Making sense of waste: understanding the (in)visibilities of waste in Sydney through labour and infrastructure

Elizabeth Duncan

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School of Geosciences, Faculty of Science

The University of Sydney

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Statement of Authorship

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

Elizabeth Duncan

Making sense of waste

The material world is always in excess of human control. Weeds grow through the cracks in the pavements, leaves fall onto concrete streets. Hard boundaries require constant maintenance. Work is exerted on the world to create order. However, some excesses are less benign than others. Climate change threatens the core of the human endeavour and flourishing, a global problem caused by the leakages and excesses of industrial projects. What leaks is often thought of as a waste and, potentially depending on the substance being leaked, as pollution.

Waste as the matter of concern of this thesis will be understood in two ways. First, waste is that which exceeds use: the discards of excess and leakage; and second, waste is understood as what is categorised and accounted for as waste through the placement of materials within waste infrastructure and therefore, as an assemblage between materials, infrastructure and labour. Infrastructure is both a form of making waste legible to the global, national and local scripts of accounting for material flows, and also a form of boundary making. Waste, however, is more than what is bounded by this infrastructural logic because if waste is only made through infrastructure, then we fall into a trap of circular logic, where waste is only waste if it is defined or accounted for as such.

The very act of creating a border or a boundary creates an excess that must exceed it. A sculptor must carve away material to make a sculpture. By making waste manageable, excess is also created and so these two aspects of waste are the product of the same phenomenon. Waste is theorised in two fundamentally different ways within this thesis. Firstly, waste is understood as co-produced through and by its relationships to the city (this is an historical account of waste that shows how history is configured in Sydney's present). This first framing of waste relates to land, place, embodied memory, and the forms of waste that exceeds use. The second way in which waste is theorised relates to conceptions of waste, and the ways in which these ideas result in waste materials. In this way, waste is understood through the points at which it is accounted for and managed. This framing implies a causal flow from epistemology to ontology. The second way of understanding waste is contradictory to the first framing, which like Barad's ethico-onto-epistem-ology, supposes a simultaneity between ethics, epistemology and ontology.

I argue throughout this thesis that both ways of understanding waste are fundamental – the first, because waste co-produces and affects the spaces in which it is sunk or leached; and the second, because the management of waste is shaped by the ways in which waste is understood. This thesis explores how these perspectives might be brought together. Insofar as the legacies of materials ultimately become waste, the notion of waste is conceived as a material ongoingness that holds the political stakes of the past and shapes the political stakes of the future.

This thesis considers how waste works in Sydney, with an emphasis on the infrastructure, labour and materials of city's waste system. This work is grounded on feminist literature, specifically in the fields of human geography, discard studies and science and technology studies. Having undertaking fieldwork within Sydney's waste infrastructure, as well as historical and present-day document and policy analysis, this PhD research makes sense of waste through situatedness, scale, and standardisation.

Situatedness allows for an understanding of how waste relations produce(d) the city to be developed, through attending to how waste flows are directed through infrastructure, the points at which waste is 'fixed' through technocratic interventions and the forms of labour and maintenance involved in this work. Scale and standards allow for a detailed analysis of the ways in which waste is rendered manageable and knowable. Critical attention is given to these processes, in particular asking why are some aspects visible and others invisible, while also understandings that vision and visibility is always situated.

The thesis shows how waste has been managed and exceeds manageability, and how it has shaped Sydney in specific ways. While this work is about the production of Sydney as a city, it also exceeds this space, avoiding the hard boundaries of space. The logics of infrastructural reproduction illustrate how the form and function of waste and waste infrastructure is reproduced across space and time. However, it is important to keep in mind that infrastructure and the flows it supports is not a homogeneous process replicated instantaneously, rather is it a continuously process of many situated bodies working collectively over time.

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Abbreviation and Acronyms

AWT – Alternative Waste Treatment

C&D – Construction and Demolition

C&I – Commercial and Industrial

CE – Circular Economy

CoS – City of Sydney

CSO – Cleansing Services Officer

EPA – Environmental Protection Agency

FO – Food Organics

FOGO – Food Organics Garden Organics

LGA – Local Government Area

MSW – Municipal Solid Waste

MWOO – Mixed Waste Organic Output

NSW – New South Wales

QLD – Queensland

STS – Science and Technology Studies

VENM – Virgin Excavated Natural Material

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[1] Photographs are the authors own. Figures include photographs that were not taken by the author.

Prelude – Encounters with waste: thinking with fatbergs

Waste and water infrastructure are often coupled as entities (materials) that traverse the city. Water is engineered to provide the flows required to take waste 'away'; in the management of sewerage, it is used for flushing large quantities of waste through vast pipelines. Alternatively, water can provide the means of accumulation in the first place. Sites of industry are historically located alongside bodies of water, which facilitated the easy delivery of materials (Duncan, 2019). In another sense, bodies of water have long enabled the production of hydroelectric power (see Appendix 1, Encounter 3). My first encounters with waste in the field (in 2018 and 2019) were focused on the points where water and waste infrastructure converged (see Appendix 1). These experiences included attending the *Composting Feminisms Walkshop* and 'toxic tour' of Sydney Olympic Park (formerly a site of heavy industry) and site visits to the North Head Wastewater Treatment Plant (in Manly, Sydney), as well as the former Little Manly Point and Millers Point Gasworks (see Figure 1). I was also influenced by a tour of the historic Crossness Pumping Station (on the outskirts of London).

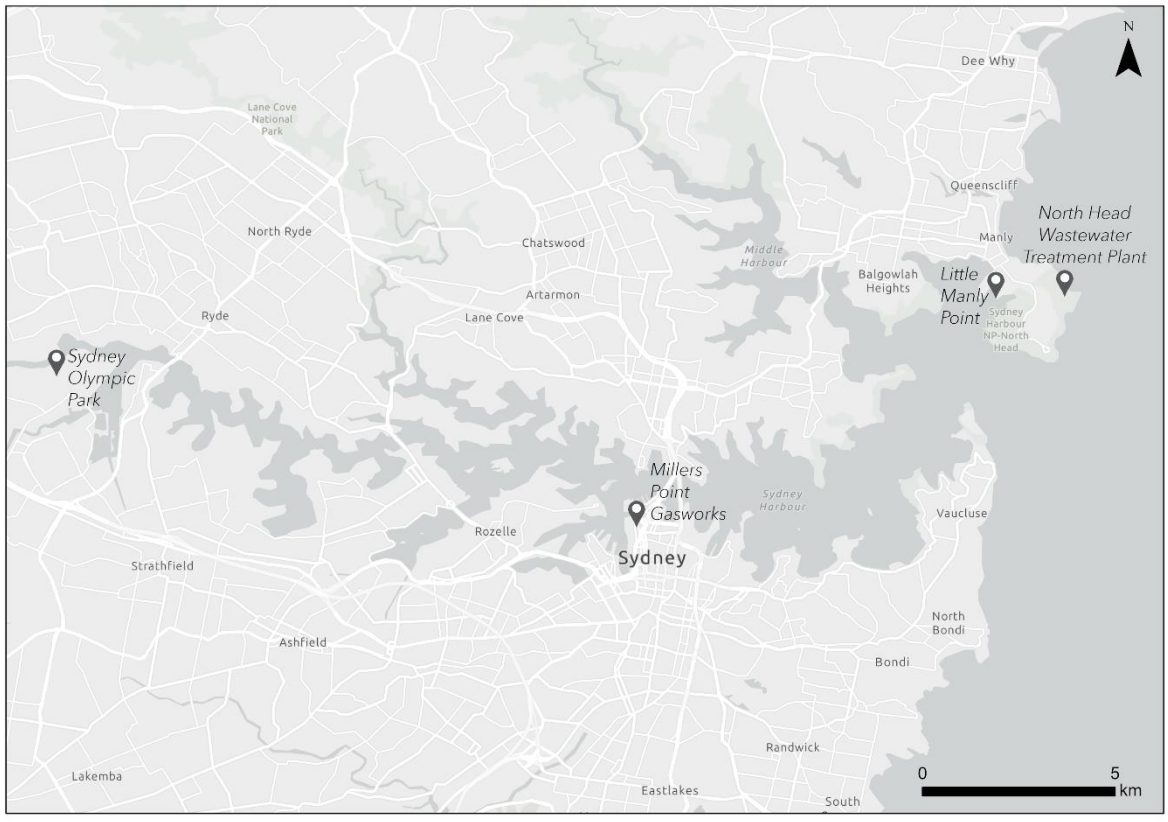


Figure 1: Map of Sydney sites (created by Alex Jones)

My first deep-dive into the 'convergences' between water and waste infrastructure was inspired by the Whitechapel Fatberg (in London). Fatbergs – a congealed mass of fats, wet wipes, tampons, condoms, Q-tips and other matter found in the sewer – become solid blockages within a system of flows. The term originated within the English 'flusher' community (workers tasked with cleaning and maintaining the sewer network), as a colloquial way to refer to FOG (fat, oil and grease) blockages that they were beginning to clean from the system (Harding, 2018). Between 2013 and 2015, a few notable fatberg discoveries took place in England, Wales, and even Dee Why (in Sydney) generated media coverage (Logan, 2013; Odling, 2014; Dirnhuber, 2015; Swain, 2015). As a result, in 2015, the term 'fatberg' was formally added to the Oxford Dictionary. Fatbergs are now defined as "a very large mass of solid waste in a sewerage system, consisting especially of congealed fat and personal hygiene products that have been flushed down toilets" (Harding, 2018). They announce themselves as a sticky, impassable problem. For me, fatbergs (in particular the spectacular Whitechapel Fatberg) became a lens through which I could research the ways infrastructure, governance, labour and maintenance *co-create* a waste system, and how more-than-human bodies are *interacting* and *co-becoming* with waste flows.

At the start of the 21st Century, fatbergs became an escalating problem (Wallace et al., 2017) on a global scale. In September 2017, fatbergs caught the public's attention. During a routine check of the sewers in Whitechapel, London, sewerage workers stumbled upon an immense find. Dubbed 'the Whitechapel Fatberg', it was historic and unprecedented in its size, weighing the equivalent of '11 double decker buses and stretching the length of two football pitches' (Taylor, 2017). The Whitechapel Fatberg was framed as a monster because of its size:

> Thames Water's head of waste networks, Matt Rimmer, said: "This fatberg is up there with the biggest we've ever seen. It's a total monster and taking a lot of manpower and machinery to remove as it's set hard." (Taylor, 2017)

The appearance of the 'monster' fatberg in the Whitechapel sewer, and its subsequent exhibit at the London Museum, was reported by multiple media outlets (Adams 2018; Flockhart, 2018; Moss, 2018; William, 2018) across the UK, the USA, Europe, Australia and New Zealand. Indeed, my attention was drawn to the monstrous fatberg by Australian news media and then through extended reportage covering the Museum of London's *Fatberg!* exhibit (during 2018, the first year of my PhD research).

The fatberg intrigued me, both as a waste object that emerged through a system of disposal and as an exhibited waste object. My ability to interact with the fatberg (as a digital observer via the 'Fatcam' run by staff at the Museum of London) enhanced my fascination with, and connection to, the object. A fortuitus introduction facilitated by a colleague, Bradley Garrett, to Alex Werner, the lead curator of the Museum of London,[2] led to the fatberg becoming a critical part of my research into waste. As a 'many mode(al) encounter', the Whitechapel Fatberg, and the many ways I was able to interact with it, were critical to the formulation of my research questions. Thinking with[3] the Whitechapel Fatberg as an encounter is a way to acknowledge and situate the origins of my thoughts. The feminist research proposition posed by Belgian philosopher Isabelle Stengers inspired me too: 'I try to never separate a proposition from the problematic path from which it resulted, situating it in an open-ended story, not concluding it' (Savransky and Stengers 2018, p. 131).

This Prelude will help me illustrate how the research questions emerged through my initial encounters with the Fatberg:

> (1) How do infrastructural systems of classification and containment constrain or enable the ability of material to matter?
>
> (2) How do material practices of wasting persist and (re)turn in space and time?
>
> (3) How is waste responded to and who becomes responsible for materials?

Classification and containment – the mattering of waste (question 1)

The sewerage system is premised on a system of flows facilitated by the movement of water. A common mantra among waste companies (for instance, Thames Water and Sydney Water, the respective water and wastewater providers for London and Sydney) is to only flush the three Ps: pee, poo and paper. The fatberg shows us that individual categorisations of what is considered flushable diverge from the recommended 'three P's'. Fatbergs are primarily

[2] While I was in England attending the *Experimenting with Methods* workshop in Manchester, I had the opportunity to follow up with the Museum of London in regards to their *Fatberg!* exhibit.

[3] *Thinking with*, rather than *about,* is a collaborative approach to research. Thinking with is analytically distinctive because the enquiry is not premeditated, but is produced as a result of the meeting in the field. Thinking with embodies a porous feminist approach in which the research becomes co-produced in the field or in the process of enquiry. This prelude is an experimentation with the approach of thinking with through detailing how thinking with the Whitechapel Fatberg generated the research questions for this thesis.

understood as created through the collective mis-allocation of fats and plastics in the sewers, at both the household and commercial level.

While fatbergs are produced through the materials that enter the sewerage system, they are also produced through the material conditions of the sewerage system. In this way, the sewerage infrastructure (or infrastructure of the sewerage system) became a co-creator in the materialisation of the Whitechapel Fatberg. As Vyki Sparkes, curator of the *Fatberg!* Exhibit, explained in an interview: 'It is actually salt in the brick lining which helps form the fatberg through the process of the saponification.' The bricks (common in this section of the sewerage system running underneath Whitechapel Road) are part of the original 19th Century sewers designed by Sir Joseph Bazalgette.[4] These sewers are notorious for being narrow, aiding in the development of fatbergs, as the build-up of fats on the lining of the sewer can quickly form into a complete blockage. This occurrence has become increasingly common, as emergent forms of plastics (such as wet wipes) are caught and congealed. This infrastructural system was not designed to accommodate London's population growth or the new materials entering the system and has not been updated since its construction in the 19th Century. Initially, the system was designed to control the *miasma* (smell) – rather than the bacterial threat – of sewage. The Fatberg illustrates how infrastructural process of classification and containment makes materials matter in new ways, which can constrain the infrastructural system that contains and creates them. There is a relationship of co-creation and co-production between the materials that enter the wastewater system and the system itself. This relationship is compounded by the volumes of water added to facilitate the flow of waste, which, in the event of a blockage, can become problematic in terms of spillage onto the city streets.

Space and time – the persistence of waste (question 2)

Fatbergs, through their presence as a blockage, demand our attention; it is as though they represent the assertion that what was flushed away within the system can return to the surface. It took nine weeks to extract the 'monster' Whitechapel Fatberg from the sewerage

[4] Joseph Bazalgette was an English civil engineer. As the Chief Engineer of London's Metropolitan Board of Works, he was responsible for the creation of the sewage system of central London in the 19th Century, and the pumping stations at Deptford, Crossness and Abbey Mills used to pump sewage out of the city (and then release raw sewage into the Thames further downstream at high tide). I was fortunate to visit Crossness Pumping station while in London in 2019. I was given an extensive tour of the site by Petra Cox and able to see the volunteer restoration work in process.

system. The public spectacle of extraction, as Whitechapel is now a busy arterial road, 'flush[ed] up to consciousness' (Ukeles, 1969, p. 3) what had been flushed away by the residents of London. Through its presence, the fatberg demonstrates that material practices of wasting persist within infrastructural systems. The Whitechapel Fatberg now places waste in relation to specific sites in the city, disrupting the idea that waste goes 'away' to a distant location. In reports from the time, the extraction of the Fatberg from the sewer was characterised as a 'battle' (BBC, 2017); since then, a commemorative access lid cover has been installed at its extraction point, marking its 'defeat' (see Figure 2).

Figure 2: Image of the commemorative access lid on Whitechapel Road (Brown, 2019).

Media depictions of the Fatberg as a monster requiring defeat reveals how non-standardised bodies are treated. This is particularly true of those bodies that, in failing to comply with the system, cause systemic blockages.

Following its removal from the sewer, the majority of the Fatberg was converted into bio-energy and used to power London's buses. This transformed a waste 'problem' into a resource – although this form of energy production is by no means efficient, or ideal. In the end, not all of the Whitechapel Fatberg was destroyed or transformed; instead, the Museum of London collected a piece for display. The exhibit *Fatberg!* was open at the London Museum between February and July of 2018, its centrepiece being a preserved chunk of the Whitechapel

Fatberg. The exhibit was a standout success, although there were concerns before it opened to the public. The curator, Vyki Sparkes, explained to me that upon finding out the relatively small size of the samples, "I must have spent three days with my head in my hands. I was like everybody is expecting the monster, they are expecting size and this is what we've got." The small samples harvested from the initially gigantic Fatberg, however, did not detract from the monstrous narrative. Indeed, it allowed for the ambiguous[5] materiality and character of the Fatberg to be brought to the fore, without being overwhelmed by sheer volumetric presence.

The preservation of part of the Whitechapel Fatberg fundamentally changed previously conceived waste-human relations. The act of keeping sewage sits uncomfortably with most of us – it goes against norms of cleanliness and innate desires to expel waste. By saving a part of the Fatberg from transformation into bio-energy, the staff at the Museum of London have allowed us to continue to think with the Fatberg; in short, this provides a rare opportunity to care for the monstrous.

Through the very act of preservation, the surviving piece of the Whitechapel Fatberg becomes a useful model to 'think with' (Haraway, 2018; Ballestero, 2018). Positioning the Fatberg as an experimental model – one that can be considered – helps us sense the world; the model can help us see beyond the visible, or attempt to rescale worldly phenomena, so that disparately situated effects can become visible (Duncan, 2021). Thinking with the Fatberg as a model helps us identify the ways in which more-than-human politics transform material practices (in that it is the accumulation of different material, social and biological agents) and informs how we respond to, and are responsible for, materials (by grounding a relationship with waste and allowing our response to evolve over time).

Waste risks and responsibilities (question 3)

Waste can be understood in terms of the risks it poses to urban function, the health of people and the environment. In the case of the Whitechapel Fatberg, a small sample size of English media from February 2018 (the opening month of the *Fatberg!* exhibit) revealed that the media focused on the fatberg as a risky object. Within the reviewed media, the risks attributed to the Fatberg materialised in four ways:

[5] This is really where the monstrosity begins in the ambiguity between the aliveness and innateness of the Fatberg.

1. Risks posed by a blockage – these are the risks posed to the functioning of infrastructural systems, namely spillage and the financial burden of clearing blockages;
2. Public health risks – posed by the bacterial threat of the fatberg;
3. Health risks to the 'flushers' – 'The heroic flushers worked in teams for 30-minute shifts before they had to come up for rest… Generators pumped fresh air so they didn't inhale the fatberg's poisonous stench' (Harding, 2018); and
4. Embodied, recurring risks of fatbergs returning within the system – 'Fatbergs are lurking, congealing and growing fast under our feet and as soon as we clear one, another is growing somewhere else in our sewer network' (Williams, 2018).

Fatbergs elicit a response in the reader through the risks they pose. In the same manner, the mitigation of these risks also guides their removal from the sewer. In the case of the Whitechapel Fatberg, the responsibility for careful removal and the risks of such work were outsourced by Thames Water to 'Lanes for Drains', the 'largest privately owned drainage and wastewater utility specialist in the UK' (Lanes Group plc, 2023). Later in Chapter 9, this thesis will grapple with the consequences of deferred risks and responsibilities towards waste.

Other than the risks posed by fatbergs, media articles also addressed the complex materialities of the Fatberg. A report published by the Guardian discusses how more-than-human politics, that is the agency of matter and the political stakes created through this, emerge in its formation:

> When the fats, oils and grease are in the sewer's alkaline environment, they combine with all the material that gets down there, such as wet wipes and napkins, and form a mass that becomes calcified [by the interaction with calcium in the sewer water] and solid. It becomes like concrete and can't easily be broken up. The teams working in the sewers have to break them up using hand tools because the high-pressure jet hoses can't break it down sufficiently. (Moss, 2018)

This quote connects with Whatmore's insights into 'the processes and excessive livingness of a more-than-human world' (2006, p. 604). The verbs used in the description of the Fatberg (such as *combine, form,* and *become*) indicate the agency of matter as distinct from human intervention, even though it is inevitably linked to humans through our discards and the labour exerted in the removal of matter. In its formation, the fatberg shows us how more-than-human practices emerge to create specific politics of materials that can raise the stakes for urban endeavours increasingly premised on uninterrupted material flows.

By preserving a part of the Fatberg, the curators of the London Museum created the opportunity to care for the city's monsters formed at the intersection of more-than-human lives and infrastructural systems. This caring shifted the notions of responsibility and raised many questions about the ways materials are understood. Speaking to the staff at the Museum of London, I became aware that the management of the Fatberg sample was an involved and delicate process; caring about the fatberg became a daily task. To minimise the risk of exposure to the Fatberg, the Collections Care Manager was the only staff member allowed to touch the fatberg. The risks of collecting and displaying the fatberg were closely managed: 'We dried it out, it was obviously a very wet piece of sewage which would leak out water and that was the main cross contamination risk' (interview with Curator). Risk management determined interactions with the fatberg and the methods available for display. Unfortunately, the museum was only able to provide the viewer with a visual experience of the Fatberg. As I was told: 'One of the first questions was: are you able to smell it? But if you were smelling fatberg, you were inhaling fatberg' (ibid.). For this reason, this sensation had to be evoked through textual representations, including the explanation that, upon receipt of the Fatberg, it smelled like rotting nappies.

Early on, the museum recognised that they were working with unstable matter that was prone to behaving and misbehaving: 'The presentation was almost of something alive and we were embracing that ambiguity and uncertainty... We had flies hatching out of it occasionally. When it went into display it had a slight outbreak of, sort of like fungal mushrooms, very, very tiny, they looked like tiny trees, sort of came and went...' (ibid.). The Curator at the museum also detailed the inherent risks in displaying this material: 'We hadn't decided whether we were going to keep it and part of that, as we didn't know if it would even last the whole four months. The display was very much experimental in that way…' (ibid). The Fatberg was allowed to perform within the constraints of a risk-managed environment. The exhibit and the fatberg provoked a '... very strong and violent emotional and physical response in people' (ibid). The level of response was also reflected in the 'unprecedented press and public responses to the display' (Sparkes, 2019) and an estimated 2 billion twitter mentions before the closure of the exhibition. In the case of the *Fatberg!* exhibit, the opening of a space for the material to respond also opened a space for response and responsibility within members of the public that attended or heard about the exhibit.

The Fatberg's ability to respond to its new environment led to a series of attachments that persisted after the closure of the exhibit. This response was illustrated by Vyki the Curator and the Andy the Collection Care Manager:

> *So basically, at the end of the four months, having sworn blind I won't bring it in over my dead body, it just got to the point where it... actually argued its way into the collection. [V]*
>
> *We reduced the handling to basically me… And that turned into something sort of more paternal I suppose (laughing), … and now that it is in the permanent collection… whenever I go up to the store, I will go and look at it and I don't do that with a lot of other objects. [A]*

The response by staff at the Museum of London shows that, in responding to waste materials, it is possible to open ourselves to a relationship of responsibility, listening and paying attention to these material relations. I am certainly not suggesting that keeping fatberg samples should become common practice as a way of being responsible for waste materials; in fact, I would like to take a moment to actively discourage the practice outside of a controlled setting. However, this circumstance shows us that thinking with, and listening to, waste spaces and/or particular waste objects or assemblages can enable unique responses to these places and things. This is an ethos and practice that I took into my subsequent fieldwork.

Thinking with fatbergs

Fatbergs – in particular, the pieces of the Whitechapel Fatberg that were preserved by the Museum of London – raise critical questions in relation to this research project: *What is waste, and how does it come to exist? What is the context of infrastructural systems*?

Waste and waste-places tell a story about the past; they speak to patterns of consumption and configurations of infrastructure, the uses and abuses of land and water bodies as 'containers' for what is discarded. The preservation of the Fatberg is unique, as waste tends to be researched through historical infrastructural legacies, in a day-to-day sense through tracking movement or flow of materials to a point at which it is considered disposed of or transformed into new resources, or as it leaches or pollutes as a contaminant. The works of Myra Hird, Nigel Clark and Gay Hawkins present notable exceptions (Clark & Hird, 2014; Hawkins, 2006, 2007, 2009; Hird, 2012, 2013), as they think with the liveness of waste materials. By thinking with waste as it settles (as an alternative term to disposal or

transformation), the preserved Fatberg allows us to form attachments to waste. Typically, relationships with waste are premised on the existence of infrastructure for maintenance and distancing from materials. Seeing the Fatberg as an alternative to traditional waste relations offered a critical lens through which one might view processes of maintenance and (ir)responsibility within waste infrastructure differently.

Through the accumulation of multiple materialities, converging processes, and the lively bodies at play in the Whitechapel Fatberg, our discards, intimate relations, the things thought to be forever expelled, have been 're(turn)ed' to the surface. The Fatberg – as extracted from the sewer – invites us to encounter ourselves in its return and as such it invites a response. This encounter focused on the multiple recurring ways in which the Fatberg both responded to stimulus and elicited a response from observers. Indeed, I would argue that it was the centring of more-than-human interplays (including the experimental preservation of the Fatberg and its potential risks) that allowed for the enormous and surprising public response. Finally, the Fatberg, as a figuring of the monstrous, moves away from the violence inherent in both destruction and categorisation. By allowing its more-than-human politics and materialities to be seen, the Fatberg (as a model) provides opportunities for more intimate responses to waste.

I invite the reader to come along on a journey into the world of waste. This thesis will encourage you to take note of your own responses to waste, as they are encountered in the reading of this thesis and everyday life. We can all learn something from our waste materials, especially if we are willing to stop and 'think with' those materials, and willing to hear their response.

1. Introduction

> To address the past (and future), to speak with ghosts, is not to entertain or reconstruct some narrative of the way it was, but to respond, to be responsible, to take responsibility for that which we inherit (from the past and the future), for the entangled relationalities of inheritance that 'we' are, to acknowledge and be responsive to the noncontemporaneity of the present, to put oneself at risk, to risk oneself (which is never one or self), to open oneself up to indeterminacy in moving towards what is to-come. (Barad 2014, p. 183)

In 2018, when I first read this passage by Karen Barad, I was struck by its dense resonance. In just a few words, Barad expresses complex ideas relating to time, responsibility and inheritance. To 'speak with ghosts', the past echoes loudly within each one of us, as the future is unfolding in the present. How can we begin to reckon with our inheritance of the past? Being is never light – being is always heavy with responsibility – weighed down by the inheritances of genes and exposures, among many other elements. Inheritances are the material and emotional artefacts of life. That which passes through lingers, even once it is forgotten. Matter is always returning from the realm of the forgotten. My fascination with waste connects with the themes in this quote; waste, being that which is unwanted, commonly represents the past. Although, for those people working in waste it is also the ongoing and never-ending present. Throughout this thesis, I have 'thought with' what it means to be responsible for waste and who holds these responsibilities. The only way to address the future of waste is to address the past, to look at and 'think with' the indelible legacies of waste.

This PhD is concerned with waste, reaching deeper than the transformation of waste into resources. It sits with the legacies of waste, of material use and the production of space. By thinking about waste over time in Sydney – the city where I was born and currently live as a settler – I provide an account to the reader of these legacies, as they are particular to this space. I acknowledge that my research takes place and crosses over the lands, waters and skies of the Gadigal (City of Sydney), Wangal (Leichhardt and parts of the Inner West), Gayamaygal (Manly), Bidigal (Kensington) and Dharawal (Lucas Heights). I also acknowledge the colonial legacies of violence and structural processes of dispossession and how they connect to waste and waste management. In the context of writing a thesis on waste, land

relations become important as in colonial contexts such as Australia, waste disposal is premised on 'infrastructural access to Indigenous Land' (Liboiron, 2021a, p. 8) – meaning, as Max Liboiron states, 'pollution is not a manifestation or side effect of colonialism but is rather an enactment of ongoing colonial relations to Land' (ibid., p. 6).

Thinking with legacies of waste is about focusing on how waste remains present – even when its (in)visibility shifts. (In)visibility is a key concept in this PhD; the two implied states sit at the tension point between **situatedness**, **standardisation** and **scale**. These themes will form the core discussion chapters in this thesis. As the thesis deals with situatedness, standardisation and scale it is important to first introduce what is meant by waste, waste infrastructures and how understanding time and space is essential for a thesis on waste. This introduction therefore is divided into four sections. The first section will introduce waste in the city as the relation between materials and the production of space; the second section introduces waste infrastructures; the third section introduces time as a setting and a synchronised experience through which waste and labour are experienced; while the fourth section details the scope of this thesis and its structure.

1.1 Waste and the city

The scope of my research is generated from a concern with waste in the city, and how waste produces the urban space. In short: how does the production of waste co-produce the city as a spatial product? The creation of the city of Sydney – as space – was a process premised on displacement of First Nations Peoples from their Countries (see Chapters 2.2.2; 7.2), mobilised through the logic of *terra nullius* (Clements, et al. 2023); unaddressed the structural legacies of settler-colonialism carry into present (Porter, 2018). The production of the city of Sydney has displaced (not erased) each of the connected cultures from their Countries within the Greater Sydney region (see section 7.2). The city of Sydney emerges in its built form from the harbour, with the laboured placement of materials to build the urban. The built environment is made possible by using materials that were extracted from 'somewhere', materials that will eventually erode (if not maintained with the support of new materials and labour) and be displaced (again), occupying other spaces and replaced by the 'new'; they will be removed as they become old or 'out of fashion', to be taken somewhere else, likely in the form of waste.

A concern with how the city is produced is also a concern with how the city is experienced. The work of Vanessa Berry (*Mirror Sydney*, 2017) is a key influence in thinking about how we might tell stories of our experiences of the city. While my view of waste in the city is both informed by my personal everyday experiences of waste and the city itself, the work of this PhD has been to probe further into areas of concern beyond my everyday knowledge of waste by situating myself within industrialised waste systems. The focus on waste is, therefore, a lens through which one can understand the production of the city as an industrial space. Doreen Massey's propositions about space will be used as a scaffolding from which to understand waste and the city, in particular through their materiality, infrastructure and labours. Massey's three propositions are as follows: firstly, 'space as a product of interrelations'; secondly, 'space as the sphere of the possibility of existence of multiplicity'; and lastly, 'space is always under construction' (Massey, 2005, p. 9). Therefore, space is co-produced and relational. For these reasons, space is never eternally one thing or another, nor is space experienced homogeneously. Space can offer opportunities for existence, and these opportunities are bound to the preconditions of what came before.

This PhD is specifically interested with the ways in which waste, their infrastructures, management and disposal co-create the City of Sydney (CoS) as a space. At its core, this thesis argues that waste provides the material precondition to produce space. This is not to say that waste is the only precondition; instead, this thesis is specifically concerned with how waste preconditions space, and how this reading configures the pasts, presents and futures of Sydney. Therefore, in this project, waste is not understood as static entity that is neatly defined; waste is perhaps best understood through a feminist lens (see section 2.3.2), which sees matter as 'coproduced'. While the term 'coproduced' is picked up on from the work of Gregson et al. (2010), the work of Barad provides a useful companion, framing, in particular, their ideas on 'intra-action' and theory of agential realism (see section 2.3.3). The next section looks at how waste infrastructure is framed within this thesis.

1.2 Waste and waste infrastructure

Waste can be understood as anything that is in excess of the system in which it is produced – the city – something to be discarded. There is an historical marginalisation of the effects and

agency of waste in producing space; instead waste is thought of only as a problem to manage which requires an 'end of pipe' solution.[6]

In this thesis it is argued that all systems are underpinned by infrastructure. Discard studies as a field, led by Robin Nagel and transformed by Max Liboiron, asserts that 'infrastructure is the material embodiment of power in the world' (Liboiron, 2022b), giving rise to the notion that it is necessarily the point at which systemic change can be leveraged or forced. This thesis pays attention to infrastructure that supports the flow and trajectory of matter, in particular waste. Because infrastructure is materialised power, it can be repositioned to decentre one system's dominance and ask how it could be otherwise, invoking an 'accountability to what is discarded in the system' (Liboiron & Lepawsky, 2022, p. 152). Therefore, waste infrastructure for this project is the point from where change can be leveraged.

Discard studies proposes that all systems (create) waste; one critical theory of change within the discard studies field proposes that we no longer consider how to stop waste and wasting (an impossible pursuit), but rather how to *waste well* (Liboiron & Lepawsky, 2022, p. 149). Discard studies provides a focus on *infrastructure* as a system of producing discards, rather than the exclusive *management* of waste. Discard studies includes waste in its interest, but discard and discarding is a broader lens that includes infrastructures beyond systems that manage waste. Therefore, this thesis focuses on waste infrastructures, while being sensitive to the wider systems of discarding that produce the city. In particular, the thesis considers the flows of waste and how the movement of flow is facilitated through infrastructure or constrained through its blockage.

1.3 Labour and waste

Where and when fieldwork is undertaken is as significant or impactful as the type of fieldwork that is undertaken. The preoccupations of the workplace at the time of my fieldwork became a key concern of my thesis. For this thesis I conducted work with the CoS between November 2019 and March 2020 (see Chapter 3), in particular with the Cleansing and Waste Services teams. This was a time when council operated waste services, but they were about to be outsourced to a private contractor, creating a time of deep disruption and uncertainty. From

[6] A turn of phrase encountered in the waste management industry to indicate that this work is responding to whatever comes down the pipe, rather than changing the system in with the waste material is produced.

the outset of my PhD, I questioned what it meant to do this work; this question was then necessarily mediated by the particularities of my access points in the infrastructural system of waste. Ultimately, the timing of my fieldwork necessarily impacted the content and concerns of my research.

I commenced this PhD in March 2018. As it happened, this timing coincided with the beginning of a major disruption to the Australian waste regime. China's 'National Sword Policy' came into effect on the 1st of January 2018, introducing stringent, low-contamination levels for the import of waste into China. The policy effectively banned the import of Australian recyclable waste, which had been routinely sent to China for processing. The ban also impacted other countries across the global North.

At the state level, in New South Wales (NSW), the Environmental Protection Agency (EPA) clearly identified the resulting pressures placed on the existent waste management systems:

> China is now stringently enforcing its 'National Sword' policy, which forbids the importation of 24 types of waste and introduces strict contamination limits for other forms of waste. The NSW recycling industry cannot currently meet these stringent requirements and needs additional processing or alternative markets for recyclables such as paper, cardboard, plastics and metal... (NSW EPA 2018, *China's National Sword Policy*, para. 1)

As a result of the National Sword policy, governments were put in the position to incentivise private industry responses and infrastructure to address the influx of waste materials remaining in Australia.

In the weeks before the first COVID-19 'lockdown', I had what would be the last day of my fieldwork (*in situ*, in the 'field') with the Cleansing and Waste Services Teams of the CoS. After my fieldwork – during those months of quiet, housebound reflection – it felt as though my *in-situ* experiences had taken place years ago, in a different time. Of course, for the Cleansing and Waste services teams carrying out the vital work of emptying household bins, their perception of time was radically different to mine. When I was allowed to reconnect with the employees of the Cleansing Services team later in 2020, I asked about the impact of COVID-19 on their day-to-day work. They matter-of-factly stated:

> (G and J) Nothing has changed for us.

(G) We are still out and about.

(J) Except the traffic, it's a lot easier to get around but it's getting back up there now with more people on the roads. It's sort of back to normal.

Their work was impacted by the stress and pressures of COVID-19, which added logistical and staffing complications, however the day-to-day work remained the same. The temporal context in which the thesis has taken place has been very important. As this thesis contains ethnographic and participant observation work, I was required to be in sync with the pace of the works being carried out. There is no shortcut to understanding how work is performed; it will take as long as the time that it takes to do the work. The process is valued over the aim of producing an outcome.

Time and the work of Mierle Laderman Ukeles was the subject of the opening panel at the 2022 *Discard Conference,* held in New York (which I attended virtually). Six scholars, artists and curators discussed the legacy and continuing impacts of Ukeles' work, much of it focused on fieldwork in sanitation and waste disposal[7]. An emphasis on time emerged, and how Ukeles draws attention to the connections between the performance of maintenance and the 'taking of time'. As she stated in her influential *Maintenance Art Manifesto*: 'Maintenance is a drag; it takes all the fucking time, literally'. As a proto-practitioner of what is now referred to as 'social practice', Ukeles was deeply focused on time spent listening, being physically present and the act of synchronisation.

Keith Miller, a filmmaker and curator, notes that these values are exemplified in Ukeles' video 'The San Man Speaks', going on to say that she 'spent time doing work that takes a lot of time', making a point of shaking the hands of the 8,000 plus men employed by the New York Department of Sanitation. As it was work that could not be outsourced or speeded up, Ukeles had to be physically present for each 'thank you' she gave and for each accompanying 'touch'. The pairing of the handshake with the process of recognition meant that she could not give thanks in an abstract sense (using letters, for instance); rather, it had to be an embodied meeting. This also meant that she had to sync with the schedules of over 8,000 people working shifts in order to complete the performance.

[7] Roundtable Discussion with Mohammed Rafi Arefin, Rosalind Fredericks, Nina Katchadourian, Eugenia Kisin, Keith Miller, and Robin Nagle: https://wp.nyu.edu/thediscardstudiescollaborative/2022-conference-program/

In this sense, being in sync with others becomes a central tenet from which the processes of social practice (for the artist) and ethnographic fieldwork (for the geographer) might unfold. Throughout the thesis the reader will encounter narratives of my presence in the field, of the time spent there, but also about the times in which the fieldwork was happening – from geopolitical arrangements on waste managements to COVID-19 lockdowns.

In this spirit, doing the work with the City of Sydney employees put me in sync with the people carrying out the work, as well as the work itself. There was an element of timing associated with each of the cleansing operations, a factor I learned firsthand while joining several crews on their shifts. In the beginning, it was important for me to gain an understanding of the physical nature of the work, joining Cleansing's 'gang' sweeping teams in their daily grind. The temporal necessities of the work became apparent: when to sweep, what methods to use, how to work in concert with the roadway, being on the street in the rhythms of the city, the daily lives of passers-by, workers, businesses, and local residents. The work involved early morning starts and seeing the sun rise on many occasions, as the core operations of cleansing began at these quiet times.

Time and productivity are counter to one another, to take extra time, to take time in excess is to be inefficient, which is caught up with notions of being ineffective and not productive and being wasteful. As Keith Miller stated, 'Mierle is not a productive artist, this kind of work counter produces'; it is neither a product nor a solution and yet this is what makes it both radical and political. As Miller went on to state, it is both: 'It is shocking to me that this work is not easily taken as a political. It is not just garbage and shaking hands, but a kind of resistance to progress that in a certain way I think is a radical gesture.' This thought was echoed by Robin Nagel, who stated:

> Let me just add one more note about time, we live according to average necessary quotidian velocity, which is the wonkiest way of saying that we think we have to move fast, we think we cannot slow down, we think we cannot care. A couple of words that have been used to describe Mierle are inspirational and revolutionary, and it is revolutionary to slow down, to stop, to give care the time that it needs to be real. And that is again another one of the gifts that she gives us.[8]

[8] Comment made by Nagel at the Roundtable Discussion.

We can draw from the work of Mierle Ukeles an understanding of the necessity of being out of sync with the quotidian velocity, and instead being in sync with the temporal rhythms of maintenance work. This is an invitation to the reader to reject the 'average necessary quotidian velocity' and to 'slow down', to take the time to consider the work and maintenance required every day in the city. Being in sync with the gradual and repetitive work of maintenance necessarily also transforms conceptions of space and time and moves away from a progress or hero narrative. In doing so, a new level of care and understanding is reached, developing our ideas of labour and waste itself.

1.4 Scope – thesis structure

Waste accumulates. It does not simply go away through processes of management and disposal. This PhD research makes sense of waste in three ways. Firstly, through the ways in which waste is *standardised* through processes of categorising, reporting, and creating infrastructure. Secondly, through the ways in which waste is *situated* in the city through infrastructure and forms of labour and maintenance. And thirdly, through the *scale* of waste and the ways in which waste materials are scaled. Making sense of waste, through *standards* and *scale* allows for a detailed analysis of the ways in which waste, through an assemblage of materials, infrastructure, and labour, is made sense of. Also considered is how making sense of waste renders some relational aspects of waste visible and others invisible, while introducing the lens of *situatedness* allows for an analysis of waste that shows the ways in which the presence of waste is always situated and therefore the (in)visibility of waste is always situated (Duncan, 2020). I will now provide a road map for the thesis's structure to help guide the reader and set expectations for what is to come.

1.4.1 Research questions

This research has been guided by three overarching research questions which have been introduced and grounded in the prelude of the thesis through thinking with the Whitechapel Fatberg. These questions are as follows:

1. How do material practices of wasting persist in space and time? (*waste*)
2. How do systems of classification and containment constrain and enable the ability of material to matter? (*infrastructure*)
3. How is waste responded to and who becomes responsible for materials? (*labour*)

The thesis is organised in relation to the questions as they are guiding concerns of the thesis. Each research question carries a core concern of this thesis, noted in brackets at the end of each question. The research questions will be addressed throughout the thesis, with some chapters touching on multiple research questions rather than being addressed in a strictly linear manner. The conclusion of this thesis reviews how the research questions were answered and list the main contributions of this work.

1.4.2 Chapter overview

Following from this introduction, Chapter 2 is a review of the literature that grounds its theoretical contributions. This chapter is structured on three predominant themes: place as conceptualising waste, materials as 'ontologically copresent' and waste systems. These themes connect with the research questions. Conceptualising waste relates to research question 1 concerning waste, materials as 'ontologically copresent' relates to research question 3 and concerns about labour, and finally the section on waste systems relates to research question 2 concerning infrastructure.

Within this introduction I have already shared some insights into the ethnographic work conducted for this thesis. The methodology chapter (Chapter 3) expands on the work of Ukeles and her *Maintenance Art Manifesto*, as well as addressing other inspirations for the fieldwork. This chapter also provides methodological grounding through the concepts of *maintenance* and *attunement*, shedding light on how the research was conducted and highlighting some of the challenges associated with working with waste. A combination of ethnographic work/interviews and document analysis forms the bulk of primary and secondary data used for this thesis. The process of organising and performing fieldwork is described in detail in this Chapter.

Chapter 4 helps set the context through an overview of waste histories in Sydney, contextualising with historical depth and providing the basis for the core discussion Chapters (6,7,8 and 9). The chapter reviews *where* and *how* waste has been disposed of in the city over time. It also presents the historical infrastructural approaches to waste and the key concerns that have shaped its management over time.

Chapter 5 (see on Chapter 8, below).

Chapter 6 consists of nine photo-essays that visually narrate different days during fieldwork. Each essay focuses on a unique type of shift highlighting various forms of plant (see Appendix 1), including the Roadway, the Link Truck, the Mini Compactor and the Footway. To conclude this chapter, the Lucas Heights landfill is presented. The photo-essays provide a visual introduction to the themes of waste, infrastructure, and labour, offering visual references that support the analysis undertaken in the core discussion chapters. These images have also been situated in a map of Sydney, providing the reader with a simple overview of the geographical area and the scope of the fieldwork.

Chapter 7 – Infrastructure, Machines and Standards – argues that waste infrastructures reflect epistemological ideas of waste (while achieving ontological aims). As waste-infrastructure processes materialise, they confirm the status of waste or facilitate material diversion away from the waste stream. The chapter argues that waste infrastructures are embedded with, and built in relation to, how waste is epistemologically understood. Therefore, the material construction of infrastructure reveals the framings about 'what waste is', at different scales. I also discuss how the waste system and the production of waste in Sydney is created through an assemblage of standards, infrastructure, and labour, essentially arguing that waste infrastructures *produce* waste.

Understanding the waste systems in Sydney is about acknowledging how the city is layered with the biography of waste and waste infrastructures. Chapters 5 and 8 address the theme of situatedness, think with the biography or life story of waste in Sydney. These biographies will tell a story of the historical sites of pollution in Sydney, specifically thinking with the Millers Point Gasworks (Chapter 5); and a story of the present waste spaces and infrastructures that the city has grown around, thinking with the current operations of cleansing the city every day (Chapter 8). In doing so, I examine how waste has been woven into the fabric of the city, both through its historical and current day management. These chapters present a methodology of staying with material presences through a biography of the living stratigraphy of waste, as layers of time and material settle to form new topographies. Through the ethnographic work undertaken with the Cleansing and Waste Services teams of the City of Sydney, I gained a situated understanding of the workings and operational capacities of Sydney's waste infrastructure and those who maintain it.

Industrial processes are made through modes of (dis)assembling objects at scale. Chapter 9 will focus the reader's attention on the proliferation of scalability as a business tactic. This chapter will look at how the waste and resource recovery industry has evolved. As part of this process, attention will be given to the ways in which the industry is a patchwork of local and globalised industries, with an increasingly stratified mix of public and private operators. This will contribute to discussion of the ways in which matters of waste become translated through scale and will question what it means to be responsible for our material discards at an industrial scale.

In questioning modern relationships to materials and focusing on waste relations, three key elements are made apparent. Firstly, the role of standards in producing and representing material flows through the forming of categories and acceptable practices (Chapter 7). Secondly, the situatedness of people and places within the form, function, and essential maintenance of these systems (Chapters 5 and 8). And finally, scale becomes an important element through the ways in which standards are used to produce scaled infrastructure and mass material flows (Chapter 9). Each of these aspects of the waste system tells a different angle of an important story about how the present came to be.

2. Literature Review

2.1 Introduction

This literature review presents an overview of the literature that inspires and influences my work. Predominately this thesis engages with Human Geography literature (in particular, in the sub area of Urban Geography), while drawing this literature into conversation with the literatures of Discard Studies, Waste Studies and the Science and Technology Studies (STS). The aim of this thesis is to understand how waste – both as it was historically produced and as it continues to be produced – is an 'intra-action' of substances that shape Sydney as a city. This process is typified by the 'coming together' of waste infrastructure, labour and materials.

This chapter is organised into three parts. The first section is concerned with how waste is understood and how those understandings manifest in material ways and in relation to place. That is, that waste as an idea has created place,[9] shaping legacies that are unevenly distributed across space due to an embedded ideology within the concept of waste, which sees some land as wasted and therefore able to be used (productively) to manage waste. Section 2.2 focuses on the materiality of waste and how the specifics of waste are made through ontological copresence within the compendium of materials that comprise a waste phenomenon. This section also engages with the (in)visibilities of waste in urban environments and feminist theories of matter in order to understand bodily relations to waste materials. The third section develops a framing for waste systems and how infrastructure comes to matter.

These three sections align with the main components/concepts of my research topic in connection to waste: infrastructure, labour and place. The theoretical grounding of this chapter lays the foundation for the discussion chapters that follow. Primarily, this chapter provides the theoretical basis for the importance of situating waste and taking a feminist approach to waste – rather than generalising about waste at an abstract level. The feminist focus on materials as co-produced is imbued with a sense of the importance of place, as well

[9] 'If space is rather a simultaneity of stories-so-far, then places are collections of those stories, articulations within the wider power-geometries of space' (Massey, 2005, p. 130). Places as 'spatio-temporal events' (ibid.).

as the entwined relationship between place and the production of waste. A feminist lens also provides tools for the interrogation of waste from a systemic perspective, which is important in unpacking how standards and scale shape the boundaries of the waste system in Sydney.

The literature review theorises waste from multiple perspectives, with the help of many distinguished scholars. The relevant literature was predominantly drawn from the fields of human geography, Science and Technology Studies (STS), waste studies and discard studies. The work of feminist and anti-colonial scholars also grounds this thesis (section 2.2), in particular the writings of geographer and STS scholar Max Liboiron. The geographical theory of Urban Political Ecology (UPE) is also discussed, to conclude this section with a specific focus on the urban (section 2.2.3).

In section 2.3, feminist theories of 'mattering' are introduced; notable scholars in this field include Nicky Gregson, Angeliki Balayannis, Astrida Neimanis, Stacy Alaimo, Michelle Murphy, Elizabeth Povinelli and Karen Barad – specifically, the work of Gregson is in section 2.3, Balayannis in section 2.3.1, Neimanis, Alaimo and Murphy in section 2.3.2 and Barad in section 2.3.3. I have had the immense honour of thinking with many of these scholars through their writing and in-person events and site visits over the course of my PhD.

The final section of this chapter draws on the contributions of waste studies (Zsuza Gille and Josh Lepawsky) and discard studies (Max Liboiron and Josh Lepawsky) to look at the theorisation of waste and waste systems (section 2.4). Waste studies takes the object of waste as its primary focus and does not innately challenge the systematic ordering of materials. Discard scholars place a greater emphasis on the systems of discarding, which can include – but is not limited to – wasting (see section 2.4 for broader discussion). As part of the final section, I will also mobilise STS theories of infrastructure, namely the works of Susan Leigh Star, Maria Kaika, Brian Larkin, and the work of Hannah Appel, Nikhil Anand, and Akhil Gupta.

2.2 Place: Conceptualising waste

How do material practices of wasting persist in space and time? Materials persist presenting possibilities even once they are discarded (Balayannis, 2020; Liboiron et al., 2018); indeed, it is the process of discarding, of exceeding what is used or useful, that generates waste. Discarding can be intentional or a form of excess, such as a leak or leaching. The possibilities of materials can both open-up and close-down possible worlds; they can either enable

flourishing or dismissing flourishing (Cuomo, 1998). Flourishing, as Chris Cuomo notes, is not an accomplishment of autonomous, self-reliant individuals; real flourishing takes time and can be accomplished only with others (1998, p. 74). Flourishing, in other words, is made possible by our complex enmeshment in community with human and nonhuman others. To understand how waste materials enable or disable flourishing we first need to ask about the ways that waste is understood, paying attention to how conceptions of waste are imbued with specific notions of space and place that can diminish or enable worldly flourishing.

The key concern to be addressed in this section is the significance of thinking with and from place. Feminist and anti-colonial praxis are situated (Balayannis, 2020; Liboiron, 2021a; Osborne, 2019). Living with waste in the ongoing process of ruination that is the industrial present requires a renewed attention to the specifics of place and process. Working from place offers a way to be involved in an 'ongoing process of care' (Balayannis, 2020, p. 16) and an active contestation to the dominant ethics of removal and disposal – techno-fixes upon which capitalism is premised. Instead, what we are left with is an 'ethic of remediation' (ibid.). This is also a way of 'staying with the trouble' (Haraway, 2016, p. 1). Staying with the trouble is a mantra of Donna Haraway, a key feminist STS scholar. The mantra reveals a method of approach to the world and worldly problems. As Haraway (2016, p. 1) explains:

> In urgent times, many of us are tempted to address trouble in terms of making an imagined future safe, of stopping something from happening that looms in the future, of clearing away the present and the past in order to make futures for coming generations. Staying with the trouble does not require such a relationship to times called the future. In fact, staying with the trouble requires learning to be truly present, not as a vanishing pivot between awful or Edenic pasts and apocalyptic or salvific futures, but as mortal critters entwined in myriad unfinished configurations of places, time, matters, meanings.

Thinking with place provides a context from which to think that is disengaged from universal knowing and engages instead with the specificity of place as it is configured by time, matters and meanings. It also allows response-abilities to form (Barad, 2014 and Haraway, 2016) (see 3.2 for more on this concept).

It is useful therefore to review the etymology of the word. 'Waste' first appears as a 13th c. Anglo-French and Old North French word, altering the Latin root *vastus* meaning 'empty, desolate' and its sister verb *vastare* meaning to 'lay waste' (*Online etymology dictionary*,

2017a). The root of the Latin word lies in the Proto-Indo-European word 'eue-', meaning 'to leave, abandon, give out,' with derivatives meaning 'abandoned, lacking, empty' (ibid.). For this reason, derivatives include several terms that connote emptiness or lacking.[10]

The etymology of waste, therefore, shows how waste is typically understood as a lack of something. The politics of this lack are numerous and have been connected to the processes of colonialism (premised on 'empty' or 'un-utilised' land) (Liboiron, 2021a; Wilkes & Hird, 2019) and the Protestant European work ethic combined with 'extractivism and imperial capitalism… [powered] by the logic of fossil-fuelled work' (Daggett, 2019, p. 5). In these ways waste becomes both an object and a concept, used as a noun, adjective or verb, and is politically charged as a signified lack, which has been used to substantiate ongoing processes of colonialism and extractivism. Essentially, how waste is conceptualised creates the pre-conditions for the production of waste.

2.2.1 Place becomes a usable space: 'waste sinks'

The need to put the world to work is fuelled by the need to productively use land, in universal ways based on the laws of thermodynamics which seek to maximise energy-as-work while minimising waste. Based on this logic:

> …Land becomes a Resource. Resources refer to unidirectional relations where aspects of land are useful to particular (here, settler and colonial) ends. In this unidirectional relation, value flows in one direction, from the Resource to the user, rather than being reciprocal… (Liboiron, 2021a, p. 62)[11]

When land is not used as property or an extractive resource, then it becomes a disposal resource insofar as it is used as a sink for waste (Liboiron, 2021a, p. 10). This creates a feedback loop; as waste is managed through these sinks, the sinks serve to minimise waste by removing it from view and also historically from the polluters' responsibility (insofar as parcels of land can be bought and sold). While these logics are centuries old, the problem of waste

[10] Words such as: avoid; devastation; devoid; evacuate; evanescent; vacant; vacate; vacation; vacuity; vacuole; vacuous; vacuum; vain; vanish; vanity; vaunt; void; wane; want; wanton; waste.

[11] Liboiron draws a distinction between land as a common noun (a non-specific descriptor) to Land as a proper noun (Land insofar as Land is always specific holding relational capacity and associated responsibilities). Liboiron's distinction between land and Land is similar to the distinction between land and Country within the Australian context (see Tynan, 2021, p. 6). For further discussion on the concept of Country see Section 2.2.2 of this chapter. Liboiron capitalises Resource in the text because it is a colonial translation of the extraction and pollution of the specific relations embedded in Land; see Liboiron (2021a, pp. 10 & 14), and Shadaan and Murphy, (2020, p. 8) with reference to the work of Liboiron.

production has become unprecedented due to the scale of modern waste fuelled by the processes of industrialisation. As Liboiron (2021a, p. 41) states:

> When most people refer to waste and pollution today, they are referring to a set of relations that uses Land as a sink for a relatively new form of waste characterized by unprecedented tonnage, toxicity, and heterogeneity.

Industrialised sources of waste require different forms of management and governance; however, they are still largely premised on Land, Air and Water bodies being used as a sink. Even well-insured sinks will eventually exceed the material and temporal bounds of containment (Gabrys, 2009).

It is possible to see how the foundational logic of land as empty and useless if not being governed under the European understanding of private property and ownership gives way to conceptions of land as useful and productive as a sink for waste.[12] This logic became universalised through Streeter and Phelps' *Study of the Pollution and Natural Purification of the Ohio River*. The 1925 study specifically looked at the oxygen threshold for the metabolisation of organic waste in the river. The article concluded that the:

> oxygen self-purification of the Ohio River is a measurable phenomenon, governed by definite laws and proceeding according to certain fundamental physical and biochemical reactions. Because of the fundamental character of these reactions and laws, it is fairly evident that the principles underlying this phenomenon as a whole are applicable to virtually all polluted streams. (Streeter and Phelps, 1925, p. 59 in Liboiron, 2021a, pp. 50–51)

Through the universalisation of the phenomenon of self-purification the authors claim a universal truth, which becomes a formula to substantiate pollution to a maximum level before the system becomes overwhelmed. This is further ingrained by the prevailing techno-scientific logic that proscribes:

> Today, the logics, techniques, and infrastructures (in forms from pipelines to policy) of maximum use of sinks uphold land as something that is not only pollutable, but properly so. (Liboiron, 2021a, p. 70)

Therefore, maximum use is proper use! Through their reading of the study, Liboiron (2021a) shows how Streeter and Phelps rendered the problem of pollution both legible and

[12] In part this mentality has helped to preserve green urban space as urban parks in cities such are Sydney (Evans, 2015) and further afield (Harnik et al., 2006; Frickel & Elliott, 2018).

simultaneously technical and universally manageable. As such it becomes evident how the shape and form of the waste system is predicated on universal logic that land can and should be properly used as a sink. By revealing these underlying logics Liboiron (2021), Daggett (2019),[13] Gabrys (2009) and Tarr (1996) allow us to question both their premises and ongoing practices.

This is important because the notion of sinks includes 'land' but also water and air. The function of sinks is to render matter invisible. The capacity of sinks to conceal things that are visible is crucial, while things that are largely or sometimes invisible to the human eye, for example greenhouse gases, are emitted into the atmosphere. In *The search for the ultimate sink*, Joel Tarr (1996) shows how the underlying logic of sinks is perpetuated regardless of the form of pollution/waste or the nature of the sink (land/water/air). The logical assumptions required for the 'functioning' of sinks to work means that the planet is both a resource and a sink for human use and there will be no significant consequences of us thinking and acting this way**.** However, as we know from the current and pressing effects of climate change, the consequences of the use of atmospheric sinks are wide-ranging and pervasive, changing the very conditions of the world in which we live (Morton, 2023).

2.2.2 Place as Country – Urban Country

When thinking of cities in terms of waste it is important not to fall into the trap of the persistent colonial logics and framings of terra nullius or unused land. Rather we might think of waste and cities in regard to Indigenous sovereignty and the injustices that are enacted as ongoing processes of dispossession. Australia, the country where this thesis is written from and about, and from where I am situated as a settler, is an Indigenous place. Over the course of writing this thesis I have learnt the practice of acknowledging Country and considered the significance of this practice. When I was organising the 'Sydney we need to walk!' workshop for the 2021 Institute of Australian Geographers Conference[14], Emily McDaniel (a Wiradjuri woman from the Kalari Clan in central NSW) encouraged me to pose the question to the participants: 'what does it mean to acknowledge Country?', after we had a Welcome to

[13] The logic of 'maximizing productive work and minimizing waste' (Daggett, 2019, p. 8) requires land to be used as a sink. Indeed; 'Energy intake allowed for work – and growth – but only if waste could be adequately processed or expelled' (*ibid*.).

[14] The workshop was organised as one of a small number of practical outings that was planned to accompanied the conference.

Country by the Metropolitan Local Aboriginal Land Council. Unfortunately, due to COVID-19, this workshop was cancelled and so except for a trial run (which did not include the participation of Emily McDaniel or the Metropolitan Local Aboriginal Land Council) the promise of this workshop was never fulfilled. Acknowledging Country forms the intention behind the series of curated stories and walk *Eora Journey: Harbour Walk* by McDaniel. The walk itself provides an opportunity to introduce yourself to Country through Yananurala[15] and 'deepening your understanding of place' (McDaniel, 2023). In Australia the significance and meaning of place is inextricably connected with Indigenous understandings of Country. As McDaniel (2019, p. 3) states:

> Country is a term with complex meaning and understanding for First Peoples. It is not simply what lies beneath our feet, but the water, winds, seasons, constellations, tides, animals, plants. It acknowledges all those that have lived and those yet to be born. Acknowledging Country is not merely a sentence to be repeated, but an action and a responsibility. The Harbour Walk is an Acknowledgement of Country in its truest, most ancient form. We tread lightly and mindfully, with the knowledge that this site holds all the memories of everyone who has ever lived on that land.

Acknowledging Country as McDaniel shows us is more than words. The acknowledgment is both an action and a responsibility. Lauren Tynan's paper, titled *What is Relationality? Indigenous knowledges, practices and responsibilities with kin*, illustrates how Country teaches relationality and how to be 'in good relation' (Tynan, 2021, p. 3); this is premised on the logic and 'practices of care, rather than processes of extraction or ownership' (ibid., p. 6). In Acknowledging Country, we are placed in relation: 'Relationality is about connection, to Peoples and Country, but connection to Country is not always rosy either' (ibid., p. 3). As Country et al. (2015, p. 270) state; 'Country and everything it encompasses is an active participant in the world, shaping and creating it.' To be in relation to Country is to acknowledge Country as productive in the co-becoming of the world.

Country is not diminished through the production of the urban landscape. Libby Porter contends that it is vital that urban Country is acknowledged to overturn structures and processes of settler-colonialism. Porter (2018, p. 242) tells us: 'A settler colony is a unique kind of colony. Settlers come to stay. They arrive with intentions, private property, livestock,

[15] 'Yananurala, translated from the Gadigal language as Walking on Country' (McDaniel, 2023).

diseases and guns.' Settlers replace and override indigenous ways of being in place. To this end Porter (2018, pp. 242–243) asserts:

> settler-colonialism is intensely production because it endlessly seeks to create new ways of asserting belonging and home… Settler-colonialism and its dispossessing intent and logic are, then, a structure not an event… As urban dwellers, we are here because of these events and processes. Our cities and towns are a *continuation* of these activities, not a separate period of the colonial time has finished.

