

# The Drain is just for Rain



**Light industrial SME environmental management for  
the protection of stormwater quality**

**Final report**

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# Chapter 1 Introduction

## 1.1 Environmental management

This research is located in environmental management, as a component of sustainable development. Clarke in Barrow (2006, p. 6) describes environmental management as;

“an approach that goes well beyond natural resource management to encompass the political and social as well as the natural environment ... it is concerned with questions of value and distribution, with the nature of regulatory mechanisms and with improved, geographic and intergenerational equality”.

The contribution of this research is in the examination of light industrial small and medium enterprise (SME) environmental risk management for the protection of stormwater quality. Stormwater is an important natural asset contributing to the health, flows and functions of groundwater, wetlands and waterways, which provide ecosystem services, such as drinking water and fisheries. Stormwater is described here as the water flowing over ground surfaces and in natural streams and drains, as a direct result of rainfall over a catchment, consisting of rainfall runoff, and any material (soluble or insoluble) mobilised in its path of flow (Department of Water, 2005).

Therefore, the specific environmental management being investigated is non-structural, or structural, best management practices designed to minimise the generation of excessive stormwater runoff and/or pollution of stormwater, at or near the source, and protect receiving environments (Department of Water, 2005). The term ‘environmental risk management’ is also used to describe the policies and procedures SMEs use to manage hazards and risks associated with the protection of stormwater quality.

## 1.2 Small and Medium Enterprises (SMEs)

Medium, small and micro enterprises are categories of business size based on employee numbers, and are collectively known as small and medium enterprises (SMEs). Australian medium, small and micro enterprises are defined as having less than 200, 20

and 5 employees respectively (Condon, 2004). In Australia, small and micro businesses are recorded as 96% of all businesses, 89% of which are micro businesses, collectively employing 47% of the non-agricultural private sector (Walker and Redmond, 2006). The broad characteristics of Australian SMEs are well described by Walker and Redmond (2006, p. 10):

- disparate group, not a collective;
- often works in isolation from industry groups and associations, unless required for registration;
- diverse activities covering every industry sector and type of business;
- owned and operated by sole traders, families, and businesses partners of all ages, genders and ethnic background;
- competent technicians in their field, with limited managerial experience;
- resource poor in time and finances;
- function tends to be operational rather than strategic, reactive rather than proactive; and
- views training as a cost rather than investment.

SMEs are generally very close to their community, often an integral part of the social and economic fabric in the communities in which they are located (Murillo and Loranzo, 2006; Vives, 2006). The close connection and integration with the community has obvious implications for sustainable development. Schaper (2002 p. 257) astutely observes that “although usually not given a great deal of attention, the role of small firms and the entrepreneurs who operate them is a key part of the sustainability debate”.

In Australia, light industrial SMEs are typically found in areas specifically zoned for light industrial activities, although they can be found within predominantly commercial and residential areas. Typical activities of SMEs discussed in this research are mechanical repair, vehicle smash repair, engineering and metal fabrication, metal finishing, machinery hire, chemical manufacture and blending, transport depots, concrete products, landscape supplies and printing.

The direct environmental impacts of SMEs are often diffuse and difficult to measure (Perez-Sanchez *et al.*, 2003; Hillary, 2000). Attempts have been made in the UK by Hillary (1995), KPMG (1997), Netregs (2002), Environment Agency (2003) and Smith and Kemp (1998) and reported in Williamson *et al.* (2006a). It was estimated that SMEs account for 70% of pollution, 60% of commercial waste and 80% of pollution incidents. SME impacts tend to be incidental and cumulative, and significant due the sheer number of businesses making small contributions to overall pollution loads in any given area (Williamson *et al.*, 2006).

In Western Australia, SME industrial premises have been identified as representing a significant cumulative risk to the health of water resources (Swan River Trust, 2000), and the improvement of practices that impact on stormwater and groundwater at these premises is a priority for water resource protection (Department of Water, 2005).

### **1.3 SERCUL SME project**

The South East Regional Centre for Urban Landcare is a not-for-profit, community managed and incorporated organisation. SERCUL functions as a community information, advice and advocacy centre for natural resource management. SERCUL receives funding from, and collaborates with, the government and private sectors for the management and delivery of programs related to natural resource management. SERCUL was formed in 2003 through the collaboration of 4 major community landcare groups and acts as a resource and administration centre for many smaller groups. SERCUL's operational area covers 13 southern metropolitan Perth Local Government areas south of the Swan River to Armadale and across to Rockingham.

The SERCUL SME project focused on the effect of Local Government Authority (LGA) Environmental Health Officer (EHO) contact with light industrial SMEs in a voluntary, education and support role for the protection of stormwater quality. The research was titled the 'SERCUL industrial survey and inspection project' and is referred to as the 'SERCUL SME project' in this document. SERCUL has collected survey and audit data regarding the environmental management awareness, perceptions and practices of SMEs in 8 light industrial areas, located in 5 Local Government areas

in southern Perth, Western Australia, from September 2005 to May 2007. The project was collaboratively implemented with the City of Canning, City of Armadale, City of Rockingham, City of Cockburn and the Town of Kwinana. A Local Government Environmental Health Officer was present with a SERCUL officer at each of the 445 SME interviews conducted.

The intent of the SERCUL SME project was to;

- stimulate local attention and debate in the field of light industrial SME environmental management;
- examine local SME barriers to environmental management;
- examine potential education interventions for the protection of stormwater quality; and,
- test the acceptance of Local Government when engaged with light industrial SMEs in environmental management.

## **1.4 Research objective and questions**

The overarching objective of this study is;

To examine the effect of voluntary contact with Local Government Environmental Health Officers on light industrial Small and Medium Enterprise environmental risk management for the protection of stormwater quality.

In addressing this objective, the research addresses three key questions:

- i. What are the barriers to improvement in SME environmental risk management?
- ii. Does education influence SME environmental risk management?
- iii. Do SMEs perceive Local Governments as suitable change agents for improving light industrial environmental risk management?

## **Chapter 2 Literature review**

### **2.1 Introduction**

This literature review focuses on the engagement of small and medium enterprises (SMEs) in environmental management. The review details the relatively recent research focus on SME environmental management, and the contrasting definitions of micro, small and medium sized enterprises.

SME responses to change and innovation, and the importance of social factors in the diffusion of environmental awareness and practices, are explored. The level of SME environmental awareness and involvement in environmental management is examined in reference to environmental management barriers and motivators. The effect of market forces, policy, legislation and regulation on environmental management are discussed, and contrasted, with voluntary SME participation in environmental programs.

The importance of social factors, such as trust and credibility, are examined in the context of suitable change agents to engage SMEs in environmental management. The review concludes by highlighting West Australian light industrial SME research and identifying the need for further research.

### **2.2 A developing focus on SME environmental management**

Environmental management in business has been a growing community, government and corporate concern for more than 40 years (Tilley, 1999). The dispersed impacts of pollution from businesses resulting from the contamination of soil, water and air can considerably reduce the quality of life in society at large (Barrow, 2006). The paradigm shift to the concept of sustainable development has encouraged questioning of the role of all stakeholders in society, from government and large multinational companies to individuals and small and medium business enterprises (Smith *et al.*, 2000).

The focus on pollution control and prevention has traditionally been targeted to large businesses (Wills, 2003). Large corporations have a business culture more readily accessed by government and are more vulnerable to community pressure through their desire to maintain a positive consumer image (Wills, 2003). Large corporations are also often large producers of waste and pollution, and therefore a natural target for pollution reduction (Vidovic and Khanna, 2007; Vives, 2006). Large corporations provide the opportunity to engage with a smaller number of stakeholders and potentially achieve a significant reduction in overall pollution levels (Wills, 2003). Large corporations also usually have considerable in-house environmental expertise, research and development budgets and staff allocated specifically to address environmental issues (Wills, 2003).

Whilst SMEs generally make considerably smaller individual contributions, their aggregate impact is immense; socially, environmentally and economically (Condon, 2004; Hobbs, 2000). SMEs are also presumed to be less waste and resource efficient, per unit of production compared with large corporations adding further significance to their overall impact. (Gunningham, 2002 in Williamson, 2006a; Hobbs, 2000)

### **2.3 Contrasting SME definitions**

The description of micro, small and medium enterprises varies considerably across continents. The micro category is defined as less than 5 employees in Australia (Walker and Redmond, 2006) and less than 10 in the UK and US (Mir, in press; Williamson *et al.*, 2006). While a small business in Australia is considered to have less than 20 employees (Walker and Redmond, 2006), a small business in Europe has less than 50 employees (Williamson *et al.*, 2006) and in North America less than 99 employees (Mir, in press). Medium sized businesses employ between 20 and 200 people in Australia (Condon, 2004), from 50 to 250 employees in the UK (Williamson *et al.*, 2006) and 100 to 499 employees in the US (Mir, in press). It is clear from these descriptions that a comparative analysis using business category, measured by employee numbers, cannot be easily performed between continents. Many international studies are likely to be examining a much larger size of business than those most prevalent in Australia, although Lynch-Wood and Williamson (2005 in Williamson *et al.*, 2006) suggest that the needs amongst these groups may not differ greatly.

## 2.4 SME environmental education and innovation

SMEs are a very disparate group, not really a group at all (Hillary, 2004). However, they are readily distinguishable from large corporations by their less formal structures and closer personal relationships with staff and customers (Vives, 2006). SMEs demonstrate a great variation within and amongst industry types, and business sizes, in their adoption of environmental management practices (O'Regan and Ghobadian, 2004).

Friedman and Miles (2001) identify the key motivator in many best environmental practice examples as the existence of a 'green champion', usually an individual or small group of individuals that drive and sustain the change of culture and practices within an organisation (Murillo and Lozano, 2006; Clarke, 2000; Petts *et al.*, 1999). Conversely Petts *et al.* (1999) also identify situations where the culture of the individual is surpassed by the culture of the organisation, rendering individual beliefs and intentions impotent. However, Burns (2007) comments SMEs often reflect the culture of the individual because the smaller the business, the more likely business practices will be driven by the personality of an individual. Friedman and Miles (2001) speculate that 'green champion' businesses can demonstrate the relevance, applicability and implementation of environmental practices, leading other more conservative business owner/managers to adopt these practices. There does not appear to be strong evidence in the reported literature for this to be the case (Stone, 2006).

The 'green champion' approach is suggestive that information, leading to increased awareness, is the mechanism for achieving behaviour change. This theory is challenged by McKenzie-Mohr and Smith (1999) who explain Community Based Social Marketing (CBSM). The adoption of change is described as being complicated by barriers, perceived and real, and the benefits of the current behaviour. CBSM has been shown to be effective in changing behaviour A to behaviour B, when the barriers to the desired behaviour, and benefits of the current activity, are well defined and barriers can be alleviated in an acceptable way to the subject(s) being encouraged to change. It may also be important to reduce the benefit that is obtained from the current practice, in

order to facilitate a change of practice (McKenzie-Mohr and Smith, 1999). Information alone often does little to alleviate specific barriers or address the undesirable benefits associated with the current practice. Mass media and extensive marketing campaigns are also considered ineffective in sustaining long-term behaviour change (McKenzie-Mohr and Smith, 1999). The CBSM approach highlights the importance of understanding the role of barriers in promoting behaviour change.

Everett Rogers' (1962) seminal work on the Diffusions of Innovations model provides some insight into how to approach SMEs as a group; by their reaction to innovation. Rogers describes the diffusion of innovations occurring within a social system, being regulated by social norms and the dominant values of each member of that social system. Five innovation adopter categories are described (Figure 5.1, p. 83), and their dominant values and relative proportion of members are included here; Innovators (venturesomeness, 2.5%), Early adopters (respectable, 13.5%), Early majority (deliberation, 34%), Late majority (scepticism, 34%) and Laggards (tradition, 16%). The theory identifies the influence of opinion leaders in each adopter category and the importance of interpersonal communication, such as face-to-face communication, in the diffusion of innovations (Rogers, 2003). The speed of the diffusion of an innovation can vary, but the adoption is considered to follow a bell shaped standard deviation curve according to the grouping described above. This theory lends some credibility to the 'green champion' approach described earlier, but is more sophisticated, taking into account the values of opinion leaders and change agents that appeal specifically to the 'followers' in each adopter category. The Diffusions of Innovations theory highlights the importance of social interaction in behaviour change. Like the Community Based Social Marketing technique, the Diffusion of Innovations theory also describes how the alleviation of barriers can speed the adoption of an innovation, although the barriers are likely to be more specific to adopter categories (Rogers, 2003).

Stone (2000) suggests that organisational theories such as organisational and industrial psychology and sociology, and change management theory can provide insights into why these barriers exist and how they can be overcome. Stone (2006) asserts that environmental management guides and advice have been technically driven and too simplistic, ignoring the role of human relationships and politics that effect an

organisations ability to change. This approach concurs with END (1999a) in Jayne (2001, p. 367) that “a lack of human rather than financial resources is the main obstacle stopping SMEs implementing environmental management systems”. Stone (2006) advocates a customised approach be taken according to the specific needs and culture of individual businesses. Williamson *et al.* (2006a), Peters and Turner (2004) and Petts *et al.* (1999) report SMEs as having a paternal or ‘hand holding’ attitude to environmental management, the expectation being that they will be individually guided and instructed on how to perform their environmental management or corporate social responsibilities. The importance of social factors in organisational and behaviour change highlights the need for an individualised and site-specific approach to SME environmental management.

## **2.5 Barriers and motivators**

The reporting of SME barriers, motivators and incentives to environmental management is a significant feature of many papers (Alemagi *et al.*, 2006; Studer *et al.*, 2006; Williamson *et al.*, 2006; Vives, 2006; Simpson *et al.*, 2004; Tencati *et al.*, 2004; Hillary, 2004; Tilley, 1999; Petts *et al.*, 1998). A considerable range of barriers are reported in the literature, but there are many common elements. Lack of information, time, expertise, regulations, consumer demand, and finance are commonly reported SME barriers to environmental management (Studer *et al.*, 2006; Williamson *et al.*, 2006; Hitchens *et al.*, 2003; Pimenova *et al.*, 2004; Hillary, 2004; Gerstenfeld and Roberts, 2000).

A lack of understanding for a need for change is also reported as a significant barrier. Hitchens *et al.* (2003, p. 56) considers that “firms need more expert help than they seek or realise they need, to adopt environmental initiatives ... poor environmental performance is not the outcome of a negative attitude to the environment”. The positive attitude of SMEs towards environmental management, and concern for the environment, is widely reported in the literature (Williamson, 2006a; Castka *et al.*, 2004; Hitchens *et al.*, 2003; Schaper, 2002a). Many SMEs simply don’t realise a need for environmental management in their businesses, and generally cannot recognise their environmental

impacts (Williamson *et al.*, 2006a; Vives, 2006; Tilley, 1999). Vives (2006, p. 47) observes that “this is supported by other results that indicate that the lack of activity is mostly due to a lack of knowledge. Once a firm is aware or it is bound by regulations, it will tend to have a high degree of involvement”. Interestingly site inspections are a rare feature in the research literature. Given the acknowledged lack of SME awareness of environmental impacts, onsite inspections appear important to assist in the identification of site-specific environmental hazards and risks.

A lack of awareness of impacts provides some explanation for the poor adoption of environmental management tools by SMEs. The uptake of pollution prevention measures (Schaper, 2002), Cleaner Production (Van Berkel, 2002), Eco-efficiency (Van Berkel, 2004; Hitchens *et al.*, 2003), and Environmental Management Systems such as the Eco-Management and Audit Scheme and ISO14000 series, is generally reported as being poor and at low levels (Alemagi *et al.*, 2006; Studer *et al.*, 2006; Hillary, 2004; Williams *et al.*, 2000).

The reporting of primary motivators is more varied. Regulation is reported as a primary motivator by several researchers (Williamson *et al.*, 2006; Revell and Blackburn, 2004; Hillary, 2004; Hitchens *et al.*, 2003). Market forces such as cost savings (Williamson *et al.*, 2006a), supply chain pressure (Williams *et al.*, 2000) and product differentiation (Arora and Carson, 1995) are reported, and less frequently ethical considerations such as environmental protection (Alemagi *et al.*, 2006; Castka *et al.*, 2004) and staff welfare (Spence and Loranzo, 2000). The market forces, policy and legislation, and voluntary participation motivators will be examined in the following sections.

## **2.6 Market forces**

Maintenance of a positive reputation or good public image is reported as a motivator for environmental management (Vidovic and Khanna, 2007). However, public image may be more important to large companies with large and dispersed customer bases, as Williamson *et al.* (2006) report that SMEs are not necessarily reputation driven. Image may be more important to SMEs that are easily identified in their local community, or

those directly engaged with the public through retail services, however, Williamson *et al.* (2006, p. 326) quote Graafland and Smid (2004) reporting that “too much faith in self-enforcing working of the reputation mechanism is unwarranted for these companies”.

Accreditation in an environmental standard allows businesses to verify to customers that they meet a published environmental criteria. However, the uptake of environmental accreditations by SMEs has been very low (Hillary, 2004). Ironically, accreditations can function as a market-based driver for SME environmental management, when customers can both recognise the value of an accreditation, logo, etc. and decide to purchase preferentially for those products as a result of the accreditation. Therefore, a very significant role of environmental accreditation schemes is the marketing and promotion of the value of the accreditation to the customer, more so than to the potential businesses to be accredited, who are likely to become certified when it presents a clear competitive advantage (Gerrans and Hutchison, 2000). Hillary (2004, p. 568) explains that;

“customers are a key driver for the adoption of [Environmental Management Systems] EMSs and have influence far beyond any of the other stakeholders ... Paradoxically, customers also show a lack of interest in, or are satisfied with SMEs current environmental performance”.

This suggests that the environmental awareness, or lack thereof, amongst SMEs is a simple reflection of society in general. There are indications that market drivers are potentially crucial in sustaining long term improvements in SME environmental management (Hillary, 2004). This highlights a need to assess the SME perception of market demand for environmental management and their perception of business benefits resulting from involvement in environmental management.

## **2.7 Policy, legislation and regulation**

Legislation is driven by policy, and the type of policy and regulation mix has a substantial effect on the achievement of the desired outcome (Gunningham *et al.*, 1998).

Legislative compliance is commonly reported as a primary motivator for SME environmental management (Williamson *et al.*, 2006; Hillary 2004; Pimenova *et al.*, 2004; Petts *et al.*, 1999; Tilley 1999). Gunningham *et al.* (1998) believe that it is important to use a broad range of policy tools. They believe a combination of policy instruments builds on the strengths of some, and compensates for the weaknesses of others. This is especially relevant in light of a finding by Hitchens *et al.* (2003) that environmental regulation does not appear to adversely affect SME competitiveness.

However, there are important considerations for the advocates of legislation, regulation and enforcement as the most significant drivers for environmental management improvement (Revell and Blackburn, 2004). Whilst legislative compliance may be a technique for 'forcing' environmental innovation upon SMEs, it may not encourage, or may in fact discourage, participation in 'beyond compliance' sustainability initiatives (Van Berkel, 2004). Williamson *et al.* (2006, p. 318) argue that SMEs will not exceed regulatory standards as;

“a consequence of the free-market decision-making frames used by manufacturing SMEs and the interconnected free-market pressures affecting their operating environment. These frames and pressures encourage a focus on profit-ability to the detriment of social and environmental practices”.

If regulation were viewed as the only tool to correct market failures in environmental protection, this could have serious implications for the uptake of environmental management components of sustainable development such as Cleaner Production. Van Berkel (2004, p. 289) states that;

“the broad implication of technology diffusion theory for promotion of Cleaner Production is that Cleaner Production and Eco-efficiency depend on companies becoming proactive i.e. companies seeking improvements on their own as part of their competitive strategies rather than in response to specific regulations”.

The importance of establishing a regulated and enforced 'level playing field' is acknowledged as being essential to support existing legislatively compliant businesses

and maintain their competitiveness (Petts, 2000). However, an undue emphasis on legislative compliance may diminish participation in ‘beyond compliance’ sustainability initiatives. Williamson *et al.* (2006, p. 326) cites Edwards *et al.* (2004), Patton and Worthington (2003) and Petts *et al.* (1999) whose studies indicate that “regulation does not induce behaviour that goes beyond compliance in the form of modernisation and cultural change”.

Whilst the market and regulations are seen as primary drivers for environmental management by some researchers, Petts *et al.* (1999) believe that neither the market nor regulations are likely to be sufficient for protection of the environment.

Gunningham *et al.* (1998) suggest a two track regulatory system:

- one for best practice performers encouraged and facilitated in going ‘beyond compliance’ with existing regulation; and
- another with the Laggards, who are brought to existing legal standards by a variety of other strategies.

The suggestion by Gunningham *et al.* (1998) for a two track regulatory system highlights the need to target education interventions appropriately for each of these groups. Rogers’ (2003) Diffusions of Innovations theory suggests that targeting of environmental programs could be further divided according to adopter category (Section 2.4).

## **2.8 Voluntary participation**

A significant focus of the SME environmental management literature is the level and effect of engagement with voluntary initiatives (Murillo and Lozano, 2006; Tencati *et al.*, 2004; Peters and Turner, 2004; Annandale *et al.*, 2004). Gunningham *et al.* (1998, p. 432) suggest that “volunteerism will compliment most forms of command and control regulation, particularly where levels of environmental performance ‘beyond compliance’ are desired”. This view is supported by Peters and Turner (2004) and Arora and Carson (1996).

A wide variety of reasons are given by SMEs for participation in voluntary initiatives.

Peters and Turner (2004 p. 453) describe some strengths as:

- flexibility in reaction to challenges, possibly in preparation for potential stricter regulations;
- potential to achieve improvements ‘beyond compliance’;
- potential to increase positive dialogue, and image, with government, NGO’s and consumers; and
- improved competitive edge.

Peters and Turner (2004) list potential weaknesses as:

- the participants need to feel sufficient trust to participate; and
- the participants recognising sufficient benefits to participate.

Peters and Turner (2004) also recognise the potential for participants to gain a ‘free ride’ by participating for the recognition, whilst not attempting any significant outcomes. One study, focussed on large businesses in the USA reported little positive effect on environmental management as a result of participation within a voluntary ‘beyond compliance’ environmental program (Vidovic and Khanna, 2007). Voluntary participation does imply that the initiative can be simply avoided, without an enforced consequence. Some potential participants may also feel that engagement in a voluntary program may bring unwanted attention to potentially non-compliant business activities.

However, voluntary engagement offers the potential to achieve beyond compliance environmental management, with several benefits possible for participants. Trust is a crucial element for both educators and businesses to engage in voluntary environmental programs meaningfully.

## 2.9 Engaging SMEs in environmental management

The description of Australian SMEs given in the Introduction (Section 1.2) is consistent with the findings of researchers in many parts of the world (Murillo and Loranzo, 2006; Vives, 2006; Williamson *et al.*, 2006; Tencati *et al.*, 2004; Spence and Lozano, 2000; Tilley, 1999). This provides an indication that successful engagement strategies reported in other continents may be readily applicable to the Australian context and vice versa.

