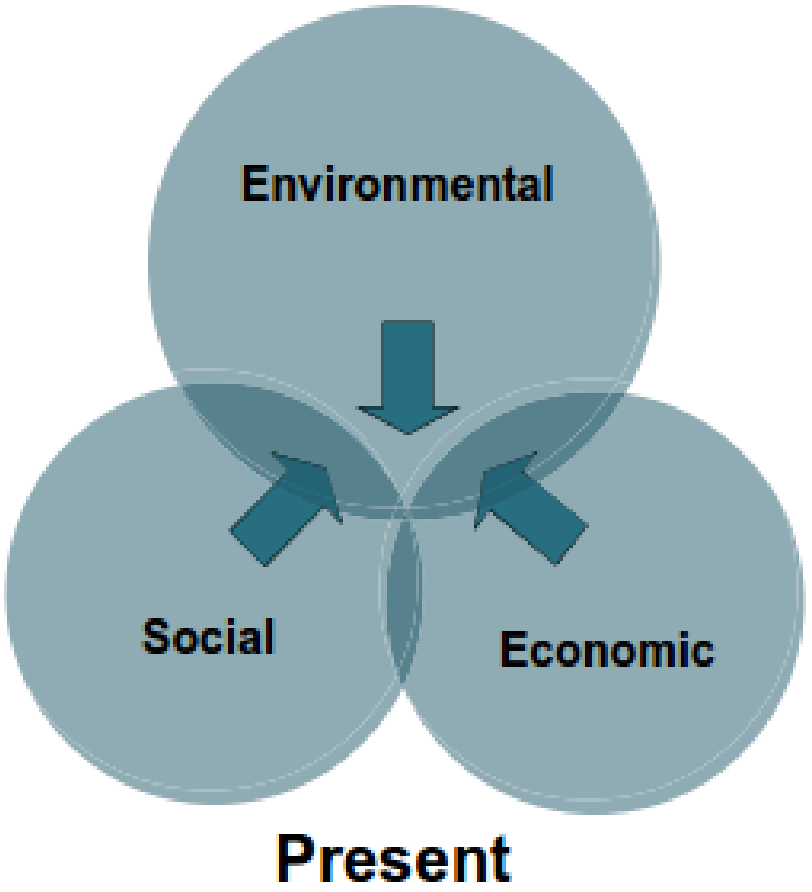


Figure 1-1. Sustainability schematic. *Source*: Based on IUCN 2006.

Green and Sustainable Remediation (ITRC 2011)

Site specific risk based approach that seeks to mitigate contaminant risk to receptors

- Balance of community expectations
- Economic implications
- Environmental impact.



Source: ITRC 2011

Pressure

Many internal and external pressures seek to influence the clean up of any Site and generally involves consideration of

- Risk to human health
- Risk to environment
- Risk to beneficial users
- Emotional outrage
- Commercial reality
- Moral and legal obligation
- realistic logical and practicable approaches.
- More recently….sustainable treatment

Process Tools

Consultant Tools

- Remediation process optimisation, considerations
  - Operational process
  - Equipment selection
  - Resource requirements
  - Waste generation/Recycling
- Early sustainable considerations

Client Tools

- Performance based cleanup approaches
- Milestone incentives
- Life-cycle cost considerations
- Environmental impact
- Community engagement

Spill…just clean up!

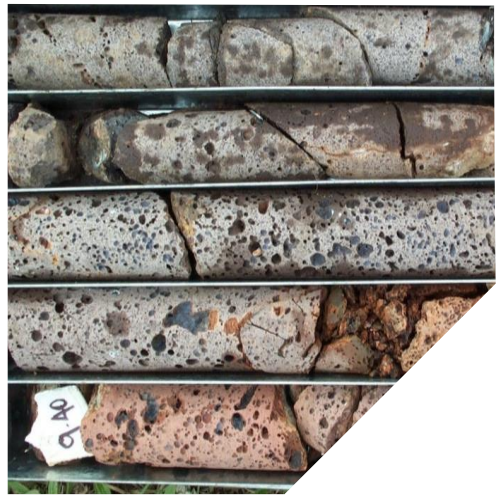
Regulatory/Community pressure

- Punish the polluter
- Emotional outrage
- Intergenerational impact (historic issue)

Risk of a non-sustainable approach

A project example…major chemical facility

Background – operational history



Clean-up of a complex and diverse chemical manufacturing facility, Australia (former Major Hazardous Facility)

Source of impact … every day activities eg.

