

Cooperative Research Centre for **Contamination
Assessment and Remediation of the Environment**

www.crccare.com



CRCCARE

*A safer, cleaner
environmental future*



TECHNICAL REPORT NO.35

Value-based land remediation: Improved decision-making for contaminated land

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, Technical Report series, no. 35

August 2016

Copyright © CRC CARE Pty Ltd, 2016

This book is copyright. Except as permitted under the *Australian Copyright Act 1968* (Commonwealth) and subsequent amendments, no part of this publication may be reproduced, stored or transmitted in any form or by any means, electronic or otherwise, without the specific written permission of the copyright owner.

ISBN: 978-1-921431-48-7

Enquiries and additional copies:

CRC CARE, C/- Newcastle University LPO, PO Box 18, Callaghan NSW, Australia 2308

Tel: +61 (0) 2 4985 4941

Fax: +61 (0) 8 8302 3124

admin@crccare.com

www.crccare.com

This report should be cited as:

CRC CARE 2016, *Value-based land remediation: Improved decision-making for contaminated land*, CRC CARE Technical Report no. 35, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.

Disclaimer:

This publication is provided for the purpose of disseminating information relating to scientific and technical matters. Participating organisations of CRC CARE do not accept liability for any loss and/or damage, including financial loss, resulting from the reliance upon any information, advice or recommendations contained in this publication. The contents of this publication should not necessarily be taken to represent the views of the participating organisations.

Acknowledgement:

CRC CARE acknowledges the contribution made by Roel Plant, Joanne Chong, Aleta Lederwasch, Jason Prior and Sally Asker of the Institute for Sustainable Futures, University of Technology Sydney, and Spike Boydell, Asia-Pacific Centre for Complex Real Property Rights, University of Technology Sydney, towards the writing and compilation of this report.

CRC for Contamination Assessment and Remediation of the Environment

Technical Report no. 35

**Value-based land remediation:
Improved decision-making for contaminated land**

August 2016



Acknowledgements

CRC CARE would like to thank the following:

- Roel Plant, Joanne Chong, Aleta Lederwasch, Jason Prior and Sally Asker, Institute for Sustainable Futures, University of Technology, Sydney, for the preparation of this report.
- Spike Boydell, Asia-Pacific Centre for Complex Real Property Rights, University of Technology, Sydney, for the preparation of this report.
- All interviewees for their participation in this pilot project.
- All members of our Project Reference Group for their advice on methodological development and assistance with establishing the Australian case studies.
- Paul Bardos, Sean Shiels and Bruce Kennedy for their helpful comments on earlier versions of this report.

Executive summary

This project on value-based land remediation (VBLR) for improved decision-making in relation to contaminated land was funded by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) and undertaken by a multidisciplinary team from the University of Technology, Sydney (UTS).

The report intends to provide regulators and remediation professionals with a summary of the findings from the research, highlighting how the findings might be incorporated in current and future site remediation practice. The VBLR research encompassed a pilot and did not set out to investigate specific regulatory approaches or stakeholder engagement techniques, so should not be treated as handbook or manual for applying the VBLR approach.

The VBLR pilot study focussed on Australia and the Pacific (Fiji). The research explored how remediation institutions interact with the values held by various stakeholders, as reflected in site remediation decision-making processes (RDMPs), and hence the outcomes of these decision processes. Four case study sites were explored:

- Western Australia – a small-scale soil and groundwater remediation project in an urban industrial area
- New South Wales – a series of interrelated sites including chemical stores and contamination of groundwater and soil
- South Australia – a single urban site surrounded by existing residential neighbourhoods, and
- Fiji – a disused open dumpsite near Suva, the national capital.

This research is innovative along two axes. Firstly, it modifies and applies institutional analysis to explore the question of whether, and how, institutional change could enhance decision-making around contaminated sites. Secondly, the research complements and extends the nascent practice and policy paradigm of sustainable remediation. The research explores opportunities for public policy to consider contaminated site remediation beyond notions of mitigating risks and costs, towards enhancing value.

Abbreviations

| | |
|----------|---|
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| CRC CARE | Cooperative Research Centre for Contamination Assessment and Remediation of the Environment |
| CUTEP | Cleanup to the extent practicable |
| EIA | Environmental impact assessment |
| EPA | Environmental Protection Agency |
| ESD | Ecologically sustainable development |
| EU | European Union |
| IAD | Institutional analysis and development |
| NHMRC | National Health and Medical Research Council |
| NSW | New South Wales |
| RDMP | Remediation decision-making process |
| SA | South Australia |
| SURF | Sustainable Remediation Forum |
| UK | United Kingdom |
| UNESCO | United Nations Education, Scientific and Cultural Organisation |
| US | United States |
| UTS | University of Technology, Sydney |
| VBLR | Value-based land remediation |
| WA | Western Australia |

Table of contents

| | |
|---|------------|
| Acknowledgements | i |
| Executive summary | ii |
| Abbreviations | iii |
| 1. Introduction | 1 |
| 2. Site remediation – Value creation, history and context | 3 |
| 3. Analytical framework: Theories of value and institutional analysis | 5 |
| 4. Methodology – Case study selection and data collection | 8 |
| 4.1. Australian case studies | 8 |
| 4.2. Asia-pacific case study: Fiji | 9 |
| 5. Results – Australian case studies | 11 |
| 5.1. Participants seek diverse outcomes but share common aims | 11 |
| 5.2. Informal rules, rather than legislation, directly influence decision processes | 13 |
| 5.3. Information flows are necessary to build trust and ensure success | 15 |
| 5.4. Formal evaluative criteria do not reflect the full scope of value sought | 16 |
| 5.5. Conclusion | 16 |
| 6. Results – Fiji case study | 18 |
| 7. Policy implications | 21 |
| 8. Conclusion | 23 |
| 9. References | 24 |

Appendices

| | | |
|----------|--------------|----|
| Appendix | Publications | 27 |
|----------|--------------|----|

Tables

| | | |
|----------|---|----|
| Table 1. | Initial (I) value and Emerging (E) value sought by type of participants in the Australian RDMPs. | 12 |
| Table 2. | Selected values and degree of power (reflected by level of shading) over the decision-making process. | 19 |

Figures

| | | |
|-----------|--|---|
| Figure 1. | The Institutional Analysis and Development (IAD) Framework (adapted from Ostrom et al. 2005) | 7 |
|-----------|--|---|

1. Introduction

The value-based land remediation (VBLR) project is a pilot study, focussed on Australia and the Pacific (Fiji). It aims to develop and apply theory and methods to investigate the institutions which govern how stakeholders operate and interact in a range of contaminated site remediation decision situations (Plant et al. 2010). In this context, we use the term institution to indicate the rules and norms that govern human interactions around site remediation projects, rather than a building or a professional body. For the purpose of this report, institutions are defined as:

‘The prescriptions that humans use to organise all forms of repetitive and structured interactions including those within families, neighbourhoods, markets, firms, sports leagues, churches, private associations, and governments at all scales’ (Ostrom 2011).

The research explored how remediation institutions interact with the values held by various stakeholders, as reflected in site remediation decision-making processes (RDMPs), and hence the outcomes of these decision processes. Four case study sites (RDMPs) were explored:

- Western Australia (WA) – a small-scale soil and groundwater remediation project in an urban industrial area
- New South Wales (NSW) – a series of interrelated sites including chemical stores and contamination of groundwater and soil
- South Australia (SA) – a single urban site surrounded by existing residential neighbourhoods, and
- Fiji – a disused open dumpsite near Suva, the capital of Fiji.