Engaging SMEs, particularly small and micro enterprises, in any form of environmental management can be notoriously difficult (Condon, 2004; Peters and Turner, 2004; Friedman and Miles, 2001; Spence and Lozano, 2000). Friedman and Miles (2001) report that SMEs are unsensitised to their environmental impacts and that any initiatives need to offer immediate and tangible benefits. This suggests that at a minimum, SMEs need to perceive immediate value in participating in an environmental management program to justify time away from 'core' business activities.

The involvement of micro businesses in SME environmental management programs is not as common as the involvement of small and medium enterprises (Mir, in press). Petts *et al.* (1999, p. 18) concluded that "the 'very small' or micro category of fewer than ten employees was not included because of the known difficulties in involving them in research, the smaller percentage of potentially polluting industries in this group, and the potential difficulty in gaining non-management responses". This view is not supported in Mir (in press) who cites Mir (2002) and NetRegs (2003), stating that the local or aggregate environmental effect of micro enterprises can be severe.

Engaging SMEs, particularly micro enterprises, in environmental management will require communicating to potential participants that there are immediately recognisable benefits in participation.

## 2.10 Suitable change agents

Who is best positioned to engage with SMEs in environmental management? Rogers (2003, p. 27) identifies the role of the change agent as “an individual who influences clients’ innovation-decisions in a direction deemed desirable by a change agency”. Previous research provides some guideposts to potentially useful characteristics and techniques of a change agent. Trust is identified as integral in the way SMEs do business (Murillo and Lozano, 2006; Peters and Turner, 2004; Tilley, 1999) and Rogers (2003) identifies social rather than technical factors as likely to be primary motivators for accepting advice and making change. Vives (2006, p. 49) advocates an approach that is “informal, gradual of the ‘one thing at time’ type, and almost unnoticeable” and believes that the preferred method for involving SMEs should be persuasion through encouragement and support. Jayne (2001) assumes that university researchers generate more trust amongst SMEs, presumably having less commercial or regulatory driven motives than business people or government officials.

The use of particular language can be a barrier. Murillo and Lozano (2006) identify the inappropriate communication of concepts leading to the terminology itself becoming a significant barrier to engagement. Williams *et al.* (2000) stress the need to keep environmental management processes and paperwork simplified for small businesses, and Castka *et al.* (2004) identified either an aversion to paperwork or a lack of perceived need to document environmental management amongst SMEs.

What type of change agents have these characteristics? Tilley (1999, p. 247) recommends delivery by “an affordable independent trusted expert who can interpret individual needs”. However, Hitchens *et al.* (2003) reported a poor awareness of client services and infrequent use of consultants, and Hillary (2004) reported poor advice received from consultants as an SME barrier. Clarke (2004) suggested trade associations were less effective ‘change agents’ than portrayed.

Local Government were the most consulted source for environmental information in Pimenova and van der Vorst’s (2004) study of SME environmental performance. Local Government were also recommended as preferred for SME engagement in Peters and

Turner (2004), Pedersen (2000) and Leeuw *et al.* (1999). In a recent Perth light industrial SME survey reported by Walker and Redmond (2006), SMEs showed a strong preference for Local Government as the level of government responsible for management of environmental issues in their industrial estate.

## **2.11 Light industrial SME environmental management research in Western Australia**

Previous light industrial SME research projects in the Perth metropolitan area have established poor environmental practices (Walker *et al.*, 2007; Walker and Redmond, 2006; Green Stamp MTA WA, 2004; Van Berkel, 2004; 2002; City of Armadale, 2002; Swan River Trust, 2000). The management of wastewater, and contamination of stormwater, has been highlighted as a particular area of concern (Department of Water, 2005; Swan River Trust, 2000).

## **2.12 Summary**

In summary, the literature reviewed identifies a need to improve SME environmental management, particularly stormwater protection (Department of Water, 2005; Gunningham and Sinclair, 2002a; Swan River Trust, 2000). However, there is no readily identifiable method to facilitate high quality SME environmental management. Enforcing legal compliance may diminish SME aspirations beyond basic environmental management (Patton and Worthington, 2004; Van Berkel, 2004) and voluntary participation may not induce a level of participation that significantly improves SME environmental management (Vidovic and Khanna, 2007; Annandale *et al.*, 2004).

To encourage a level of SME environmental management that is progressing towards sustainable development, voluntary participation is the preferred method (Van Berkel, 2004). Gaining voluntary SME involvement in an environmental management program is likely to require considerable effort to obtain a high participation rate (Friedman and Miles, 2001). A predominantly face-to-face delivery of the program could encourage SME participation by:

- recognising the importance of social interaction in the diffusion of new ideas;
- recognising the diversity of SME activities and offering site-specific advice;
- assisting in the identification of environmental risks and hazards by inspection;
- the educator completing documentation;
- precisely estimating the requirements for SME time; and
- increasing the likelihood of contact with micro enterprises.

Stone (2006) and Rogers (2003) suggest that social factors, particularly trust and credibility are important for a change agent to be effective. Local Governments are identified as potential change agents for engaging light industrial SMEs in environmental management (Walker and Redmond, 2006; Pimenova and van der Vorst, 2004; Peters and Turner, 2004; Pedersen, 2000) and their effectiveness in this role warrants further research. A relatively informal interview structure (Vives, 2006) with a minimum of paperwork requirements may also increase SME participation (Williams *et al.*, 2000).

The research literature indicates the following issues are important to analyse in relation to SME environmental risk management:

- identification of environmental awareness and the influence on environmental behaviour (Mir, in press); and
- identification of significant local SME barriers to environmental management (McKenzie-Mohr and Smith, 1999), including the influence of market drivers which could hamper meaningful participation in either compliance based or voluntary initiatives (Williamson *et al.*, 2006; Hillary, 2004);
- identification of communication methods and environmental information sources that may promote environmental behaviour change (Roy and Therin, in press).

The following chapter will detail how the SERCUL SME project addressed the challenges of engaging SMEs in research, and outlines the methodological approach SERCUL used to collect data regarding light industrial SME awareness, perceptions and practices for the protection of stormwater quality.

## **Chapter 3      Methodology**

### **3.1      Introduction**

The SERCUL SME project was designed to identify factors that would assist in understanding, and improving, light industrial SME environmental management, particularly the protection of stormwater quality.

This project was specifically designed to illicit a high response rate from the small and micro enterprise light industrial SME category, a group that are known to be difficult to involve in research (Peters and Turner, 2004; Condon, 2004).

A mixed methodology (Creswell, 2003) was utilised in an interview and survey format to collect data regarding SME awareness of, and practices relating to, the protection of stormwater quality. Different forms of printed information, and a stencilled prompt, were tested for their effectiveness at promoting SME stormwater protection. The challenges of obtaining accurate and reliable data using the chosen methods are also discussed.

The chapter concludes with a description of the use of data in this analysis, and the identification of limitations to the research design.

### **3.2      Epistemology and theoretical framework**

The SERCUL SME project is considered to be located in the constructivist epistemology (Crotty, 1998), acknowledging that the observer is unavoidably a part of the social construction (Moisander and Valtonen, 2006; Hughes, 1990), and that knowledge is a socially constructed experience, arising from interaction with participants (Stake, 2000). The theoretical framework considered to reflect this form of research is known as critical theory (May, 1997).

## 3.3 Research design

### 3.3.1 Methodology

A mixed methodology was used to engage with SME participants (Creswell, 2003). The attraction of mixed methods research is being able to utilise the strengths and minimise the weaknesses of single method research studies, and is used extensively in SME studies (Vives, 2006; Simpson *et al.*, 2004; Hitchens *et al.*, 2003; Patton and Worthington, 2003; Williams *et al.*, 2000; Spence and Lozano, 2000). The intention was to maximise the participation rate of small and micro enterprises; a group that are known to be difficult to involve in research (Peters and Turner, 2004; Condon, 2004).

A survey method was chosen to record responses to standard questions from a sample engaged in a diverse range of industrial activities. The use of case studies, in this instance, would not have provided sufficient information regarding the diversity of SME owner/manager beliefs and practices, and information regarding barriers to environmental management, essential for environmental education planning (McKenzie-Mohr and Smith, 1999).

Postal and telephone surveys were not used because SME response rates had been recorded at 30% and lower (Condon, 2004; Peters and Turner, 2004; O'Regan, 2004; Pattern, 2003). A concern with a low response rate is the potential for recording a bias towards positive environmental behaviour, as a consequence of only those with an interest in the topic of research likely to participate (Gunningham *et al.*, 2003; May, 1997).

While postal and telephone survey methods are considered to have the advantage of being less expensive, and providing relative anonymity for participants (Rea and Parker, 1997; Moser and Kalton, 1971), a face-to-face approach was chosen as the method most likely to deliver a high response rate (Peters and Turner, 2004; Rea and Parker, 1997).

### **3.3.1.1 Semi-structured interviews**

On-site surveys and inspections provided a means to address the diversity of needs and activities amongst the SME 'group'. The survey and audit used by SERCUL (Appendix A) served as a guide around which conversation was focussed, but not limited to, therefore the interview type was semi-structured (Hauge, 1993; May, 1997). This allowed the interviewer to seek elaboration and/or clarification on responses given, when required, but care was taken not to lead participants to answers through clarification (Neuman, 2000). The audits and inspections were observations of current perceptions and practice, not compliance checks.

The interview comprised of two parts: a survey and an audit. The survey was conducted as an interview whereas the audit was both interview and inspection. The initial survey differed from the evaluation survey, while the audit remained the same in both the initial and evaluation stages.

Face-to-face interviews at the SME premises allowed for participant responses, regarding their environmental management practices, to be confirmed by inspection. Differences in the understanding of standards, between auditor and participant, could also be resolved by inspection. Inspections were a rare feature in the SME environmental management research literature reviewed. However, they are considered particularly important in The SME group who are regularly unable to identify environmental hazards, risks and impacts in their workplace (Vives, 2006; Hitchens *et al.*, 2003; Tilley, 1999).

### **3.3.1.2 Survey**

The use of surveys containing closed and specific questions allowed for a precise estimation of time and resources required by participants and researchers. A minimal time commitment from SMEs was identified as being important for accessing small and micro businesses (Gerstenfeld and Roberts, 2000). The survey consisted of attitudinal questions (what participants feel or think) and the audit contained mostly factual questions (concerning the material situation) (May, 1997). The construct and face validity (Sirkin, 1999) of the audit is assumed from the Swan Canning Industry Survey,

developed by a committee of 'experts' in the field (Swan River Trust, 2000), on which the audit is based. The content validity (Sirkin, 1999) was established by constructing a criteria for each survey and audit question (Appendix B). The reliability of the survey and audit is related to familiarity with the criteria for each question. The criteria directed judgements made by the SERCUL and LGA officers.

In the field there are several potential errors in recording responses during, and across, interviews. Potential errors that are particularly relevant to the SERCUL SME project are contrast, proximity, constant and halo errors (May, 1997). These errors were controlled by having the same SERCUL officer record all data, and by the awareness, co-ordination, professionalism and experience of the SERCUL and LGA staff (May, 1997)<sup>1</sup>.

The majority of the survey and audit responses were collected as nominal data (yes/no/don't know/not applicable), being judgements made by the SME participant, SERCUL officer or LGA Environmental Health Officer. Most SME participant judgements were confirmed by inspection. SERCUL and LGA officer judgements conformed to a standardised and agreed criteria (Appendix B). The survey also collected profile data (sample group characteristics) and ordinal data (rankings) using unipolar, numerical attitude rating scales (Brace, 2004), similar to Likert scales, for recording the barriers and preferences of SME participants.

The survey and audit were recorded electronically on a laptop computer and were linked to a scoring matrix, embedded in the audit form, that automatically calculated individual results (Appendix C).

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<sup>1</sup> May (1997) quotes (Gearing and Dant, 1990 p.152) saying that "there is a tension in the biographical interview between, on the one hand, the need of the interviewer to establish and maintain a rapport and a trusting relationship in which the interviewee will disclose significant personal information and, on the other, the practical demands and constraints of any research enquiry ... what transpires is inevitably something of a balancing act".

### **3.3.2 Survey instrument**

The survey component of the interview was entirely developed by SERCUL. The initial survey collected data regarding:

- (i) a test of awareness of stormwater contaminants, and legal obligations regarding the protection of stormwater quality;
- (ii) potential barriers to environmental management; and
- (iii) preferred environmental information and communication sources.

The evaluation survey collected data regarding the participants:

- (i) perception of the most useful environmental information sources used in the SERCUL project;
- (ii) perception of environmental management improvement since the initial audit, and
- (iii) perception of LGA involvement in environmental management.

#### **3.3.2.1 Stormwater awareness survey**

Participants were provided a list of eight potential stormwater contaminants (Appendix B) and asked to identify which they believed to be contaminants. Participants were also asked three questions regarding the:

- (i) treatment of stormwater;
- (ii) legal obligations for protection of stormwater; and
- (iii) the level of perceived stormwater quality protection undertaken in their business.

Each question relating to a potential stormwater contaminant attracted one point for an incorrect answer. Two points were scored for incorrectly identifying stormwater being centrally treated (like sewerage), and five points were allocated for incorrectly answering that there was no legal obligation to protect stormwater. Therefore, an assumption is made that the higher the audit score, the higher the risk of stormwater contamination. The question regarding the level of perceived stormwater protection being undertaken in the business was not scored. The questions were weighted according to the perceived level of risk. For example, being unaware that there was a legal obligation to protect stormwater quality automatically excluded a low risk result. The scores from each question were summed to provide a Stormwater Awareness

Rating (SAR) from which a category of low (0-4 points), medium (5-7 points) or high risk (8-15 points) to contaminate stormwater was assigned.

### **3.3.2.2 Attitude rating scales**

The attitude rating scale contained six divisions without a neutral (or undecided) category. This technique is used when a large number of undecided or middle of the scale responses are anticipated, and an even numbered scale requires that participants choose between alternatives (Rea and Parker, 2005). Participants were informed that answering 4, 5 or 6 represented an increasingly positive response to the question asked, whereas answering 3, 2 or 1 represented an increasingly negative response.

A standard list of barriers, and a standard list of preferences were presented and the responses recorded to the specific statements provided. The standard lists allowed an accurate estimation of time required to complete the survey. However, this method then frames the context of possible responses, and can preclude thought about barriers or preferences not presented on the standard lists (van der Ven, 1980). Therefore the content validity is limited because the scales do not measure all the generally accepted aspects of the concepts they are recording (Sirkin, 1999). However, Hague (1993) states that the bias in scales is usually only minor and has much less effect on results than the potential errors in interviewing.

### **3.3.2.3 Barriers to environmental management**

In the initial survey, a standard list of nine barriers to environmental management was compiled from the most common barriers indicated in four previous Australian SME studies (Green Stamp MTA WA, 2004; Van Berkel, 2004; 2002; de Leeuw *et al.*, 1999) This list is presented in Appendix B. An option was provided to add other barriers not presented in the standard list.

#### **3.3.2.4 Preferred environmental information and communication sources**

In the initial survey, a standard list of nine environmental information and communication sources was compiled from commonly used sources. This list is presented in Appendix B. An option was provided to add other preferences not presented in the standard list.

#### **3.3.2.5 Most useful sources of environmental information**

In the evaluation survey, participants were asked to indicate, from a list, which environmental information sources they perceived to be most useful, using the six division attitude rating scale (Section 3.3.2.2). Participants were also asked if they believed that LGA audits improved their environmental management, and if the project had contributed to the development of a positive relationship with their local Council. A complete list of questions is presented in Appendix B.

### **3.3.3 Environmental risk management audit and inspection**

An audit form was adapted from the paper-based Swan Canning Industry Survey (Swan River Trust, 2000), condensed and produced in electronic format. The audit uses an environmental risk management format due to the non-prescriptive nature of the Environmental Protection (Unauthorised Discharge) Regulations (2004); the legislation most relevant to the protection of stormwater quality in light industrial areas in Western Australia.

The audit assessed 15 categories of environmental policies and practices considered important in the protection of stormwater quality. Each category was scored and weighted according to a predetermined level of risk, derived from the Swan Canning Industry Survey (Swan River Trust, 2000) and are presented in Appendix C. The summed score for each participant's audit represented the Management and Infrastructure Risk Rating (MRR). There is an assumption that a higher score indicates a higher risk to contaminate stormwater. For example, the absence of an environmental policy was considered a low immediate risk to the contamination of stormwater, and scores a single point. Whereas, storage of liquids outdoors in an uncovered and

unbunded area, or inadequate wastewater treatment, were considered high risks, and each attracted four points. The questions and scoring matrix were trialled in a pilot and adapted according to on-ground experience. Low (0-10 points), medium (11-20 points) and high risk (21- 46 points) categories indicate the overall potential risk of stormwater contamination, and are arbitrarily divisions of the range of MRR scores. Low risk generally reflects an absence of environmental management documentation, whereas medium risk, and particularly high risk, usually indicates practices leading to the contamination of stormwater. The scoring system is subjective, but reflects the experience and professional judgement acquired through several hundred audits and inspections.

During the audit, an inspection was made of the entire premises and grounds by the EHO. Recommendations and advice for improving environmental management were given by the EHO, and SERCUL officer, following the audit and inspection.

For the purpose of analysis, questions related to recycling, and waste to landfill minimisation, were removed from the scoring matrix, and the MRR scores were recalculated for each audit. This was considered to improve the content validity of the audit in relation to stormwater quality protection. The initial SERCUL audit totalled a maximum of 55 points, the amended audit for this analysis totals 46 points (Appendix C).

### **3.3.4 Environmental Health Officers**

Local Government representatives have previously been identified by SMEs as acceptable sources of information, and/or responsible for local environmental regulation (Walker and Redmond, 2006; Pimenova and van der Vorst, 2004; Peters and Turner, 2004; Pedersen, 2000; de Leeuw *et al.*, 1999). Environmental Health Officers (EHOs) were chosen by SERCUL as potential environmental management regulators, given their professional training in regulating aspects of the WA Health Act (1911), and prior involvement in SME environmental management regulation (Swan River Trust, 2000). Some of the participating EHOs were already knowledgeable in environmental education and legislation, and others were trained prior to, and during, the audits and

inspections. The judgements of EHOs regarding the acceptability, or otherwise, of particular environmental practices were standardised through conversation, and common agreement, prior to any fieldwork, according to the audit criteria (Appendix B). A total of six EHOs from the five LGAs were involved in the SERCUL SME project. In one LGA there was a different EHO for the evaluation surveys and audits, in the four other LGAs the same EHO was present at the initial and evaluation surveys and audits.

### **3.3.5 Education interventions**

Education is a broad concept and can encompass many different forms of information, communication, activities and interventions. The following education interventions were used in the SERCUL SME project and employed with all participants:

- an environmental risk management survey and audit (face-to-face discussion); and
- a generic light industrial SME environmental management pack (printed information).

The following educational interventions were optional for all participants:

- paint stencilled stormwater drain inlets, on the premises (prompt); and
- personalised industry-specific information packs, delivered by post (printed information).

The intention was to test the effect on SME environmental risk management of one, and combinations, of the education interventions. The acceptance of the survey, audit and inspection was voluntary and the principal was continued with the education interventions. All interventions were offered to all participants who could choose any, none or all of the interventions. This method allowed collection of data regarding the voluntary acceptance rate of the various interventions, and their subsequent effects.

#### **3.3.5.1 SME environmental management information pack**

Hard cover, generic light industrial SME environmental information packs were supplied to all participants, at the time of the initial audit, containing:

- an environmental management checklist;

- environmental management fact sheets and contact numbers;
- a waste and recycle ready reference;
- an environmental services directory; and
- an environmental improvement plan template.

### **3.3.5.2 Drain stencilling**

Participants were given the option of an on-site prompt; a type of behavioural reminder (McKenzie-Mohr, 1999). Stormwater drain inlets, located on their premises, could be paint stencilled with a frog logo and the message ‘clean drains, river gains’, or a fish logo and the message ‘the drain is just for rain’. The choice of the logo and message used was dependant on the drain stencil previously adopted by the LGA for use in residential areas.

Drain stencilling was not applied at the time of the survey and audit, but in the weeks and months following the initial survey and audit.

### **3.3.5.3 Personalised industry-specific information pack**

Participants were given the option of receiving further personalised industry-specific environmental management information. This information was tailored to the industrial activity and specific to the expressed needs of each business. The information was posted out in the weeks and months following the initial survey and audit.

### **3.3.6 Sample population**

There are an estimated 185,000 SMEs in Western Australia (PrintNet, 2007). The proportion of those that are light industrial SMEs is not accurately known. There is no up-to-date database describing the number, type or specific location of light industrial SME premises in the Perth metropolitan area. Businesses of this type generally appear in areas specifically zoned for light industrial activities. The sample size required to satisfy the condition for a randomly chosen, normally distributed population (May, 1997), was considered too numerous for SERCUL resources. Therefore sample

selection and size was primarily limited by SERCUL and LGA resources, and secondly by SME participation.

The sampling procedure employed was a non-probability purposeful sample (Frankfort-Nachmais and Nachmais 1992), where a normal distribution cannot be assumed. Therefore potential participants were not chosen at random, and sampling was concentrated in areas that were likely to have a high proportion of small and micro enterprises. This technique can be used to gain an preliminary understanding of some of the key issues in the research area (Rea and Parker, 2005).

The participating LGAs (Section 1.3) chose the light industrial areas for sampling without a specified criteria. In one LGA, sampling was also influenced by the presence of an SME environmental management program being conducted by the Swan Catchment Council, assessing the environmental management practices of automotive businesses. To avoid repetition for the businesses involved, the sampling of this particular business type was excluded, in this LGA. Therefore assumptions of the business types represented across the LGA light industrial areas surveyed cannot be reliably made, and the sample cannot be considered entirely representative (Robson, 1993).

#### **3.3.6.1 Recruitment process**

Participants for the SERCUL SME project were identified by a SERCUL officer, using a face-to-face, door-to-door approach, to determine if businesses met the criteria of:

- (i) generating wastewater from industrial activities; and/or
- (ii) storing liquids and/or chemicals.

Potential participants were provided with an official letter from the participating LGA outlining the aims of the SERCUL SME project, the potential benefits of being involved, the organisations involved, and the types of information that would be requested. Contact details were collected from those businesses that met the criteria. One to two weeks following the initial contact, formal permission was sought from

potential participants by telephone, requesting an appointment for a survey, audit and inspection of their premise.

Recruitment for the evaluation survey mirrored recruitment for the initial survey, without the need to identify the businesses door-to-door. All businesses participating in the initial survey and audit were offered an evaluation survey and audit.

### **3.3.6.2 Consent process**

Participation was voluntary and could be cancelled leading up to the scheduled appointment or during the survey or audit. The survey and audit process was transparent, with participants able to view the data being entered into the computer by the SERCUL officer throughout the interview. All participants received a printed copy of the data collected at the conclusion of the survey, audit and inspection. Participants could choose to decline to participate in the evaluation survey.

### **3.3.7 Survey procedure**

Appointments were booked for a specific day and time. The interview began with the survey, followed by an environmental risk management audit and inspection of the premises. Interviews were semi-structured and participants' questions and observations were answered and discussed throughout the interview. At the conclusion of the audit and inspection, the results of the stormwater awareness test (SAR), and management and infrastructure risk rating (MRR) were discussed, and recommendations were made for improving stormwater quality protection. The contents of the generic SME environmental management information pack (Section 3.3.5.1), provided to all participants, was explained in detail. The initial surveys and audits typically took 40-50 minutes to complete; evaluation surveys were regularly 30-40 minutes in length due to familiarity with the participants and premises, and a reduced survey component.