1. Constant small drips and weeps,
2. Washing of chemicals down drains

Major releases were cleaned up immediately during operations

Minor releases are the issue over 70+ years of operations.

Background – operational history

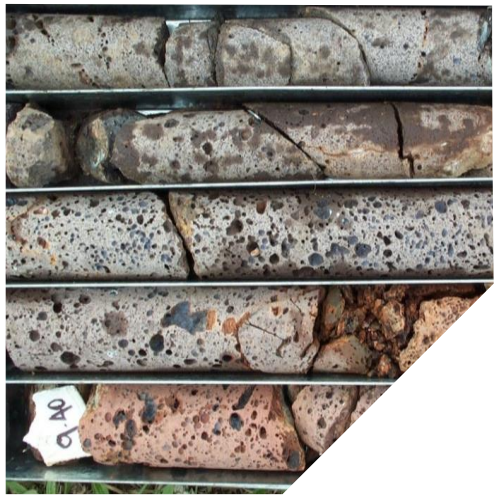
Consider this

- x1 drip/min (0.5ml)
- 525,600 min/year
- Equates, 263 L/yr
- Over 40 years of operation 10,520 L/per pump

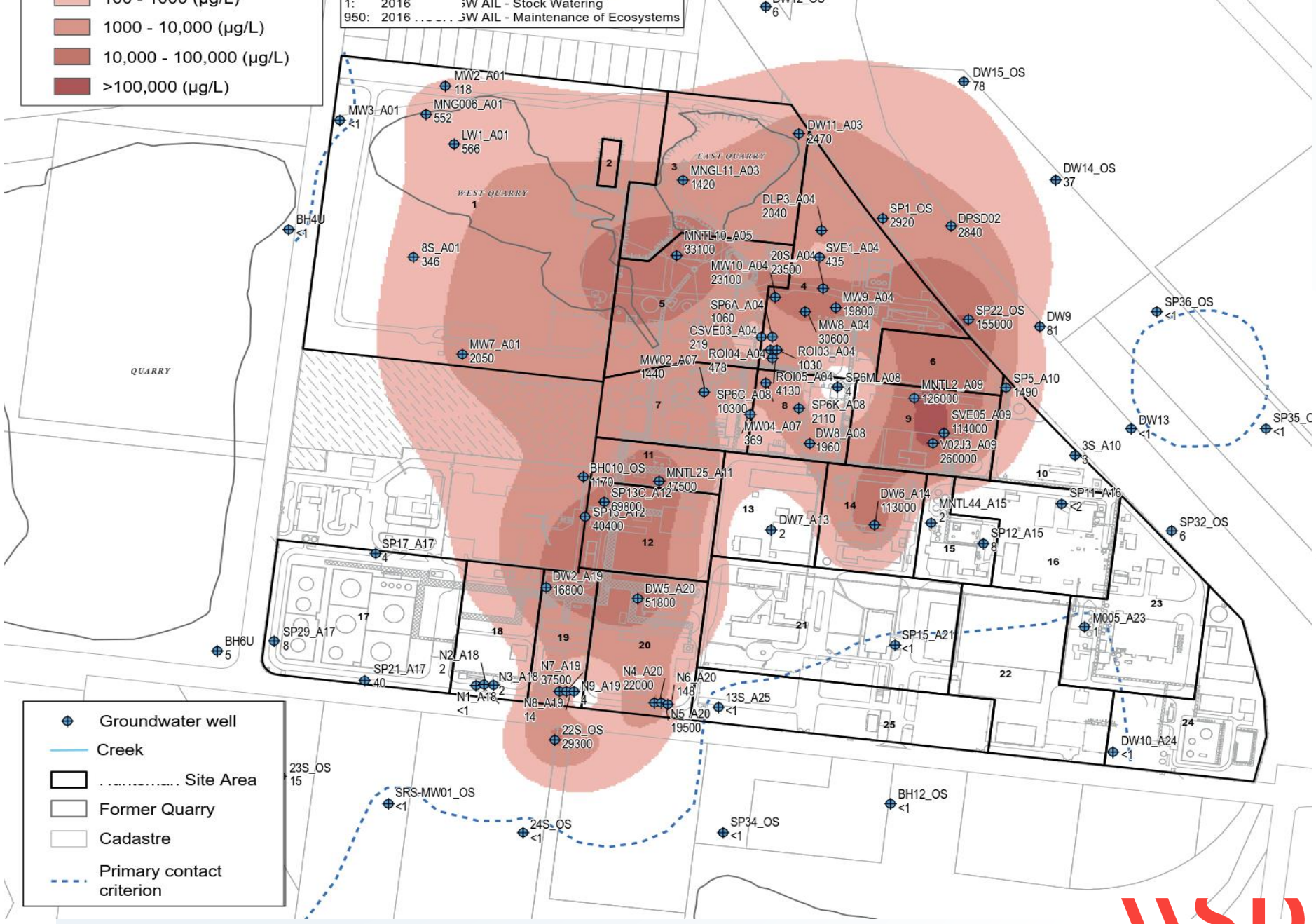
Where does all the chemical go?