This research is innovative along two axes. Firstly, it modifies and applies institutional analysis to explore the question of whether, and how, institutional change could enhance decision-making around contaminated sites. As described further in Section 3, the VBLR research adapted the theory and techniques of institutional analysis and development (IAD) to structure the inquiry and analysis of contaminated site remediation decision situations. The IAD framework has been incrementally developed and widely applied over the last three decades to investigate common property resource governance, and has more recently been applied to a wider range of decision and governance contexts, including private property (Ostrom et al. 2005; Schlüter & Theesfeld 2010; Basurto et al. 2010; Siddiki et al. 2011). Secondly, the research complements and extends the nascent practice and policy paradigm of sustainable remediation (Baker et al. 2009; US Sustainable Remediation Forum 2009; Basurto et al. 2010). The research explores opportunities for public policy to consider contaminated site remediation beyond notions of mitigating risks and costs, towards enhancing value. These notions are described in more detail in Section 3.

As the research sought to understand and elicit a wide range of values, stakeholders from a range of backgrounds and interests could find this material relevant to informing and stimulating ideas about their involvement in current and future contaminated site remediation decision processes. In the Australian context, the principal target audience consists of regulators, auditors, consultants and other commercial parties involved in site remediation, and local communities. In the Pacific context, the research aimed to

have relevance to national and local governments, civil society, industry and international donors in Fiji as well as other Pacific Island countries.

The report intends to provide regulators and remediation professionals with a summary of the findings from the research, highlighting how the findings might be incorporated in current and future site remediation practice. As the VBLR research encompassed a pilot and did not set out to investigate specific regulatory approaches or stakeholder engagement techniques, it should not be treated as handbook or manual for applying the VBLR approach.

The research was funded by CRC CARE and undertaken by a multidisciplinary team from UTS.

This report provides a brief overview of the research undertaken and emphasises policy implications. Further theoretical and methodological detail is provided in a series of peer-reviewed journal articles (see Appendix for details).

2. Site remediation – Value creation, history and context

In developed countries, over the past 30 years increased public awareness of contaminated sites has encouraged governments to develop policy and legislation to facilitate site clean-up (Fowler 2007; 2008). This in turn has sparked substantial research into clean-up technology, measurement and assessment techniques, and the development of a significant international remediation industry (Khan et al. 2004).

The evolution of approaches to contaminated site remediation can be broadly described as three generations of policy and practice.

- Contaminated land reclamation began in the 1960s, mainly in the form of regeneration using landfill (Bardos 2012a). By the 1970s, concerns over human health and environmental issues had come to the fore, and linkage of site pollution to ideas of harm began. During the 1970s and 1980s, responses to these ideas started to emerge in several countries as a series of threshold guidance values, based on various degrees of expert judgement. At the same time, remediation technologies began to be developed and used, though not always selected on competitive cost grounds. The first generation of policy and practice guidelines (including the ANZECC/NHMRC guidelines in Australia) was based on contaminant threshold guidance values. Regulators allowed remediators some flexibility to, for example, target certain sections of contaminated sites (Nathanail 2006). Despite the relative simplicity of designing remediation approaches to meet explicit reference levels, this was recognised as failing to encourage cost-effective remediation. Particularly in Europe, this approach left contaminated sites that were too expensive to remediate, or were limited to industrial rather than other uses (Hamilton & Viscusi 1999). Another significant development over this period was the reduced emphasis on multi-functionality (Bardos 2012a).
- The second generation of contaminated site remediation moved the approach towards notions of risk and sustainability. Towards the end of the 1980s and into the 1990s, risk assessment began to emerge as a tool for making judgements about avoidance of harm. By the end of this period work in the Netherlands, the UK, Germany and other countries began to look at wider impacts and sustainability (Bardos 2012a). Process-based risk assessment theory influenced the adoption of a risk-based approach in contaminated site regulation, which was based on the key notion that the risk to health involved in development of contaminated land is a function of the exposure to the contaminant (Pollard 2005). The risk-based approach enabled a focus on controlling exposure as a means of controlling risk, for example using active barriers. By the early 2000s risk based decision-making was fairly widely accepted, and in 2009 the Sustainable Remediation Forum (SURF) in the US catalysed a renewed consideration of sustainability which has led to an emerging international consensus on approaches. More recently, this approach has been extended to incorporate sustainable/green remediation concepts in which the remediation approach requires balancing health risks against other environmental, economic and social impacts and objectives (Bardos et al. 2011; Superfund Green Remediation Workgroup 2010; Simon 2010), such as energy and climate change impacts.

- A number of formal and informal networks worldwide are now engaging in debate on achieving sustainable development when remediating or regenerating damaged sites (CL:AIRE 2010; NICOLE 2010; Bardos et al. 2011). This debate centres on how sustainability benefits can be assessed and maximised and how negative impacts can be avoided or limited. There is a remarkable degree of consensus across these initiatives about what a vision of sustainable remediation might be (Bardos 2012b). In broad terms, concepts of sustainable remediation are based on the achievement of a net benefit overall across a range of environmental, economic and social concerns that are judged to be representative of sustainability. There is also a developing consensus that it is possible to assess sustainability, at least on a site specific basis, compare possible rehabilitation options, and monitor sustainability performance once a chosen option is implemented. There is also a general view that assessments should begin simply, and only progress to more complex assessments where a simple approach does not reveal a generally agreed outcome. However, there is far less agreement about what precisely sustainability is in the context of remediation. Indeed it may not be capable of precise definition in an overarching way. Mostly sustainable remediation or sustainable regeneration is discussed as an emergent property resulting from the interaction of factors related to the site, the project, options available, locality and stakeholders involved in the decision-making process.

This research is focussed upon driving a further paradigm shift in policy, law and practice for contaminated sites. This nascent shift stems from the emerging idea, held by both private and public owners of contaminated sites, that site remediation presents opportunities rather than merely problems such as liabilities and costs. Increasingly, limited public funds combined with often readily available legislative tools provide a major opportunity to shift the policy focus from costs and liability to value creation by tapping into the potential of what has been termed the energetic society (Hajer 2011). This emerging philosophy of governance argues that government has much to gain from a better utilisation of its citizens' creativity and innovation potential, as many organisations already consider ecologically responsible behaviour as a precondition for success and survival. Practical application of this new mode of governance to the remit of remediation is likely to require further research into how stakeholders can be motivated and incentivised to engage positively in what has traditionally been seen as negative, of concern, and problematic.

In summary, there is the potential for additional value to be created from remediation for communities and industry in the short, medium and longer term. The VBLR project has explored this potential and its drivers, including community expectations, planning controls and land constraints in urban areas, by means of an enquiry into values and institutions.

In developing countries (compared with Europe, North America and Australia), the absence of enforceable legislation and presence of other pressing economic and social development priorities means there can be limited rehabilitation of contaminated sites, despite potentially considerable human and environmental risks. However, the remediation industry is global in character and contemporary technologies and practices can be made available to developing countries, for example where remediation is funded through overseas donor assistance. Even in the absence of evolved contaminated site policy and regulation, the VBLR concept has potential to better inform decision-making in developing countries.

3. Analytical framework: Theories of value and institutional analysis

There has been increasing recognition of the importance of (and challenges encompassing) the inclusion of stakeholder values in remediation decision-making processes (Pollard et al. 2004). Stakeholder participation is now recognised as essential to incorporating the perspectives of various participants into remediation. This was a central consideration driving our approach in both Fiji (a developing country) and Australia (a developed country), where we adopted an interactive and consultative nature to research.

Due to the ambiguity of the term value, value conflicts are commonplace in the realm of environmental policy and decision-making (O'Neill et al. 2008). An environmental decision maker is often not faced with a clear-cut choice between protection and damage, but rather with decisions regarding the distribution of different kinds of damage and benefits across different dimensions of value (O'Neill et al. 2008). This is because environments matter to humans in different ways: they live from them (means to existence), they live in them (homes and familiar places, personal, social histories, etc.), and they live with them (living against the backdrop of the natural world). The general consensus is towards an approach to environmental values that is pluralistic and aimed at finding an acceptable balance among competing legitimate values – using sociology, economics and ethics theory (Norton 2005; Spash 2008). Norton (2005) identifies four fundamental questions about value which are immediately relevant in the context of decision-making for contaminated land:

- What is the nature of value?
- How can or should we use value to evaluate and justify particular actions?
- How should we measure value?
- How can multiple perceptions of value be harmonised?