Surveys were primarily conducted with the owner or manager of the business. In larger businesses, the survey was occasionally conducted with an environmental officer or manager. All surveys were conducted by the same SERCUL officer, while the audit

and inspection was usually conducted by both the SERCUL officer, and an LGA Environmental Health Officer responsible for the particular industrial area.

## **3.4 Statistical analysis**

Questions in the audit considered to be recorded inconsistently or inconsistent with the content validity for this analysis, were removed and not considered in the results (i.e. questions regarding solid waste management were considered largely inconsistent with stormwater protection and were removed from the MRR calculation).

A forced choice scale was included in the initial survey, regarding the participants perceived adequacy of their current environmental management. This question was not used in the analysis because the question was considered to be leading and the responses were considered unreliable.

### **3.4.1 Pilot data interpretation**

The SERCUL SME project was piloted in the City of Canning and small amendments were made to the audit questions following the pilot. The following audit questions were not included in the initial stage in the City of Canning pilot:

- Storage of waste materials                      acceptable/unacceptable
- General housekeeping                              acceptable/unacceptable

In order to include the data from the City of Canning pilot in the analysis, the following assumptions were made so the data could be compared with the rest of the sample:

- The storage of raw materials result for the evaluation stage was also recorded as the result for the initial stage.
- The storage of raw materials result in the initial stage was recorded as the result for storage of waste materials in the initial stage.

- Onsite activities discharge to stormwater in the initial stage was also recorded as the result for general housekeeping, but inversely. Therefore, *no* answers were changed to *yes* and vice versa.

The arguments for the assumptions made in the transformation of the pilot data are presented in Appendix D.

### **3.4.2 Correlations**

The Chi-Square method was used to test the relationship between variables when nominal data was involved (Grimm, 1993). The significance of the relationship was tested with the Pearson correlation coefficient once a linear relationship was established with the Chi-Square method (Grimm, 1993). The Spearman's correlation coefficient was used when both variables contained ordinal data (Russo, 2003).

### **3.4.3 Perceived improvements**

During the evaluation survey the participants were asked to indicate what areas of environmental risk management, if any, they believed they had improved in. The participants' response was then compared to their assessed MRR score (Section 3.3.3) from the initial and evaluation audits. The list of 15 audit categories was divided into six major categories of environmental management, containing from one to four variables, described in Appendix E. To satisfy the improvement criteria at least one variable needed to show improvement and no other variables could be assessed as being unacceptable. A more detailed description of the criteria is given in Appendix E.

## **3.5 Limitations of the research design**

Three significant limitations are identified in the SERCUL SME project research design:

- (i) The survey methodology is limited in its ability to show causal relationships between variables (May, 1997).

- (ii) Non probability sampling limits the scientific generalisations that can be made in the SME population outside of the study group (Rea and Parker, 2004).
- (iii) Results can be biased by poor performers that avoid contact with the SERCUL SME project due to voluntary participation (Gunningham and Sinclair, 2002).

The research design limitations will be further discussed in Chapter 5.

## **3.6 Summary**

The methodology chapter has outlined the research design employed in the SERCUL SME project and any alterations made for the purpose of this analysis. The research design consists of:

- A semi-structured interview format for face-to-face delivery to improve the response rate and enable a broader discussion about environmental issues during the interview.
- A survey technique utilising closed and specific questions to allow a precise estimation of time requirements and the collection of data that can be easily compared.
- An initial survey and audit, and an evaluation survey and audit approximately 12 months following, conducted by a SERCUL officer and LGA Environmental Health Officer.
- A stormwater awareness survey (SAR) measuring participants' knowledge regarding stormwater contaminants and obligations to protect stormwater quality (initial survey).
- A survey of participants' barriers to environmental management and their preferred environmental information and communication sources (initial survey) and their perceived most useful environmental information sources (evaluation survey).
- An environmental risk management audit and inspection (MRR) assessing management practices and appropriate infrastructure for the protection of stormwater quality.

- The supply of environmental education materials:
  - a generic SME environmental information pack to all participants;
  - an optional paint stencilled prompt on the stormwater inlet; and
  - an optional personalised industry-specific environmental management pack.
- A non-probability sampling procedure which targeted small and micro light industrial businesses in particular.
- Participation in all components of both the initial and evaluation stages of the project was voluntary.

# **Chapter 4 Results**

## **4.1 Introduction**

This chapter presents the results of the analysis of data collected in the SERCUL SME project. The results detail the participants' characteristics, what participants thought, what practices they were using, and how they responded to the education interventions, in regards to the protection of stormwater quality.

The characteristics of the initial and evaluation sample groups are described, followed by the results of the surveys and audits. The survey results describe participants' stormwater awareness, perceived barriers to environmental management, preferred and most useful environmental information sources, perceived environmental management improvement and acceptance of LGAs as auditors. The audit results detail the level of management practices for the protection of stormwater, the response to the education interventions, and the effect of government licensing and industry association membership on environmental risk management.

## **4.2 Characteristics of participant businesses**

### **4.2.1 Response rate**

The SERCUL SME project had a high response rate, with 84% (n=268) of businesses formally approached participating in the initial survey and audit, and 73% (n=177) of businesses formally approached participating in the evaluation survey and audit. Businesses that had moved or closed were excluded from the calculation for the response rate in the evaluation survey. Reasons for non-participation in the evaluation survey are presented in Section 4.6.

### **4.2.2 Location of SME participants**

The location of the participants from the eight industrial areas contained in the five LGAs was recorded. Table 4.1 shows the total number of individuals located in each of

the LGAs (listed in brackets), and the proportion of the sample that this represents. A further breakdown into the number and proportion of participants from each industrial area, within each LGA, is also provided. Table 4.1 indicates that the location of SME participants were reasonably evenly distributed across the five participating LGAs, although some participants were recruited from more than one light industrial area, within the same LGA.

**Table 4.1 Location of SME participants**

LGA	Industrial area	Initial survey n=268		Evaluation survey n=177	
		Frequency	Percentage	Frequency	Percentage
City of Canning		(57)	(21)	(46)	(26)
	Welshpool	57	21	46	26
City of Armadale		(53)	(20)	(32)	(18)
	Kelmscott	53	20	32	18
Town of Kwinana		(54)	(21)	(38)	(21)
	Naval Base	23	9	15	8
	Medina	8	3	5	3
	Kwinana Beach	23	9	18	10
City of Rockingham		(52)	(19)	(29)	(16)
	Rockingham	52	19	29	16
City of Cockburn		(52)	(19)	(32)	(18)
	Jandakot	18	7	12	7
	Bibra Lake	34	12	20	11

The rounding of percentages may result in totals do not equal 100%

### 4.2.3 Business size

The number of employees at each participating business was recorded in the initial survey. Table 4.2 shows the frequency and percentage of businesses in the micro, small and medium business size categories. Participant businesses were predominantly from the micro and small enterprise categories (>88%), the percentage remaining almost unchanged from the initial to the evaluation stage.

**Table 4.2 Business size by employee number categories**

Business size (employees)	Initial survey		Evaluation survey	
	Freq.	%	Freq.	%
Micro (0-5)	147	54	95	54
Small (6-20)	90	35	62	34
Medium (21-200)	31	11	20	12
Total	268	100	177	100

#### 4.2.4 Business types

Participating businesses were allocated into a business type based on the major activity carried out on the premise inspected (Appendix B). Table 4.3 shows the frequency and percentage representation of each business type. Of the 18 business types recognised, most businesses (70% initial survey, 71% evaluation survey) were represented in the mechanical trades, transport depots, engineering and metal fabrication, vehicle body repairs, and chemical manufacture or storage categories. The proportion of businesses in each business type remained relatively unchanged in the evaluation stage.

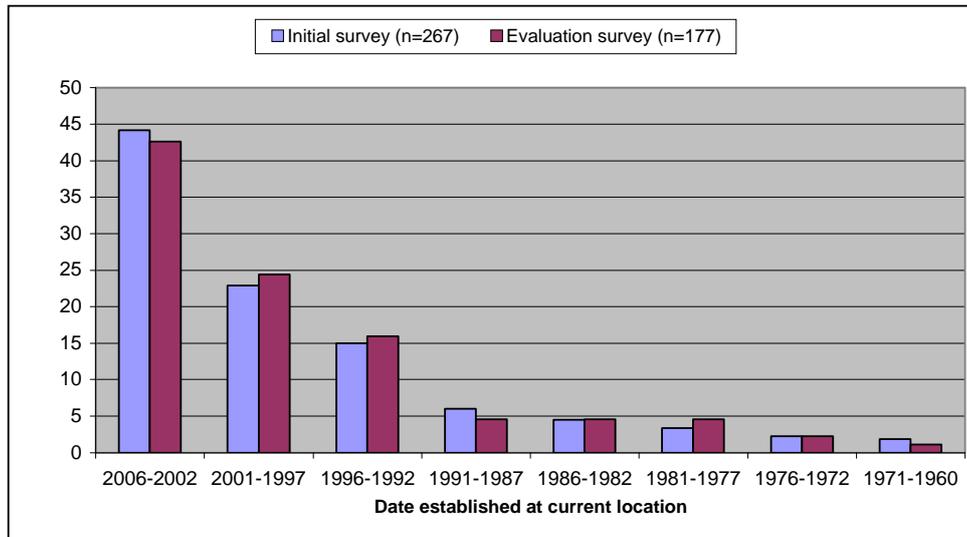
**Table 4.3 Business types participating in the SERCUL SME project**

Business types	Initial survey		Evaluation survey	
	Frequency	%	Frequency	%
Mechanical services	78	29	49	28
Transport depots	36	13	25	14
Engineering and metal fabrication	32	12	21	12
Vehicle body repairs	24	9	17	9
Chemical manufacture or storage	19	7	14	8
Metal finishing	14	5	9	5
Electrical repair	10	4	7	4
Printers	9	3	6	3
Wood products	7	3	5	3
Fibreglass fabrication	6	2	3	2
Garden and landscape products	6	2	3	2
Concrete production	6	2	4	2
Rubber and foam	5	2	2	1
Cleaning	4	2	3	2
Radiator repair	4	2	4	2
Foundry or foundry contractor	3	1	1	1
Salvage storage	3	1	2	1
Animal products	2	1	2	1
<b>Total</b>	<b>268</b>	<b>100</b>	<b>177</b>	<b>100</b>

#### 4.2.5 Date established at current location

Figure 4.1 contains the data recorded regarding the number of years a business had been located at their current premise. Results have been grouped into divisions of 5 years for presentation (the last category covers 11 years). Figure 4.1 illustrates that the majority of businesses had been at their current premises less than 10 years, many less than 5 years. The length of time located at the current premises was not a significant variable in relation to environmental risk management audit scores (MRR) for the protection of stormwater quality ( $\chi^2 = 12.601$ ,  $df = 14$ ,  $p = 0.558$ ).

**Figure 4.1 Date established at current location**



#### **4.2.6 Industry group or association membership**

Approximately half of the businesses surveyed were members of an industry group or association. The percentage of businesses with a membership in an industry group or association was virtually unchanged between the initial and evaluation survey (49% and 50%, respectively). The influence of industry group or association membership on environmental risk management is presented in Section 4.15.2.

#### **4.2.7 Licensed by a government organisation**

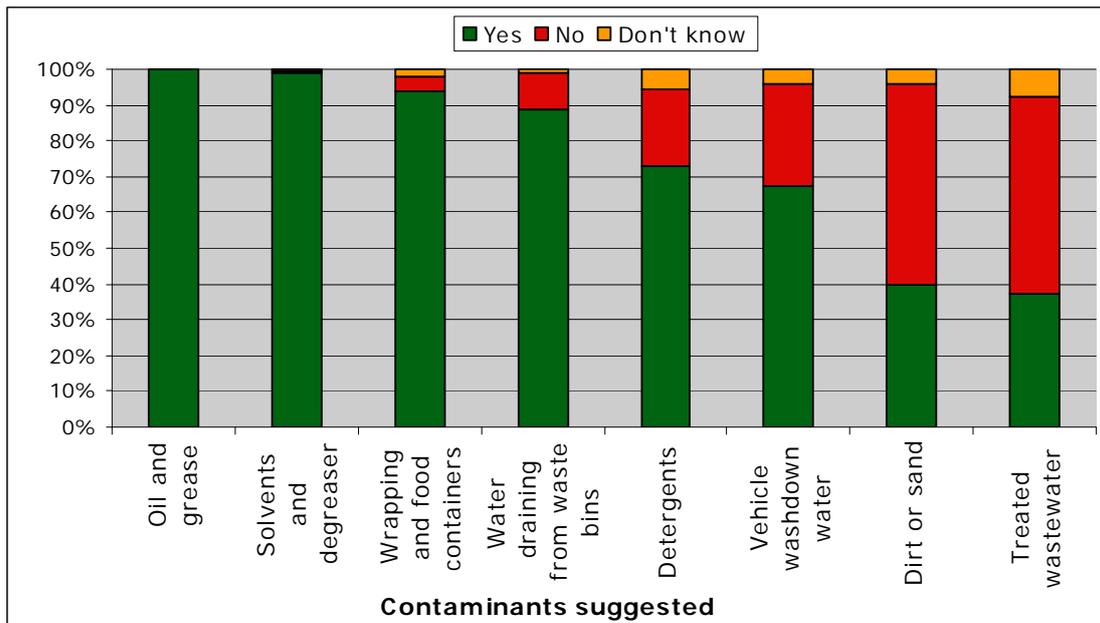
Seventeen percent of businesses were licensed by a government organisation for an environmental activity in the initial audit. The percentage of businesses licensed by a government organisation increased to twenty four percent in the evaluation survey. The influence of licensing by a government organisation on environmental management is presented in Section 4.15.3.

### **4.3 Stormwater awareness**

Participants were asked to identify stormwater contaminants from a standard list (Appendix B). The participants' recognition of common stormwater contaminants is illustrated in Figure 4.2 as a percentage of yes/no/don't know responses. Awareness of

contaminants was generally high. For example, 100% of businesses recognised oil and grease as a stormwater contaminant. However, participants' recognition of some other contaminants, particularly: treated wastewater (63%); dirt and sand (60%); and, vehicle washdown water (33%) was much lower.

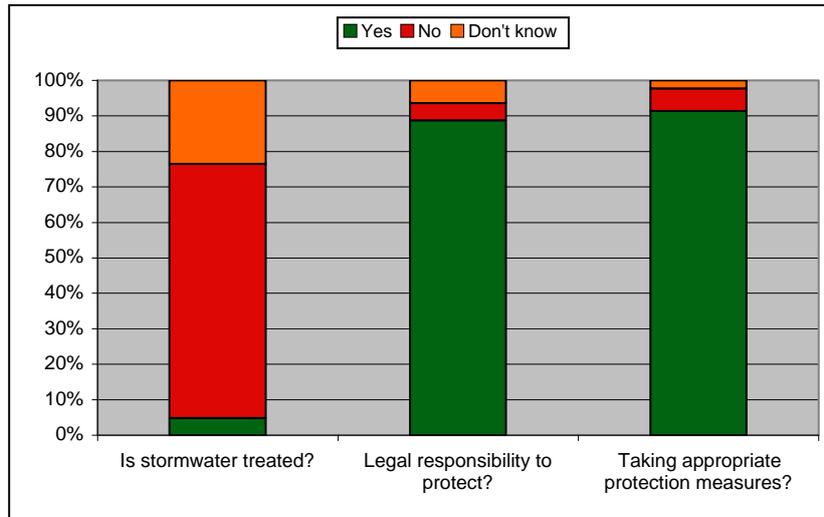
**Figure 4.2 SME participant recognition of stormwater contaminants (n=268)**



Despite some participants not recognising some contaminants, Figure 4.3 highlights that awareness of stormwater protection issues was generally high. Prior to the initial audit, most participants:

- understood stormwater was not treated in a centralised facility like sewerage;
- demonstrated a high awareness of a legal obligation to protect stormwater quality; and
- believed they were adequately protecting stormwater quality.

**Figure 4.3 SME participant awareness of stormwater protection issues (n=268)**



The average Stormwater Awareness Rating (SAR) was assessed to be low risk to contaminate stormwater (mean 3.15, median 3) (Section 3.3.2.1).

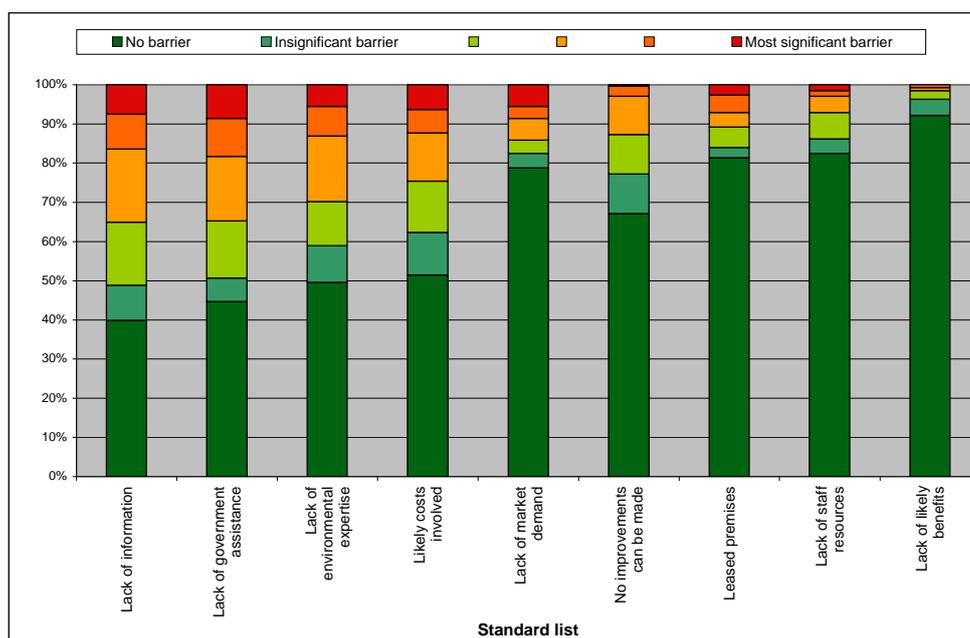
## 4.4 Barriers and preferences

### 4.4.1 Barriers to environmental management

Participants were asked to indicate significant barriers to environmental management from a standard list (Appendix B). Figure 4.4 shows the range of responses recorded on the attitude scale (Section 3.3.2.2) to the list of barriers presented.

Table 4.4 presents the significant barriers to environmental management (stacks of red and orange in Figure 4.4) aggregated as a percentage. The reporting of barriers to environmental management was lower than expected. The most frequently reported barriers were lack of information (35%), lack of government assistance (35%), lack of environmental expertise (30%) and likely costs (25%). Barriers mentioned by participants, that were additional to the standard list below, are recorded in the ‘other’ category, and presented in Appendix F. The majority of the additional barriers offered by participants are similar to the four most significant barriers in Table 4.4.

**Figure 4.4 SME participant barriers to environmental management (n=268)**



**Table 4.4 SME participant barriers to environmental management aggregated to represent significant barriers (n=268)**

Do these issues make environmental management difficult in your business?	
List of potential barriers	Rating 4,5,6 combined (%) (affirmative answer)
Lack of information	35.1
Lack of government assistance	34.7
Lack of environmental expertise	29.9
Likely costs involved	24.6
Lack of market demand	14.2
No improvements can be made	12.7
Leased premises	10.8
Lack of likely benefits	1.5
Lack of staff resources	7.1
Other	12.3

#### 4.4.2 Preferred environmental information and communication sources

Participants were asked to indicate their preferred source of information and communication from the standard list presented in Appendix B. Figure 4.5 shows the range of responses recorded on the attitude scale (Section 3.3.2.2), to the list of environmental information and communication sources presented.

**Figure 4.5 SME preferred environmental information and communication sources (n=268).**

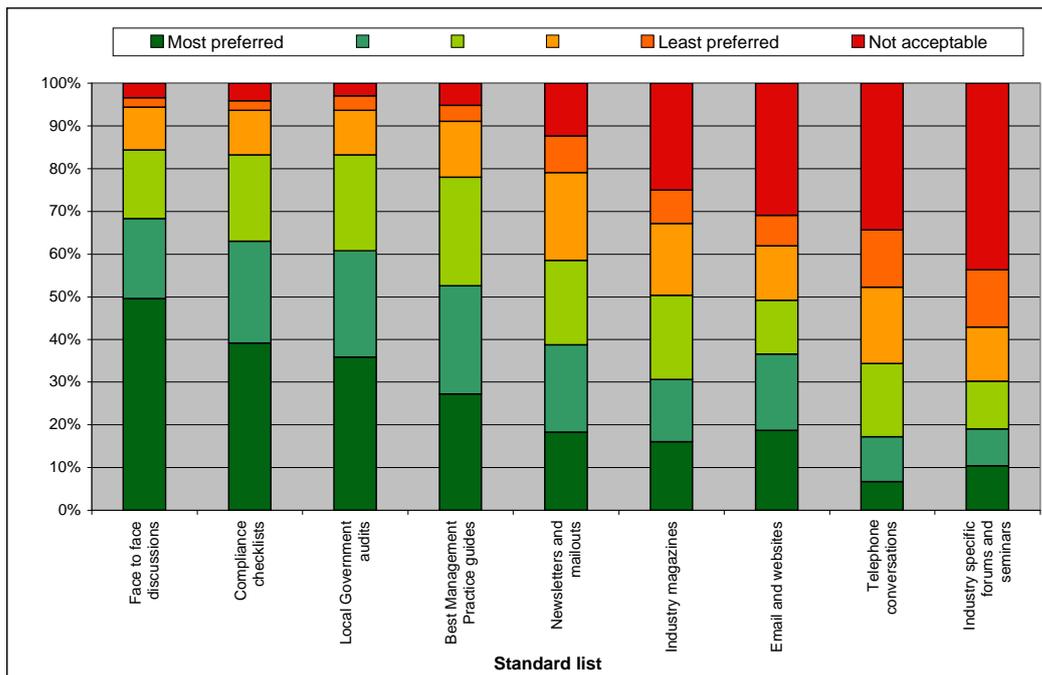


Table 4.5 presents the preferred environmental information and communication sources (stacks of green in Figure 4.5) aggregated as a percentage. The most preferred sources were face-to-face discussions (84%), legal compliance checklists (83%), best management practice guides (83%), and Local Government audits (78%).

**Table 4.5 SME preferred information and communication sources aggregated to represent significant preferences (n=268)**

What is the best way to provide information to you?	
List of potential sources	Rating 4,5,6 combined (%) (affirmative answer)
Face to face discussions	84.3
Local Government audits	83.2
Compliance checklists	83.2
Best Management Practice guides	78
Newsletters and mailouts	58.6
Industry magazines	50.4
Email and websites	49.3
Telephone conversations	34.3
Industry specific forums and seminars	30.2
Other	1.9

## 4.5 Environmental Risk Management audit results for businesses in the initial stage.

The management and infrastructure risk rating (MRR) comprised of 15 different environmental risk management categories listed in Table 4.6. The MRR is calculated by adding the weighted scores accumulated from individual categories that were judged as unacceptable against the criteria (Section 3.3.3). A lower score indicates less risk of stormwater contamination. The full list of audit categories and associated weightings are presented in Appendix C.