Insofar as this thesis theorises the urban through the lens of a waste space, it also understands that the production of the urban space is a continuation of the structures and processes of settler-colonialism,[16] just as the production of waste and pollution continue the structure and process of colonialism through the continued enactment of the right to pollute. Theorising the city and urban environments in terms of waste, waste places, waste sites, waste infrastructures and waste labours is not a way to undermine Indigenous sovereignty; in fact, viewing the city through this lens provides an additional analytic framework to recognise the ways in which the processes of dispossession have functioned over time and continue to function in the production of the urban (while dually acknowledging that sovereignty was never ceded). Country is never diminished through pollution and waste; rather, relations or responsibilities are configured in different ways.

2.2.3 Situating and thinking from 'the urban'

Discussing waste and engaging with place is crucial because waste is often moved (or moves) from one place to another, and an important aspect of this movement is to "remove" the waste from proximity to urban populations. This means crossing urban-rural boundaries, which are themselves a matter of debate (Tzaninis et al., 2021; McManus, 2021). The 'urban' as a space has been a subject much theorised by human geographers. The field of urban political ecology (UPE) has much to say about the production of the urban. Prior to the understanding developed by UPE theorists such as Maria Kaika (2005), Nik Heynen (2014), and Erik Swyngedouw (2006), the city or urban environment was positioned as diametrically opposed to the natural environment. In its most general form this traditional urban logic

[16] There are of course exceptions to this; the process of settler-colonialism varied depending on who was colonising, when the processes occurred, how Indigenous people responded, etc. There are countries that have never officially been colonised (e.g. Thailand, Liberia) and countries that formed from various invasions over centuries (countries in Europe that went on to colonise other parts of the world), so it does not necessarily happen everywhere; however, in Australia settler-colonialism is a significant factor.

supposes that nature exists beyond the city, therefore the city is an unnatural and produced space (Heynen, Kaika & Swyngedouw, 2006), while Houston et al. (2018, p. 192) identify that 'urban planning has a history of viewing cities as somehow separate from nature'. The contributions of UPE, and more recently the turn to more-than-human cities, argue that the city is 'the result of an historical-geographical process of the urbanisation of nature' (Heynen, Kaika & Swyngedouw, 2006, p. 6). To this end, the authors speak to the idea of urban natures which are explained as a material-discursive phenomena: 'The material production of environments is necessarily impregnated with the mobilization of particular discourses and understandings (if not ideologies) of and about nature and the environment' (ibid.). This understanding of urban natures is embedded in the conceptualisation of waste developed in this thesis, namely that waste is understood as a material and discursive phenomenon, and as such, ideas of waste and the ideologies embedded within it cannot be separated from its material production.

Through conceptualising the urban, UPE provides a framework to understand urbanisation. The process of urbanisation is explained by UPE scholars as 'metabolic interactions between social and ecological processes' (ibid., p. 10). In this way the city as a space is theorised as being produced through material inputs (both in the form of natural resources and capital) that are transformed through technology and work processes (fuelled through labour and energy, largely derived from fossil fuel) to in turn become the metabolism of the city, producing the urban environment, infrastructures and commodities, and – critically for this thesis – waste. In this keystone publication of UPE, Heynen, Kaika and Swyngedouw (2006) characterise waste and waste places as 'ecological war zones of depressed neighbourhoods with lead-painted walls and asbestos covered ceilings, waste dumps and pollutant-infested areas' and they are mentioned insofar as they 'shape the choreography of capitalist urbanisation process' (ibid., p. 10). UPE research focused on waste, specifically plastic bags in Nairobi, Kenya, argues that these materials reconfigure the urban landscape/metabolism and become active in the production of the urban landscape (Njeru, 2006). While an awareness of waste was always present at the peripheries of UPE as a phenomenon that creates inequities in the city, it has also been somewhat external to it, particularly as waste as material accounted for and measured tends to be disposed of beyond the city, even if this is a recent phenomenon of post industrialised cities (see chapter 4, histories of waste, for an account of

these practices in Sydney). Nevertheless, recent UPE research has suggested that a more-than-urban continuum might allow for a focus on 'shadow places' (Plumwood, 2008, and see section 2.3.1) such as 'garbage dumps' that are not strictly urban (that is, sub-urban, peri-urban or ex-urban) (Tzaninis et al., 2021). Within my focus on waste and the urban, I argue that rather than simply being a by-product of the city, waste is a material in constant relation to the labour and infrastructures employed to manage it. Waste becomes part of the metabolism that produces and reproduces the city. Therefore, I argue that waste remains a fundamentally urban, rather than a more-than-urban, phenomenon. This is not to say that waste does not exist or produce spaces outside of the urban, rather this thesis focuses on the production of the city; in this context, waste remains fundamentally urban even when it is exported beyond the boundaries of the city. Here the framing of waste as excess comes to the fore, the production of the city produces waste in excess of its boundaries and yet these excesses should not be excised from the production of the urban.

The focus of this thesis is waste in the city, specifically waste in Sydney, Australia. Cities are layered with history; through their development as sites of extraction and production they become in relation to layered and historical industrial legacies and materialities, they are spaces of waste and ruination.[17] As critical human geographer Natalie Osborne argues, there is a direct connection between the process of city-making and the production of waste: 'Settler-colonial, extractivist, capitalist cities are built and policed on logics of disposal and disposability, of waste products, spaces, people' (Osborne, 2021, p. 2). However, in conceptualising urban spaces as spaces of waste and ruination, we are not subscribing to hopelessness or inaction. Instead, Osborne (2019, p. 7) proposes 'nurturing still possible cities in the cracks in the concrete, in the ruins and wastespaces we find ourselves in.' This is the same ethos of staying with the trouble (Haraway, 2016), and the ethos of this thesis. This thesis does not seek solutions that enable a purified future where both the idea and the material of waste has ceased to exist; instead, I ask how we might 'think with' waste and pollution in the present, without simply reaching for managerial solutions. To this end this

[17] The theorisation of ruination in this thesis is guided by the work of cultural geographer Caitlin DeSilvey. DeSilvey specifically refers to the processes of ruination rather than using the framing of ruins in relation to her sites of research 'because the label would fix their identity, and what I am most interested in is how these identities can remain unfixed yet still productive' (DeSilvey, 2017, p. 18). DeSilvey states: 'Weathering and ruination can be understood as a form of self-excavation through which a structure gradually discloses its internal properties and material constituents' (ibid., p. 19).

thesis conceptualises the 'making of waste' as a territorialisation process in the urban, a claiming of land (sinks) and a making of layers (stratigraphy). It is in the identity-making of the urban that a territorial claim is made. I propose that engagement with (urban) place is therefore through a constant recognition of the processes of making it, consuming it and wasting it.

Writing on cities and waste allows me to show that urban spaces have layered histories of deep contamination that actively shape the development of urban space as well as the politics of urban dwelling (Berger, 2006; Dillon, 2014a, 2014b; Duncan, 2019; Houston & Ruming, 2014; MacFarlane, 2019). In many cases we can look to waste as it is made in the processes of extraction and disposal, to read the topography of the urban environment, as Gabrielle Hecht states:

> We are turning the Earth inside out…Whether you are talking about atmospheric circulation or the tailings piles that constitute the topography of Johannesburg, you are talking about things that were once inside the Earth that are now on or above the surface. (Gille et al., 2021, p. 24, citing Hecht)

While Hecht is talking about waste as it forms the surface level of the city, waste in the form of landfills re-engineers the sub-surface of the urban landscape (Evans, 2015; Harnik et al., 2006; Frickel & Elliott, 2018). Cities are built on and in relation to what was there before. The before remains present today but is often rendered invisible or marginalised.

This section (section 2.2) has considered the materialities of waste, defined waste and talked about the 'where' of waste and wasting by discussing sinks and the visibilities of waste. In doing so it has considered how waste is defined and what kind of assumptions about the world are embedded in the idea of waste, showing how waste is entwined with colonial ideals and metrics of maximum use. The discussion also addressed how engaging with place is necessary to understand waste, through situating it within the context of the urban, specifically Sydney.

2.3 Materials as 'ontologically copresent'

To critically evaluate waste systems (section 2.4 discusses waste systems as a concept in depth), it is important to think about the ways in which we come to know the form, effects and substance of materials, particularly once they are considered waste. In this section I will use the framing of ontological copresence as proposed by Nicky Gregson et al. (2010) in

relation to waste, and think about the form, effects and substance of waste materials. Building on relational aspects of waste, these authors argue that 'asbestos and indeed all materials need to be thought of as ontologically copresent' (Gregson et al., 2010, p. 1067). As they explain:

> materials need to be thought through transformative states, not just stable states, and that materials' performativity varies according to material states… More broadly, the paper works with asbestos to show that material properties are not fixed but processual, relational, and distributed. (Gregson et al., 2010, p. 1065)

They illustrate these arguments through drawing on examples of production of hazardous waste during the demolition of retired ships in the EU. The ships are sold as a resource, however the presence of asbestos materials problematises the extraction of resources and creates large amounts of hazardous waste that must be disposed of to extract materials of value such as steel.

Waste is most understood as material that is no longer useful. Depending on the type of material, its use might have a long duration or a short duration before becoming waste. The rise of disposable or single-use materials has been theorised to enact a distinct ontological change in materials. 'Yet while most disposables appear the same before and after their use, their ontology has fundamentally changed. Before use, the object is a desirable commodity; afterwards it is garbage' (Hird, 2012, p. 455). Myra Hird (2012), citing Kennedy (2007), argues that the use of disposables changes what the disposable material is, shifting it from commodity to garbage. This shift might be enacted multiple times, depending on how materials are sorted and categorised, insofar as garbage might become a resource and vice versa.

Use is not the only way through which the ontologies of material can change; spills also render material commodities waste. In 2020 a container ship lost more than 50 containers in rough seas off the NSW coast which led to air conditioner ducts and face masks being washed up on Sydney beaches. Once ready-to-be-sold commodities, the spillage of these materials into the ocean meant they became pollution. Transformations of materials into waste and pollution is often obscured. Hird (2012) argues that society is engineered to help us forget the production and existence of waste:

> making garbage is something we *do* every day yet rarely talk about. Indeed, as I have argued elsewhere, waste is an ironic testimonial to a desire to forget (Hird 2012). Diligent middle-class western practices of placing garbage on sidewalks to be taken to dumping stations, landfills, incinerators and the like ritualises this forgetting. It is made possible by legislative decision, regulative enforcement, risk models, community accession and engineering practice. (ibid., p. 455) (italics in the original)

However, even waste management practices do not ultimately and definitely sideline the materiality of waste.

> The problem with landfills is that their containment is always temporal; eventually they spill and leak... Successful landfill design and aftercare, in engineering terms, extends to perhaps one hundred years, a mere moment in geological and bacterial time. (ibid., p. 465)

The ontology of waste or garbage does not become void through the process of waste management, rather waste as an ontological category becomes meaningful, a presence as opposed to an absence. This also opens new questions for what it means to know waste.

2.3.1 Making waste (in)visible

There are inherent tensions between what waste is and how it is rendered legible or known. Thinking with the removal of a stockpile of expired dichlorodiphenyltrichloroethane (DDT) from Tanzania, Balayannis (2020) argues that technologies of waste disposal help to obscure the persistence and specific ways in which materials matter, insofar as materials are epistemologically sidelined through disposal. As noted in her work: '… although the stuff of removal always lingers, waste can be erased representationally' (Balayannis, 2020, p. 5). To this point, Gregson and Crang argue that academic work on the science of waste largely defines waste only as it is disposed of or managed:

> Just as much as societies have sought to distance themselves from and hide their wastes for fear of contamination, so academia has been shy of the stuff of waste. Predominantly, social science work identifies waste in terms of waste management; a move which ensures that waste is defined by, and discussed in terms of, `disposal' technologies, or more correctly waste treatments, and their connection to policy… The matter of waste becomes fixed and limited through management. Caught within a teleological fix, that which is managed as waste is waste, and that which is waste is what is managed. (Gregson and Crang, 2010, p. 1026)

Balayannis' work offers a way out of this 'teleological fix' by paying careful attention to how the practice of bordering and containment is achieved by investigating these processes and attuning 'to how materials exceed containment' (Balayannis, 2020, p. 16). Balayannis asks careful questions about the how, where, what and why of the chemical removal. She shows how the narrative of removal, communicated through the before and after pictures of the emptying of a shed used to house stockpiled DDT, is incomplete. In this way Balayannis speaks to how waste and pollution exceed the boundaries through which they are managed. Clearly, then this work 'thinks with' waste as excess and how these excesses are made invisible to achieve particular technical and political aims.

My entry on the concept of 'Invisible' in the *A-Z of Shadow Places Concepts* draws out the tensions inherent to situating, vision and (in)visibility in relation to waste (Duncan, 2021). With reference to Val Plumwood's concept of 'shadow places',[18] I argue that the ability to render waste invisible is critical to the ongoing production of waste. As vision is situated, the sight of things can be displaced through the movement of said things through space. That which is waste is rendered invisible to the urban dweller by moving it beyond the city and historically below the ground, as explained in the entry:

> The words visible and vision both come from the Latin root videre, "to see". When Haraway tells us that vision is always situated (Haraway, 1988), there is an implication that (in)visibility is also always situated (Star and Ruhleder, 1996; Carse, 2012; Larkin, 2013). Invisibility has two modes; that is "unable to be seen, either by nature or because concealed (or) treated as if unable to be seen" (Soanes & Stevenson, 2006, p. 748). Central to this definition is the interplay between what is physically hidden from view and what is systematically rendered invisible through our situated ways of knowing (epistemology) and being (ontology) in the world...
>
> … In proposing that we care for our shadow places marked by extraction, pollution and waste, Plumwood (2008) calls for these sites of extraction and excretion to be (re)turned to a line of sight, to become visible as a first step in re-establishing responsible relations (ibid.) (Duncan, 2021, p. 1).

While this entry was not focused on a discussion of Balayannis' work, it is directly relevant to the themes raised by Balayannis. In her companion article, 'Routine Exposures: Reimaging the Visual Politics of Hazardous Sites', Balayannis (2019, p. 17) shows how the technical

[18] Shadow places 'provide our material and ecological support, most of which, in a global market, are likely to elude our knowledge and responsibility' (Plumwood, 2008, p. 139).

photographs taken on the site make visible the 'messiness of remediation', through showing traces left behind and internalised through the dead bodies of small mammals and insects found on and around the site in subsequent visits. More broadly, Balayannis speaks to how people living in the Vikuge village in Tanzania were excluded from technical forms of accounting. Balayannis's work illustrates the bounded prepositions of remediation, noting that:

> The uneven lines of exposure in disposal were unclear. The only exposures accounted for were the bodies of those employed to perform the work of removal. Those living in Vikuge were zoned out of the site of the site spatial imagery. (Balayannis, 2020, p. 9)

In this way, (in)justices come into the discussion of the (in)visible. There are bodies, lands, waters that are more likely to be permanently exposed to waste. Visibility under the frame of justice can become a matter not of the senses, nor the materiality of waste that allows us to 'sense' it, but of embodied relations to it, of living with or next to it.

The enabling and disabling of bodies (both human and more-than-human) are wound up in infrastructural worlding (a concept which will be introduced later in section 2.4.2 of this chapter), and so is the transformation and terraforming of Land. One of the key arguments of Balayannis' (2020) article is to demonstrate how infrastructure is used to sever responsibilities for stockpiled waste. Colonial infrastructures (such as those that enabled the DDT to become stockpiled in Tanzania) are the result of land relations that assert settler access to land, while denying or mitigating Indigenous access to Land and sovereignty (Liboiron, 2021a). The use of sinks as a form of waste management has been premised on the use of land and water bodies as spaces that can absorb wastes serving the function of removing waste from view (see section 2.2.1). Posing timely questions around the ways in which we can 'think with' underground spaces that are generally used as sites of extraction or disposal Marilu Melo Zurita et al. state:

> The call to embrace subsurface and volume ontologies is a call to bring into account current practices of containment and proliferation, to ask: what happens in places that are out of mind, out of sight? It is thus a call for critical scrutiny of the ways in which the Subterranean Anthropocene is currently being made through dominant economic and scientific stories and practices. (Zurita et al., 2018, p. 302)

To reflect on the ways in which material practices of wasting persist in space and time attention needs to be given to the spaces that are typically 'out of sight, out of mind'. As Melo Zurita et al. (2018, p. 299) argue, we need to move 'our conceptual thinking from an ontology of area to one of volume' to help overcome the 'surface bias' in geographical thinking. There is a need to articulate the relationship between what is extracted from the underground and the 'political project' of '*sub terra nullius*' (Melo Zurita, 2020, p. 270) in order to reconfigure relations to the underground. As Hird puts it: 'waste constitutes perhaps the most abundant and enduring trace of the human; a major human-instantiated planetary de- and re-stratification' (Hird, 2017, p. 188).

In these ways, waste is remaking the world and the layered underground. The production of waste is based on ideas that are infused with colonial and scientific attitudes, namely that the world should be 'put to use'. Such materialist logics are often espoused within broader political aims and structures, shaping the world through government actions and polices. These political aims are often underpinned by specific projects, which come to typify that way of understanding the world. These structural forces are often unseen, resulting in an inattention to the material of waste and the attendant structures involved. This is why it is important that the political stakes of waste be acknowledged.

2.3.2 Feminist theories of mattering: material feminisms

The politics of material feminisms or ontological co-presence is against a politics of purity and the dichotomies between the pure, and impure, that purity politics intend to create.

> To be against purity is to start from an understanding of our implication in this compromised world, to recognize the quite vast injustices informing our everyday lives. (Shotwell, 2016, p. 204)

Feminist engagements with technoscience and materials are largely focused on bodily relationships and interdependencies (Alaimo & Hekman, 2008; Barad, 2007; Haraway, 2016; Neimanis & Walker, 2014; Shotwell, 2016; Star, 1990). As Alaimo and Hekman (2008, p. 17) state:

> attending to materiality erases the commonsensical boundaries between human and nature, body and environment, mind and matter. In short, taking matter seriously entails nothing less than a thorough rethinking of the fundamental categories of Western culture. In the process, these categories may become nearly unrecognizable.

Through ‘attending to materiality’ the boundaries of the body are not reinforced but rather understood as always already transgressed. In this way the interdependencies between bodies become recognised and centred within methodological enquiry. This is important because: ‘Focusing exclusively on representations, ideology, and discourse excludes lived experience, corporeal practice, and biological substance from consideration’ (Alaimo & Hekman, 2008, p. 4). The methodological approach of this research thinks through the body as a subject of viscous porosity (Tuana, 2008) or trans-corporeality (Alaimo, 2008). The body is never pure or singular; it is always becoming plural through its interdependencies with other more-than-human bodies (Shotwell, 2016). This logic is also taken up by Michelle Murphy, when they state;

> Bodies are not Terra Nullius. Our Bodies are the land. They are of toxic chemicals, and they are something more. They are a manifestation of something bigger, that stretches outward to water, air, ancestors, and other beings, that stretches backwards to messy histories, and forwards to a something else. (Murphy, 2017a, p. 11)

In stating that bodies are part of and an extension of their situated land and water relations, Murphy (2017a) underlines the continuous relation between place and the chemical makeup and bodily relations of Indigenous bodies. From my own embodied position as a settler I engage with these theories (spanning from feminist to Indigenous) as a way to foreground porosity and think about bodily differences when it comes to situating oneself.

Feminist literature is often concerned with how specific bodies come to matter in material and discursive ways, troubling dualistic constructs of mind and matter. While there is a proliferation of theories that speak to these ideas, viscous porosity, trans-corporality, and posthuman phenomenology are summarised below as examples of how relational understandings of matter might transform our understanding of how waste comes to matter. Viscous porosity was proposed by Tunana (2008) in an essay on the effects of Hurricane Katrina on New Orleans in 2005, and the toxic waste that the hurricane unsettled. She states: ‘There is a viscous porosity of flesh-my flesh and the flesh of the world. This porosity is a hinge through which we are of and in the world’ (Tunana, 2008, p. 109). Alaimo proposes a theory of “trans-corporality” which understands ‘the time-space where human corporeality, in all its material fleshiness, is inseparable from “nature” or “environment”’ (Alaimo, 2008, p. 238), while Neimanis proposes a ‘posthuman phenomenology’ to understand the figuring of bodies

of water. 'Our wet matters are in constant process of intake, transformation, and exchange – drinking, peeing, sweating, sponging, weeping. Discrete individualism is a rather dry, if convenient, myth' (Neimanis, 2016, p. 2). These three feminist materialisms theories trouble material and theoretical bordering between the self and the world. Moving away from notions of individualism also moves away from the politics of purity; if the boundaries of the self are porous as these authors theorise, then we are porous to the pollution and contamination that exists around each of us.

Another way to look at this is through the work of Murphy, conceptualising embodiment by troubling the idea of bodies as contained:

> The individualized body, as given to us by Western liberal political structures, as a container for rights, labor, risks, capital, and biological processes, will not do. The singularized body alone cannot dismantle the disturbing entanglements of knowledge-making within violent infrastructures. (Murphy, 2017a, pp. 4–5)

Within this framing Murphy argues that 'the demarcation of the singular, discrete body is non-innocent' precisely because 'non-innocent bodies are caught up in each other's conditions of life support and diminishment' (Murphy, 2017a, p. 3). As such '[e]mbodiment is a collective binding of profoundly uneven relations of porosity to exposure: my vulnerability to injury is entangled with your comfort'(ibid.). From this logical standpoint Murphy proposes a politics of 'alter-embodiments' which might be guided by entanglement, kinship and responsibility, rather than modes of reproduction (which perpetuate violent infrastructures; see section 2.3.2.) in order to do alternative embodiments at the collective scale. In this way Murphy seeks to shift the focus on embodiment from being to doing.

Embodiment, as an action, ties in with the concepts of 'worlding' and 'alter-embodiments', which propose an active engagement, a shaping that is both intentioned and intended upon. Attuning through the body and drawing on embodiment as method allows these understandings to become threaded with my own inter-activity in the field. Understanding the body as more than a container for the self, Povinelli (2017, p. 508) asks: 'How does one probe and discover the world that one is in, but can experience only peripherally?' The implications of Povinelli's paper, *Fire, Fogs, Winds* (2017), are that the elemental, the temporal and porosity of the flesh – in both a manner that is at once material and discursive (shaped by layers of memory) – commingle to form ways to narrate the peripherals of experiences of

toxicity and transformation. Alongside the narrative of her childhood memories of risky material playfulness, playing with blazing fire and racing fog machines spraying DDT, Povinelli talks to the toxicity of Kodak memories.

> As company and personal debt rose, tales of toxic swamps and sinkholes leaked out... The material afterimages of those Kodak moments emerged as fibromyalgia, neuropathy, and primary biliary cirrhosis. Lawsuit after lawsuit followed. Kodak admitted to violations of air- and water-pollution laws that created "an underground plume of chemicals" (Hanley 1990) (Povinelli, 2017, p. 507).

Yet she goes on to reflect and to draw this toxicity together with the material assemblages that combine memory and toxicity in the form of chemical scents; smelling is a pathway of exposure forming an interactivity, of affect and effect.

> The anthropologist Ali Feser (2015) has found that in spite of the hard evidence of Kodak's liability, many former employees and their children simply could not kick their habit of associating the astringent smell of photographic chemicals with better days, happier moments, more secure futures. The sensory history of chemicals sear into the affects, creating bonds of desire, nostalgia, and mourning for the very toxins now slowly overheating bodies and landscapes. (Povinelli, 2017, p. 508)

The chemical materialities of Kodak's legacy that came to signify harmful effects and nostalgic affects is wrapped up in the complex assemblage of time, memory and materiality. This highlights how biopolitics is never evenly materially embodied and that the politics of the material work both with and against our desires.[19] Once embodied, toxicity cannot be removed from lived experience, and as such toxicity and its related infrastructure of distribution becomes intimately experienced. This thesis foregrounds the body as a relation of utmost importance when theorising waste as a feminist practice of theory – by grounding theorisation of waste through the body the author is claiming (following Sarah Ahmed) that the 'personal is theoretical' (Ahmed, 2017, 10). This technique is also used by the author as

[19] 'Sure, it has become clear by now that profit always mattered more than the vitality of bodies; that Michel Foucault's understanding of biopolitics should have emphasized more the fact that making live was an ideological cover for letting die; that the experience of vitality and potency was more like what a meth addict feels; that the battery acid, drain cleaner, antifreeze, and Sudafed are more expertly mixed than anyone thought. Now we know that geontopower was hiding in the open, telling everyone not to worry about the great expanse of nonlife, the soils and subsoils, the aquifers and ozone, until suddenly their irradiated glow surrounded us as chemicocapital made its vicious deal with consumptive and informational capitalism (see Povinelli 2016)' (Povinelli 2017, p. 509).

one technique through which to place waste through the situated relations of bodies, both my own as researcher and the bodies of the labourers who perform this essential work.

The processes of industrialisation are inextricability linked to reconfigurations in material scales. As Liboiron et al. (2018) acknowledge in the distinctions made between toxins and toxicants – where toxins are 'naturally' occurring, and toxicants are human engineered materials – regarding substance or scale:

> Toxicants are characterized by human creation via industrial processes, compositional heterogeneity, mass tonnage, wide economic production and distribution processes, temporal longevity, both acute and latent effect, and increasing ubiquity in homes, bodies and environments. (Liboiron et al., 2018, p. 334)

In this way 'toxicity is a system' and one that is 'unique in the 20th and 21st centuries' (ibid.), in relations to waste and toxicants, systems of toxicity fundamentally reconfigure bodily and social relations to waste and make the ways in which waste scales more insidious and invisible.

2.3.3 Ethico-onto-epistem-ology and waste regimes

As mentioned in the introduction, this research is informed by *agential realism*, a theoretical[20] positioning developed through the work of feminist technoscience and STS scholar Karen Barad.[21] As such, waste is understood as the product of particular agential cuts, forms of intra-action that continuously remake the world (worlding), shaping the ethical possibilities of particular configurations of the future. Agential realism supposes that the world is made up of phenomena rather than 'independent objects with inherent boundaries and properties' (Barad, 2007, p. 139). Reality is configured through performativity; therefore, in seeking to understand the world, to perceive, comprehend and conceptualise it, 'we' are also shaping the stakes of the world as it continues to come into being. Therefore, *'practices of knowing are specific material engagement that participate in (re)configuring the world'* (Barad, 2007, p. 91; italics in original text). Another way to appreciate this theory is: 'Agential realism contends that wide-ranging apparatuses do not measure but, rather, produce material realities' (Hollin et al., 2017, p. 921). Barad's work is configured in relation to the findings of

[20] Theory is a simplified descriptor; agential realism is at once a theoretical, methodological and ethical positioning. Considering that we find ourselves in the literature review chapter of this thesis, agential realism will be primarily referred to as a theoretical underpinning, the sense-making device.

[21] Barad has been understood to align most clearly with the 'feminist technoscience perspective' within STS (Hollin et al., 2017, p. 925).

quantum physics, in particular the work of physicist Neil Bohr. Central to Bohr's contributions to philosophy-physics was his work on the two-slit experiment, a theoretical apparatus that demonstrated the diffraction of atoms, theoretically proving that matter – not just waves – could occupy a superposition.[22] Thinking with Bohr's contributions to philosophy-physics, Barad decentres the doing of 'man' [human] and offers the reader the theory of agential realism premised around posthumanist performativity.[23]

> My posthumanist account calls into question the givenness of the differential categories of human and nonhuman, examining the practices through which these differential boundaries are stabilized and destabilized. Relatedly, agential realism does not merely offer a unified theory of cultural and natural forces but inquires into the very practices through which they are differentiated. (Barad, 2007, p. 66)

Barad guides the reader to think with diffraction rather than reflection, as reflection reproduces sameness while diffraction allows for material-discursive understanding of why difference matters to emerge.

In many respects my research questions address different aspects of Barad's ethico-onto-epistem-ology – a method that merges ethical, ontological and epistemological concerns so that any analysis of what is at stake is always an interweaving of these three concerns, both as points from which to ask questions but also as points of action.

> what we need is something like an *ethico-onto-epistem-ology* – an appreciation of the intertwining of ethics, knowing, and being – since each intra-action matters, since the possibilities for what the world may become call out in the pause that precedes each breath before a moment comes into being and the world is remade again, because the becoming of the world is a deeply ethical matter. (Barad, 2007, p. 185)

There are two other authors who's conceptual work is useful to introduce here. These are Gille and her concept of a Waste Regime and Stengers' concept of mesopolitics. The layering of Barad's concerns in their ethico-onto-epistem-ology can also be mapped into three different

[22] An occupation of a simultaneous position.

[23] Posthumanist performativity resonates with the more-than-human (Whatmore, 2002) turn in cultural geography (Hawkins, 2009; Houston et al., 2018; Houston & Ruming, 2014; Maller, 2018; Poe et al., 2014; Whatmore, 2013). While Barad does not engage directly with this work, other authors have made connections between contributions of Whatmore and Barad (Hollin et al., 2017).

but interrelated terms: production (ontology), representation (epistemology) and politics (ethics)as detailed by Gille (2010) to be the three core components of a waste regime[24]:

> The concept of waste regime is a macrolevel concept but is concerned with the production, circulation, and transformation of waste as a concrete material…Waste regimes differ from each other according to the production, the representation, and the politics of waste. (Gille, 2010, p. 1056)

Similar to the positioning of Barad (2007), that a concept is a material articulation,[25] Gille (2010) argues that a waste regime is not an abstract concept – rather that it is distributed and grounded through materials and the embodied actions of multiple relational and more-than-human actors across space and time. Essentially, Gille is proposing that we might understand macro waste processes without moving to a level of abstraction. Here Stengers' theory of 'mesopolitics' provides useful language, i.e. an articulation of a level in between the macro and the micro, through which to position an analytical approach to waste materials.

> [T]he meso… concerns not matter, but material. Why does glue stick? Why do metals tend to stress and break? This is a science of the interstices and the cracks. It's a science of defects. It is the kind of science where it is always a question of this material, rather than Matter, and which encounters "procedures," like those of metallurgy. Why must the iron be beaten as long as it is hot? The macro is matter in general. Gas is marvellously "in general." With the meso, on the other hand, it is necessary in each instance to redefine topically how the relations between the micro and the macro are assembled. (Stengers et al., 2009, p. 4)

Stengers here illustrates how simple questions can be asked about the relationships between materials and procedures in order to assess the stakes of the mesopolitical. The mesopolitical clarifies the specifics of how waste as a material matters and provides a useful framework to talk about scale, like Barad's ethico-onto-epistem-ology both provide direction as to the openings and points from which to ask questions about the stakes of matter at hand and points of action at which to intervene. In the context of research on waste it also links well with Gille's (2010) concept of a waste regime. Therefore, understanding waste is always grounded in understanding its materiality in relation to the environmental conditions in which

[24] This is not the first time the work of Gille and Barad has been brought together, nor for that matter that Barad's agential realism has been drawn on to think with waste. Geographer Myra Hird's work, Knowing Waste: Towards an Inhuman Epistemology, builds upon Barad's theorising of Indeterminacy.

[25] It is important to note that, following Barad, concepts are not distinct from materials, rather they are 'particular material articulations of the world' (Barad, 2007, p. 139).

it is situated. Specifically, these three theories can be used to assert the importance of theorising matter, with each offering a different avenue through which to interrogate or highlight the political stakes of the matter at hand.

Considering that the work of both Barad and Gille accounts for the capacities of materials across scales, it is worth picking up on how changes in scale are reconciled by Barad and Gille. Waste as it is theorised, measured and managed becomes a scaled phenomenon. Waste is scaled in terms of its mass and volume insofar as it becomes an object of governance, accounting and management. The insights of Barad and Gille show how within scaled and dispersed phenomena such as waste, attempts can be made to understand the specifics of the materiality and the stakes of the apparatus through which we understand the materialities of waste. There is consensus in waste studies that waste is 'socially constructed', that is, waste is 'made' and therefore the particular ways in which waste becomes made are what matters most in waste studies (Gille & Lepawsky, 2021, p. 5). The classification of matter as waste (whether that be formally through apparatuses such as standards, regulations and laws or informally such as the placement of materials within household bins) is a way of making distinctions about matter. It matters how and where distinctions are made. As Hollin et al. (2017), distilling the work of Barad, state:

> Scale is, instead, an outcome of on-going worldly processes of production, contestation, and reproduction (Barad, 2007: 245) … Attention is thus shifted away from '[q]uestions of size and shape (geometrical concerns)', and is instead reoriented to 'questions of boundary, connectivity, interiority, and exteriority (topological concerns)' (Barad, 2007: 244). (Hollin et al., 2017, p. 924)

The agential cuts configure the production of scale, drawing attention towards topological concerns. What happens if the questions we ask about waste are questions of boundary, rather than questions of size and shape? The work of Balayannis (2020) introduced in section 2.3.1 shows this type of accounting by focusing on how specific material-discursive borders rendered a stockpile of DDT 'removed' despite the persistence of the material in the location and surrounding area.

Section 2.3 has argued that the capacities of materials are ontologically copresent. It has therefore been argued waste may come to be known through understanding it as ontologically copresent and in doing so how it is possible to define waste beyond the bounds of its

management and disposal, which tend to make invisible the continuing legacies of waste materials. Section 2.3.2 foregrounds the body as a relation of utmost importance when theorising waste, while section 2.3.3 argues that waste might be best understood as a compendium of materials through topological concerns such as through the lens of an ethico-onto-epistem-ological grounding or the framing of a waste regime. The final section of this literature review will review and develop the ideas of waste systems and infrastructural systems.

2.4 Waste systems

The field of discard studies, as discussed in the introduction, has brought a renewed focus to waste systems, although systems are framed within the wider context of discards rather than specifically in relation to waste. On this ground waste studies and discard studies are emerging as two distinct but related fields of study; for which, see the recent publications, *The Routledge Handbook of Waste Studies* (Gille & Lepawsky, 2021) and *Discard Studies: Wasting, Systems and Power* (Liboiron & Lepawsky, 2022). Indeed, Gille and Lepawsky (2021) note that:

> Discard studies is somewhat different from waste studies in that the former makes a claim about systems, that is, that all systems must rid themselves of that which challenges their ordering so as to remain the systems that they are (Liboiron and Lepawsky, forthcoming). In most instances, waste does not challenge such systemic ordering. Indeed, as Liborion [*sic*] reminds us in this handbook Douglas' notion of dirt—that which constitutes an existential threat to a given order—is not synonymous with waste. (Gille & Lepawsky, 2021, p. 15)

This distinction is important as the analytical focus is different between systems of wasting and waste systems. Systems of wasting is a framing that can be aligned with systems of discarding whereas waste system specifically calls attention to materials that are considered and classified as waste.

Engaging with the work of Mary Douglas (1996), waste can be understood as a cultural object, a phenomenon which is produced through forms of cultural categorisation, in particular her argument about dirt as matter out of place, as the text of *Purity and Danger* tells us:

> if uncleanness is matter out of place, we must approach it through order. Uncleanness or dirt is that which must not be included if a pattern is to be maintained. To recognise this is the first step towards insights into pollution. (Douglas, 1966, p. 50)

The work of Douglas is often seen as a starting point from which to talk about waste theory; however, this is also because waste and pollution can become conflated terms (Liboiron, 2019). In their critique of Douglas's work, Liboiron notes that: 'Douglas specifically says that trash is not matter out of place' (Liboiron, 2019, para. 2). In this way waste becomes the material categorised within the waste system, while pollution and litter become the material that is uncontained within systems of waste accounting and management, that is, that which threatens the system.

However, as Liboiron later argued, litter or pollution can serve to maintain rather than threaten the waste system (Liboiron, 2022b). The examples they use include the 1970 *Keep America Beautiful* campaign, which framed pollution as primarily caused by individuals (the ad's slogan: *People start pollution, people can stop it*). The campaign was funded by beverage and packing companies to draw attention away from structural factors that contributed to waste and litter. As they note: 'most narratives about litter, including those that moralize litter as bad, maintain systems of power rather than disrupt them' (Liboiron, 2022b, p. 34). Similar arguments can be made around the 'greening' discourses of recyclability (ibid.). Liboiron argues that Douglas's work is about power, giving the reader a basis from which to critique systems which accumulate power through developing schemes of categorisation, resulting in hierarchical ordering within the system and systematised exclusions from the system through the maintenance of the system's borders. As Liboiron states:

> Rather than saying "where there is dirt, there is system," the way Douglas does, we can think that "where there is system, there is dirt," that which threatens the system. These threats must be eliminated–not merely sorted! (Liboiron, 2019, *Materialism as power,* para. 3)

Liboiron here addresses the violence of categorisation, and the ways in which categorisation creates excess, that is, that which exceeds the system. Understanding waste only as a culturally produced object accentuates the cultural understandings of materials and undermines the importance of material properties and their cumulative interactions. Waste systems are developed within the established industrial order. The global waste regime under capitalism is based on the industrial order. Therefore, waste systems are about the maintenance and flows of industrial order; they are typically maintained through vested power interests (Altman, 2015, 2017). Building on understanding of waste systems developed

in this section, the next section will look at how waste systems are underpinned by infrastructure.

2.4.1 Infrastructural systems: the movement of materials through classification and containment

This chapter has been building an argument that waste is not an ontological property of material. That is, rather than being inherent, waste becomes waste through the positioning of materials in relation to a system of categorisation, that is placement within the infrastructure of the waste system. As Evans (2018, pp. 114–115) suggests:

> waste is a matter of placing insofar as "waste" is not a property of things, rather, stuff that is (or was) "food" only becomes "waste" when it is placed in a conduit – the bin – that carries it in the direction of the waste stream.

This conduit here referred to by Evans (2018) highlights the importance of infrastructure in the transformation of materials into waste. Evans investigates waste as it is produced in the home environment, but these depository infrastructures within the home link to a wider system of industrial waste infrastructures. Furthermore, it is only by entering industrial waste streams that these materials become accounted for in state, national and global statics.

Further to this, this thesis frames infrastructure as a system that is both embedded in and transformative to the structure of the city itself. The framing of infrastructural systems is taken from the context of the sewage system. What are we speaking about when we speak about infrastructure? How do infrastructures structure the city? What is the relationship between waste and infrastructure? These questions are themselves up for debate and the shape of the answer is political in both form and function. As Larkin (2013) argues:

> Infrastructures are not, in any positivist sense, simply "out there." The act of defining an infrastructure is a categorizing moment. Taken thoughtfully, it comprises a cultural analytic that highlights the epistemological and political commitments involved in selecting what one sees as infrastructural (and thus causal) and what one leaves out. (Larkin, 2013, p. 42)

One of the political legacies often cited in infrastructure is modernism (Bradley, 2016; Anand, Gupta & Appel, 2018; Lawhon et al., 2022), which has been expressed in the form and function of infrastructure. As Bradley (2016, p. 1957) states: 'The obfuscation of the system was connected to modernist, and then neo-liberal, political projects promising greater efficiency

through what many came to understand as functional ahistorical spaces of utilitarian infrastructures.' So it is the political ideas embedded in infrastructure that have led it to become a largely obfuscated system. However, in the process of developing and building new infrastructural projects, infrastructure becomes foregrounded and contested for its political promise (McManus & Haughton, 2021; Haughton & McManus, 2022).

It is commonly understood that 'infrastructure can never exist outside of a deictic (for example, infra "below") relationship to something else' (Boyer, 2018, p. 226). These engineered processes of circulation move logics and power as much as materials. Due to the infra level of circulation of these currents, they remain out of sight; however, the critical question to ask is 'out of sight to whom?' (Balayannis, 2020; Davies, 2019). This is a question of justice. Situated below, infra-structure is a system that holds together the workings of the surface, like the functioning of fungus whose mycelium networks are vital to the health of the plants growing from the soil. Therefore, a focus on infrastructure provides a way of asking questions about how the world 'works', is 'put to work' and how particular wordings are considered. Keeping this in mind, the question arises: who is the world being put to work for?

Infrastructure is not merely enabling, it is also disabling; in facilitating some material flows it stops or frustrates the flows of others. Importantly a focus on infrastructure leads to a critical understanding of the ways in which infrastructures simultaneously able and disable particular bodies and modes of operating in the world (Star, 1990, 1999; Murphy, 2017c; Liboiron, 2021b). Therefore, a critical take on infrastructure typically pays attention to the ways that infrastructures and their mutual companion standards produce insiders and outsiders and how the flows of infrastructure influence the pooling of power.

This emphasis on bodies has recently taken form in a focus on working bodies, their labour and connections to the production of infrastructure within the field of urban geography. Fredericks (2018, p. 152) calls this the 'vital infrastructures of labour' and argues that 'infrastructures matter in their intersection with human bodies'. Ramakrishnan, O'Reilly, Budds (2021, p. 683) look at the 'embodied labour' of infrastructure. Stokes & De Coss-Corzo (2023, p. 429) speak to 'infrastructural labour', defining it 'as intentional human work, whether waged or unwaged, which is fundamental in sustaining collective life by enabling, mediating, maintaining, and modifying infrastructural assemblages' (ibid., pp. 437- 438). These works foreground labouring bodies as a form of infrastructure.

The relationships between infrastructure and power can be critically examined on many different scales; however, for urban geographers such as Fredericks, Ramakrishnan, Stokes and Kaika it is most closely understood within the scale of the urban environment. In densely networked urban environments, infrastructure is a locus of power and politics. As Kaika states:

> However, once completed, the networks became buried underground, invisible, banalized, and relegated to a marginal, subterranean urban underground. Their contemporary hidden form contributed to severing the process of the social transformation of nature from the process of urbanization, blurring the tense relationships between nature and the city further. Perhaps more importantly, the hidden flows and their technological framing occlude the social relations and power mechanisms that are scripted in and enacted through these flows; that is, they contribute to the process of commodity fetishism. (Kaika, 2005, pp. 28–29)

Kaika therefore questions: what symbolic and discursive meanings are enmeshed in the systematising of material flows through urban environments and what ideologies become emergent through these processes? Infrastructure has been understood to be premised on the promise of endless circulation: 'it is difficult to separate an analysis of infrastructures from this sedimented history and our belief that, by promoting circulation, infrastructures bring about change, and through change they enact progress, and through progress we gain freedom' (Larkin, 2013, p. 332). For this research, understanding the importance of waste infrastructure is also understanding the ways in which waste infrastructures enable the production of waste and/or produce waste, but it is also about the limits to this infrastructural logic. The idea that materials can be in endless circulation fundamentally obscures the seemingly endless material throughput that a system of progress (unrestricted flow) is based upon, fundamentally ignoring entropy.[26] At the most basic level, all matter carries energy, which will transform over time through the application of heat and work or degrade through the process of entropy.

[26] A note on entropy: 'In 1865, shortly after Thomson's insight about energy's tendency to dissipate, a German scientist named Rudolf Clausius first coined the term *entropy* and offered a mathematical equation describing it. For Clausius, entropy describes how heat tends to spontaneously disperse. Entropy, which stands for how widely heat is dispersed, is thus always increasing (e.g., hot goes to cold) in a closed system. Riffing off of energy's Greek origins, Clausius adopted entropy from the Greek *en + tropein*, or in-turning. Clausius translates it as transformation. Just as Thomson related irreversibility to energy, so Clausius also considers entropy and energy as partnered observations about the universe' (Daggett, 2019, pp. 44–45).

2.4.2 Infrastructural systems and power

Infrastructure grounds these questions in the movement of materials, bodies and discourse, allowing one to ask critical questions about scale, governance and power and the 'epistemological and political commitments' that are inherent in making infrastructure seen or unseen (Larkin, 2013, p. 330). Furthermore, it is increasingly recognised that the ways in which infrastructure is formed and operates, govern the possibilities of what infrastructure creates (Star, 1990, 1999; Kaika, 2005, Larkin, 2013; Boyer, 2018; Appel, Anand & Gupta, 2018). The stakes of infrastructural projects are high for those who co-habit within the spaces produced by infrastructure, but also for those who are placed beyond or excluded from their services, as infrastructures underlie the creation of the urban structure.

> Study a city and neglect its sewers and power supplies (as many have), and you miss essential aspects of distributional justice and planning power. Study an information system and neglect its standards, wires, and settings, and you miss equally essential aspects of aesthetics, justice, and change. (Star 1999, p. 379)

As Star and other STS scholars have pointed out (Larkin, 2013; Boyer, 2018; Appel, Anand & Gupta, 2018), the politics of the city and their locus of power are shaped by its infrastructure. Infrastructures produce cities and material relations, as Jensen and Morita (2017, p. 329) argue: 'we…see infrastructures as emergent systems that produce novel configurations of the world – new practical ontologies.' Because of their pivotal role in the worlding of cities, this PhD understands waste through the lens of infrastructure. Therefore, attention is paid to infrastructure insofar as it enables the act of discarding and as a way of grounding and situating research on waste and wasting.

Infrastructure delivers structural outcomes, resulting in significant exclusions, separations and blind spots when it comes to understanding the temporalities, politics and promises of infrastructure. As Appel, Anand and Gupta (2018, p. 4) state: 'While privileging the circulation of people and things, infrastructures also serve to permit states to separate politics from nature, the technical from the political, and the human from the nonhuman.' Appel, Anand and Gupta (2018, p. 8) further summarise STS literature on infrastructure as attending to the 'practice and design of engineering' and propose that this mode of enquiry might situate the vision of the researcher on the practice of infrastructure becoming and the work of repair and maintenance needed to maintain the system's functions. This framing grounds the politics of

infrastructure in the bodily intimacy of those who work to hold the system together and restates a necessary focus on the social regarding investigating infrastructure.

The intimacy of infrastructure has been raised by Wilson (2016) as it is a structure that is at once distributed while also being embodied and relational (Berlant, 2016; Ferguson, 2012; Fredericks, 2014; Lea & Pholeros, 2006; Star, 1990, 1999; Star & Ruhleder, 1996). For instance, Ferguson (2012) speaks to the 'common bond' that is brought about through the connectivity of infrastructure; however this dynamic also allows for violence to be enacted through infrastructure without culpability and responsibility.

> The ways that infrastructures shape our worlds are so often pernicious, for these authors, precisely because infrastructure does its violence in ways that make it peculiarly hard to ascribe responsibility. If a policeman kills my baby, I know who to blame; if a team of urban planning consultants does it, neither the planners nor I may have any idea of the connection. The violence that is built into the massive inequalities that dominate our societies today is often naturalized, made invisible, or made to seem inevitable, by the walls, pipes, wires, and roads that so profoundly shape our urban environments, even as we take them for granted. (Ferguson, 2012, p. 559)

Therefore, understanding infrastructure as a form of intimacy also highlights the ways in which relationships with Land/Country, home and community can become mediated through forms of infrastructural violence (Davies, 2019; Liboiron, 2021a; Arefin, 2017).

Infrastructures create systems, networks of flows that are defined as much by their capacities as their limitations and borders. As I have discussed elsewhere:

> In spite of the inherently "sunken" nature of infrastructure, "[s]iting (sighting) boundaries is a risky practice" (Haraway, 1988, p. 595). Through the process of situating, sight transitions from the background to the foreground. That which is rendered background infrastructure sets the political stakes of material flows, as it is dependent on one's collective situatedness in relation to the system. Are you someone the infrastructural system services? Or are you the outsider that is excluded from the system as a form of boundary making?
>
> Furthermore, the system is never stable, its parts are always corruptible and in constant need of maintenance through the continuous performance of labour and materials co-creating the system. (Duncan, 2021, p. 1)

Following Barad, thinking with borders rather than size allows for pertinent questions about power and scale to be recognised (see also section 2.4.3). As Appel, Anand and Gupta (2018,

p. 12), building on the work of Star and Ruhleder (1996), state: 'Rather than being a singular thing, infrastructure is instead an articulation of materialities with institutional actors, legal regimes, policies, and knowledge practices, that is constantly in formation across space and time.' In this way infrastructure is both standardised through institutions, laws and policies and situated through the specifics of its particular formation in space and time.

2.4.3 Infrastructural systems as apparatus

Following the work of Barad this thesis understands waste infrastructure as an apparatus. Apparatuses are phenomena, boundary-making but not bounded. They are not in the world, rather they are of the world in this way: 'apparatuses are specific material reconfigurings of the world that do not merely emerge in time but iteratively reconfigure spacetimematter as part of the ongoing dynamism of becoming' (Barad, 2007, p. 142). Infrastructure produces its own material realities. In arguing that infrastructure can be understood as an apparatus I am seeking to detail how infrastructure (with a focus on waste infrastructure) at once produces the world and makes sense of it. Infrastructure is not just used to manage waste, but it actively participates in the production of space; as an agent it produces particular worlding configurations.

Infrastructure, as agent, is neither the villain nor the hero. In their 2021 lecture, *Building Feminist and Anticolonial Technologies in Compromised Spaces // Oh. Shit. K… now what? Infrastructural Theories of Change* (Liboiron, 2021b), Liboiron argue that infrastructure can never deliver a clean slate (or else it reproduces the logic of terra nullius). Therefore, compromise and reproducing infrastructure is the prerequisite for action even when we consider how feminist and anti-colonial practices and 'collaboration with the ground you stand on' might be achieved through infrastructure. Importantly, it is at the points of compromise and reproduction where changes to the system can be made. As Hollin et al. (2017, pp. 924–925) state: 'Objects, entities and phenomena are demonstrably instantiated in and by material practices, produced performatively in concrete situations and thus – crucially – can anchor political actions.' Neither change nor politics can be removed from the concrete situations or land, water or bodily relations which they are a product of.

Infrastructure is always multiple and layered, as it is distributed and relational, in the practice of continuous becoming and situated in Land and bodily relations. Experiences of exposure

and toxicity become wrought into the fabric of bodies even if the bodies move away from the sources of exposure. Thinking with and attending to the practice of infrastructure is how this thesis will provide a critical stance on waste; this stance will pay attention to relationships between infrastructure and scale, the ways that standards form infrastructure and the particularities and legacies of infrastructure situated in Sydney. The focused lens of looking at infrastructure in practice with these considerations in mind will be referred to as infrastructural systems.

2.5 Conclusion

This literature review has laid the conceptual groundwork for my thesis. I have engaged in depth with bodies of work, drawing mainly on the works of human geographers and STS scholars. The discussion has moved through theories and understandings of place, from the Indigenous conception of Country in Australia to contextualising waste as part of the production of the urban environment. This understanding of waste has accounted for waste as a relational phenomenon of both meaning and mattering at the scale of land and bodily relations and is therefore embedded with questions of power and justice which are raised when considered a critical stance on the situated distribution of waste. Finally, systems of waste have been considered, especially regarding how systems configured through infrastructure enable and reproduce waste as excess and how these infrastructures configure the city in productive and uneven ways. These frameworks will now be applied to data obtained during fieldwork undertaken in Sydney. The following chapter, Chapter 3, discusses my methodological approach and process.

3. Methodology

3.1 Chapter overview

This chapter is an overview of the methodology used to conduct the field research for this thesis. This chapter is divided into three core parts. The first, section 3.2, considers the justification and framing of the methodological approach and introduces the work of Mierle Laderman Ukeles and Robin Nagle as key artists and scholars from who my work has taken inspiration and direction. This section also introduces the core methodological ideas of maintenance and attunement.[27] Section 3.3 reviews my research intentions, while section 3.4 details how the proposed methodology worked in practice. This last section is divided into two parts. The first, section 3.4.1 speaks to the delays and divergence I experienced in setting up fieldwork. This is important because to tell a story of one's intentions and expectations is also to tell a story of how these expectations were met with the intra-activity of the world (Barad, 2007; van Dooren & Rose, 2016). Section 3.4.2 reviews the implementation and outcomes of organisationally embedded fieldwork. The chapter concludes with some methodological reflections.

3.2 Justification and framing of the methodological approach

Maintenance work can be understood as operating in both domestic and industrial spheres. These spheres have historically been broken down into feminine and masculine domains (Vickery, 1996); however, feminist scholars and artists have taken an interest in the differences and similarities between the scales and practices between maintenance work performed within these spheres (Carr, 2017; Foster, 2020; Ukeles, 1996). As such, often these concerns of labour and maintenance are spread across domestic and industrial scales (Carr, 2017; Foster, 2020; Ukeles, 1996). The work of New York City artist Mierle Laderman Ukeles is a key example of this. Ukeles draws out the connections between the maintenance of the home and the maintenance of the street. In her *MANIFESTO FOR MAINTENANCE ART 1969! Proposal for an exhibition "CARE"*, she sets up the tension between macro level drivers of 'Development and Maintenance':

[27] Fieldwork with the City of Sydney is largely an exercise in attuning to maintenance work through labour and infrastructure.

> B. Two basic systems: Development and Maintenance. The sourball of every revolution: after the revolution, who's going to pick up the garbage on Monday morning? (Ukeles, 1969, p. 1)

In specifically linking these tensions to the question of 'who's going to pick up the garbage on Monday morning?' she is foreshadowing her performance work a decade later with the New York Department of Sanitation: *Touch Sanitation*. In the manifesto, Ukeles contrasts macro level maintenance practices with the micro level maintenance performed within the domestic sphere:

> C. Maintenance is a drag; it takes all the fucking time (lit.) The mind boggles and chafes at the boredom. The culture confers lousy status on maintenance jobs = minimum wages, housewives = no pay.
>
> clean your desk, wash the dishes, clean the floor, wash your clothes, wash your toes, change the baby's diaper, finish the report, correct the typos, mend the fence, keep the customer happy, throw out the stinking garbage, watch out don't put things in your nose, what shall I wear, I have no sox, pay your bills, don't litter, save string, wash your hair, change the sheets, go to the store, I'm out of perfume, say it again— he doesn't understand, seal it again—it leaks, go to work, this art is dusty, clear the table, call him again, flush the toilet, stay young. (Ukeles, 1969, p. 1)

In 1977 Ukeles became an Artist in Residence at New York City's Department of Sanitation, a position that enabled her performance artwork, *Touch Sanitation*, in which Ukeles personally thanked and shook the hands of over 8500 sanitation workers in New York City between 1979 and 1980. The work of Ukeles draws links between touching, observing and recognition. Wanting to understand the scale of work (as a relational practice rather than a matter of numerical accounting) that goes into the city's maintenance, she becomes accountable (that is) able to account to the scale of this work. And through the documentation and public display of this performance art Ukeles draws a wider audience into the account.

Embodied methodologies extend theory into practice. The practice of being guided through infrastructures by those who labour within it was committed to as a method by Robin Nagle. Nagle's ethnography of the Sanitation Workers of New York City, titled *Picking Up: On the Streets and Behind the Trucks with the Sanitation Workers of New York City* (2013), began in 2006 with the aim of understanding:

> some of the human costs and labour requirements of waste. All of us create trash in great quantities, but it's a troubling category of stuff that we mostly ignore. We

> particularly ignore how much care and attention it requires from a large, well-organised work force. What would life be like if the people responsible for managing the waste of contemporary society were not on the streets every day? What do their jobs entail? (Nagle, 2013, p. 13)

In pursuit of embodied understanding, Nagle takes on the full responsibility of a salaried employee working for the New York Department of Sanitation. For her it was not enough to simply see and do, she must do within the context of the responsibility and accountability of a salaried sanitation worker. While it was outside the scope of my PhD to undertake this work as paid employment, my research scope was also slightly different to Nagle's as my research is not solely concerned with the practice of doing these jobs, but also how this work enables the development and construction of the city. What my methods are really getting at is how can paying attention to waste lead us to a layered understanding of the production of Sydney and urban environments as time and matter settle to form new topographies.

Inspired by Ukeles and Nagle, my work is methodologically grounded in embodied methodologies. Embodiment as a method is a more-than-geographical thinking tool, with studies coming from varying disciplines and fields such as health studies, education and sociology (Hopwood, 2013; Pitt, 2015; Puwar, 2020; Springgay & Truman, 2017). Returning to thinking with Barad's agential realism is helpful here as bodies, and embodiment as a process, are specifically spoken too;

> The world is an ongoing intra-active engagement, and bodies are among the differential performances and properties, including those of spacetime. Technoscientific and other practices entail space-time-matter-in-the-making. Nothing stands separately constituted and positioned inside a spacetime frame of reference, nor does there exist a divine position for our viewing pleasure located outside the world. The is no absolute inside or outside. There is only exteriority within, that is, agential separability. *Embodiment is a matter not of being specifically situated in the world, rather of being of the world in its dynamic specificity.* (Barad, 2007, pp. 376–377) (italics in original)

In this way embodiment as a method is not a way to constrain the representation of the world through particular and specific bodies, but rather to open up the body to propositions of dynamic specificity of its worlding. Both Haraway and Barad speak to the practice of being response-able. As Barad concludes:

> Responding – being responsible/response-able – to the thick tangles of spacetimematterings that are threaded through us, the places and times from which we came but never arrived and never leave is perhaps what re-turning is about. (Barad, 2014, p. 184)

For Barad, response-ability is about opening the capacity to respond and be responsive to the mattering of the universe, while for Haraway the emphasis is on the more-than-human world, questioning "Who would render whom capable of what?" (Haraway, 2016, p. 22.) Barad, in an interview with Gandorfer, tells us:

> the conditions of possibility for theorizing are not external to theorizing; the apparatus itself—that is, the material-discursive conditions of possibility for theorizing—needs to be understood as an integral and constitutive part of theorizing. This enables a response, which is the matter of the response-ability of theorizing. (Barad & Gandorfer, 2021, p. 17)

Here Barad asserts that response-ability is a result of intra-activity following from an agential realist account of the universe.

Attunement through 'acts of noticing' (Tsing, 2015) is generally understood to be a key tenet of more-than-human methodological practice (Dowling et al., 2017). Others have referred to this as 'engaged witnessing' (Bell, Instone & Mee, 2018) and 'arts of attentiveness' (van Dooren, Kirksey & Münster, 2016). Key to this understanding of the importance of attunement is an articulation of the entanglement between knowing and being in the world. Barad's 'agential realism' (Barad, 2007) is premised on exactly this entanglement. It is important that multiple modes of paying attention are included as part of the story (Haraway, 2016; van Dooren, Kirksey & Münster, 2016; Wiame, 2018; Judith, 2020), to create not just modes of responsiveness and responsibility in the storyteller, but also within communities of readership. These methods are perhaps best encapsulated by Le Guin (1989), whose well-known 'carrier bag theory' of crafting stories is 'made of things picked up, and moved, and reorganised', rather than a simple retelling of the Western hero narrative (Wiame, 2018, p. 526). The story of waste in Sydney follows a multifaceted narrative of waste as it is picked up, transported and reorganised. As such this theory helps to tell these stories and de-centre the predominant human experience.

Approaching waste systems as a more-than-human accomplishment allows for a nuanced understanding of the ways in which waste materials exceed the boundaries of systems of

management and become accounted for in desperate bodies and locations (Hird, 2012; Shapiro, 2015; Liboiron, 2016; Wakefield-Rann, Fam & Stewart, 2020). In turn it allows for phenomena generally accounted for by hard sciences such as chemistry, physics, biology and engineering to be thought about in the terms of how these meso-level agencies might collectively come to matter from the perspective of human geography (Whatmore, 2002; Pitt, 2015; Dowling, Lloyd & Suchet-Pearson, 2017) and STS (Liboiron, 2016; Shapiro, 2015; Wakefield-Rann et al., 2020). These methods revealed not just new ways of finding knowledge, but also point to a more nuanced field of attention that is necessary for this research; in this way new onto-ethico-epistem-ological dimensions of concern are revealed (Barad, 2007).

In this thesis, photography is utilised as a method to foreground the work of waste (see Chapter 6) and bring the not-often-considered work into full view. Photography has been used to centre fieldwork, to critique and analyse the 'field' itself; this is evident in the work of Pitt (2015), Garrett (2016), Balayannis (2019) and Zhang (2020). These authors actively use photography as a method of attunement with space (the *field,* within which we *work*) that can be read beyond modes of aestheticisation or technical accounting. In this thesis, photographs in the form of photo essays are used to document the field. The photo essays visually introduce the reader to the fieldwork, accounting for and to the presence of waste, infrastructure and labour in a narrative form. Rather than providing a singular still snapshot, the photographs as a collection account for the passing of time and more-than-human agencies of the field, that it is relationships between waste materials, the environment, animals (such as birds) and the infrastructures and mechanical aids that facilitate the work of waste management and street cleansing. Therefore, photo essays are utilised to provide a wider view into the world of waste in the city, to help the reader situate themselves in the field and enable visual forms of recognition – attunement.