The first question about value can be answered by distinguishing between three types of value:

- Monetary value – material or monetary worth (e.g. increased property value)
- Importance or worth – the regard that something is held to deserve (e.g. cultural heritage), and
- Individual and organisational values – principles or standards of behaviour.

For the purpose of the VBLR research we use the noun value (singular) to refer to the first two types of value (monetary and importance or worth), while values (plural) is used for the third type (principles or standards of behaviour). Brown (1984) offers a useful typology of values, distinguishing between held values ('someone has a value', 'someone's value') and assigned values ('the value of an object', 'what a thing is worth'). Held values can be thought of as labels to describe concepts of the preferable as well as modes of conduct. Held values, therefore, reflect one of the major institutions that govern remediation: social norms, or values to which others in society are asked or expected to assign great value. Held values can be further classified as instrumental (means), such as moral and competence values, and terminal (ends), such as personal and social values. Assigned values are expressions of the relative importance or worth of an object and arise when the conceptual notion of value enters

the relational realm. Here, value is that which arises from the preference of a subject (e.g. the actor in the remediation process) for an object (e.g. a remediation solution and its expected outcomes) in a given context (e.g. a contamination problem involving multiple actors with conflicting interests). The economic notion of value becomes apparent in what Brown calls the object realm. Here, value is 'a quantity of substance, or a measurable degree of a property, to which substance or property the quality of valuableness is attributed on the basis of a value principle [i.e. a held value]' (Najder 1975). Fundamentally, any assigned value reflects to some degree the perception and held value of the valuator and depends on the context to which it relates.

Supplementing the typology of values provided by Brown (1984), held values in an action arena can be explained in terms of the underlying intention of each stakeholder. To this end the research drew on the work of Keeney (1994) who, like Brown (1984), distinguishes between 'means outcomes' and 'fundamental outcomes'. Fundamental outcomes are the outcomes that stakeholders value most, whilst means outcomes are important to stakeholders in that they enable fundamental outcomes.

Assigned value can be measured in many ways, for example using measures expressed by actions (prices and time commitments – revealed preference), or measures expressed by words (opinions of importance such as willingness to pay – stated preference). Adopting the broad criticisms on the measurement of stated and revealed preferences under the rational choice model used in conventional economics (Ben-Ner & Putterman 1998; Bromley 2004), the VBLR project focuses on held values and their role in the negotiated decisions that are made in the remediation process. In doing so, we adopt the premise that the optimal decision, based on a rational expression and tallying up of quantified costs and benefits, does not exist (Bromley 2008). Rather, our enquiry into held values intends to elicit opportunities for policy reform that embraces social learning – capitalising on the energy, determination and creativity of the energetic society (Hajer 2011).

To elicit the interactions between values and the institutions governing the remediation process in the Australian and Fiji case studies, we used IAD adapted from Ostrom and colleagues (Plant et al. 2016). IAD provides a robust theoretical framework, grounded in a long tradition of institutional economics (Paavola 2007), to guide analysis of the decision-making processes involved in contaminated site reuse. A summary of the framework is provided in Figure 1.

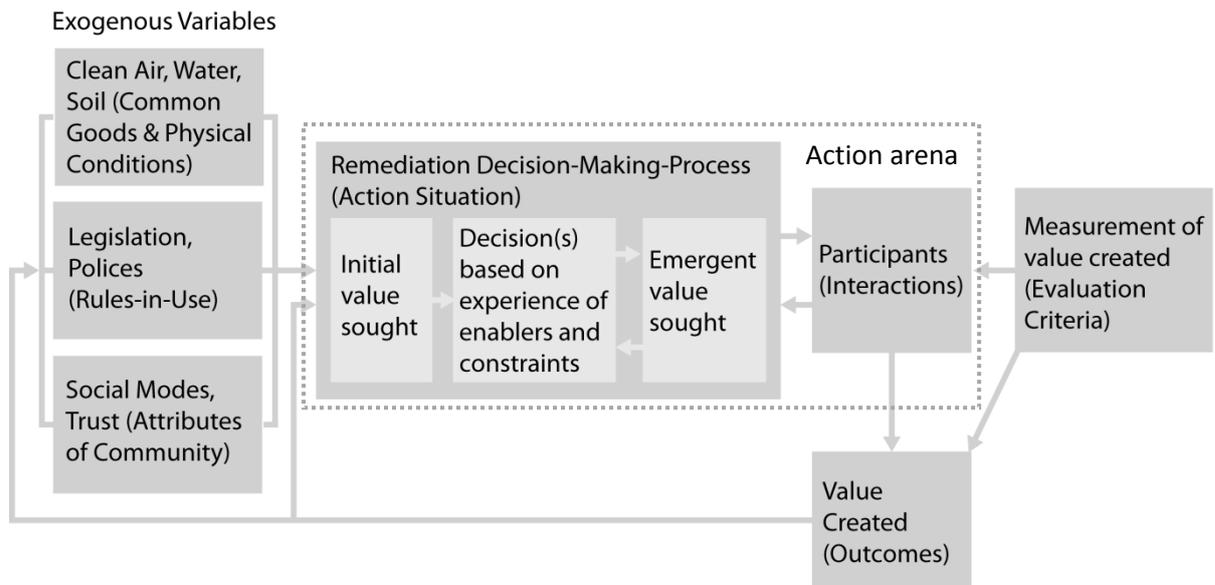


Figure 1. The IAD framework (adapted from Ostrom et al. 2005).

IAD has been applied extensively to investigate common-resource allocation issues (Blomquist & DeLeon 2011; Ostrom 2011), but less so to other decision situations. There have been recent calls to extend analysis from common-pool resources to other kinds of environmental resources (Ostrom et al. 2005; Paavola 2007). Our research takes up this challenge and is novel in its approach to applying IAD to analyse value generation from site rehabilitation, conceptualising the contaminated site as a private resource, the rehabilitation of which is likely to generate spill-over effects to both the common, public and the private good. One can think of these spill-over effects as externalities in conventional economics (Ayres & Kneese 1969). This notion of spill-over effects may be seen as somewhat contrary to the philosophy of sustainable remediation which seeks to find a common purpose among stakeholders.

At the core of the IAD framework is the action situation as the unit of analysis and the focus of investigation. Within this action situation, participants interact and the combined entity of action situation and participants is termed the ‘action arena’ in the IAD framework (Figure 1). The institutions, or rules-in-use determine who is eligible to make decisions, what actions are allowed or constrained, what procedures must be followed, what information is or is not provided, and what payoffs will be made between participants (Ostrom et al. 1994). Rules are statements about what actions are ‘required, prohibited, or permitted and the sanctions authorised if the rules are not followed’ (Ostrom et al. 1994, p.38).

The IAD framework conceptualises institutions as nested levels of action situations. The rules-in-use affecting an action situation are set by interactions at a higher level action situation. In Ostrom’s framework the operational level involves the day-to-day activities that affect the world directly. In our case, these activities are to do with the remediation of contaminated sites.

4. Methodology – Case study selection and data collection

A case study approach was selected as it enabled investigation of a few contaminated site remediation cases in depth. Whilst knowledge is generated mainly for the specific situations, case-based research also enables learnings to be extended beyond the unique instances that are studied, within ranges of applicability (Yin 2003; Byrne 2009).

Data collection methods were primarily semi-structured and structured interviews, which were used to elicit perspectives on processes and value(s). Due to differences in socio-cultural, geographical and institutional context, the degree of structure varied between Australian and Fiji sites. This is discussed further below.