SME practices for the storage of waste materials such as used oil, wastewater treatment and disposal, and emergency spill preparedness were frequently unacceptable for the protection of stormwater quality. Discharge of contaminants to stormwater was observed in more than half of the sample (58%). The mean MRR reflected a medium risk of stormwater contamination (17 points - high risk begins at 20 points) (Section 3.3.3)

**Table 4.6 Environmental risk management results by audit category (initial audit n=268)**

Environmental risk management audit categories	Data type	Initial audit
Number of businesses audited	freq.	268
Raw material storage acceptable	(%)	91.4
Waste storage acceptable	(%)	64.1 <sup>a</sup>
Waste water treatment acceptable	(%)	45.7
Waste water discharge acceptable	(%)	48.4
Wastewater equipment maintenance program	(%)	75.8
Discharge to stormwater	(%)	58.2
Housekeeping to minimise stormwater cont.	(%)	60.3 <sup>a</sup>
Spill procedures acceptable	(%)	32.1
Spill kit acceptable	(%)	34.3
Records kept about spills	(%)	21.5
Emergency contact numbers visible	(%)	30.3
Environmental policy	(%)	21.6
Knowledge of type and quantity of substances stored	(%)	74.1
Material data safety sheets kept on site	(%)	59.5
Visible signage of hazardous chemicals	(%)	62.9
Some form of recycling*	(%)	90.3
Comprehensive landfill minimisation*	(%)	34.1
Awareness rating average mean (median)	rating	3.15 (3)
Management rating average mean (median)	rating	17.06 (16)

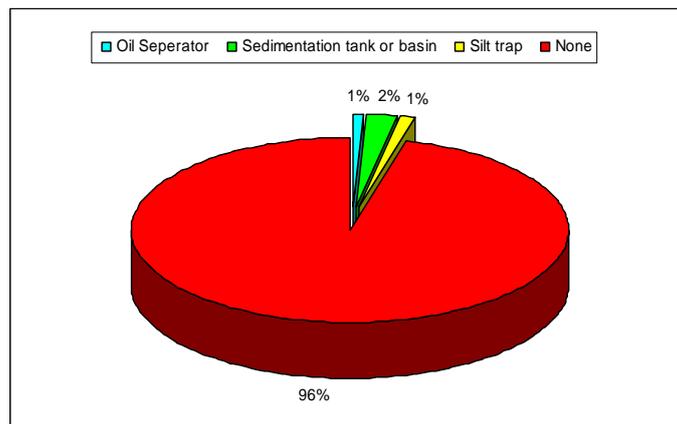
\* These results were not included in the MRR calculation

<sup>a</sup> n=211, results were not recorded in the City of Canning

### 4.5.1 Water quality treatment methods for stormwater disposal from light industrial sites.

The method of stormwater treatment for water quality improvement was recorded for each business premises. Figure 4.6 illustrates that the vast majority of businesses do not provide any form of stormwater treatment before disposal from their site.

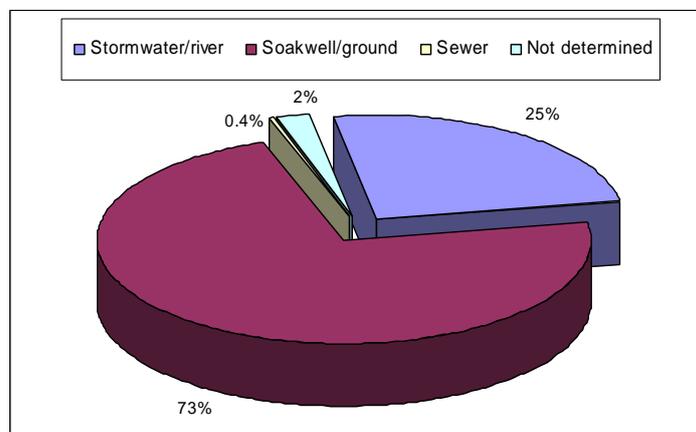
Figure 4.6 Water quality treatment methods for stormwater (n=268)



### 4.5.2 Disposal points for stormwater

The disposal point for stormwater released from each business premises was recorded. Figure 4.7 illustrates that three quarters of stormwater disposal was to onsite soakwells, allowing stormwater to dissipate in the ground. One quarter of stormwater was released into a piped stormwater system emptying into compensation basins, the ocean or direct to a river.

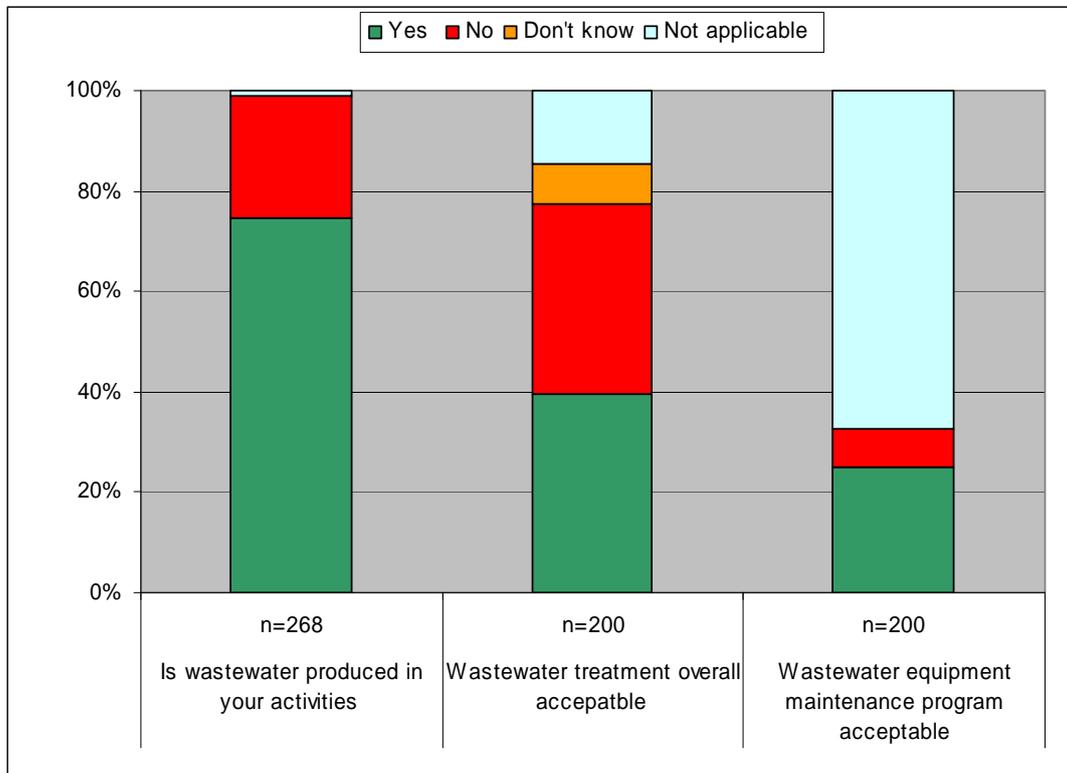
Figure 4.7 Disposal points for stormwater (n=268)



### 4.5.3 Wastewater treatment

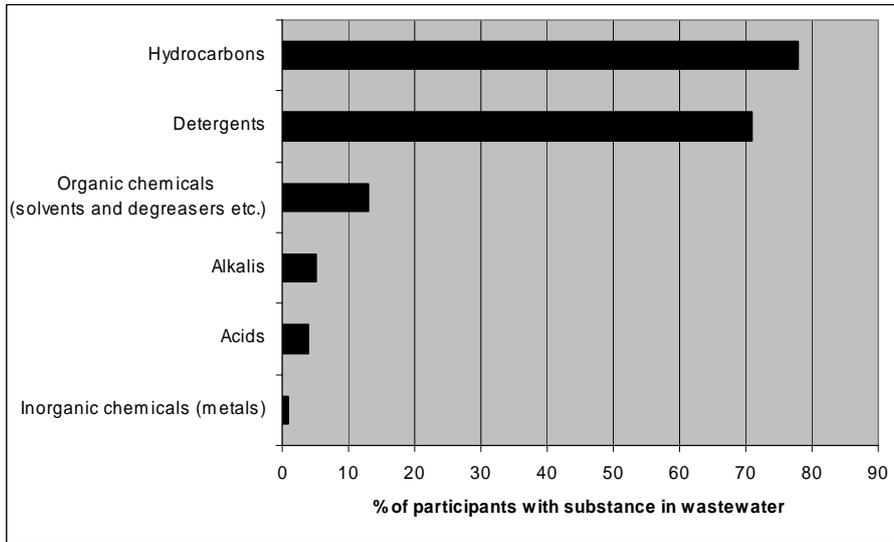
Figure 4.8 is an analysis of the number of businesses generating wastewater, adequately treating wastewater, and having adequate maintenance of wastewater treatment equipment. Figure 4.8 illustrates that most businesses produced wastewater (75%), but approximately half of those businesses that needed to treat wastewater were not doing so adequately. Approximately one quarter of businesses with wastewater treatment facilities were not maintaining their facilities to an adequate standard.

**Figure 4.8 Businesses that produced wastewater, had acceptable treatment, and an acceptable wastewater equipment maintenance program for the protection of stormwater quality**



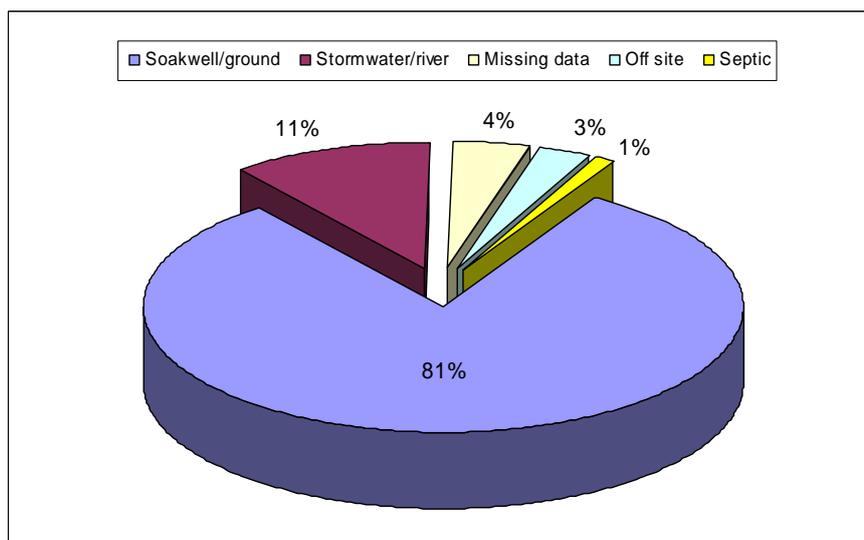
The four most common substances present in wastewater was recorded from a standard list for each business. Figure 4.9 is an analysis of the most common substances present in the wastewater of businesses that were considered to have inadequate wastewater treatment (n=76). Figure 4.9 illustrates that hydrocarbons and detergents were the most common wastes that were being disposed of inadequately.

**Figure 4.9 Most common contaminants for businesses with unacceptable wastewater treatment (n=76)**



The disposal point for wastewater released from each business premises was recorded. Figure 4.10 illustrates that most businesses that were disposing of wastewater, that was considered inadequately treated, were using on-site soakwells. However, some wastewater was being disposal of into piped stormwater systems that flowed directly to the ocean, compensation basins or rivers.

**Figure 4.10 The method of disposal of wastewater for those businesses assessed to have unacceptable wastewater treatment (n=76).**



## 4.6 Representativeness of evaluation sample group

The sample size reduced from 268 participants in the initial survey and audit, to 177 participants in the evaluation survey and audit. Like the initial survey and audit, participation in the evaluation stage was voluntary. Reasons for business owner/managers not participating in the evaluation survey are presented in Table 4.7.

**Table 4.7 Reasons for non-participation in the evaluation survey (n=268)**

Reason	Freq.	%
Evaluation survey and audit	177	
Unable to arrange suitable time	38	14.2
Closed or moved	25	9.3
Declined	16	6.0
Not at arranged appointment	12	4.5

The characteristics of the evaluation sample group (n=177) is considered representative of the initial sample group (n=268). All participant characteristics, including barriers reported and information preferences, did not differ significantly between the two sample groups.

Table 4.8 highlights that the audit scores for environmental management practices (MRR) (Section 3.3.3) were also very similar between the evaluated and non-evaluated sample groups. However, the non-evaluation sample group were assessed to have a slightly better awareness of stormwater contaminants and issues (SAR). The proportion of businesses represented in the management and infrastructure risk rating (MRR) categories of low, medium and high (Section 3.3.3) is similar overall (mean and median). The proportion of businesses represented in the high, medium and low categories for the single highest risk activity results is also very similar (mean). Audit results for the evaluated group are presented in greater detail in Section 4.9.

**Table 4.8 MRR comparisons for the evaluation sample group (initial audit) and non-evaluated sample group (initial audit).**

	n	MRR		SAR	
		mean	median	mean	median
<b>Evaluated group</b>	177	16.81	16	2.99	3.75
<b>Non-evaluated group</b>	91	17.48	16	2	3

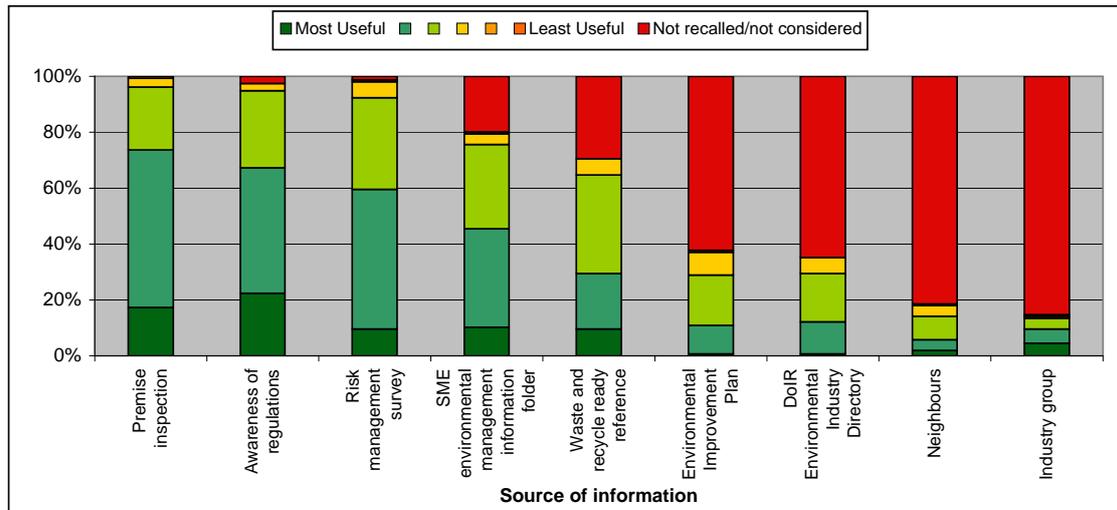
Where comparisons are drawn between the initial and evaluation surveys and audits, results presented relate only to businesses who participated in both the initial and evaluation survey and audit (n=177).

## **4.7 SME perceived usefulness of environmental information sources**

In the evaluation survey, participants were asked to indicate the usefulness of particular environmental information sources, from a standard list (Appendix B).

Figure 4.11 illustrates the range of participant responses recorded on the attitude scale (Section 3.3.2.2), regarding the usefulness of the environmental information sources presented. Strong preferences were recorded for information delivered face-to-face (premise inspection, risk management survey, awareness of regulations). Common preferences were also recorded for some components of the generic SME environmental management information pack (SME environmental management fact sheets, waste and recycle ready reference). Some of the printed information resources provided in the initial survey were often not recalled by participants in the evaluation survey (environmental improvement plan, environment industry directory).

**Figure 4.11 SME participant perceived usefulness of environmental information sources (n=156\*)**

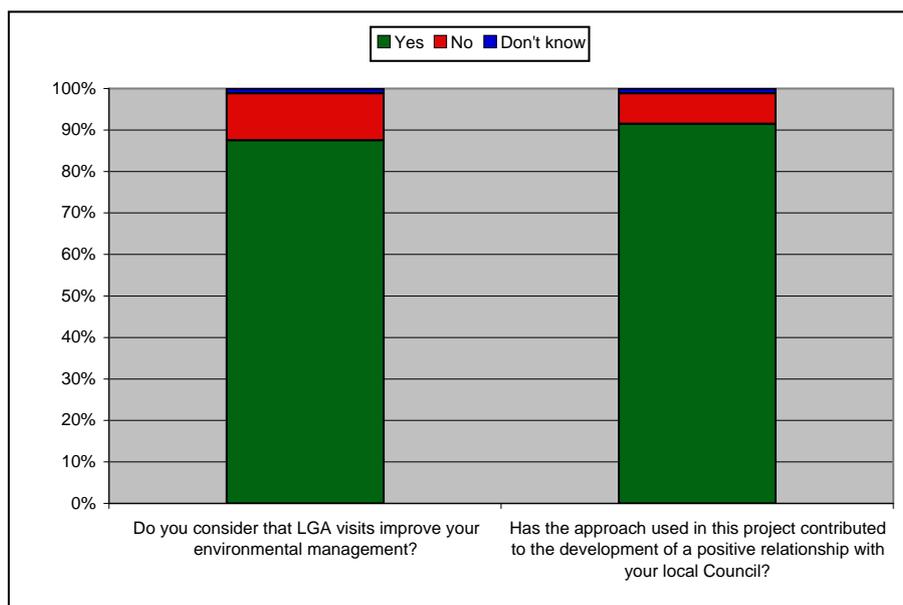


\* n=156, 21 responses were excluded where the participant representing the business was not present at both the initial survey and audit.

## 4.8 Local Government audits

The participants' perception of Local Government as environmental auditors was assessed in the evaluation survey, and the results are illustrated in Figure 4.12. The graph describes a very high participant agreement with the statements 'Local Government visits improve environmental management' (88%) and 'this project contributed to the development of a positive relationship with the local Council' (92%).

**Figure 4.12 SME perception of LGA involvement in environmental management (n=177)**



At the conclusion of the site visit, immediately following both the initial and evaluation audit, participants were asked if they found the survey and audit useful in identifying environmental hazards and risks in their business. The shaded section of Table 4.9 highlights that most participants reported finding the surveys and audits useful (initial stage 86%, and evaluation stage 97% (n=131)). Even those participants who indicated that Local Government audits were *not* preferred in the initial survey (17%), usually indicated the survey and audit was useful (initial stage, 80% and evaluation stage, 95%; n=45).

**Table 4.9 SME perceived usefulness of the environmental risk management survey and audit**

Has this survey and audit helped you to identify environmental hazards and risks in your business?						
Stage	Initial stage		Initial stage		Evaluation stage	
Data type	Freq.	%	Freq.	%	Freq.	%
Yes	187	89	112	86	127	97
No	24	11	19	14	4	3
Total	211*	100	131*	100	131*	100

\* This question was not asked in the initial pilot of City of Canning participants (n=57), reducing the sample size for these questions to n=211 for the initial survey, and n=131 when directly comparing businesses surveyed in both the initial and evaluation stages.

## 4.9 Environmental risk management audits

The management and infrastructure risk rating (MRR) was comprised of 15 different environmental risk management categories listed in Table 4.10. The MRR is calculated by adding the weighted scores from individual categories judged as unacceptable (Section 3.3.3). A lower score indicates less risk of stormwater contamination. The full list of audit categories and associated weightings are presented in Appendix C.

On average (mean), all categories of environmental risk management recorded improvement (environmental policy remained unchanged), although there was large variation in improvement across categories. Emergency spill preparedness, knowledge of materials stored on site, and appropriate hazardous signage improved significantly to very high levels. Acceptable wastewater treatment, wastewater disposal and discharge to stormwater also improved significantly, although a large percentage of businesses (>30%) were still assessed as having unacceptable practices.

On average (mean), all 18 business types (Table 4.3) showed improvement in their environmental risk management for the protection of stormwater.

**Table 4.10 Environmental risk management results by audit category (evaluation audit n=177)**

Environmental risk management audit categories	Data type	Initial audit	Evaluation audit	% change
Number of businesses audited	freq.	177	177	
Raw material storage acceptable	(%)	90.4	91.5	<b>1.2</b>
Waste storage acceptable	(%)	58.7 <sup>a</sup>	63.6	<b>8.3</b>
Waste water treatment acceptable	(%)	47.4	64.2	<b>35.4</b>
Waste water discharge acceptable	(%)	47.2	67.2	<b>42.4</b>
Wastewater equipment maintenance program	(%)	80	86.2	<b>7.8</b>
Discharge to stormwater	(%)	58.2	43.5	<b>-25.3</b>
Housekeeping to minimise stormwater cont.	(%)	63.8 <sup>a</sup>	70.1	<b>9.9</b>
Spill procedures acceptable	(%)	32.9	68.8	<b>109.1</b>
Spill kit acceptable	(%)	35.3	74.9	<b>112.2</b>
Records kept about spills	(%)	23.4	26.6	<b>13.7</b>
Emergency contact numbers visible	(%)	33.1	57.8	<b>74.6</b>
Environmental policy	(%)	22.6	22.6	<b>0</b>
Knowledge of type and quantity of substances stored	(%)	74.5	91.5	<b>22.8</b>
Material data safety sheets kept on site	(%)	63.3	65.1	<b>2.8</b>
Visible signage of hazardous chemicals	(%)	68.2	88.1	<b>29.2</b>
Some form of recycling <sup>*</sup>	(%)	90.4	98.9	<b>9.4</b>
Comprehensive landfill minimisation <sup>*</sup>	(%)	35.1	51.1	<b>45.6</b>
Awareness rating average mean (median)	rating	3.06 (3)	nc	<b>Low risk</b>
Management rating average mean (median)	rating	16.21 (15)	11.76 (10)	<b>Medium risk</b>

\* These results were not included in the MRR calculation

<sup>a</sup> n=131, results were not recorded in the City of Canning

#### 4.9.1 Movement in management and infrastructure risk ratings (MRR)

The management and infrastructure risk rating (MRR) results for each business were allocated into categories of low, medium and high risk, based on their likelihood to contaminate stormwater (see Section 3.3.3). Table 4.11 highlights that the percentage of medium and high risk rated businesses reduced significantly in the evaluation audit, and the percentage of low risk rated businesses increased substantially. Overall 66% of participants improved, 12% remained unchanged, and 22% regressed in MRR audit scores in the evaluation audit.

**Table 4.11 Percentage of businesses occurring in stormwater contamination risk categories (MRR)**  
(n = 177)

Risk category	Initial survey	Evaluation survey	% change
Low	33.9	52.5	54.9
Medium	31.6	26.6	-15.8
High	34.5	20.9	-39.4

### 4.9.2 Single highest risk activity

In contrast to the results in Table 4.11, the environmental risk management (MRR) improvement often did *not* occur in the high risk activities (i.e. improving signage or record keeping, while waste water treatment remained inadequate). Each of the 15 audit categories (Table 4.10) is assigned an individual risk rating, based on the potential to contaminate stormwater (Appendix G). Table 4.12 illustrates that most businesses (62%) still retained at least one high risk activity in the evaluation audit.