Best environmental outcome is maintenance…

Background – source areas



Benzene Impact in Groundwater (2016)



Which Treatment Approach?

Treatment considerations

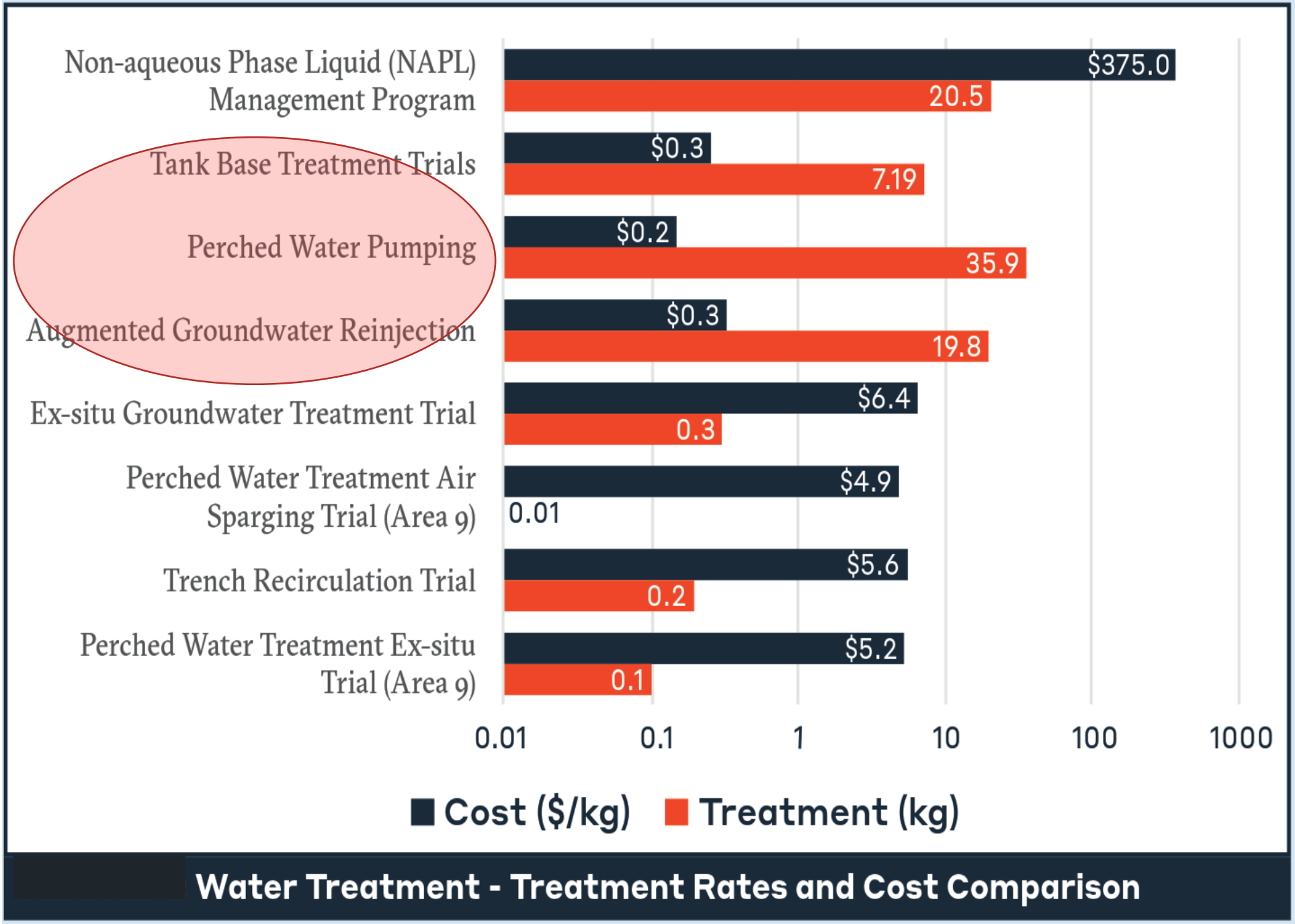
- Chemical interactions (complex mixture)
- Fate and Transport (where is it going, risk?)
- Logical and practical (does this make sense)
- Economic (commercial considerations)
- Intergenerational (future implications)
- Project success (where has this approach worked)