4.1. Australian case studies

Three case studies were selected in Australia (Prior 2016, in preparation) and one in Fiji (Chong et al. 2013). A second international case study, located in Vietnam was scoped but not progressed further. We provide a brief summary of the four remediation cases here and refer to Prior (2016) and Chong et al. (2013) for further details.

The RDMP in WA is a small-scale soil and groundwater remediation project in an urban industrial area. The site is owned by a corporation which inherited the remediation issues as a result of a land purchase. The RDMP is focused on contamination that emanated from a single point, and resulted in a plume of contaminants in groundwater under adjacent properties, and which extended towards waterways.

The NSW RDMP is made up of a series of interrelated RDMPs for various contaminants. Contamination associated with the NSW RDMP includes a groundwater plume, stores of chemicals, and various areas of contaminated soil. As with the WA RDMP, the groundwater plume associated with the NSW RDMP extends under adjoining residential properties.

The RDMP in SA comprises a large site bordering on highly populated suburban areas. The close proximity of the neighbours led to detailed consultation processes.

For each site two data sets were collected through two methods:

- archival research of policies, legislation and other relevant documentation, and
- semi-structured in-depth interviews with participants.

The archival research was used at the outset of the project to provide the context for each RDMP case study, and after the interviews to reflect on key points made by participants about legislation, policies, planning instruments and other documents.

The semi-structured interview pro forma was designed to obtain information about the various components of the IAD framework. Interviewees were not explicitly made aware of the IAD framework as it only served as a thinking aid and organising principle for the researchers. Once the interview pro forma was designed it was piloted with a participant from one of the case studies. Interviewees (six per case study) were selected from the archival research; participants who had extensive involvement in the RDMP case studies were preferred over those who had less involvement. The 18

respondents (six from each RDMP) included owners, regulators, auditors, neighbours, local council officers and remediation consultants. The qualitative data in the interviews were thematically coded using NVIVO software¹. The thematic coding was used to identify those findings that could be generalised, within reason, for participant groups from the three case studies.

4.2. Asia-pacific case study: Fiji

Two Asia-Pacific case studies were initially included in the research design. The developing country context was introduced within the research as we premised that the magnitude for improved outcomes – in terms of economic, social and environmental impacts – was potentially great. Case studies in the Asia-Pacific were also included to widen the conceptualisation of development value. Reflecting its broad meaning, development can take place at different scales and in many forms, such as site development, community development, or regional, local and national economic development. At the transnational scale, development is commonly interpreted in terms of the Millennium Development Goals (Paddon & Herriman 2007).

One case study in each of Vietnam and Fiji was initially selected (Plant et al. 2010). The criteria for selection of these case studies were: one case study in Asia and one in the Pacific; potential for transferability of findings to other countries in the region; involvement of state and/or donor partners; a range of potential social and environmental values that could be gained from remediation; and the ability to impact Millennium Development Goals.

Preliminary research and stakeholder engagement was conducted in Vietnam, around the plans to close and remediate open-cut coal mines in Quang Ninh Province, near Ha Long Bay. Key government agencies were initially keen to access research support, and the initial investigations indicated the potential for value to be created environmentally (through reduced pollution of a UNESCO World Heritage Site), and socio-economically (through alternative employment). However, subsequent advice from key government stakeholders indicated that due to other planning priorities the window for research to inform their decision-making would not align with our research timelines. The Vietnam case study was not progressed, and instead three (rather than one) Australian case studies were undertaken.

The Fiji case study, Lami Dump, represents one of the few contaminated site reuse examples in the Pacific region. Since its establishment in 1945 over a mangrove swamp, pollution from Lami Dump has affected human health, amenity and the general environmental condition of Suva Harbour, its surrounding informal settlements and local through traffic. Negative impacts have included odour, toxic fumes from fires, and leaching to coastal environments. During a transition period, starting from 2005, Lami Dump was closed when a new landfill funded by the European Union was established at Naboro. The EU granted a further €550,000 for the rehabilitation of the Lami site, with rehabilitation design commencing in April 2009.

¹ NVIVO is software that supports qualitative and mixed methods research. It lets the researcher collect, organize and analyse content from interviews, focus group discussions, surveys, audio as well as social media and web pages.

The data collection process for Fiji was necessarily semi-structured. Out of respect for participants, interviews were not recorded or transcribed. Themes were identified beforehand and explored to varying extents with each interviewee. Interviewees had a range of levels of involvement in the site reuse decision – from driving the key processes, to none at all (although with interest in the outcomes). There was limited documentation of the Lami dump since its closure, and hence the researchers had limited information about the level or nature of involvement of each interviewee prior to the interview. Therefore, interviews were necessarily tailored as they progressed with each participant.

5. Results – Australian case studies

5.1. Participants seek diverse outcomes but share common aims

The analysis of the Australian case studies revealed that participants in the remediation decision-making process (RDMP) value a diversity of outcomes. Six types of participants were interviewed in the case studies:

- owner (of the contamination ‘problem’)
- regulator
- auditor
- neighbour (residents and businesses)
- local government, and
- remediation consultant.

All participant types indicated that the outcomes they valued evolved over the life of the remediation decision process (the ‘action situation’ in IAD). At the time of the interviews the WA RDMP had been going for almost a decade, whilst the NSW process had been underway in various forms for almost two decades. The SA RDMP was brought to a close about a decade ago.

Participants also revealed that what they valued expanded as a result of communications between participants during the course of the decision processes. They found that unexpected opportunities arose through the decision process, such as contributing to scientific knowledge and learning about new perspectives and approaches. All participants noted that when they initially became involved in the process, they brought preconceived ideas (held values) about the outcomes they valued to the process – their ‘initial value sought’. All participants also noted that the scope of the outcomes they valued shifted, most often expanding as a result of their interactions in the action situation – ‘emergent value sought’ (e.g. contributing to scientific knowledge, demonstrating innovation, enhancing environmental value as opposed to simply protecting it). Table 1 shows the distribution of initial value sought and emergent value sought across the six participant types.

Table 1. Initial (I) value and Emerging (E) value sought by type of participants in the Australian RDMPs.

| Code | Value sought | Participant type | | | | | |
|------|--|------------------|-----------|---------|-----------|------------------|------------------------|
| | | Owner | Regulator | Auditor | Neighbour | Local government | Remediation consultant |
| VS1 | Minimising natural environmental risk | I | I | I | I | I | I |
| VS2 | Minimising human health risk | I | I | I | I | I | I |
| VS3 | Removing or neutralising the contamination so it poses no significant risk of harm | I | I | | I | I | I |
| VS4 | Fulfilling regulatory and contractual requirements | I | I | I | | | I |
| VS5 | Removing blight on land caused by the contamination | I | I | I | I | | |
| VS6 | Removing legacy issues | I | | | | | |
| VS7 | Maintaining and enhancing symbolic capital/reputation | I | | | I | | I |
| VS8 | Extracting economic value from the remediated land via sale/redevelopment | I | | | | | |
| VS9 | Achieving effective remediation with minimal costs | I | | I | | | I |
| VS10 | Enhancing the natural environment | E | E | E | E | E | E |
| VS12 | Contributing to industry-wide scientific and technical knowledge | E | E | E | E | | E |
| VS13 | Building trusting relationships between participants | E | | E | E | E | |
| VS14 | Improving existing and future decision-making processes | E | E | E | E | | |
| VS15 | Minimising levels of perceived risk held by community (increase sense of safety and security) | E | E | E | E | E | E |
| VS16 | Learning new perspectives and approaches to remediation | E | | | | | |
| VS17 | Empowering and building capacity in the community so they can engage with the remediation decision | E | | E | E | E | |
| VS18 | Developing effective collaborations and communication between participants | I,E | I,E | I,E | I,E | I,E | I,E |