**Table 4.12 Percentage of businesses occurring in stormwater contamination risk categories based on single highest risk activity (n = 177)**

Risk category	Initial survey	Evaluation survey	% change
Low	14.1	21.5	52.5
Medium	16.9	16.9	0
High	69	61.6	-10.7

### 4.9.3 Consistent high risk

Despite the overall movement away from the MRR high risk, towards the low risk category represented in Table 4.11, a small group of participant businesses, documented in Table 4.13, recorded high risk in both the initial and evaluation audits. A smaller percentage of business regressed from being assessed medium risk in the initial audit to high risk in the evaluation audit. These results are highlighted by the shaded cells in Table 4.13.

**Table 4.13 Businesses assessed as a consistent high risk of stormwater contamination**

Percentages		Initial stage MRR distribution			
		Low Risk	Medium Risk	High Risk	Total
Evaluation stage MRR distribution	Low Risk	28.3	13.6	11.3	<b>53.1</b>
	Medium Risk	4.5	10.7	11.3	<b>26.6</b>
	High Risk	0.0	5.1	15.3	<b>20.3</b>
	Total	32.8	29.4	37.8	<b>100.0</b>

## 4.10 Influence of business size

Table 4.14 presents the frequency and percentage of businesses by employee category (Section 1.2) in the evaluation sample, and the frequency and percentage of those businesses that were assessed high risk (MRR) in both the initial and evaluation audit. Table 4.14 documents that micro enterprises were over represented in the group of businesses that scored a high risk MRR audit score (Section 3.3.3) in both the initial and evaluation audits.

**Table 4.14 The percentage of businesses assessed as having a high risk MRR audit score in the initial and evaluation surveys presented by business size category**

Business size (employees)	Evaluation group		Consistent high risk	
	Freq.	%	Freq.	%
Micro (0-5)	95	54	17	63
Small (6-20)	62	34	8	30
Medium (21-200)	20	12	2	7
Total	177	100	27	100

The number of employees in a business did *not* have a significant relationship with the majority of variables tested. However, a few variables did have a statistically significant relationship to the number of employees in a business and are presented below.

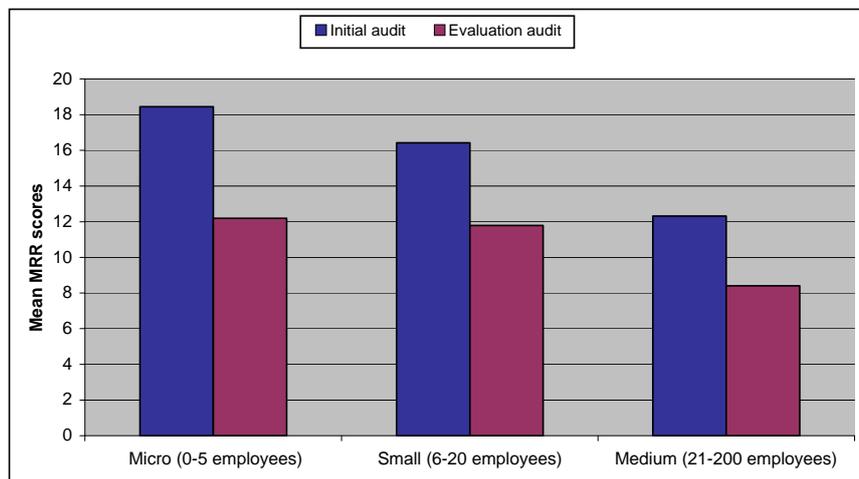
Statistically as the number of employees *increased*:

- the management and infrastructure risk rating (MRR) reduced  
(Spearman's Rho = -0.156, p = 0.01) (see Figure 4.13);

- environmental management documentation improved:
  - environmental policy ( $\chi^2 = 45.148$ ,  $df = 4$ ,  $p < 0.000$ );
  - information recorded about accidental spills ( $\chi^2 = 54.915$ ,  $df = 2$ ,  $p < 0.000$ );
  - signage for hazardous chemicals ( $\chi^2 = 14.428$ ,  $df = 2$ ,  $p = 0.001$ );
  - material safety data sheets held on site ( $\chi^2 = 27.731$ ,  $df = 4$ ,  $p = 0.000$ ).
- the likely costs barrier is reported less ( $\chi^2 = 13.393$ ,  $df = 2$ ,  $p = 0.001$ ); and
- email and websites became more preferable as a source of information and communication ( $\chi^2 = 14.855$ ,  $df = 2$ ,  $p = 0.001$ ).

Figure 4.13 shows the MRR audit score (Section 3.3.3) of businesses in the initial and evaluation audits by business employee category (Section 1.2). Figure 4.13 illustrates that the initial MRR audit score reduced as employee numbers increased. Micro businesses are shown to have achieved the most significant reduction in mean MRR audit score in the evaluation audit.

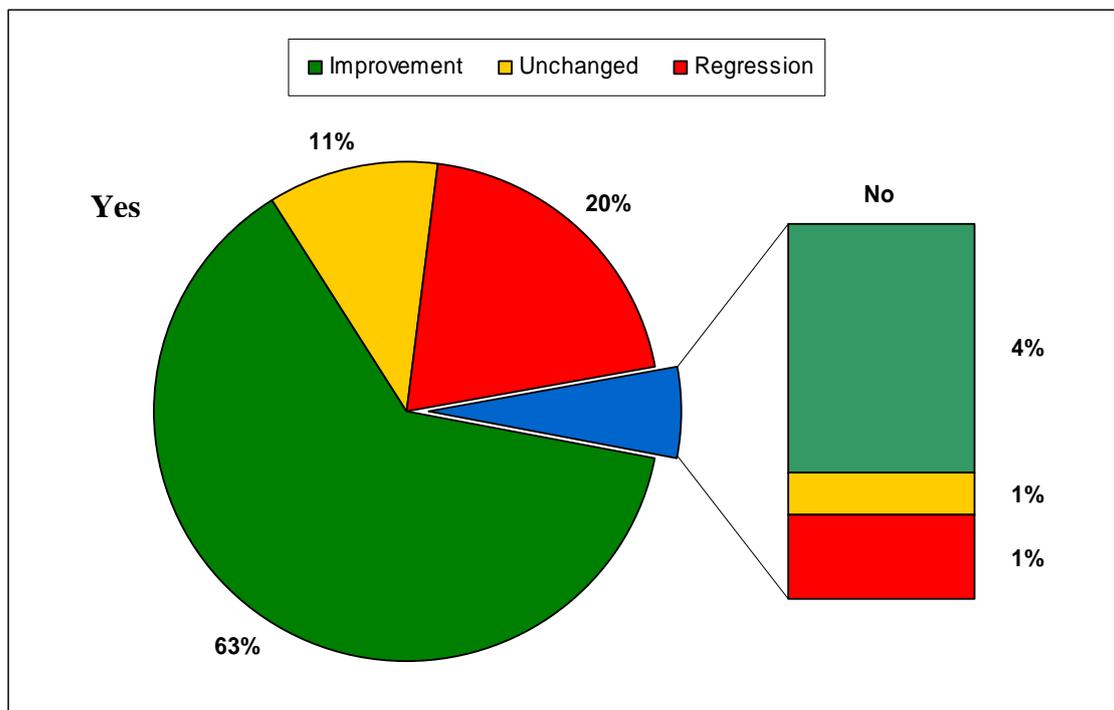
**Figure 4.13 Mean MRR audit score in initial and evaluation audits displayed by business size category (n=177)**



#### 4.11 SME perceived environmental risk management improvement compared to audit results.

Participants were asked to indicate in the evaluation survey if they felt that they had improved their environmental management since the initial audit. Figure 4.14 illustrates the participants perception of their environmental management improvement (or otherwise) compared to the change in MRR score (Section 3.3.3) generated by the evaluation audit. The section of the pie graph in blue represents those participants that answered *no* (i.e. had not improved) and the comparison to their assessed MRR score. Figure 4.14 shows that most participants who believed they had made environmental management improvements were also assessed to have done so. Even most of those who thought they had not made improvements were assessed to have made some improvement.

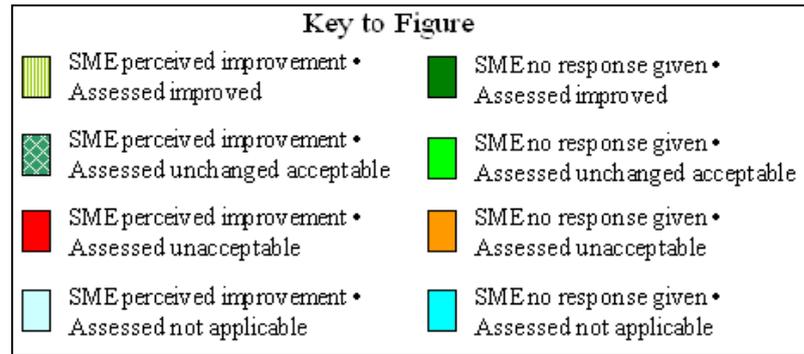
Figure 4.14 SME perceived improvement in environmental risk management compared to audit results (n=154)



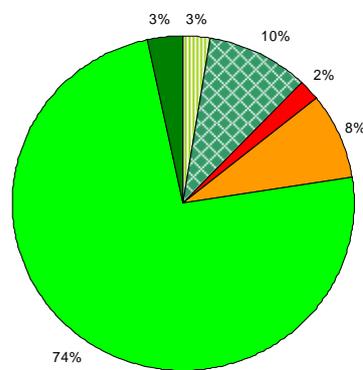
## **4.12 SME perceived environmental risk management improvements compared to audit results by aspect**

In the evaluation survey participants were asked to indicate which aspects of environmental management they felt they had improved the initial audit. Figure 4.15 illustrates the participants perception of their environmental management improvement (or otherwise) in a range of audit aspects, compared to the assessment by the auditors (Appendix E). Figure 4.15 shows that there was a high degree of difference in improvement across the various audit aspects and some differences between the participants indication of improvement (or otherwise) compared to that assessed by the auditors.

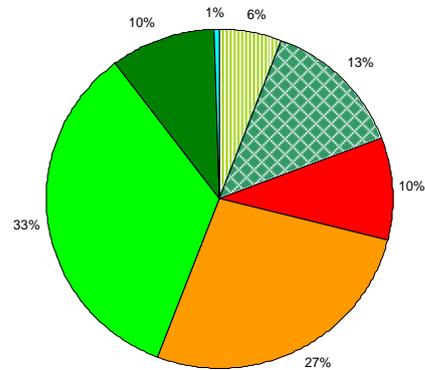
**Figure 4.15 SME perceived improvements in various aspects of environmental risk management compared to audit results by aspect**



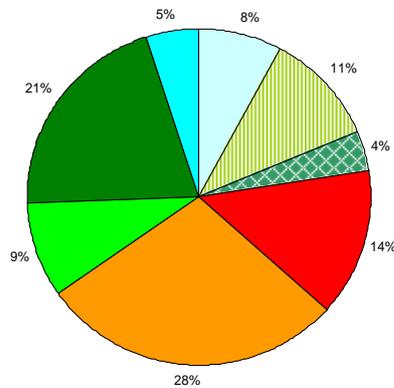
**Raw material storage**



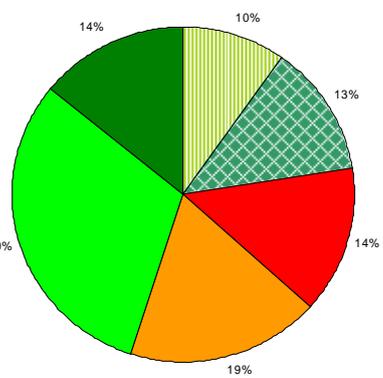
**Waste Material Storage**



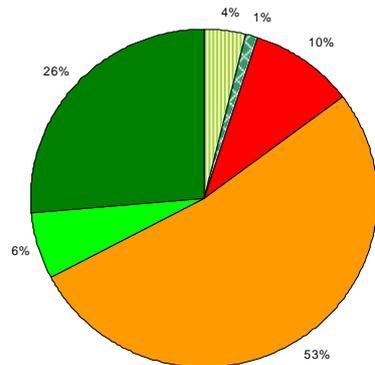
**Wastewater management**



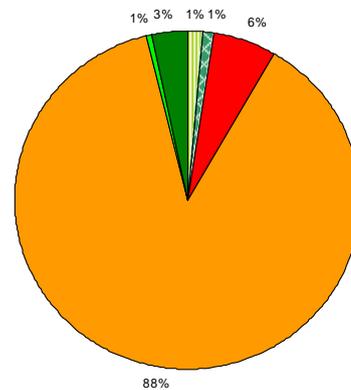
**General Housekeeping**



**Emergency Preparedness**



**Policy and documentation**

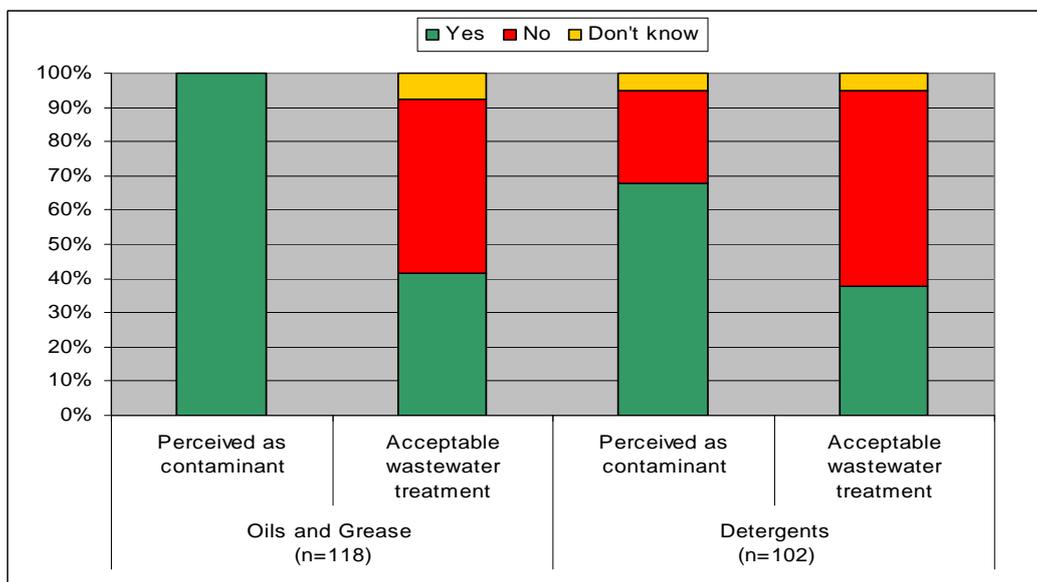


## 4.13 The relationship between environmental awareness and behaviour

A weak statistical relationship was found between a high level of stormwater protection awareness (SAR) and low risk management and infrastructure practices (MRR). This result is best represented by Spearman's correlation coefficient because the variables contain ordinal data (0.169,  $p = 0.008$ ) (Section 3.4.2).

The relationship between the awareness of stormwater contaminants and appropriate stormwater protection practices is contradicted by the following result. Figure 4.16 illustrates the practices of participants who recognised oil and grease, or detergents, as stormwater contaminants, had them present in their wastewater, and had unacceptable water treatment. Figure 4.16 shows that while all participants recognised oil and grease as a contaminant, many (43%) did not prevent the inappropriate discharge of these substances.

**Figure 4.16** Participants with oil and grease and/or detergents in their wastewater, their perception of the substances as stormwater contaminants, and acceptability of wastewater treatment.

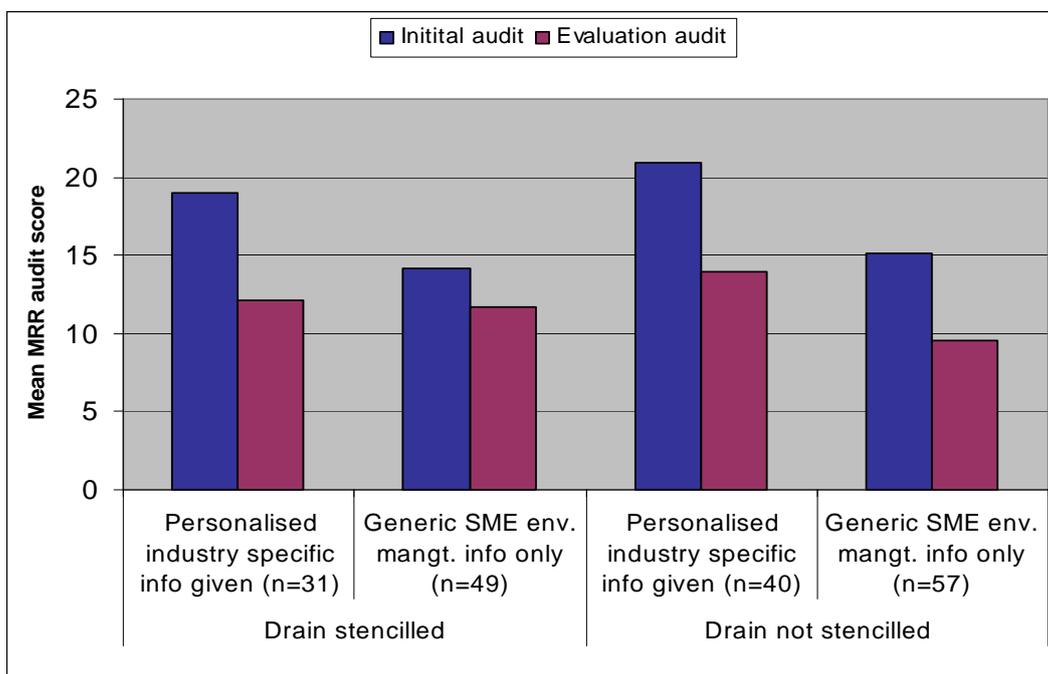


## 4.14 Education interventions

The results regarding the effect of the education interventions on environmental risk management (Section 3.3.5) for the protection of stormwater quality are now examined.

Figure 4.17 illustrates the mean MRR (Section 3.3.3) of participants that received only the survey, audit and generic information pack (Section 3.3.5.1) compared to participants receiving the optional drain stencilling (Section 3.3.5.2) and/or industry-specific information (Section 3.3.5.3). Figure 4.17 demonstrates that the group accepting the least education interventions (not drain stencilled and, generic SME environmental management information only) had the lowest MRR in the evaluation audit. However, participants who received the personalised industry-specific information showed the greatest mean improvement in MRR.

**Figure 4.17 Mean MRR of businesses drain stencilled, not stencilled, and provided personalised industry-specific information and provided only generic information**



#### 4.14.1 Drain stencilling

Figure 4.18 illustrates the mean MRR scores for those businesses provided with paint stencilled stormwater drains (Section 3.3.5.2), and those that were not. Figure 4.18 shows that businesses who were *not* provided with stencilled stormwater drains demonstrated a greater degree of mean improvement in MRR. This result was not statistically significant ( $\chi^2 = 3.611$ ,  $df = 2$ ,  $p = 0.164$ ).

**Figure 4.18 Mean MRR scores for businesses that did, and did not, have stormwater drain inlets paint stencilled with a prompt**

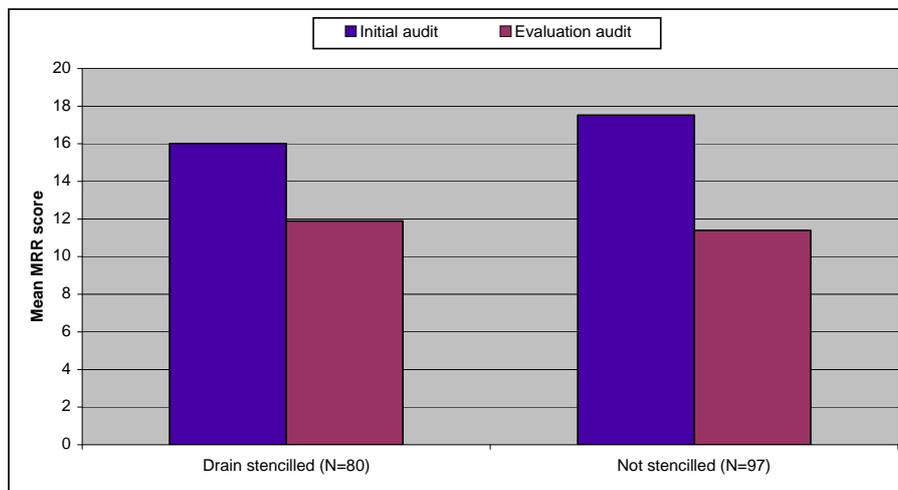
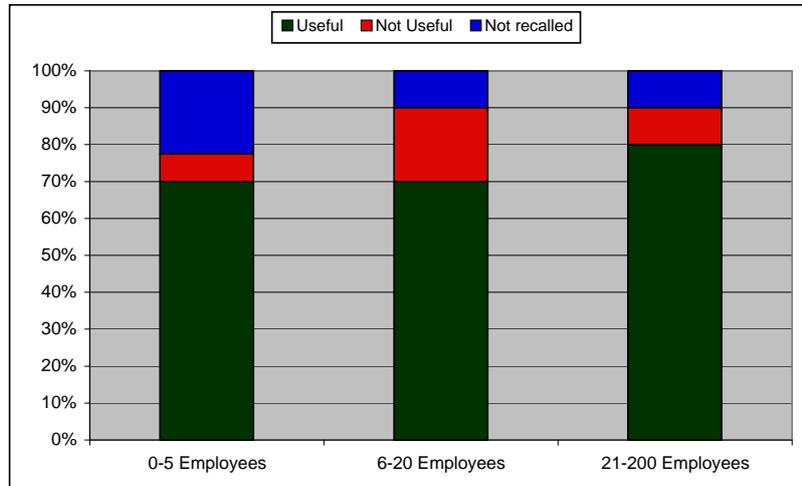


Figure 4.19 illustrates the response of participants when asked if they considered their drain stencil to be a useful education intervention. Figure 4.19 shows that most participants that received drain stencilling, irrespective of business size, believed the education intervention to be useful. Note that not all participants who agreed to have their stormwater drains stencilled received a stencil, due to difficulty in gaining permission from landlords or the body corporate, or being unable to arrange a suitable time with the business owner/manager to apply the paint.

**Figure 4.19 SME participants who indicated that paint stencilling stormwater drain inlets was a useful educational intervention (n=80)**



#### 4.14.2 Personalised industry-specific information

Figure 4.20 illustrates the MRR audit scores (Section 3.3.3) for those businesses who were provided personalised industry-specific information (Section 3.3.5.3), and those that received generic SME environmental management information only (Section 3.3.5.1). Figure 4.20 demonstrates that businesses with a higher MRR score were more likely to request the personalised information. This result was not statistically significant ( $\chi^2 = 4.014$ ,  $df = 2$ ,  $p = 0.134$ ).