3.3 Research intentions

Research, and in particular research for a PhD, is constrained by timelines. My research proposal, while inspired by the work of Ukeles and Nagle, was modest in comparison to their undertakings. Furthermore, as was the case with this PhD where the research project was self-directed rather than pre-prescribed, the first year of research was spent envisioning the research project, while the second involved gaining organisational approval both internally

through the university ethics approval processes, and externally from my research partners. My ethics application proposed the following scope for the PhD fieldwork:

> I am requesting that a 'call for participants' be circulated amongst both your organisational staff working in the daily operations and maintenance of Sydney's waste systems. I am proposing an ethnographic approach which would be informed by the method of participant observation.
>
> Writing an ethnography is the product of participatory observation field method, a research method common to anthropology (Nagle, 2013), geography (Crang & Cook, 2007) and sociology (Goffman, 2014). As a method of approach, participant observation requires that the ethnographer/researcher, observe, participate and interview participants in the field (Spradley & McCurdy, 1972). The process of field observation is then recorded by the researcher in their field diary through taking notes, making detailed descriptions and sketching parts of the environment. This method of gathering information can be supplemented by other non-verbal recordings such as audio recordings of the field and the use of photography.
>
> Throughout the process of undertaking participatory observation my experience in the field will be enriched by talking with a small number, ideally around six, of research participants, with the view to expand if there is wider interest in the project. It is envisaged that the researcher will be able to accompany research participants on a work shift between 3 and 6 times over a time period of a few months.

At the time of compiling and submitting my ethics proposal, I was hoping to work with, and research, various organisations to understand the different and interacting operations and maintenance processes of Sydney's waste systems. In particular I was hoping to do fieldwork with the City of Sydney,[28] Sydney Water and Veolia (see Chapter 4.7 for more information) and SUEZ (see Chapter 4.7 for more information) following a multi-sited ethnographic approach (Hine, 2007). This rationale meant that I proposed to work with a small group of research participants from each organisation. In practice things worked out differently (see section 3.4).

My intention was to gain a situated understanding of the workings and operational capacities of Sydney's waste infrastructure and those who maintain it. Puig de la Bellacasa (2015, p. 692)

[28] Wanting to research an area where I lived and worked, I approached both the City of Sydney and the Inner West Councils (as it turned out, before I started my fieldwork I would have moved to Manly). The City of Sydney was chosen as a representative council area, after some preliminary scoping with the Inner West council revealed that the waste services were still fractured along the lines of the former Leichhardt, Marrickville and Ashfield council areas. To my surprise it turned out the waste and cleansing services of the City of Sydney remained sectionally separated along the lines of the former divides between the City of Sydney and City of South Sydney Councils which were merged in 2004.

articulates this intention well when she describes her 'approach to the field of soil knowledge' as a 'feminist approach that engages with care as a way to draw attention to the significance of practices and experiences made invisible or marginalized by dominant, 'successful', forms of technoscientific mobilization.' And of course, technoscientific mobilisation is oriented and ordered through bodily networks, as Star states:

> Just as feminist theory has tried to valorize housework and domestic labour as intrinsic to large scale economics, the invisible work of practice, balancing membership and the politics of identity is critical for the economics of networks.
>
> Who carries the cost of distribution, and what is the nature of the personal in network theory? (Star, 1990, p. 95)

Indeed, it is this superposition of infrastructure and bodily intimacy that interests me most and became a driving force of my research. In this way my methodological question asks: how might we care for infrastructures and the networked bodies that maintain them and are serviced by them? This is a question of scale at the meso-level. As Stengers argues, the meso-level provides us with a way to account for the specific materialities of waste, while not losing sight of infrastructural flows or labouring bodies that enable configured distributions of waste. A situated understanding of place means engaging with the histories of place including the violent settler colonial beginnings and continuing legacies of Sydney as a settlement and now city.

3.4 Methods in practice

One of the reasons this PhD is focused on the various encounters which show different, albeit related, methodological propositions of attuning is that these examples are illustrative of the ways in which my methodological approach began and developed prior to my fieldwork. There is an important methodological proposition to be made about what it is to do fieldwork and where 'the field' begins and ends. Looking back on my research I have come to understand that I became a field theorist before my 'fieldwork' was able to being. For me the process of theorising in the field started at the very beginning of my PhD with my very first composting walkshop (see Appendix 1: Encounter 1), and then continued throughout the PhD journey within various collaborative and self-guided explorations (see Appendix 1: Encounters 2 and 3). Further to this, in attending reading and working groups, the field also became remade

beyond interactions in a location; this was particularly the case when these groups moved to Zoom in light of COVID-19.

Methods are propositions for how one will conduct themselves as a researcher; that is, the ways in which one interacts with and observes a particular phenomenon in the world, of which the researcher themselves is a part. Methods necessarily involve a combination of ethics and practices. With a focus on the materiality of wastes, this research is grounded in 'material ethics' which 'allows us to shift the focus from ethical principles to ethical practices. Practices are, by nature, embodied, situated actions' (Alaimo & Hekman, 2008, p. 7). Practice is guided by ethics; there is no practice that escapes entanglement with our ethical obligations. As such, over the course of my methodological journey, various connections and commitments were threaded through the places (in all of their more-than-human capacities) and the people that I thought with. The connections between these places became embodied within my threaded experiences. Through attunements to place, they became audible, drawing me into relations of responsibility by generating the ability to respond. As a methodological tool attunement is a core practice of this PhD research. Attunement requires the capacity of thinking-with (Haraway, 2018) 'what is trying again to become audible' (Savransky & Stengers, 2018, p. 133).

3.4.1 Delays and divergence/diffraction

The delays in commencing what I had originally conceived of as the 'fieldwork' portion of my PhD led to other research sites, encounters and opportunities.[29] Back in 2018, in the first year of my PhD, I was looking for ways to ground my research on waste by focusing on particular waste materials. Intending to do fieldwork within the sewage system in Sydney, the idea of researching fatbergs as a particular waste material was alluring. As an infrastructural blockage

[29] I participated in the following 12 work/walkshops: Composting: Intoxicated Ecologies (University of Sydney); Monstrous Life: A workshop with Oron Catt (Macquarie University); Sydney Toxic Tour (4S); Thomas Lemke Masterclasss (University of Sydney); Karen Barad Masterclass (Deakin University); Hacking the Anthropocene (University of Sydney); Making Waste, Talking Trash (University of NSW); The Working with Water (University of Sydney); Creative Methods for exploring infrastructure (Manchester University); Everyday Militarisms – Public Symposium (University of Sydney); New Urban Natures: Volatile Worlds (University of Wollongong), and the City Habits workshop (Western Sydney University). I was also able to present a conference paper at the IAG in Hobart in 2019 on the Whitechapel Fatberg, and was invited to write a contribution to the first *Housing for Health Journal* issue and the *A – Z of Shadow Places Concepts*.

within a system of flows, the fatberg reveals the necessity of the everyday workings of infrastructure through making a spectacle of the ruptured flows (Garrett, 2016). As it turned out, in September 2017 just before I started my PhD, an historically sized fatberg was discovered in the sewers of London (see the Prelude to this thesis). By the time my PhD had commenced, the Museum of London would be running their *Fatberg!* exhibit with a piece of the Whitechapel fatberg, preserved as the centrepiece of the exhibit. Upon the closure of the exhibit and due to its popularity, the preserved fatberg was able to be viewed on FatCam, a 24 hour live stream. This was how I found myself reflecting on what I could learn from viewing this fatberg at a distance. As it turned out, I would come much closer to seeing the Whitechapel fatberg than I expected, and yet it would be closeness at a distance.

As a result of my acceptance to the Creative Methods for exploring infrastructure workshop in Manchester I was headed to the UK in March of 2019. Fortuitously Bradley Garret was completing a fellowship within the Faculty of Geosciences at the University of Sydney at the time. Having read Brad's work on the aesthetics of the London sewer network, which opens with the proposition that fatbergs through the spectacle of their removal bring the sewers back into public consciousness (Garrett, 2016), I spoke to him about my research interest in fatbergs and my upcoming trip to the UK. In turn, Brad put me in contact with the lead curator of the Museum of London, who agreed to being interviewed regarding the *Fatberg!* exhibit. In this way, interviewing key staff at the Museum of London involved in the *Fatberg!* exhibit, and visiting the Crossness Pumping Station (just outside of London) became my first PhD experiences interviewing people about the process of caring for our waste places and waste objects. This also meant that even though my proposed research with Sydney Water was rejected, fatbergs and sewers nonetheless remained/became matters of concern within this PhD.

Approaching field sites related to wasting and discards through artefacts and infrastructural remains was a research trend that continued upon my return to Sydney.[30] As a way of asking questions about the ways of attuning to Sydney's former industrial sites and their histories over time, I focused on two former Gasworks sites in Sydney. This research was inspired by an invitation to write an article for the first issue of the *Infrastructural Inequalities Journal* that

[30] Delays in getting organisational go ahead for my proposed fieldwork when I returned to Sydney led to me researching other sites that were not in the original scope of my research.

came out of the Housing for Health research group and my participation in their monthly reading group. Inspired in particular by the reading of Michelle Murphy's work on 'chemical infrastructures' (Murphy, 2013) and the edited book questioning the 'promise of infrastructure' (Anand, Gupta & Appel, 2018), I began to think about the infrastructural remains of Sydney and their material, more-than-human and chemical legacies and how these legacies might be made visible through attuning to material signatures in place.

The setting up of fieldwork became a yearlong endeavour (a piece of fieldwork in and of itself). Thankfully, having read about Nagle's experience setting up fieldwork with the New York Department of Sanitation (Nagle, 2013, see Chapter 2), I understood that the task of getting organisational approval might be a politically fraught and time intensive process. For this reason, I scheduled meetings to seek organisational consent for fieldwork requests with both the City of Sydney (CoS) and Sydney Water in the first week of January 2019, knowing that one or both could be denied. Both meetings went well and provided insight into structure and matters of concern of each organisation. From the outset the CoS was open to my research, although a missed opportunity, university ethics delays, navigating various internal communications and departments, and setting up induction training caused some delays. This meant that a meeting with a CoS representative in January 2019 would result in starting fieldwork ten months later in late November 2019. In spite of the logistical delays, being able to work with the CoS was a big achievement in terms of research scope. I am very thankful for this hospitable opportunity.

A research agreement was not granted to me by Sydney Water, even though I continued to have a good working relationship with the Sydney Water Education Team through university teaching work, organising and attending field trips to Water Recycling and Filtration plants with the students. Both SUEZ and Veolia (discussed in Chapter 4.7) facilitated a guided field visit to their waste management infrastructure, with a representative agreeing to be interviewed. However, due to my fieldwork delays and then the onset and impacts of COVID-19, extended ethnographic fieldwork within these organisations was not pursued further after the tour and interviews.

The fieldwork for my PhD consisted of two scoping interviews with the City of Sydney and two scoping interviews with Sydney Water, conducted in late 2018 to early 2019; one interview and site visit to the Crossness Pumping Station in London and one interview with three key

staff members integral to the *Fatberg!* exhibition at the Museum of London in March to April 2019. Multiple site visits between May and June of 2019 were conducted at the former gasworks sites at Millers Point and Little Manly Point in Sydney. At this point in time the Millers Point Gasworks was undergoing significant remediation, a century after the facility had been decommissioned.

The key ethnographic research in my thesis was done with the CoS from November 2019 to March 2020.[31] As part of this research, 13 shifts were worked with the cleansing and waste services across the various service and plant operator roles, including Team Leaders. This involved spending periods of six to eight hours on shift with various workers. Some days I would switch between operator or staff roles. For instance, one morning I spent with a shift manager and then later in the day I was on a roadway with another staff member. I conducted nine interviews with the CoS. These conversations were recorded with consent of the participants. These conversations complement the time spent in the field talking with the staff and observing their labouring process. Interviews were also conducted with a representative from Veolia and SUEZ after touring the Banksmeadow Transfer Terminal, the Port Botany Transfer Station (Resources Recovery Centre) and Lucas Heights Resource Recovery Park respectively. In total, the 11 interviews with the CoS, Veolia and SUEZ were conducted between October 2019 and September 2020. The average interview was 45 minutes, although this includes two short interviews of around 15 minutes conducted during or after I had spent a few hours in the field with a participant. All interviews were conducted face-to-face with the exception of the final two interviews with the CoS which followed up on fieldwork that was cut short due to COVID-19. All but one interview was recorded, and they were transcribed.

3.4.2 Organisationally embedded fieldwork

By the time fieldwork started I had given a conference presentation at the Institute of Australian Geographers Conference on the Whitechapel Fatberg and its exhibit at the Museum of London (Prelude) and written an article on the Millers Point and Little Manly Gas Works for the *Infrastructural Inequalities Journal* (Duncan, 2019). From the initial green light for my research with the CoS in March 2019 there were delays in starting fieldwork due to the university ethics process, my travel plans to the UK and negotiating a timeframe for setting up

[31] A couple of follow-up Zoom interviews were completed in August and September of 2020 to follow up with fieldwork that was abruptly ended due to COVID-19.

research with both the CoS and Sydney Water. My intention to work with the CoS's waste services had been internally conveyed as I wanted to research their newest waste contractor, Cleanaway – a request, which I had been told, was rejected. Fortunately, this news was communicated to me over the phone, which allowed me to have a conversation about how the City's waste contracts were managed. As a result of this conversation, I was provided with the contact points for other big contractors, such as Veolia and SUEZ. I also organised an interview with the CoS Contracts Manager for Cleansing and Waste shortly after the conversation in September 2019. This interview not only provided me with a broad overview of how waste services were operationalised within the council, it also allowed for an opportunity to clarify that I was interested in working with internal waste services. As a result, I was put in touch with the Manager of Cleansing and Waste Services who was happy for my research to go ahead. My research was able to progress from there.

On my first day, Monday 25th November 2019, I was given a safety induction to the Alexandria and Bay St Depots, and safety induction to the practice of street sweeping (correct broom handling, traffic awareness and sharps collection – which was the training for level 1 cleansing staff hires). I was also given a uniform (which I had specifically requested), having read the work of Nagle (2013) and Lea (2020) about the utility of fitting in. After being inducted I was able to come into the depots and work across the different shifts and machinery in coordination with the acting Team Leader for the shift. After 12 months, from my first point of contact with the City of Sydney, my fieldwork began with a deep dive and a running start. Reflecting on my first week of fieldwork I wrote:

> After spending the last four days (Monday – Thursday) participant observing and having 5.30am starts at the Council I'm both exhausted and exhilarated. To have been able to make such an immersive start on my fieldwork is incredibly satisfying. The amount of situated organisational understanding that I have been able to gain (even through I've only just scratched the surface) and the general openness to my presence and questions has been a very rewarding experience as a researcher.

In the lead up to Christmas 2019 I worked 10 shifts across the three council depots – Alexandria, Bay St and Woolloomooloo – whilst covering a variety of shifts: street sweeping, roadway, link truck, mini compactor (servicing the street bins), footway, compactor (servicing bulky waste), and the compactor servicing residential red bins.

My presence on site as a researcher was enhanced by working with embodied methodologies. Participant observation work is necessarily situated research, however my methods extended this approach through drawing on embodied methodologies where possible enabled through techniques of attuned of sensory awareness to the risks and stains of this work, tracing work through movement, and storytelling through embodied memory. In this spirit, doing the work with the City of Sydney employees put me in sync with the people carrying out the work, as well as the work itself. There was an element of timing associated with each of the cleansing operations, a factor I learned firsthand while joining several crews on their shifts. In the beginning, it was important for me to gain an understanding of the physical nature of the work, joining Cleansing's 'gang' sweeping teams in their daily grind. The temporal necessities of the work became apparent: when to sweep, what methods to use, how to work in concert with the roadway, being on the street in the rhythms of the city, the daily lives of passers-by, workers, businesses, and local residents. Wearing the City of Sydney uniform along with doing the work of street sweeping allowed me to blend in with the workforce with members of the day's gang sweeping team and public passersby seeing me as one of the crew. By embodying this role and doing this work, even for a short time, I was able to gain insight into how this work reconfigured the worker in relation to the city and how this work impacts the body of the worker. Waste work is difficult work, which can leave the bodies of workers exposed and subject to exhaustion, illness and injury. By participating in the work the daily exposures of crew became my exposures also, the smells, the dust, the soreness of knees from climbing in and out of the truck's cabin, albeit my routes of exposure where limited. Importantly my limited exposures enabled me to ask specific bodily informed questions about the cumulative impacts of this work overtime.

New Year's Eve is one of the biggest nights of the year (along with Mardi Gras) for cleansing and waste services; as such, I organised to be part of the on-street clean-up seeing in the start of 2020 (see Photo essay V). Pre- and post-New Year's Eve (NYE) interviews were conducted with Jason, the Project Officer on the event, who was 'heavily involved in the day to day build up to the event' (Internal City of Sydney document). Jason was also the Agency Supervisor.[32] These interviews were conducted to understand the scope of this event, as my experience on

[32] This role oversees 'Coordination with labour agency organisation to ensure all agency staff are properly inducted and screened prior to the event' (Source internal City of Sydney document).

the night was situated and therefore provided only a narrow window from which to understand the scope of the clean-up. I also attended an internal interdepartmental debrief for the waste and resource management of the NYE event at the CoS main offices at Townhall on the 12 March 2020. In March 2020 I returned to the Alexandria Depot to continue fieldwork with waste services, an additional two shifts on the compactor (servicing bulky waste and residential red bins) were worked before waste services was outsourced to Cleanaway as of April 1 2020 (see Chapter 9.6). I had also planned to do a shift with the Food Organics collection trucks, but unfortunately COVID-19 restrictions stopped this from happening. Instead, a follow up Zoom/phone interview was conducted with the staff involved in this trial.

In addition to the more in-depth field work with the City of Sydney I was able to set up site visits to a transfer station run by Veolia and a landfill run by SUEZ, thanks to the contacts passed on to me by the Contracts Manager of the City of Sydney. These visits included a walk-through or drive-through (in the case of the landfill) of the locations, lasting roughly an hour, where the different infrastructure of the site was explained followed by a semi-structured interview conducted with the guide. Further site visits to different waste infrastructure sites were discussed with these organisations; however, ultimately due to COVID-19, these options were not able to be pursued.

My approach to organising fieldwork 'shifts' was ordered through a rotation of different roles and equipment use. This meant, however, that when I turned up for a research shift, I was never sure with whom I would be working. Based on what I communicated I was interested in looking at, the team leader for the day would assign me to a certain plant[33] which would be operated by either one, two or three staff members. Usually, it was the case that I had not worked with any of them before.

Obtaining research consent was a process that I engaged with at the beginning of each shift. At the start of an early morning shift I would be allocated a work buddy for the day. The team leader would briefly explain my presence, that I was a researcher from the University of Sydney looking at the process of waste management. Essentially the person/people selected for me to work with would be told that I would be tagging along with them. Upon being introduced I would provide a brief spiel explaining my presence; however, it normally wasn't

[33] The different types of machinery operated by the staff are called plant.

until I was in the plant with the staff where I would even get an opportunity to introduce ethics forms and ask people if they were comfortable with me taking notes or photos throughout the shift. Generally, as at the start of a 5.30am shift it might still be dark or people were already in the process of operating the plant and planning the routes for the day, I would mention the ethics forms and give them out at a more opportune moment (that is, on a break or sometimes even at the end of a shift). In this way the research participants were multiple, but not necessarily recruited as reoccurring research participants, although there were a few people that I worked with a couple of times.

The process of participant observation involves an openness to be guided and to pay attention to the context. In conducting field research of the City of Sydney's Cleansing and Waste operations, my attention was guided by the workers who actively keep the city clean as they traced the routes of their daily cleaning and waste management practices. In this form of fieldwork my attention and namely my vision was guided by the people who are expertly aware, as they embodied knowledge of the work required to keep the city clean. By centring my positionality as a researcher in relation to the people who performed this work, I was stating that the expert in the field was the worker performing the task, rather than the upper echelons of management whose knowledge of these practices may be abstract. As a researcher I witnessed and experienced the form and function of this work; in this way the cleansing and waste staff helped me attune to their modes of sensing and cultivating attention, as these capacities were necessary to performing the labour of their work.

Research in the field was about more than simply attuning to the labour of this work. Necessarily, the ways in which this labour actively created the infrastructure of the waste system was also a point of attention. As Blok, Nakazora and Winthereik (2016, p. 3) state: 'What needs our ethnographic attention, Star (1999) argues, are those relational settings in which otherwise invisible infrastructures become visible, not infrastructures per se, but the practices, materials, and settings of infrastructuring.' In this way, this research thought with the 24 hour construction of our infrastructure system, as the 'settings of infrastructuring' were continuously remade through the performativity of labouring bodies in relation to machinery and other waste and not-waste materials. Beginning this research with the triple-layered lens of material, infrastructure and labour, these layers were read together in the field. This form of immersive fieldwork also meant that 'the field' was an active participant in the research

with the workers, becoming both research participants and research guides of the field over which the waste system is distributed.

I had originally envisioned in my ethics submission that all research participants would be followed up for an interview. Interviews were again something that were tricky to schedule/facilitate given the 'go, go, go and rest'. I was reluctant to use morning tea or lunch time for interviews as I had already been asking questions all morning. Instead, I tended to give the workers and myself space at these times. There was a secondary and perhaps more important consideration here as well, which was needed to make sure that participants had time to look at and read over my ethics documents and provide informed consent prior to me formally interviewing them. Perhaps this was an odd ethical distinction that I was operating on, particularly because for the most part my research was conducted in an ethically grey area, that is, participating on shifts agreed to by the organisation before the consent form was signed by workers due to the factors discussed above. One of the other effects of me conducting research in this way was that while I had some great conversations on shift and took notes about these, I did not audio record on shift, even though it would have been a fantastic source of data. Without formal consent, and even though they had indicated that they were comfortable with my presence, I felt it was more appropriate to take notes rather than record. My note taking was also more conspicuous than a 'passive' and somewhat forgettable recorder, and allowed participants to ask questions about what I was writing down and why I was asking particular questions.

The fusing of research participants and research guides meant that this research was most valuable when it was situated in place – follow-up interviews when they happened generally tried to re-capture the conversations that were had in the process of performing the labour so that they could be recorded verbatim in the participant's own voice. However, with a couple of exceptions, recorded interviews were conducted mainly with management level staff where opportunities to be with them in the field were limited, as their work is primary desk based. Insofar as there was a separation between what was being spoken about and the taking of those actions in recorded interviews, the politics/bias of representation could play a greater role.

3.5 Concluding thoughts on the methodology

The body is central to the methodological approach proposed within this PhD. With an interest in the convergence of materials, infrastructures and labours that co-create our waste systems, the body and bodies in convergence become key mediating structures. As a creative process this research journey is mediated through my body; it is only through the porosity of my body, rather than in spite of it, that this research becomes grounded through modes of attuning. Throughout this chapter I have shown the ways in which the particular things I carry predisposes modes of attunement within the world. As Puwar (2020, p. 6) states: 'The bodies of researchers are themselves archives of histories and labour.' My research works with this idea and takes it further to both the bodies of research participants and the idea of places as more-than-human embodiments. Therefore, the 'carrier bag' (Le Guin, 1996) through which I interpret and construct my research is necessarily compiled by other human and more-than-human actors (such as infrastructure, plant, waste materials and weather). Carrying is always a relational process. Carrying prescribes interdependence and embodiment. From the outset, the methods used in this thesis have been against purity (Shotwell, 2016). This research works with the idea of porosity as a feminist approach, working with methods of attuning within particular setting to the legacies and ongoingness of infrastructures, labours and materials to see what becomes visible, to hear what becomes audible, and sense what becomes sensible.

Knowledge of waste is particularly keen for those who work to maintain waste flows and to maintain both the physical cleanliness of the city and the image of the clean city. I am indebted to the cleansing and waste employees who graciously shared their knowledges, trucks and workspaces with me and shared stories of their work and lives. Debts matter in producing research. I remember talking to Marilu Melo Zurita when I had begun my fieldwork. I articulated a feeling that now I had to complete the PhD, I was now accountable to the research participants, I had a debt to them. While I was, of course, in debt before this point to my supervisors and various other people and ideas that helped me to begin the PhD journey in the first place, it was really the moment of reflecting on the experiences that research participants had shared with me that I felt a level of accountability which meant that the work that I had started was no longer about me. I am humbled by the ways in which they accommodated my presence and our dependence on their labour to maintain the city. Acknowledging that this a debt that will never be repaid is perhaps where I would like to

conclude this methodology. As Snack Syndicate so deftly put it in their one-page essay, *Infinite Debt*:

> We have bad debt. We have debt that is unpayable, debt that continues to accrue. We are indebted to the books we read, to each other, to the people we love, to the histories that make us. Our debt is intergenerational: we share debt with those who have come before us and with those who come after...
>
> We seek the abolition of debt from above and the proliferation of debts side-by-side. We aim to find those ever-shifting spaces that allow debts between us to bloom. Our lateral debts are infinite – this is a condition of infinite possibility. (Snack Syndicate, 2021, p. 300)

Waste can also be understood through the lens of debt, as a material that carries with it a debt of production, that is the ways in which waste is situated in the world and the world is situated in it (Dumit, 2014). The next chapter will look at the how the debt of waste production is historically situated in Sydney.

4. Waste Histories

4.1 Introduction

This chapter presents the layered waste histories of the city to show how the city has dealt with waste management over time and the different rationales that dominated each form of infrastructure. To tell the history of waste in Sydney is to present a story of colonial settlement. Waste infrastructure becomes a way to secure ongoing occupation as well as to allow for urban growth and development. It is to tell a story of how the city expanded and how infrastructure, in particular waste infrastructure, co-became with the city. It is also a way to tell a story about the city's industrial history through the ruins and remains of this past and continuing present. This story, while focused on the context of Sydney, also requires an understanding of both the national and international context of Sydney's waste management. This chapter will engage with the different types of infrastructural systems used to manage waste in Sydney since colonisation. While an infrastructural system is not built on one type of infrastructure and always requires an infrastructural assemblage to systematise any approach, there have been forms and fashions within the history of waste infrastructure in Sydney. This chapter is organised around the history of waste and infrastructure in the context of the urban.

This chapter is not a comprehensive account of waste histories in Sydney (see Coward, 1988; Beder, 1989; Nicholls, 2002), but it incorporates these works. Presenting an historical analysis of waste history in Sydney is not the focus of this thesis. Rather, this chapter aims to ground my empirical work, which looks at the contemporary management of waste in Sydney. To this end, an overview of the historical processes of waste management in Sydney will help to situate discussions of the present day within historical processes of waste and waste management, in connection to bodies of land, water and air within and beyond the city.

4.2 Water bodies as sites of disposal

In 1788, Sydney Cove Camp was established around a fresh water supply which came to be known as the Tank Stream (Beder, 1989) (see Figure 3). The water source originated in the swampland now known as Hyde Park (the central parkland within the CBD). The Tank Stream

was necessary for the establishment of the Sydney Cove Camp, while its preservation became a guiding reason to consider the cumulative impacts of waste on the environment, in particular the discharge of sewage. There was cause for concern about the state of sanitation in the city. As Beder describes:

> Pollution was also caused by poorly constructed and badly sited cesspits that weren't cleaned out often enough. Little more than holes in people's back yards, these cesspits often overflowed when it rained, seeping into groundwater wells and draining into low-lying neighbourhoods where the poorest people lived, saturating these areas with sewage and other household waste. Open ditches and other accumulations of foetid matter all added to the pollution problems of early Sydney. (Beder, 1989, p. 1)

The harbour became the default depository for the colony's waste (Montoya, 2015). By 1828 the heavily polluted Tank Stream could no longer be used as a fresh water source and was declared a tributary for sewage into the harbour (Sydney Water, n.d., Nowra, 2022).

By the early 1800s, while a growing colonial population was creating waste and pollution problems for Sydney, the first industries were set up around the harbour. Sydney is a harbour city, both in its geographical attributes but also insofar as it is imagined particularly in the earlier days of the colony as an isolated promontory girt by sea. This is shown in Figure 3: where space is drawn, imagined, configured and mapped according to property and infrastructural relations as they are marked and designated upon the map. The mouth of the Tank Stream is illustrated flowing into Sydney Cove in the top centre of Figure 3:

Figure 3: Plan of the town and suburbs of Sydney, August 1822 (Dictionary of Sydney, 2021)

Aside from being critical infrastructure (Rogers, 2022) the harbour was also a site of disposal for industry. Figure 4: Port Jackson Mapped In 1857 – Chowder, Cockle, Rozelle, Blackwattle Bays and Glebe Island are identified on the map (State Library of New South Wales, 2023a)

shows a map of the harbour drawn in 1857, a time when the space of the harbour was used predominantly as a form of waste and cargo infrastructure.

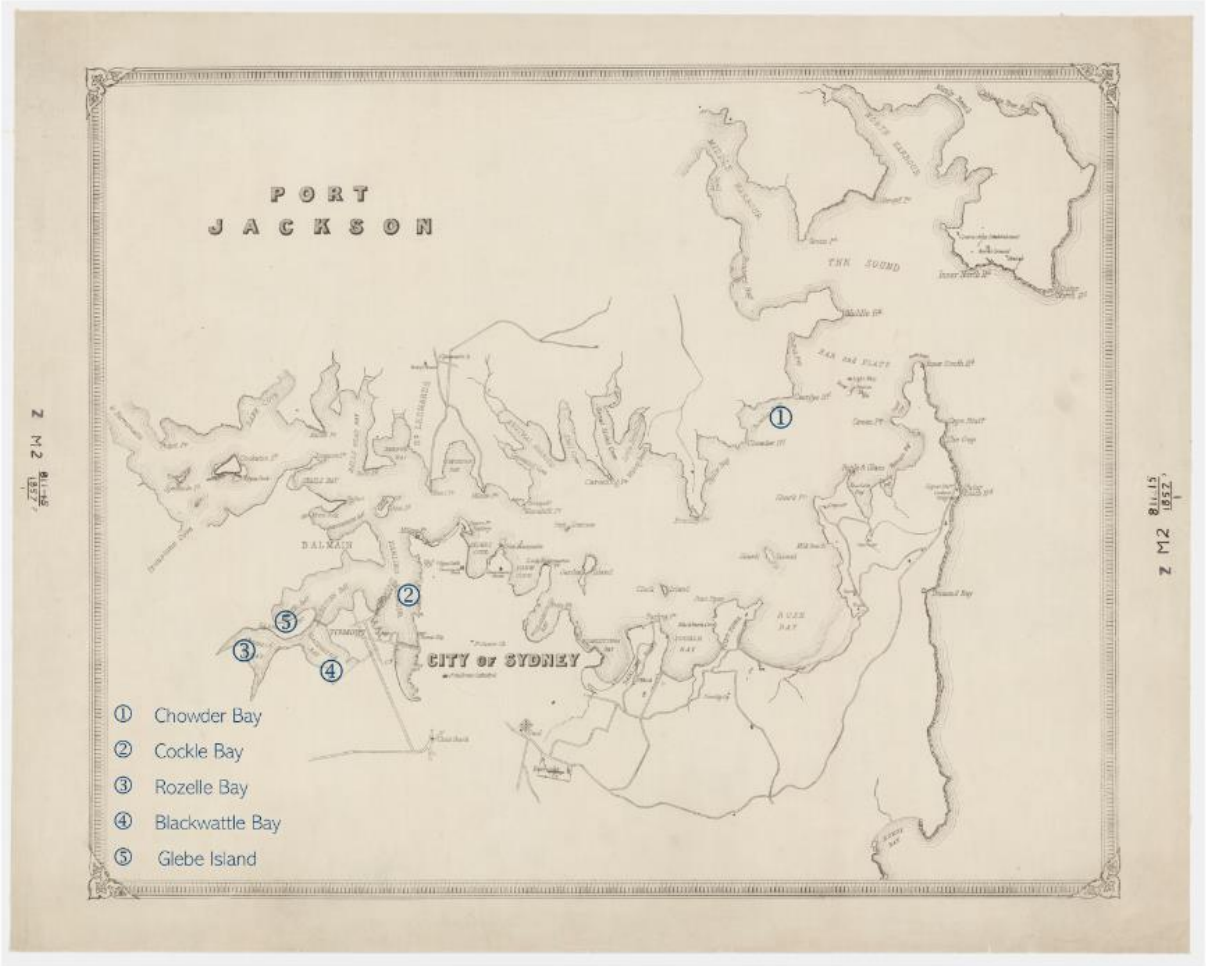


Figure 4: Port Jackson Mapped In 1857 – Chowder, Cockle, Rozelle, Blackwattle Bays and Glebe Island are identified on the map (State Library of New South Wales, 2023a)

Whaling was the first major industry in NSW, and Australia in general, with industrial sites for processing established in Chowder Bay. There were other industries appearing to support the colony;

> In Port Jackson, industries were first established on the banks of Darling Harbour in about 1800. From there, they spread to Cockle, Rozelle and Blackwattle Bays. Metal foundries were the first to be set up, followed closely by tanneries. Whale oil processing was consigned to the north shore of the Port, due to the noxious smell. Other industries located on the north shore that required isolation included a sugar works and distillery, a kerosene refinery, and a wool washing plant...
>
> The Glebe Island abattoirs were the biggest water and air polluters in the city. Built in 1860 to replace dozens of unregulated fellmongers, the abattoirs were intended to end the practice of backyard disposal of blood and offal down drains and sewers. Not only did it fail to do so, it compounded the problem with its own flood of effluent. (Montoya, 2015, pp. 19–20)

The of siting industry along the harbour would precipitate both how the harbour was used for what would become municipal waste streams, solid and liquid (that is, sewage) and wastes that were discharged from industry (Beder, 1989; Duncan, 2019; Montoya, 2015; McManus, 2001).

By the 1850s Sydney's population had grown rapidly, resulting in the need for the development of infrastructures such as the Glebe Island abattoirs (McManus, 2001) and sewage systems to facilitate the flow of wastes into the harbour. At this period the development of the sewage system was also a core concern in other cities – London, for example. Epidemic diseases were a catalyst for infrastructural development for cities across the globe. In London the sewage system was developed in response to a series of deadly cholera outbreaks and the summer of 1858 which became known as the Great Stink. The logic of the first sewerage systems were based on the development of infrastructure to manage the flows of waste to the peripheries of settled space. Typically, this meant the construction of drains that emptied into larger waste bodies. For example, in Sydney drains were constructed to drain into the harbour. As Hawkins states:

> When a sanitation system was being developed for Sydney in the 1850s, all drains pointed seaward. The value of the harbor and beaches was seen to lie not in their recreational or real estate possibilities but in their potential as waste treatment facilities. Here was the ultimate natural resource for allowing waste to disappear, to be rendered invisible. (Hawkins, 2007, p. 349)

In 1857 the construction of five combined sewers was completed: Bennelong, Blackwattle Bay, Hay Street, Tank Stream[34] and Woolloomooloo.[35] These sewers drained directly into the harbour. The dispersion of sewers did not work and by the 1870s Sydney Harbour was being extensively polluted from the discharge of stormwater and sewage (Beder, 1989). The invisibility of wastes through the discharge and dilution into a larger body of water (the harbour) was a short-lived illusion of waste management. The problem of visible waste returned to the common view as the harbour's pollution through appearance and smell.

[34] Yes – Sydney's first water source was turned into a sewer.

[35] These sewers would become stormwater drains as the sewage system was updated with an emphasis on ocean outfall.

4.3 Street cleaning and the bubonic plague

As the issues of waste and pollution became more apparent, so too did the need for oversight of these issues. The City of Sydney employed an Inspector of Nuisances from 1847 to keep 'the streets clean, sanitary and safe' (City of Sydney, 2023a). The role related to the oversight and ordering of various public health nuisances in connection to food, buildings and roadways. Part of the role was also the supervision of 'the carters who removed rubbish' from the streets (ibid.). This could be seen as the beginning of a system of waste removal by local councils. In 1899 the CoS separated cleansing from the the Inspector of Nuisance duties and created the Cleansing Department headed by the Superintendent of Street Cleansing. According to the City of Sydney records:

> In 1901 the Department consisted of the Superintendent, 5 gangers, a clerk, 82 carters, 100 labourers, 97 block and footpath cleaners, 11 urinal cleaners and attendants, 7 night flushers and 3 horse brooms.
>
> The City Cleansing Department was responsible for the removal of all house garbage, trade refuse, street sweepings, mud, continuous cleansing of wood blocked streets and pavements, cleansing of gullies, urinals, horse troughs, fountains etc, and flushing and machine broom sweeping. (City of Sydney, 2023b)

The timing of this prioritisation of cleansing was important. Firstly, it highlights the heightened attention given to sanitation, while secondly, it occurred just before the bubonic plague reached Sydney in 1900. Thirdly, cleansing and sanitation came with a specific framing of progress and development that underpin the achievement of the project of modernity (Kaika, 2005) and the colonial project.[36] Historically, the development of the cleansing department is also contextually important for this thesis as most of the fieldwork and discussion revolves around fieldwork conducted with the City of Sydney's Cleansing and Waste department (see Chapter 3).

The arrival of the bubonic plague in Sydney in 1900 required a systematic approach to waste and cleanliness. As Philip H. Nicholls (2002, p. 172), an Environmental Historian, surmises 'Accumulations of waste around Sydney were recognized as both harbourage for rats, and a

[36] In relation to the 'Great Stink' of London 1858, the *Illustrated London News* (26 June 1858, pp. 626–627) commented that: 'We can colonise the remotest ends of the earth; we can conquer India; we can pay the interest of the most enormous debt ever contracted; we can spread our name, and our fame, and our fructifying wealth to every part of the world; but we cannot clean the River Thames.'

source of miasmic threats, in the battle to rid the city of bubonic plague.' In 1900 over 2000 men were enlisted by the City to perform a systematic cleansing of the City resulting in:

> On the first day, the 27th of March 1900, 750 tons of garbage was removed from yards and houses and punted out to sea. Gallons of disinfectants were poured into drains causing tons of fish to die in the harbour. Through until the 11th of June 52,030 tons of silt and sewage was dredged from around wharves in Sydney Harbour, 28,455 tons of garbage taken to sea in punts, 24,430 tons of garbage was burnt on site and 1,400 dead animals taken from the harbour and burnt. (Nicholls, 2002, p. 189)

Not only did the bubonic plague spur waste collection efforts, it also turned rats into waste to be discarded and eradicated from the system if possible. While miasma (air-borne transmission) was still the prominent theory of disease, epidemiologist John Ashburton Thompson correctly theorised that the plague in Sydney was spread between rats and humans through the vector of fleas, which spread disease through their bites (The University of Sydney, 2023). Consequently, the bodies of rats became a critical part of the documented waste accounting of the efforts of the City to resist the bubonic plague. Figure 5 shows the 'professional ratcatchers' of Sydney and their haul of rats that became a part of the'cleansing' of the city.

Figure 5: Professional ratcatchers. 'Views taken during Cleansing Operations, Quarantine Area, Sydney, 1900, Vol. IV / under the supervision of Mr George McCredie, F.I.A., N.S.W' (State Library of NSW, 2023b)

Due to the petitioning of Thompson, a medical officer and epidemiologist, ratcatching was financially incentivised. The initial rate was 'two pence per head for every rat killed and delivered to the health authorities… and by the 27th of April 1900, the capitation fee was trebled to sixpence' (Nicholls, 2002, pp. 173–174). From its outset it is clear that the City of Sydney employed a range of labourers to keep the city clean, and that this labour force was supplemented with incentivised labour when considered necessary. Bodies have always been necessary to recruit to in order to constrain the excesses of the system (in this case the many and multiplying rats). This photograph is evocative of the many hands and bodies that labour to constrain materials, and in this case, other bodies (of rats). The current day patchwork of labour types employed to handle waste will be discussed in Chapter 9 (on scale).

4.4 Incineration

Prior to 1900s there had been calls for the construction and use of incinerators in Sydney; however, as they were a more costly form of waste management, the arguments for their

construction were largely ignored. However, with the presence of the bubonic plague in Sydney, the 'sanitary' management of waste became a pressing concern.

> There was an all-out war declared on rats and garbage around the city. The incidence of outbreaks of plague in the vicinity of the city's Moore Park dump did not go unnoticed; the dump was condemed in the eyes of the fearful public. Five hundred gallons of disinfectant were poured onto the Moore Park tip as a precautionary measure. Sydney City Council had no choice but to agree to the building of an incinerator at Moore Park. (Nicholls, 2002, p. 174)

By 1902 Sydney's first incinerators were running in Moore Park and Annandale.[37] In a *Sydney Morning Herald* article addressing the opening of the destructor (incinerator), Alderman Thomas Hughes (Mayor of Sydney) said:

> that in connection with the municipal life of the city, it must be a source of great gratification to know their representatives were alive to the duties attaching to the welfare of the people under modern conditions. The municipal tip was an abomination, an antiquated thing which should be swept out of every municipality. (*The Sydney Morning Herald*, 18 October 1902, p.7)[38]

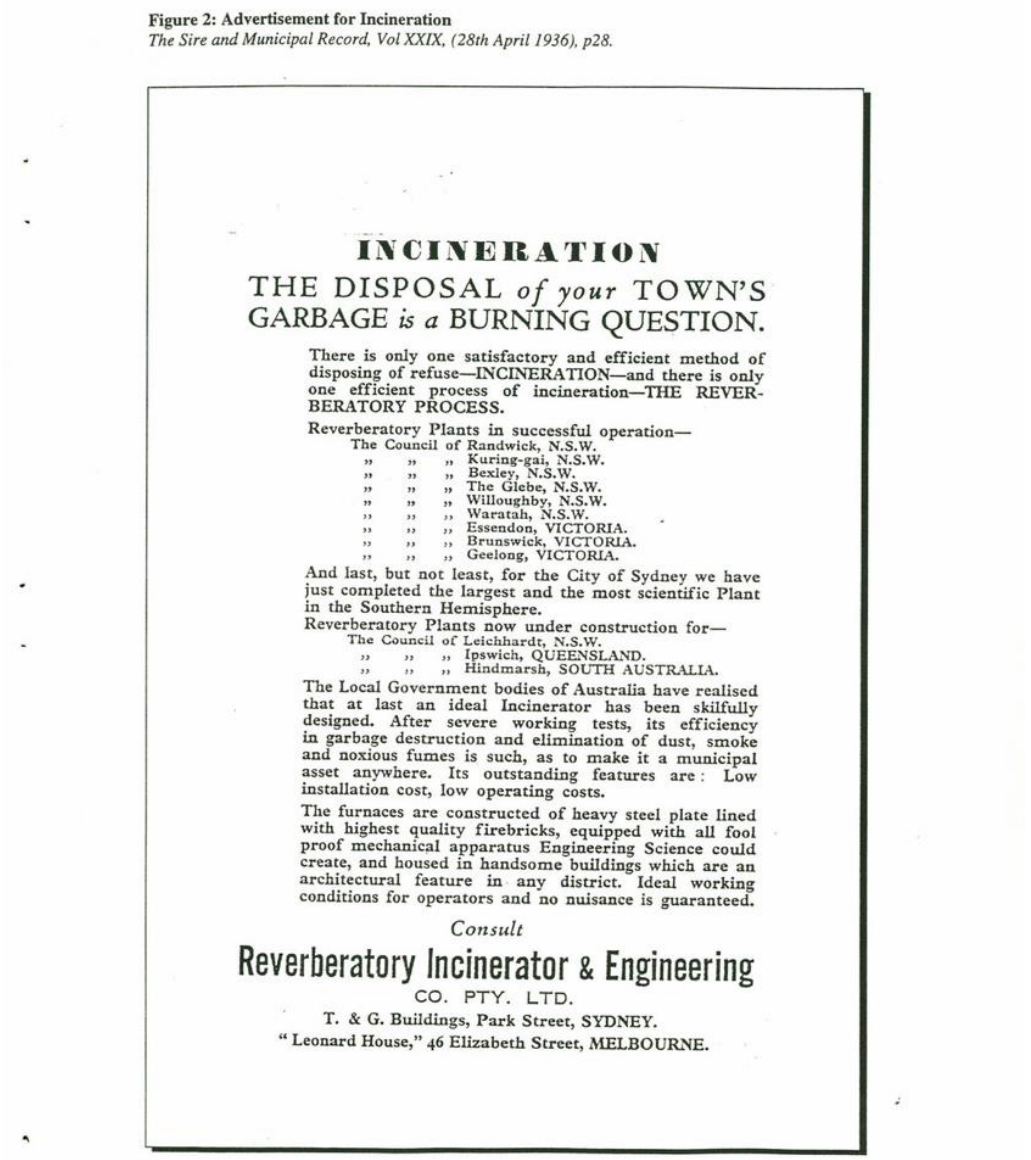
These early incinerators, along with those at Balmain and Pyrmont, were presented as 'state-of-the-art' technology in waste management at the time. Although, as we will see over the course of this chapter and thesis (see in particular the discussion in chapter 6 on standards), state-of-the-art techology is often a matter of trends and is subject to change. By the end of 1935 thirty incinerators were being used to 'meet the disposal needs of twenty-three municipalities in and around Sydney' (Nicholls, 2002, p. 176 citing Coward, 1988). Their function could also serve a dual purpose as they 'produced heat that drove steam engines and in turn electric generators that could provide electric lighting and power electric trams' (ibid.). It is clear that the birth of centralised incineration as municipal waste disposal practice was rationalised with many reasons, whether for the purposes of keeping a healthy population, the use and reclamation of sites of extraction and the useful production of energy over the disutility and expense of sea dumping.

[37]The Annandale and Leichhardt destructor was positioned on the corner of Catherine and Hill St on a site purchased by the councils which was an 'old quarry'; this was reporterly useful because 'it could be utilised for despositing the residue clinker' (*The Sydney Morning Herald*, 18 October 1902, p. 7).
[38] The event was also attended and applauded by Dr. Thompson.

The development of incinerators did not, however, discontinue other modes of waste management. Indeed, landfilling and sea dumping of waste continued until the early 20th Century. Sea dumping 'was approved as a "temporary measure" in 1900 that had been extended incrementally from that time onwards' (Nicholls, 2002, p. 177). The choice between these options of disposal came down to the physical properties of waste materials in relation to the infrastructure of disposal, namely waste could be classified and then subsequently managed based on whether the material was *sinkable* or *unsinkable* and/or *combustible* or *incombustible* (ibid., p. 176). Destructors were expensive to run and maintain and had a limited life span. By 1928 there were reports that the Moore Park destructor was in need of replacement, with the Moore Park tip also reaching capacity. While the Pyrmont destructor was still operating, the city relied on sea dumping to rid itself of excess waste until 1933 when the New South Wales government banned 'sea dumping within fifteen miles of the Sydney coast' (ibid., p. 177). This change in regulation was preceded by the Commonwealth Government's *Beaches, Fishing Grounds and Sea Routes Protection Act* of December 1932. Nicholls notes that this 'appears to be the first direct intervention by the Federal Government into the area of urban waste disposal' (ibid., p, 179).

As the first wave of destructors/incinerators aged, a fresh wave of infrastructure was developed, termed the '*second wave* of incineration' by Nicholls (ibid. p. 179). These new incinerators were designed by Walter Burley Griffin and the Reverberatory Incinerator and Engineering Company. Noteable for their impressive Art Deco designs and marketed for their 'efficient process of incineration' (see Figure 6), this process involved the drying of waste before its incineration (Knight, Mertz & Walker 1997). In an advertisement for incineration, the message, *The disposal of your town's garbage is a burning question*, was posted (see Figure 6). The ideas of efficiency and 'your' town's garbage, prescribe certain notions of responsibility. There is a bounded notion of responsibility locked into the notion of 'your town' and the mention of the ever present need to optimise waste processing to minimise wasted energy in the disposal process. These themes of responsibility and forms of waste will recur throughout this thesis.

Figure 2: Advertisement for Incineration
The Sire and Municipal Record, Vol XXIX, (28th April 1936), p28.



INCINERATION

THE DISPOSAL *of your* TOWN'S GARBAGE *is a* BURNING QUESTION.

There is only one satisfactory and efficient method of disposing of refuse—INCINERATION—and there is only one efficient process of incineration—THE REVERBERATORY PROCESS.

Reverberatory Plants in successful operation—
The Council of Randwick, N.S.W.
" " " Kuring-gai, N.S.W.
" " " Bexley, N.S.W.
" " " The Glebe, N.S.W.
" " " Willoughby, N.S.W.
" " " Waratah, N.S.W.
" " " Essendon, VICTORIA.
" " " Brunswick, VICTORIA.
" " " Geelong, VICTORIA.

And last, but not least, for the City of Sydney we have just completed the largest and the most scientific Plant in the Southern Hemisphere.

Reverberatory Plants now under construction for—
The Council of Leichhardt, N.S.W.
" " " Ipswich, QUEENSLAND.
" " " Hindmarsh, SOUTH AUSTRALIA.

The Local Government bodies of Australia have realised that at last an ideal Incinerator has been skilfully designed. After severe working tests, its efficiency in garbage destruction and elimination of dust, smoke and noxious fumes is such, as to make it a municipal asset anywhere. Its outstanding features are: Low installation cost, low operating costs.

The furnaces are constructed of heavy steel plate lined with highest quality firebricks, equipped with all fool proof mechanical apparatus Engineering Science could create, and housed in handsome buildings which are an architectural feature in any district. Ideal working conditions for operators and no nuisance is guaranteed.

Consult

Reverberatory Incinerator & Engineering
CO. PTY. LTD.
T. & G. Buildings, Park Street, SYDNEY.
" Leonard House," 46 Elizabeth Street, MELBOURNE.

Figure 6: Advertisement for Incineration (Knight, Mertz and Meredith 1997, p. 5).

The Sydney incinerators designed by Burley Griffin include the Pyrmont Incinerator (1937-1971) (see Figure 7) that replaced the Moore Park destructor, the Glebe Incinerator (1934 - 1940s), and the Willoughby Incinerator (1922 -1949), the bones and exterior of which have been restored and are now a café.

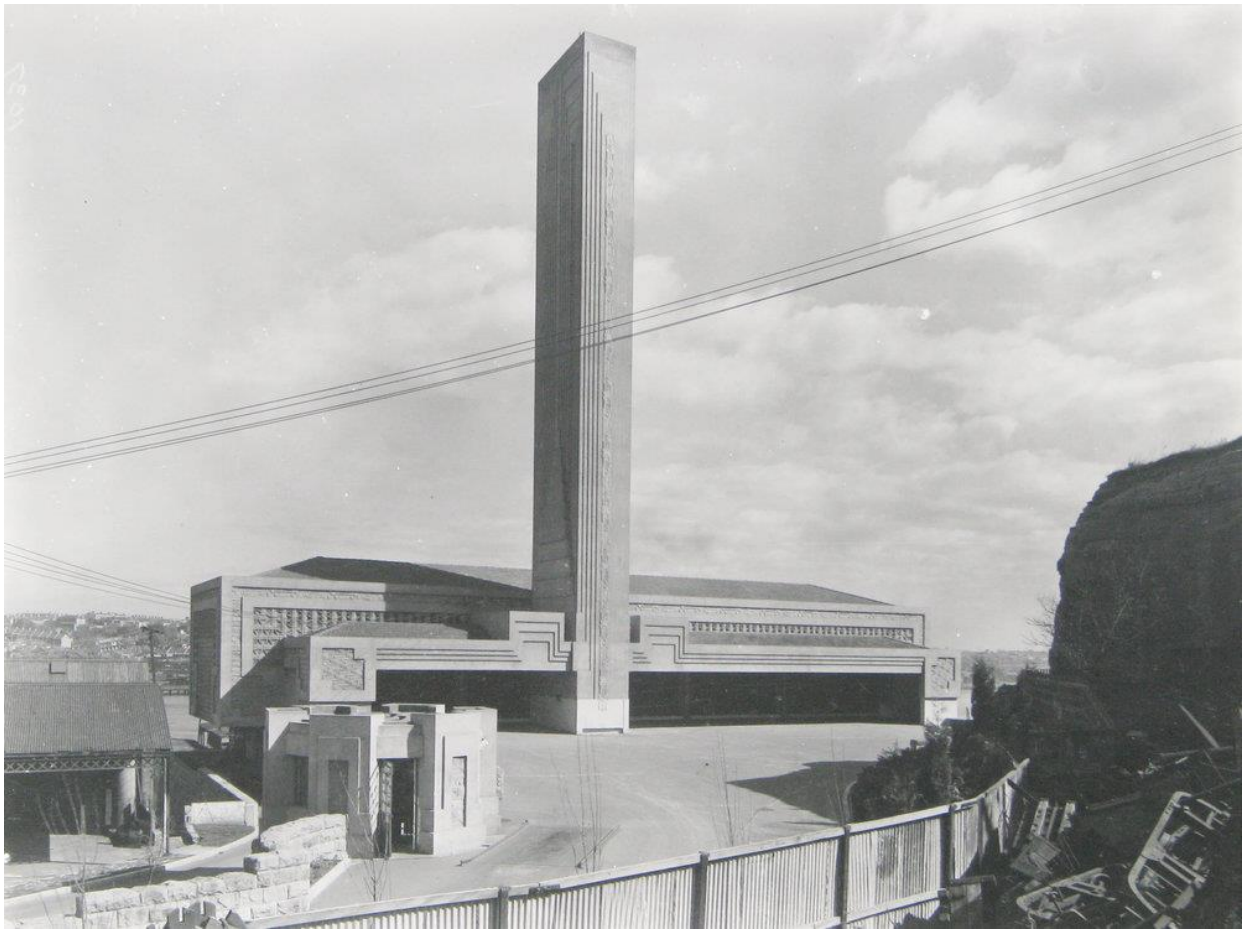


Figure 7: Pyrmont Incinerator (City of Sydney 2023C)

The sites of these incinerators, aside from being part of the waste history fabric of the city, did not play a role in my fieldwork. While I spent time in and around Pyrmont over the course of my fieldwork, this site was never pointed out – although it would still exist in living memory (particularly in its ruined state). It is now completely materially erased from the landscape. Interestingly, the only incinerator that was mentioned during fieldwork was the Waterloo/Zetland Incinerator, which was active between 1973 and 1996 (a clear outlier in the incineration infrastructure timeline in Sydney, see Section 4.6). The Waterloo/Zetland Incinerator was used by City of Sydney waste employees over this period and some of the fieldwork participants can attest to tipping waste at this facility.

4.5 Landfilling

The use of incineration as a technique of waste disposal waned significantly between 1945 and 1955. Various reasons have been suggested for the closure of these forms of infrastructure, including 'fuel costs and shortages, changes in clean air requirements, adjoining development and inadequacy for the Council's increased needs' (Mertz & Walker,

1997, p. 38). The changes in clean air requirements can in part be attributed to smog, from the burning of coal for household heating in London, in December 1952 which caused thousands of deaths and led to new clean air acts in other cities around the world (Nicholls, 2002; Read & Parton, 2019). By 1948, however, even with the Pyrmont Incinerator in operation, the City of Sydney was seeking:

> disused brick pits, quarries or low lying land – for suitable use by the Council for the tipping of incombustible refuse on the basis of outright purchase or, alternatively, long term lease by Council' (SCA, MCS TC 1932/48). A series of landfills were subsequently created at St Peters in 1948. (Nicholls, 2002, p. 180)

Ultimately, across Sydney and Australia more broadly, landfilling was the lower cost option and was re-engineered and marketed through the practice of 'controlled tipping' to a 'sanitary landfill' (ibid., 183). Both methods involved the introduction of covering materials for the landfill. Sanitary landfills required a daily practice of creating a dirt seal atop of the fill. Aside from its cost benefits, tipping was in part brought back into vogue by arguments that it could be used to reclaim land (to refill pits and quarries that had been dug to extract resources such as clay, shale or sandstone) and through the proposed utilisation of 'dangerous' swamps by infilling them with waste materials (Nicholls, 2002, p. 182). The practice of extracting value from waste has been valued historically; however, the ways in which waste was determined to be of value is itself value laden, presented absent to relations with Country, or the role of swamps in wider ecosystem functions of the city.

4.6 State-run waste corporations

In the period between 1960 and 2000 global and national concerns about environmental limits and sustainability shaped the outcomes of waste disposal in Australia. The publication of the Club of Rome's *Limits to Growth* (1972) and *A Blueprint for Survival* (1972) and the 1972 UN Conference on the Human-Environment in Stockholm have been understood as the 'first major attempt to reconcile economic development with environmental integrity' (Purvis et al., 2019, p. 683). The 1987 Brundtland Report, *Our Common Future*, popularised the concept of Sustainable Development, and in 1992 the Commonwealth of Australia introduced the National Strategy for Ecologically Sustainable Development.

Changes in the way the environment and environmental limits or thresholds were conceived had flow-on effects to how waste was conceptualised, managed and regulated. Over this

period 1960 to 2000 the classifications of waste materials and methods for disposal became more discrete (Nicholls, 2002). In NSW the first changes were distinctions between solid and liquid waste and their disposal sites. Standards of pollution control, clean water and clean air were also legislated, through the creation of parliamentary acts and their regulated authorities (for more on the impact of standards see Chapter 7).

By 1969 waste disposal in Sydney was reported to have reached 'crisis' levels:

> Already most of the local council tips were nearing the ends of their lives, and the shortage of suitable new sites had become acute. Then in December of that year most of the local councils were told for health reasons to close their depots to liquid wastes.[39] Industry had to find other ways of getting rid of them. Considerable amounts were illegally discharged into the sewer system. Some contractors even resorted to such methods as dumping in the bush at night and, worse still, in water-courses. (CSIRO, 1975, p. 29)

These events set in motion a review of waste disposal practices. The Barton Report, commissioned by the New South Wales Parliament in 1970 to review the scope of current waste production and disposal capacities of the Sydney region, made several recommendations. Overall the report was critical of the then prevailing forms of waste infrastructure, finding most landfills in Sydney unsatisfactorily managed.

In light of the report's findings, a suite of Bills was passed by the NSW Parliament in December 1970, namely: the *Waste Disposal Act 1970*, the *Waste Recycling and Processing Service Act 1970*, the *State Pollution Control Commission Act 1970*, and the *Clean Waters Act 1970*. These new acts joined the *NSW Clean Air Act 1961* that was formalised in December 1961 and became operative in January 1965 (Cleary, 1969). The charter of the *Waste Disposal Act 1970* was:

> An Act to provide for the constitution of a corporation to be called the "Metropolitan Waste Disposal Authority"; to confer and impose on the corporation responsibilities, powers, authorities, duties and functions with respect to the transport, collection, reception, treatment, storage and disposal of waste within the Metropolitan Waste Disposal Region; and for purposes connected therewith.

The Metropolitan Waste Disposal Authority (MWDA) was the first state corporation to seek to harmonise the management of waste across metropolitan Sydney and its various council

[39] Such as paint solvents, insecticides, or grease-trap wastes.

regions. It was intended to 'rationalise the system of movement and disposal of waste in the region, to progressively improve the standards of transportation and disposal, to develop the least cost solution [*sic*], and to develop a continuous phasing plan with in-built flexibility' (MWDA, 1976) (in Nicholls, 2002, p. 237). Essentially the MWDA needed to plan for the future disposal of the council waste across the metropolitan area. The plan prioritised landfilling as the most economical means of disposal, although the Waterloo incinerator,[40] which was already commissioned by 1973, was also accounted in its role in disposing of a proportion of waste in Sydney.

> The projection for 1978 was nine landfill sites (including the new Heathcote Road landfill at Lucas Heights) and the Waterloo incinerator, working in conjunction with four transfer stations. The plan divided the greater Sydney region into nine sectors and outlined a preferred solution for each sector based on proximity to waste disposal facilities, volumes of waste generated and ease of transport. (Nicholls, 2002, p. 237)

Waste management in Sydney at this time was therefore localised across the various council regions of Greater Sydney.

Waste management in NSW has been regulated by various government bodies; from 1970 these bodies effectively formed a government monopoly on transfer stations and putrescible landfills in Sydney. This was in principle[41] dissolved by the *Waste Minimisation and Management Act 1995 No 102*, which allowed for and encouraged private enterprise to enter the waste management arena. The NSW state government oversight of waste services and disposal infrastructure began with the *Waste Disposal Act 1970* and Metropolitan Waste Disposal Authority (MWDA), who oversaw the development and operation of the Castlereagh Liquid Waste Depot in western Sydney. In 1989 the MWDA became the Waste Management Authority (WMA) and then the Waste Recycling and Processing Service.