Whilst, as expected, fundamental outcomes (the key drivers) differed significantly across participants, in many instances what was important as a means to an end for some participants, was important as an end (fundamental outcome) for others. In other words, some participants aimed to achieve the fundamental outcomes of other participants but importantly pursued these for a different overarching purpose. For example, all participant types indicated that ‘minimising natural environmental risk’ (VS1, Table 1), ‘minimising human health risk’ (VS2, Table1), and ‘removing or neutralising the contaminant’ (VS3, Table 1) were types of value sought through the RDMP. However, the underlying drivers behind these aims varied across participant types. The owner participant type indicated that the ultimate goal behind their range of aims was to manage legacy issues and protect the reputation of the company that they represent. This can be compared to the auditor and remediation consultant participant types who pursued these same outcomes as a means to fulfil regulatory and contractual requirements. The Environmental Protection Agency (EPA) and local government, on the other hand, pursued these outcomes for the purpose of fulfilling their function to protect the community from potential risks to human health. These underlying goals of the EPA and local government closely relate to the community’s fundamental aim to ensure that their health (human and natural environment) and property are not subject to unreasonable levels of risk.

Whilst many valued outcomes may be shared by a range of participants, the case study findings revealed that the pursuit of some outcomes may come at the expense of achieving others. This was demonstrated in one Australian RDMP, where the problem owner’s interest in ‘removing legacy issues’ (VS6, Table 1) and ‘removing or neutralising the contamination’ (VS3, Table 1), resulted in the discovery of an additional contaminant on a neighbour’s property. The blight that ensued from this discovery impeded the outcome that most participants valued, that is ‘removing of blight on land caused by the contamination’ (VS5, Table 1), which significantly devalued the neighbouring land. This finding reflects a fairly positive message for the ability of stakeholders to work together.

5.2. Informal rules, rather than legislation, directly influence decision processes

A key finding from the Australian case studies is that the ‘rules-in-use’ (per IAD), rather than the ‘rules-on-paper’, are highly influential in shaping the interactions between the participants involved in RDMPs and the outcomes of these processes. That is, the informal rules, or institutions beyond legislation – such as social norms, routines, custom, usage and practice – are key to driving remediation processes and decisions. This finding reinforces the results of a recent audit which found that most remediation decision-makers make decisions voluntarily (especially where increasing land values play a role) rather than being explicitly compelled by command-and-control regulation (Fowler 2008).

One area in which informal rules predominate in terms of influencing practice is in the adoption of sustainable remediation approaches. As noted in Section 2 of this report, there is a degree of consensus across sustainable remediation initiatives about what a vision for sustainable remediation might be. Yet, in the states in which the case studies are located, legislation governing remediation does not (yet) explicitly require the incorporation of sustainability principles into remediation projects (although broad

principles of sustainable development are acknowledged in some state planning and development legislation). Generally, legislation was seen by stakeholders as providing only fragmented support for the adoption of sustainability principles into remediation practice, instead focussing on green technologies, carbon reduction and waste reduction.

The absence of mandatory requirements for sustainable remediation was not, however, in itself a barrier for stakeholders to express values. In the absence of cohesive legislative requirements, processes and outcomes were driven by the emphasis on corporate social responsibility and considerations around problem owners' social licence to operate, and the emerging links to sustainability. For example, the case study findings suggest that problem owners sought the value of 'developing effective collaborations and communications between participants' (VS18, Table 1), which is consistent with sustainability objectives, out of an appreciation that achieving this is a crucial step toward achieving the value outcome 'maintaining and enhancing symbolic capital/reputation' (VS7, Table 1). Further, some site owners noted that the relatively imprecise legislative requirements enabled them to build their reputation credentials in the eyes of other participants, as they are seen to be exceeding regulatory requirements.

Other values sought that reflect notions of sustainable remediation include those that were related to the value outcome 'improving existing and future decision-making processes' (VS 14, Table 1). This value outcome was commonly identified by four participant types (owner, auditor, regulator, neighbour) but driven by a range of goals. The regulator, for example, sought this value outcome for efficiency and cost effectiveness reasons and also as a means to achieve the value of 'empowering and building capacity in the community so they can engage with the RDMP' (VS 17, Table 1). Neighbour participants also sought this value. One response, from a neighbour, revealed that this was for the purpose of setting strong foundations for future generations to effectively engage in RDMPs and take effective resident action where appropriate:

'...for future generations, we believe that we've shown them that resident action doesn't have to be aggressive. Sometimes you have to be aggressive to get the initial attention if you need, and when you get the attention you've got to work on getting the respect of people...I'm hoping that because of the hard yakka that we have put in, future generations won't have to have the same hard fight.'

The above quote strongly reveals community interest in, and valuation of, the pursuit of intergenerational equity (one of the principles of ecologically sustainable development (ESD)) and is consistent with the trend toward sustainable remediation.

A brief examination of the formal rules that govern the RDMP within the states in which the three case studies are located (i.e., the contaminated land and related policy and legislation), reveal that the emerging values sought align with the objects of these formal rules.

In NSW, the *Protection of the Environment Operations Act 1997* expresses the objective at s3:

- a) to protect, restore and **enhance** the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development

- b) to provide increased opportunities for public involvement and participation in environmental protection, and
- c) to ensure the community has access to relevant and meaningful information about pollution.

The South Australian Public Health Act 2011 also demonstrates objectives that align with emerging value sought. The objects expressed at s4 include:

- a) to promote health and wellbeing of individuals and communities
- b) to promote the provision of information to individuals and communities about risks to public health, and
- c) to encourage individuals and communities to plan for, create and maintain a healthy environment.

Furthermore, the *WA Contaminated Sites Act (2003)* states as its objective 'to protect human health, the environment and environmental values'.

The objectives of enhancing environmental and human health, increasing community engagement and improving access to information for more effective community participation in issues concerning community health and wellbeing are thus expressed in the formal rules for these states.

5.3. Information flows are necessary to build trust and ensure success

With respect to information flows, participants identified that there were limited formal rules governing information, and that most information exchange occurred informally and voluntarily. In some cases, problem owners were uncertain about what information to provide, and other participants were uncertain about what information to request. As noted by one auditor:

'There's an awful lot of information... and a decision has to be made about how much to provide and when... as most companies, they release a certain amount... and hang on to the rest unless someone asks for it... though often the community doesn't know what to ask for'.

Information flows were a key determinant of the outcomes of the decision processes via the effects of information on relationships and interactions between participants. Participants identified poor communication as causing mistrust and increasing angst amongst community members, which may in turn have led to a snowball effect impeding the remediation process. Mistrust leads to increased levels of perceived risk; which in turn may lead to the denial of access to property for soil and water sampling; resulting in additional costs and time to the remediation process. Participants also identified a lack of opportunity to collaborate and identify areas of common interest. On the other hand, effective information sharing was associated with transparency and the building of trust, which can lead to a positive cycle of effective stakeholder engagement and community input.

5.4. Formal evaluative criteria do not reflect the full scope of value sought

The evaluative criteria used by owners and regulators are limited in range and do not reflect the full spectrum of values sought by participants. Participants identified cost minimisation considerations and contaminant trigger levels as evaluative criteria, but as one owner noted, 'we have [...] no real value measurement'.

The narrow scope of formal evaluative criteria suggests that there is a gap between the objectives of formal rules governing RDMPs and the full scope of value creation opportunities being sought throughout RDMP. The formal rules in NSW have as an objective the improvement of valuation systems operating in RDMP: the *Contaminated Land Management Act 1997* s3(2)(d) states that a particular objective of the Act is:

'To ensure that contaminated land is managed with regard to the principles of ecologically sustainable development (including): s9(3)(d) **improved valuation, pricing and incentive mechanisms**-namely, that environmental factors should be included in the valuation of assets and services.'