**Figure 4.20 Comparison of mean MRR scores of SME participants provided personalised industry specific information, and generic SME environmental management information only**

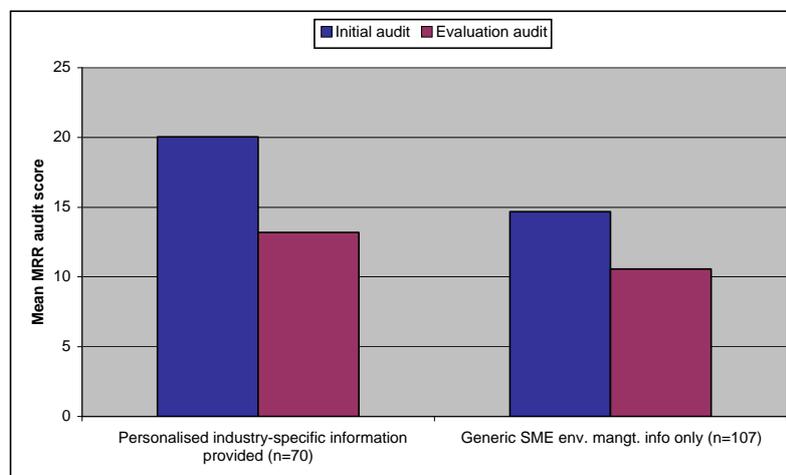
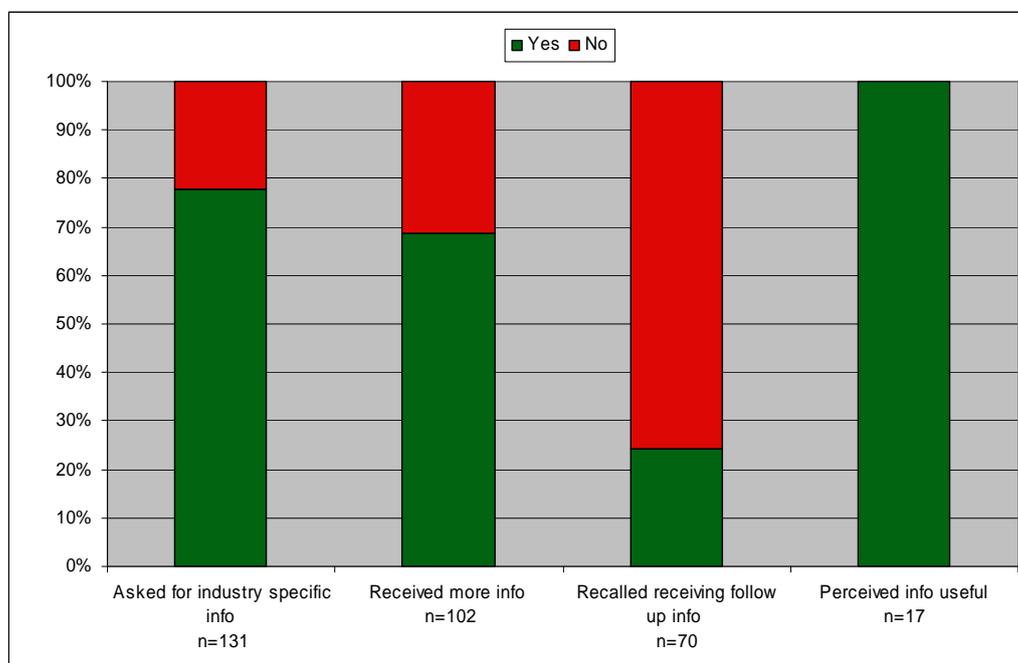


Figure 4.21 highlights the challenge of providing relevant, personalised industry-specific, printed information for the diversity of SME light industrial activities. The columns in Figure 4.21 are presented as a sequence, each new column being formed from the 'yes' portion (green block) of the column to the left. Most businesses requested additional personalised industry-specific information (80%) at the conclusion of the initial audit. Approximately 70% of those businesses who requested further information were supplied information considered relevant to their specific needs. However, less than 25% of the participants who received the additional information could recall having received it approximately 9 months later.

Note that this information was not able to be supplied to all participants who requested it. Supply of information was dependant on the information being readily sourced by SERCUL for the type of industrial activity being undertaken.

**Figure 4.21 Businesses who requested optional industry-specific information, were supplied with the information, could recall receiving the information, and perceived the information to be useful.**



Optional personalised industry specific information was not offered in the initial of City of Canning participants reducing the sample size to n=131 in the evaluation survey.

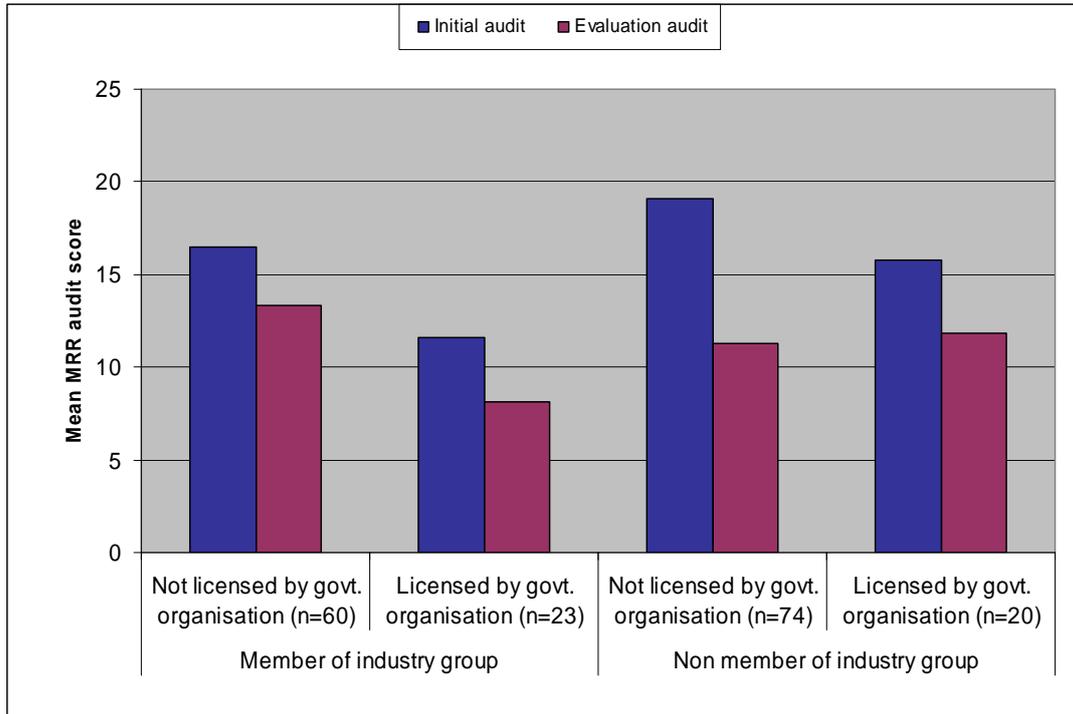
## **4.15 External sources of environmental management information**

The influence of potential environmental management information sources external to the SERCUL study were also evaluated. The variables were limited to licensing by a government organisation, membership in an industry group or association, and industrial neighbours.

### **4.15.1 Businesses licensed by a government organisation and/or members of industry associations, or neither licensed or members**

Participants were asked if they were licensed by a government organisation for an environmental activity, or a member of an industry group or association. Figure 4.22 compares mean MRR scores for those businesses that were licensed and unlicensed and members and non-members. Appendix H lists the organisations and associations nominated by participants. Figure 4.22 illustrates that in the initial audit businesses without a membership, and not licensed, had the highest mean MRR audit score. In the evaluation survey this category had the largest mean MRR improvement and had a lower mean MRR score than licensed/non-members and member/not licensed groups. Those businesses that were licensed and members consistently had the lowest mean MRR score.

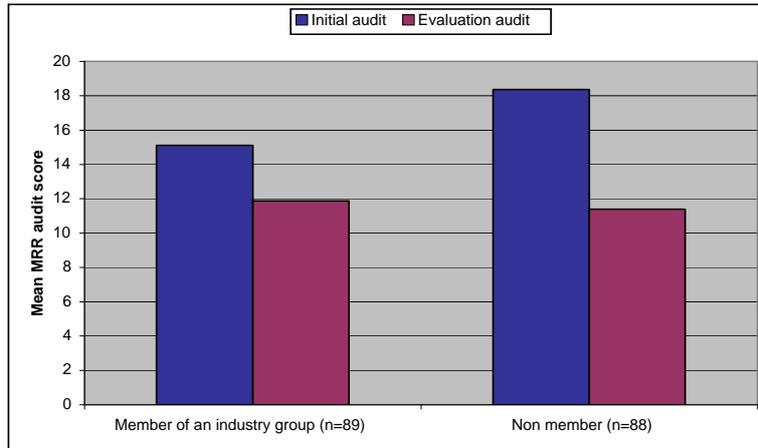
**Figure 4.22 Comparison of MRR score for businesses licensed and not licensed by a government organisation, and members and non-members of a industry group or association**



#### 4.15.2 Industry group or association membership

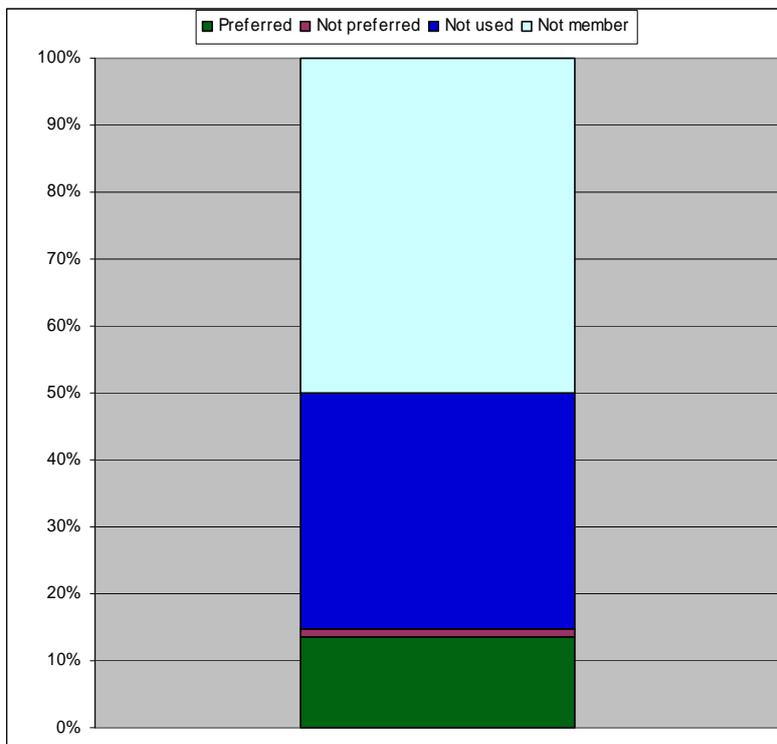
Figure 4.23 compares the initial and evaluation mean MRR audit scores (Section 3.3.3) for businesses who were members of an industry group (Section 4.2.6) and those that were not. Figure 4.23 illustrates that members of industry groups had slightly lower MRR audit scores than non-members in the initial audit, but higher mean MRR audit scores in the evaluation audit. This result was not statistically significant ( $\chi^2 = 4.519$ ,  $df = 2$ ,  $p = 0.104$ ).

**Figure 4.23 Mean MRR for businesses that were, and were not, members of an industry group or association**



During the evaluation survey participants were asked, as part of a standard list (Figure 4.11), if they found industry groups and associations a useful source of environmental information. Figure 4.24 illustrates that half of participants were not members of an industry group or association, and overall only 13% considered industry groups and associations a useful source of environmental information.

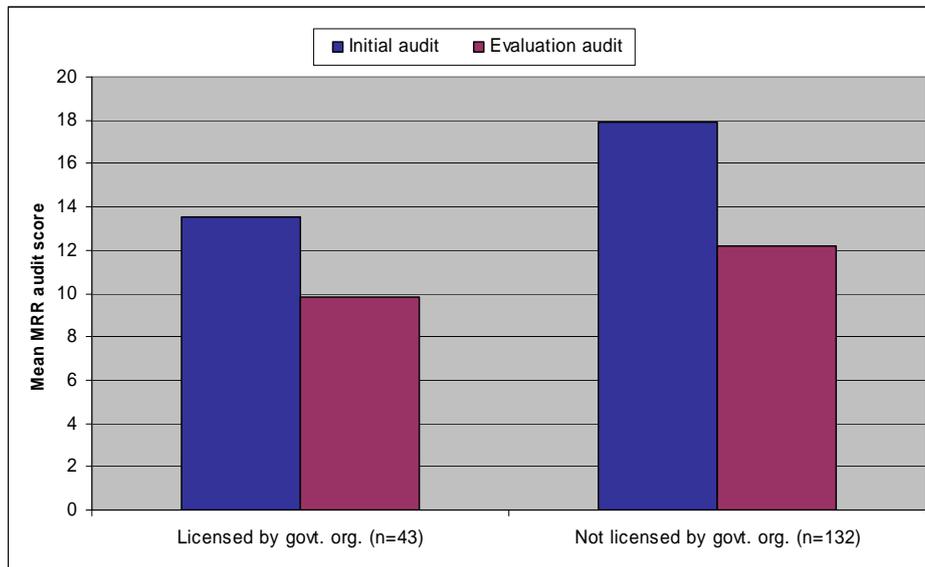
**Figure 4.24 Participants who consider industry groups and associations as a useful environmental management information source (n=177)**



### 4.15.3 Licensed by a government organisation

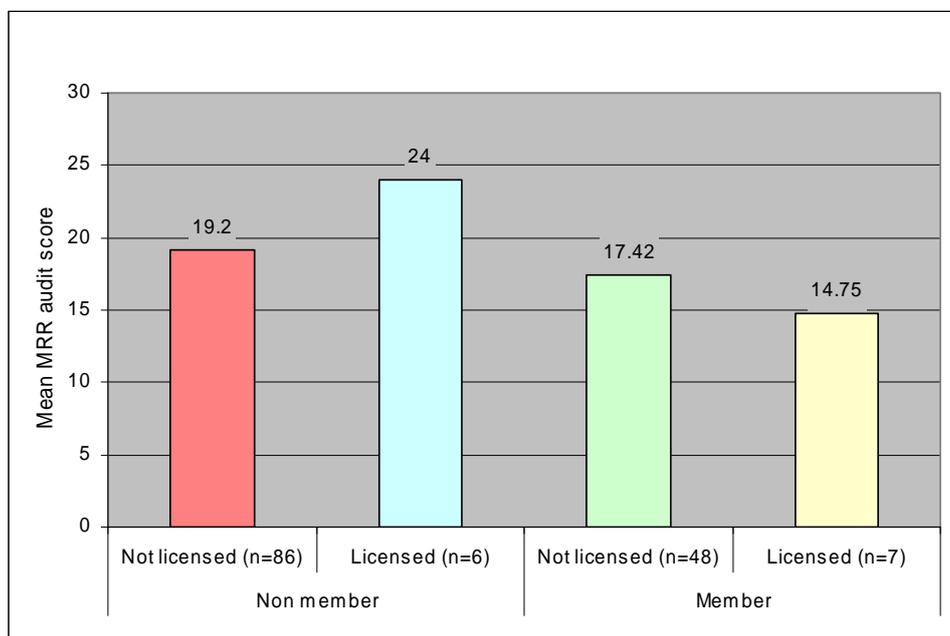
Figure 4.25 compares the initial and evaluation mean MRR audit scores (Section 3.3.3) for businesses who were licensed by a government organisation for an environmental activity (Section 4.2.7) and those that were not. Figure 4.25 illustrates that members of industry groups had slightly lower mean MRR audit scores than non-members in the initial audit, but higher mean MRR audit scores in the evaluation audit. This result was not statistically significant ( $\chi^2 = 3.975$ ,  $df = 2$ ,  $p = 0.137$ ).

**Figure 4.25 Comparison of initial and evaluation audit mean MRR score for businesses that were licensed and not licensed by a government organisation**



In the initial survey participants were asked if they were licensed by a government organisation for an environmental activity, or a member of an industry group or association. Figure 4.26 compares mean MRR scores for micro businesses that were licensed and unlicensed and members and non-members. Figure 4.26 illustrates that micro businesses that were non members of an industry group, but licensed to a government organisation, had the highest mean MRR audit score.

**Figure 4.26 Micro businesses licensed by a government organisation, member of an industry group or association, or neither licensed or a member**



#### 4.15.4 Industrial neighbours

Figure 4.11 (page 60) shows that industrial neighbours were not usually considered a useful source of environmental information (>15%).

### 4.16 Summary

In summary, the results presented demonstrate a high response rate (Section 4.2.1) from a sample consisting of predominantly small and micro business (Table 4.2). The sample was evenly distributed across the 5 LGAs (Table 4.1) with most businesses being from one of five business types (Table 4.3). Most of the businesses had been at their current premise less than 10 years (Figure 4.1) and half were members of an industry group (Section 4.2.6). The evaluation group were representative of the initial group (Section 4.6).

The reporting of barriers to environmental management was lower than expected (Section 4.4.1). The preferred SME environmental information and communication sources (Table 4.5) in the initial survey were similar to the environmental information

and communication sources SMEs considered most useful in the evaluation survey (Figure 4.11). Awareness of stormwater protection was generally high (Section 4.3), although this was not necessarily reflected in management practices that protected stormwater quality (Figure 4.8). In the evaluation audit environmental risk management practices were found to have generally moved away from being high risk towards low risk (Table 4.11), although most businesses retained at least one high risk activity (Table 4.12).

Most businesses found the survey and audit useful (Table 4.9) and believed that Local Government visits improved their environmental management (Figure 4.12). The optional education interventions (Section 4.14), industrial neighbours (Figure 4.11), licensing by a government organisation (Figure 4.25) and industry group membership (Figure 4.23) did not appear to have a significant influence on participants' environmental management practices, unless both licensed by a government organisation and a member of an industry group or association. The Discussion chapter following explores the results, highlighting factors that are considered significant in facilitating improved light industrial SME environmental management.

# Chapter 5 Discussion

## 5.1 Introduction

This chapter begins by examining the degree of SME environmental management improvement after voluntary contact with Local Government Officers, and the advantages and disadvantages of voluntary participation compared to a regulatory compliance approach. The potential to cost effectively target particular subsets of the light industrial SME group, to improve stormwater quality protection, is then discussed.

The relationship between the participants' awareness of stormwater protection issues and their behaviour is explored, including how this relationship affects the reporting of barriers to environmental management. The connection between the participant's preferred environmental information and communication sources, recorded in the initial survey, and the participant's perceptions of the most useful sources of information, recorded in the evaluation survey, is also examined. These findings are discussed in reference to how they also influence the reporting of barriers to environmental management.

The variable effect of the education interventions are evaluated and the potential influence of external information sources, unrelated to the SERCUL SME project, are also examined.

The participants' perception of LGA involvement in light industrial SME environmental management and the usefulness of the surveys and audits is then discussed in reference to the participants' preferences and perceptions of environmental management information sources. The suitability of LGA officers in the 'change agent' role is then considered.

## 5.2 Environmental risk management

### Research design limitations

The results presented in Chapter 4 demonstrate that voluntary SME participation was effective in achieving a high response rate (Section 4.2.1) and that LGA contact with light industrial SMEs did have a positive effect on environmental risk management for the protection of stormwater (Table 4.10).

It is probable that some SMEs, with particularly poor environmental management practices, avoided contact with the SERCUL SME project because participation was voluntary. This could potentially skew results, portraying environmental practices to be better than the reality (Section 3.5). This was a particular concern with postal and telephone surveys (Section 3.3.1). However, it is also recognised that ‘beyond compliance’ businesses occasionally refused the survey and audit, stating that the time should be spent on the poorer performers. The sample is therefore considered reasonably representative of businesses that met the ‘generates wastewater’ and/or ‘stores liquids and chemicals’ criteria (Section 3.3.6.1).

Establishing the representativeness of the sample in the wider population is important. The non-probability sampling procedure utilised (Section 3.3.6) limits the reliability of scientific generalisations (Section 3.5) made about SME environmental management outside of the study group (Rea and Parker, 2005). However, results regarding SME environmental management practices are consistent with other local light industrial SME studies (Walker *et al*, 2007; Walker and Redmond, 2006; Greenstamp MTA WA, 2004; City of Armadale, 2002; Swan River Trust, 2000), suggesting the sample is reasonably representative of the overall Perth metropolitan population.

Whilst voluntary participation in environmental management programs risks not being all inclusive (Gunningham and Sinclair, 2002), compulsory participation is also limited, in that, businesses may not feel compelled to exceed basic compliance (Pattern and Worthington, 2003). Without voluntary or willing engagement by participants the necessary relationships may not develop to encourage higher level environmental management planning (Van Berkel, 2004; Patton and Worthington, 2003)

Assertions that voluntary participation should be an augment to compliance regulation (Peters and Turner 2004; Gunningham and Sinclair, 2002) are supported by the findings of this study. Further, Revell and Blackburn (2004) believe that SMEs will not be sufficiently motivated to address environmental management without a regulatory driver. However, findings in the studies of Patton and Worthington (2003) and Petts *et al.* (1999) suggest that many businesses are unlikely to move beyond compliance, and that compliance will not be sufficient to protect the environment. These findings highlight the tension and delicate balance to be struck between regulating compliance and voluntary participation in SME environmental management.

### **Stormwater quality protection**

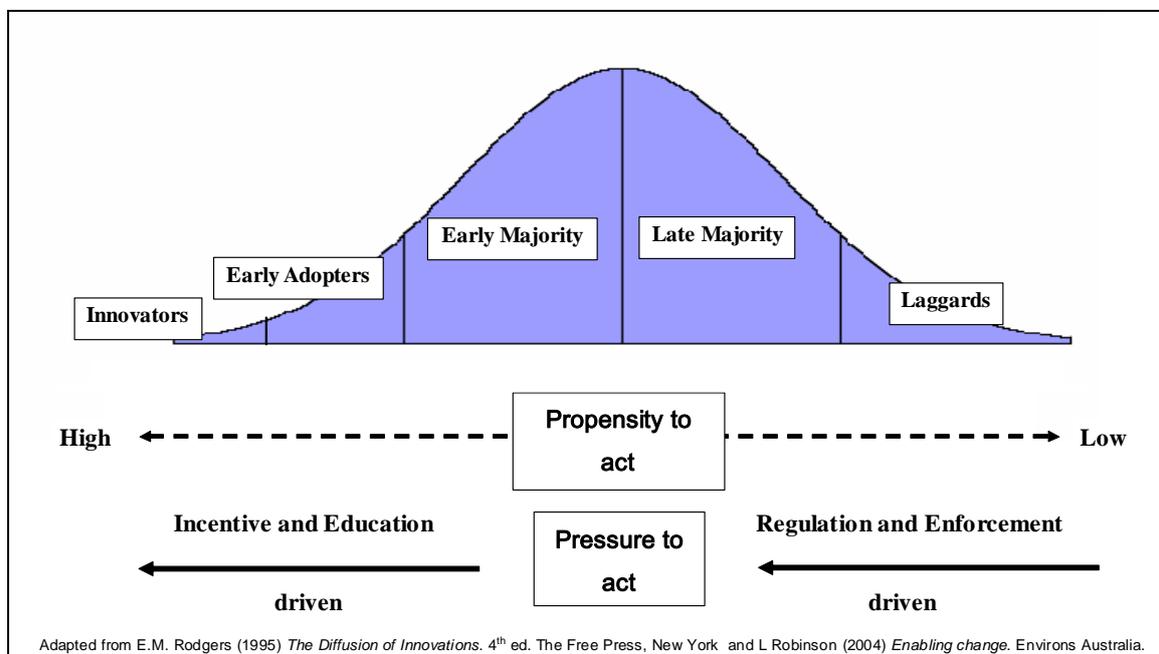
Results from the initial audit indicate that treatment of stormwater from industrial premises, to ensure high quality, is rare (Figure 4.6). Virtually all stormwater disposal was observed to be to the ground and groundwater, and rivers and the ocean. The capture and use of stormwater is very uncommon. The presence of wastewater treatment facilities was not a guarantee of water discharge quality because the facilities were often not maintained to an appropriate standard (Figure 4.8). The most common contaminants from inadequate wastewater treatment were hydrocarbons and detergents (Figure 4.9), although a variety of other contaminants were recorded.