> On the 1st of March 1992 the WMA passed over its waste minimisation, recycling and environmental regulation functions to the newly formed EPANSW to be managed by the Waste Recycling and Processing Service (WRAPS). At that time also, the

[40] It should be noted that the Waterloo incinerator was the only exception to the dominance of landfilling as an infrastructural process to deal with municipal waste on the Australian mainland:
'The Commonwealth Government's Report on Waste Disposal in 1994, (SSC 1994), identified the fact that the Waterloo incinerator in Sydney, operated by the Waverley-Woollahara Council, was one of only two high temperature incinerators handling domestic waste in Australia. The other was in the Australian Antarctic Territory' (Nicholls, 2002, p. 236).

[41] The article by Klostermann (2022) tells a story of the push-back private enterprise received when setting up the NSW first privately-owned transfer station in Clyde in the early 2000s.

> management of all existing waste disposal facilities (including Castlereagh) was transferred to Waste Service New South Wales WSNSW). This organisation maintained the board structure of the WMA and became proactive in all aspects of waste management and disposal in the 1990's. (Nicholls, 2002, p. 246)

The 1995 Waste Minimisation and Management Act 1995 No 102 is important because it indicated and paved the way for new direction in waste management in NSW by opening the market to private operators. As the period of 1960-2000 came to an end, Waste Services NSW ran and owned the majority of Sydney's putrescible waste infrastructure. This also meant the end of local councils owning and operating their own waste disposal infrastructure.

> As of June 1999 WSNSW operated *engineered landfills* at Jack's Gully (from 1975), Grange Avenue Marsden Park (1977), Belrose (1979), Eastern Creek (1985), Lucas Heights 2 (1987), and the Liquid Waste Plant at Lidcombe (1988). ln addition, WSNSW also manages [*sic*] seven solid waste transfer stations and two materials recycling facilities within the Greater Sydney Metropolitan area (WSNSW Annual Report 1999). (Nicholls, 2002, p. 249)

Meanwhile, industrial and construction waste was mainly being managed and disposed of by private waste corporations (Nicholls, 2002, pp. 249–250). This is an indication of the growth in private waste management that was about to emerge in Sydney.

4.7 Private waste management

This shift in direction towards private waste companies was necessary for the siting of Sydney's first remote landfill site. From the mid-1990s the need for additional landfill space for Sydney was apparent. From 1995 various landfill locations were attempted to be set up in the 'old mine sites at Cessnock, Singleton, Ardlethan, Muswellbrook and Woodlawn' (Nicholls, 2002, p. 253). Only one of these applications (Cessnock) was delivered by WSNSW. The rest were private tenders. Four of the five applications faced significant community opposition, ultimately rendering these sites unviable. The only successful siting was the application made by Collex (now Veolia) for the Woodlawn site near Goulburn, which is still functioning as a major landfill for the Sydney region. Collex gathered community support for the landfill:

> When the Denehurst mining company went into receivership over the Woodlawn mine, they left millions in unpaid wages and superannuation, little rehabilitation over a vast mining footprint area, considerable environmental issues (AMD, etc.), and an open void 900m wide and more than 200 deep. As part of the project, Collex (now

> Veolia) agreed to step in and pay out the mine-workers' entitlements and to commit to rehabilitation of the site. (Holcombe, 2020, p. 9)

Nevertheless, the siting of the Woodlawn site required the procuring and siting of a Sydney transfer station. After more than two years of negotiations between Waste Service NSW and Collex, the company was unsuccessful in procuring an existing transfer station from Waste Services NSW (although it was also alleged that Collex did not find WSNSW's sites suitable for their purposes) (New South Wales Legislative Assembly, 2003). Collex's proposed Clyde transfer station in Western Sydney received sustained opposition from residents. However, in 2005, the court ruled in favour of Collex and the 'four-year battle' by the Residents Association came to an end (Holcombe, 2020, p. 11). The Woodlawn site is cited as a cautionary tale of the timeframe for the siting of future landfills and their related infrastructure (see Klostermann, 2022). It is an issue of pressing relevance again today, with the two major Sydney landfills, Lucas Heights and Woodlawn, nearing their predicted closure dates.

From 2000 the management of Sydney's waste infrastructure transitioned from a largely public enterprise to a largely private enterprise. The privatisation of Sydney's waste facilities was initiated by the siting of Collex's Woodlawn landfill that opened in 2004. Meanwhile, the potential sale of the WSN was foreshadowed in the 2008-09 Mini-Budget Speech when the Treasurer, Eric Roozendaal, pointed to the potential sale of WSN (along with other government enterprises) as a fundraising mechanism for the state (New South Wales Legislative Assembly, 2008, p. 14). The sale was enabled shortly after through the *Waste Recycling and Processing Corporation (Authorised Transaction) Act 2010*. SITA Environmental Solutions (SITA) (at the time a 60:40 SUEZ Environment (France) and Sembcorp Industries (Singapore)) consolidated its scope in the Australian (Sydney area) waste and recycling market in 2010 (Sustainability Matters, 2010). The Binding Offer by SITA was agreed by the Government in December 2010. In January 2011 WSN was transferred to SITA for $235 million (ibid). The acquisition consisted of 'three engineered landfills in Belrose, Lucas Heights and Eastern Creek (including a landfill at Eastern Creek), two Advanced Resource Recovery

ventures – the wholly-owned ArrowBio Facility at Jack's Gully and the Eastern Creek UR-3R waste contract, eight transfer stations and three material recovery facilities' (ibid).

From 2000, the entry of Collex (now Veolia) into the Australian waste landscape heralded the beginning of two major international waste and water providers dominating Sydney's municipal waste infrastructure landscape, namely Veolia and SUEZ, with Cleanaway, an Australian waste company, also becoming a major waste services provider. Table 1 shows the 2020 holdings of Veolia, SUEZ and Cleanaway before the 2021 mergers (see Chapter 9.4 for discussion of these).

Company; Country of Origin; Founded	**Scope of operations** (locations) and processes and *Revenue (FY2020)*	Scope of operations (Assets in NSW)
Cleanaway; Australia; 1979[42]	**National** 'Australia's largest waste, recycling, industrial and liquids service provider with a substantial network of state-of-the-art facilities, transfer stations, engineered landfills, liquid treatment plants and refineries' (Cleanaway, 2020a). *Revenue (FY2020): $2.1 billion*	Cleanaway ResourceCo Recovery Facility (RRF), Wetherill Park Waste Oil Refinery, Erskine Park Transfer Station, Eastern Creek Container Sorting Facility, Rutherford Waste Oil Refinery, Western Sydney Energy and Resource Recovery Centre (WSERRC) Eastern Creek, EarthPower Camellia (Cleanaway, 2020b).
SUEZ, France; 1858	**International** "We've been experts in water and waste management for 160 years. We operate on 5 continents, on which SUEZ harnesses all its desire for innovation to achieve a smart and sustainable management	Ten Transfer stations in Sydney – six Resource recovery centres: Artarmon, Auburn, Belrose, Rockdale, Ryde, Seven Hills, and four Resource Recovery parks: Spring Farm, Wetherill Park, Eastern Creek and Lucas Heights (SUEZ, 2020c). Materials Recycling Facilities (MRFs) and Resource Recovery & Recycling Facilities (RRFs) are also in operation at Belrose, Camellia and Wetherill Park) (SUEZ, 2020d). Four Advanced Resource Recovery Technology (ARRT) Facilities: Kemps Creek, Raymond Terrace, Eastern Creek, Spring Farm (SUEZ, 2020e).[44] Smart Cell

[42] Merged with Toxfree and Daniels Health in 2018 and Grasshopper Environmental in 2020.

[44] 'Inside our ARRTs, organics can be composted for use in agriculture and mining to replenish severely degraded soils. Dry materials can be manufactured into alternative fuels to replace fossil fuels in industrial furnaces.' (SUEZ, 2020e)

	of resources throughout the world." (SUEZ, 2020a)[43] *Revenue (FY2020): not publicly available*	technologies are being used on four landfill sites at Lucas Heights, Kemps Creek, Raymond Terrace and Eastern Creek (a closed landfill) (SUEZ, 2020f). Closed Richardson Road Engineered Landfill (managed as part of the spring farm resource recovery site) (SUEZ, 2020g). Organic Resource Recovery Facilities (ORRFs): Lucas Heights, Spring Farm, Eastern Creek and Camden (SUEZ, 2020h).
Veolia; France; 1853	**International** 168 years ago (Compagnie Générale des Eaux) 1998; 23 years ago (Vivendi) 2003; 18 years ago (Veolia Environnement) (WIKI) *Revenue (FY2020): €26.010 billion* (*Veolia, 2020)*	Horsley Park Facility, Woodlawn Bioreactor; Earthpower; Woodlawn MBT, NSW; Clyde Transfer Terminal; Greenacre Transfer Terminal; Banksmeadow Transfer Station; Port Botany Transfer Station.

Table 1: The 2020 holdings of Veolia, SUEZ and Cleanaway before the 2021 mergers

As the rise and accumulation of private waste and resource companies become the major players managing waste in Australia, we can see how these actors expanded what was done to waste, enacting ideas of 'less waste more resources' through infrastructure by means of material or energy extraction and transformation. These practices underpin the capitalist logic of more resource use while minimising efficiency losses (highlighted by the enormous revenues of these companies), while simultaneously providing necessary solutions for pressing material problems. The privatisation of waste also fundamentally affects labour and contracts. These aspects of waste management are talked about in relation to the fieldwork undertaken in this thesis in Chapter 9, in particular Section 9.6.

4.8 Conclusion

This chapter has provided an overview of the development of the waste infrastructural system and related trends in Sydney, which grounds the empirical contributions of this thesis. Through looking at how waste management in Sydney is a result of historical processes, this chapter provides a brief historical analysis of waste management in Sydney. In doing so it establishes how waste has been perceived in Sydney and speaks to questions of who is

[43] 'We operate across the whole resource value chain from building and operating water and waste collection infrastructures and sorting facilities, to delivering circular economy solutions and integrated services. We have the experts and the know-how to: Consult, Design, Integrate, Fund, Build, Operate, Maintain, Improve & Transfer.' (SUEZ, 2020b)

responsible for waste and how these responsibilities have changed over time. This chapter also adds to a conversation that takes place throughout this thesis, which is about how historical trends might influence or leave legacies for current day waste management practices and conceptions of waste, and in doing so, organise the very fabric of the city. The next chapter (Chapter 5) thinks with specific and situated ways in which the fabric of the city was produced.

5. Situating the production of the city

5.1 Introduction

This chapter works on the idea of situatedness as a way of thinking with Sydney as a city on Country and with ongoing colonial legacies. My own situatedness is crucial to an understanding of the city where I live and where the majority of this research took place, especially as I sought to understand how the city *became* in relation to its waste places. In thinking with waste across the Sydney region, I aim to embody a research ethic of 'practising humility with specificity'. As (Liboiron, 2021a, p. 32) so deftly put it:

> Humility means that you are connected to others, and it is the recognition that you cannot do anything without these many others, from the people watching your dogs, your kids, and your students so you can go to conferences, to the people who ensure that your water pipes and garbage vans and Internet work as intended. (Liboiron, 2021a, p. 30)

From the specificity of my positionality, I remain 'humble' through the understanding that research is placed in land relations. Waste as a concept and material phenomenon is understood and produced through land relations or rather a lack thereof. As Wilkes and Hird (2019) state:

> Into the 1600s, European notions of waste still referred to land that was "unfit for use." Land which appeared so desolate, and inhospitable, was synonymous with wilderness. Wilderness, in short, was wasted land: a wasteland. Within this ideology, the very inhospitality of wastelands obligated good Christians to bring these lands under control, under Christian sovereignty, to redeem these barren lands through utilization.

The story of waste is a grand narrative that is often simplified, generalised and rendered aspatial through accounts of tonnage and other unfathomable and abstracted metrics. However, this thesis (and this chapter, in particular) draws out the ways in which waste is historically situated in Sydney on land. In particular, I focus on the city as a laboured site of production and disposal, understanding that some inhabitants of the city live in closer proximity to waste – knowing waste through the embodied means of memory, labour, touch, sight and smell.

This first chapter on situatedness will engage with *The Production of the City*. In this chapter, connections are drawn between the production of waste and the production of the city. These

concerns will be first examined through an historical lens focused on the Millers Point Gasworks (see figure 1). The second chapter on situatedness – *Embodied and place-based understanding of working with waste* (Chapter 8) – will look to the links between the past and current waste management practices in the city. This second chapter will be based on my experiences of working with Cleansing and Waste teams of the City of Sydney, as well as site and field visits to various waste spaces situated within and around the city.

5.2 The city in production

On a crisp autumn day I found myself in the maps room of the State Library of NSW. While the 'Heritage Map Room' displays maps at a global scale, the adjoining 'Michael Crouch Room' displays numerous maps of Sydney, dating back to the establishment of the colony. The maps in the Crouch Room tell a localised story about how the production of the city is a colonial project. The fundamental transformation of these lands and waters – which were never empty and never ceded – poses a question that Sydney's residents must reckon with that is: what was taken and discarded in order to produce this city?

In *The cities that ate Australia,* Mununjali Yugambeh (South East Queensland) poet Ellen van Neerven reflects on what has been viscerally destroyed, used and discarded in the process of making 'Australia', when they write:

> Sydney piled sand on the canvas and called it safe harbour.
> Melbourne curated the trees and called it culture.
> Brisbane cleared the sky of butterflies and called it sunshine.
>
> We get lost in these galleries.
>
> Leaving pieces of ourselves in the cloak room.
> Probing for the exit sign.
>
> They make us feel like we should be so grateful just to be here. (van Neerven, 2020, p. 114)

Van Neerven's poem critiques the clean image of Australian cities as they appear today, connoting the process of constructing a city and its systematic sidelining of First Nations peoples. In her novel, *Benevolence,* Julie Janson, a Burruberongal woman of the Darug Aboriginal nation, tells the story of Darug woman Muraging (Mary James), who is based on Janson's great-great-great grandmother. Muraging's story is one of displacement from her family, culture and lands through the enaction and production of an emergent colonial regime.

The book spans the time period from 1816 to 1843, ending just after Sydney is incorporated as a city in 1842. The final chapter opens in 1843 and speaks to the colonial violence perpetuated against both First Nations Australians and settlers, as the city is produced:

> Riots over terrible conditions are happening back in Parramatta at the Female Factory after their sugar and bread ration is cut. The rioting women say they will shave the Governor's head. They march on Parramatta town. Troopers are sent to quell the rioters and eighty women are arrested. The ring leaders are placed in stocks. It is pitiful.
>
> Thirty thousand European people now live in Sydney town while the camps at Woolloomooloo, Botany, Kirribilli, Manly and Narrabeen have about thirty Aboriginal survivors each. (Janson, 2020, p. 330)

As Janson illustrates, the processes of city-making in Sydney is experienced in deeply uneven and often complex ways, particularly for First Nations peoples. As seen in this chapter on the historical process of city-making through the logics of production and waste, there are legacies of the past that continue to haunt the city.

Back in the maps rooms at the State Library, the maps tell a story of land ownership and planning, through authoritative boundary lines dissecting the space (*Map of the County of Cumberland in the Colony of New South Wales, 1840* – a map of the area known today as greater metropolitan Sydney, divided into 57 parishes). Sydney was incorporated as a city in 1842. The increasing production of saleable land titles – through various land releases and subdivisions – is highlighted in the display of 19 different land release posters from across Sydney. Earliest among these is a poster dated 1882, which shows the subdivision of George Street, a street which was and remains Sydney's main throughfare. The street connects the wharfs at Circular Quay to the rail lines at Central Station, as well as providing a prominent business and commercial strip. The portion of George Street depicted in Figure 8 is part of the

area that would eventually become Wynyard Station (opened in 1932).

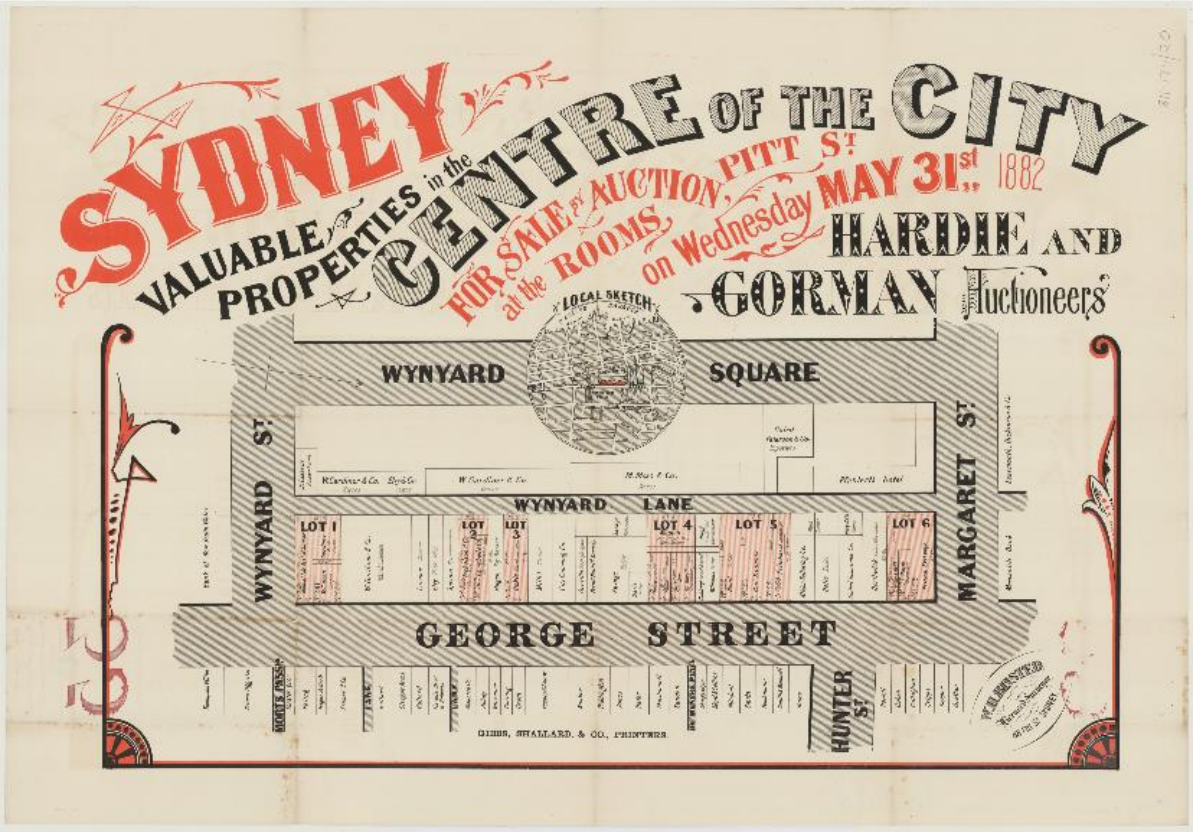


Figure 8: Sydney, valuable properties in the centre of the city: Lots 1 to 6 – Wynyard Square, George St, Wynyard St, Hunter St, Wynyard Lane and Margaret St, 1882

These maps speak directly to the many property boundaries that were drawn in order to produce the city. Through the transformation of land into property through colonial interventions, responsibilities to land are delineated in relation to property titles and their boundaries lines. The creation of boundary lines also creates spaces that we consider 'away'. In order to throw something 'away' and deem it waste, there needs to be a demarcation, a sense of a place beyond where we are. In other words, waste must first move beyond the land considered 'ours' (land that we are related to, or for which we are singularly responsible). But there is no 'away' if our responsibility extends beyond the borders of our property (or property relations). The map depicted in Figure 9 is of particular interest because of the ubiquitous way in which it represents the various sources of industrial pollution across the City of Sydney and beyond. The map highlights the industries that fuelled the production of the city, initially positioned around Sydney Harbour. In particular, the areas that would become known as Millers Point and Darling Harbour are marked by significant industrial buildings, and the

smokestacks of Ultimo Power Station and the Gasworks at Millers Point[45] (including the spiral guided gas holder) are depicted in a position of prominence. The prevalence of the smokestacks' plumes – depicted as black tufts in the picture – speaks to the way in which pollution in this era was depicted/considered as a visual signifier of progress, production and wealth (that is, the modernist industrial/promethean narrative of progress) (Kaika, 2004). The industrious-looking map also signified that land and energy (largely produced through the burning of coal) was being 'put to work' and used accordingly, illustrating 'the drive of industrial imperialists to put the world to work' (Daggett, 2019, p. 194), or 'the morality of maximum use of Resources, dispossession, and property as a way to control both time and space to secure settler and colonial futures'(Liboiron, 2021a, p. 36). As Daggett and Liboiron point out, energy and resources are often mobilised to the self-fulfilment of some people and the exclusive detriment of others.

Figure 9: The City of Sydney [a bird's-eye view], 1888

[45] See the following section, 5.3, for more on the significance of the Millers Point Gasworks.

The map in Figure 9 also depicts Sydney as actively working and producing, with black exhaust emanating from activities on both the land and water. As a view of the production of the colonial city, it is of primary importance to think about the violent displacement (not erasure) of the Gadigal People of the Eora Nation, whose sovereignty has never been ceded. These displacements marked a first step[46] in enabling the ensuing legacy of industrial manufacturing – with its contamination, mobilised in the name of progress and the production of a new 'city'. Liboiron (2021a) asserted that 'Pollution is Colonialism' in their book of the same name, declaring that: 'I redefine pollution as central to, rather than a by-product of, colonialism' (Liboiron, 2021a, p. 36). Liboiron is specific with their use of the term 'pollution'[47], by which they mean 'modern environmental pollution' defined as 'post-miasma theories of environmental pollution based on quantitative science, threshold limits, and industrial capture' (Liboiron, 2021a, p. 18). This assertion fundamentally transforms waste relations, as waste always needs a sink – a space in which waste is absorbed as a form of containment or dilution. Such spaces frequently include land, water bodies, human and more-than-human bodies and the earth's atmosphere (Gabrys, 2009; Liboiron, 2021a).

As a way forward in colonial contexts, Liboiron proposes that an Anticolonial methodology or ethic be pursued: '*Anticolonial* here is meant to describe the diversity of work, positionalities, and obligations that let us "stand with" one another as we pursue good land relations, broadly defined' (Liboiron, 2021a, p. 27). In this way, an anticolonial approach to waste works with the relations embedded in land and materials rather than severing them. Instead of seeing waste as that which divides – the point at which material relations are severed – this thesis seeks to work through how the legacy of waste has shaped and continues to shape the production of the city as a co-creation process. That is not to say that we are all related to waste in the same way, or even that this might be possible; rather, that specific waste relations not only form a waste regime (Gille, 2010), but that our waste relations are a form of important land relations. Therefore, this thesis asks: what might good relations look like with a city? The possibility of

[46] While the displacement of the Gadigal people (visually and literally) was important in the story of Sydney developing as a settler-colonial city, the displacement in itself did not guarantee that Sydney would develop into a city. Eden in southern NSW illustrates this point as it was once envisioned as the future capital, due to its equidistance between Sydney and Melbourne and the depth of the harbour (the third deepest in the southern hemisphere).

[47] 'pollution as bad relations that can exceed scientific evidence of harm is exactly what we need' (Liboiron, 2021a, p. 19).

good relations is not cut off through the presence of waste or pollution, because, as Liboiron (2021a, p. 22) suggests: 'Land can be polluted and still foster good land relations'. Therefore, good relations with a city are not based on assertions of purity; instead, they are predicated on the practice of 'remembering for the future' (Campbell, 2014, p. 135). Following Alexis Shotwell's (2016) notions against purity, and against the dichotomy that this myth perpetuates, this thesis seeks to move 'against purity', because Sydney (by its founding and formation on stolen land) can never be a place of clean relations, particularly for settlers such as myself that have benefitted immeasurably from the city's creation.

5.3 Grounding the production of the city

As a scholar of waste/waste and discard studies scholar/academic interested in waste and discards, I am interested in the production of space, particularly the production of the city in relation to – and through – its waste places. Recently I attended a celebration commemorating 100 years of Geography at the University of Sydney. Mitch Gibbs, a Thunghutti man through kinship of the Dunghutti nation and staff member of the School of Geosciences, gave an Acknowledgement of Country to open the event. Directing our attention to the Gadigal custodianship of land on which we gathered (being the Holme Building in the University of Sydney), Gibbs drew our attention to the mortar used in the construction of the buildings within the university. A critical ingredient in mortar is lime, which he explained was extracted from shell middens, built by Indigenous people over the thousands of years prior to colonial settlement of Sydney (Pearson, 1990).[48] The Aboriginal Heritage Office (2023, para. 1) defines middens as: 'shell mounds built up over hundreds and often thousands of years as a result of countless meals of shellfish'. The shell middens around Sydney Harbour were pointed out to me only a couple of months prior, by a guide on the 'Tribal Warrior' cruise operating in Sydney Harbour.[49] The guide told us that Bennelong Point, prior to being the site of the Sydney Opera House in 1973, a tram depot in 1902 and a military fort in 1821, was known by the name Tubowgule and was the site of a significant midden. Today, the managers of the Opera House acknowledge this greatly mitigated past:

[48] The article by Michael Pearson (1990) speaks to the industrialisation of the Lime Industry in Australia, consequently noting the sites of extraction all over NSW and Australia more broadly.
[49] This First Nations cultural cruise was offered to the staff of the school of Architecture, Design and Planning where I was a research associate in late 2022.

> The British who arrived in 1788 to colonise the area used Tubowgule to confine their cattle and horses, and renamed it as Cattle Point. The colonists also needed lime to bind together bricks and stones into buildings, so they crushed the middens from around the Harbour, including Tubowgule, and mixed the remnants with water to make a lime slurry. The promontory thus became known as Limeburners' Point. (Sydney Opera House, 2023)

In 2000, Architect Peter Myers theorised that colonial Sydney was a Second City, one that was preceded by a First City designed by the Gadigal people. The Gadigal people marked out sites of significance with their middens, or what Myers refers to as 'shell monuments'. Myers (2000) argues:

> So we, or rather our predecessors, burnt the shell monuments of the prehistoric or First City, in order to construct the present historic or Second City… Thus the construction of the second, historic Sydney was really a 'reworking' of the city fabric that Phillip discovered in 1788.
>
> Bennelong Point was a most important Aboriginal site, upon which a number of very large shell monuments once stood, and which we can also be sure was overlooked by an exquisite range of rock engravings, just precisely where Edward Blore's Government House was subsequently located… Every important colonial building was placed upon a significant First City site, and that goes for both Sydney University and Gladesville Asylum…
>
> Sydney's Second City is probably the largest urban system ever built from, and upon, an existing fabric… (Myers, 2000)

We can learn from the middens that there is a relationship between city-making and discarding; discarding is a way of marking and producing space and showing/proving our relations to space. Importantly, and somewhat tellingly, the middens were neither waste to the First Nations people of Australia nor to its colonial settlers. Myers (2000) argues that the city as it is known today has a form that relates to Country and its management prior to colonial settlement in 1788, including main roads such as George Street, Oxford Street, Parramatta Road and King Street being constructed upon Aboriginal pathways. As the Australian Broadcasting Commission states: 'While Adelaide and Melbourne were carefully planned on grids, Sydney was more haphazard, "largely following either ground contours or Aboriginal tracks", according to the Dictionary of Sydney' (Wotherspoon, 2010, in Daniel, 2018). While the configuration and flow of the city and its arterial roads is based on thousands of years of Indigenous habitation and knowledge of this space, this thesis focuses on the

colonial production of waste and how that process has shaped the city. I have used specific layers to identify how we might talk about the complexity of waste production in the city; these layers involve groundings in specific times and sites, such as the aforementioned 1888 map of Sydney (figure 9) and the Millers Point Gasworks.

However, I did not begin my thinking about the production of the city and waste with a consideration of the middens of Tubowgule. My thinking with sites of waste began at North Head, with its Waste Water Treatment Plant (see Figure 1). Located in the beachside suburb of Manly, North Head is a national park promontory, which forms the northern headland of the opening to Sydney Harbour. In a blog-post discussing the site, I wrote: 'Water is a historical and current force that runs through, around and within North Head. Just as the historical significance of this place has left its mark on the present, large volumes of Sydney's waste water continue to pass through the headland to be processed and then expelled and diluted within the ocean's watery mass' (Duncan, 2018). Indeed, North Head is connected to a vast swathe of the land mass of Sydney, with the facility servicing an area of 452 km2 (Sydney Water, 2023). Across this huge area, wastewater is captured through the sewerage and stormwater network. My interest in North Head, as a site of significance, led me to form other connections to waste and the production of the city. Significantly, it was at the foot of North Head's parklands where I was introduced to the role played by Sydney's gasworks in the development of the city; it was here that I took note of these sites of waste and contamination for the first time.

I was led to that exact location after attending a guided First Nations tour of North Head, led by Karen Smith from the Aboriginal Heritage Office.[50] The tour started in the park at Little Manly Point, a former gasworks site that contains a commemoration of the site's industrial history. I subsequently wrote about the industrial history and legacy pollution at the Little Manly Point Gasworks and the Millers Point Gasworks (the oldest gasworks in the Southern Hemisphere, operational from 1841, which at the time of writing was being remediated) in an invited piece in the *Infrastructural Inequalities Journal*:

[50] Having taken such a tour I am disappointed to see that my references to the Aboriginal 'histories' of this place as just that– historicising – and in so serve to omit ongoing connection, custodianship and relationality. Just as my descriptors are colonial insofar as I describe Country as land having use and value. In seeking not to reproduce these prior understandings I acknowledge my current reading of parts of this work has evolved.

> Sydney's industrial histories are never too far from view. At Millers Point, the ground below the gasworks lay contaminated for almost a century after the facility was de-commissioned, while Little Manly Point was known informally as Poison Point until remediation processes began in the early 1990s. Reminders of Sydney's industrial past persist in both benign and harmful ways – as signposts in the city's cultural landscape, but also as material traces that leach beyond our attempts to narrate these sites into tidy historical positions. (Duncan, 2019, p. 2)

Gasworks provided significant infrastructure for the city and the state, offering 'a viable alternative to light derived from the whaling industry, and led to the first networked energy supply in Sydney' (Duncan, 2019, p. 3). This network persists in terms of value and utility today (AEMC, 2023). While no longer in use, the technology of the gasworks was reproduced and proliferated within the context of Sydney and NSW: 'Over 60 former gasworks sites have been identified in NSW. The gasworks produced 'town gas' for heating, lighting and cooking. Most ceased operating in the early- to mid-1900s and the last of the known gasworks was decommissioned in 1985' (Department of Environment and Conservation NSW, 2005, p. 1). The cultural and material framing I applied to these sites became the foundation for thinking with the links between the current uses of these sites and their past, and grounded my research on waste and infrastructure within the context of Sydney's colonial development.

As sites of colonial significance, gasworks (in particular, the Millers Point Gasworks) can shed light on how the city of Sydney was produced. When I say the city of Sydney (as opposed to the City of Sydney) I am referring to the city as a metabolism that extends beyond the borders of the council area of the City of Sydney.[51] The Millers Point Gasworks tells a story of a colonial city becoming through the endowment of individualised property rights, a legal claim under the commonwealth 'to make it [land] ahistorical in order to hack away the narratives that invoke prior claims and thus reaffirm the myth of *terra nullius*' (Tuck & McKenzie, 2015, p. 64), as a site of energy production and as a site of land transformation and contamination. Gasworks ground this chapter, illustrating how patterns of production, pollution and waste continue to shape the production of the City. In a similar vein, the city (made up of local government area boundary lines) continues to shape the management of waste for its citizens

[51] Sydney is currently being re-envisioned with supporting planning and infrastructure as a metropolis of three cities to accommodate for the urban growth of the greater Sydney region. The three cities emerging from this plan include the Western Parkland City, the Central River City and the Eastern Harbour city. Therefore, as the city moves toward a three-city model, this framing of one city in Sydney becomes increasingly outdated.

and the legacies of historical sites of manufacturing and production that have left contaminated land in their wake.

In the map presented in figure 2, the Millers Point Gasworks is depicted in a position of prominence towards the centre of the right-hand side of the map. This prominent positioning echoes the significance of this infrastructure for the city, at the time. The Millers Point Gasworks was the beginning of the Australian Gas Light Company and is especially significant in the development of the modern city:

> On 26 May 1841 it was reported in the Sydney Herald newspaper that 'the application of gas as an agent of light' was successfully achieved on the previous night. The article describes the significance of this achievement: 'Australia is the first country, and Sydney the first city, in the Asiatic world – and, indeed, in the southern hemisphere – into which this beautiful art, justly denominated "one of the most important inventions of modern times," has been introduced.' Indeed, the use of gas lighting was a 'modern' achievement; competitive with the cost of sperm oil, coal gas offered a viable alternative to light derived from the whaling industry, and led to the first networked energy supply in Sydney. (Duncan, 2019, p. 3)

Despite the critical role of this industrial infrastructure in creating the modern city, the contamination legacies of the Millers Point Gasworks have been seemingly displaced from their sites of production, first through the expansion and then relocation of the Australian Gas Light Company Gasworks to Mortlake in 1886.

Despite this notional relocation, the material legacies of the Millers Point Gasworks persisted. Gasworks produced gas through burning coal and capturing the gas vapours; in the process, other residues were produced in excess. In particular, this process created mass amounts of the industrial by-product known as coke and coal tar. As Altman (2017) states: 'Wherever cities gasified coal to light 19th-Century streetlamps, or converted coal into hotter-burning coke to smelt metals, coal tar piled up as waste.' Initially an excess or by-product, coke became a product as the coal products tree (Figure 10, below) illustrates; with a little more work, so too was coal tar transformed into a viable product. In doing so, industrial processes solidified and were legitimised even further: 'when organic chemistry adopted coal tar as its primary feedstock, it wedded itself to the residues of industrialization' (Altman, 2017). Altman details how coal tar, as an industrial by-product, became central to an industry focused on coal-tar

chemistry, leading to ‘new dyes, and also to new drugs like aspirin, a synthetic version of a molecule once sourced from willow bark’ (Altman, 2017).

Figure 10: Coal products tree from the Semet-Solvay pamphlet, “Products of Coal" (National Archives/Courtesy of Adam Romero) in Altman (2017).

Figure 10 provides a visual representation of the many products stemming from coal, illustrating the degree to which one substance is turned into many through the processes of manufacturing and industrialisation. Ultimately, waste was minimised to extract as much energy as possible from materials (Dagget, 2019) so as to power further accumulations of capital.

Despite moves to maximise resources and energy extraction, waste was inevitably created. This inevitable legacy was apparent in the toxic accumulations that contaminated the working environment (James, 2013). In 2005, the Department of Environment and Conservation NSW produced a report titled ‘Information for the assessment of former gasworks sites’, which included Table 2 (as represented below). The table provides an overview of the material legacies likely to be encountered at a gasworks sites.

Principal waste type	Source	Distinguishing characteristics	Likely chemical groups
Coal tar Tar oils	Separated from gas and liquors at various stages of the purification processes.	Dark brown to black colour Strong phenolic odour May be present as non-aqueous phase liquids, either dense (DNAPLs) or light (LNAPLs) Lower melting point than petroleum tars Different phases have low to high density and viscosity	PAHs Petroleum hydrocarbons, including BTEX Phenols
Spent oxides (including complex cyanides)	Used to remove sulfur during gas purification.	Strong sulfurous odour Distinctive Prussian blue colour when weathered/oxidised Grey/black/green, very dusty when not weathered/oxidised Granular appearance Iron staining common	Complex cyanides Free cyanides Metals
Coke, cokebreeze (powder), Ash, Clinker residues (glassy material)	By-products and furnace residues.	Granular or powdery texture Light grey to black	PAHs Metals
Light oils Drip oils	Light oils used around all machinery and as scrubbing agent in recovery process. Drip oils condensed from gas.	Oily smell and appearance	Petroleum hydrocarbons, including BTEX
Ammoniacal recovery wastes	Nitrogen removal during gas purification processes.	Ammoniacal odours Fine powders or sludges	Phenols, Nitrates, sulfates, sulfides, PAHs
Asbestos	Used as lagging around many of the 'hot' processes and pipes.	Fibrous to powdery texture, Grey-white/blue/greenish colour (crystalline)	Asbestos
Lead, Mercury, Zinc	Lead from batteries, pipelines, paint, etc. Mercury sometimes used in metering switches.		Metals

Table 2: Summary of the principal waste types at gasworks sites (*Department of Environment and Conservation NSW, 2005, p. 11).*

The report noted that:

> While many of these wastes and by-products were recycled or reused, it was common for some to be buried on or near the gasworks site, for instance in underground tar wells, liquor wells, pipes and purifier beds and were not removed when the gasworks were decommissioned. (Department of Environment and Conservation NSW, 2005, p. 1)

Under colonial regimes, the underground becomes a site of extraction and wastage. The Millers Point Gasworks provides a prime example of how these sites were used; effectively, such sites were 'out of sight and out of mind'. From the 1960s, the former Gasworks site was capped with an extensive cement slab described as a 'featureless concrete apron, obliterating any sign of what had gone before' (Barangaroo Delivery Authority 2017).

While the below-ground structure of the site would lay contaminated for a century after the closure of the Gasworks in 1921,[52] the Australian Gas Light Company would eventually become AGL, Australia's largest power company/energy provider and Australia's 'biggest climate polluter' (Greenpeace, 2023.)[53] It was not until May 2009, two months after the *Barangaroo Delivery Authority Act 2009* was established[54], that the site would be declared

[52] Upon the closure of this site, operations moved further up the Parramatta River to the suburb of Mortlake, in particular a section of which is now known as Breakfast Point in light of the recent housing development.
[53] In May 2021 Greenpeace launched a campaign that rebranded AGL as 'Australia's greatest liability'.
[54] The Barangaroo Delivery Authority was established to ensure management and compliance of Barangaroo in achieving five objectives: the first of which is to 'encourage the development of Barangaroo as an active,

significantly contaminated land by the New South Wales Environment Protection Authority (2015).[55] In the delay, it is evident that responsibility for the pollution of this land was avoided until the area was rebranded, 'activated' and regulated by a specific (in this case temporary[56]) government authority.[57] Ultimately, the remediation costs were shared between the Barangaroo Delivery Authority, LendLease and Jemena (who now owns AGL (Jemena 2009)). The distribution of costs between these stakeholders remains confidential, though the final costs of remediation were in excess of $400 million (McNab, 2018).

This raises key questions about land pollution, capitalism and colonialism. The delicate handling of the Millers Point Gasworks illustrates the material legacies and costs of settler/colonial governance processes, where contaminated land is only addressed or attended to when its remediation is perceived as worthy (mostly through the commercial valuation of its surface land). This framing shows us how the city is produced through particular logics in which legacies of toxicity can be abandoned or not paid attention to under particular conditions – namely when capital cannot be extracted. Unless deemed lucrative, the sites would likely remain (in)visible, in every sense of the word. The remediation of the Millers Point Gasworks also illustrates the interconnectedness of these relations and the *reasons* contamination is made visible through government intervention. The EPA ruling – which was issued *after* a government body was formed to take designated responsibility – suggested that contamination should be made visible only *when there was money to be made from the development of the land/when its commercial development was in the economic interests of the state*. In a sense, this extends the colonial tendency to view something that is

vibrant and sustainable community and a location for national and global business' (*Barangaroo Delivery Authority Act 2009*).

[55] A. On 6 May 2009 the Environment Protection Authority ("EPA") declared the following area to be significantly contaminated land (declaration No. 21122) under the Contaminated Land Management Act 1997 ("the Act"):

· Part Lot 5 and Part Lot 3 in Deposited Plan (DP) 876514, Hickson Road, Millers Point.

· The part of Hickson Road adjacent to:

30 – 34 Hickson Road being Lot 11 DP1065410;

36 Hickson Road being Lot 5 DP873158 and Lot 12 DP1065410; and

38 Hickson Road being SP72797, Millers Point.

B. The land was so declared because the EPA believes that the site is significantly contaminated with gasworks waste and particularly waste tar as a result of the previous use of the site as a gasworks plant (New South Wales Environment Protection Authority, 2015).

[56] "On 1 July 2019, the Barangaroo Delivery Authority was abolished with its functions transferring to Infrastructure NSW" (Barangaroo Delivery Authority 2021).

[57] The delivery authority model has been used in other highly polluted former industrial sites including the redevelopment of Darling Harbour in the 1980s and Sydney Olympic Park.

without material value as worthless, or not worthy of attention; alternately, it espouses the classic 'use maxim' utilised to devastating effect in the colonial period, wherein land only becomes worthy of attention once it brings a material, often monetary, benefit.

5.4 Conclusion

The history of the city's becoming is layered with waste. In a city with a median house price of over one million Australian dollars, it is clear that this project has been produced with particular erasures; this includes the primary erasure of Indigenous land rights through *terra nullius*, alongside erasures of particular land uses. These erasures may come in the form of division between industrial aesthetics and industrial use, with its resulting pollutions and contaminations.[58] For the most part, the industry represented in the 1888 map of Sydney has faded from the memory of the city's inhabitants, as these sites are no longer 'productive'[59] in the same ways they once were. The city has changed drastically since 1888; nowadays, Sydney is marketed by the City of Sydney as a 'Green, Global and Connected' city with a global image to maintain as a gateway into Australia (City of Sydney, 2022a). Despite the constant need for progress and a change in identity, it is important to acknowledge that the past cannot be completely erased; even if remediation has been carried out, the effects of these processes may have already leached and travelled, contaminating other bodies, land and waterways. While images and conceptions of the city may change, the city's heavy industrial production must be given attention, as contamination and exposure are *written into the land and bodies*[60] *within the city.*

There must be continued awareness and responsibility towards the various sites of waste, contamination and industry that continue to be present within and beneath our cities. The site of the city is never singular or discretely bounded (insofar as it emerges from the City of Sydney and the wider Sydney Region); this fact is of particular interest to this research, as

[58] See, for example, the highlighting and heritisation of particular features of the gasworks in the 'Bond' – the 2004 Lendlease development on Hickson road, built in part on top of the remnant toxic substructure of the gasworks. See Duncan (2019) for more on this.

[59] Thinking about the relationship between the visibility of pollution in the map and the ways in which these forms of pollution have been erased from the image of the city.

[60] Bodies here is used to refer to human and more-than-human bodies, for example, the water body of Sydney Harbour which lies deeply contaminated.

modern cities are typically places of dense population and consumption, built across sites of largely historical manufacturing with highly divided individual property rights.[61]

The following chapters will think with fieldwork carried out with the City of Sydney's Cleansing and Waste teams. This was undertaken in order to comprehend the work of keeping the city clean and to gain an intimate understanding of 'where waste goes'. As some of the Cleaning and Waste staff have worked in the city for many years, I was able to see *how* and *where* waste is managed today and was managed in the past. Delving into these current and former practices or sites provides a layered history of the production of the city over time, one that is valuable and provides profile to the city's waste management regime.

[61] The 1888 map of Sydney depicts the city as being put to work (i.e. a city that could be invested in), in the 21st century Sydney is marketed as a tourism and a service based economy. Sydney is also marketed for its saleable property especially those with water views. In this way the harbours and water ways went from providing the infrastructure for industrial shipping, meaning major infrastructure including the Gasworks were largely located adjacent to the water, to being the multimillion-dollar property valued for their views and proximity to the water as a site of leisure.

6. Photo-essays on the mechanics of infrastructure and labour

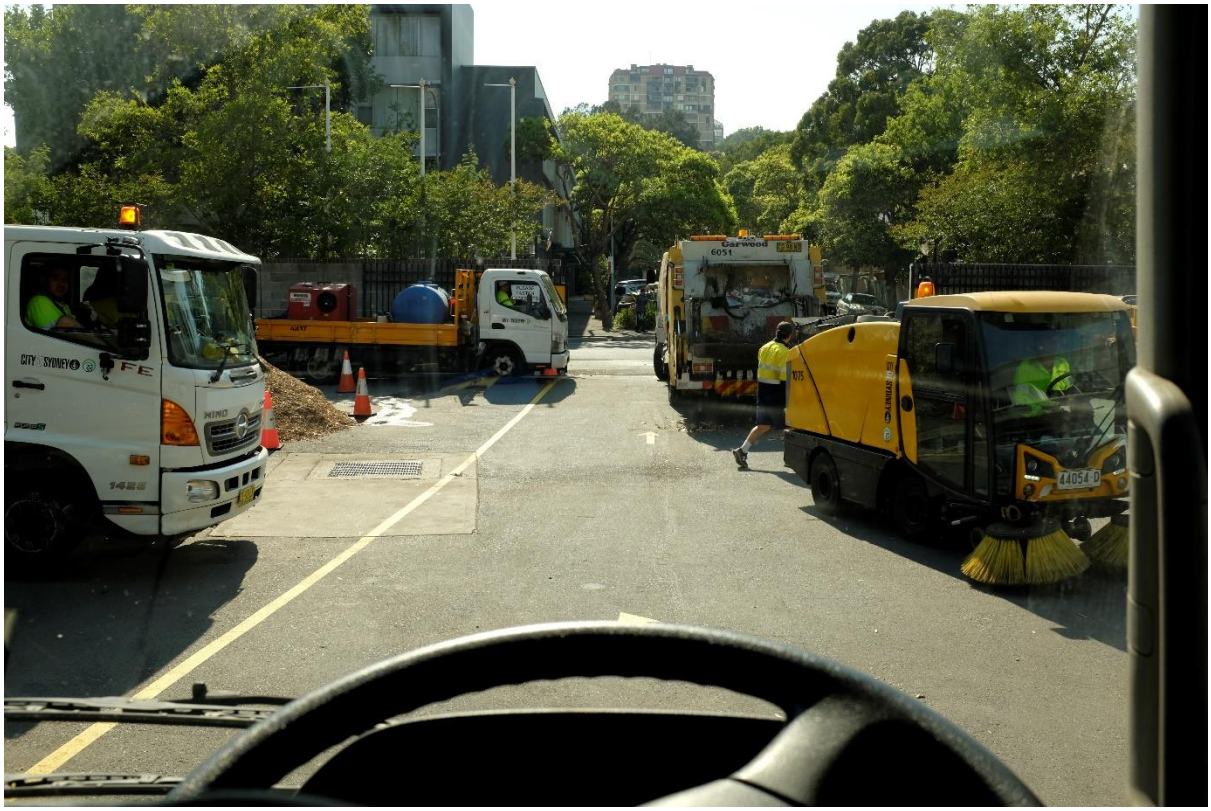
The following photo-essays visually introduce and narrate the fieldwork undertaken with the City of Sydney (CoS). They illustrate the different types of shifts and plant used[62] as well as helping to locate the field work and wider waste system within the City of Sydney and Sydney more broadly. The focus of the fieldwork was with the CoS Cleansing and Waste Services Teams. These teams were responsible for servicing the local government area (LGA), which is made up of 33 suburbs in central Sydney. The area is depicted in Figure 11, below. The area governed by the CoS encompasses 26.15 square kilometres, with an 'Estimated Resident Population' of 246,343 in 2019 (the time at which the fieldwork was undertaken) and 217,748 in 2022 (ibid., 2023). While the fieldwork was a fluid experience, involving extensive movements within and beyond the bounds of the CoS LGA (see Transfer Stations (Resource Recovery Centres) and the Lucas Heights Landfills marked in Figure 11), these photos freeze moments of fieldwork. The photographs in these essays have been have been located on the map in Figure 11 below to ground these references in the geographical context of the city.

[62] The City of Sydney's machinery is referred to as plant (see Appendix 1 for contextualisation and discussion of this terminology).

Figure 11: Map A of the City Sydney marked with photograph locations, # refers to photograph number in figure caption. Map B marked with photograph locations (#) beyond the City of Sydney. Maps created by Alex Jones.

6.1 Photo-essay I: The Roadway

As we pull out of the Bourke Street Depot in Woolloomooloo, various forms of plant assemble in our view. On the left side of photograph (#) 1, the front of a Roadway is visible (this is the same form of plant that I find myself in), moving from the left-hand side we then have the Steam Plant, which is a pressure hose used to clean footpaths and paved areas. Then there is the Mini Compactor, used to empty street litter bins and finally the Footway appears in the right side of the image.



Photograph 1: Plant assembled at the Bourke Street Depot

The Roadway is used as a road-sized mechanical vacuum cleaner (# 2). The Roadway will work in concert with the manual sweepers who will use brooms to push out leaves from behind parked cars into piles on the road.

Photograph 2: The Roadway

The Roadway has two mechanical arms that rotate to suction up the leaf litter (# 3).

Photograph 3: The mechanical arm of the Roadway

Manoeuvring the Roadway takes skilful coordination, a careful juggling of the controls, steering and spatial awareness (# 4). Dale, the Roadway operator I am with, has worked in cleansing for five years; however, he is new to the Roadway and is 'experimenting' with the controls to find the best results.

Photograph 4: The Roadway's controls

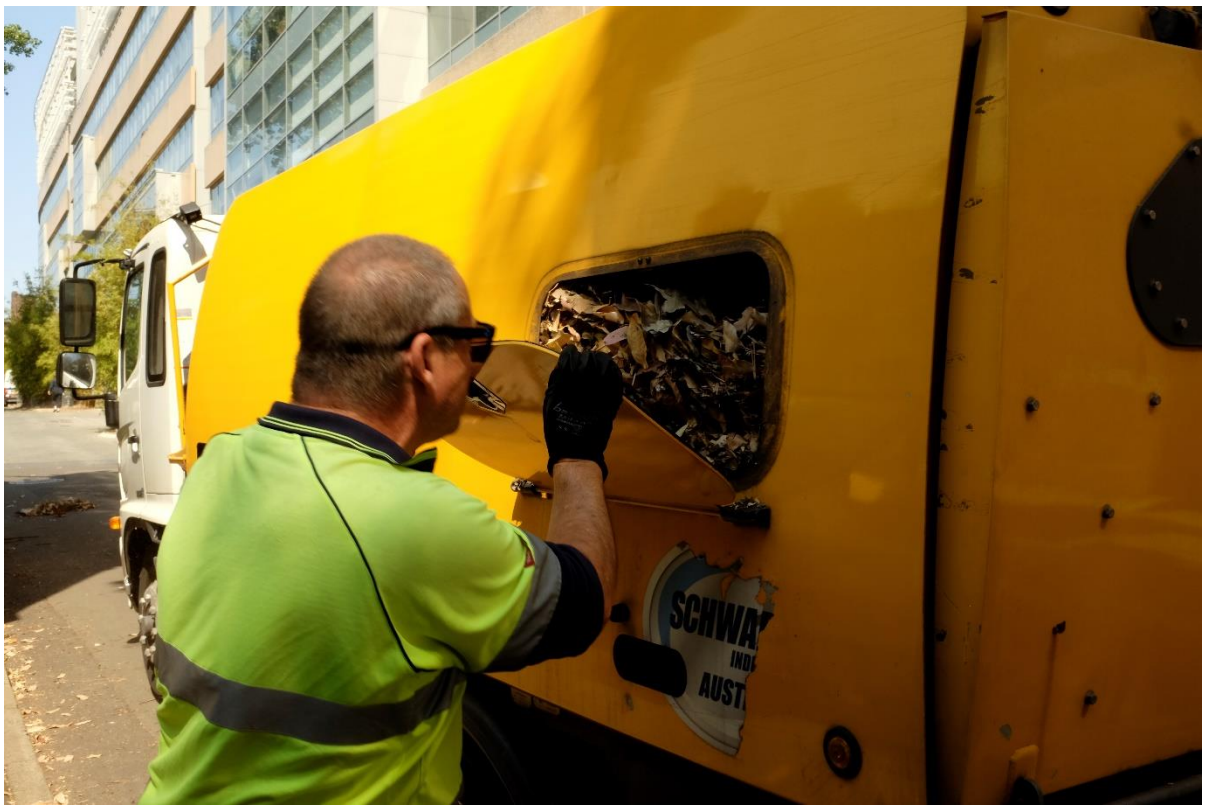
The streets are often narrow and very leafy, particularly around Potts Point and Darlinghurst where we were cleansing (#5).

Photograph 5: The view ahead of the Roadway, with leaves to be collected

Dale tilts the Roadway open to check for blockages, exposing the mechanics and the suction tube in the centre which adjoins (when in function) to the back receptacle of the plant where the accumulated litter is stored (#6).

Photograph 6: Tilting the Roadway open to check for blockages

Dale checks the truck's capacity, by peering through the side viewing panel (# 7). It's time to head to the depot to empty the Roadway.



Photograph 7: Checking the Roadway's capacity

We head through the city to the Bay Street Depot in Ultimo to empty the Roadway into the Link Bin skips, as seen through the rear-view camera (# 8).

Photograph 8: Tipping the Roadway

6.2 Photo essay II: The Link Truck

One early smoky December morning as the sun began to rise, work was already underway at the City of Sydney's Bay Street Depot (# 9).

Photograph 9: An early smoky morning at the Bay Street Depot

Link bins filled with waste need to be emptied. Link bins are the depot's skip bins that the smaller plant such as the Roadway and Footway empty into throughout their shifts. Neil (the Link Truck operator) reaches out with the arm of the link truck to drag the bin out of its bay (# 10).

Photograph 10: Moving the Link Bin

Neil covers the link bin with a mesh cloth and ties it down with rope to secure the load for transportation (# 11).

Photograph 11: Covering the Link Bin

From the driver's seat in the truck's cabin, Neil mechanically loads the link bin onto the truck. The link bin is loaded onto the truck, as seen through the back window of the cabin (# 12).

Photograph 12: Loading the Link Bin

And secured in place, on the link truck (# 13).

Photograph 13: Securing the Link Bin

Neil drives the link truck through the city, across the harbour bridge to the SUEZ[63] Artarmon Transfer Station (Resource Recovery Centre). Inside, the transfer floor is a mess with action. Various piles are accumulated across the transfer floor and are being worked upon by machine (# 14) and birds alike (# 15).

[63] Since the time of fieldwork this Transfer Station is now being run for Cleanaway (see section 9.6.5 for details).

Photograph 14: At the Transfer Station

It takes a second to realise that the pile of waste is covered in ibis (a native bird) taking their pick from the debris (# 15).

Photograph 15: At the Transfer Station

From the transfer station floor, look out the window and notice the perimeter of the building is also ringed with ibis, colloquially known in Australia as the ‘bin chicken’ (# 16).

Photograph 16: Ibis’ on the roof

Neil takes to the floor and opens up the back of the Link Bin (# 17). From back in the truck’s cabin Neil uses the automated button to trip the Link Bin.

Photograph 17: Neil opening the Link Bin

He is tipping and moving forward slowly, until all the waste spills out (# 18).

Photograph 18: Tipping the Link Bin

Photograph 19: The Link Truck moving forward

Photograph 20: The load tipped onto the floor of the Transfer Station

We leave, having formed a new pile on the transfer station floor (# 20). The link bin is empty once again.

Photograph 21: The Transfer Station

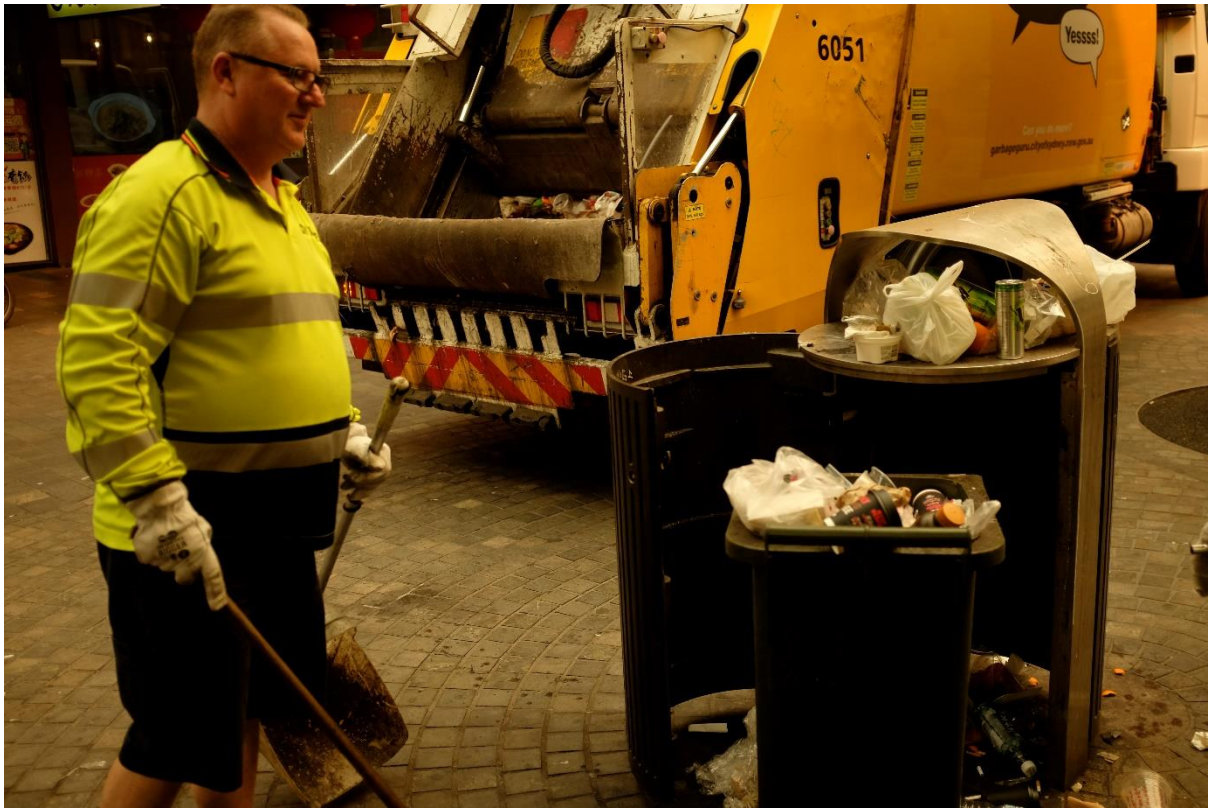
The transfer station is a vertical structure. The transfer floor is raised with a cement cut-out in the back of the floor. Waste is periodically pushed through this opening and loaded onto the receiving truck driven in below. Once the SUEZ truck is loaded It will then be driven offsite to Lucas Heights Landfill (see Photo essay 6.9 - IX).

6.3 Photo essay III: The Mini Compactor

On another smoky December day, I arrive at the Bay Street Depot. This time on an afternoon shift, I am shadowing Sean and Aaron on the mini compactor as they methodically empty the city's street bins. The heat of the city peaks as the afternoon comes and we start the shift.

Beginning at Broadway we work our way down the main thoroughfare as it turns into George Street. As Sean operates the vehicle, Aaron dismounts the truck when we stop at each street litter bin. Each time Aaron opens the bin with a universal key to remove the internal plastic bin and empty it into the Mini Compactor.

After starting out on Parramatta Road-George Street, the major arterial road in the city, we turn off the main road and into Haymarket.