Whilst some individuals, particularly those with significant influence over the RDMP, may be in a position to influence and make decisions based on value that lies outside formal evaluative criteria, such an approach leads to inconsistent value outcomes that are limited in scope. To put this differently, variability is likely to lead to inconsistency, which in turn could lead to uncertainty, and ultimately paralysis among stakeholders.

5.5. Conclusion

From the Australian case studies it can be concluded that the relationships between sought values and the various institutions of the RDMP with which they interact, have great potential to inform policy, particularly via policy mechanisms promoting the identification and communication of joint goals pursued by different stakeholders. Increasing the awareness of shared values (as expressed in terms of outcomes sought), whether they serve as a means to achieve alternative value outcomes or not, have potential to increase cooperation and collaboration between participants. A potential flow-on effect of this is increased opportunity and willingness to share and appreciate different perspectives and drivers, leading to greater efficiencies and synergies.

Encouraging and supporting stakeholder forums at the start and throughout the RDMP, aiming at increased awareness of shared values and providing space to share different drivers, may help to achieve this. Such forums could be realised by requiring them through formal rules or, less formally, labelling such forums as best practice. This in itself may increase value through enhancing reputation, community trust and sense of safety where projects satisfy best practice. Careful consideration needs to be given, however, to the feasibility of stakeholder forums in light of the scale, scope and complexity of the remediation project at hand. Relevant factors for forums would include timing, frequency, location and scope.

A key area of regulatory deficiency is the lack of overt support for longer term adaptive management; that is, flexible long-term approaches that embrace changing information

and exposure levels, for example because of changing land uses, changing land (dollar) values, or changing remediation standards in the light of new scientific knowledge on remediation performance against containment measures. Such approaches, supported by institutional controls (e.g. site management plans, orders, audit reports, special arrangements, financial assurance, and covenants) are of particular importance to sites where contaminants are retained on-site for extended periods of time – an increasingly common practice under the risk-based approach. Several participants noted that regulators’ risk aversion, a product at least in part of regulatory uncertainty around new technologies and potential political pressures, means that limited resources may be spent on implementing complex remediation technologies – or indeed the very simplest option of dig and dump. This raises an important question for regulators as to mechanisms for discharging their regulatory function and making others accountable for risk.

The proposed National Remediation Framework currently under development through CRC CARE may well facilitate an adaptive management approach to site remediation.

Stakeholders also identified a need for formal evaluation criteria that capture a wider range of values. In the absence of these, however, the onus is on industry to demonstrate the benefits of sustainable remediation. In this context it is important to note that the onus has always been on the developer or site owner to demonstrate the benefits of a proposal, avoiding/minimising environmental impacts and managing residual environmental impacts to the satisfaction of the environmental regulator. Stakeholders identified a need for rigorous and transparent assessment tools and metrics – beyond financial considerations – to support the incorporation of sustainability into RDMP. Although sustainability is seen as an emerging albeit ‘fuzzy’ area, stakeholders expressed an appetite for new metrics and guidance to complement existing risk-based metrics to capture wider notions of sustainability, including value creation. Sustainability metrics and guidance complementing the risk-based approach are currently being developed as part of EPA Victoria’s CUTEP initiative and within the context of SURF Australia.

In the action situations explored, avenues of communication between participants were key to formulating decisions that reflected stakeholders’ held values. Information sharing was vital, as was the sharing of perspectives and views. Participants such as regulators and local governments may be in the position to facilitate greater collaboration, from the outset, between interested parties in order to enhance respective understanding and promote the identification of mutually interests. EPAs, generally trusted as impartial, could act as information brokers to help owners and other participants to identify key information.

6. Results – Fiji case study

As with the Australian RDMPs, a wide range of values also emerged from our participant interviews conducted in Fiji. The participants, what they value, their interactions and their level of power are summarised in Table 2.

Following closure of Lami Dump, there was considerable interest in the community and amongst businesses about what potential the site had for commercial and financial reuse value. As one potential developer enthused, the dump site was equivalent in location and potential development value to the ‘Sydney Opera House of Fiji.’ However, most interviewees were unaware that a decision had already been made to convert the site into a recreational park.

The two municipal councils involved in the Lami Dump RDMP held divergent views. The site was under Lami town council jurisdiction, but Suva City Council originally held jurisdiction and had leased the site for many decades. Suva City Council, concerned about waste transport costs, preferred the site to be developed into a waste transfer station. In contrast, Lami town council, representing its constituents, strongly opposed any waste management activity occurring at the Lami site post-closure.

The Department of Environment is the Fijian national government agency with primary responsibility for oversight over the rehabilitation of Lami Dump. In practice, this responsibility was implemented through the European Commission Delegation to the Pacific contracting a project manager, from a Europe-based consulting business, to oversee the rehabilitation and help build capacity within the department.

Fiji’s Environmental Management Act (2005) represents a significant legislative development to protect and enhance environmental quality in Fiji. At the time of the interviews, one public meeting had been conducted as part of an environmental impact assessment (EIA) for the site. Interviewees generally noted that consultation processes were focussed on providing information rather than engaging the public in the decision-making process. Both a government and private sector participant observed that in Fiji community members were not traditionally proactive in engaging in decision processes until well after the decisions had been made, noting that ‘people in Fiji react when there’s a problem rather than go to consultation’ and that ‘we have a culture of accommodating – people wait and see first, and then react’.

The European Commission was the participant with the greatest effective power over the reuse decision process. This level of control arises from the European Commission’s determination of the ‘size of the envelope’ or the amount of funding available for the site. In practice, this only enabled rehabilitation (site stabilisation), rather than site remediation.

Table 2. Selected values and degree of power (reflected by level of shading) over the decision-making process.

| | | Health & amenity | Environment | Access to site to grow/collect food | Commercial potential | Fiji autonomy overuse of donor funds | TOR met for EU technical contractor | Low cost of waste transfer | Effective waste management throughout Fiji |
|-----------|--|------------------|-------------|-------------------------------------|----------------------|--------------------------------------|-------------------------------------|----------------------------|--|
| Concern | Squatters | Shaded | | Shaded | | | | | |
| | Developers | | | | Shaded | | | | |
| | Civil Society NGO | Shaded | | | | | | | |
| | University staff | Shaded | Shaded | | Shaded | | | Shaded | Shaded |
| Influence | Lami residents | Shaded | Shaded | | Shaded | | | Shaded | |
| | Suva residents | Shaded | Shaded | | Shaded | | | Shaded | |
| | Suva City Council | Shaded | Shaded | | | | | Shaded | |
| | Lami Town Council | Shaded | Shaded | | | | | Shaded | |
| Control | Dept of Environment | Shaded | Shaded | | | | Shaded | | Shaded |
| | Ministry of Finance | | | | | Shaded | Shaded | | |
| | EC technical contractor | Shaded | Shaded | | | | Shaded | | Shaded |
| | EC Pacific Delegation (as representing EC) | Shaded | Shaded | | | Shaded | Shaded | | |

Ultimately, only one redevelopment option was found feasible - that of a recreational park. This outcome, whilst arguably preferable to do-nothing, emerged as a result of the interactions between the formal and informal rules governing the decision situation under investigation. These interactions significantly limited the extent to which other values and options were considered. The key influential factor for Lami Dump's reuse was the amount of European Commission's funding (the envelope) for the site. This amount was sufficient only for rehabilitation and site stabilisation; it was far from sufficient for any remediation or geo-engineering works that would have enabled other redevelopment options involving construction, such as commercial or industrial uses.

Stakeholder engagement in the decision-making process is a key determinant of whose values and interests are reflected in the site reuse decision. Had there been flexibility in determining the amount of funding available, the outcome would still have been strongly shaped by a number of formal and informal rules influencing stakeholder engagement. These rules were not driven in any way by the European Union donor agency, as in the interests of country-led development the stated values of the EU delegation were for the Fijian national government to drive the rehabilitation process.