Although positive, the approach used in the SERCUL SME project did not result in a comprehensive SME implementation of pollution prevention measures for the protection of stormwater quality. Evidence of on-site discharge, considered the best indicator of legal compliance in this data, did not improve dramatically, although there was a twenty five percent improvement in businesses eliminating on-site discharge to stormwater (Table 4.10). It is also worth noting that the data does not reflect those businesses who could have significantly reduced discharge, but had not eliminated it as the criteria required (Appendix B). However, we cannot ignore that more than two fifths of businesses were still assessed to be discharging contaminants to the ground, groundwater or stormwater system in the evaluation audit (Table 4.10).

### 5.3 Consistent high risk

A small group of businesses (15%) were assessed as having high risk management practices in both the initial and evaluation audits (Table 4.13). A smaller group (5%) moved from being medium risk in the initial audit to being high risk in the evaluation audit (Table 4.13). This group could potentially be the Laggard group (Figure 5.1) described by Rogers (2003)<sup>2</sup>. A further examination of the participants' beliefs and values would be required to conclude this, as the survey methodology employed in the SERCUL SME project is limited in its ability to show causal relationships between variables (May, 1997)(Section 3.5).

Figure 5.1 Diffusions of Innovations model



The micro enterprises were over represented in the consistently poor performers (Table 4.14). This result is also reflected by environmental risk management (MRR) improving as employee numbers increase (Figure 4.13). This is not to suggest that all micro businesses have these characteristics, far from it, but it is an observable trend in the data collected. As micro and small businesses represent the vast majority of

<sup>2</sup> Rogers (2003) described the dominant values of Laggards as traditional; resistant to innovation and suspicious of change agents. The Laggard's reference point is considered to be in the past i.e. what has been done in the past is the reference for activities that will be undertaken in the future.

businesses in Australia (Walker and Redmond, 2006), their collective environmental impact is potentially immense (Scott, 2000).

### **Cost effectiveness**

These results suggest the consistently poor performers, potentially Laggards, represent a cost effective group to target due to their disproportionate contribution of stormwater contaminants. Laggards can represent not only unlikely participants in environmental improvement programs, but can seriously diminish the cost effectiveness of outcomes achieved in a program engaging Innovators and Early Adopters (Figure 5.1). Any outcomes achieved by program participants could be significantly overshadowed by the continued detrimental effects of the activities of those not participating in the program. This concept is represented by Table 5.1.

**Table 5.1 Cost effectiveness of pollution prevention programs**

<p><b>Cost effectiveness</b> =</p> <p>(i.e. results divided by effort less the detrimental effects of those not participating)</p>	<p><b>Outcomes achieved / resources expended</b></p> <p><b>minus the cost of continued resource</b></p> <p><b>depletion and degradation</b></p>
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### **Targeted research**

The approach taken in the SERCUL SME project was not sufficient to substantially improve the environmental practices of more than half of those assessed as high risk to contaminate stormwater in the initial audit (Table 4.13). Further investigation is warranted to establish how to effectively engage this group in environmental management. Research that specifically targets light industrial SME poor environmental performers in voluntary activities, aimed to significantly improve environmental management, would potentially present great difficulties within the SME group, already considered one of the most difficult to engage (Spence and Lozano, 2000). However Rogers (2003) cites Røling *et al.* (1976) suggesting that when change agents (Section 2.10) directly contact Laggards and provide assistance appropriate to their needs, the results are often encouraging. Rogers (2003) also suggests that the

prejudice of change agents can lead them to avoid Laggards, believing they are traditionally resistant to change and/or irrational. This can become a self fulfilling prophecy by denying the information and assistance that is required for successful adaptation.

### **Regulation**

To regulate a large number of businesses to legal environmental compliance may be highly resource intensive and return only very modest environmental outcomes (Mir, in press; Gunningham and Sinclair, 2002a). The Western Australian Environmental Protection (Unauthorised Discharge) Regulations 2004 (UDR) is a compromise between pollution control and pollution prevention, limiting the legal discharge of many hazardous substances. In practice, the collection of evidence and sustained use of infringement notices can be onerous, limiting the appeal of UDR's to Local Government, who can be given State Government authority for LGA Officers to enforce the legislation. Undoubtedly, the use of UDRs and prosecutions may be the only measure to pressure some recalcitrant SME operators to meet minimum legislative environmental standards. However, applying the legislative 'stick' to all light industrial SMEs would be extremely resource intensive, and may only result in achieving basic environmental standards. The UDRs do not stipulate requirements to reduce the production of toxic materials, waste, water, energy or raw material usage; increasingly important considerations for industrial activities in a world grappling with the notions of sustainability and sustainable development. Nor is an enforcement approach likely to develop the regulator-regulated relationships of trust and credibility essential to encourage participation in beyond legal compliance activities (Patton and Worthington, 2003; Petts *et al.*, 1999)(Section 2.7). Table 5.2 outlines the potential costs and benefits of approaches to engaging light industrial SMEs in various levels of environmental management.

Laggards are likely to be responsible for a considerable portion, if not the majority, of stormwater contamination in the light industrial areas studied. Successfully engaging the Laggards, or the poorest performers, in environmental management immediately raises the minimum benchmark, and potentially, the environmental aspirations of other members of the light industrial area. This finding highlights the need for further

research into targeting the voluntary and willing participation of Laggard SMEs in environmental management programs, to facilitate high level and cost effective environmental outcomes.

**Table 5.2 Comparison of intervention types and likely outcomes in light industrial SME environmental management**

Cost of doing nothing	Low (potentially high)
Potential environmental outcomes	Low
Cost of enforcing compliance	High
Potential environmental outcomes	Low
Cost of beyond compliance engagement	Lower (?)
Potential environmental outcomes	High

## 5.4 Awareness of stormwater issues

Awareness of stormwater contaminants was generally high and this was reflected in the mean Stormwater Awareness Risk (SAR) rating (3.06, low risk). However, awareness was often inconsistent with practice. For example, 100% of participants with oil in their wastewater indicated that oil and grease is a stormwater contaminant. However 43% of those participants were observed to have unacceptable wastewater treatment (Figure 4.16). This clearly indicates that awareness of a stormwater contaminant does not predict environmentally responsible behaviour. It is therefore possible to conclude that awareness of contaminants alone did not lead to stormwater pollution prevention in a large number of the sample group. The poor link between SME awareness and behaviour is also reported by Schaper (2002a) and Smith *et al.* (2000).

The vast majority of participants recognised a legal obligation to protect stormwater quality (Figure 4.3), although more than half (58%) were observed to be inappropriately discharging contaminants into the soil, or stormwater system (Table 4.6). However,

prior to the initial audit, most participants (90%) felt they were taking appropriate measures to protect stormwater quality (Figure 4.3). It is therefore possible to conclude that the awareness of a legal obligation to protect stormwater did not lead to pollution prevention in a large number of the sample group. Gunningham and Sinclair (2002a) suggest that SME compliance with regulations is related to the perceived likelihood of enforcement of those regulations.

The conclusions above contrast with the statistical result that a high awareness of stormwater issues did, on average (mean), result in lower risk environmental management practices (Section 4.13). Several researchers suggest that SMEs perceive that their activities have little impact on the environment (Walker and Redmond, 2006; Hillary, 2004; Simpson *et al.*, 2004; Hillary 1995). This is a potential explanation for why an awareness of stormwater contaminants, and the recognition of a legal obligation to protect stormwater, does not automatically lead to practices that prevent their discharge. This suggests that a lack of understanding of impacts is a more significant barrier than a lack of awareness of contaminants, and provides an explanation for why a higher awareness (SAR) did not lead to a directly proportional rise in improved environmental behaviour (MRR). This attitude could be a result of a lack of perceived credibility in the message that stormwater contaminants cause environmental harm, or perhaps more likely, an inability of SMEs to locate individual discharges as part of the wider cumulative impact of thousands of discharges. It is likely that business owner/managers are unable to identify their (often small) contaminant discharges as part of the problem, and are therefore unable to see themselves as part of the solution (Friedman and Miles, 2002; Holland *et al.*, 1997).

## **5.5 When no barrier exists**

The reporting of barriers to environmental management was generally low; no barrier was significant to more than one third (35%) of the participants surveyed (Figure 4.4 and Table 4.4). The standard list of barriers provided in the survey may have influenced participants' responses (Section 3.3.2.2), and therefore limited the barriers reported. However, several barriers additional to the standard list were reported by participants and are listed in Appendix F. The barriers to environmental management reported in

this study were also generally consistent with barriers reported in local studies (Walker and Redmond, 2006; Green Stamp MTA WA, 2004), including many of those additional barriers provided by participants under the 'other' category (Appendix F).

It is possible that the barriers reported by participants were influenced by a lack of awareness of their business' environmental impacts. In the survey the question about barriers to environmental management, occurred at the beginning of the interviews, prior to the audit. This assisted in establishing a rapport with participants, by beginning the interview asking participants about their thoughts and challenges, before identifying deficiencies in practice (May, 1997). However, at the time of recording, many participants were unaware of inappropriate environmental management practices in their workplace (Figure 4.3), and or, potentially believed their impact to be insignificant (Vives, 2006). Participants that were not aware of environmental management issues, could not report barriers to a problem that they did not know existed. For example, a business routinely degreasing machinery over a stormwater soakwell, or the ground, may have a very different perception of barriers prior to an audit, compared to the conclusion of an audit, when they are alerted to environmental management problems. If, after an audit, a recommendation is made that a washdown bay and oil/water separator is required to continue degreasing on-site, at an approximate cost of \$20,000, likely costs may become a significant barrier. Similarly, a lack of information or expertise may only become a barrier when an environmental management deficiency is highlighted, and the information and expertise is then required to address it.

This finding serves to emphasize barriers as a snapshot in time, changing with a change in circumstances. It highlights the need for regular collection of SME barriers to environmental management so that regulators can respond appropriately to changing conditions influencing SME behaviour and practice, both internal (such as awareness) and external (such as customer demands or contractor services available) (McKenzie-Mohr and Smith, 1999).

A lack of understanding for a need to change environmental management practices, as a result of a lack of awareness of environmental impacts, assists in the understanding of why SME barriers to environmental management were reported at low levels. It may

also help explain why barriers such as likely costs were not reported as being more significant, particularly in the micro sector. The findings regarding preferred information and communication sources, and perceived usefulness of education sources also provide insight into the SME reporting of barriers to environmental management.

## **5.6 The relationship between SME barriers and preferred environmental information sources**

SME environmental management information preferences collected in the initial survey (Figure 4.5) were similar to the most useful environmental information sources stated by SMEs in the evaluation survey (Figure 4.11). The most common SME environmental information preferences, in the initial survey were:

- (i) face-to-face communication;
- (ii) legal compliance checklist;
- (iii) best management practices; and
- (iv) Local Government audits.

The first and fourth preferences reflect direct human contact and the second and third preferences usually relate to printed materials. These information preferences were reflected in the evaluation survey, with the most useful SME information sources reported as being:

- (i) environmental risk management survey and audit;
- (ii) premise inspection;
- (iii) awareness of regulations; and
- (iv) SME environmental management information.

The first, second and third preferences reflect direct human contact and the fourth preference relates to printed materials regarding legal obligations and best management practices (Section 3.3.5.1). The perceived usefulness of information sources is strongly aligned with the preferred information sources. However, the provision of face-to-face communication and preferred education materials supplied in the SERCUL SME project should have contributed to addressing the most significant barriers to environmental

management stated in the initial survey (Table 4.4); as the top three SME recorded barriers following suggest:

- (i) lack of information;
- (ii) lack of government assistance; and
- (iii) lack of environmental expertise.

This finding suggests that providing environmental management information and site-specific advice and expertise in the format used in the SERCUL SME project, will not immediately and substantially improve SME environmental management. It also suggests that the next most significant recorded barriers of 'likely costs' and the related barrier of 'lack of market demand' (Table 4.4) are potentially more significant than indicated by the SME participants. The high significance of a cost barrier is reported in Mir (in press) and Gerstenfeld and Roberts (2000), and includes opportunity costs i.e. time spent away from 'core business'. This finding lends support to Hillary's (2004 p. 568) explanation that "customers are a key driver for the adoption of EMSs and have influence far beyond any of the other stakeholders ... Paradoxically, customers also show a lack of interest in, or are satisfied with SMEs current environmental performance". This suggests that SME environmental management is a reflection of environmental practices, if not expectations, in the general community.

## **5.7 Effect of the education interventions**

The results suggest that the environmental risk management of the sample group did improve as a result of the education interventions, although the effect of the interventions was varied.

The poor ability of SMEs to identify environmental hazards and risks (Section 2.5) can make self reporting unreliable. Many participants reported they perceived that they had improved their environmental management, although there was some incongruity with the auditors assessments (Figure 4.14 and Figure 4.15). The results demonstrate a need to confirm self reported SME environmental behaviour by inspection.

Providing the SME participants with personalised industry-specific information and/or the drain stencilling prompt did not result in a statistically significant improvement in the Management and Infrastructure Risk Rating (MRR).

### **Drain stencilling**

Most participants who received the drain stencilling indicated that it was a useful prompt to improve environmental risk management on their premises (Figure 4.18). There was also anecdotal evidence that the drain stencils had benefits in raising environmental management discussions between management and employees, and between businesses and customers. Therefore the drain stencilling technique may have a value as a prompt to facilitate an environmental management discussion, but not as a stand alone education intervention to improve environmental risk management for the protection of stormwater quality.

### **Personalised industry-specific information**

The results for the personalised industry-specific information suggest that the delivery of specialised printed information would need to be highly targeted for the intervention to be cost effective. The results illustrate that those participant businesses with higher MRR scores were more likely to request the industry-specific information and were more likely to improve environmental practices, than those who did not receive the information (Figure 4.20). However, this did not result in a statistically significant improvement in MRR audit score (Section 4.14.2) and three quarters of those who were sent the information could not recall receiving it several months later (Figure 4.21).

However, improvements in the MRR audit score were observed between the initial and evaluation audits, suggesting the survey and audit and/or the generic SME environmental management information pack may have been influential in this result.

### **Influential interventions**

Despite SME preferences for best management practice guides and legal compliance checklists (>78% of participants in the initial survey) (Table 4.5), the usefulness of printed materials were generally reported at much lower levels by participants in the evaluation survey (Figure 4.11). Face-to-face discussions and Local Government audits

were common information and communication preferences (>83% of participants) (Table 4.5) and their usefulness was recorded to be higher in the evaluation survey than in the initial survey (Figure 4.11). Given that the survey and audit components were consistently evaluated as being more useful (>95% of participants) than the SME environmental management information pack components (75 - 29%)(Section 3.3.5.1), it is likely that the survey and audit were more influential in improving environmental risk management. As the survey and audit were delivered face-to-face this result emphasizes the importance of human contact and social factors in the adoption of new behaviours (Rogers, 2003; Clarke, 2000).

## **5.8 Other environmental management information sources**

Other potential factors contributing to MRR improvement external to the SERCUL SME project, such as membership in industry groups, licensing by a government organisation and contact with neighbours, were not considered significant in the results observed. Both industry associations and neighbours were infrequently reported as useful sources of environmental information by the SME participants (Figure 4.11).

### **Industry groups and associations**

Industry groups are often assumed to have the necessary credibility and interest in supporting businesses, whereas only 13% of the study group considered their industry group or association a useful source of environmental management information (Figure 4.23). This result could help explain the low response rate of SME involvement in environmental programs that are delivered through industry-government partnerships (i.e. the Western Australian Green Stamp programs). The infrequent use of industry groups for environmental information can be partly attributed to membership numbers, as only half of the sample group were members of an industry group or association (Section 4.2.6). The literature reporting on the effectiveness of trade or industry association involvement in facilitating SME environmental management improvement is often inconclusive (Roy and Therin, in press; Clarke, 2004).

### **Licensing by a government organisation**

Businesses that were both licensed by a government organisation and members of an industry group tended to have the lowest risk to contaminate stormwater (Figure 4.22). However, this could be a function of business size (Figure 4.13) because amongst the micro enterprises those licensed by a government organisation had the highest risk to contaminate stormwater (Figure 4.26). This is a concern, presumably the businesses are licensed because they handle substances that are more hazardous than the norm. Observations in the field suggest that government organisations tend to license a specific aspect of a business' activities rather than the overall operation. It is important that the licensed premises are included in the routine inspections of all businesses for this reason.

### **Industrial neighbours**

Neighbouring businesses were infrequently considered a useful source of environmental management information (Figure 4.11). However, informal networking within and between industrial areas is often extensive. This finding suggests that within an industrial estate, a patchwork of improved environmental risk management is more likely to occur from peer networks, rather than clusters as a result of neighbour to neighbour contact. This result is supported by Rogers (2003) stating that peers with similar value systems are highly influential in the adoption of new innovations.

## **5.9 Acceptability of LGA involvement in SME environmental management**

The SME participants did perceive that LGA intervention improved their environmental management (Figure 4.12), although this was not always reflected in participants' practice. Most participants also believed that the approach used in the SERCUL SME project contributed to a positive relationship with their local Council (Figure 4.12). In a recent Perth light industrial SME survey Walker and Redmond (2006) identified Local Government as the level of government that participants perceived most responsible for environmental management issues in their area. The findings of the SERCUL study support LGAs as potential change agents for SME environmental management.

Further support for this finding comes from most participants indicating that they found the environmental risk survey audit useful; the percentage increasing from the initial to the evaluation survey (Table 4.9). Significantly, most participants who indicated that Local Government audits were *not* preferred in the initial survey (Figure 4.5) still indicated that the environmental risk surveys and audits were useful, and perceived that Local Government audits did improve their environmental management in the evaluation survey (Section 4.7). This result suggests that those participants who were initially cautious about engaging in Local Government environmental management audits experienced increasing value in the approach as the project progressed.

While the results suggest that LGAs were perceived as suitable change agents by SMEs, this does not necessarily mean that LGAs are the most suitable, or the only organisation to perform this role; simply that they were accepted in this role by the majority of the SMEs involved in the SERCUL project.

Research reported from other continents identifying LGAs as potential change agents (Pimenova and van der Vorst, 2004; Peters and Turner, 2004; Pedersen, 2000) need to be viewed in the context of the particular structure of Local Government in their particular region of study. The findings of the SERCUL SME project and the study reported by Walker and Redmond (2006) offer significant evidence for the acceptance of LGAs as change agents for SME environmental management in the local context. However, the analysis of the SERCUL SME project data suggests that the simple presence of LGA change agents alone is not enough to immediately and substantially improve SME environmental management. The engagement approach taken by the LGA auditor, and the tools and techniques employed, are likely to significantly effect the level of SME environmental management achieved (Rogers, 2003). Indications from Rogers' (2003) Diffusion of Innovations theory suggests that the auditor as change agent will appeal to those whom most closely share their values. Therefore, a range of strategies may be required to address a range of values and beliefs that inform practices amongst the diverse and disparate SME 'group' (Hillary, 2004). Particular change agents may be required to engage with particular adopter groups (Rogers, 2003), or highly trained change agents would require a keen understanding of how to appeal to a

broad range of social values in different adopter categories (Section 2.4), acknowledging the diverse needs of the SME 'group' (Peters and Turner, 2004).

## **Chapter 6 Conclusion**

SME environmental management is generally reported as being inadequate around the world (Studer *et al.*, 2006; Walker and Redmond, 2006; Vives, 2006; Hillary, 2004). In Australia, SMEs constitute the vast majority of businesses (Section 1.2) and their involvement in environmental management is an important step towards achieving sustainable development (Schaper, 2002). However, SMEs are a diverse group and are well known to be difficult to engage (Peters and Turner, 2004) and there is considerable debate regarding appropriate mechanisms for engaging SMEs in environmental management (Section 2.7). Some studies identify regulation as a crucial driver in SME environmental management (Revell and Blackburn, 2004; Studer *et al.*, 2006). However, it is acknowledged that SMEs do not tend to exceed regulatory standards (Patton and Worthington, 2003), and that regulation alone is unlikely to lead to the protection of the environment (Petts *et al.*, 1999).

This research has examined the effect of voluntary light industrial SME participation in an environmental project conducted by the South East Regional Centre for Urban Landcare (Section 1.3). A total of 445 semi-structured interviews, consisting of a survey, audit and inspection were conducted in an initial, and evaluation stage (Section 3.3.1). The project recorded light industrial SME stormwater awareness, barriers, preferences, perceptions and practices for the protection of stormwater quality. Optional printed resources and a drain stencilled prompt were made available to participants, to test their effectiveness as education interventions in the protection of stormwater quality (Section 3.3.5).

The results confirm inadequate protection of stormwater quality (Section 4.5), and a lack of local SME awareness of business impacts on the environment that is often documented in other studies (Williamson *et al.*, 2006a; Vives, 2006; Tilley, 1999). The optional printed materials and drain stencilled prompt were ineffective in substantially

improving the protection of stormwater quality protection (Section 4.14). The improvements observed in environmental risk management are attributed to face-to-face and site-specific delivery of environmental management information. The importance of human contact and social factors in the adoption of new behaviours featured prominently in the discussion (Section 5.7).

Undoubtedly the perceived lack of a market driver for environmental management is a core, and under acknowledged, barrier (Section 5.6). This research also serves to emphasize that the SME awareness of environmental impacts is a significant barrier to improved environmental outcomes (Section 5.5). In the present economic climate, the level of SME environmental management outcomes attained is likely to be directly related to the skill of the change agent in being able to personally engage the business owner or manager. This analysis has identified that southern Perth light industrial SMEs do perceive Local Government as acceptable change agents for environmental management (Section 5.9), and more importantly, highlights the significance of social factors in the behaviour change process. Further research is recommended to investigate the role of social factors in the SME adoption of new innovations, particularly the poorest performing in environmental management, who are likely to be contributing a disproportionately large percentage of the stormwater contamination.