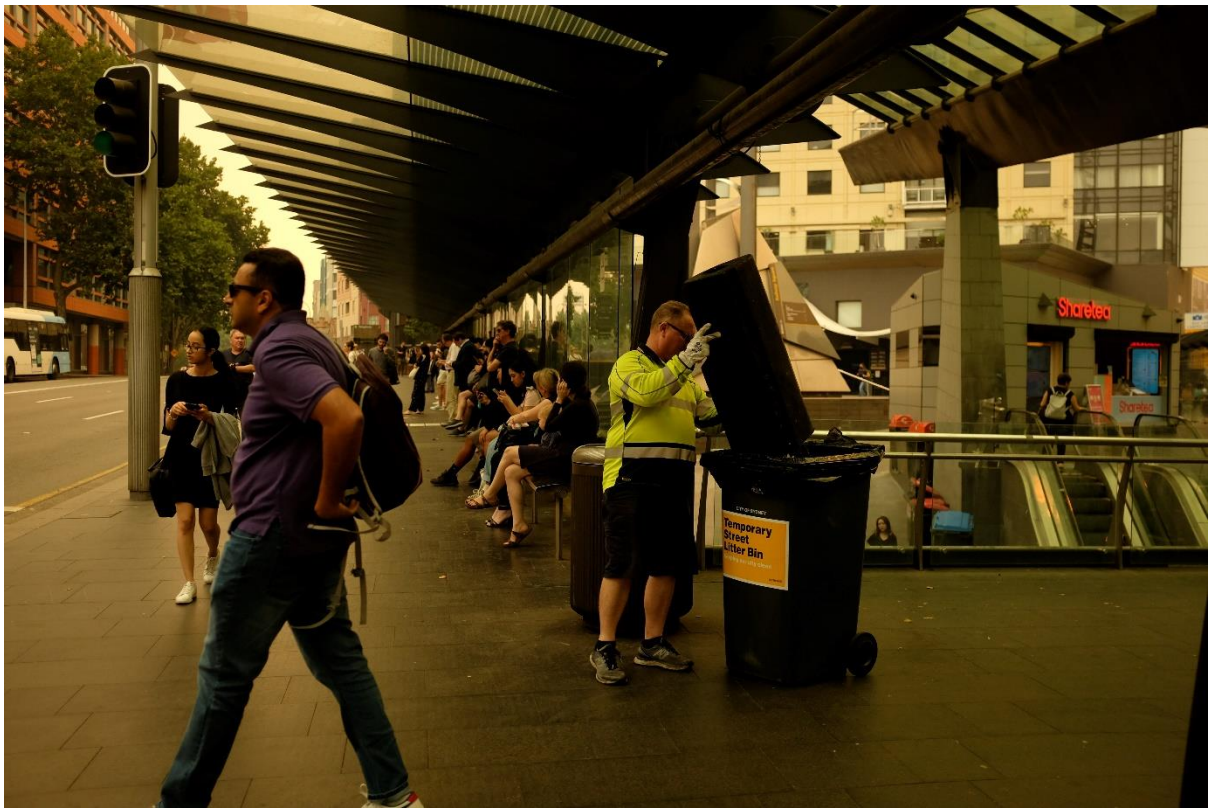


Photograph 22: Cleaning an overflowing bin in Haymarket

Upon the bin being emptied and the rubbish removed, the area around the bin is given a final sweep (# 23).

Photograph 23: A final sweep

At Railway Square a different bin infrastructure is used (#24). Some street bins contain within them three triangular plastic bins that must be tipped individually. Intermediary bins are useful here as they can compile the materials of the three triangular bins.



Photograph 24: Tipping bins at Railway Square

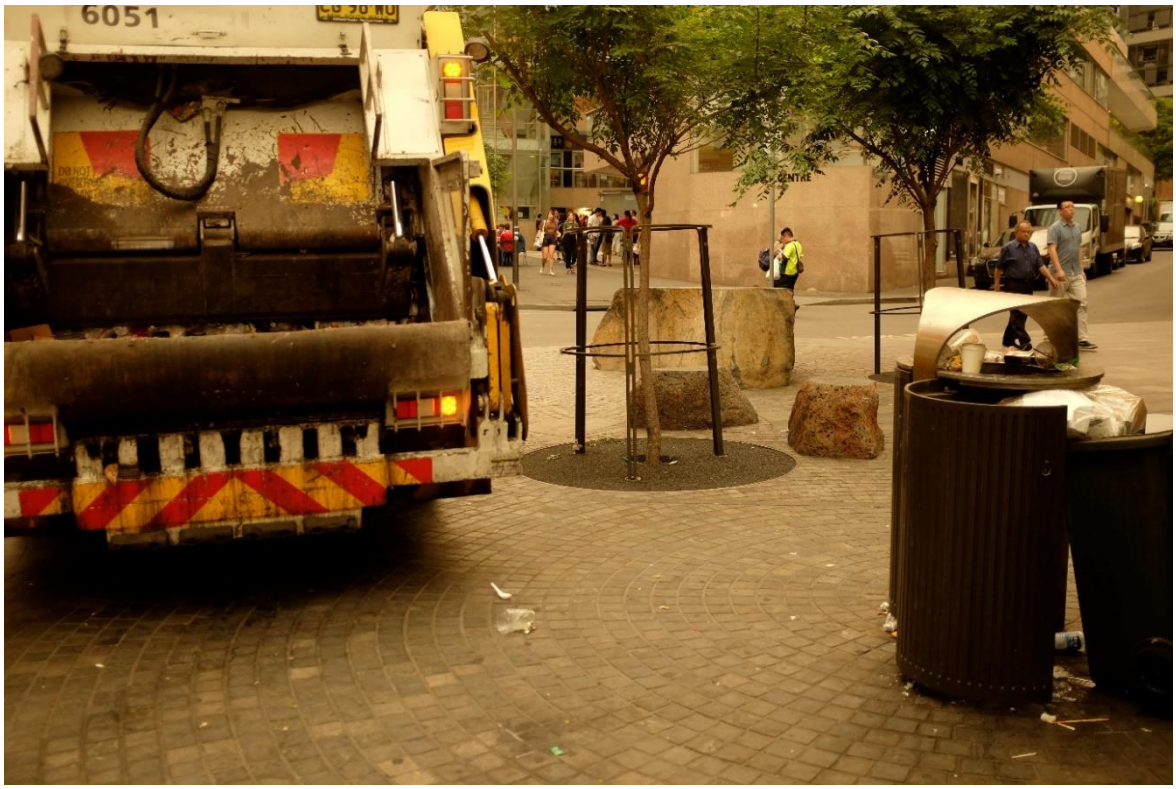
This means containers are tipped into containers to be tipped into the container tray of the mini compactor (#25). Waste is transferred and accumulated through this 'Russian Dolls' process of stacking within stacks.

Photograph 25: Loading the Mini Compactor at Railway Square

A smoky haze blankets the evening sky turning it to a pale orange-brown hue (due to the devastating NSW bushfires of 2019) as we return to the Bay Street Depot for a dinner break.

Photograph 26: A smoky sky; returning to the Bay Street Depot for a dinner break

On the road again and back in Haymarket. Bins that were emptied hours before are overflowing again (# 27).



Photograph 27: Emptying the bins again

Round and round we go. Progress is slow through the city traffic, lights are always changing and pedestrians milling (# 28).

Photograph 28: Round and round we go

Our day has been soundtracked by WSFM 80's radio, with intermittent singalongs: we 'got to keep on moving'. The dashboard tells us our load is weighted at 9850 kilograms; the waste accrues in the truck, but also keeps accruing in the street litter bins.

Photograph 29: View from the truck's cabin

Missenden Road, Camperdown (# 30). Day turns to night; the work continues as does our circuit of the city.

Photograph 30: As the day becomes night, we continue emptying street bins - Missenden Road, Camperdown

6.4 Photo essay IV: The Footway

On Monday the 9th of December 2019 I spend the morning with Neil on the Footway. Neil has worked in cleansing services since 2012. He operates various plant; today he is tasked with operating the footway. Early in the morning, plant are sitting in the Bay Street Depot ready to be driven out for the day. The Footway sits in between the response trucks, waiting for us.

Photograph 31: The plant assembled at the Bay Street Depot

The Footway, the smallest of the plant, is used to ride along and clean foot and bike paths. This plant uses the two large inwardly rotating circular brushers at the front of the machine to pull litter in towards the vacuum chute at the vehicle's centre.

Photograph 32: The Footway

Operating this plant was typically acknowledged to be the hardest of all the plant as the extendable brush arms can get stuck on odd surfaces and operators need to contend with pedestrian and cyclists due to their use of shared infrastructure. The capacities of this machinery are also smaller both in terms of size of the material able to be sucked up through the chute and the volume of portable collection material in comparison to the Roadway. As a result, the Footway would often have to be stopped, opened and cleared (as depicted in the photograph 33 below) by Neil, the vehicle operator for the day. We start the shift heading to Pyrmont.

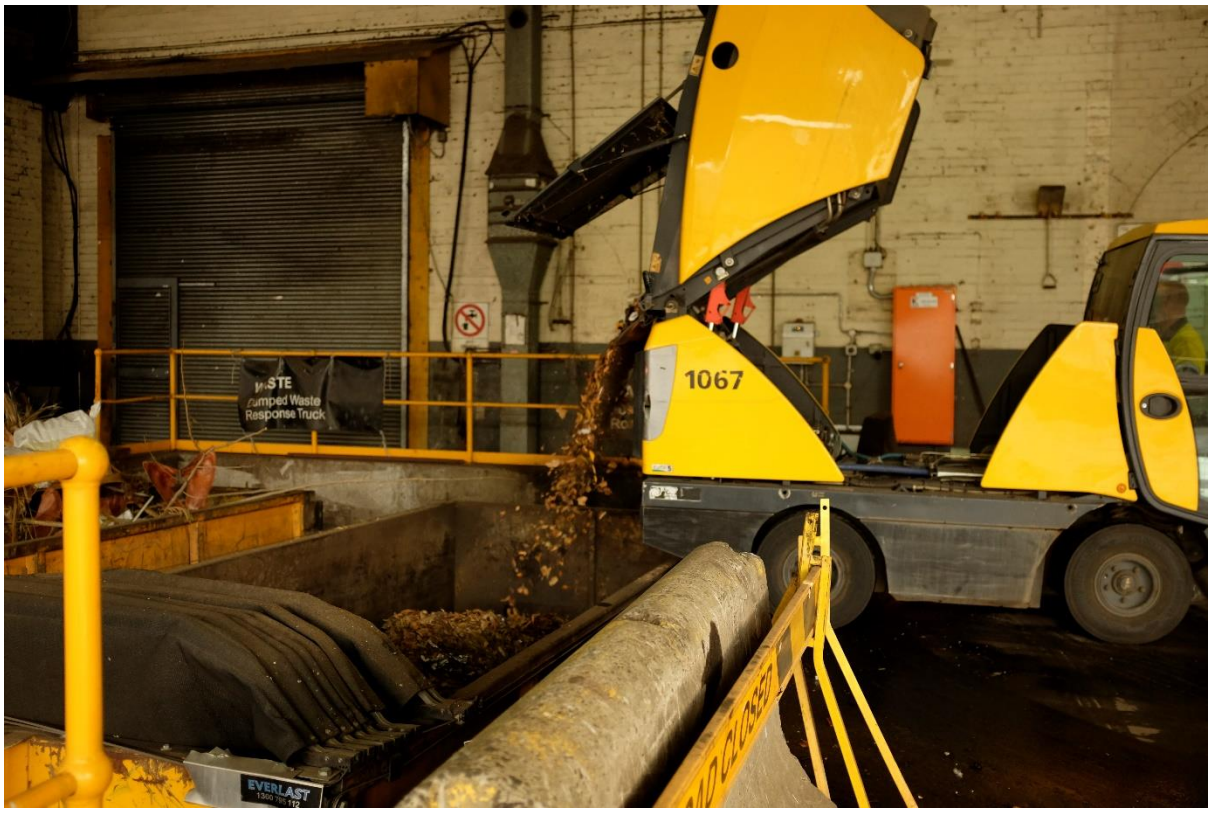
Opening the Footway to clear blockages (# 33).

Photograph 33: Opening the Footway

Cleaning the filters with the broom (# 34).

Photograph 34: Cleaning the filters

Our first drop-off of street sweepings at the Bay Street Depot (# 35).



Photograph 35: Emptying the Footway at the Bay Street Depot

Neil marking off the run sheet (# 36). Doing fieldwork with the Cleansing team has been a lesson in understanding that the value of work is in ways in which the task exceeds a tick box exercise, how the capacities and the services offered on the job revolve around and then extend beyond checking off streets on the day's run that is, in caring for streets that aren't on the run, laneway hot spots, and being flexible with the run sheet on hot days. Tomorrow is forecast to be 37 degrees. We discuss how this might affect the run, such as cutting down on non-necessities. Neil cleans extra side streets today in preparation for tomorrow.

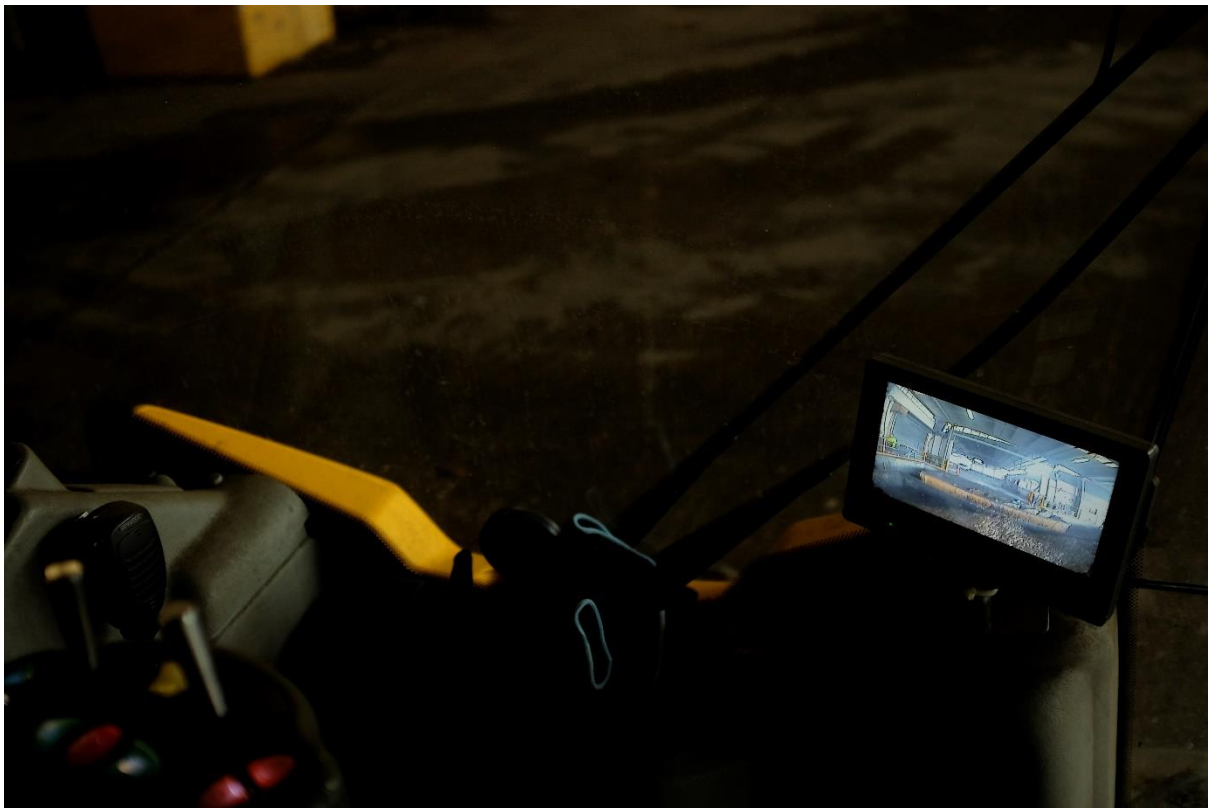
Photograph 36: Neil marking off the run sheet

Photograph 37: Neil opening the Footway

Neil needed to stop the Footway at various points throughout the day to open it and clear the vacuum system. This activity could also be in part pre-empted by visually assessing the size of litter. If it was thought to be big enough to cause a blockage then it would need to be manually picked up by the machine operator.

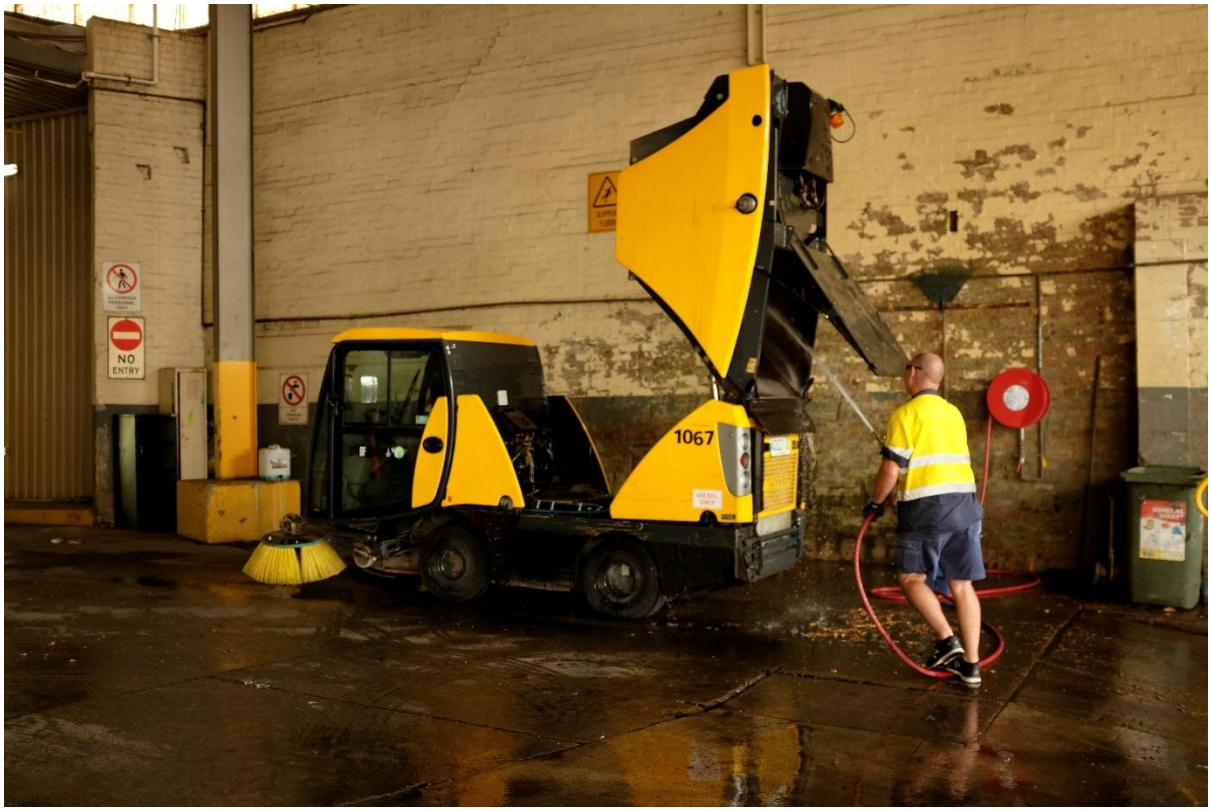
Photograph 38: Neil checking the chute for blockages

Our second drop-off of street sweepings at the Bay Street Depot (# 39).



Photograph 39: Second drop-off at the Bay Street Depot

Talking about the footway, Neil tells me: 'The machine is worth nearly $300,000, it's nearly equivalent to a Ferrari.' Neil described to me how plant are constantly worked across the three shifts (morning, afternoon and night), and posed the question, how well would you work if you were worked 24/7? There was something very empathetic about the way he talked about the machines. The rhythms of this type of maintenance work are slow and repetitive. Even with the aid of mechanised plant there are still limits to the duration of work. Breaks are needed to fix the poor function of the Footway, like cleaning the filters (something that we were constantly doing) and the checking for sticks blocking the vacuum and coming back to the depot to tip the truck and hose it (# 40).

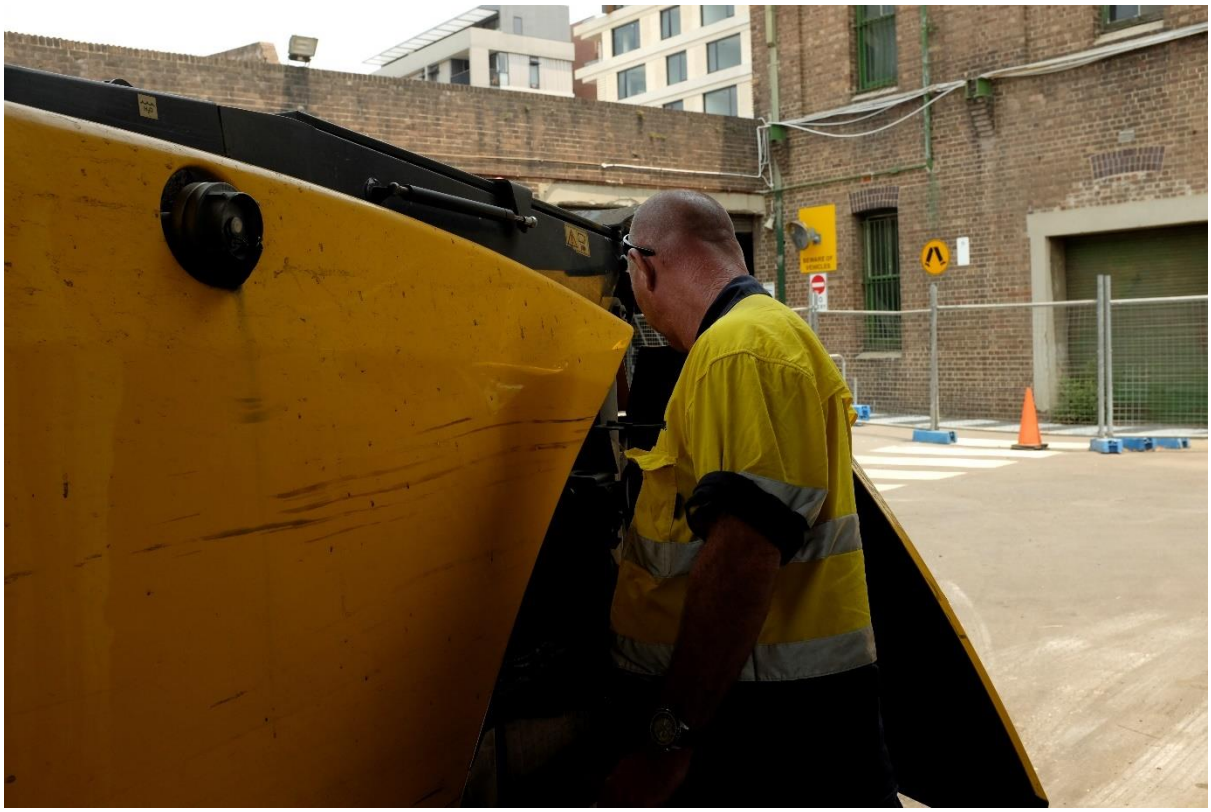


Photograph 40: Hosing down the Footway

Cleaning the footpath under the Moreton Bay Fig Trees on Bridge Road in Ultimo – a daily cleansing task (# 41).

Photograph 41: Bridge Road in Ultimo, footpath under the Moreton Bay Fig Trees

Neil refilling the footway at the Bay Street depots biodiesel pump (# 42).[64] Cleansing work is slow work. Neil tells me his normal work speed is about 5km an hour. The work is also repetitive, involving repeatedly detailing sections of the city and frequently returning to the depot to empty the collected litter. And yet within the repetition and the slowness there is satisfaction to be found in the job. As Neil states; 'People think street cleansing in boring, but there's something new every day, you meet people and just riding the footway around it's a good look for the city.' I noticed this myself being on the job in a high-vis uniform. People smile at you when you're in the plant and you are interacting with people when you get lunch. On the job you represent the city and become an integral part of its fabric.



Photograph 42: Neil filling the Footway with biodiesel at the Bay Street Depot

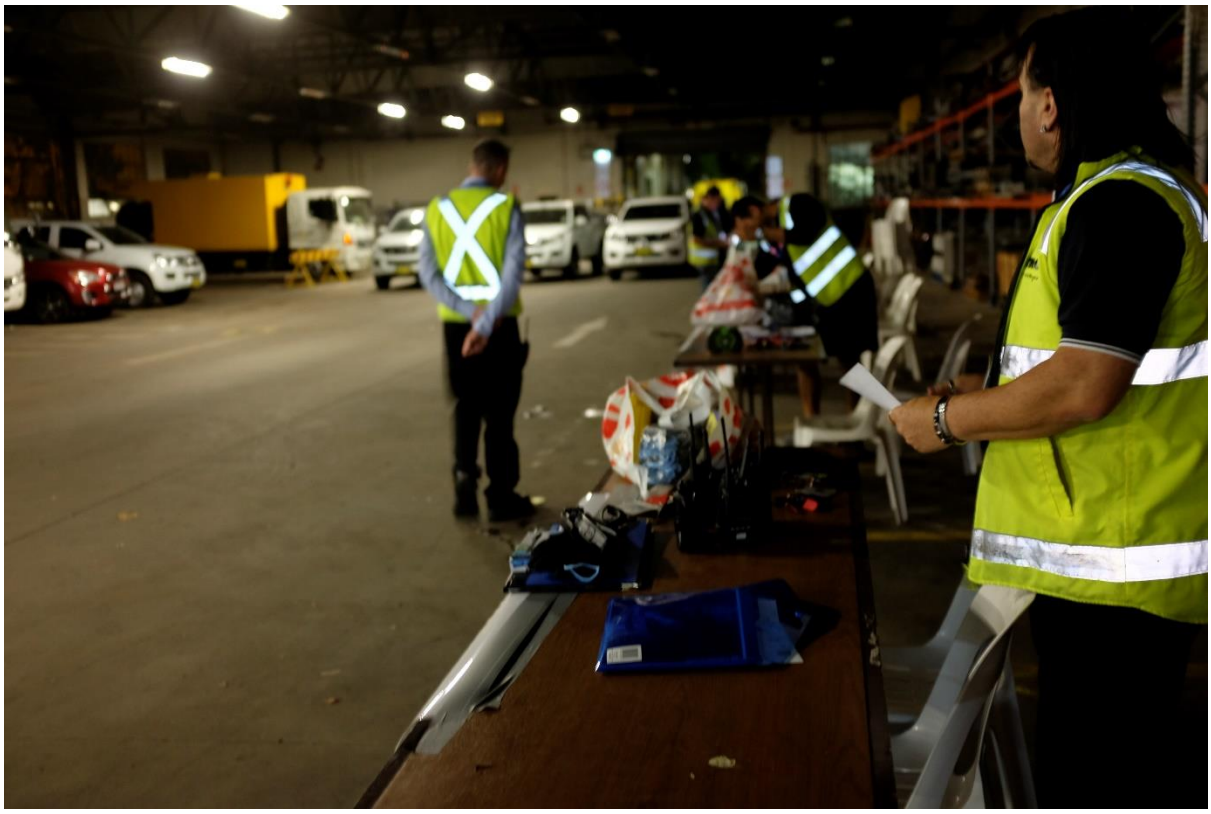
[64] 'Biodiesel – The City tendered for sustainable biofuels in 2011. The fuel supplied comprises of recycled cooking oil and waste animal fats' (Local Government NSW, 2014).

6.5 Photo essay V: New Year's Eve

The teams were arranged in the weeks leading up to December 31st. Jason shows me everything laid out and ready on December 30th as he talks me through the plan for cleaning the city.

Photograph 43: Organisation for the teams on New Years Eve (NYE)

Just past midnight on the 1st of January, the Team Leaders are set up and waiting for the teams (# 44).



Photograph 44: Team Leaders set-up and waiting for teams to begin the shift

The staff assemble, waiting to start their shift (# 45).

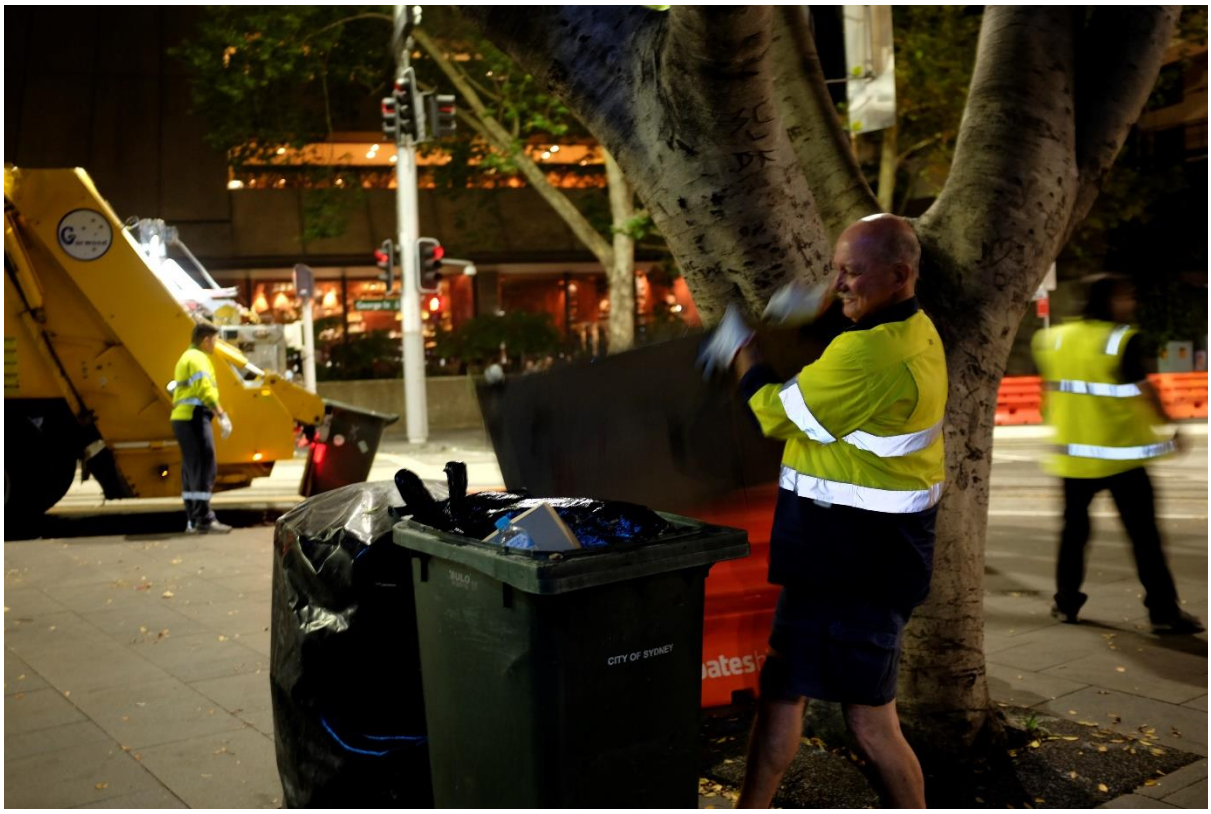
Photograph 45: Staff assembling

The teams are assigned. We each receive a coloured wrist band to mark our team. I am part of the red team who are assigned to take The Rocks and then move up through George Street.

Photograph 46: Assigning teams

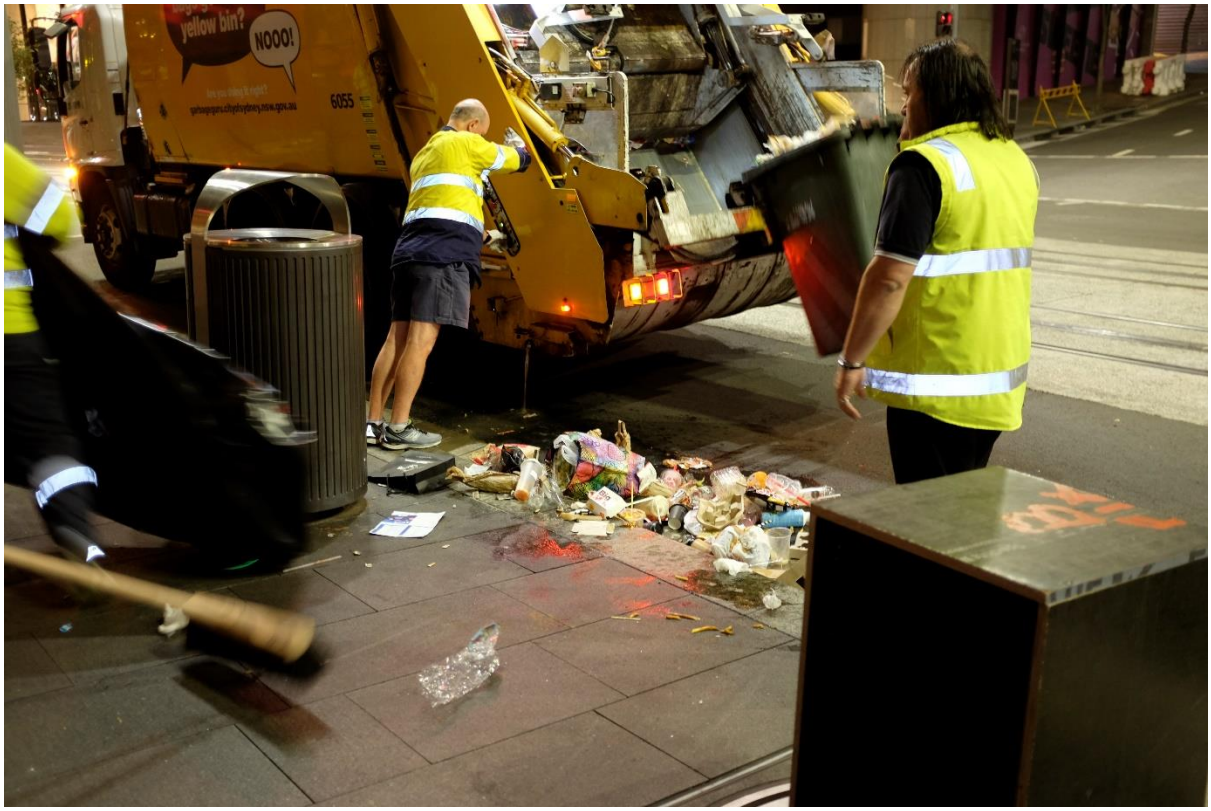
Photograph 47: Teams taking buses to their drop-off points in the City

The red team (myself included) were then bused together to the start of our route. We begin the manual work under the Harbour Bridge at the start of George Street (after delays caused by NYE traffic and roadblocks). Here we are each equipped with brooms and begin sweeping our way up George St into the heart of the CBD – Town Hall.



Photograph 48: Collective cleaning efforts at Circular Quay, on the corner of George Street

We work in concert with plant and team on the Mini Compactor. Waste is swept into piles and collected (# 48 - 49).



Photograph 49: Collective cleaning efforts at Circular Quay, on George Street

KFC litter is plentiful at Town Hall, which is located across the road from the fast-food store.

Photograph 50: Street cleansing at Town Hall – utilising a 'drop sheet'

The team makes light work of the litter with the aid of brooms and a drop sheet (# 50- 51).

Photograph 51: Street cleansing at Town Hall – moving a 'drop sheet'

6.6 Photo essay VI: Alexandra Canal Depot

The day starts at the Alexandra Canal depot. I am shadowing a Team Leader on the streets and have been dropped off with the leaf blowers, already at work in the Cope Street Council Car Park in Redfern. The leaf blowers work in concert with the Roadway (# 52 – 53). It's a windy day - the Roadway needs to be quick to pick up the piles of leafy matter and debris, before the work is undone by a gust.

Photograph 52: Electric leaf-blowers in action

Photograph 53: The Roadway working with the leaf-blowers

After lunch - back at the Alexandria Canal Depot - staff are assigned their afternoon routes (# 54).

Photograph 54: Folders containing details of the afternoon shift

Team leaders explain additional notes included in the shift (# 55).

Photograph 55: Team leaders explaining shift notes

The Alexandra Canal Depot in the afternoon (# 56).

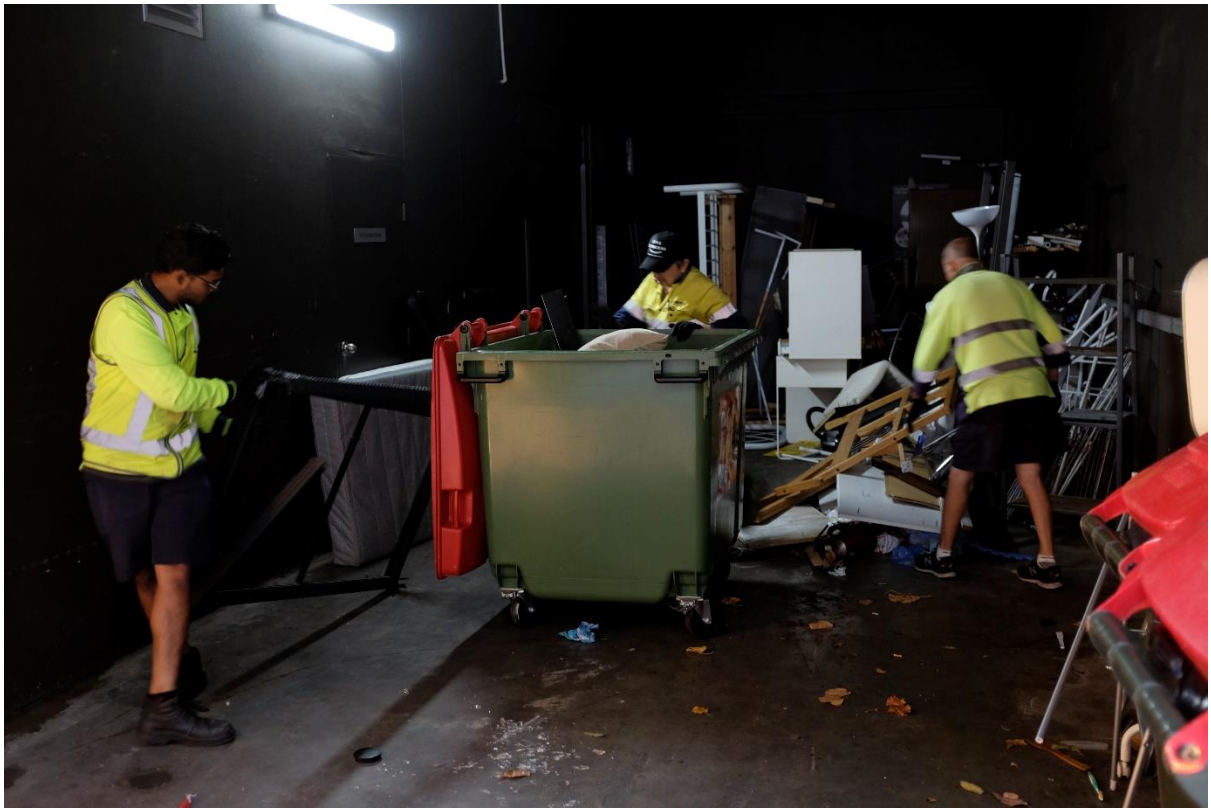
Photograph 56: The Alexandra Canal Depot

6.7 Photo essay: VII Bulky waste collection

This shift was spent with a crew collecting bulky waste, seeing load-after-load of booked collection material moved into the compactor. Here in Waterloo, a bin room full of near-new items was cleared and loaded by Will and the team.

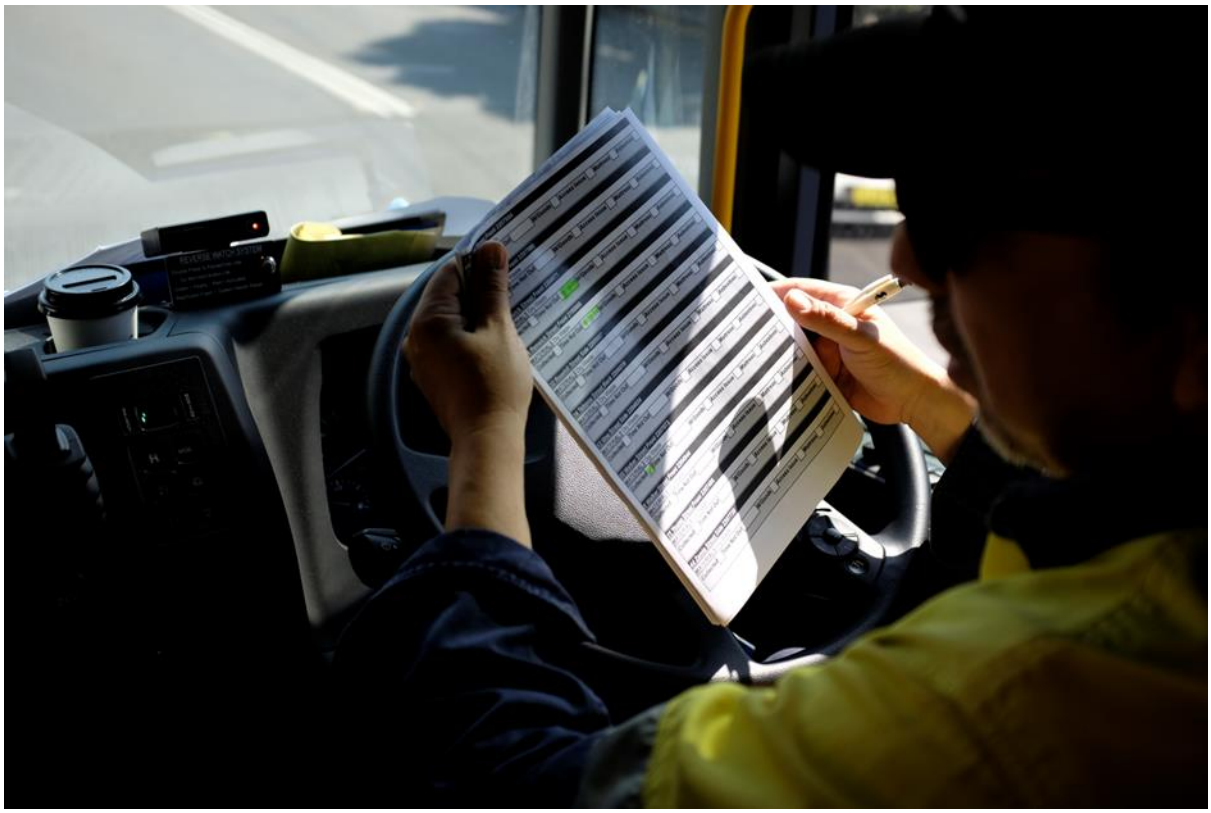
Photograph 57: Bulky waste collection in Waterloo

Halfway through emptying the bin room.



Photograph 58: Bulky waste collection in Waterloo

Will ticks-off the collection sites as the jobs are completed and plans the next stops.

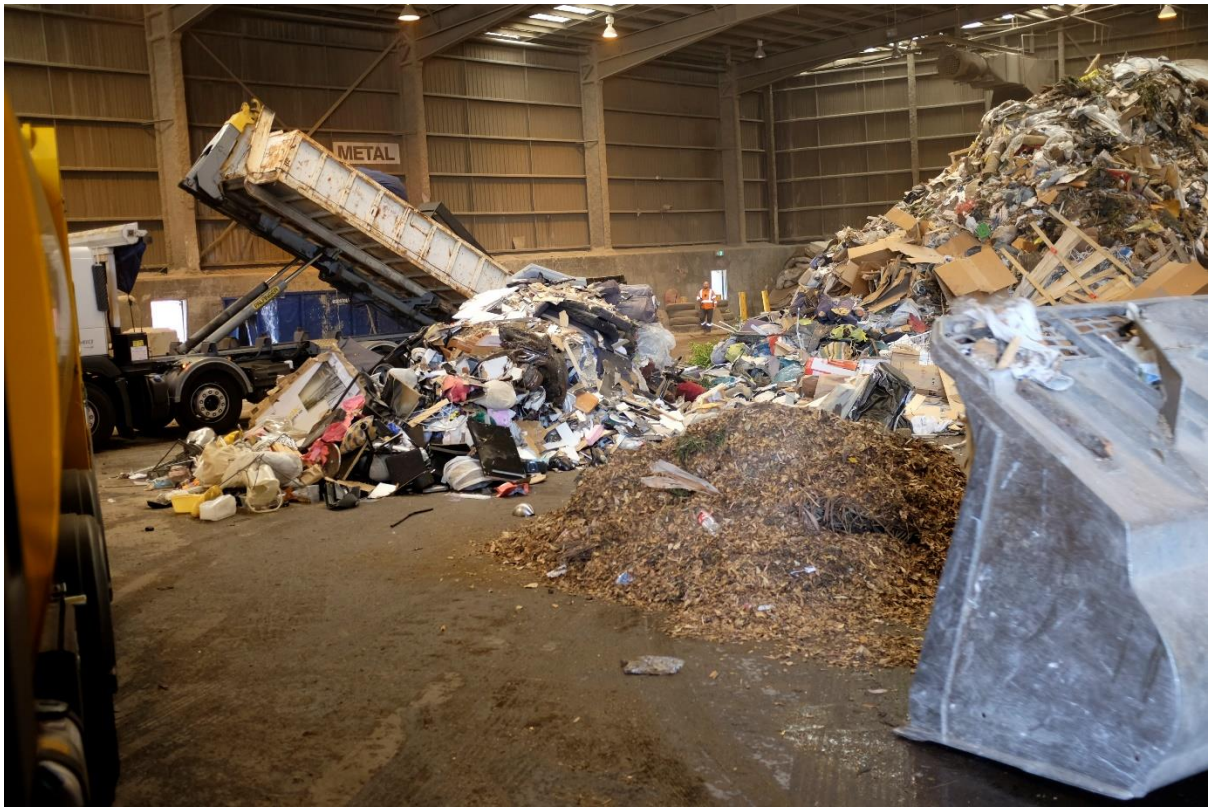


Photograph 59: Marking-off the run sheet

At the Redfern Public Housing Towers, old couches (along with other items) are loaded into the compactor. Bulky items need to be steadied by hand as the compactor arm pulls the objects into the tray, crushing them in the process (# 60).

Photograph 60: Bulky waste collection at the Redfern Public Housing Towers

We drop the waste collected during the first half of the shift at the Veolia Port Botany Resource Recovery Centre, located in Matraville. Waste is sorted on the transfer station floor. The middle of the floor is filled with mixed bulky waste. The area for metal is visible on the wall at the back of the photograph. At its left is a space for concrete. On the opposite wall, there are bays for street sweepings, timber and green waste. The pile of sweepings in the foreground of the photograph is about to be collected and moved to its designated bay.



Photograph 61: Port Botany Resource Recovery Centre

6.8 Photo essay: VIII Southside residential waste collection

As the first bins get picked up in Redfern - an early morning in March 2020 - the sun has yet to rise.

Photograph 62: Redfern - an early morning in March 2020

The truck quickly amasses waste, thanks to the collective efforts of Ben, Patrick and Andreas.

Photograph 63: Redfern - an early morning in March 2020

Throughout the day, the crew serviced a mix of different sized residential bins across the south-east side of the CoS. This included 80 L to 240 L wheelie bins (# 62 and 63) and 500 L bins used in apartment blocks (# 64 to 66).

Photograph 64: Servicing an apartment block in Redfern

Photograph 65: Servicing an apartment block in Redfern

As the truck reaches capacity at a unit complex in Rosebery, we head off to empty the load.

Photograph 66: Servicing an apartment block in Rosebery

On the way to Rockdale, we are following another CoS compactor.

Photograph 67: On our way to Rockdale Resource Recovery Centre

We are waiting for our turn to enter the waste transfer station. At the (then SUEZ – now Cleanaway owned) Rockdale Resource Recovery Centre.

Photograph 68: Waiting to enter the transfer station floor at Rockdale Resource Recovery Centre

Inside, we add to the piles of garbage. The site is busy with activity; waste is being tipped and unloaded, the misting jets are hissing and hundreds of birds (ibis' and myna birds) are scavenging and singing, their echoing chirps adding to the surreal atmosphere.

Photograph 69: The transfer station floor

6.9 Photo essay: IX Lucas Heights Landfill

At the Lucas Heights Resource Recovery Park, my guide drives me to the top of the landfill, where the trucks are actively tipping. We see a SUEZ truck pull away from the edge of the landfill. This truck would have been loaded at a SUEZ transfer station (such as Rockdale or Artarmon). My guide calls these big green trucks 'the hulks': they are compactors that compress the waste for transportation and then 'shuffle' the waste out through the floor of the trailer upon discharge.

Photograph 70: The edge of the landfill

The earth is completely terraformed through the process of landfilling, where new stratigraphies are made through the insertion of waste into the earth and topography is transformed. 'Litter fences' (photograph 72) provide barriers to waste picked up by the wind, before the landfill is covered for the day with a new fill layer.

While surveying the desolate surface typology, the follow conversation took place:

> Me: It's a really interesting landscape; it feels a bit moon-like, almost.
>
> Guide: You should see it on a sunny day, it is absolutely spectacular, it's just so sparkly because this site is a sandstone-based site, so a lot of sandstone, and it just

> glitters. So all this is all stockpiled, so this is everything that we have pulled out building this landfill down here, and then daily we will use some of this as a landfill cover. Because every day we have to cover the waste.

Through the processes of landfilling and covering, each day a new 'lift' is created. My guide tells me '… each lift is probably about 3 meters before you do a fine lining of dirt, and then you do another lift on top of that.' In this way, the typography is reformed and the strata constantly re-layered.

Photograph 71: A SUEZ truck pulling away from tipping

Pointing to the machine in photograph 72, my guide tells me: 'That's a compactor. That's worth about 1.2 million dollars to buy; it weighs about 60 tonnes and he will use one thousand litres of diesel a day and he can compact one tonne of rubbish into one cubic meter square, which is massive.'

Photograph 72: The Compactor

Referring to the view in photograph 73, my guide states:

> That down there is our leachate dam, so that's where all the leachate is being pumped into. Then the leachate gets pumped into tanks, where bacteria eat the ammonia. When there is no more ammonia left, we then pump the leachate to the local water treatment plant.

The typology of the landfill is engineered to control the flow of leachate into the dam; this involves the staged movement of the tipping site around the landfill. The 'roadway' that we are driving on now (#73) has been made over prior landfilling sites.

My guide describes how the landfill is engineered to create a sealed space, with piping infrastructure for drainage. The seal is buffered by VENM (virgin excavated natural material). They stated:

> …the VENM that you use is really important, you compact 900mm thickness into the earth and what that does is, if any liquids get through all the other linings, then that will hold it like a sponge - it absorbs it.

Photograph 73: The leachate dam at the bottom of the hill

Observing the landscape in photograph 74, I ask the guide:

> Me: Is there any landfill under this?
>
> Guide: Yes - towards the left, towards the back there is… we were tipping down there for a little while and then like I said we then had to come back up here and start tipping back up here and then we thought, well we can use this area as a storage area for now.
>
> Me: When is this expected to be online as a landfill again?
>
> Guide: Probably about in 5 years I think they will start using this again as a landfill.
>
> Me: Right and that will take you up to when?
>
> Guide: 2032.
>
> Me: That's a while, but also its not that long, considering the space.
>
> Guide: It will come very quickly, it will come very quickly.

Photograph 74: A 'to-be-filled' section of the landfill

The former Lucas Heights 1 landfill sits just up the road from current Lucas Heights Resource Recovery Park.

> 'Lucas Heights 1 is a former landfill comprising two major filling zones; those operated by the Sutherland Shire Council between 1965 and 1976, and those completed by the Metropolitan Waste Disposal Authority, now known as Waste Service NSW, between July 1976 and 1987.' (Hassel, 1998, p. 5)

The site is now a recreational sporting ground. Photograph 75 shows the ridge pump track opened in 2018, funded by SUEZ and the NSW Government.

Photograph 75: The Ridge Pump Track

The site of the prior landfill is now occupied by sporting facilities (including playing fields, rugby fields, netball courts, an athletic track and a golf course) (# 76).

Photograph 76: Sporting facilities

7. Infrastructure, machines, and standards

7.1 Introduction: the importance of infrastructure and standards

This chapter argues – with reference to fieldwork and the waste infrastructures investigated – that waste infrastructures reflect epistemological ideas of waste (for example, conceptions of what is considered recyclable or organic materials influence technologies and processing mechanisms), and as waste-infrastructure processes materialise, it confirms their status as waste or its diversion away from the waste stream (for example, producing mixed waste organic output (or MWOO), as discussed below). As such, my argument is that waste infrastructures produce waste[65]. This argument is not new. Scholars like Tuçaltan (2020), Liboiron (2014, 2021) and Barlow (2022) have shown the links between the creation of infrastructures of disposability and the capacity to scale disposable materials, particularly in relation to plastics. As Lloyd Stouffer, editor of *Modern Packaging* magazine, infamously asserted at a 1956 meeting of the Society of the Plastics Industry in New York City: 'the future of plastics is in the trash can' (Liboiron, 2021a, p. 1). This statement is telling of the logics of waste infrastructures that allow for waste to be disposed, or materials to be recovered through processes of resource recovery. While waste materials continue to pile up at alarming rates globally, a solution-oriented mentality – that it, is it 'possible' to recover materials from waste – enables the continued production of things that are ultimately destined to become waste, due to their material excess and proliferation. This chapter, in connection to research question 2, asks:

> How do systems of classification and containment constrain and enable the ability of material to matter?

And it contributes to this discussion by thinking with infrastructure and standards as worlding apparatuses which function through the logic of classification and containment.

The chapter is grounded on the materiality of infrastructure rather than its conceptualisation. It will be argued that waste infrastructures are embedded with, and built in relation to, how

[65] In section 5.1 an argument was introduced that land was deemed a wasteland to justify settler-colonial projects, based on this claim that waste infrastructures produce waste it therefore it holds that waste infrastructure produced land as waste. Specifically, settler-colonial infrastructures produced land as waste.

waste is epistemologically understood, and it is therefore the material construction of infrastructure that reveals the framings about 'what waste is' at different scales (local government, city, state, national and global levels). Infrastructures are often valued for their replicability across scales and geographical locations; this rationale, though revealing in terms of its embedded logics of replicability, is problematic for the particulars of space, place and their material configurations (Barlow, 2022). It is often the case that waste infrastructures reveal global assumptions about waste, in particular a right to pollute by using land, water or air as a sink for waste (Barlow, 2022; Liboiron, 2021a). This chapter argues that an idea of waste, 'what waste is', creates the material of waste through the following mechanisms: infrastructure/machinery; standards and guidelines; and the creation of the city as a space of/for waste. While standards have previously been acknowledged for their world-shaping capacities (Bowker & Star, 1999; Timmermans & Epstein, 2010) the specifics and foregrounding of how standards shape waste and waste materials have been under-researched (with the significant exceptions of Lepawsky, 2018 and MacBride, 2021). This chapter focuses on the ways waste is made (in)visible through systems of classification and containment. As such, my contribution involves thinking about how the waste system and the production of waste in Sydney is created through ideas of waste embedded within standards and infrastructure.

7.2 Theorising standards

Standards are systems of classification applied uniformly across a designated area, at different scales, across cities, regions, continents, and at the global scale. They become a way of measuring performance across space and time and seek to translate difference into a predetermined level of sameness/performance. The word 'standard' originates from the mid-12th Century, and by the 14th Century it referred to a 'flag or other conspicuous object to serve as a rallying point for a military force' (*Online etymology dictionary,* 2017b). The word had come to have a secondary use inferring a 'weight, measure, or instrument by which the accuracy of others is determined' (ibid.). The link between the two uses of the word, while obscured, may have originated through the reference to the 'king's standard', which are 'the standard weights and measures... set by royal ordinance' (ibid.). The idea of a system of measurement that extended beyond the rule of a singular leader was not developed until the metric system evolved. The metric system has its basis in 18th Century France (with the French

adoption of a metre for length and a kilogram for mass), formally developing into the International System of Units (SI) in 1960 (*Britannica*, 2023). The value of this measuring system lies in its standardisation of units, including mass, length, temperature, or electrical current, which means that 'each unit has a universally recognized size.' ('Unit of measurement, n.d.). This allows for phenomena to be translated through units of measurement across space and time, and for universal systems to develop (as they require standards to be formed and operate).

As a mode of translation, standards also communicate that a level of performance has, or has not, been achieved. Based on the work of Bowker and Star (1999), *Sorting things out: classification and its consequences,* standards have six characteristics:

1. Standards produce rules to produce texts and materials. This chapter will argue that standards work in the production of waste (the bin as a standard of waste infrastructure not only contains but produces waste).
2. Standards are replicated and replicable beyond the here and now. Standards therefore have a temporal logic that extends to support or disable the use of infrastructures into the future.
3. 'Standards are deployed in making things work together over distance and heterogenous metrics' (Bowker & Star, 1999, p. 14). Standards allow waste to be conceptualised as both a global phenomenon and a highly localised and situated phenomenon.
4. Standards are enforced – namely through legal mechanisms. This chapter will look at the effects of policy changes to waste management standards at international, national, state and local government levels.
5. Standards are not always well chosen. 'There is no natural law that the best standard shall win' (ibid.). To this end, changes in waste management standards are looked at, as new ideas of 'best practice' take shape.
6. 'Standards have significant inertia and can be difficult and expensive to change' (ibid.). This chapter will look both at the fallout from China's National Sword policy (2018), which employed higher standards for the importation of waste materials, and the dismantling of the use of Mixed Waste Organic Outputs (MWOO).

Through the six characteristics of standards outlined above, it is clear that standards operate at different *scales* (see Chapter 9) to produce cohesive systems. In the case of waste and waste infrastructures, the produced system is both stable and subject to change. Standards, to a

large extent, produce waste and waste infrastructure; this is because changes to the standards that produce classifications of waste not only change *what is considered waste* (see section 7.5.2, where MWOO is not considered waste, and then is considered waste), but also *how much waste is produced* (forms of waste infrastructure such as AWT (section 7.5.2) that divert waste from landfill diminish the total amount of waste produced).

Through the act of translating differences, standards also erase differences. To compare 'apples with apples', everything must be translated into the scale and texture of an apple. For instance, in *The Economization of Life,* Michelle Murphy argues that demographic models 'offered a way to govern human population growth at massive scales and temporal distance – through intensive abstraction and the long view – such that calibrations of human worth were removed from consideration of any specific actual life' (Murphy, 2017b, p. 42). In doing so, Murphy also highlights arguments made by feminist scholars who have shown that in modelling reproduction at national and global scales, the female body becomes erased. Standards can hide the very bodies and materials they relate to, as they produce homogenised phenomena. In this manner, standards can hide the production of waste as they homogenise its accounting (as tonnes produced or tonnes are diverted, instead of taking account of what it means to manage waste and where this management is undertaken).

Standards have dictated changes in the material that is discarded over time, and also changed the infrastructural mechanisms and machinery through which the process of discarding has been achieved. The challenges posed by discards change according to the materials that are wasted, the predominant modes of waste infrastructure at the time and the places where things become discarded. A key effect of the operation of standards is the way they enable the production of infrastructure through replicability across space and time. As Wilson (2016, p. 274) states: 'Infrastructure offers a way to describe a context of governed, material systems – artificial light, parking, walled spaces, security systems, sanitation – that reveals capital flows and property regimes.' Following the material/discursive borders and boundaries of infrastructure, this chapter draws on ethnographic data gathered from fieldwork carried out within the Cleansing and Waste Services Teams of the City of Sydney (CoS) (see Chapters 3, 8 and 9). In utilising this data, it is possible to examine how the practices of cleansing and waste management within the local government area are driven by institutional policies and metrics,

which operate as instruments of standardisation. While not immediately apparent, this chapter asserts that local practice is driven by international and national events.

7.3 National waste policy and exports bans

Groundwork has recently been laid to establish principles for defining and regulating waste at a national level, as each Australian state and territory maintains different definitions of waste. Since the Federal Government's *Nation Waste Policy: Less Waste, More Resources* was published in 2009, slow progress has been made towards national policy settings and standards.[66] It is vitally important to share common understandings of waste, so that national waste statistics are transparent and consistent. A new edition of *National Waste Policy: Less Waste, More Resources* was released in 2018, and a supporting *National Waste Action Plan* followed in 2019. The *Recycling and Waste Reduction Act 2020* was then introduced in late 2020.

The most recent updates to the national waste policy (from 2018 onwards) were precipitated by the pressure posed by changes to international waste import standards in China. The effort to standardise waste reporting at a national level coincided with the implementation of the 'National Sword' policy, which was introduced as national policy in China (effective from January 2018). First introduced in 2017 – as 'Operation National Sword' – this policy was foreshadowed in 2013 when China introduced 'Operation Green Fence', which sought to reduce levels of contamination in imported recyclables. The National Sword policy set strict contamination levels for imported waste, which essentially restricted the material export of recyclables to China to fractional levels (a concern when considering the high rates of contamination of Australian recyclables).[67] Australia was heavily reliant on China as an importer of waste materials: 'Australia alone sent 1.25 million tonnes of recycled material to China in 2016-17 which is now impacted by the National Sword policy' (New South Wales Environment Protection Agency, 2018a). In the face of a serious institutional waste management dilemma, there has been an increasing public demand for an overhaul of the waste system in Australia. The key messaging coming out of the WASTE 2018 conference ('the

[66] The Hyder Consulting (2011) and Sustainable Resource Use (2012) reports were both commissioned to extend the work of the National Waste Policy: Less Waste, More Resources (2009), which called for standard definitions and classifications of waste to be shared between Australian states and territories.
[67] The National Sword 'import restrictions…exclude 99% of the recyclables that Australia previously sold to China' (Macklin & Dominish, 2018).

industry's leading waste management conference' (Impact Environmental, 2018)), which I attended in my first year as a PhD student, was that the impact of the National Sword policy on Australia represented an opportunity to change the debate and industry thinking around waste. The well-known gardening presenter and personality, Costa Georgiadis, in his keynote, spoke to ways in which this disturbance might be viewed as an opportunity. Arguing that the disturbance of the National Sword policy was 'timely' in terms of 'thinking about the currency of waste thinking', and that it was 'time to shift the dialogue', he appealed to the audience to 'put values and value on the approach' and added that 'it is not a race to the bottom'. Georgiadis ultimately called for a focus on quality and accountability, pointing towards the circular economy as an example of the much-needed change in modes of thinking.