Which Treatment Approach?

Numerous pilot studies to determine best sustainable approach for impacted groundwater included

- Hand bailers
- Active skimmer pumps
- Multiphase vacuum extraction (MPVE)
- Total fluids pumps
- Soil vapour extraction (SVE)
- Air stripping
- Diffusive biosparge (aerobic bio stimulation)
- Microbial enhancement (anaerobic bio stimulation)

Water Treatment Approach?



Water Treatment - Treatment Rates and Cost Comparison

Treatment Approach (source)

Clean-up of a complex and diverse chemical manufacturing facility involved

1. Source area treatment
2. Plume area treatment

Source area treatment (SVE/Cryogenic)

- Cooling, Compression & Condensation (C3™)
- Est. 9 tonnes (6 months)
- Energy intensive approach
- Diminished returns

Treatment Approach (source)

- Est. 9 tonnes (6 months)
- Treatment time reduced (x4)
- Cost savings ($mils AUD)
- Lower O&M costs
- Reduced greenhouse
- Waste recovered as a resource
- No landfill waste

Importantly regulatory and community support.

Note: Clean Up Project Excellence Award (ALGA 2014)

Treatment Approach (plume)

Plume area treatment (microbial)

Bio-augmented microbial treatment in source areas to enhance natural attenuation (microbial)

Demonstration of natural attenuation

- Physical properties
- Statistical trends
- Center of mass
- Mass flux and mass discharge