The relatively new *Environmental Management Act* requires environmental impact assessment to include stakeholder engagement, and in the case of Lami Dump at least one public meeting was held. Participants noted that there is increasing familiarisation with the processes of EIA, including community engagement. The enabling character of this formal rule was offset at least somewhat by the informal rule stemming from a general cultural reluctance, noted by several participants, to only engage in decision processes and express values after a decision has been announced. Engagement of civil society through nongovernmental organisations would be one avenue amongst several to better incorporate stakeholder values, however their role in the Lami dump reuse decision and other decision processes is limited by their own resources and whether an issue fits within the local thematic program priorities – again reflecting stated values.

Overall, the outcome of transforming Lami Dump into a recreational park can be seen as a far from negative outcome for the local communities, municipal councils, and national government agencies. Although the rules-in-use overall prevented exploration of held values and therefore other options to enhance value, there are certainly many institutions in place, stemming from legislation, which although emergent have the potential to enable a wider range of values to be represented and incorporated in future decision-making processes.

7. Policy implications

Three key insights emerge from our case study analysis:

- values held by stakeholders play a critical role in how they engage in the RDMP
- active engagement in the remediation process can change stakeholders' beliefs about what they value (e.g. means values can become ends values), and
- the institutions (i.e. formal rules and informal norms) governing the RDMP are key determinants of both whose values are incorporated (e.g. who is allowed a seat on the table?) and how held values are expressed and shaped (e.g. is there institutional opportunity for learning and information sharing?).

The empirical findings presented in this report point to a model of site remediation governance² that sets clear objectives and evaluative criteria within a legislative framework but also plays a facilitating role, promoting collective learning and supporting innovation.

The underpinning thought of VBLR is that remediation governance can foster and promote collective action in the RDMP. In every site contamination case, individual stakeholders face risks and uncertainties about the fate and impacts of possibly toxic chemicals. Based on their initial held values, within the boundaries set by the regulator, stakeholders will strive for better knowledge³ about the future outcome of the remediation process. These quests for knowledge, when properly facilitated by the governance model, can lead to better stakeholder participation: the individual (and/or representative) stakeholders participate in collective action in pursuit of jointly shared values and associated sustainability outcomes.

Drawing from Hajer (2011), we propose that value-based site remediation governance would comprise multiple elements, including clear government positioning, enabling regulation and enforceable legal instruments (institutional controls, requirements for stakeholder participation), economic/financial instruments, and monitoring and feedback fostering adaptive management.

Clear positioning: as the government is often a major participant in most RDMPs, a clear statement of government objectives is of critical importance. Policy makers often explicate the held values of their agencies (or national government) through visioning statements in key legislative documents, for example objects clauses in legislation.

Enabling regulation: to represent the public interest, it is imperative to always maintain a level of regulation of contaminated sites. Legally enforceable instruments are an essential part of the regulatory toolbox. Where such instruments can place a significant burden on problem owners, they can also provide opportunities for fostering value creation. For example, site management plan requirements could be extended to include explicit value statements, or even participatory processes for eliciting and developing shared values.

Financial instruments: Financial (or economic) instruments increase the attractiveness of clean up by means of incentives given to polluters. Incentives can be

² The establishment, promotion and enforcement of governing institutions for the resolution of site contamination problems.

³ Knowledge in the sense of justified true belief. This characterisation assumes as knowledge any belief that is true and justifiably believable.

negative (e.g. regulating levies) or positive (e.g. subsidies, negotiable rights). Financial instruments have, arguably from a purely economic perspective, been given ample attention in the context of brownfield remediation (Nijkamp et al. 2002; Hamilton 2007). They could be extended to foster value-based stakeholder engagement and interaction, for example by subsidising problem owners who proactively acknowledge value pluralism and voluntarily put mechanisms in place (e.g. stakeholder forums) to elicit the diversity of held values.

Monitoring and feedback: monitoring and feedback to the broader stakeholder community is an essential component of adaptive management and plays a role in both the actual clean up and long-term management of contaminated sites. With an increasing trend towards in-situ retention of contaminants, there is both a need and an opportunity for monitoring and feedback of stakeholder values. Are the values sought being achieved? Are the values that are sought changing, due to new scientific findings, changing community perspectives, or a structural change in the neighbouring communities? EPA Victoria is approaching this with its Outcomes Monitoring Research, which broadly assesses its effectiveness as a regulator. Embedding value-based monitoring and feedback in the relevant (enforceable) institutional controls would safeguard explicit consideration of values over the longer term and thereby enhances the potential for the RDMP to deliver enhanced value to both current stakeholders and future generations.

8. Conclusion

Within the context of decision-making for contaminated sites, our research has addressed the challenge of considering values. Pollard et al. (2004) articulated this challenge as follows:

'[We are] likely to have a complex range of values associated with a contaminated site. [There is] potential for inadvertent scientific and professional bias in risk assessments; [One challenge is the] consideration of broader stakeholder values with respect to remedial objectives. Early discussion of varied agendas is important'.

Our VBLR pilot has focused on theoretical and methodological aspects of eliciting stakeholder values. We have introduced a simple typology of values to distinguish between means and end values, and have used IAD to frame decision-making for contaminated land as an RDMP. This has allowed us to elicit, broadly speaking, values, outcomes and objectives in the context of the institutions (the formal and informal rules and norms) that govern the RDMP. Application of our theory and methods in two different socio-cultural situations (Australia and Fiji) has highlighted that the approach is highly flexible and has potential to be applied in a diverse array of jurisdictional settings.

One area for future research is the further testing the approach in RDMPs with different characteristics in terms of the action arena (types of action situations and types of participants).

A second area for further research is the notion of value-based site remediation governance. Section 7 of this report briefly outlined some elements of a value-based governance model. The current study focussed on concepts, methods and empirical data collection, and further research will be required to generate policy guidance tailored to different jurisdictions. This research challenge revolves around policy and law that can foster deliberation, learning and collective action. It has been summarised by Pollard et al. (2004):

'Deliberation is one way of uncovering people's values, but there are challenges as to how those values are incorporated into decision-making and how representative groups are, such that deliberative analysis of small groups views may need to be supplemented by surveys of a larger sample of the relevant population.'

9. References

- Ayres, RU & Kneese, A 1969, 'Production, consumption, and externalities', *American Economic Review*, vol. 59, pp. 282–297.
- Baker, CB, Smith, LM & Woodward, DS 2009, 'The sustainable remediation forum', *Remediation Journal*, vol. 19, pp. 135–139.
- Bardos, P 2012a, *RE: Remediation History*, pers. comm. to Plant, R.
- Bardos, P 2012b, *RE: Sustainable Remediation*, pers. comm. to Plant, R.
- Bardos, RP, Bone, BD, Boyle, R, Ellis, D, Evans, F, Harries, N & Smith, JWN 2011, 'Applying sustainable development principles to contaminated land management using the SuRF-UK framework', *Remediation Journal*, pp. 77–100.
- Basurto, X, Kingsley, G, McQueen, K, Smith, M & Weible, CM 2010, 'A systematic approach to institutional analysis: Applying Crawford and Ostrom's grammar', *Political Research Quarterly*, vol. 63, pp. 523–537.
- Ben-Ner, A & Putterman, L 1998, 'Values and institutions in economic analysis', in Ben-Ner, A & Putterman, L (eds.) *Economics, Values, and Organization*. Cambridge University Press.
- Blomquist, W & Deleon, P 2011, 'The design and promise of the institutional analysis and development framework', *The Policy Studies Journal*, vol. 39, p. 1.
- Bromley, DW 2004, 'Reconsidering environmental policy: Prescriptive consequentialism and volitional pragmatism', *Environmental and Resource Economics*, vol. 28, pp. 73–99.
- Bromley, DW. 2008, 'Volitional pragmatism', *Ecological Economics*, vol. 68, pp. 1–13.
- Brown, TC 1984, 'The concept of value in resource allocation', *Land Economics*, vol. 60, pp. 231–246.
- Byrne, D 2009, 'Case-based methods: Why we need them; what they are; how to do them' in Byrne, D & Ragin, CC (eds.) *The SAGE Handbook of Case-Based Methods*. London: SAGE Publications.
- Chong, J, Asker, S & Plant, R 2013, 'An institutional analysis of value creation from Lami Dump, Fiji', *Journal of Pacific Studies*, vol. 33, no. 1, pp. 96–135.
- CL:AIRE. 2010, 'A framework for assessing the sustainability of soil and groundwater remediation', <www.claire.co.uk/surfuk>.
- Superfund Green Remediation Workgroup 2010, *Superfund Green Remediation Strategy*, U.S. Environmental Protection Agency.
- Contaminated Land Management Act 1997* (NSW).
- Contaminated Sites Act 2003* (WA).
- Environmental Management Act 2005* (Fiji).
- Fowler, R 2007, 'Site contamination law and policy – Trends and challenges', Presented at Cleanup 07 Conference, Adelaide, June 24–28.