One of the key messages of the conference was the need for a national waste strategy that would strengthen the development of local waste and resource recovery industries and manufacturing (ibid.). In line with the themes of the conference, the National Waste Policy 2018 was 'agreed by Australian Environment Ministers in December 2018' (Australian Government Department of Climate Change, Energy, the Environment and Water, 2021). The policy promoted a strategy based on the principles of the waste hierarchy and the Sustainable Development Goal 12 (Sustainable Consumption and Production), and proposed that waste management in Australia be underpinned by a 'circular economy' (CE) approach. The CE is an economic ideal, in which materials are recirculated in the economy beyond their initial point of use. As Hobson states (2016, pp. 88–89): 'Overall, the goal is to keep valuable materials in circulation through a series of systemic feedback loops between life-cycle stages, powered through resource-efficient industrial processes'. We can see here that CE is moblised at the level of the industrial (see Section 9.2 for the importance of this). Generally, this model is understood to be based on three principles: firstly, the elimination of waste; secondly, the circulation of materials within an economic accounting framework; and finally, the regeneration of nature to mitigate material extraction (The Ellen MacArthur Foundation, 2023). The 2019 National Action Plan stems from the 2018 National Waste Policy and sets six targets that seek to address pressing issues within Australian waste management. The first target is a 'Ban on export of waste plastic, paper, glass and tyres, commencing in the second half of 2020'. The *Recycling and Waste Reduction Act 2020 (No. 199*, 2020*)* was passed by both houses of the Parliament of Australia on the 8th of December 2020 (Parliament of Australia,

2023), to regulate the ban on the export of glass, plastic and tyre waste from 2021 (and paper and cardboard waste from the 1st of July 2024) (Australian Government Department of Climate Change, Energy, the Environment and Water, 2022). The act also includes legislative mechanisms to increase the use of recycled materials in Australian manufacturing.

This Act is the culmination of an aligned stakeholder push to reconstitute domestic responsibility for Australian waste, especially considering the effects of China's significant policy settings and the resulting waste crisis. The 'paradigm shift' towards national responsibility (as it has been described by some[68]) has led to the view of waste as a potential resource waiting to be reclaimed; as such, the financialisation of waste governs its management (Gregson & Forman, 2021). The evolution in attitudes towards understanding the value of waste allows for the logic of industry and capital – instead of environmental conservation – to prevail as the dominant justification for regulation and governance. Indeed, the desired effect of these policies is the speedy enhancement and proliferation of Australia's resource recovery infrastructure – despite an evident time lag between infrastructure projections, their establishment and operation.

This time lag, along with other significant factors, has resulted in little progress on the six targets set out in the National Waste Policy: Action Plan 2019 (listed below).

> 1. Ban the export of waste plastic, paper, glass and tyres, commencing in the second half of 2020
>
> 2. Reduce total waste generated in Australia by 10% per person by 2030
>
> 3. 80% average resource recovery rate from all waste streams following the waste hierarchy by 2030
>
> 4. Significantly increase the use of recycled content by governments and industry
>
> 5. Phase out problematic and unnecessary plastics by 2025
>
> 6. Halve the amount of organic waste sent to landfill by 2030
>
> 7. Make comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions (Australian Government, 2019, p. 2).

[68] See SUEZ CEO Mark Venhoek's comments in *Waste Management Review* (2019a), in which he calls for the packaging sector, Federal government and states and territories to '… *step up and show more leadership in taking responsibility for their material processing*.'

In fact, the National Waste Report 2022 shows that, relative to the targets that address proportionally enhancing waste diversion rates, limited progress has been made on target three. Meanwhile, targets two and six have seen a negative trend (see Table 3).

2 **Reduce total waste generated in Australia by 10% per person by 2030**	Estimated core waste plus ash per capita, Australia	**2016–17**	**2017–18**	**2018–19**	**2019–20**	**2020–21**	Estimated increase of 3% since 2016–17
		2.86 t	2.95 t	2.95 t	2.94 t	2.95 t	
3 **80% average resource recovery rate from all waste streams following the waste hierarchy by 2030**	Estimated resource recovery rate, Australia	**2016–17**	**2017–18**	**2018–19**	**2019–20**	**2020–21**	Estimated increase of 2.2 percentage points since 2016–17
		60.8%	62.4%	63.0%	62.7%	63.1%	
6 **Halve the amount of organic waste sent to landfill by 2030**	Estimated organic waste disposed of in landfill[17]	**2016–17**	**2017–18**	**2018–19**	**2019–20**	**2020–21**	Estimated 3% increase since 2016–17[18]
		5.73 Mt	5.59 Mt	5.60 Mt	5.51 Mt	5.89 Mt	

Table 3: Extract from National Waste Report 2022, progress against the national waste targets (Blue Environment, 2022, pp. 14–15)

There is always a time lag in waste accounting, particularly with data that needs to be collated at a national scale; for that reason, in Table 3 above, we see that the reporting only covers the period up to 2020-21. Reporting begins in 2016-17, forming the baseline data against which the targets are measured. Considering the limited reported data, current trends are not encouraging indicators of the nation's ability to meet the standards by 2030. Gayle Sloan, the Chief Executive Officer of WMRR,[69] has been critical of the National Waste Policy Action Plan. She states:

> The result is that despite having significant data at a federal level, there has been no consideration of how to meet our targets or actions informed by evidence and data available. What we do have is a list of actions that have not closed the gap to meet the goals set, a well-intentioned but not well thought through export ban, as well as a lack of market and infrastructure emphasis or co-ordination. There has also been radio silence on the federal and state/territory regulatory settings we operate by and no mention of carbon, let alone prioritising actions that would make the greatest impact. It is a linear document that in many ways continue [*sic*] to entrench business-as-usual. (Sloan, 2023)

Despite these criticisms, Sloan remains optimistic that the soon-to-be-released *National Waste Action Plan 2023* will deliver a more circular approach to material management. It is clear that changes to material flows and infrastructural systems take time, and that standards

[69] The Waste Management and Resource Recovery Association of Australia (WMRR) is 'the national peak body for the waste and resource recovery industry. Members range from large multinational corporations, SMEs, local and state governments, equipment and service providers, and individuals' (Waste Management and Resource Recovery Association of Australia, 2023a).

alone – in the form of national level targets without regulatory or practical backing – are insufficient to produce systemic changes to the waste system.

7.4 What do standards maintain and who maintains standards?

Standards set the time. Living in Sydney, Australia, I inhabit the Australian Eastern Standard Time (AEST) zone. Contrastingly, standards are multiple and create a filtered experience of the times in which we live and the spaces we inhabit. For instance, while under lockdown during the COVID-19 pandemic, sensations of time slipped away, particularly for those working from home (myself included). In April 2020, in the midst of the first Sydney lockdown, I wrote on a post-it note: 'The only marker of time these days is the once-a-week bin day noise of the trucks and the tipped material'. In this way, waste infrastructure and the standards that uphold it – the collection schedule – became for me the most grounding indication of time, when other temporal routines of life (traditionally shaped by Australian Eastern Standard Time) became less noticeable.

COVID-19 also fundamentally changed the waste production routines of society at large. As more people were spending more time at home than ever before, volumes of municipal waste increased; this trend was evident in nationally collated 2020-2021 waste data (National Waste Report 2023, xiv). The passing of time necessitates the collection of waste, as industrial excess accumulates (see chapter 9), through the ever-present production of waste. At a municipal level, with each passing day, residents consume an array of products, leaving in their wake a trail of waste. With each passing hour, street litter bins are filled and trees lose their leaves, the discards accumulating on footpaths and roadways. The photo-essays (chapter 6), though documented before COVID-19 lockdowns, are visual tools that narrate the production of waste across the city and document its collection over the course of an average shift.

There were other ways that the COVID-19 pandemic impacted the operations of Cleansing at the CoS. However, the routines of waste management thankfully remained in place. The increase in residential waste was also accompanied by an increased understanding of the importance of the work, highlighted by the spread of the virus, as matters of cleanliness became a growing concern. As a response to the pandemic, 'cleansing' as a practice became more visible, whether through the increased attention to cleansing of streets (see Figure 12), the continuous disinfecting of high-contact surfaces on public transport, or in workplaces.

Figure 12: City of Sydney Update from 9 April 2020 (City of Sydney, 2020a)

Waste collection and the ability of urban residents to rely on these services is important in times of certainty. However, the necessity of this service becomes paramount in times of crisis, as Ukeles (1969, p. 1) states and as has been noted in this thesis previously: 'The sour ball of every revolution: after the revolution who's going to pick up the garbage on Monday morning?' While the process and function of waste collection has changed over time, the essence of waste collection has remained constant and, in some ways, has increased with the volume and complexity of the materials entering the waste system. Standards often come into effect after systems become overwhelmed by new materials; this is the case with the new Flushable Products Standard (DR AS/NZS 5328:2022) that was introduced to help prevent the development of fatbergs in sewers (Water Services Association of Australia, 2022). Waste crises can be brought on by changes in international standards and can create problems of excess in new, divergent locations (see Section 4.8 on the effects of China's National Sword policy). In turn, these newly arisen issues can lead Australia to update its own waste system, infrastructure, waste diversion targets and related standards. Standards are achieved through infrastructure; however, infrastructure is also built with, and in relation to, standards.

7.5 Plant, machinery and infrastructure in the City of Sydney

The photo-essays in Chapter 6 provide a visual way to introduce the infrastructure and labour of the CoS's waste system. In this chapter, the plant introduced in the photo-essays will be reviewed and considered in terms of how these forms of infrastructure relate to standards. One way in which processes are standardised is through mechanisation and the creation of

industrial processes, which must be replicable across scales. Infrastructure and mass-produced machines are therefore underpinned by the creation of standards. Infrastructural systems have evolved with advances in technology and as system inputs have become more significant. Infrastructural systems that deal with waste are no exception. For instance, the plant used by the CoS to collect waste in the city has evolved from a horse-and-cart in the 1800s, to mechanical plant fuelled by petrol and biodiesel (at the time of fieldwork)[70] and the introduction of electrified trucks into the fleet (City of Sydney, 2020b).

Standards are put in place to scale-up processes and make them actionable across locations through a diverse array of actors. Standards fundamentally set the stakes for the management and measurement of operations, and often result in the creation of 'insiders and outsiders, bodies and materials that conform to the standard and are enabled by it, along with bodies and materials that are non-standard and are therefore dis-abled by it (Star, 1990; Anzaldua, 1987; Wilson, 2016; Lea 2020). Thinking of infrastructures as bodies that move materials through space gives rise to the premise that infrastructure is relational. In a seminal science and technologies studies article on infrastructure, Star & Ruhleder (1996, p. 112) note that 'infrastructure is something that emerges for people in practice, connected to activities and structures'. Infrastructure is a relational practice rather than a stable construct/material. As such, infrastructures are structured by modes of practice and standards; the tension between infrastructures being a relational assemblage and standardised reproducible construct is ever-present within infrastructural bodies. As Star and Ruhleder (1996, p. 122) state: 'There is no absolute center from which control and standards flow; as well, no absolute periphery (Hewitt 1986)'.

Bins as a primary form of waste collection plant and infrastructure are evocative in their form and function. They constrain and provide limits and in doing so set capacities (in a spatial sense) for the production of waste and the production of litter matter that falls or is placed beyond their capacity. Bins, in the context of this chapter, refer generally to containers or plant used for the containment or transportation of waste. Bins effectively create standards – by providing usable space, the bins' capacity and use will dictate the rhythms with which they need to be emptied and are then redeployed. The photo-essays in Chapter 6 focus on points

[70] Used to power Footways.

of transition for waste materials, from one form of infrastructural containment to the next. Each transition has its own standards that pertain to the type of materials that are placed in each residential bin: red, yellow, and green, that is, rubbish, recycling or garden organics, respectively (see Figure 13). Similarly, the collection of waste materials via the roadways, footways, link-trucks, mini-compactors and street bins (common plant utilised by the CoS) is standardised in terms of volume (plant size) and its subsequent management (waste cycles, frequency of service and infrastructural pathways).

Figure 13: Waste and recycling services (image, City of Sydney, 2023d).

The example given in the photo-essay on the footway illustrates how materials cause blockages to the performance of infrastructure. There is a symbiotic relationship between materials and infrastructure – and materials that do not fit into standardised infrastructure cause blockages to the flows of materials entering or moving within the waste system. Spending a day with Neil on the footway highlighted this point. We needed to stop the footway at various points throughout the day to open the machine and clear the vacuum system. If a piece of litter was thought sizeable enough to cause a blockage, then it was manually picked up by the machine operator. As Neil described:

> With the footway you are only picking up coffee cups, cigarette butts, leaf litter. Things like pizza boxes, anything bigger than say a dinner plate, you won't pick up in the footway because it just won't go up the chute, so you've got to hop out and pick it up.

In this example, the pizza box presents a non-standardised item that can block the flow of the infrastructure performed by the footway in two ways. The first is through the literal blockage of flow, by blocking the vacuum chute, if it goes unnoticed or is accidentally sucked into the machine through the reach of the brushes. The second way in which a pizza box can block flow is through the plant operator having to stop the vehicle, unbuckle their seat belt and manually pick up the box and then load it into the back of the footway, avoiding the size constraints posed by the chute. The second option works out quicker, in the long run, even though it blocks the flow of infrastructure by literally causing the vehicle to stop. Infrastructure is created through the development of standards that govern both the practices and materials of the infrastructural body, as well as the flows that infrastructure enables.

While infrastructures clearly underpin technology, standards become a form of sense making, a reproducible logic that enables continued process. Standards set the boundaries of a system. As a universalising metric, standards also set the logics of the infrastructures they support/uphold; in doing so, they simultaneously configure infrastructures and the flow of matter through them. Thinking with the ways in which waste is organised and understanding the maintenance work required to maintain standards are concepts relevant to this chapter. I argue that the main function of standards is to distinguish between waste and that which is not considered waste, making standards fundamental in determining the very existence of waste.

7.5.1 Standards in practice (or practising standards) within the City of Sydney

This thesis is largely set in the City of Sydney (CoS) Local Government Area. The governance boundaries of the CoS (see Figure 14) effectively draw a definitional and physical boundary around 'the city'.

Figure 14: City of Sydney Local Government Area (City of Sydney, 2013, p. 7)

This information is intended to help inform the reader of geographical references made throughout the discussion chapters, and because references to standards fundamentally relate to boundaries and the assessment of borders of land. Indeed, the concept of area as represented in cartographic terms is a standardised metric, which has become one form of account and comparison between land type, uses, sizes and their governance. The spatial

boundaries within which the CoS operates (illustrated in Figure 14) also set the scope for the council's governance targets and action plans.

The CoS is currently operating under the *Leave nothing to waste: Waste strategy and action plan 2017-2030*. The plan recognises the importance of responsible consumption and production, as outlined in the Sustainable Development Goals, and notes that '...[t]he plan has been developed for the medium to long term, in the context of the NSW Government Waste Strategy [WaRR 2014]' (City of Sydney, 2017, p. 4) setting a zero waste by 2030 target, which was established in the City's *Sustainable Sydney 2030: Community Strategic Plan* and *Environmental Action 2016–2021: Strategy and Action Plan*. Zero waste has become best practice as a standardised end-goal for local government waste standards across the globe (C40 Cities Climate Leadership Group, 2023; Zero Waste Europe, 2023). As a standard, 'Zero Waste' signifies a 90 per cent reduction in waste (City of Sydney, 2017, p. 5). Although it is not without critics (MacBride, 2012; Macklin, 2017). In particular zero waste as a goal raises critical justice questions of how these figures will be achieved (MacBride, 2012). Zero waste is an ambitious standard, particularly because waste is projected to grow significantly by 2030 – the point at which the 'zero waste' is projected to be achieved (see Figure 15).

Figure 15: A visual depiction of the three core waste streams: Municipal Solid Waste, Construction and Demolition, and Commercial and Industrial, and their projections (City of Sydney, 2017, p. 13)

Figure 15 also illustrates the different sectors which produce waste in the city; these categorisations of Municipal Solid Waste (MSW), Commercial and Industrial (C&I) waste and Construction and Demolition (C&D) waste will be detailed in section 9.3. The *Leave nothing to waste: Waste strategy and action plan 2017-2030* states that:

> The waste managed by the City represents less than 10% of the total waste generated in the local government area. That's why we provide extensive support and advice to city businesses that want to manage waste in a more sustainable way. (City of Sydney, 2017, p. 3)

The strategy and action plan sets targets for waste managed by the City (municipal waste streams), as well as waste generated in the local government area by C&I and C&D sources. In this way, the plan sets both hard and soft targets, ones that the City can control or manage and others that can only be influenced.

In 2017, the CoS published *Leave nothing to waste: Managing resources in the City of Sydney*, which set targets for operations, residents and businesses. Two targets are particularly relevant for my fieldwork with the CoS. The first is a 50 per cent diversion rate from CoS parks, streets and public places away from landfill by 2021, with an increase to 90 per cent by 2030. The second is a 70 per cent diversion rate from residential waste away from landfill by 2021, with an increase to 90 per cent by 2030 (see Table 4, below).

By June 2021

Targets for our operations:

- To divert 50% of waste from City parks, streets, and public places away from landfill
- To divert 70% of waste from City-managed properties away from landfill
- To divert 80% of construction and demolition waste, generated and managed by City operations, away from landfill.

Targets for our residents:

- To divert 70% of waste (with a minimum of 35% as source-separated recycling) away from landfill.

Targets for our businesses:

- To divert 70% of waste from operating businesses in the local government area away from landfill
- To divert 80% of waste from construction and demolition activities in the local government area away from landfill.

By June 2030

The long-term goal of the City is to reduce all waste for maximum resource recovery, so materials we use aren't just used once and then disposed of.

Many international cities have adopted zero waste targets. These are defined as greater than 90% of waste diverted from landfill[2].

Targets for our operations:

- To divert 90% of waste from City parks, streets, and public places from landfill
- To divert 90% of waste from City-managed properties from landfill
- To divert 90% of waste from construction and demolition, generated and managed by City operations, from landfill.

Targets for our residents:

- To divert 90% of waste (with a minimum of 35% as source-separated recycling) from landfill.

Targets for our businesses:

- To divert 90% of waste from operating businesses in the local government area from landfill
- To divert 90% of waste from construction and demolition activities in the local government area from landfill.

Achieving zero waste in Sydney depends on sustained advocacy to reduce the impact of product manufacture. We also need alternative technologies, such as a waste-to-energy, for any remaining waste.

Table 4: 'Our targets' (City of Sydney, 2017, p. 5)

The report uses the circular economy (see Section 7.3 for definition) as a long-term strategy to minimise and ultimately move away from the increasing volumes of waste (ibid., p. 14). It also acknowledges areas where recycling outcomes could be improved, the most significant among these being food waste in the residential bin. According to the city's statistics, this makes up 35 per cent of general red bin waste (ibid., p. 26). Based on community research conducted by the CoS, the report explains that a flexible option is needed to reduce this waste stream:

> When we asked residents about food waste and what to do about it the responses varied greatly. Some residents strongly supported a separate food waste collection but others preferred a single bin solution where the waste can be sorted after collection. (ibid., p. 26)

The significance of these findings will become more apparent in Section 7.5.2, where Alternative Waste Treatment (AWT) will be discussed. However, accommodating 'the diverse needs of the community' (ibid.) is only possible if there are two options available. Currently,

one of those options has been revoked (AWT, see Section 7.5.2), and the other is being made mandatory by the *National Waste Policy Action Plan 2019*, action 6.4, which mandated that State and Territory governments and local governments 'Deliver Food Organics and Garden Organics (FOGO) collection to households and businesses' by 2023 (Australian Government, 2019, p. 27). Interestingly, this timeline was postponed to 2030 in the *National Waste Policy Action Plan (Annexure) 2022*, due to significant and widespread inertia on progress with targets. The NSW state waste policy requires 'the separate collection of food and garden organics from all NSW households by 2030' (Department of Planning, Industry and Environment NSW, 2021, p. 25). These legislative reforms will of course impact the infrastructure required to ensure compliance.

The CoS Green Report provides yearly 71 statistics on the targets (in Table 4), in order to track progress and review highlights for both council operations and services provided. The CoS states in the report: 'We are responsible for managing the waste and recycling produced in our own buildings, from our construction and asset management projects, in the parks and public spaces that we manage, and from residential dwellings' (City of Sydney, 2022b, p. 27). As such, the report provides a detailed breakdown of waste data within the scope of the council's direct responsibilities. The data provided shows that CoS had already met and exceeded its 2025 target for parks, streets, and public places by 2021 (see Figure 16).

[71] Up until 2020 these reports were published every six months.

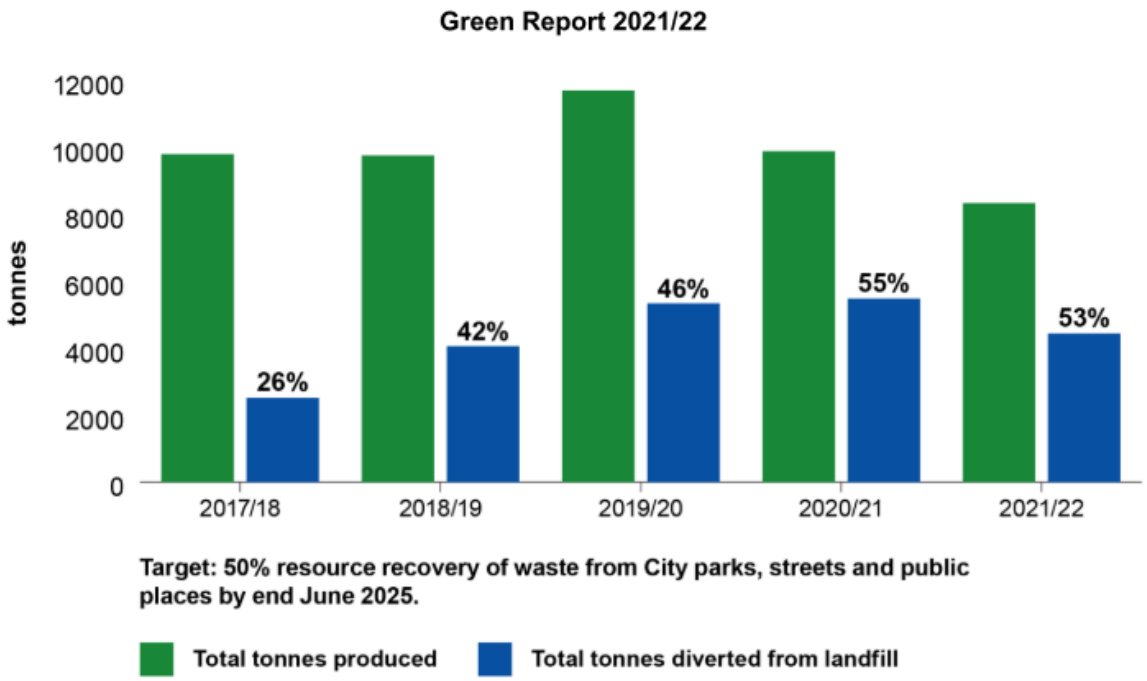


Figure 16: The Green Report 2021/22 (City of Sydney, 2022b, p. 28)

However, the CoS did not meet or exceed all targets. The council was unable to meet its 70 per cent diversion target by 2021 for residential waste. Figure 17 (below) shows that not only did the city fail to meet its reduction target, but it significantly decreased the proportion of waste diverted between 2018 and 2019. This backward trend aligns with a 2018 regulatory change made by the NSW Environmental Protection Agency (EPA), which banned the restricted use of Mixed Waste Organic Output (MWOO)[72] (see Section 7.5.1 of this chapter).

[72] MWOO was derived from the processing of organic content in the red lidded garbage bins and hence significantly aided diversion rates.

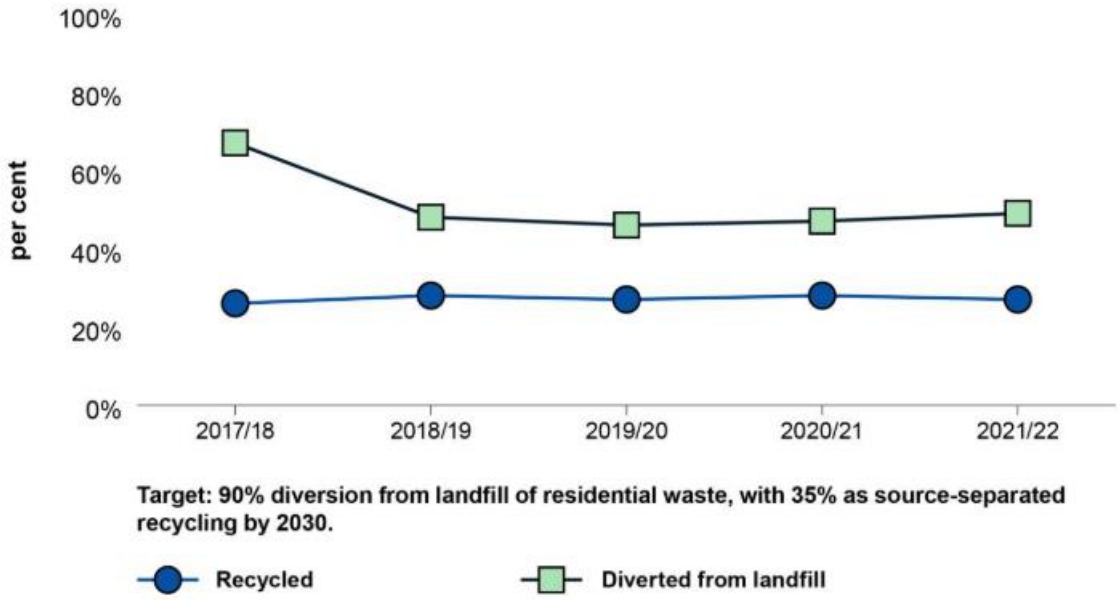


Figure 17: Target: 90% diversion from landfill of residential waste, with 35% as source-separated recycling by 2030 (The Green Report 2021/22 (City of Sydney, 2022b, p. 31).

Each target contains embedded standards, not just in terms of percentages and amounts of waste diverted from landfill, but also in terms of standardised definitions of waste. These definitions are needed to draw boundaries around waste and any resulting actions that may be undertaken to achieve a reduction in waste. The implications of this logic will be developed in Sections 7.5.2 and 7.5.3 of this chapter, with a focus on two core examples: MWOO and Waste to Energy (WtE).

Language matters when talking about waste, in particular the management of waste (MacBride, 2022). The use of terminology essentially changes the way discarded materials are considered and framed by these representations. Ukeles' *Sanitation Manifesto!* 1984 (Ukeles, 1996) and Robin Nagle's work at the New York Department of Sanitation (Nagle, 2013) were at the forefront of my mind while doing fieldwork. As a result, I framed my initial questions around sanitation, as this was the terminology used in those works. However, after asking the City of Sydney's Waste Contracts Manager how their view of Sydney has changed since they started working in sanitation, they exclaimed:

> K: In sanitation! That's an old term!
>
> E: What's the current term? Resource Management?
>
> K: Resource recovery is better, because of the intention of the City, they have a project which is *Sustainable Sydney 2030*. They're also working on extending that one now to

> 2050. But *Sustainable Sydney* has some objectives and targets that we need to achieve. And they are achievable, if we want to put some really hard work into it, and we are.

We can see here how the language that Kim suggested (resource recovery rather than sanitation) is reflective of the Sustainable Sydney 2030 document. As noted in Section 4.3, sanitation has a specific framing of progress and development that underpins the achievement of the project of modernity (Kaika, 2005). Resource recovery, however, is aligned with the urban shift towards the framing of sustainability – and how this is a driving factor for the development of standards that align with this goal and the standards in language. The ways in which material flows are described determine, in part, how they will be treated, laboured with and valued. In this way, working either in sanitation or waste management results in a unique conceptualisation of material management. The work and overarching aims of waste management differ from working in resource recovery.

Understanding the adaptability of these subtle variations in terminology (and their inferences for those labouring within the field) requires an assessment of the City's core documents and stated waste management aims. *The Sustainable Sydney 2030 Community Strategic Plan (2013)* (City of Sydney, 2013) calls for a 'Green, Global and Connected city' as a strategic pathway to a sustainable city. While there is no specific reference to waste within the ten 'Specific targets to make the City more Sustainable' (City of Sydney, 2013, p. 24), there is a reference to waste in Strategic Direction 2 (Objective 2.2 – 'A leading environmental performer'):

> **Reduce waste generation, the impact of disposal and improve resource recovery from waste across the local government area**. **City Now**: City focused on diverting residential waste from landfill. **City In 2030**: A City that sees waste from all sectors as a valuable resource. (ibid., p. 32) (bold used for emphasis)

Here, we can see the source of Kim's emphasis on the term. The control, management and diversion of waste into resources are presented as key indicators on the City's environmental performance. As such diversion becomes the standard of environmental best practice.

The 2017 update of the plan (*Sustainable Sydney 2030 Community Strategic Plan 2017-2021*) contained no direct references to waste within its ten targets. Like its previous iteration, the document contains a single reference to waste under the second strategic direction objective 2.2:

> Waste from the city is managed as a valuable resource and the environmental impacts of its generation and disposal are minimised. (City of Sydney, 2017, p. 45)

This was the guiding directive relating to waste at the time of fieldwork. The transformation of waste into a resource was not generally a part of the work experience of the Cleansing and Waste teams, as this process was not witnessed by them. Interestingly, the Food Organics (FO) Collection team regularly emptied their loaded plant at a facility especially designed to create fertiliser and energy from organic imports. All other waste was taken to mixed waste transfer stations. Insofar as this standard related to my fieldwork, Cleansing and Waste Services focused on the critical first stage – public collection, the cleansing of the City's debris and waste – rather than the transformational or processing stages. After drop-off, the responsibility for waste was transferred and effectively severed from those performing the work of collection. The separation between this work and other, less publicly visible, stages of waste management or resource recovery, speaks to the multi-layered network of waste disposal and resource recovery, that in its laying creates (in)visibilities; blind spots and situated vision (Haraway, 1988).

In 2022, the aims were expanded in *Sustainable Sydney 2030-2050 Continuing the Vision* (City of Sydney, 2022a). The term 'circular economy' is mentioned in the strategy, while the term 'resource recovery' is no longer used. Within the report, the aims of a Green, Global and Connected City are guided by six principles measured through ten targets. The second and the fourth targets are most relevant to a discussion of standardisation, waste management and resource recovery, considering the City's responsibility for managing leaf litter and various other forms of waste.

> **2. By 2050 there will be a minimum overall green cover of 40%**, including 27% tree canopy cover.[73]
>
> **4. By 2030 there will be a 15% reduction in waste generated by each person** based on 2015 level. And by **2030 there will be 90% recycling and recovery** of residential waste, commercial and industrial waste, and construction and demolition waste, which will be maintained at that level to 2050. (City of Sydney, 2022a, p. 13).

[73] It might not be immediately evident why I have highlighted target two as relevant to waste and cleansing for the city, however in section 8 it will become clear how amounts of leaf litter impact the workload of cleansing services.

Target 2 will generate more leaf litter for the Council to manage as a result of the increase in vegetation. Target 4 sets measurable standards and benchmarks, against which the City's overall progress towards the 'zero waste' goal can be assessed. Zero waste and other less ambitious resource reduction targets are premised on the operation of certain standards that allow waste to be transformed into a resource within agreed-upon parameters. The material transformation of waste into resources – and its overall efficacy or practicality – will be further explored in sections 9.3 and 9.4.

7.5.2 Standards: Turning waste into resources (and then back again)

Recovering resources from waste streams results in various categories of recovered materials, such as compost or mixed waste organic output (MWOO), as well as the development of industrially-scaled (a figuring of size rather than relations) sorting practices. In NSW, these practices are a based on a complex relationship between the classification of waste and objectives outlined within strategic policy documents, as well as the actualisation of these objectives with development of infrastructure. Over a 20-year period (ending in 2018) a growing number of local councils began diverting a significant portion of the red-lidded bin and deriving organic outputs from mixed waste (New South Wales Environment Protection Agency, 2018b).[74] The result: 'Mixed waste organic material [output] … is a soil amendment made predominantly from the organic material in household general waste (red-lid bin). It is then sold or provided for use on agricultural land, mine-site rehabilitation and plantation forests' (ibid., p. 2). The CoS was a first adopter of this technology and infrastructure:

> In 2012, the City of Sydney was among the first group of councils in Australia to send waste from general garbage bins (red bins) to a resource recovery facility. From there, food waste is separated to produce compost for mine and landfill remediation. This helped us divert 69% of waste from landfill in 2016. (City of Sydney, 2017, p. 4)

In October 2018, the NSW EPA banned the restricted use of MWOO due to concerns for 'physical contaminants' and 'potential environmental risks' (New South Wales Environment Protection Agency, 2018b, p. 2). Uncertainty from this regulatory change was still being felt by

[74] The first AWT Facility was opened in Eastern Creek in Western Sydney in 2004 (New South Wales Treasury, 2006).

local governments in late 2019, when the interview below was being conducted, with a stakeholder consultation closing in November 2019.

In late October 2019, Kim (the CoS Waste Contracts Manager) explained some of these uncertainties in our discussions:

> K: …There are some issues relating to the EPA at the moment in the processing of waste, and we are working on those with the EPA and we will see where that goes.
>
> E: Is that related to the red bins being separated and composted?
>
> K: It's the compost that comes out of the process and the quality of the compost and what it is used for, the end use. They have some concerns about that and as such until their concerns are addressed… unfortunately, what is produced has to go to landfill at the moment. So it is a significant cost that is being supported, but that's the way it is. We are hoping for a positive outcome and we expect that in the next month, once we hear the decision of the EPA we will know where we stand… Every council other than maybe three councils in the Sydney area is processing waste [in this manner]. So, it is a very important decision that we are grasping, but watch this space.

In this conversation, we see the degree to which standards and classifications can impact the flows of materials, as well as the development and dismantling of infrastructural systems. These concerns were echoed by Ross Fox, an accredited specialist in Planning and Environmental Law and Principal Lawyer at Fishburn Watson O'Brien, who elaborated on this theme in the *Waste Management Review*:

> Operators are thinking: why should I invest hundreds of thousands of dollars in a piece of equipment that can produce material up to today's specifications, when Resource Recovery Exemption legislation allows those specifications to be changed tomorrow?
>
> If the degree of risk is too great then it will discourage investment in resource recovery, which will have a negative impact on NSW meeting its resource recovery targets. (Keys, 2019)

Standards and regulatory environments provide the conditions in which infrastructures either grow or are deemed obsolete and dismantled. Sometimes infrastructures (such as AWT facilities) emerge in the context of the lack of formalised regulatory practices. For example, the application of MWOO in agricultural and urban contexts was only regulated in 2010. As Keys (2019) states:

> Specifically, EPA regulations restrict the material's use near crops harvested below the soil surface.
>
> Within those restrictions however was a Resource Recovery Exemption Order [that] allowed MWOO in some land applications under specific conditions, based on its then status as beneficial or fit-for-purpose.
>
> In a statement released at the time, then EPA Acting Chair Anissa Levy said the MWOO exemption was made on the basis that the material provided a beneficial reuse solution for waste. The revocation was made in 2018 because the material no longer met those requirements, she said.

Regulatory changes such as these are seen by the resource recovery industry as a challenge to processes of discarding, as they fundamentally re-standardise what was considered 'useful' material output as waste that has no further use. These changes disrupt resource recovery targets, result in financial losses and lead to outdated infrastructure. When I asked what challenges he faced in doing his job well, Kim answered:

> The challenges are more influences from external parties, like the EPA or the NSW government... from those that may not understand the waste and waste processing industry very well, and therefore believe that we should go down a path without really understanding that if you go down that path it will impact over there, more dramatically than what we want.

Whereas Bruce,[75] a Sydney representative of a multinational private waste operator, stated:

> Landfilling is still big – we have tried to evolve the management – moving towards Mixed Waste Organic Outputs [MWOO], but that's a perfect example of how things can just change, after having invested a lot of money and time trying to do something good. The next two years are going to be interesting – with change comes opportunity.

Alternative waste treatment (AWT) facilities – as both technology and infrastructure – turned waste into a resource through the production of MWOO. In this way, turning waste into a resource is achieved through both the discursive means of categorisation and the material transformation of general waste into MWOO through the sorting and extraction of organic materials within the general waste stream. Accordingly, 'useful' material outputs were determined to have been created through exemption standards and their related

[75] A pseudonym.

standardised applications. In practice, this resulted in the State limiting both the locations in which the product could be used and the amounts used:

> The NSW EPA began regulating the industry and imposed restrictions in 2010 around the production and land application of the material. It prescribed strict controls on how much material could be applied to agricultural land, stipulating the types of agriculture it could be used for, and applying withholding periods for agriculture products post-application. The material could be applied at a maximum rate of:
>
> • 10 tonnes per hectare for broadacre[76] agriculture (excluding keeping/breeding of poultry or pigs, food root crops, vegetables or crops where the harvested parts touch or are below the surface of the land)
>
> • 50 tonnes per hectare for non-contact agricultural use (fruit or nut trees or vines but not where fallen produce is or may be collected off the ground) or plantation forestry use
>
> • 140 tonnes per hectare for site rehabilitation at mine sites. It also prohibited its use for domestic and urban purposes. (New South Wales Environment Protection Agency 2018b)

Since revoking the general exemption order, only one site retains an exemption to use MWOO to rehabilitate land: the Woodlawn Eco Precinct managed by Veolia (see Chapter 4 Section 7 for a history of the development of Woodlawn). The Woodlawn Eco Precinct also runs a Mechanical and Biological Treatment facility that produces MWOO, or as it has been named by them, WOO (Woodlawn Organic Output). In February 2021, a trial commenced for 'the use of Woodlawn Organic Outputs in the rehabilitation of the tailings dam at the neighbouring Woodlawn Zinc Copper mine' (Rakete, Stanley & Withanage, 2021, p. 9). This practice was still in place in late 2022, with 57,622 tonnes of Sydney's MSW processed in September 2022 (Veolia, 2022).

Around the same time, the CoS began a trial focused on the management of Food Organics (FO), which functioned alongside the AWT process. For the CoS, it is important to note that compost, biosolids and MWOO are categorised as fundamentally different materials (New South Wales Environment Protection Agency, 2018c). These dual processes both function as potential ways to divert organic waste from the red-bin, with the critical distinction being that

[76] 'Broadacre in Australia is land suitable for farms practicing large-scale crop operations'. Crops include: canola, sunflowers, wheat, barley, oats, triticale, sorghum, maize, millet, lupins, chickpeas, fava beans, field peas, mung beans, soybeans, lentils, sugar cane and rice ('Broadacre' n.d.).

one creates compost or fertiliser, while the other results in MWOO. In 2019, the CoS was trialling a Food Organics (FO) collection system. The system was being run by waste services and would continue as an in-house service after waste services were outsourced (see Chapter 9 on Scale for more on this context). The FO collection trial facilitated new infrastructure: miniature maroon street-bins, kitchen caddies and food waste collection trucks. The purpose of the new infrastructure and trial was to see if the high standards required for this infrastructure could be maintained. In other words, would the contamination rate be low enough that this process could become a new standard in waste management? See Figure 18 for the material standards of this new infrastructure.

Figure 18: What to put in the maroon lid food scraps bin (City of Sydney 2023e).

At the time of fieldwork, the CoS was taking its collected food scraps to *Earthpower*, just over 20 kilometres north-west of the Sydney city centre in the suburb of Camellia. *Earthpower,* which is owned and operated by Veolia, produces both bioenergy and fertiliser pellets by processing food waste; this is achieved through the aid of 'bugs in the digester tanks' (Veolia,

2023), a process more formally known as ***anaerobic digestion***. Essentially, it is 'a biological process in which organic matter is broken down by microorganisms in the absence of oxygen' (Jarvie, 2023). The official explanatory video states:

> Our bugs are special; they will eat any kind of food waste. They quicky breakdown the material, creating biogas and sludge... they are happy and productive bugs when eating the right food. They like working hard. (Veolia, 2023)

Anaerobic biological processes such as these are common in industrial organic waste processing and separate to the ***composting process***, which is different insofar as the process utilises oxygen to enable decomposition. While there are different ways to process organic waste, the relevance of EPA-exemption standards to (AWT) facilities is that this type of infrastructure handles mixed-solid waste and, therefore, the waste stream coming into these facilities was more complex. The Veolia Woodlawn Mechanical and Biological Treatment Facility still processes 'two separate streams, including Municipal Solid Waste (MSW) and Food Organics Garden Organics (FOGO) for the production of compost' (Rakete, Stanley & Withanage, 2021, p. 9). Waste diversion is important in terms of standards, as the National Waste Plan 2019 set benchmarks for diversion standards. In particular, Target six addresses the aim to '... halve the amount of organic waste sent to landfill for disposal by 2030' (Report, 2019, p. 26). Similarly, the related action 6.4 (mentioned in Section 7.5.1) expressed an intention that all councils should have FOGO by 2023 – which, incidentally, was extended at the end of 2022 to 2030, considering only three NSW councils had met this standard (Bowring, 2022). The CoS FO collection trial ended in October 2021. The council's website states: 'Our team is evaluating the trial results to inform a wider service rollout, subject to Council approval. In the meantime, we're continuing to collect and recycle food scraps from properties that participated in the trial' (City of Sydney 2023f). Given the various policy pressures to reduce volumes of waste, it is likely that FO collection will become a standardised waste stream across the local government area in the near future.

7.5.3 Energy extraction through infrastructure: energy as standard (of extraction)

There are other means of converting waste to resources that continue to be practiced in the Sydney Region and across NSW. In particular, the embodied energy of discarded materials becomes the standard to be extracted. This was the case for the CoS's bulky waste collection, from which energy can be extracted. At the time of my fieldwork (November 2019-March

2020), the southside of the City's bulky waste was collected by CoS's Waste Services (excepting metals, whitegoods, electronics and mattresses); materials that were accepted for collection included:

- Household furniture: tables, chairs, sofas or lounges, wardrobes, bookshelves, desks, drawers, cabinets, wooden bedheads, bedframes, bed slats and cots.
- Mats and rugs: cut large rugs into 1m lengths, roll and tie them with string or tape.
- Wooden barbecues: barbecues with both wooden and metal parts.
- Garden and outdoor furniture: furniture with glass tops or panels are not accepted.
- Household bulky goods: toys, strollers, prams, baby seats, suitcases, pots and pans.
- Garden waste bundled and tied together: branches, plants, clippings. Branches shouldn't be more than 1m long or 10cm thick. We don't collect loose piles of garden waste. If you regularly put out garden clippings, order a free green lid bin to sign up for the fortnightly garden organics collection.
- Christmas trees: real and artificial – trunk shouldn't be wider than 10cm. (City of Sydney 2023g)

Bulky waste was collected by Waste Services using a compactor truck (see Photograph 52). This meant that collected material was crushed by the compactor upon collection. As he loaded items into the truck, one of the waste services employees commented: 'See those springs [indicating the springs lining a board ready to be crushed in the back of the compactor]? When I was about 18 or 19 years old, I used to make them in a factory around here' (see Photograph 77). Upon being crushed in the compactor, these materials become valuable only for their embedded energy, ceasing to reflect the energy of their creation.

Photograph 77: Bulky waste collection *fieldwork* shift.

The transformation of bulky waste into energy sits in the middle of the waste hierarchy. Of the six-tiered waste hierarchy (embedded in national, state and local government waste policy and legislation), Waste to Energy (WtE) comes after reduction, re-use and recycling, but ahead of treatment and disposal. While the previous examples show the ways in which the separation of waste streams places value on breaking down and extracting specific material resources, resource recovery through WtE uses materials for their caloric value, rather than their specific material properties. While red bin processing through WtE infrastructure has yet to become a part of the mainstream Australian waste infrastructure (although in the 20th Century, waste incineration was a prominent waste management practice in Australia, see Section 4.4), there are common ways in which energy is produced from waste. These include the harvesting and processing of methane gas from landfills to produce energy, or the engineering of fuels derived from particular waste streams.

As referred to above, furniture and bulky household items booked for collection referred to as 'bulky waste' are collected by the CoS in a compactor truck and subsequently crushed on collection. The compactor is then emptied at Veolia's Port Botany Transfer Station, located in the south-eastern Sydney suburb of Matraville. Here, the waste stream is tipped onto the

station's floor. The stream is then transported to the Cleanaway Resource Co Resource Recovery Facility (RRF) in the Western Sydney suburb of Wetherill Park. As described on Cleanaway's website:

> The facility takes dry commercial, industrial and demolition waste and residential hard waste, like timber and hard plastic, and produces process engineered fuel, or PEF. PEF is used in cement kilns to replace coal. PEF reduces reliance on fossil fuels such as coal and gas and the RRF is expected to replace more than 100,000 tonnes of coal usage per year. (Cleanaway, 2023)

The CoS Waste Contracts Manager, Kim, added:

> The processed engineered fuel – that is on-sold to, in their case [Boral] Berrima Cement, and some goes overseas, but mainly Berrima Cement, as a substitute for coal. And what they are achieving at the moment is something like 95% diversion from landfill so that's a significant and positive outcome. And plastics…have a very high calorific value and so are able to burn very well, so it's a good outcome. (K)

In these examples, energy is extracted from waste materials through infrastructural assemblages. The quantity of resources diverted from landfill and the total energy produced become the standard units of accounting, while also helping form the rationale for these infrastructural practices. These practices of energy extraction do not happen in a spatial void; indeed, their positioning matters and affects the ability of the potential energy to be thermodynamically 'put to work.'

On a tour of the SUEZ (now Cleanaway, see Section 9.6.5) Lucas Heights Resource Recovery Park in Greater Sydney, the black plastic flare-pipes protruding from the surface of a capped section of the landfill were pointed out to me by my guide (Photograph 78):

> Guide: These are just flare pipes for the methane, but very rarely do we flare anymore.
>
> Me: So that will be any methane that is unable to be captured?
>
> Guide: Yeah, if the electricity grid is full. But now that we've got new homes being put in [close to the site] it is very rare that we will have to flare.

Photograph 78: Black plastic flare-pipes at the Lucas Heights Resource Recovery Park

Next we drive past the Lucas Heights Waste to Energy Power Station which is joint initiative between EDL and SUEZ (Photograph 79). My guide tells me:

> So this is the waste power energy station; so all the methane that is currently being collected from our landfill is being placed into these engines, the engines are very similar to a train engine's as they are turning and pulling in the methane, it's like a turbine and then that creates electricity, that electricity is then sent to the local electricity grid and we can supply up to nearly 20,000 homes, just from this site, with electricity…

Photograph 79: Lucas Heights Waste to Energy Power Station, at the at the Lucas Heights Resource Recovery Park

The increasing number of new housing developments in Sydney's south-west [77] means that a higher proportion of methane can be harvested from the landfill and put to work powering homes, increasing infrastructural efficacies and decreasing the use of virgin fossil fuels.

7.6 Cost as a standard

The outcomes of waste disposal or resource recovery are enacted within a complex web of financial arrangements, where trade-offs are made between different types of services and material processing options (Gregson & Crang 2015; Gregson & Forman 2021). As Kim tells me, the high cost of waste management options is concern for the city:

> I understand that you should have sustainable outcomes and I understand that you should have good use of by-products and recycle or reuse where possible, but there is a cost, there is a significant cost to the city... look at landfilling at the moment, and I'm just giving you some examples, $240 a tonne, while if you look at processing you are up in the $300s or middle or low $300s. And that's just a commercial decision, and a sustainable outcome, and meeting our targets and what our residents also want is this outcome, so I'm happy to work within those parameters.

[77] This reference to Sydney is to the Greater Sydney Region, not the City of Sydney Council.

Kim's comments on this theme are underlined by the NSW waste levies. In 2023, at the time of writing, in NSW the Metropolitan Levy Area has increased from $58.80 in 2009-10, to $143.60 in 2019-20 (the time of Kim's comments) and the current levy of $151.60 (2022-23) (New South Wales Environment Protection Agency, 2023). Waste levies have historically been a major issue for equitable waste management in Australia; as each state and territory sets their own levies, there are differences between the figures in each jurisdiction. For example, Queensland (a state bordering NSW) only introduced a waste levy in 2019, long after the NSW levy was first applied. The regulatory discrepancy between NSW and Queensland resulted in waste from NSW being transported to the other state, in order to avoid the levy charges. As Ron Wainberg of MRA Consulting Group stated in 2019:

> The trouble with waste disposal, however, is that it tends to flow to the point of cheapest disposal. Just like water, waste flows downhill to the lowest point. This has led to unintended outcomes in recent years such as hundreds of thousands of tonnes of waste sent from Sydney to South East Queensland for landfilling. (Wainberg, 2020)

Currently, all Australian States and Territories – except for the Northern Territory (NT) – have a waste levy (see Figure 19, below). Generally, this helps to alleviate the transportation of waste across borders.

Figure 19: Australian State and Territory Waste Levies 2022-23 (Waste Management & Resource Recovery Association Australia 2023b)

With these considerations in mind, cost as a standard influences the flows of waste, both in terms of how it is processed and where it is disposed. The ability for local authorities to choose favourable standards – or rather to 'shop' for the most economical waste management standard – is of central importance, balancing the ultimate cost to the ratepayer with environmental outcomes (landfilling vs. recycling). In this simple 'dollars-and-cents' way, the management of waste is thoroughly standardised and broken down.

7.7 Conclusion

As ways of thinking about waste change through time – from sanitation to circular economy – the standards with which materials are managed change too. Standards provide one mechanism through which we can achieve waste reduction. As has been argued throughout this chapter, these standards also accord with the production of waste. Therefore, careful attention should be paid to the (in)visibilities of the production of standards that shape waste. As has been illustrated, standards are not inherently bad because they produce waste; rather, attention should be drawn to the ways in which standards produce waste as a result of their attempts to govern a complex relationship between materials and infrastructures. There is a tension between standardised waste and waste diversion rates; standards produce waste and turn waste into resources, successfully achieving diversion rates. However, these diversion rates are a potentially precarious matter of accounting, as the standards that shape material waste management are subject to change over time in unexpected ways.[78]

This chapter has foregrounded the work of standards and infrastructure in producing waste. As such, the visibility of waste is not the central purpose of this chapter. Instead, there is a focus on the system, standards, infrastructure and measurements that support the functioning of the city through their ability to both produce and transform waste. One thing is certain: materials (waste especially) and infrastructures are produced through their relationship/s with standards. It is, therefore, necessary to ask critical questions about what is being extracted or built through the standards that shape the systems of waste and waste infrastructures. In particular, this chapter has shed light on the different levels of politics, policy and accounting that impact the practices of workers in the CoS and private corporations

[78] It may not be the standards of the local area that change, but those of another jurisdiction where waste is (or was) being exported, so that can have impacts in the source location.

handling waste on a daily basis. The following core chapters will focus on centring the labour and everyday materialities of this work.

8. On situatedness: embodied and place-based understanding of working with waste

8.1 Introduction

Understanding the waste systems in Sydney is a process of understanding how the city is layered, how it recounts its own biography of waste and waste infrastructures. This chapter will think with the biography or life story of waste in Sydney. This biography tells a story of the present operations involved in cleansing the city day-to-day, focusing on the continuously present waste spaces and infrastructures that the city has needed to grow. Following waste as a techno-materiality, I look at how waste is woven into the fabric of the city, both through its historical and present-day management, thinking with the layers of time and materials that settle to form new topographies. Drawing on ethnographic work undertaken with the cleansing and waste crews of the City of Sydney, a biography of waste and the city is narrated.

This chapter sits with what it means to work with waste, and the ways in which waste becomes situated and positioned through its continued material presence, examining the ways in which the presence of materials is traced through the embodied memory of places or infrastructural remains. The notion of waste will be conceived as a material ongoingness that holds the political stakes of the past and shapes the political stakes of the future. This chapter takes a dual approach to thinking with waste by incorporating a focus on labour and work, while also focusing on memory and relations with place over time. Memory, in this sense, is understood as more-than-human, with spaces formed through the collective presence of bodies and materials over time. This chapter is approached as a biography of waste in the city, with this biography told through the presences of waste and waste infrastructure that remain both in memory and material.

8.2 Working with waste: relations and production

This section focuses on what it means to work with waste, and the ways in which waste becomes both situated and positioned through its continued material presence. This discussion is grounded on my ethnographic fieldwork with the Cleansing and Waste teams of the City of Sydney, which was done in order to understand the *presence* of waste in the city as a material ongoingness. In the English language, the noun *presence* and adjective *present*

are derived from the Latin *praesentia*, which is translated as 'being at hand'. The present participle of the derivative 'praeesse' contains within it the words 'prae' (before) and 'esse' (to be) (*Online etymology dictionary,* 2020). The word *present* therefore signifies a state that is imbued with the hierarchical and temporal implications of 'being before'.

Presence denotes an ongoingness – something that can be touched or recalled – but it also refers to the ways in which it is managed or controlled. The dual function of the word also has pertinent implications in terms of waste, in particular, waste management as a practice. Indeed, management is derived from the word 'manus' meaning hand, specifically in relation to the handling of a horse (*Online etymology dictionary*, 2021). In looking at how waste is responded to and who becomes responsible for these types of materials, I am seeking to decentre the practice of waste management as an omniscient technocratic and automated networked response, and to reposition working with waste at the scale of many hands and bodies constantly shaping material flows. As Shotwell (2016, p. 77) states:

> Attending to the present moment implies, necessarily, understanding that the present we move through – a perpetually shifting bubble-node that we cannot fully grasp but that simultaneously is the only thing we can experience – is reliquary of the past, holding traces of everything that has happened and everything that has been erased.

Presence, in this way, will be 'thought with' as an acknowledgement of what came before. These continuing legacies ultimately become waste materials. The notion of waste is conceived as a material ongoingness that holds the political stakes of the past and shapes the future ones.

Hands are essential to working with waste. While the scale of waste management is enabled through mechanical infrastructure such as the mini compactor (Chapter 6) or the roadway (Chapter 6) hands and bodies are essential to this work. Though aided by mechanics, it is not automated work. During my first day of fieldwork, I was given an induction equivalent to that given to an agency labour hire.[79] Along with being given site inductions at the Alexandria and Bay Street Depots, I was trained in manual broom handling, as well as the handling and disposal of needles and syringes. An entry level position as a cleansing officer is referred to by

[79] At the time of my fieldwork there was a labour hire freeze and with additional labour hires being contracted out to four job service agencies. New agency labour hires were made to fill labour shortages for New Years Eve 2019 as this is the biggest night for cleansing and waste management in the City of Sydney.

the code ‘CS1’ (equivalent to my induction level). CS1’s work on the street as manual sweepers. Broom handlers do the tricky manoeuvring of ‘pushing out’ leaves that would otherwise get trapped behind parked cars. Sweepers may work in teams, performing what is known as ‘gang sweeping’ (preparing the roads for the approach of the roadway), or on solo shifts in which they might ‘bag-and-drop’ the sweepings on street corners for later collection by a response truck.

Sweeping (the practice of manual broom handling), is arduous and dusty work. My first morning of gang sweeping left my hands tender from the texture and motion of the broom, despite wearing gloves. Resnick (2021, pp. 222, 230) speaks to her research street sweeping with ‘Romani waste laborers in urban Bulgaria’ and her ‘blistering hands’, and the advice from her fellow workers that she would ‘get used to it’. Later she explains; ‘When they focus on ‘getting used to it,’ they are not referring to acts of individual will but a practice of communal solidarity and constant, ongoing labor’. While employment conditions and practices in Sydney differ from those experienced by Romani street sweepers in Bulgaria, there are similarities in the ongoing labour of human bodies. The ongoing labour of the sweepers and the roadway is also a collective practice – an assemblage between the labour of human bodies, technologies and fossil fuel energy inputs.

Sweeping in its essence is a relational act. Sweeping involves partnerships between tools, hands and weather. Sweeping is a practice (that of cleansing), rather than a categorisation. A swept area does not necessarily become clean as opposed to dirty; instead, it becomes cleaner in the process of being cleaned. This idea was made explicit through the work of the Cleansing staff and how I was instructed to go about this work. Though it was important that the streets were swept and the leaf litter cleared, removing every leaf was deemed both unnecessary and impossible. In windy weather, the mantra ‘don’t look back’ is necessary because the wind will quicky scatter the piles of sweepings[80] moved out onto the street for collection by the roadway. ‘Don’t look back’ provides a meaningful insight into the ethos of this work. The process of cleaning is continuous; this is maintenance work that is constantly

[80] It is mainly dropped organic material from trees that is collected by the roadway. However, takeaway coffee cups and other forms of litter are also collected. Size matters here – if the bark, sticks or litter (for instance, a pizza box) is wider than the (basketball sized) suction tube of the roadway, they will become stuck and form a blockage. Therefore, sweepers need to be on the lookout for larger items and break them up by hand, if possible. Otherwise, they will move items such as large palm branches off the road and flag them for collection by a response truck.

being undone and in need of being re-done because of the livingness of the city. Each day provides both challenges and opportunities for the labour of Cleansing, as Neil, a cleansing staff member, describes:

> When it's rainy weather, sometimes if you're a sweeper it's good because after it's rained it looks clean, so it helps you. When you are on a machine, the footway, it doesn't pick up quite as well so it doesn't really help you. If it's windy, it's a waste of time, because it's just blowing everywhere, and it doesn't even look like you've done anything. And the heat, obviously it is only a small machine [the footway] so it warms up quite quick, the temperatures can get up to about 54 degrees inside that cabin.

In this context, fieldwork was conducted in summer, at the peak of a drought and at a time when smoky days from the 2019-2020 record-breaking bushfire season cloaked Sydney: see Photograph 26 in Chapter 6 (NSW Department of Planning and Environment, 2021; see McManus, 2021). The ambient environment was not just affective, as it induced sweating bodies inhaling dry air laced with smoke and dirt, but as a setting it also transformed the work of cleaning the city. As part of a stress response to an extended dry period, the city's trees were dropping leaves at a time out of sync with the known trajectory of the seasonal response. This arboreal response to drastic environmental conditions was noticed in the work of the city's cleansing staff, those responsible for cleaning the discards of the city. Neil commented that:

> …with the drought, it's a lot dirtier in the streets. You would normally finish at the end of Autumn and you get that little bit of a break, but the last couple of years, because there is no rain, it is getting very leafy.

As people who maintain outdoor paved or concreted areas near trees know, 'it is getting very leafy' means work, it means sweeping and then sweeping again, the continuous and ongoing work of cleaning up.[81]

Even without periods of historically affecting drought, the city's trees provide continuous work for the cleansing teams. One participant told me '... it's seasonal with illegal dumps,[82] it depends on the time of the year. Leaves are obviously seasonal. Like I said earlier, there's pollen season, bark season and anything else in between, so there is always something to do.' Weather patterns that bring rain, wind and storms also make a difference to the work of

[81] As a soundtrack, try Parquet Courts' 2016 song 'Dust', from their album *Human Performance*.
[82] Illegal dumps are bulky waste put out for collection without a booked pickup.

keeping the city clean. Waste is literally weathered into existence through the distribution of organic matter into the streets. Essentially, Sydney's waste flows are not disconnected from the particularities of the local climate. In cleaning the concrete roads and paths, the cleansing and waste teams also allow the city to drain, enabling the passage of stormwater through functional sewers. In this way their work enables weather to flow through the city.

Weather and its cumulative derivative climate are illustrated by Liboiron (2021, p. 30); Neimanis and Walker (2014); Neimanis and Hamilton (2018) and Verlie (2022) as atmospheres through which we can attune to our situatedness. This connectedness may keep us grounded in these relations, even though they can cause us inconvenience and trouble. Attuning involves embodied relations with – and exposures to – place (Shapiro, 2015; Zhang, 2020). Weather provides opportunities for interaction; each season brings with it change and there is always something to do. But as weather patterns change and atmospheres dynamically shift, so too may our bodily relations with waste and its management.