## Recommendations

1. Deliver light industrial SME environmental inspection programs through Local Government, with funding support from State Government.
2. Use environmental risk management tools which encourage a precautionary and beyond compliance approach to the non-prescriptive Environmental Protection (Unauthorised Discharge) Regulations 2004.
3. Focus on face-to-face contact and site-specific problem solving at SME premises.
4. Focus environmental management programs on the development of positive relationships. This will increase the likelihood of future participation in voluntary schemes that promote the reduction of toxics, energy, water and resource use and improves the cost effectiveness of environmental management support programs.
5. Continuously assess SME barriers and motivators to environmental management for an understanding of how to address changing SME priorities and needs.
6. Develop high level training opportunities for Industry Support Officers. The communication and technical skills of the Officers is likely to be the determinant factor in the level of SME environmental outcomes achieved.
7. Provide an initial inspection of all SME premises, including State Government licensed premises, prior to developing audit frequencies based on actual assessed risk.
8. Obtain Green Stamp accreditation for LGA depots as a positive promotional feature demonstrating Councils are 'walking the talk'.
9. Develop targeted strategies for adopter groups, particularly differentiating the approach to 'change of behaviour' versus 'change of belief' groups.
10. Establish a level playing field where Laggards are not gaining a competitive advantage by avoiding waste management costs that are a legal requirement. Unregistered and backyard operators also impact on the level playing field, particularly in the automotive industry. Use enforcement where all other options for compliance are not viable.
11. Market environmental accreditations (i.e. Green Stamp) to the customer, encouraging green purchasing that offers an economic incentive to SMEs to perform high quality environmental management.

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# Appendix A

## SERCUL SME project - survey and audit questions

An overview of questions that were asked in the SERCUL SME project, relevant to this analysis, are presented by dot point below. The criteria for judging responses for the purpose of scoring the Stormwater Awareness Rating (SAR)(Section 3.3.2.1) and Management and Infrastructure Rating (MRR)(Section 3.3.3) are presented in Appendix B. The scoring table for the MRR is presented in Appendix C.

### Initial survey

1. Business location
2. Business type
3. Employee numbers
4. Date established at location
5. Industry group or association membership(s)
6. Awareness of stormwater contaminants (test from list, yes/no/don't know)
7. Legal obligations for stormwater protection (yes/no/don't know)
8. SME perceived - appropriate level of stormwater protection currently?  
(yes/no/don't know)
9. Barriers to environmental management (from standard list, rating scale)
10. Preferred environmental information and communication sources (from standard list, rating scale)

### Evaluation survey

11. SME perceived usefulness of environmental information provided and interventions taken (from standard list, rating scale)
12. SME perceived - does your environmental management improve due to LGA environmental management visits? (yes/no/don't know)
13. SME perceived - did this project contribute to the development of a positive relationship with your local Council? (yes/no/don't know)
14. SME perceived – Do you think your environmental management has improved since our last visit? (yes/no/don't know)
15. SME perceived – which aspects of environmental management do you think improved? (from standard list)

## Initial and evaluation audit

16. Storage of new/raw materials (from list and acceptable/unacceptable/don't know/na)
17. Storage of waste materials (from list and acceptable/unacceptable/don't know/na)
18. Knowledge of type and quantity of substances stored (yes/no/don't know/na)
19. Comprehensive waste management plan (yes/no/don't know/na)
20. Some form of recycling used (yes/no/don't know/na)
21. Material Safety Data Sheets (MSDS) present for substances handled (yes/no/don't know/na)
22. Hazardous signage present (yes/no/don't know/na)
23. Water used in process (yes/no/don't know/na)
24. Wastewater constituents (from list)
25. Wastewater treatment process (from list)
26. Wastewater treatment (acceptable/unacceptable/don't know/na)
27. Wastewater disposal method (from list)
28. Waste water disposal (acceptable/unacceptable/don't know/na)
29. Waste water equipment maintenance program and documentation (yes/no/don't know/na)
30. Emergency spill procedures (yes/no/don't know/na)
31. Emergency spill equipment (yes/no/don't know/na)
32. Emergency spill equipment (acceptable/unacceptable/don't know/na)
33. Records accidental spills (yes/no/don't know/na)
34. Emergency contact numbers visible (yes/no/don't know/na)
35. Documented environmental policy (yes/no/don't know/na)
36. Onsite activities discharge to stormwater (yes/no/don't know/na)
37. Stormwater treatment process used (from list)
38. Survey useful in environmental hazard and risk identification (yes/no)
39. Further industry-specific information requested (yes/no)
40. Permission to stencil stormwater drains (yes/no/na)
41. General comments
42. Recommendations made by auditors

# Appendix B

## SERCUL SME project survey and audit question criteria

### Initial survey

**1. Business location**

**2. Business type**

Based on most significant activity undertaken at the premises. Therefore it is possible that a plumbing business is recorded as a vehicle depot, if no plumbing is undertaken on site, but the premises is used to repair and maintain company vehicles.

**3. Employee numbers**

Includes all staff on site including owner/manager. Does not differentiate between full time and part time employees.

**4. Date established at location**

Date of current business established at site audited.

**5. Industry group or association membership(s)**

**6. Awareness of stormwater contaminants (test from list, yes/no/don't know)**

- i. detergents
- ii. oil and grease
- iii. solvents and degreasers
- iv. wrapping and food containers
- v. dirt or sand
- vi. vehicle washdown water
- vii. treated wastewater
- viii. water draining from solid waste bins

The correct answer to all potential contaminant questions was 'yes'. However it was acknowledged that the 'water draining from waste solid bins' question was ambiguous and answers of don't know, possibly and maybe were also accepted as correct for this question.

**7. Legal obligations for stormwater protection (yes/no/don't know).**

**8. SME perceived appropriate level of stormwater protection (yes/no/don't know).**

**9. Barriers to environmental management (from standard list, rating scale).**

- i. Leased premises
- ii. Lack of likely benefits
- iii. Lack of staff resources
- iv. Lack of information
- v. Likely costs involved
- vi. No improvements can be made
- vii. Lack of government assistance
- viii. Lack of environmental expertise
- ix. Lack of market demand
- x. Other ... (specify)

**10. Preferred environmental information and communication sources (from standard list, rating scale).**

- i. Industry magazines
- ii. Local Government audits
- iii. Best management practice guides
- iv. Compliance checklists
- v. Face to face discussions
- vi. Telephone conversations
- vii. Email and websites
- viii. Newsletters and mailouts
- ix. Industry specific forums and seminars
- x. Other... (specify)

## **Evaluation survey**

### **11. SME perceived usefulness of environmental information provided and interventions taken (from standard list, rating scale).**

- i. Risk management survey
- ii. Premise inspection
- iii. Waste and recycle ready reference
- iv. EID (Dept. of Industry and Resources Environmental Industry Directory)
- v. EIP (Environmental Improvement Plan)
- vi. Drain stencil
- vii. Industry specific info (follow up)
- viii. Awareness of regulations
- ix. SME environmental management information folder
- x. Neighbours
- xi. Industry group

### **12. SME perceived - does your environmental management improve due to LGA environmental management visits? (yes/no/don't know)**

### **13. SME perceived - did this project contributed to the development of a positive relationship with local Council? (yes/no/don't know)**

### **14. SME perceived – Do you think your environmental management has improved since our last visit? (yes/no/don't know)**

### **15. SME perceived – which aspects of your environmental management do you think improved? (from standard list)**

- i. Raw material storage
- ii. Waste material storage
- iii. Wastewater management
- iv. General housekeeping
- v. Emergency preparedness
- vi. Policy and documentation

## **Initial and evaluation audit**

### **16. Storage of new/raw materials (from list and acceptable/unacceptable/don't know/na)**

Materials stored under a cover with no obvious spills were acceptable.

### **17. Storage of waste materials (from list and acceptable/unacceptable/don't know/na)**

Materials stored under a cover with no obvious spills were acceptable.

### **18. Knowledge of type and quantity of substances stored (yes/no/don't know/na)**

A simple verbal description from the owner/manager of the types and quantities of materials stored on site was sufficient. This was confirmed by inspection.

### **19. Comprehensive waste management plan (yes/no/don't know/na)**

Included all wastes that could be easily recycled including office paper and drink containers as well as wastes from industrial activities.

### **20. Some form of recycling used (yes/no/don't know/na)**

Any material being recycled rather than being disposed to landfill. Recycling of waste oil was included in this category.

### **21. Material Safety Data Sheets (MSDS) present for substances handled (yes/no/don't know/na)**

A verbal acknowledgement from the owner/manager that the MSDS are stored onsite is sufficient. Not confirmed by inspection.

### **22. Hazardous signage present (yes/no/don't know/na)**

A very basic assessment according to the DOCEP formula for the requirement for hazardous signage, based on the type and quantity of materials stored, was used.

### **23. Water used in process (yes/no/don't know/na)**

### **24. Wastewater constituents (from list)**

### **25. Wastewater treatment process (from list)**

### **26. Wastewater treatment (acceptable/unacceptable/don't know/na)**

Professional judgement on the adequacy of wastewater equipment based on the substances treated and the process used. For example oily wastes require an oil/water separator (or capture and off site disposal) or high and low pH substances require chemical neutralisation and containment.

**27. Wastewater disposal method(from list)**

**28. Waste water disposal (acceptable/unacceptable/don't know/na)**

Acceptable disposal relies on the type of substance, method and degree of treatment, maintenance of treatment facilities and method of disposal. Disposal to the stormwater system is unacceptable. However, approved treatment and disposal to an onsite soak well is acceptable.

**29. Waste water equipment maintenance program (yes/no/don't know/na)**

Verbal confirmation that a wastewater equipment maintenance program exists. Confirmed by inspection that the equipment is in proper working order.

**30. Emergency spill procedures (yes/no/don't know/na)**

Verbal confirmation of emergency spill procedures covering;

- a. Assessment of the hazard created by the spilt substance.
- b. Selection of appropriate clean up procedure.
- c. Disposal to an appropriate waste contractor i.e. not in the general waste bin.

**31. Emergency spill equipment (yes/no/don't know/na)**

Verbal confirmation that spill equipment is on site. Confirmed by inspection.

**32. Emergency spill equipment (acceptable/unacceptable/don't know/na)**

Type and quantity of emergency spill equipment is adequate to clean up the largest likely spill. Confirmed by inspection.

**33. Records accidental spills (yes/no/don't know/na)**

Verbal confirmation that records are documented.

**34. Emergency contact numbers visible (yes/no/don't know/na)**

Numbers visible on the workshop wall or near the telephone with the location known to staff.

**35. Documented environmental policy (yes/no/don't know/na)**

Verbal confirmation that policy is documented.

**36. Discharge to stormwater**

Any obvious sign of contamination that could be transported by stormwater. For example, leaks and spills from storage containers outdoors, vehicle washing with detergents outdoors, oil or diesel contamination of the outdoor areas.

**37. Stormwater treatment process used (from list)**

**38. Survey useful in environmental hazard and risk identification (yes/no)**

- 39. Further industry-specific information requested - initial audit only (yes/no)**
- 40. Permission to stencil stormwater drains - initial audit only (yes/no/na)**
- 41. General comments**
- 42. Recommendations made by auditors.**

# Appendix C

## MMR scoring table

**Environmental risk management audit categories, and weightings, used to determine the management and infrastructure risk rating (MRR) to assess the risk of stormwater contamination.**

The SERCUL and LGA officers used the audit categories listed below, in combination with the audit criteria in Appendix B, to determine the management and infrastructure risk rating (MRR) for each business audited (Section 3.3.3). A response, or practice, judged as unacceptable according to the criteria, resulted in the addition of the points listed in the weightings column. At the conclusion of the audit the sum of the points accumulated gave the MRR result.

**Table C.1 Management and Infrastructure Risk Rating (MRR) weightings**

<b>Environmental risk management audit categories</b>	<b>Weightings</b>
<b>Storage practices</b>	
Raw material storage	4
Waste material storage	4
Detailed knowledge of materials on site	3
Material Safety Data Sheets ( MSDS) available	2
Signage for hazardous substances	1
<b>Wastewater management</b>	
Wastewater discharge to stormwater	5
Wastewater treatment	4
Maintenance of wastewater equipment	4
<b>Emergency management</b>	
Emergency procedures or spill response plan	4
Appropriate spill cleanup equipment	3
Emergency contacts visible	1
Records for accidental spills	1
<b>Policies and procedures</b>	
Onsite activities drain to stormwater	5
Housekeeping to minimise stormwater contamination	4
Environmental policy	1
<b>Total points (MRR score)</b>	<b>46</b>

## Appendix D

### Amendments to the pilot data

The SERCUL SME project was initially piloted in the City of Canning with 57 participants. The following questions were added to the audit after the pilot in the City of Canning, and were therefore not asked or recorded in the pilot:

- Storage of waste materials (acceptable/unacceptable)
- Housekeeping to minimise stormwater contamination (acceptable/unacceptable)

In order to use the City of Canning data for the MRR analysis and comparison with the rest of the sample, the following amendments were made. The data amendments only affect the MRR audit score. For all other statistics the sample size is reduced where these questions were not asked:

- The storage of raw materials result for the evaluation stage was also recorded as the result for the initial stage.
- The storage of raw materials in the initial stage was recorded as the result assessed for storage of waste materials in the initial stage.
- Onsite activities discharge to stormwater in the initial stage was also recorded as the result for general housekeeping, but inversely. Therefore, *no* answers were changed to *yes* and vice versa.

The arguments for amending the data are presented below:

The storage of raw materials result for the evaluation stage was also recorded as the result for the initial stage.

- Only minor movements (1.2%) in the acceptable storage of raw materials were observed between the initial and evaluation audits in the other four LGAs where audits were conducted.
- The pilot result for the acceptable storage of raw materials, in the City of Canning, was significantly below the average for the mean result in the four other LGAs in the initial stage. This indicated that the storage of waste materials was the major influence in this result.

The storage of raw materials in the initial stage was recorded as the result assessed for storage of waste materials in the initial stage.

- It was uncommon (5.1% n=118) in the combined LGA sample for a business to record acceptable storage of waste materials but unacceptable storage of raw materials. Therefore the result for the acceptable storage of materials in the pilot in the City of Canning is assumed to relate to the storage of wastes, and not raw materials, because the two categories were combined at the time of the audit.

Onsite activities discharge to stormwater in the initial stage was also recorded as the result for general housekeeping, but inversely. Therefore, *no* answers were changed to *yes* and vice versa.

- A series of cross-tabulations with Chi-square tests and correlations included, were conducted using General housekeeping and other audit variables to look for any directly proportional relationships. The variable On-site discharge to stormwater was found to have a strong relationship ( $p < 0.000$ ) with General housekeeping, but the relationship is inverse. Therefore a result indicating that there was no on-site discharge to stormwater is also recorded as acceptable general housekeeping to minimise the contamination of stormwater in the pilot data.

# Appendix E

## SME perceived environmental management improvements

Participants were asked if they felt their environmental management had improved since the initial audit (Figure 4.14). Participants were also asked to indicate in which aspect they believe the improvement was thought to have occurred in. Participants responses were compared to the judgements of the auditors (SERCUL and LGA officer). The six aspects of environmental management were constructed from the environmental risk management audit categories (Table 4.10). Each environmental management aspect consisted of between one and three of the audit categories, and are listed below.

To satisfy the criteria for improvement at least one variable in the environmental management aspect needed to be assessed to be acceptable, where it had previously been assessed unacceptable and, no other variables in the same aspect could be assessed as unacceptable.

This analysis is designed to illustrate if an environmental management aspect had improved to an acceptable standard since the initial audit and if the business owner/manager could recognise the improvement, or otherwise.

### 1. Raw material storage

- raw material storage overall acceptable.

### 2. Waste material storage

- waste material storage acceptable.

### 3. Wastewater management

- wastewater treatment overall acceptable,
- waste water discharge acceptable; and
- wastewater equipment maintenance program acceptable.

#### **4. General housekeeping**

- housekeeping to minimise stormwater contamination.

#### **5. Emergency preparedness**

- spill kit acceptable,
- spill management procedure or plan; and
- chemical material safety data sheets kept on site.

#### **6. Policy and documentation**

- chemical material data safety sheets kept on site;
- records kept about spills;
- environmental policy

# Appendix F

## **‘Other’ barriers to environmental management**

During the initial survey participants were asked to indicate if they experienced any barriers to environmental management that were presented on a standard list (see Section 3.3.2.3 and Appendix B). The barriers to environmental management presented below were offered additional to the standard list, and are recorded in the ‘other’ column on Figure 4.4.

### **Lack of government assistance (total of 18 responses)**

- Lack of regulated benchmark (8 responses)
  - Level playing field
  - Level playing field
  - Level playing field
  - Level playing field
  - Back yard businesses not regulated
  - Self regulation can be difficult
  - Too many chiefs, multinationals doing anything
  - Government bodies need to look at own backyard
- Getting precise information from govt agencies (4 responses)
  - Difficult to get conclusive advice on correct waste treatment systems
  - Lack of understanding of regulations
  - Lack of knowledge of government risk management
  - Lack of approvals information and advice
- Recycling not collected each week. (2 responses)
  - Recycling bin not provided
  - No recycling bin
- Government to improve marketing of quality assurance
- Change of planning and shrinking of area where work can take place
- Higher development densities
- Research and development assistance

**Lack of information (total of 2 responses)**

- Risk management tool required
- Time for research and accessing readily available information

**Likely costs (total of 10 responses)**

- Cost of waste management (5 responses)
  - Cost of waste disposal
  - Cost of removal of toxic waste
  - Cost of compliance, waste management, tyres
  - Cost or removal of toxic waste - insurance companies not contributing
  - Free waste management drop off centre required

**Lack of responsibility by insurance companies (5 responses)**

- Insurance company squeeze
- Insurance companies not contributing to environmental management
- Insurance companies
- Insurance companies not contributing
- Controlled by insurance companies

**Lack of facilities (total of 2 responses)**

- Lack of deep sewer and appropriately trained environmental managers
- Lack of facilities i.e. washdown bay

**Lack of client care (total of 1 response)**

- Clients allowing oil to spill from vehicles delivered for repair

# Appendix G

## Individual activity risk ratings

Each of the 15 questions in the audit was assigned a weighted score to produce the MRR result (Section 3.3.3) and given an individual risk rating, used in the single highest risk activity calculation (Table 4.11). Individual activities are rated according to their perceived immediate potential to contaminate stormwater.

**Table G.1 Environmental risk management audit categories – Individual activity risk ratings**

Environmental risk management audit categories	Weighting	Single activity risk category		
Onsite activities drain to stormwater	5			High
Discharge of waste water to stormwater	5			High
Storage of wastes	4			High
Raw material storage	4			High
Waste water treatment	4			High
Wastewater equipment maintenance program	4			High
Housekeeping to minimise stormwater contamination	4			High
Emergency procedures and spill response plan	4		Medium	
Appropriate spill cleanup equipment	3		Medium	
Material Safety Data Sheets (MSDS) available	2		Medium	
Detailed knowledge of materials on site	3		Medium	
Signage of hazardous chemicals	1	Low		
Emergency contacts visible	1	Low		
Records kept of accidental spills	1	Low		
Environmental policy	1	Low		
<b>Total points (MRR score)</b>	<b>46</b>			

## Appendix H

### Memberships in industry groups and associations and government organisations licensing participating SMEs.

**Table H.1 Government organisations licensing SME participants for an environmental activity.**

	Initial		Evaluation	
	Frequency	Percent	Frequency	Percent
None	204	76.12	136	76.84
Department of Environment	23	8.58	20	11.30
Department of Industry and Resources	7	2.61	6	3.39
Department of Consumer and Employment Protection	5	1.87	4	2.26
Department of Health	5	1.87	4	2.26
Department of Defense	2	0.75	0	0.00
Department of Mines	2	0.75	1	0.56
Local Government	2	0.75	0	0.00
Australia Defense Industries	1	0.37	1	0.56
Civil Aviation Safety Authority	1	0.37	1	0.56
Department of Planning and Infrastructure	1	0.37	0	0.00
Department of Transport	1	0.37	0	0.00
Don't know	1	0.37	1	0.56
Department of Fisheries	1	0.37	0	0.00
Main Roads	1	0.37	1	0.56
Motor Vehicle Dealers Licensing Board	1	0.37	1	0.56
Water Corporation	1	0.37	1	0.56
Missing	9	3.36	0	0.00
	<b>268</b>	<b>100.00</b>	<b>177</b>	<b>100.00</b>

**Table H.2 Industry groups and associations that SME participants stated they held a membership with (n=268)**

	Initial		Evaluation	
	Frequency	Percent	Frequency	Percent
None	137	48.58	93	50.82
Motor Trades Association	41	14.54	28	15.30
Chamber of Commerce and Industry	31	10.99	20	10.93
Institute of Automotive Mechanical Engineers	5	1.77	3	1.64
Housing Industry Association Ltd	5	1.77	2	1.09
Civil Contractors Federation	4	1.42	3	1.64
Foundary Institute of Australia	4	1.42	1	0.55
Master Painters Australia Western Australian	4	1.42	0	0.00
Hire and Rental Assoc (Aust.)	3	1.06	3	1.64
Master Builders Association	3	1.06	1	0.55
Australian Drilling Industry Association	2	0.71	2	1.09
Australian Mines and Metals Association	2	0.71	2	1.09
Australian Institute of Metal Finishing	2	0.71	1	0.55
Planning Institute of Australia	2	0.71	1	0.55
Plastics and Chemical Industries Association	2	0.71	0	0.00
Australian Association Motor Insurers Ltd.	1	0.35	1	0.55
Australian Film Institute	1	0.35	1	0.55
Australian Institute of Steel Construction	1	0.35	1	0.55
Australian Model Railway Association Inc.	1	0.35	1	0.55
Automotive Engineering	1	0.35	1	0.55
Boating Industry Association of Western Australia	1	0.35	1	0.55
Composites Australia	1	0.35	1	0.55
Defense Industry Service Providers	1	0.35	1	0.55
Fluid Power Society	1	0.35	1	0.55
Goat Industry Council of Australia	1	0.35	1	0.55
Hydroponic Growers Association	1	0.35	1	0.55
Kwinana Industries Mutual Aid	1	0.35	1	0.55
Mining Development Associates	1	0.35	1	0.55
Mower Specialists Association of Australia	1	0.35	1	0.55
National Electrical and Communications Association	1	0.35	1	0.55
Rapid Solutions and Pest Education Service Training	1	0.35	1	0.55
Royal Automotive Club	1	0.35	1	0.55
Small Business Association, WA	1	0.35	1	0.55
Surface Coatings Association Australia Inc.	1	0.35	1	0.55
Transport Forum	1	0.35	1	0.55
Vehicle body builders	1	0.35	1	0.55
WA Livestock and Transport Assoc	1	0.35	1	0.55
Australian Prudential Regulatory Authority	1	0.35	0	0.00
Auto Parts Recyclers Association of Australia	1	0.35	0	0.00
Construction Equipment Distribution of Australia	1	0.35	0	0.00
Design Institute of Australia WA	1	0.35	0	0.00
Golf Course Business Estate Group	1	0.35	0	0.00
National Transport Commission	1	0.35	0	0.00
National Transport Insurance	1	0.35	0	0.00
National Trucking Alliance	1	0.35	0	0.00
Pet Industry Joint Advisory Council of Australia	1	0.35	0	0.00
Plumbers Association	1	0.35	0	0.00
WA Hardware Services	1	0.35	0	0.00
WA Tourism Assoc.	1	0.35	0	0.00
Waste Management Association (Western Australia)	1	0.35	0	0.00
Plasterers Association	0	0.00	1	0.55
	<b>282</b>	<b>100.00</b>	<b>183</b>	<b>100.00</b>

Participants could record up to two different memberships.