- Fowler, R 2008, 'The legal framework for management of contamination: International and Australian approaches compared', Presented at EcoForum Conference, Gold Coast, Queensland, 27–29 February.
- Hajer, M 2011, *The energetic society: In search of a governance philosophy for a clean economy*, The Hague: pbl Netherlands Environmental Assessment Agency.
- Hamilton, JT & Viscusi, WK 1999, 'How costly is 'clean'? An analysis of the benefits and costs of superfund site remediation', *Journal of Policy Analysis and Management*, vol. 18, pp. 2–27.
- Hamilton, SR 2007, *Brownfield remediation and associated financial instruments in the State of Washington*, Washington, University of Washington.
- Keeney, RL 1994, 'Creativity in decision-making with value-focused thinking', *Sloan Management Review*, vol. 35, pp. 33–41.
- Khan, FI, Husain, T & Hejazi, R 2004, 'An overview and analysis of site remediation technologies', *Journal of Environmental Management*, vol. 71, pp. 95–122.
- Najder, Z 1975, *Values and evaluations*, London, Clarendon Press.
- Nathanail, C 2006, 'Generic and site-specific criteria in assessment of human health risk from contaminated soil', *Soil Use and Management*, vol. 21, pp. 500–507.
- NICOLE 2010, 'NICOLE road map and guidance: Considering sustainability in remediation', Apeldoorn, the Netherlands: NICOLE, Deltares.
- Nijkamp, P, Rodenburg, CA & Wagtendonk, AJ 2002, 'Success factors for sustainable urban brownfield development A comparative case study approach to polluted sites', *Ecological Economics*, vol. 40, pp. 235–252.
- Norton, BG 2005, *Sustainability: A philosophy of adaptive ecosystem management*, Chicago, University of Chicago Press.
- O'Neill, J, Holland, A & Light, A 2008, *Environmental values*, London, Routledge/Taylor and Francis.
- Ostrom, E 2011, 'Background on the institutional analysis and development framework', *The Policy Studies Journal*, vol. 39, pp. 7–27.
- Ostrom, E, Gardner, R & Walker, J 1994. *Rules, games, and common pool resources*, Ann Arbor, Michigan, The University of Michigan Press.
- Ostrom, E, Gardner, R & Walker, J 2005, *Understanding Institutional Diversity*, Princeton.
- Paavola, J 2007, 'Institutions and environmental governance: a reconceptualization', *Ecological Economics*, vol. 63, pp. 93–103.
- Paddon, M & Herriman, J 2007, *City Development Strategy (CDS) for Ha Long City, Vietnam*, Sydney: Institute for Sustainable Futures, University of Technology, Sydney.
- Plant, R, Boydell, S, Prior, J, Chong, J & Lederwasch, A 2016, 'From liability to opportunity: an institutional approach towards value-based land remediation', *Environment and Planning C: Government and Policy*, Online First.

- Plant, R, Chong, J, Prior, J & Boydell, S 2010, 'Value-based land remediation: improved decision-making for contaminated land', Discussion Paper prepared for the CRC for Contamination Assessment and Remediation of the Environment (CRC CARE). Sydney: Institute for Sustainable Futures.
- Pollard, S 2005, 'Toxicity and risk: Context, principles and practice', *Journal of Risk Research*, vol. 8, pp. 453–453.
- Pollard, SJT, Brookes, A, Earl, N, Lowe, J, Kearney, T & Nathanail, CP 2004, 'Integrating decision tools for the sustainable management of land contamination', *Science of The Total Environment*, vol. 325, pp. 15–28.
- Prior, J 2016, 'The norms, rules and motivational values driving sustainable remediation of contaminated environments: A study of implementation', *Science of the Total Environment*, vol. 544, pp. 824–836.
- Protection of the Environment Operations Act 1997 (NSW)*
- Public Health Act 2011 (SA)*
- Schluter, A & Theesfeld, I 2010, 'The grammar of institutions: The challenge of distinguishing between strategies, norms, and rules', *Rationality and Society*, vol. 22, pp. 445–475.
- Siddiki, S, Weible, C, Basurto, X & Calanni, J 2011, 'Dissecting policy designs: An application of the institutional grammar tool', *The Policy Studies Journal*, vol. 39, pp. 79–103.
- Simon, JA 2010, 'Editor's perspective-green and sustainable remediation – fad or revolution?', *Remediation Journal*, vol. 21, pp. 1–8.
- Spash, CL 2008, 'Deliberative monetary valuation and the evidence for a new value theory', *Land Economics*, vol. 84, pp. 469–488.
- US Sustainable Remediation Forum 2009, 'Sustainable remediation white paper – Integrating sustainable principles, practices, and metrics into remediation projects', *Remediation Journal*, vol. 19, pp. 5–114.
- Yin, RK 2003, *Case study research design and methods (Third Edition)*, London, Sage Publications.

APPENDIX: Publications

Theoretical background

The following journal article presents the theoretical and methodological background to VBLR as well as a summary of the Australian and Fijian case studies:

- Plant, R, Boydell, S, Prior, J, Chong, J & Lederwasch, A 2016, 'From liability to opportunity: an institutional approach towards value-based land remediation', *Environment and Planning C: Government and Policy*, Online First.

Australian case studies

The following journal article details the findings from three Australian case studies:

- Prior, J 2016, 'The norms, rules and motivational values driving sustainable remediation of contaminated environments: A study of implementation', *Science of the Total Environment*, vol. 544, pp. 824–836.

Additional Information about the Australian VBLR case studies can also be found in:

- Prior, J, Lederwasch, A & Plant, R 2011, 'From liability to value: analysis of land remediation decision-making processes in two Australian cities', *State of Australian Cities National Conference 2011*, Melbourne, Australia.

International case study

The following journal article, detailing the Fiji VBLR case study, has been prepared and submitted to the *Journal of Pacific Studies*:

- Chong, J, Asker, S & Plant, R 2013, 'An institutional analysis of value creation from Lami Dump, Fiji', *Journal of Pacific Studies*, vol. 33, pp. 96–135.



CRC CARE

*A safer, cleaner
environmental future*

CRC CARE

ATC Building
University of Newcastle
Callaghan NSW 2308
Australia

Postal

C/- Newcastle University LPO
PO Box 18
Callaghan NSW 2308
Australia

Contact us

P: +61 2 4985 4941
E: admin@crccare.com

www.crccare.com



Australian Government
Department of Industry,
Innovation and Science

Business
Cooperative Research
Centres Programme