The production of the city is never removed from nature. As David Harvey (1993, p. 28) notes, 'there… is nothing unnatural about New York City and sustaining such an ecosystem even in transition entails an inevitable compromise with the forms of social organisation and social relations which produced it'. Harvey terms urbanisation as a 'created ecosystem', a process created through a socio-natural metabolism (ibid.). Cities are not produced by erasing 'nature'. Just as the process of production does not render the 'natural' 'unnatural', cities are entwined socio-natural phenomena, always grounded in specific land/Land relations (Liboiron, 2021a) (and see Chapter 3) – in the case of the City of Sydney relations with Gadigal Land. In the work of cleaning the city, the cleansing team responds to the city as a socio-natural metabolism. In this sense, what is cleansed does not function or appear outside the 'natural' environment; rather it is a condition of it, just as those who labour to clean the city understand their work as inextricably connected to the city as an 'environment'.

8.3 Working with waste: distinctions

My fieldwork was conducted with both Cleansing and Waste services, which were differently responsible for the discards of the City, although workspaces, equipment and even staff might be shared between the two services. Cleansing covers the cleaning of public roadways and footpaths across the city; this entails all things from street sweeping to the operation of plant

such as roadways, footways, and steam plants. Aside from the roads and footpaths, cleansing also uses mini garbage compactors to service the public street bins positioned around the city. Waste Services serviced the household red bins and bulky waste collection in the south side of the city until 1st April 2020 (more on the specifics of this in chapter 9: see 9.6). Cleansing continues to operate in-house and runs FO collection services.

The relationship between these two services, however, was not even; there was a hierarchy between the operations of Cleansing and Waste which was described to me as coming from Waste Services as having a 'start point and end point', that is, bins and booked pickups needed to be emptied/collected, while with cleansing it is 'how long is a piece of string', it is a job which is never finished. Because of the distinction in their tasks, cleansing was required to 'back up' waste if additional staff or equipment was required. Because waste services have discrete tasks to complete by the end of shift, if a contractor finishes a six-hour shift with waste services they can opt to work eight hours by completing two additional hours with the cleansing team. At the time of my fieldwork, contractors generally start as a CS1 and may perform other roles if they receive additional training. The distinctions between the tasks of cleansing and waste are also fundamentally different in terms of how they relate to materials. Cleansing performs the task of gathering and collecting the city's debris, while waste services handle/manage materials that have already been classified as waste (except for cleansing servicing the City's street litter bins). Ultimately these materials end up at similar destinations, if not at the same transfer stations, with the differences between these labours of collection becoming erased in the process.

What allows waste services to have a 'start point and an end point' is the containment of waste within a bin; a specific volume of material is categorised by the bin for collection. However, insofar as the work of cleansing is based around manual or mechanical sweeping, the focus remains on the process of cleansing (that is the process of material collection) rather than waste management (the movement of material collected together within a container which marks the designation as 'waste'). Sweeping is defined as 'clean (an area) by brushing away dirt or litter' (Soanes & Stevenson, 2006, p. 1454). It is worth noting here that the process of sweeping does not create waste. Sweeping creates sweepings, that which has been swept into a collective pile. In this way the process marks the material, but the material is not yet transformed into waste. It is not until the sweepings enter the waste stream that they

might be described as waste. Cleansing does perform discrete tasks in which waste is managed; the service of street litter bin collection sits within the operations of cleansing, as does the transfer of the link bins, whereas the roadways and footways empty into link bins at the depots, which are subsequently emptied at privately-owned waste transfer stations. As it happens the discreteness of both tasks arises from the material being placed within a container, although both tasks are more responsive than the standardised and scheduled collection of household red bins, insofar as both street litter bins and link bins may be emptied continuously over the course of the day.

8.4 How do waste relations maintain the city?

The work of waste collection is continuous. Waste infrastructure needs constant maintenance in order not to spill beyond forms of temporary containment. Being driven around central Sydney on an afternoon in December 2019, in a Mini Compactor shift collecting street bins, the words of Mierle Laderman Ukeles kept cycling in my head: 'Maintenance is a drag; it takes all the fucking time (lit.)'. The day was dry, sticky and smoky, and the traffic tiring. Congestion meant that the infrastructural flow was slowed to a crawl, dragging out the task at hand. After a 6pm dinner break back at the depot, the exhaustion of the day's heat still lingered. The repetitiveness of our actions became clear as we retraced routes to re-empty overflowing bins, already brimming despite being emptied only hours before. Reflecting on this work, I was told by a cleansing employee that: 'George Street is like the Harbour Bridge – you finish painting it and start again.' The work is in doing something and then doing it again. The work is never done, though every shift ends. In that, there is some point of boundary, of satisfaction, of completeness. But every day, this 'doing' in repetition accumulates in the worked-upon bodies: dust accumulates in lungs, limbs are sore, knees are worn down by repetitive action, especially climbing in and out of the truck.[83]

Maintenance requires several skills, principle amongst which is patience. An ability to work within and adapt to an unpredictable system of traffic and pedestrians requires attentiveness

[83] At the time of fieldwork, the steps had been taken off the back of the compactor due to work health and safety concerns. The steps were used by the runners to stand on the back of the compactor as the truck moved between pick-ups. The removal of the steps meant that the runners (the two personnel that tip the bins into the compactor) had to climb in and out of the truck more often. The cabin of the truck is quite high; even my body could feel the strain on my knees after a day on-shift, following the runners as they climbed in and out of the other compactor.

to sudden changes. As Sean, the driver of a Mini Compactor, told me matter-of-factly upon getting cut off by a driver: 'You practically have to drive for other people'. While the city can be a place of churn and rush, it is paramount that the people servicing its systems keep going at a steady rate that allows for attention to be paid to the safety of themselves and those around them. In the case of the Mini Compactor, this is true for both the driver and the runner responsible for emptying the bins. Carr (2017, p. 644) defines maintenance as 'an ongoing process of adjustment that inherently looks to the future (what needs to be done so that disruption can be minimised)'. This definition comes to life through the experience of Cleansing and Waste workers negotiating the city. Their work is temporally bound; while never-ending, it must be performed within specific times so that the disruption of waste can be minimised.

Though maintenance work can be monotonous, it is also of the upmost importance in terms of keeping the city clean and because of the essential value of work. Speaking about smart bins and moves towards automation, Sean tells me: 'I feel for a future when these jobs aren't there.' The value of this work is important both for the city and for the workers themselves. The staff across the shifts I participated in reinforced the value of working for Waste and Cleansing. The work was appreciated as a secure stream of income (for those fortunate enough to be employed through the council rather than a labour hire agency),[84] and for the freedom it provided; so long as the day's run was done safely, there is autonomy regarding how the shift is performed. For many, spending time outdoors and in the city was the reason they enjoyed the work.

For the workers in Cleansing and Waste, paying attention to the geography of the city and its changing terrain is important in order to 'keep up with the changes of a constantly moving city' (Sean), where a street might be inaccessible and thereby force a different route. In this way, it is necessary that the workers attune to the city as a space, which is not always a pleasant experience. At one point after emptying a bin, Aaron climbed into the truck exclaiming that the 'bin juice is rank'; his shoes had just copped a hit. Aaron explained that when the open street bins were first installed, they filled with rain and would be very heavy

[84] This is framed as a matter of concern for the employee, but it should also be a matter of concern for the residents of the city. Relationships built with place, space and people over time matter – the importance of this is spoken about by Flanagan (2019) in relation to the social work that long-term employed school cleaners perform alongside their practices of cleansing.

to tip. This resulted in bins being drained in the gutter and then the workers picking up the resulting waste overflow. In response to these problems, holes were drilled in the bins. Now, a splashing of bin juice had become a common occurrence for the runners, as the holes allow for inadvertent leakage from the base of the bin. Both the weather and the materiality of waste come to matter in different ways. Attunement with the city has its highlights, as a kid waves to Sean in the truck. Waving back, he says to me, 'Now this is what I love'. Upon returning to the truck with our takeaway dinner, Aaron and I find Sean with a captive audience, showing a little boy and his mother how the button to scoop the truck's tray works. There are so many ways in which Aaron and Sean's work is essential reproductive work, an indispensable part of the fabric of the city, shaping possibilities for us all. This maintenance work is responsive and co-creative, work that responds to the city and, in doing so, shapes its form and function. It is also evocative to the imagination of children, appealing to them with the performative aspects of producing space, with its large-scale mechanics of movement, sight and sound.

Thinking of waste management as a form of reproductive labour is inspired by the work of feminist scholars Mierle Laderman Ukeles (1969), Frances Flanagan (2017) and Astrid Lorange (2020). Their work reveals how waste work can be understood across both domestic and industrial scales as an extension and form of reproductive labour. As Lorange (2020, pp. 50, 52) states in the poem *Labour*:

As we already know, the question of production
is also always a question of reproduction: how
the worker is made and remade daily and how
the worker is made and remade generationally
and how the worker is made and remade
structurally.

This makes the word 'labour' especially potent, since
it must account not just for the activity of work, but
also the potential of a body to work and therefore
that body's value in a given market; it also must
account for the collaborative processes of birthing and
being born, the very process of becoming a body
at all.
…

And so: it is not just the category of work, the figure
of the worker, and the power of the strike that must expand
to include the raced and sexed labour easily obscured by
economic theory; the history of labour itself – a history of
the colony, the factory, the nation-state, the city, the family,
the possession; a history of agitation, rebellion, revenge, survival,
hope, collectivity; a history of birth, death and trade; a history
of kinship, maternity and lost relations – must also be recognised
in its fullness.

Thinking with waste relations through a feminist lens highlights the many ways in which labour and work *produce* the city, giving meaning to the relational spheres in which it is embedded and which are embedded in it; 'the colony, the factory, the nation-state… the family, the possession' (Lorange, 2020, p. 52). This framing illustrates how the product of the 'clean' city must constantly be reproduced through ongoing acts of maintenance. If the city is reproduced over and over through the means of cleansing and removal, then it is clear that the very essence of the city – in both its form and function is continuously laboured into being. The city needs constant maintenance. In its most basic form, this work is performed through the actions of collection and emptying. It is the kind of mundane and monotonous work that is focused on repetition and retracing. There are no short cuts for this work; the city takes time to maintain. This maintenance is facilitated by bodies and the infrastructures they uphold. Flows of waste maintain ease of movement and freedom for some; for others, their movements are tied in relation to waste, to maintaining its flow and bearing the weight. The city upholds infrastructures of disposability to keep public spaces clean. Working with waste is not the work of development, and yet it fundamentally underpins this drive. The streets are cleaned, but the waste flows, clogging up the infrastructure. These blockages can only be overcome through acts of maintenance and the performance of cleansing. Infrastructural systems are put in place lest the city be overcome by its own production.

In addition to a story of the present operations of cleansing the city day-to-day, the following section will focus on the continuously present waste spaces and infrastructures that the city needed to grow.

8.5 Situating a Biography around sites of waste in the city

Focusing on the site of the Bay Street Depot, we can think with the city's waste places, waste infrastructure and those who labour with waste (and their memories over time). The Bay Street Depot has been owned and run by the City of Sydney since the early 1900s. Since this time, the site has been used to manage waste, allowing for the city to function without blockage by its own debris. The depot has also long been a site of shelter and storage for the plant that enables and extends the capacities of human labour to pick up and collect the city's debris.[85] The Bay Street Depot was originally built as a stable to house the city's horses, then utilised as the first mechanised assemblage; the horse and cart enabled the city's waste collection. To this day, the stables remain as a key structure on this site, repurposed and retrofitted as offices, storerooms and a breakroom.

The city has become *in relation* to the Bay Street Depot[86]. During fieldwork with the 'Cleansing Services' staff at the Bay Street Depot, the significance and layered history of the Bay Street Depot became clear. While most staff members are relatively new to the job, there remain a few long-term employees who remember and offer a living memory of the history of the site. As part of my fieldwork, I spent some time riding along in a Link Truck[87] with John, a cleansing services officer who has worked for the city since he was 20 years old. John was first based at the Bay Street Depot when he started working for the city in 1978.[88]

John's memory of the depot extends beyond his working years, back into his childhood. Growing up in the inner-west suburb of Camperdown, he remembers coming to the Bay Street depot as a child and feeding apples to the workhorses. He explained how the horses were trained to know the pickup routes, including where to stop along the way. He remembers that

[85] This is not just the excess discarded from the city's people, but also the excess that is discarded from the plant and animal life that inhabits the city. Leaves, bark and pollen (depending on the time of year) all form a major part of the waste stream managed and cleared by the cleansing staff.

[86] It is worth acknowledging that the Bay Street Depot has also become in relation to the city. Urban growth and City of Sydney boundaries have influenced the siting, construction, etc. of the depot. Changes in technology mean that the horse ring is now archaic while the layout of the site has evolved to account for plant, staff parking for cars, new workplace health and safety laws, etc.

[87] The Link bins are essentially giant skip bins that are used to empty waste collection plant, like Footways and Roadways (Mini-Compactors, commonly known as 'garbage trucks', are emptied directly at transfer stations). The Link Truck is then used to transport the Link bins to waste transfer stations (then) operated by Veolia and SUEZ.

[88] This was just a short time after the February 1978 Hilton Bombing on Pitt Street, in which two waste services employees of the City of Sydney and a policeman were killed after a bomb placed in a garbage bin was collected and compacted, causing it to explode.

each horse on the route would have newspaper tied around its legs to keep them clean throughout the route. With the horses trained to navigate the city, the labourers were free to follow the cart, picking up and tipping the city's waste. It is a patient, echoing illustration of how labour, in particular waste labour, is and was a more-than-human endeavour. This assertion matters in recognising other-then-human bodies are part of the accomplishment of waste management and of living with waste and its legacies.

John's vision of the city is overlaid with a detailed knowledge and understanding of waste places. On a Link Truck run to tip street sweepings at the Botany Transfer Station, he points out to the Botany Golf Course. 'This used to be a tip,' he says, '…as did the Cronulla Oval.' Just before we reach the transfer station, John draws my attention to the site of an old tip, now a horse paddock, sitting inconspicuously on the corner of Bunnerong Road and Botany Road. On the way back to the depot, we pass the Green Square developments and John indicates the space where the 'Zetland Monster' (also known as the Waterloo Incinerator) once stood (see Chapter 4.4). Sites of waste and waste management spread out through the city; these sites live in the memories of the labourers and residents, but also in the memory of grounds, soils, waters. Bodies, human and more-than-human, are engaged with the process of making, keeping, maintaining the city. While the historical materialities and biographies of waste may become invisible, escaping the present moment of vision, they remain caught up in these bodies in externally imperceivable ways.

Upon returning to the depot, John shows me the ring still bolted into the wall of the old stables (Photograph 80). The work horses were once harnessed using this ring. The infrastructural legacies of these sites remain wrought in the structure of the site, even though they are not commonly understood in terms of their function. The ring no longer served a purpose, though its presence persists, signifying a past function as a holding to which horses were tied. When I mentioned it to another staff member, they were surprised to learn why it was there.

Photograph 80: The old stables – now storage rooms. Under the NO STOPPING sign, a small steel-bolted ring is visible. It is not the focus of the picture, as indeed at the time it was not the focus of my attention. I was not responsive to it, though its presence persists.

John's knowledge of this space runs deep, his memory is place-based and embodied, gained through becoming part of the city's waste infrastructure over many years; he's seen these places evolve and their histories forgotten. However, as Ukeles (1984, p. 64) so aptly reminds us: 'We are, all of us whether we desire it or not, in relation to Sanitation, implicated, dependent – if we want the City, and ourselves, to last more than a few days.'

These places matter because, in coming to know them, we can understand what it means to attend to the present in all its iterations. By looking at sites of response and responsibility that enable the city to function (like the Bay Street Depot), we can come to appreciate the infrastructural effort of embodied labour required to respond to the city and keep it clean. This work and effort will remain materially and in memory as it is traced into sites of infrastructure and the bodies and minds of the workers. The steel ring shows how processes of removal and forgetting are never complete, speaking to the ways in which a layered history of materials, labour and horse and human lives can be signified by such an object. Through his narration, John renders me *response-able* to the waste histories of our city.

8.6 Conclusion: situatedness and the body

This chapter sits with the multiple embodied forms of working with waste. Embodiment has been understood through labour, how this work leaves trace-memories and through the exhaustion of hands, arms, ligaments, and bones. The work of the labourer is aided through the technologies of infrastructure: brooms, bins, trucks and carts. This work is always in progress, it is never finished and must be performed continuously. As seasons change, so too do the demands of the work. In this way, time becomes a significant factor when considering the work, while the work remains steady. The ongoingness of cleansing and the management of waste provide ways of attuning to place. Through that attunement, we might be rendered capable[89] of translating the material signatures that speak to the layered histories of place over time, after their context – and therefore their significance – has long since faded. In moving beyond metrics of accounting for waste simply as tonnes removed or managed, it is important to acknowledge the cleansing of the city and its waste management as a collaborative act, a coalition of labour that fundamentally produces the city. As ways of interacting and thinking about waste change through time (from sanitation to circular economy), the bodies that remain in contact with waste and in charge of cleansing have a permanence in the city.

[89] 'Who would render whom capable of what?' (Haraway, 2016, p. 22).

9. Becoming Waste and Becoming Industrial (Scale)

9.1. Introduction

As a geographer researching and organising for social change, Amanda Tattersall reminds us that scale is a word wrought with ambiguities, that is used in fundamentally different ways by different groups of people (Tattersall, 2022). For human geographers and discard studies scholars, scale is a relational concept (Massey, 2005; Liboiron & Lepawsky 2022), unlike the use of scale in economic terms, which speaks to the scalability of processes and capital through vertically integrated businesses (*Waste Management Review*, 2019b). The proliferation of scalability as a business tactic means that scale is commonly associated with becoming larger in size, possibly through vertical integration, but also through the integration of multiple services, across sectors, and quite often across boundaries. This practice is common in the waste and resource recovery business, where large companies secure multiple waste flow points across a system, such as collection contracts with businesses or local councils, MRF, and landfills/resource recovery centres. This chapter will work through some of the tensions in the use of the concept of scale, particularly at the seams of the relation between scale and scalability, and show how the two perspectives of scale are pertinent to understanding and theorising waste.

9.2 Industrial responsibility: a matter of scale

The argument in previous chapters (Chapters 5 and 8) on situatedness suggested that *wasting is a material engagement that produces space.* This proposition is inspired by geographer Doreen Massey's theory of 'practised space', defined as: '… its relational construction; its production through practices of material engagement' (Massey, 2005, p. 61). This chapter extends this proposition to look at how the production of waste is fundamentally entangled with matters of scale. As Liboiron and Lepawsky (2022, pp. 45–46) argue:

> One of many ways to understand the history and scholarship of discard studies is as a dedication to questions of scale. Discard studies researchers often ask what the important relationships and processes are that make up a waste phenomenon. We also spend a lot of time solving, debunking, or demythologizing common scalar mismatches.

Scalar mismatches occur when the scale of the solution to the problems of waste does not align with the scale of the problem. In a general sense, this often occurs when a systematic problem such as plastic pollution is individualised, so that the individual becomes the good or bad actor depending on the use/refusal or disposal/recycling of single use plastics – while issues of production are not addressed (see Section 9.3). This chapter will focus on the scale created through industrial processes as it relates to municipal waste streams. Industrial processes create a scale of multiples and mass that is evoked in the photographs of Canadian Edward Burtynsky, who is famous for his large-scale industrial landscape photographs.[90] For example, his series *Oil* documents industrial-scaled processes moving from the extraction of oil in Belridge, California, through to its refinement in Houston, Texas. Burtynsky asks the viewer to look at the ways that oil configures the urban environment, enables the automobile and aeronautical industry and the infrastructure on which these industries rely. His work also addresses the waste and ruins that are produced over time, due to the scale of these processes (Figure 20).

Figure 20: Oxford Tire Pile #1 Westley, California, USA, 1999 Edward Burtynsky.

[90] It is worth noting that Crang (2010) has critiqued the work of Burtynsky for his aestheticisation of the 'industrial sublime' and its erasure of the 'material and labour worlds of global capital' (Crang, 2010, p. 1084).

Reflecting on this photography series, Burtynsky added:

> When I first started photographing industry it was out of a sense of awe at what we as a species were up to. Our achievements became a source of infinite possibilities. But time goes on, and that flush of wonder began to turn. The car that I drove cross-country began to represent not only freedom, but also something much more conflicted. I began to think about oil itself: as both the source of energy that makes everything possible, and as a source of dread, for its ongoing endangerment of our habitat. (Burtynsky, 2023)

What relationships matter at the scale of municipal waste collection and processing? This is especially so as waste returns to become an industrial phenomenon, or indeed was never anything other than industrial (Liboiron, 2013a). The scaling up of materials to be managed through industrial level processes (re)creates the object of waste and the responsibilities that come with it. Industrial processes are made through modes of (dis)assembling objects *en masse*. It is the logistics and practice of collection, the disposal and transformation of matter at scale, that makes the waste industry 'industrial'.

Waste production has become a scaled problem, with the Circularity Gap Report 2020 – an initiative that delivers an annual metric that measures global economy and the key levers to transition to circularity (Circle Economy, 2023) – tracking global throughputs of materials (minerals, ores, fossil fuels and biomass) as reaching a new annual high of 100 billion tonnes (Wit, Hoogzaad & Daniels, 2020). Of this figure, 92 billion tonnes is virgin extracted material comprised of minerals, ores, fossil fuels and biomass (based on 2017 data), while only 8.6 billion tonnes of this input came from 'cycled resources'(ibid., p. 18). At the back-end of this accounting (depicted in Figure 21, below), 32.6 billion tonnes of the 100.6 billon tonnes of inputs will be categorised as waste through its 'end-of-use' stage; of this waste, only 8.6 billion tonnes will become 'cycled resources' and re-enter the global materials economy (ibid., p. 19).

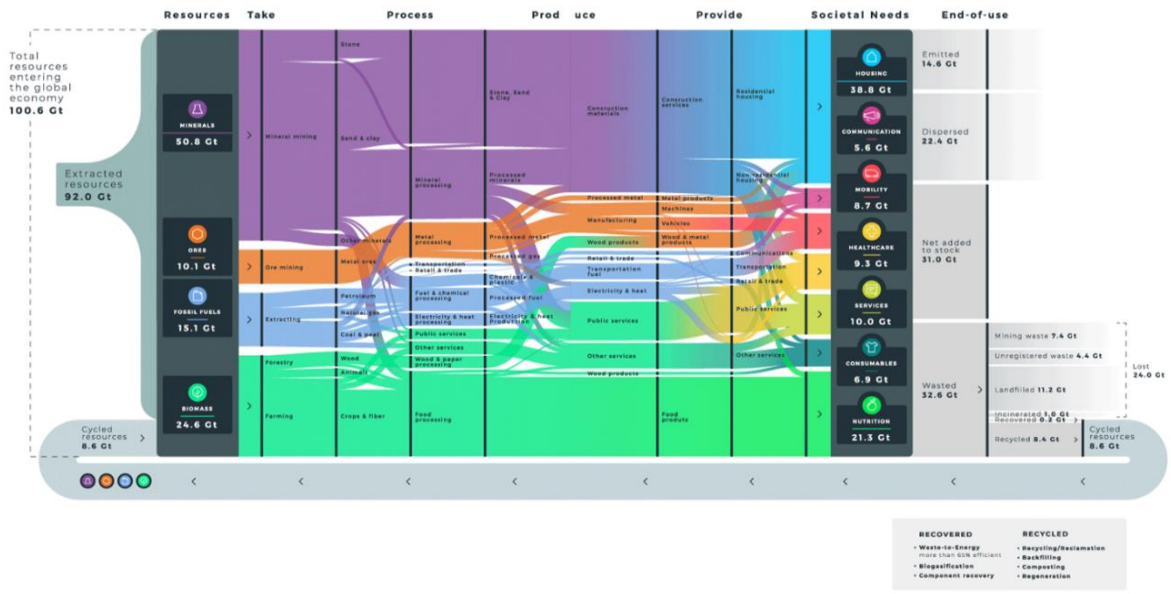


Figure 21: The global material footprint behind satisfying key societal needs (Wit, Hoogzaad & Daniels, 2020., pp. 18–19).

This report is premised on the need for a global circular economy (CE) model. Three years later, the report tracks the widening gap, with cycle resources only accounting for 7.16 billion tonnes of material throughput (Fraser, Haigh & Soria, 2023, p. 20). The idea of the CE has gained traction in the UK and Europe. This prevalence was born of the policy direction for CE established by the EU in 2014, which culminated in the publication of the 2015 European Union's Circular Economy Action Plan (Friant, Vermenulen & Salomone, 2021). Despite good intentions, the effective translation of words into actions has been questioned by scholars (Ibid). In Australia, the CE discourse is relatively new (2018) and largely operationalised in relation to waste management and resource recovery (Australian Government, 2018). NSW states that the motivation for the CE-focused policy is that:

> Current patterns of resource use in NSW are no longer sustainable and current resource recovery policies and technologies are no longer fit for purpose. This impacts businesses, household, the environment and human health, State and Local Government and the NSW economy. These impacts have been compounded by China's National Sword policy. (State of NSW and NSW EPA, 2018, p. 2)

Despite a growing rhetoric on the circular economy and an international governmental policy push in this direction, 'The Circularity Report Gap 2020' begins with the assertion that:

> Today, the global economy is only 8.6% circular — just two years ago it was 9.1%. There are reasons for this negative trend, but the result remains the same: the news is not just bad, it is worse. This negative trend can be explained by three key related,

> underlying trends: high rates of extraction; ongoing stock build-up; and, increasing (but still low) levels of end-of-use processing and cycling. These underlying trends are deeply embedded within the 'take-make-waste' tradition of the linear economy — the problems are hardwired. As such, the outlook for closing the circularity gap looks bleak under the dead hand of business as usual. We desperately need transformative and correctional solutions; change is a must. (Wit, Hoogzaad & Daniels, 2020, p. 15)

The report situates this linear material use as a practice that emerged as recently as 200 years ago, with the on-set of the Industrial Revolution. The argument being presented is that circularity is not a new or 'modern' idea, but rather a return to prior forms of material use before extraction processes ramped up and created problems of industrial excess rather than seasonal abundance (ibid., p. 12).

For the purposes of this thesis, which was written in relation to Sydney, it is necessary to ground this critique within the Australian context. The use of material in Australia and NSW is comparatively high on the global scale. The 2020 NSW Circular report, *The circular economy opportunity in NSW*, states:

> Australia is the largest materials user per capita in the region and Australians have the 2nd highest material footprint per capita in the OECD. NSW generates almost 3 times the global average CO2 emissions per capita. (NSW Circular, 2020, p. 5)
>
> It also has lower materials productivity and lower domestic supply chain sufficiency than most of the OECD and the region.
>
> In addition to our high use of scarce resources, Australia landfills more of its waste than other developed economies like the UK, Netherlands, Singapore and Japan. (ibid., p. 7)

Within the context of global material use, Australia (and more specifically NSW[91]) are not excepted from the trend of a high degree of material use. Viewing the space of Sydney from the metaphorical ladder provides a new view, from which one can comprehend the cornucopia of the city, which both reveals and obscures particular visions of space and, in doing so, produces the space differently. Sense-making translations are often necessary at scale to produce a relative form of comprehension. Often metrics and figures are converted into sizes and scales that are able to be comprehended through everyday experience. For

[91] 'The NSW upper house inquiry report said NSW is the second highest per capita producer of waste in the world' (Topsfield, 2018).

example, the 130-ton Whitechapel Fatberg (see the Prelude) was often translated by the English media in terms of local equivalence:

> This being a London phenomenon it was invariably described in local currency: at 820 feet, the fatberg was "longer than Tower Bridge" or "twice as long as Wembley Stadium" and "the weight of 11 double-decker buses". (Adams, 2018)

This type of sense-making equivalence for large quantities of waste is also commonly translated into equivalencies that work at a global scale, the most prevalent of which is the waste produced per capita. A critique of this obliquitous form of sense making is presented in section 9.3.

9.3 Accounting for waste at the industrial scale

Scale is as a conceptual tool within the field of discard studies which asks critical questions about the production and management of waste (Liboiron and Lepawsky, 2022) combined with notions of responsibility. The work of STS scholars Donna Haraway and Karen Barad and their feminist engagements with matter point towards taking responsibility as a repetitive (re)opening up to and enabling of responsiveness. The work of Doreen Massey, in particular her 2004 article 'Geographies of Responsibility', posits that '[t]he political argument should be about how those small and highly differentiated bits of all of us which position us as 'Londoners' give rise to responsibility towards the wider relations on which we depend' (Massey, 2004, p. 17). For my study, Sydney is considered as an industrial space, where materials flow through and within the city at industrial scales that are significant to the function of the city. From a human geography standing, reference to scale is not substitutable simply with size. Liboiron and Lepawsky (2022, p. 43) illustrate how scale is distinct from questions of size:

> When we use "scale," we're not concerned with relative size differences, where cleaning up is too "small" for the "big" economic problem of marine plastics. Scale is instead about the important processes that have significant influence within a given context (e.g., Marston 2000; O-Neill and King 1998; Sayre 2005; Sheppard 2002; Smith 1993, 2004; Swyngedouw 1997).

It was noted in the previous section that NSW has a particularly high proportion of waste production when measured on a per capita basis. The scale of concern here is the relationship between the amount of waste materials produced and the residential population that this is

being accounted for. These modes of accounting and measurement matter, and they matter in a personal sense to me as one of the bodies that is being accounted for. Moreover, looking at waste through the scale of Sydney is significant to me simply because this is the place in which I live and work. There is a relationship between my life and the life of the city. My life is implicitly part of the city, just as the forms of pollution that the city and I produce become part of my body.

By making the industrial *personal*, I am removing overworn distinctions and accounting metrics that individualise waste without accounting for difference; for example, the differences between the municipal waste stream and the city's ever accumulating construction and demolition waste, produced by a city in churn. Positioning my thinking in the scale of the industrial, I am moving away from everyday and individualised waste relations. These relations tend to be over-examined as leverage points to reduce waste and as such result in common forms of 'scalar mismatch' (Liboiron and Lepawsky 2022, p. 46), where a solution to a problem is provided at a scale that does not address the systemic nature of the problem (such as recycling to address plastic pollution or carbon emissions). Liboiron uses the comic shown in Figure 22 to explain how individual actions just do not add up to the sum of carbon emissions.

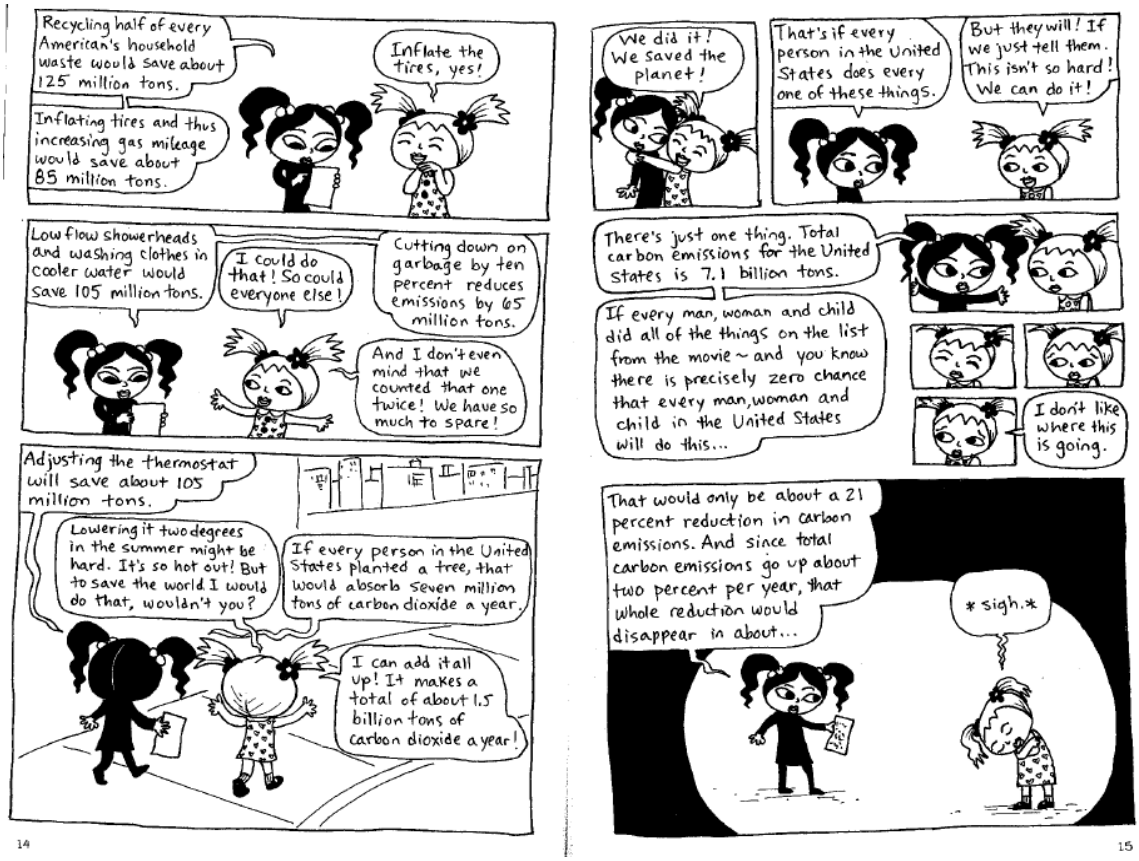


Figure 22: Page from 'As the World Burns: 50 Simple Things You Can Do to Stay in Denial – A Graphic Novel by Derrick Jensen, Stephanie McMillan (as cited in Liboiron, 2014).

The total mathematics of pollution problems do not add up to the sum of individual actions. The comic strip leads us to see that there are forces at play, forces that are better understood as operational at a level of industrial – rather than individualised – accounting. This argument applies to waste materials as well as pollution and carbon emissions more generally. For example, in terms of plastic waste, these forces are identified by Sandra Laville in *The Guardian,* who argued that:

> Twenty firms produce 55% of the world's plastic waste… [the top of which is ExxonMobil]… contributing 5.9m tonnes to the global waste mountain... The largest chemical company in the world, Dow, which is based in the US, created 5.5m tonnes of plastic waste, while China's oil and gas enterprise, Sinopec, created 5.3m tonnes. (Laville, 2021)

Rather than attribute the issue to the haunting spectre of capitalism, I am grounding my critique of the systemic in the industrial. By this, I am referring to the industrial processes at a

state, national and global scale. Waste, if assessed on a per capita basis, will be represented as significant in a relatively sparsely populated country such as Australia.

Yet despite the knowledge that the sum of individual actions will not add up to the whole of the industrial system (see Figure 22), frustration remains when wastefulness, both at the individual and systemic level, is encountered. This frustration can be particularly acute for the bodies working with waste in the city, as Will, one of the three staff members on a bulky collection shift, expressed his frustration when new, near new and useful items are put out for council collection. His frustration spanned both the actions of the individual and the system that he worked within. Reflecting on quality items found during his shifts, he stated: 'Obviously we are a throwaway society… Something is not working, we find clothes with tags on them, either the education's not working or people don't care.' Upon loading the compactor with a load of near new furniture and appliances, Will spoke about the need for a system that repurposes and rehomes bulky waste, before it goes in the compactor: 'I've spoken to management – in one ear and out the other. They aren't interested, they're just worried about their own pockets. Like I said, there are bushfire victims who could use this stuff.' Amongst the waste staff there is no satisfaction in seeing useable things destroyed, particularly when the scent of destruction is in the air.[92] Will's comments speak to the points of tension in the waste system, those emotions often felt at the individual level. These tensions will be developed further in section 9.6 of this chapter. For now, we move away from the personal experiences of the waste system, and return to an understanding of it as a scaled industrial phenomenon.

At an industrial scale, the quantification of waste is typically divided into three categories: Municipal Solid Waste (MSW), Commercial and Industrial (core) (C&I) and Construction and Demolition (C&D) (see also Section 7.5.1). The scope of this thesis focuses on the infrastructural system of MSW, which is investigated through ethnographic work undertaken with the CoS' Cleansing and Waste Services Teams. Following Liboiron (2013a) I argue that MSW is a form of industrial waste because of the industrial processes that create household consumable products, and because of the industrial systems that incorporate MSW. Naming MSW as industrial waste also troubles the idea that MSW solid waste is produced by

[92] At the time of fieldwork, Sydney was facing record poor air quality due to the smoke from bushfires burning across NSW.

individuals whose practices are understood as cumulative at the local government level. As explained within the field of discard studies:

> As its starting point, *discard studies holds that waste is not produced by individuals* and is not automatically disgusting, harmful, or morally offensive, but that both the materials of discards and their meanings are part of wider sociocultural-economic systems. Our task is to interrogate these systems for how waste comes to be, and our work is often to offer critical alternatives to popular and normative notions of waste. (Discard Studies, 2018) (Italics added)

Naming MSW as industrial waste is also a way of offering an alternative understanding of how the MSW system developed and those whose interests it upholds. However, naming MSW as industrial waste should not erase the differences in size of material composition of the current categorisations of the waste streams. MSW is consistently smaller in volume as a waste stream than C&D and C&I. For example, in the 2018-19 Australia-wide report, MSW was only 20 per cent of the total volume of waste produced, and would be even less if non-core waste such as coal ash was included in the figure of total waste produced[93] (Pickin et al., 2020, p. x). Meanwhile, in America and Canada, MSW has been understood to be only 3 per cent of total waste, while the sweeping category of 'industrial waste' accounts for the other 97 per cent (Liboiron, 2016). And yet, despite the volume disparities, a common form of accounting and comparison of the total amounts of waste is to quantify it on a per capita basis – whether that be conveyed at the volume of particular waste streams, or at the state, national or global scale. For instance, the opening paragraph of the *National Waste Report 2020* states: 'In 2018-19 Australia generated an estimated 74.1 million tonnes (Mt) of waste... This is the equivalent to 2.94 tonnes (t) per capita' (Pickin, et al. 2020, p. x). Representing waste on a per capita basis generates an image that each individual is responsible for the total national sum of waste divided by the sum of the population (Liboiron, 2013b).

Per capita accounting distributes the burdens of waste across the population, where people at all stages of their lives and from diverse socio-economic backgrounds are implicated in the consumption process. Moreover, it also renders the industrial producers of products – from the production of consumables to development and mining projects – invisible in terms of the

[93] Total volumes of waste produced in Australia are accounted for under two metrics: firstly, total 'core waste' which is MSW, C&D and C&I (core), or total 'core waste + ash'; MSW, C&D, C&I and C&I (electricity generation).

ways in which waste is measured. For these reasons, Liboiron and Lepawsky (2022, p. 104) identify universalism as technique of power that both 'erases and maintains difference' to reinforce the status quo. They state:

> Descriptions of "humanity's" effect on the planet erase differences between core emitters and consumers, affluent consumers and nonconsumers, groups invested in pollution and groups invested in environmental conservation. At the same time, a universal "we" reinforces difference and injustices by making one group the dominant global group… (ibid., p. 104)

The reduction of complex globalised and industrialised processes to the singular notion of the individual erases differences. It is essential that these forms of accounting are interrogated, as they assert notions of responsibility and blame for the production and disposal of waste at the level of the individual. However, both systems of material/waste production and material/waste disposal function at a scale beyond the interventions possible at the level of individual action, thereby producing individual feelings of powerlessness that result from a 'scalar mismatch' (Liboiron and Lepawsky, 2022) between who is able to respond and each individual who feels that the weight of their existence can be measured.[94] Even with a singular focus on the MSW stream, it would not be possible for individuals to process household waste – even a zero-waste consumer (an idea typified by the image of the mason jar able to be filled with years' worth of waste (see Figure 23).

There is a stark contrast between global waste production being weighed at 2.94 tonnes per person and the image of a Lauren Singer (see Figure 23) posing to balance the waste she produced over multiple years, on her head.

[94] Even if only the MSW stream was looked at it would not be possible for individuals to process household waste; industrial waste systems are required.

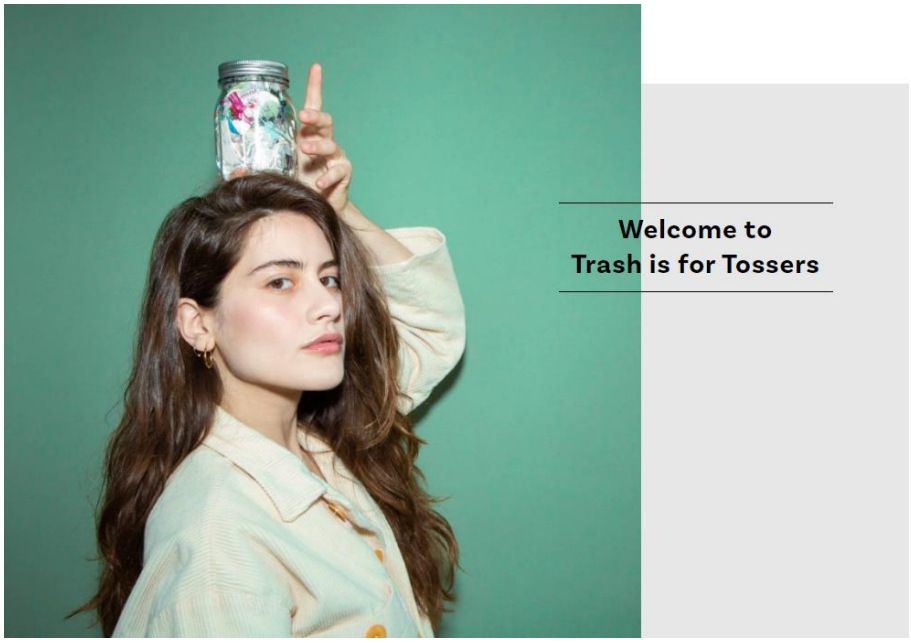


Figure 23: Lauren Singer's website cover image (Trash is for Tossers, 2023). Singer is a prominent American zero waste advocate/social media influencer.

Clearly, two very different systems of accounting for the personal weight of waste are at play. In one system, all nationally produced waste is accounted for in terms of the individual; and in the other, individual actions are taken to minimise waste but also obscure reliance on wider systems of extraction, production and industrial waste disposal. At this juncture, it is worth thinking about the politics of distribution, purity and contamination inherent in the systems used to account for waste. As Povinelli states:

> What are the politics of thinking about climate change and toxicity as systems of liberal complicity? The subtext is that you can't replace without taking, you can't remove without dumping, and you can't restore because the distribution is already there. All you can really do—as one who has created toxins or benefited from them—is to distribute them more evenly. (Povinelli, 2018)

There is an unevenness in the distribution of responsibilities towards waste. This can align with or mis-align with exposure to the risks posed by waste. While the risks of dealing with waste need to be minimised, critical attention should be given to the ways in which the universal is tied to production of waste. This attention should help us avoid devolving into discussions of waste that are premised on a politics of purity that focus on the individual, their behaviour and their environment. Instead, I am proposing that the politics of waste are based on a critical understanding of how accounting for waste distributes responsibility in particular ways and how this might be achieved with an emphasis on the industrial production of waste.

In these ways, the industrial is thought with as a scale at which waste relations come to matter and at which change can be leveraged.

9.4 Becoming industrial

Placing the onus of waste production on the individual has also been critiqued by Samantha MacBride (2012) as an industrial strategy. In her book *Recycling Reconsidered*, MacBride highlights how the 'materials economy is a complex, global system in which businesses employ people and transform things in highly destructive ways outside the gaze or reach of the savviest consumer' (MacBride, 2012, p. 218). As such, she argues that the recycling system, with its emphases on 'personal responsibility' and 'step by step incrementalism' (ibid.), has emerged to produce individual 'busy-ness',[95] distracting from systemic reform and reproducing systems of disposability. Following the aims of discard studies, this section thinks about systems of waste and discards (the infrastructure) rather than their symptoms (pollution) (Liboiron and Lepawsky, 2022). 'Industrial' connotes a systemic process:

> from early Latin indostruus 'diligent', from indu 'in, within' (from PIE *endo-, extended form of root *en 'in') + stem of struere 'to build' (from PIE root *stere- 'to spread'). The meaning 'habitual diligence, effort' is from the 1530s; that of 'systematic work' is from the 1610s. (*Online Etymology Dictionary*, 2017c)

This last definition of industrial as 'systemic work' draws out the systemic foundation of the industrial, which by its very nature is a multiplicity becoming larger in size due to the systematic infrastructural foundation of this work. Industrialisation is a systemic process which transforms space and land. This section will think about industrialisation in an applied sense, with a particular lens on Sydney.

The word 'industrial' can also be an adjective that connotes the practice of industry. In this manner, it can be defined as 'economic activity concerned with the processing of raw materials and manufacture of goods in factories'.[96] Therefore, the practice of industry is

[95] 'At the inception of the contemporary recycling movement, industrial groups under threat discovered that they could distract civil society and send it in harmless directions, using the substitute of busy-ness. In these cases, producers strategically used the social fact of busy-ness to further their interests at the expense of civil society. Glass and plastics recycling in particular and curb side recycling in general were clear instances of this strategic mobilization.' (MacBride, 2012, p. 220)

[96] There is therefore a connection between industry and economy; the development of industry is also a mark of the birth of the nation state, viz. whaling being the first major industry in NSW. Therefore, it could be argued that industry is connected with modes of governance, underpinned by/with economic and infrastructural systems.

involved in the creation of an economy, which is premised on the existence of the nation state.[97] It is worth noting that the Colony of New South Wales (NSW) remains a useful scale to think with, especially when we are talking about the beginnings of industrialisation and waste production in Sydney. In 1901, the Colony of NSW became a State of the Commonwealth of Australia. Sydney – as the capital of the colony – is still a relevant jurisdiction today. On the 15th of September 1908, seven years after Federation, a review of the Commerce of New South Wales was published in the *Sydney Mail and New South Wales Advertiser* stated that:

> New South Wales has a splendid commercial record for a young country. Certainly she has on several occasions been severely tried, but her recovery has always been brilliant: her troubles were those of youth— to-day she is established, and is stamped as a great country of splendid development and bewildering possibilities.

The viability of the state of NSW was premised upon the viability of industry. In other parts of the world, colonialism has been introduced as a homogenous force of industry; for example, in Canada, which was a charter company of the Crown (the Hudson's Bay Company) before gaining recognition as a nation state. For 200 years, from 1670 to 1870, the Hudson's Bay Company extracted timber and fur from the land, until it sold its land holdings to the newly 'created' territory of Canada. The historical process aptly illustrates how settler colonialism is 'a company/state relation' (Murphy, 2021). Industry, as a colonising force, has a long duration. On this point, it should be noted that the universalising force of the economy gained momentum with the first industrial revolution being conceptualised by Adam Smith's *The Wealth of Nations* in 1776. Since then, it has increased in scale (through the matterings of its relations) and size to the present day, which has been dubbed the fourth industrial revolution (Schwab, 2016). Because of the global distribution of industrialisation as a colonising force (Tsing, 2015; Murphy, 2021), industrialisation is not an a-spatial process; place matters in matters of industry.

[97] It is important here to contextualise that for Indigenous Australians, 'Australia is a continent, not a country.' (Kwaymullina, 2017, p. 5). As Ambellin Kwaymullina goes on to explain: 'Aboriginal people, like Indigenous Peoples elsewhere, lived through the end of the world but we did not end; nor did our culture or our Dreamings. But we are now nations existing within the nation-states that arose from, and inherited the benefits of, our dispossession. Further, the laws and legal institutions of these nation-states sprang from the lie of Indigenous inferiority that was required in order to assert the moral and legal authority required to claim our lands' (ibid., p. 8).

Place matters as it provides the conditions and materials for resource extraction (Tsing, 2015; Murphy, 2021). Place also provides the infrastructural conditions for industry; for instance, in Chapter 6 I discussed that the positioning of the gasworks on Sydney's harbour provided the essential infrastructure for the delivery of coal via ships. Furthermore, mines are positioned where the potential to extract resources of value are identified. As Melo Zurita et al. (2018, p. 301) argue: the Anthropocene – as a phenomenon resulting from the processes of industrialisation – is dependent on the 'subterranean past'. Places become consequential in new ways, as legacies of industrialisation and contamination unfold.

As the processes of industrialisation now stretch back over centuries, we are living in a time where it *is possible to see the ruination* of the miracles of modernity becoming monsters, creating trouble and spectres haunting the present (Balayannis, 2020; Tsing, 2015). Fortun speaks to the present as a 'period of late industrialism' (Fortun, 2012, p. 448), stating: 'much of the infrastructure, many of the paradigms that have held it up, are exhausted. Things are falling apart, again' (Fortun, 2012, p. 449). The Millers Point Gasworks, (see Chapter 5), provides a place in the city to ground this argument. Thanks to the Gasworks, the city became a successful site of commerce. Indeed, the first gasworks (at Millers Point) and another 60 gasworks around NSW (New South Wales Environment Protection Agency, 2021), were needed to produce the scale of the industrial. The Gasworks is, of course, only one example, one seam through which the patchwork of the city is stitched together. The urban is a forced stitching, an assortment of things that do not go together unless woven together by humans. The city is a group of things that do not belong; legacies of contamination, waste and pollution illustrate this in material terms. And yet, with each new thread of stitching, a new scale is produced.

Following Liboiron (2016), I will use scale to talk about how the waste system is held together, by recognising its seams:

> The point is that scale is a way of talking about how things, like physical properties and action hold together even as they remain ontologically distinct; arms and cells are never the same thing, but they are always in relation. So, too, are microplastics and plastic pollution. (Liboiron, 2016, p. 104)

Seams are held together by thread, which has been laboured over into a stitch. It is the stitch that holds fabrics in relation, transforming them, and in doing so translating cloth into

clothing. This approach focuses on how scalability within waste systems is figured. Here, the lead is taken from Tsing (2015), who speaks to the idea of scalability:

> [With the] sixteenth- and seventeenth-century sugarcane plantations in Brazil, for example, Portuguese planters stumbled on a formula for smooth expansion. They crafted self-contained, interchangeable project elements, as follows: exterminate local people and plants; prepare now empty, unclaimed land; and bring in exotic and isolated labour and crops for production. This landscape model of scalability became an inspiration for later industrialisation and modernization… Interchangeability in relation to the project frame, for both human work and plan commodities, emerged in these historical experiments… The project was, for the first time, scalable – or, more accurately, seemingly scalable. (Tsing, 2015, pp. 38–39)

Through her historical grounding, Tsing shows us how scalability is a project that is premised on instability, arising from the churn of 'interchangaeability'. 'Scalability is never stable; at best it takes a huge amount of work' (Tsing, 2015, p. 294). Therefore, what becomes apparent is that constant labour is necessary to maintain the system. Waste is produced through the inability to maintain seams; think of clothing with the stitching coming undone at the seams, the durability of the object is wearing and without the attention and labour of maintenance, it will ultimately become waste. However, the waste system can also be talked about as a patchwork of actors and infrastructures that are stitched together. This stitching does not always produce harmonious relations, and sometimes the act of stitching together creates points of friction. In the following subsection, I will examine the seams (boundaries) and frictions created in managing risks and responsibilities of waste.

9.5 Scales, seams and labour

Waste systems function at an industrial scale, just as waste is produced at an industrial scale. This section will now think with the fieldwork undertaken for this thesis to address two interrelated but distinct questions, with the aim of understanding what it means to be response-able for our material discards at an industrial (as opposed to individual) scale. Firstly, how have industry and the industrial process of waste and resource recovery changed in Sydney? And how do matters of waste become translated through scale? In other words, how does waste as a material-discursive phenomenon become understood differently as it is conceptualised at different scales? This thesis understands scale to be produced through the metaphor of stitching; in this way the landscape of the city is understood as a patchwork sewn

together; taking inspiration from the work of Gregson et al. (2017). So how does scale change through the act of sewing up? These questions will be answered through a discussion of the participant observation and ride alongside fieldwork.

The CoS strongly aligns with the image of Sydney as a global city. I was told by the Waste Contracts Manager that '... the city treats its streets very well and seeks to maintain a highly presentable, global looking city. And it does.' The CoS's vision for the city is espoused in its three core values: 'Green. Global. Connected'(City of Sydney, 2022a). As was discussed in Chapter 7, a green city should be a city with an emphasis on (and seasonal understanding of) its cleansing operations, as these workers will be relied upon to keep the streets clean of tree debris.

Cleansing and Waste Services are divided into three service areas that run out of three depots: the Bay Street Depot in Ultimo, the Bourke Street Depot in Woolloomooloo, and the Alexandra Canal Depot on Bourke Road (See Figure 24). The location of the depots has been explained previously in Chapter 6, however more context is given here in this chapter. The management of the city is divided between the North and South, with sections of roads like King Street, City Road, Cleveland Street and the Eastern Distributor forming the boundary lines between them (see the red line on Figure 24 below; these are also main traffic arteries). The Alexandra Canal Depot services South Sydney, while the Bay Street and Bourke Street depots service the central city region.

Figure 24: Map of the city provided to me at my cleansing induction for the City of Sydney.

As I was told by Kim, the CoS Waste Contracts Manager, in November 2019:

> There are two parts to the city. One half of the local government area is serviced by an external contractor and that's been in place, or substantially in place, for the last twenty years. And then there is the city services or garbage services as they are called, which handles the other half of the domestic area of the local government area of Sydney. And our internal services manage the red bins, the general waste, and also the

> booked services (the bulky household waste). So that's in the south. Cleanaway do the northern end and the east and everywhere else.

Kim has an extensive industry-related background (including working for SUEZ) and at the time of fieldwork was managing all the major waste contracts that the city needs. For these reasons, he understands and is familiar with the complex governance of waste management in the city. On my first day of fieldwork, I arrived at the Alexandra Canal Depot at 5.45am. I spent the morning with Bill*, a Cleansing Services Officer (CSO) who showed me all the different routes in the southern council area. Bill showed me the area that he was once assigned for individual street sweeping shifts,[98] he pointed out different dumping hotspots in the back alleys of Redfern and drove me along the council boundary lines. As we drove down King Street, where one side is the CoS area and the other is the domain of the Inner West Council, he points out the external differences in the bin infrastructure between the two sides of the street. If you pay attention, it is possible to see that some boundary lines are marked into the everyday waste infrastructure of the city.

Other boundary lines (like the division between the North and South side of the LGA) are historical divisions that have since been merged.[99] As Kim explained:

> Well, the city in its own right was the City of Sydney and South Sydney Council, once upon time. They joined or merged and through that this was the final outcome. Essentially, the southern area is where the South Sydney Council retained the services area. Although South Sydney was up there (indicating on map) as well, it's just how it was split out.

Fieldwork in Sydney showed me that the city, like most other cities, was built in relation to its waste places. As Chapter 4 (Waste Histories) discussed, there are various remnant landfills and incinerators around inner and outer Sydney, not to mention polluted waterways and rivers. With less sophisticated waste disposal methods, more available space and a more industrial inner-city, landfills and incinerators were located within and run by local councils. A prominent example is Sydney Park, located in the Inner West suburb of St Peters. Between

[98] These are street sweeping shifts which include the use of a portable bin caddy, where an individual will collect and bag street sweepings.

[99] 'In 1982, South Sydney was brought back into the City, only to be carved off again in 1988, when the City Council area contracted to 6.19 square kilometres, smaller than its original size. The entire area covered by South Sydney Council and parts of Leichhardt Council were returned to the City's control by 2004' (City of Sydney 2020c).

1948 and 1976, the CoS Council ran a landfill operation (or dump) on the site. Today, the space has become an expansive park and wetlands, a much-needed green space in a highly urbanised area. This is representative of a style of waste management that was wholly publicly owned and governed, and as Ukeles conveys in relation to the New York Sanitation department, this places the people of New York 'in relation to sanitation' as both 'customers' and 'co-owners' with 'a right to a say' (Ukeles, 1996, p. 624). But gradually – over the last 40 years – waste services were outsourced, both in terms of the processes of collection and disposal. The CoS's waste management infrastructure and labour have been outsourced in a patchwork manner, particularly as waste materials and their potential resource streams become more specific in their material makeup.

Today, waste contracts are 'big business' and industrial in scale (as discussed in Section 9.3). Upon speaking to Kim, I was surprised to find out how many different multinational waste companies were involved in managing the city's waste streams. Kim listed nine companies involved in various stages in the management of different waste streams coming from the CoS. These included:

- *SUEZ* – receiving the red bin content that was processed using alternative waste treatment, as was discussed in chapter 6;
- *Visy* – receiving the recyclable stream;
- *Veolia* – receiving the garden organics (and bulky waste, which is then processed by Cleanaway);
- *Australian Native* – supplied by Veolia's garden organics stream;
- *Cleanaway Resource Co.* – processes Veolia's collected bulky waste at Wetherill Park;
- *Downer* – produces a product from street-sweepings that can be used as a substitution material in the production of asphalt;
- *Pro-opt* – manages the syringes collected by the CoS; and
- *United Management Systems* – manages the removal of bill posters and graffiti.

Kim concludes his rundown of the patchwork waste management system by noting: 'Again, all about a clean, tidy, neat, presentable global city, the entry to Australia.' In many ways, Kim

highlighted the ways in which responsibility for waste is distributed across a multitude of actors.[100]

Generally, responsibilities for waste become split across diverse actors with every waste stream separation. With each 'flow' being processed differently, specialisation and expertise are enacted across a variance of places with specialised mechanical equipment. This type of coordinated responsibility is evident in the operations and practice of both local government and multinational waste companies. While on a tour of the Lucas Heights Resource Recovery Park run by *SUEZ*,[101] I was taken on a drive through the Resource Recovery Centre, which is the public drop-off section of the landfill. The brief trip revealed that smaller, more specialised material processing companies were used to deal with a variety of different substances, such as paint, batteries, sump oil, mattresses. Some of the companies involved in the management of these specific items include *ORBITAS* and its brother company *Renewed Metal Technologies* (based in Wagga Wagga in Regional NSW, the companies recycle used lead-acid batteries), and *Soft-Landing* (a local mattress recycling social enterprise). In articulating the complexity of the waste industry and the various actors involved, my tour guide and research participant stated: 'It's not simple, it's just not a straight line. It's a like a tree – it really is a busy tree.'[102] The tree of industrialised waste is certainly a complex one, with many branches that reflect the complexities of the operations of a 'global city' (City of Sydney, 2017).

9.6 "Thanks Sydney. We'll take it from here.": working through tensions

The timing of fieldwork with the CoS was contextualised by periods of change in the broader environmental and social contexts. The period was marked by drought and significant bushfires, as well as the rumblings and then first impacts of COVID-19. Logistically, the management of CoS's Cleansing and Waste Services was also undergoing a transformational change: in mid-2018, through a process of competitive tender, *Cleanaway* (Australia's largest waste management company) won the bid for the CoS's major waste contract, an already-

[100] In the following section, I will provide a contextual grounding for the main waste operators listed by Kim.
[101] As of 2021, this site became owned and run by Cleanaway. More on this in section 9.6.5.
[102] This is not the first time trees have been used to evoke industrial processes; I am reminded of the chemistry trees cited in the work of Rebecca Altman (2017), in which she lays out the history of the industrialisation of chemistry (see Chapter 6). The image of the tree shown in Chapter 6 was a coal products tree. A disposal and resource recovery tree could be drawn in response with just as much labour required to maintain the tree's structure.

outsourced contract previously managed by United Resource Management (URM);[103] In April of 2020, the remaining 'in-house' part of waste services was also contracted out to *Cleanaway*. The fieldwork undertaken for this thesis saw the last days of CoS's Waste Services, as they were managed 'in-house'. In the process of doing fieldwork, *Cleanaway* trucks were often encountered on the road, as they were already servicing waste and recycling for the North side of the CoS, as well as recycling for the South.

The heading for this section takes its name from some messaging utilised during this period. "Thanks Sydney. We'll take it from here." is a reference to the slogan visible on the sides of brand-new *Cleanaway* trucks that began servicing the LGA at the time of fieldwork (see Figure 25).

Figure 25: City of Sydney Image (City of Sydney, 2023h).