Estimated Benzene mass discharge from the Site

Lines of evidence – Mass Discharge

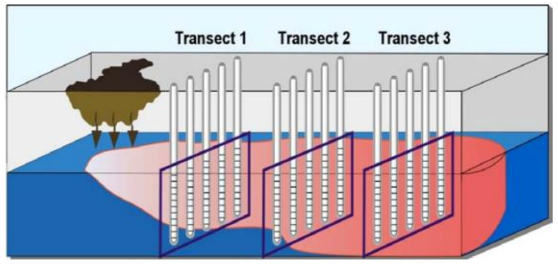
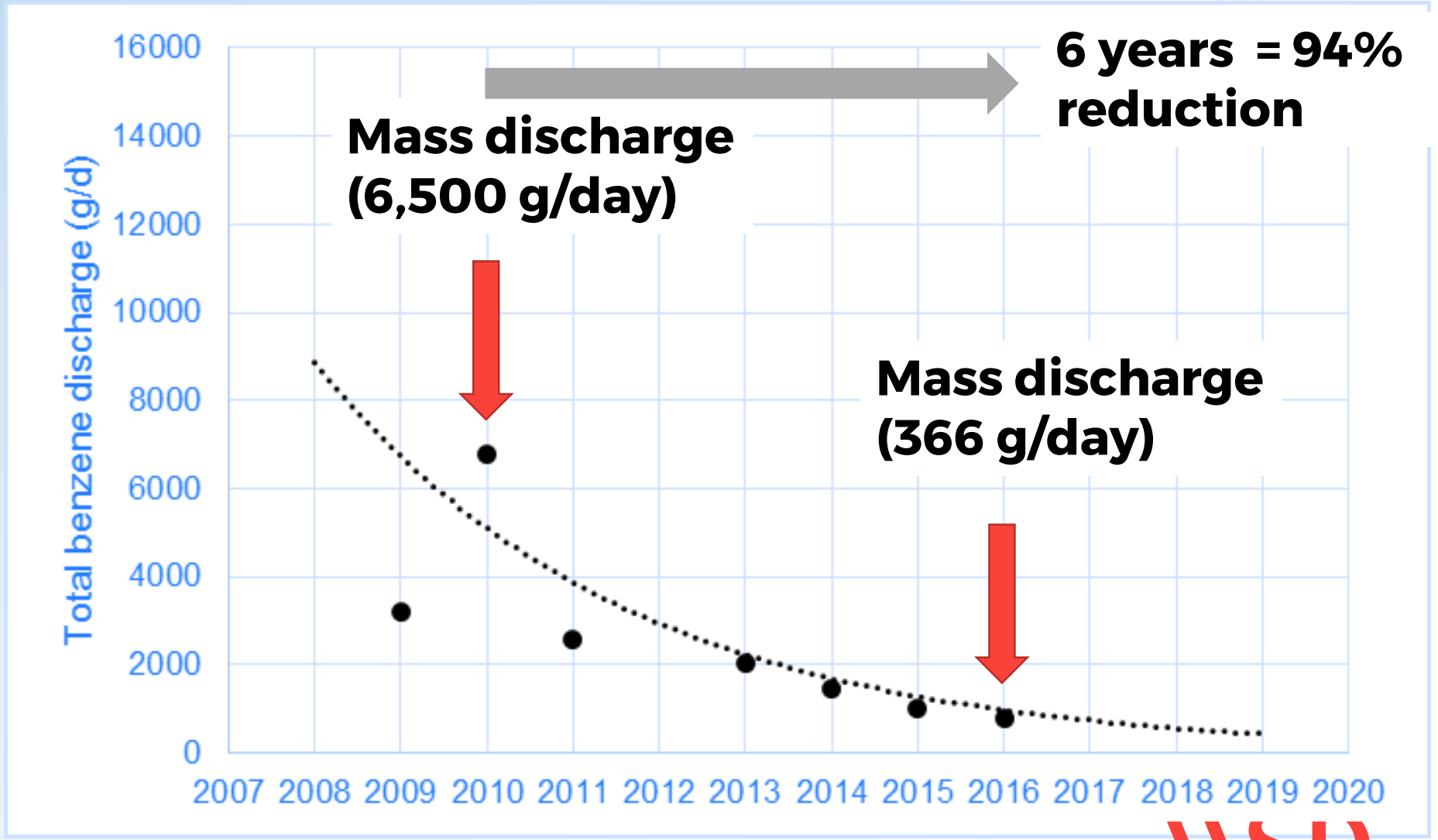


Figure ES-3. Use of multiple well transects to measure mass discharge and mass flux.
(Adapted from Einarson and Mackay 2001.)



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Treatment Approach (plume)

- Microbial treatment (Natural attenuation)
- Est. 7 tonnes (7 years)
- Est. 94% reduction (6 years)
- Sustainable approach

Data supports, mass reduction via natural attenuation is significant

Treatment Success

Technology	Resources	Period	Treatment (L)
Skimmer/Bailers	Low	2009-2017	25
MPVE	High	2009 -2013	757
C3™ SVE	Mod	2013 -2015	9,400
Pumping	High	2016-2017	80
Microbial	Low	2000-2017	7,000
		TOTAL	**17,262**

In summary, a multidisciplinary treatment approach was needed

1. Remove source and risk
2. Treat residual contamination
3. Restore beneficial use
4. Community engagement

Sustainable Treatment Approach

Key learnings

- A multidisciplinary remediation process optimisation
- Willingness to think outside of the “square”
- Use of a solid scientific rationale
- Significant savings with right approach
- Community and regulatory endorsement

Whilst, standard energy intensive approaches have a role, consideration should be given to alternative sustainable approaches when there is no immediate risk to human health or the environment.

Useful Resources

http://www.crccare.com/knowledge-sharing/national-remediation-framework

https://clu-in.org/greenremediation/

http://www.sustainableremediation.org/tools/

https://www.epa.gov/remedytech/green-remediation-incorporating-sustainable-environmental-practices-remediation

http://www.claire.co.uk/

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Questions?

Should you have any questions please contact Graham at email: graham.smith@wsp.com

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