During the second half of 2019, the remaining 'in-house' part of Waste Services was finally notified that their work would also be contracted out to *Cleanaway* (effective April, 2020). *Cleanaway's* attempt at a humorous slogan was seen by some workers in Waste Services as

[103] URM was awarded the waste contract for the CoS in 2010 (Hall, 2010).

offensive and arrogant, given the pending dismantling of council-operated Residential Waste services. In previous sections, I have discussed how the Global City is serviced by global waste management (in Sections 4.7 and 9.5) – an assortment of actors that responds to the material demands for production and consumption. A neat and clean city requires trucks, contractors and labour inputs; but what points of tension occur as the new system interacts with existing ones? What points of tension exist at the seams? The sections below present four key examples of tension that arose while in the field.

9.6.1 Boundary lines (Tension point 1)

Boundary lines between public and private property produce tensions through shifting responsibilities towards waste. A morning shift spent with Neil on the footway exemplified this tension. To start the shift, we head out in the Footway from the Ultimo Depot, working our way to Union Street in Darling Harbour. We start by cleaning the bike path. With the Footway, like using a vacuum cleaner, the slower you go the more you pick up. It's not fast work and it is slowed to a greater extent by the driver having to get out and break up any bits of carboard wider than a handspan, such as pizza and champagne boxes, on the path. If the driver does not tend to the process, the items will get stuck in the vacuum tube. As we pass the front of a kebab store, there is mess of wrappers and food service products from the night before. The mess requires a few turns back and forth, in order to be cleaned properly (Photograph 81).

Photograph 81: View from the Footway in front of the kebab shop early in the morning.

We run a lap around the bike path and work our way up onto the footpath. There is a new-looking office block set back from the footpath; to its side, there is some open space and seating (centre right of Figure 26). I notice that under the seats there are a bunch of used tissues and other debris. The Footway operator explains to me that that is private land, so that area will not be cleaned by the CoS. The change in road texture – from tar to glossy pavers, seen in the centre right of Figure 26 – indicates the boundary line between the public and private cleansing operators' responsibility.

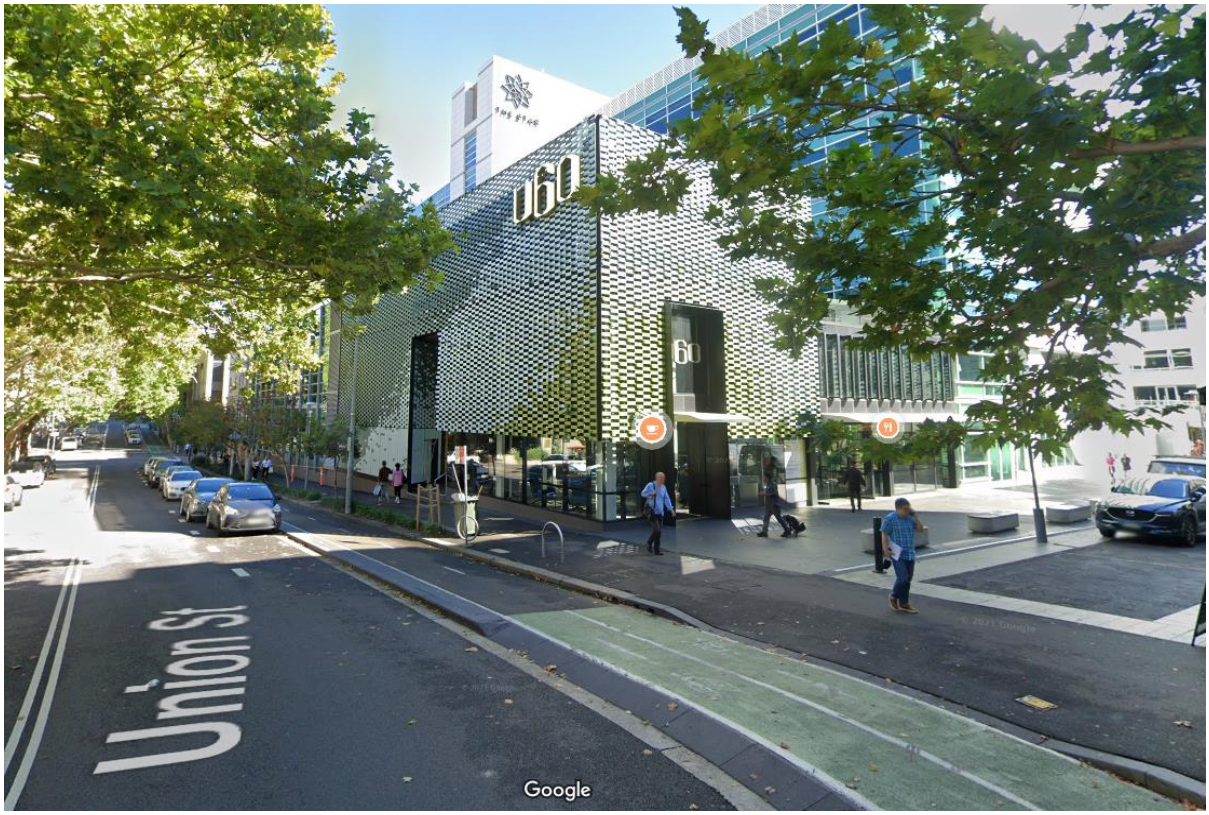


Figure 26: Google Street view image captured March 2021 (© 2023 Google)

While we were cleaning Union Street, there was also a commercial cleaner servicing the area around various office buildings. The cleaner was using a leaf blower to blow rubbish out of the area. After we finished cleaning the space around 60 Union Street, we work our way down the adjacent footpath. As we return to the same space a short time later, we see litter that was previously located in the private property zone has been blown over the CoS pathway and bike path. The driver is matter-of-fact: 'That was clean when we did it before, and now he's gone and blown it all out – what a pain in the ass!' This has happened many times before, so Neil proceeds to clean the area again, until he is satisfied that the job is done. This tension shows the material flows across lines between public and private land and how they matter in terms of who is deemed responsible for waste and also in terms of labour. Often as public space is larger and more accessible linking private spaces across the city, it becomes the default place to defer responsibility for waste. This might happen through intended actions that effectively move waste beyond the boundary of private property (like those carried out by the private cleaner, who moved responsibility for their waste onto the CoS and to the bodies that manage it), or through agential forces that move waste and debris indiscriminately (such as the wind or rain). The tension also shows that the production of the 'clean city' is always a work in progress; 'clean' is a state that is maintained, rather than the achievement of

an absolute or final state of 'cleanliness' (as discussed in Chapter 8). Litter is perhaps the most common way in which waste is understood as excess; litter exceeds containment and threatens notions of cleanliness. In this way, litter makes notions of excess visible, whereas waste, while a much more voluminous issue, tends to be kept of 'out-of-sight' through means of containment, that is, bins, transfer stations and landfills, and suchlike.

9.6.2 Public housing bins (Tension point 2)

Another tension point between public and private responsibilities can be found in the bins that are serviced within public housing estates. In late-2019, I rode along on a Garbage Services Shift. I spent the morning with three garbage services employees in a new, four-seat garbage compactor. This allowed me to ride along on a typical three-person shift. Our run for the day was to service the bin rooms – mainly of apartments and public housing estates – around the areas of Redfern, Waterloo, and Erskineville. Generally, bin rooms are filled with 500 litre bins; this means the bins must be mechanically lifted by a truck. For the most part, the bins are plastic, but as seen in Photograph 82, some of the older bins in public housing estates are made of steel.

Photograph 82: A steel bin being picked up

I was told that these steel bins are part of the original infrastructure of the housing estate, and that they are not the property of council. So, even though the council is responsible for emptying them, the bin itself is not CoS's responsibility. Later, we emptied a steel bin with a broken wheel, a factor that makes it 'very hard to wheel out'. William mentioned that he has repeatedly reported it as an issue for those tasked with emptying it, but so far it had not been fixed or replaced. He explained that as the steel bins wear out over time, they will eventually be replaced with plastic 500 litre bins supplied by the council. William also noted that these newer bins are also high maintenance, as they can be burned and break easily. The flammability of these bins is soon made clear to me, as we come across a severely burnt bin (as seen in Photograph 83).

Photograph 83: A burnt plastic bin

The damaged bin had also been reported, to no avail. The broken steel and plastic bins represent a multi-level governance challenge and illustrate the internal and external deferrals of responsibility for these objects. The two types of bins – steel and plastic – are part of the ongoing stories and history of waste management and infrastructure. The evolution from steel to plastic bins also speaks to the ubiquity of plastic as a 'modern' industrial material that

underpins current and emerging forms of industrialisation. While the use of plastic material in industrial processes has its benefits – it is light-weight and easy to reproduce – there are also significant pitfalls in terms of its durability.

9.6.3 Spilled private waste (Tension point 3)

On another morning in December, I found myself riding around Kings Cross and Surry Hills in a white CoS utility. I was riding-along with a team leader based (today) at the Woolloomooloo Depot. Part of their role as Team Leader, apart from assigning runs to their staff, is to review the streets in their area and to check for unexpected material hazards or new illegal dumps. As we drive around the back streets of Surry Hills, I am told that just yesterday she had seen a 'Bingo' branded skip-bin that had been knocked over in a back alley. They had reported this to *Bingo* for clean up. Today, we were going back to see if the bin was emptied and the spillage cleared. But as we rounded the corner to the alley, the mess was still evident. At that point, even though it was considered commercial waste, the team leader assigned staff to pick up the bin and clean the site, as it had become a hazard. In situations where the boundaries and borders of privately operated bins are breached, this tension point shows how responsibilities for waste effectively 'roll downhill', to the governing body ultimately charged with maintaining the space.[104] The tension created by waste spilling over into public space is also apparent in the volume of illegal bulky waste dumps, which will ultimately need to be picked up by the council or their bulky goods collection contractor.[105]

9.6.4 The light rail tracks (Tension point 4)

Since 23 October 2015, George Street (Sydney's historical main-street) had been undergoing major construction due to the installation of the L2 Randwick Line Light Rail tracks (Singhal, 2015). The tracks run directly up George Street from Circular Quay. On the 14th of December

[104] Local roads and roadways must be maintained by council, according to Local Gov Act. If the bins tip over in the street, the rubbish is now on council property, making it council responsibility.

[105] From April 2020 the whole of the City's bulky waste collection would be contracted out to Cleanaway. However, the garbage services staff were doubtful that the City's remaining cleansing team would not be called upon to collect missed pickups as was then the case for the two thirds of the city already serviced by Cleanaway. Indeed, on the 13th of February 2023, the City of Sydney wrote:
'The City of Sydney's bulky waste collection service has been greatly impacted by staff absenteeism and a tight labour market affecting recruitment. The industrial action has further exacerbated the situation.
In response we have temporarily paused bookings for bulky waste collections. To help clear the backlog the City of Sydney has allocated resources to help our contractor.'
Justifying the doubts of the now no longer waste services department staff.

2019, the light rail addition was opened to passengers (Raper & Chettle, 2019). The creation of the new, inner-city transport network changed the cleansing of George Street, as the central strip of the street became state government infrastructure.[106] In mid-December 2019, I was told by a Team Leader that: '...We don't know if we have the contract for the bins along the light rail. But if not, council will get the blame for overflowing bins.' This matter rested with Transport for NSW, the state government transport and road agency, not the CoS. By New Year's Eve, it had become clear that that the contract had not been awarded to the CoS teams. This meant that while on that day we were responsible for cleaning George Street, we were not tasked with cleaning the light rail tracks or the stop platforms. When street sweeping finally occurred at 3am on New Year's Day, and the tracks had bottles and fast-food wrappers strewn across them, the managers on the ground eventually asked us to clean those areas as well, raising concerns as to the practicality of having a hybrid cast of actors that maintain fragmented responsibilities across public spaces, and posing questions about responsibility for maintaining the cleanliness of the city.

9.6.5 Spaces of relation/holding environments

In action, Cleanaway's jingoistic mantra, "Thanks Sydney. We'll take it from here.", is frustrated by material spillages and the ambiguity of the boundaries of responsibility. The tensions highlighted above have focused on spaces of relation, considering the points at which tensions occur and the events that occur when holding environments for waste are breached or broken. Considering these four tension points, I ask the resulting questions: what is the infrastructure of the city? And how are the public commons governed through efforts to keep the city clean?[107] What I learnt from my fieldwork with the CoS is that waste management, in essence, is a form of hybridity with public and private responsibilities towards waste becoming merged and blurred. When waste fails to be bounded or contained within the realms of private responsibility, it spills out into the public domain; this spillage ultimately becomes the

[106] As the strip is now being used for a major transport hub, which is a state-funded asset, the land was likely acquired and the road now managed by the State of NSW.

[107] This framing comes from the Common Infrastructure workshop that I attended and presented at in February 2020. My presentation '*Thanks Sydney. We'll take it from here': the responsibilities of public versus private cleansing and waste operators*, was also where the ideas for this chapter first took shape. Common infrastructure was defined by the workshop organisers (Sophie Webber, Naama Blatman and Marilu Melo as three things: 'first, the growing recognition of the interdependencies of physical and social forms of infrastructure; second, the blurring boundaries between state and market in producing and governing infrastructures, and; third, the relations between private and collective costs and benefits.'

responsibility of the CoS, its employees and local ratepayers. This translation in responsibility may accrue through the intentional transference of responsibility (for example, the use of the leaf blower), or by actions unintended to produce these effects (perhaps an incidentally knocked-over or vandalised bin, even everyday movements of the wind). What is worth keeping in mind is the direct way in which responsibility in the form of labour is translated and transferred – from the private to the public sphere. This is particularly pertinent when observing the operations of infrastructure. As Harvey (2022, pp. xvi–xvii) states:

> Infrastructures are designed to constrain and channel movement but also routinely expand, extend, and leak not least because they provoke responses in and from the world they seek to order and constrain.

Therefore, the infrastructural system always needs to provide room to move, in order to account for the ways infrastructures extend the capacity and flow of materials in unpredicted ways.

The above tension points provide us an opportunity to understand the hybridity of public and private infrastructure. Along with raising significant questions, this knowledge also exposes the limits of what it means to be able to respond and have the ability to be responsible for the cleaning of the city in a hybridised landscape of diffused and uneven responsibilities. The tensions that exist between public and private waste management operators have shown that the process of creating a scalable waste system results in multiple, sometimes unaccounted-for points of tension, due to the responsibilities for waste being distributed between public and private actors. It is worth noting that, fundamentally, these two players have different motives. The CoS has obligations to its local residents and ratepayers, while Cleanaway is a publicly listed corporation. These differing responsibilities produce different patchwork configurations and patterns within the fabric of the city.

Waste is big business, and an industrial one.[108] Waste management trends towards centralised networks of collection, particularly in urban centres of the Global North. However, the model for centralised service provision of waste systems changes constantly. These changes are

[108] For instance, 'Cleanaway Waste Management Limited ("Cleanaway") ASX:CWY today announced a Statutory Net Profit of $80.6 million for the financial year ended 30 June 2022 ("FY22"), down 45.4% on the prior corresponding period ("pcp" or "FY21"). Statutory Net Profit was $64.4 million lower than Underlying Net Profit of $145.0 million predominantly due to costs associated with the acquisition and integration of the Sydney Resource Network ("SRN"), New Chum landfill rectification post floods, leadership transition and equipment loss in Health Services business' (Cleanaway, 2022).

unevenly distributed. There has been a split between the Global North and Global South waste management practices, with waste management systems in the South characterised by informality (Millington & Lawhon, 2019). While this is a generalisation, and networks will continue to have both state and market failures (Bakker, 2010), there is a growing trend to scale-up waste management, to achieve efficiencies of scaled processing and new innovations in waste management practices. These tendencies are highlighted in an article and interview with Daniel Tartak, Bingo Industries Managing Director, featured in *Waste Management Review* (*Waste Management Review*, 2019b). The article has Mr. Tartak asserting the 'importance of a vertically integrated business model to maintaining a chain of custody on the movement of waste', adding that '... a vertically integrated company allows for scalability'. Addressing the matter directly, he notes:

> When you become a large business, the fact that you have a large quantity of waste can sometimes work to your detriment, so controlling access to collections, transfers, recycling and landfill gives you control over your business. (ibid.)

As a result of a merger agreement reached between Veolia and SUEZ in 2021, Cleanaway has benefited from a smaller 'Plan B' deal. The deal saw Cleanaway purchase SUEZ's Sydney assets – including two landfill sites and five waste stations – for $501 million (Australian Competition & Consumer Commission, 2021).[109] The statement, 'Thanks Sydney. We'll take it from here.', which featured on the Cleanaway trucks, exemplifies a global/European trend towards the use of privatised waste services (Gregson & Forman, 2021). It also foregrounds the economically motivated motives of Cleanaway, in purchasing a significant number of waste infrastructure assets of SUEZ in Sydney (referred to as the Sydney Resource Network, or CRN). The slogan points towards a system of the interchangeability of waste relations, which is necessary for the scalability of profitable enterprises such as Cleanaway.

The businesses involved in waste management are worth noting, as they create spaces of relation to waste through their infrastructuring of the holding environments for waste. In this way, mega-corporations respond to, and facilitate, the scale of waste production, in both size and waste relations. Despite an increasingly privatised waste sector, the tensions explored in the beginning of this section – between public and private waste responsibilities – remain in

[109] 'The deal includes transfer stations in the Sydney suburbs of Auburn, Artarmon, Belrose, Rockdale and Ryde, a 9.9 million cubic metre landfill site at Lucas Heights in southern Sydney and a second 8.7 million cubic metre landfill site at Kemps Creek in Sydney's west' (Evans, 2021a) (see also Evans, 2021b; 2021c).

place, with responsibility always being deferred into the public realm, as waste 'moves downstream', becoming just another spillage on public land.

9.7 Translations between scale: how do waste relations become translated through scale?

It is necessary to pause and consider the utility of theorising waste and waste regimes from the municipal scale. Gregson and Forman (2021, p. 216) state:

> Municipalities, then, are key agents in the constitution of particular waste regimes – which is not to say that waste regimes are to be reduced (once again) to municipal waste, but rather that it is helpful to think of municipal waste regimes, as a subset of the wider whole, and to address the economic, political, and material dynamics through which waste is produced at this scale.

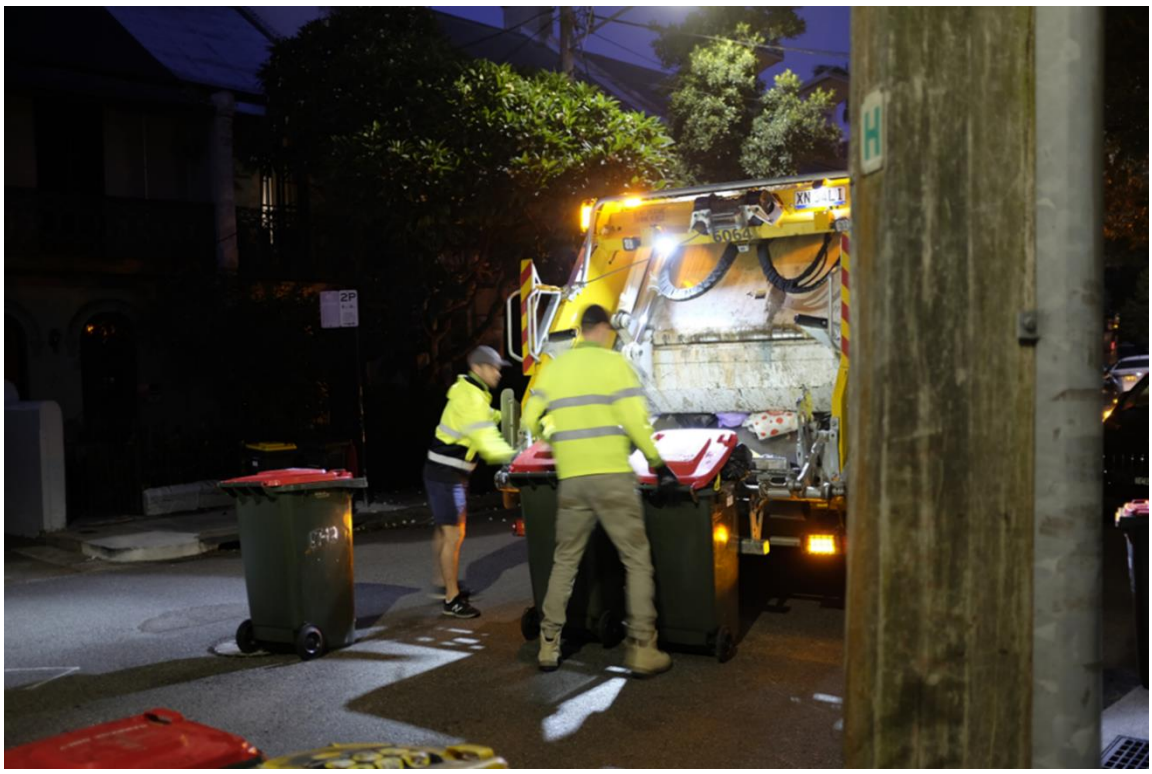
Researching waste infrastructure in Sydney, it became clear that many of the CoS's waste management practices are replicated across the Greater Sydney Region. Local council waste management practices are often centralised through waste infrastructure run by key private operators, such as transfer stations and landfill sites. My field research focuses on the points in the waste system where waste, as a material, changes scale between private individuals and public governance[110] (that is, council operations), and the accompanying change in scale from council operations to private enterprises (such as Veolia and SUEZ). Previously, in section 9.4 of this chapter, I have thought with the borders of this infrastructure, to reflect on the process of a translation of responsibility for materials at these points and think with the practice and processes of scaling-up a response to waste.

To answer this question, it is necessary to start to think with the boundary points involved with the weekly collection of household bins. At the point at which bins are collected and tipped into the mini-compactor, the waste shifts from being the responsibility of/managed by the individual household to being the responsibility of the local council (see Figure 16). It is important that waste is talked about in terms of being a responsibility, rather than production. Following discard studies, this thesis 'holds that waste is not produced by individuals' (Discard

[110] When I first started my PhD I was interested in the relationship between public and private responsibilities for waste. However, I had not fully comprehended the extent to which local council management of waste was a patchwork of public and private responsibilities – as council services become outsourced to private enterprise.

Studies, 2018); while waste is generated in the home, it is not essentially produced within this space. Waste is produced, in its shadow form, by the initial manufacturing of new material objects; each object contains within it the potential to become waste. An understanding of the broader argument, one of translations in responsibility, is therefore distinct from the idea of per capita waste accounting as it is applied to municipal waste.

Photograph 84 (below) depicts a time when the CoS was still servicing household waste, just weeks before the Cleanaway contactors would take over these duties. At this point, the scales of waste and waste management also become translated;[111] that is, the scale of waste will go from being a matter of domestic kilograms to collected tonnage.



Photograph 84: City of Sydney waste services collecting household waste before sunrise, just weeks before the Cleanaway contactors would take over this role.

Ukeles speaks to this issue: 'The tipping floor below us is like the fulcrum of transformation, like an alchemical thing. It's the first increment of scale. The scale is tipped – literally, the scale, in the sense of size, but also the scale tipping' (Ukeles, 1996, p. 211) (see Photograph 58). Here, Ukeles' focus on scale is not a geographical understanding of scale, rather it relates to size and practice (the tipping of a scale) and the changes that occur because of these

[111] This is the first point of translation for the municipal waste stream (both of relative size and relations of responsibility). This translation is different to the translation of waste into capital when it is categorised as disposed - once landfilled waste becomes accounted for in terms of volume rather than weight.

properties. When I rode along for shifts doing fieldwork with the CoS, the one thing (without exception) that the plant drivers would show me was the waste docket or receipt they received from the tipping station. The docket was time stamped and provided a record of the tipping weight of the truck. Each driver would pass it on to me to examine, believing this information was essential to my study. The fact that the information was seemingly always deemed important (in order to convey and share the scale with me) speaks to the centrality of tonnage and volumes as an accounting device in waste management.

This theme was again evident on New Year's Eve. Sydney's New Year's celebrations are the biggest yearly event for the CoS and a globally significant annual celebration; indeed, the city boasts that it is 'the New Year's Eve capital of the world' (City of Sydney, 2023). On New Year's Eve 2019 (see Photo-essay V, Section 6.5), the plant drivers were given repeated notice that they needed to have their tipping dockets back to the event manager at the Depot by 6am, so that information about how much waste had been collected could be reported by the CoS Mayor, Clover Moore, in her address to the press on the steps of the Sydney Opera House. The address was set to take place at 9 am on January 1st 2020. It is not simply the centrality of accounting, as a way of translating the importance of this work, that is of interest. It is also important to note the volumetric scale at which this accounting is registered. Tonnage is translated as being representative of the capacity to act (that is, to collect and manage X tonnes of waste). Tonnage is also an industrial scale measurement. As industrial waste managers, there must be an infrastructural (and labour) capacity to deal with multiple tonnes of waste on a daily basis. Waste can often be accounted for in terms of an absence, or lack of value (Liboiron, 2018). Alternatively, when it comes to waste management, waste becomes matter accounted for, in terms of the number of tonnes of waste material either managed or diverted from landfill. 'Captured', 'generated' and 'avoided' are all common forms for translating and accounting for waste.

Once waste is scaled (that is, picked up through residential collection steams), it continues to be moved at scale and at times is re-scaled through the process of sorting and baling particular material streams to be recycled. These processes are managed by many different actors, contracted companies, local councils and individuals who deal with waste. Sometimes these changes in responsibility for waste are accompanied by a contracted agreement, where the process of collection has also been outsourced (such as with Cleanaway); at other times, these

points of material transferral are mediated by the dropping of waste at transfer stations. Upon emptying the materials onto the transfer floor (Photograph 85), this exchange is then mediated through payment for another entity, such as Veolia or SUEZ, to take responsibility for this material (likely governed by a separate contract). Through these processes waste becomes a thing that is bought and sold, and as such, waste becomes a property relation, a problem defined insofar as it is translated into a figure of capital.

Photograph 85: The tipping of council waste onto the floor of the Artarmon Transfer station.

9.8 Conclusion

Industrial processes are made through modes of (dis)assembling objects at scale. It is the logistics and practice of collection, disposal and transformation of matter at scale that makes the waste industry 'industrial'. This chapter has looked at the ways in which waste becomes waste. By showing the ways in which scale and responsibilities for waste are contracted or 'sorted out' – becoming dispersed amongst multiple actors – I have discussed the logics of the waste system established within the CoS. These logics work on an understanding of colonial and capitalist relations, in which we are only responsible for our property relations – even when these relations can be easily severed through the selling of property. Waste is a property

relation, through which responsibility is shifted from one actor to the next, until it is ultimately disposed or recycled. Responsibility for waste is accounted for in an act of translation from material into the language of capital; however, this translation is always incomplete as waste remains present.

This chapter argues that collective responsibilities for waste do not become erased through the shift in scale away from, and then towards, the industrial. As Barad (2014, p. 184) states: 'Responsibility is not a calculation to be performed. Ultimately, this collective responsibility is not about transferring blame to the points of 'individual' or 'household consumption and disposal', as all material that came from the industrial waste system continues to be industrial waste. The conceptual level of thinking of this thesis does not try to intervene or think at the level of individual actions scaled-up to make a cumulative impact. Rather, it examines the infrastructural system of waste as a way of explaining the cumulative impact and allowances of the system. To continue with Barad, as a collective we are implicated in and responsible for the industrial process of production and waste disposal because responsibility is '... a relation always integral to the world's ongoing intra-active becoming and not-becoming' (ibid., p. 183). As such, I propose that it is important to find ways to expand our collective capacities to respond and become response-able for materials at an industrial scale.

10. Conclusion: Waste futures

Throughout this PhD, I have explored the legacies and histories of waste taking place in Sydney, and sought to reveal the ways in which waste is rendered (in)visible. On these pages I have created a layered story of waste; this has necessitated a focus on material, discourse[112], labour and infrastructure. I have also incorporated my own experiences of knowing the city of Sydney, experiencing first-hand sites of industrialisation, waste and contamination. The knowledge of these spaces and the transformation of the city is enhanced through my experience of the city over time; it requires the 'taking of time' and an ability to recall its stratigraphy, the many layers that form to build the city today. As the city continues to transform, I wonder about the 'waste futures' and the city that is consistently reproduced by waste over time.

Considering 'waste futures' is to 'address the past' (Barad, 2014). Sue Campbell refers to this as 'remembering for the future' (Campbell, 2014, p. 135), while Alexis Shotwell describes the process as 'attending to the present', which 'is reliquary of the past, holding traces of everything that has happened and everything that has been erased' (Shotwell, 2016, p. 77). My approach throughout this thesis has been to connect 'waste pasts' to 'waste presents'; in this concluding chapter, I will take the time to 'think with' the resulting 'waste futures'. This thesis has explored how the legacies of understandings and practices are brought together, producing the city and in turn reproducing waste. As the legacies of materials ultimately become a present concern, waste is understood as a material ongoingness that holds the political stakes of the past and shapes the political stakes of the future.

As a Human Geographer who 'thinks with' waste, this thesis is placed 'somewhere' – meaning that the process of producing waste takes place in the city of Sydney, in turn producing and reproducing the city itself. The relations between place and waste, as developed in the contextual chapters (Chapters 4 and 5), are not harmonious, but they are ongoing. The ongoing material presence of waste has an intimate relation with land, water, and atmosphere; it depends on these places (to be somewhere and to be waste), creating what

[112] Feminist scholars Barad and Haraway argue for the material/discussive in that one cannot be separated from the other.

Tarr (1996), Gabrys (2009) and Liboiron (2021a) call 'sinks' (Chapter 2). As per the title of the thesis – *Making sense of waste: understanding the (in)visibilities of waste in Sydney through labour and infrastructure* – I have paid attention to the processes that make waste in aiming to manage and standardise excess (for example, standards in Chapter 7), but also to the processes that have only made waste visible at certain times, in certain places and for certain bodies.

Bodily relations are at the core of feminist materialist practice; *mattering* through feminist theories challenges notions of purity and singularity, seeing bodies as always in contact and constantly co-becoming with waste. The feminist lens applied to this thesis has helped my understanding of waste as made through processes of standardisation (Chapter 7), labour (Chapter 8) and industrialisation (Chapter 9), but also making the city through these processes.

My journey with waste began with the Whitechapel Fatberg (see Prelude). This encounter helped shape the three research questions that became ever-present considerations:

1. How do material practices of wasting persist in space and time?
2. How do systems of classification and containment constrain or enable the ability of material to matter?
3. How is waste responded to and who becomes responsible for materials?

I have sought to engage with these core questions throughout the thesis, and the following section reviews the answers that emerged from my research. At the end of this chapter, I will also take the time to 'think with' waste futures by considering avenues for further research.

10.1 The persistence of waste in space and time

Over the course of this thesis, it has been argued that waste spaces fundamentally underpin and support the development of the city. As such, waste and waste spaces are performative in the creation of the urban space. I have 'stayed with' material presence by narrating a biography of the living stratigraphy of waste within Sydney.

The material practices of wasting were reviewed in an historical sense in Chapter 4, by looking at the development of waste systems in the City of Sydney and the Greater Sydney region. The placement of local infrastructure and sites of disposal were discussed, including the rationale

behind the selection of particular configurations of waste management in the city. In Chapter 5, Situating the production of the city, the legacies of waste pollution were examined in relation to the Millers Point Gasworks. These waste histories are woven into the fabric of the city and continue to enact themselves in the present. Chapter 5 'thinks with' the legacies of production in the city and the waste spaces that persist, even though heavy industry activities have since moved to other locations. Thinking with 'copresence' within Chapter 5, and then again in chapter 8, I stayed with the material presence of waste and came to see the structure of the city as underpinned by waste – that is, there are traces and legacies of waste across the wider city, which construct the city's existence and potential.

Given the findings in Chapters 4, 5 and 8, I have shown throughout this thesis that waste has a long legacy; it does not simply cease to exist or matter once it is disposed of, or when released into a sink, often making this excess invisible. Focusing on the urban space of Sydney, I have illustrated ways in which waste lingers and is made (in)visible in the fabric of the city. From the Millers Point Gasworks (where the toxic legacies of gas production lay invisible for a century until the site started remediation processes) to the CoS Bay Street Depot which has been pivotal in moving waste for more than a century, the material legacies of waste are ongoing and central to the work of cleansing today. The material practices of wasting persist in space and time through sites of infrastructure that tell stories of – and are prompts to discuss – waste in the city. Chapter 8 provides an additional reading of the sites of waste in the city, by looking at the embodied understandings of waste through the lives and labours of the people who work to keep the city clean.

10.2 Classification and containment

Waste is produced as a material expression of excess, derived from the system through which it is classified. Materials transition through different classification systems: from industrial spaces of processing and manufacturing, to commercial spaces of warehouses and shops, to the space of the home (which is constituted differently in each household) and then into the industrial waste and resource recovery system. Each of the spaces of systemic ordering provides its own classification of waste. This thesis has focused on the industrial system and the ways in which it classifies waste – specifically MSW – in the CoS.

The question of systemic classification and containment, and the role these play in the ability of material to matter, was addressed in Chapters 7 and 9. In Chapter 7, systems of classification – where infrastructure, machines, bodies and standards intersect – were examined. Critical to this examination was a discussion of the politics of language in defining and classifying waste as an issue. In a few critical interviews, waste staff thoughtfully alluded to differences in terminology and the specific material boundaries implied by the use of terminology. As the CoS moves through different ways of thinking about and managing waste, systems of classification and containment are subject to necessary change, and can sometimes be in discord with the material reality of working with waste. This subject is also addressed at the industrial scale in Chapter 9, which 'thinks with' borders and boundaries that are implicit in waste systems – how borders designate lines of classification, becoming the seams at which the tension is felt.

From the discussion and analysis in these two chapters, it was clear that systems of classification and containment constrain and enable materials to matter in uniquely different ways. As a form of classification, plant (Appendix 2) can create a quantifiable volume of material (waste – in the case of this thesis) in a common and reproducible way (Chapter 7). MWOO is also discussed as a classification that distinguishes between what materials are considered waste and what is considered a resource (Chapter 7). Also in Chapter 7, I discussed how policy produces standards through aspirational metrics, quantifiable targets and benchmarks, which form a structural system of classification. Chapter 9 builds on these framings of classification when it considers how classifications of space (as private or public, for instance) prescribe responsible actors for waste materials. Thinking with the seams of waste processes helped identify the points of tension, in terms of feeling and experience.

Finally, Chapter 7 also discussed the extraction of energy from materials as a standard. The extraction process illustrates how materials can be quantified as valuable through the harvesting of energy. This is also a potent form of classification, underlying the transformation of waste into a resource. Therefore, energy becomes the standard to be extracted/of extraction from the material. These primary forms of categorisation have cumulative implications for the amounts of waste generated and the potential trajectories of materials. In general, all forms of classification constrain, as they provide categories and create borders through which classification is operationalised.

As systems that structure the material world and waste, systems of classification make themselves a part of the material/discursive, offering definition through their parameters and essential features. Classifying and constraining enhances the capacity for material to matter, insofar as one can think at scale (*en masse* categorisation). However, in these ubiquitous forms of categorisation, the specifics of material and their situatedness can also lose their definition or agency. Classification and containment, by making material generalisations, change the relationships that matter and – importantly – who is able to be responsible for waste.

10.3 Response and responsibility

The question of how is waste responded to and who becomes responsible for materials, is addressed in Chapters 4, 5, 6, 8 and 9. This thesis has looked at how responsibilities to waste are felt differently across the spectrum of interactions. We each have a relationship with waste, even if this relationship goes unnoticed and/or unconsidered; we discard frequently as we consume and excrete on an everyday basis. Concurrently, some people have a more continuous concern and interaction with waste and waste materials. In this sense, the presence of waste becomes a pressing responsibility.

This thesis has found that waste is responded to in several ways. With its focus on industrial waste systems, this thesis has eschewed thinking about waste as a personal responsibility; instead, the broader waste system and its key actors are analysed. Responses to waste are first grounded in Chapter 5, regarding the legacies of responsibility at the Millers Point Gasworks. This chapter explores how responses to waste are often deferred, both temporally and between actors, as private waste problems are dealt with in the public sphere.

Chapter 6 visually introduces the work of responding to waste and the mechanics of infrastructure and labour. The photographic essays illustrate how the Waste and Cleansing Services workers for the CoS perform this work, documenting the specific methods, tools, plant, systems and knowledge that form the initial response to waste. Similarly, Chapters 4 and 9 engage with industrial systems at both the level of the local council and amongst corporate entities, surveying how these systems form part of a response to waste that has shifted locations and responsibilities over time.

Policies and programs, focused on different waste streams, respond to waste; these responses are discussed in Chapter 7. At the CoS level, council waste reduction policy and the food

organics trial are delved into, as ways through which the CoS becomes responsible for MSW. The State Government also responds to waste, particularly the EPA, whose remit includes the management and regulation of waste and its impacts. The MWOO process shows a traditional response at the State level through regulation and the specifying of acceptable levels, effectively setting the systems for classification and containment. Ultimately, at a federal level, shifting policies, guides and bans are sometimes a reaction to rapid changes in international policy (for example, China's response to waste provoked Australia to reconfigure its responsibilities to waste). Policies, therefore, come with certain obligations and responsibilities, even if they are not always achieved (see the delayed FOGO target in Section 7.5.1).

Finally, while not deferring responsibility for waste onto the individual, it is important to consider the ways in which responses to waste are embodied. Chapter 8 focuses on how the individual worker within an industrial system responds to waste, as a sole focus on the individual would be remiss; waste is not legitimately responded to at the individual level – see 9.3. Despite this, it is important to see how waste is managed at the level of embodiment – how a response is a bodily phenomenon, a physical process requiring many bodies working collectively towards the same goal. This thesis foregrounds the 'coalface' – the everyday people who are the eyes, the hands, the muscle of this work.

In answering the question as to *who* becomes responsible for materials, I have found that there are always bodies behind these actions, and that responses to waste are necessarily situated uniquely and are specific. Response-ability (insofar as it is envisaged as a concept in this thesis) is not a relation that is individually held; indeed, to be response-able is to be able to respond and not be overwhelmed by responsibilities. In alignment with the ethos of this thesis (and in accordance with discard studies), it is understood that assigning individual responsibility for a systemic problem, such as the production of waste, connects to the colonial project in that it places blame on the individual rather than the system. Individualising systemic issues is a technique of power that frustrates the capacities of the response-ability. Responses to waste are necessarily industrial, even if they involve the embodied labour of individuals. A response to waste can only truly be enacted at the scale of the industrial – of plant, operations, workforce – and waste responsibility flows accordingly to those providing the industrial waste response.

10.4 Timing

It matters when and where these research questions were answered; this thesis has a strong emphasis on situatedness as a form of feminist attunement with the places and times where the research took place.

The timing of fieldwork has fundamentally shaped the concerns of this thesis. In the Prelude and Introduction, the temporal specifics of the beginning of this thesis were signposted; now, at the Conclusion, the specifics of temporal aspects of the duration come to matter. Over the five years that it took to write this thesis, the changes signalled in the waste system/industry in 2018 have had time to play out and mature. Five years is not a long time in the development of industrial infrastructural projects, even considering an emergency response to the disruptions felt within the waste system at that time due to the introduction of China's National Sword policy. Even now (in mid-2023), despite *The Recycling and Waste Reduction Act 2020 (Commonwealth)*, more time is being sought so that the system can enact change. In May 2023, faced with the likelihood of stockpiled recyclable materials going to landfill, the Federal Environment Minister, Tanya Plibersek, granted a one-year exemption to Oatley Resources Australia, allowing the export of 'clean and sorted polyethylene terephthalate (PET) waste plastic' for recycling overseas (Evans, 2023).

As was detailed in Chapter 9, fieldwork was undertaken just before the remaining in-house council waste services were outsourced. In the period since my fieldwork with the CoS, the CoS's residents have experienced multiple and continuing worker strikes (an article from 17 May 2023 reports on the sixth so far in the year) (Wang, 2023). As Cleanaway staff also continue to take strike actions, bin pickups are missed and waste piles up (Rachwani, 2023). In a *Guardian* news article addressing the effects of the strikes, Waterloo resident Chris Jespen was quoted, saying:

> The chutes on each level of the building just started piling up … Usually you don't even notice them getting full but I opened it the other day and it was overflowing.
>
> We were emailed and told there was a strike going on. It's just one of those things that shows what you take for granted, all the invisible services we rely on. (Rachwani, 2023)

These two examples (the export exemption and consistent labour strikes) show that systemic changes to the waste system are not fixed and that there are continuing points of tension.

These examples also demonstrate how our 'waste futures' continue to be contested, that the future is sometimes uncertain and depends upon adequate infrastructure and labour.

10.5 Waste Futures – Directions for future research

In concluding this thesis, I would like to point to future directions for research and areas of further study. This thesis has thought with the tensions between waste systems and the points at which these systems are situated. There is an opportunity to examine the research questions detailed in this thesis at different spaces and temporal points, within Sydney and at alternative sites. As Stengers reminds us:

> We do not need to judge away the past as if what we are adding to it would somehow be what it was missing. We have to inherit it together with the possible it conveyed, to make it denser and more indeterminate in order to inhabit a thicker, ongoing present. One of the worst academic habits is the remark that somebody else has already produced something similar to what you are proposing. Well, one would hope so! But instead of stopping at the triumphant effect of recognition, what would be more interesting is to comment (in the sense of thinking-with) on the insistence of what is trying again to become audible – the changing accent it has acquired, the present-day situation it connects with. (Savransky and Stengers, 2018, p. 133)

This perspective has guided my own research and understanding of the future directions of research, as there are endless possibilities for new research propositions that might arise from being in the field and honestly interacting with sites of waste, listening to what 'is trying again to become audible', again and again. In applying the pluralist inheritance discussed above, we can 'inhabit a thicker, ongoing present.' That is to say: research in this field is ongoing and never exhaustive, necessarily evolving over time as we form different responses to waste.

Despite this realisation, specific future research opportunities exist. These may include thinking with actors that exist outside of the boundaries of the CoS and understanding how private corporations influence waste landscapes (following specific flows, their material configurations and implications). Following this thread, there are also multiple opportunities to continue thinking with industrial waste and matters of responsibility, paying attention to points at which waste response(abilities) are severed or disconnected, or where states of (in)visibility shift.

As the legal and political landscape changes, the processes of classification and containment are updated, often resulting in new and complex infrastructures or processes. Accordingly, in

the future, scrutiny will need to be applied to an evolving and quickly up-scaled waste management system; this will be especially pertinent when considering shifting international policies and the increasingly fast-paced dependence on private waste managers, as they adopt an increasing role as 'bigger players' in the waste management system. This also necessitates continued discussion of the value of council services (in particular, cleansing and waste management services) and their role in maintaining a service-based approach to waste management.

10.6 Research implications

As a human geographer, this PhD research has sought to contribute to my field of scholarship, along with the fields of discard studies and waste studies. This PhD works with waste in ways that enable a layered re-thinking of the city, approaching waste relations through a materialist feminist methodology and an understanding of standards, infrastructure, and labour. Through this process, this research has made empirical contributions to these fields of study; this is important, as waste is an understudied phenomenon in Australia and Sydney, particularly through these disciplinary lenses.

This research has theorised waste from within the waste and resource recovery sector and outside it (beyond the logics of waste management), which has enabled a layered re-thinking of the city. These two perspectives led to two different applications of logic throughout this research. The first is the logic of co-production, which implies a simultaneity between ethics, epistemology and ontology; and the second is a logic of management in which an emphasis is placed on epistemology, insofar as understandings of waste shape the very materiality of waste. While thinking with this second approach, this thesis also demonstrates the limits of these logics, with Chapter 9 illustrating how the management of waste based on epistemological borders and boundaries is always compromised by ethical and ontological considerations. Therefore, this research addresses the side effects (what is discarded, overlooked, or viewed as the exception) of privileging epistemological approaches to waste without the interweaving of ethical and ontological considerations. Nevertheless, this thesis shows how both logics produce space in different ways and, therefore, while their logics are incompatible, the interplay of both perspectives need to be considered seriously when working with waste and thinking with waste relations.

10.7 Concluding thoughts

This thesis has paid attention to infrastructure and the labouring bodies that support the flow and trajectory of matter, in particular waste. The work seeks to contribute to a growing field of scholarship that focuses on the intersection of these concerns (see: Fredericks, 2018; Ramakrishnan, O'Reilly & Budds, 2021; Carr, 2022; Kathleen & De Coss-Corzo 2023). By making a record of the impacts, flows and legacies of waste in Sydney, I am contributing to the story of the city.

The aim has been to 'think with' the (in)visibilities of waste and to consider how these states of being are subject to ways of viewing and situating oneself within the city. By rendering the invisible 'visible', this thesis utilises the framework of discard studies to produce an 'accountability to what is discarded in the system' (Liboiron & Lepawsky, 2022, p. 152). In doing so, I establish a view of waste as the excess of the city of Sydney (the studied system). Systems of waste have been considered, with regard to how specific systems (configured through infrastructure) enable and reproduce waste as excess. To this end, attention has been paid to how infrastructures configure the city in productive and uneven ways, by making waste legible in the global, national and local language of accounting for material flows (an act of translation), and also as forms of boundary making. Ultimately, this thesis conceives waste as a material ongoingness that holds the political stakes of the past and shapes the political stakes of the future.

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Appendix 1: Encounters

Encounter 1

The art of telling a good story is to make it seem seamlessly constructed, as if you – the writer – knew all along that this was how it was going it turn out. However, stories need to be purposely constructed – and construction always involves a (significant) degree of editing, of taking out and bringing in, of centring, what to begin with, may have felt marginal. Here I have chosen to show you my meandering journey and how my meandering lead to a woven net of interconnections that widened the depth and breadth of my research in ways I never could have imagined. I should note here that when I speak to meandering, I am not speaking of the hundreds of hours of reading that leads you from one idea to the next, although I did that too. What I am referring to here is the actual act of meandering, of placing my body and moving through space, not knowing what that will generate, but nonetheless showing up, being present (presenting oneself), prepared to notice what presented itself in return.

The idea of walking as method and a mode of discovery and investigation was gifted to me at the very beginning of my PhD journey, three days in to be precise. On the 7th of March 2018, I attended my first Composting[113]: feminisms and the environmental humanities reading group. The session I attended took me to Sydney Olympic Park; the walkshop was a walk around a part of the parkland running alongside the Paramatta River. This walkshop was the 23rd session of composting, titled *Intoxicated Ecologies*; the session was led by anthropologist and STS scholar Eben Kirksey and our reading for the day was my first introduction to the sociologist[114] Alexis Shotwell's work, *Against Purity*. Chapter three, our reading for the day, starts out with the following sentence:

> Attending to the present moment implies, necessarily, understanding that the present we move through – a perpetually shifting bubble-node that we cannot fully grasp but that simultaneously is the only thing we can experience – is reliquary of

[113] Composting: feminisms and the environmental humanities reading group is facilitated by the brilliant and warm Astria Neimanis and Jennifer Hamilton. See the group at: https://compostingfeminisms.wordspress.com/

[114] I am not convinced that it is necessary to introduce writers through their disciplinary background; however these are added here to give the reader an indication that multiple disciplines are being drawn on in the working and writing of this thesis. As a multi-modal scholar myself, I do not practise a keen differentiation between the borders of disciplines.

> the past, holding traces of everything that has happened and everything that has been erased. (Shotwell, 2016, p. 77)

Re-reading the sentence now (July 2020) I am surprised to see how much of what I would go on to be preoccupied with in regard to researching could be encapsulated with this opening sentence; did these ripples start here? Or was it maybe in reading the work of Vanessa Berry: *Mirror City* (at Marilu Melo Zurita's recommendation), which draws and narrates the layers of time embedded in the suburbs of Sydney? Maybe it started before I was born, with my Mother's love of cemeteries, places of historical significance in the telling of lives lived and attending to the bodily remains. Maybe I have always been at home amongst the past (or) maybe I have always held the lens of the past to the present. These reverberations might seem insignificant, but my approach leads me to believe that I am porous to my environment and all things filtered through me, attuning my bodily senses.

At this composting walkshop, my interest with waste was woven through with watery strands. I was encouraged to think with bodies that witnessed and related to our bodies of waste. We reflected on the landfill upon which we stood, now transformed into a children's playground. We thought with James Nguyen about his childhood experiences in the 1990s, of playing there in nearby storm water drains, which provided a viaduct for industrial runoff around these areas and connected to highly toxic bodies of water. We thought about the bodies of the green and gold bell frog as an unlikely survivor in the toxic landscape – as having the ability to live in spite of, or precisely because of, toxicity (Kirksey, 2020) – and the various biological and mechanical purification processes used to treat the leachate run off from the landfill – an endeavour carefully monitored to protect the river body from new accumulations of toxins.

This walkshop (along with other ideas that I had been exposed to through Marilu Melo Zurita) enabled my thinking of water as connective body, shaped my thinking around flows, and unknotted some of my dichotomous thinking around waste. In particular, the idea of being against the ethics of purity was key to laying this foundation of a new theoretical starting point. Water for me both came to embody the process of flows, which my PhD was concerned with, and became the medium through which to understand the independencies and superpositions of matter. Water as both the body and the carrier – the transistor – the network and liquid connecting slough and life body. Connecting to my research on waste, I saw water as the carrier of waste, that is, water as the infrastructure that enabled waste flows. This is

how the relationship between water and waste made a critical entrance into my PhD that would be carried through my research practice.

My approach aims to think with bodies and discourses as I encounter them in the world. I am not supposing that this is an innovative approach; my work builds on a long lineage of feminist scholars and scholarship (see Hamilton & Neimanis, 2018; Neimanis & Phillips, 2019) that combines the practice of walking and composting.[115] However, I believe, nonetheless, that my own practice of these methods, as a result of my specific situatedness, will yield something new. Therefore, my Methodology (Chapter 3) will show how this open methodological approach led me to practise research in particular ways which returned a compost pile that is specific to its ingredients, and the cultivated ecosystem that forms within me, to turn discards into compost.

Encounter 2

In 2018 I participated in a two-day Masterclass with Karen Barad, held in Melbourne. To apply for the workshop, I was asked to articulate how my 'research relates to the theme "diffracting difference and identity".' In part, my response was as follows:

> …I have recently been thinking about the materiality of waste and ruminating on how waste matters and persists even once it has been 'fixed' through technocratic intervention. Moving beyond technocratic fixes for waste that function on the assertion that waste/non-waste binaries can remain intact through artificial borders. My research troubles the ways in which waste 're-turns' in an attempt to bring 'to the fore questions of temporality, materiality and justice that are crucial to and have always already been a part of discussions of diffraction/differencing' (Barad, 2014, p. 181). Ultimately, I hope that the idea of diffracting difference might be able to inform a research methodology that is both sensitive to the ways in which waste is made and the ways in which waste makes the past, present and future.

Working with diffraction as a methodological approach changes the research focus from one of borders and boundaries (that is containing things), to focusing on patterns of interference.

[115] In this way, walking as a method is accompanied by the digesting and de/re(composition) of texts; the conveners of Composting Feminisms, Astrida Neimanis and Jennifer Hamilton, refer to this process as composting:
'Taking both Haraway's prompt and the material metaphor of the domestic composting system as our points of departure, then, we suggest that composting as practice demands that we pay attention to what goes into the compost bin. It implores that we attend to our critical metabolisms—to notice not only what is being transmogrified, but also under what conditions, why, and to what effect' (Hamilton & Neimanis, 2018, p. 503).

‘Diffraction is a mapping of interference, not of replication, reflection, or reproduction. A diffraction pattern does not map where differences appear, but rather where the effects of difference appear’ (Barad, 2014, p. 172). Barad explains the process of diffraction with an opening metaphor of an earthworm which ingests, excretes, tunnels and burrows, while in turn creating diffraction effects – aerating the soil and transforming organic matter into rich worm poo fertiliser (Barad, 2014, p. 168). In this case, diffraction is enacted through the bodily apparatus of the earthworm. As such, the worm becomes response-able. Equally our bodies render us response-able, as Barad concludes:

> Walking by the ocean in Santa Cruz, I re-turn again and again to thoughts of diffraction and entanglement. The conversation is ongoing. The redwoods, the ocean, the paths taken and those which may yet have been taken hold the memory of these explorations by foot and by mind. We are being churned by the soil, the wind, the foggy mist. A multiplicity, an infinity in its specificity, condensed into here-now. Each grain of sand, each bit of soil is diffracted/entangled across spacetime. Responding – being responsible/response-able – to the thick tangles of space-time-matterings that are threaded through us, the places and times from which we came but never arrived and never leave is perhaps what re-turning is about. (Barad, 2014, p. 184)

My methods focus on the ways in which the body could be positioned to become responsible to the labours of our waste systems and for our waste places. In this way I am diffracting, waste materials, against the labours to manage waste and infrastructural flows. Attending to the diffraction patterns moves beyond a focus on the accomplishment of waste management toward the ‘dynamic specificity’ of attuning with our unwanted materials flows. The diffraction patterns appearing from the intra-actions of materials, infrastructure and labour, reveal the different risks and responsibilities that can only emerge from within these systems of flow. To research these systems, I needed to become a part of these systems, to respond and become responsive within the apparatus. As Barad herself states:

> To address the past (and future), to speak with ghosts, is not to entertain or reconstruct some narrative of the way it was, but to respond, to be responsible, to take responsibility for that which we inherit (from the past and the future), for the entangled relationalities of inheritance that ‘we’ are, to acknowledge and be responsive to the noncontemporaneity of the present, to put oneself at risk, to risk oneself (which is never one or self), to open oneself up to indeterminacy in moving towards what is to-come. (Barad, 2014, p. 183)

This statement, along with the matter discussed at the workshop, led to a self-diffractive research methodology which I attempted to articulate in my written response at the conclusion of the workshop:

> The body; the earth body; water bodies; the human bodies; my body
>
> to respond to the body, with the body – response as bodies intra-acting
>
> Able[116] bodied – to be response (able)
>
> Troubling the self – troubling the porous boundaries of the self
>
> The body as a container for the self – that at once holds and leaks – the body as embodying the void
>
> The body at risk of death – at risk of embodying the void
>
> (My) diffracted intra-actions will reverberate long after (my) death
>
> (My) e-motions continuing to make waves
>
> (My) responsibilities continued through (my) kin[117]
>
> Oneself 'which is never one or self' (Barad, 2014, p. 183) as the material discursive
>
> > As I have explained elsewhere, intra-actions enact agential cuts, which do not produce absolute separations, but rather cut together-apart (one move). Diffraction is not a set pattern, but rather an iterative (re)configuring of patterns of differentiating-entangling. As such there is no moving beyond, no leaving the 'old' behind. (Barad, 2014, p. 168)
>
> Taking time to deal with one's waste – taking my own time to deal with my waste – times are a multitude (everybody spends and expends their time). What happens when your time is more closely aligned with seeing a material through spacetime matterings? Taking responsibility through time for our labours and for our labourings. Abjection as cutting together apart.

[116] All bodies are differently abled – able here is not used in a normative sense.

[117] 'By kin I mean those who have an enduring mutual, obligatory, non-optional, you-can't-just-cast-that-away-when-it-gets-inconvenient, enduring relatedness that carries consequences. I have a cousin, the cousin has me; I have a dog, a dog has me' Haraway (in Paulson & Haraway, 2019).

The cutting apart of labour from materials is to cut 'a/part' our responsibility – both in sensation and response.

> Who laboured to bring me into existence? I am my mother's labour – labour is continuous and always cutting together apart through life and death.

Figure 27: Photo taken of the participants of the 2018 Masterclass with Karen Barad, walking along the Yarra River we reached the Dights Falls.

As we walked down by the river, letting our bodies move beside the flowing water, we diffracted our positions as researchers in light of the discussions drawn out from the two-day workshop. Among other conversations, Hayley Singer and I talked about our research; Hayley told me about the work of Mierle Laderman Ukeles, a contemporary American artist whose practice is concerned with the work of maintenance and the labour of keeping things clean. Ukeles' Manifest for Maintenance Art 1969!, and her continuing artist residency with the New York Department of Sanitation (which has now lasted over half a century) would become deeply influential to my research practice.

Encounters 3

My methods came from a journey of collaborative practice that was undertaken over the first year of my PhD. I was very fortunate to be a part of a variety of communities of practice; each inspired my research, nourishing my roots as researcher, widened my theoretical understandings and grounded research ideas in modes of practice. Some examples of how this collaborative practice developed have already been covered in Encounters 1 and 2, along with attending various reading groups, such as Composting Feminisms and the Housing for Health Reading Group (both in person and with the event of COVID-19, online), participatory walkshops and experimenting with these methods myself within my particular sites of research.

My participation in two workshops at the beginning of 2019 focused on attuning with bodies of water – and how we might be able to sense water when we couldn't see it. That is, how might we be able to conceptualise how water made the city, when the ways in which water makes a city are mobilised largely at a subsurface or infra level? What interested me was that both workshops had an emphasis on infrastructure and applying creative methods to sense or experience what flows enabled – or perhaps (dis)abled or (differently)abled. For me it was more important that I might be able to play with these types of methods in a low stakes and communal/peer-to-peer learning environment than that the material had to be waste, or more specifically, waste water, to be relevant. The workshops allowed scope to collectively experiment with methods that involved exploring diverse sensory capacities and expressing them in other ways than through talk and text.

Water guided the movements of these walks. The *Working with Water*[118] walkshop toured Johnstons Creek in Annandale (Sydney, Australia), a place familiar to me (having lived in the adjoining suburb of Leichhardt for ten years prior). The second workshop, *Creative Methods for Researching Urban Infrastructures*[119], took place in Manchester City (UK), where the working group I was a part of walkshopped the Rochdale Canal as it flows through Manchester City, a place unfamiliar to all but one of our group's participants. The Working with Water walkshop guided us to test specific methods of attuning with water, while in the other

[118] Organised by: Susanne Pratt, Kate Johnston, Astrida Neimanis and Jennifer Mae Hamilton.
[119] Organised by: Amy Barron, Cecilia Alda Vidal, Kathleen Stokes, Lourdes Alonso Serna and Torik Holmes.

workshop methods were more spontaneously chosen. Importantly, both the walk/workshops focused on the co-constructions between materials (in this case water) and infrastructure. In the case of the waterways, the infrastructure of the cemented creek bed and the canal helps make visible, to both current places of flows and the legacies of infrastructural engagements.

I was invited to participate in the Working with Water walkshop because of my engagement with the housing for health reading group. The purpose of the Working with Water workshop was to 'experiment with ways to engage both water and water communities as lively collaborators and sources of knowledge'. As part of this two-day workshop in February 2019, we collectively participated in a walkshopping exercise/event. The workshop allowed for experimentation of mapping methods through different epistemological ways of sensing the material world both through translating visual signals and through ways of imagining the invisible through sketching. Other questions posed in the walkshop, coordinated by Kate Johnson and Jennifer Mae Hamilton, were:

> 'What would planning look like if we used our ears to attune to place?' (Kate Johnson quoting a former walkshop participant). Thinking about infrastructure and drainage as an ecosystem service. How is infrastructure 'bodied' by daily practices? Reflecting on the waterway as a drain, that enables particular types of land practices, such as development on low lying land. How might these practices need to change? How do current land and water management systems regulate your life?

By posing these questions, we were provoked to think about the ways in which imaginary and diverse modes of sensing and recording could generate diverse understandings of the world. As part of the walkshop, we were asked: how do you listen to water becoming invisible? Given pens pencils and sketch paper, we were asked to respond. In responding, we undertook a process of difficult translation – from listening to drawing invisibility, through drawing sound. My sketch featured a drawing of a pole and powerlines in the park in which I was sitting, to which I added radiating sound to visually represent the sound of the volume of the water used to produce that electricity in the distant elsewhere, while contemplating the connections between the body of water (Johnstons Creek) that we were walking along and the water bodies used in our electricity generation. This exercise and related questions generated methodological propositions about listening and interacting to flows that might only be visible for a short period of time or in particular locations, as well as thinking about flows as bodies of materials that transition between states of visibility and invisibility across spacetimes.

The following month, in March 2019, the working group I was a part of in Manchester looked at creative ways to follow water through the city. 'We were thinking collectively: where can we explore water in the city, how can we explore water access?' (#Creativeinfra, 2019). Originally, we wanted to look at public access to water – insofar as water might be used (drunk, washed in or flushed) for hydration or sanitation in public spaces – we were interested in access to drinking water and public toilets. However, due to the scope of the project (two days), we decided to look at what more visible forms of water infrastructure there were there in the city.

> The obvious choice for us was the canal, and considering we were talking about methods in the morning, talking about walking methods, visual methods, record taking, sketching and things like that, we thought, well, why don't we take a walk through this canal as a collective group and see what that generates? (ibid.)

As a group of eight young female scholars from a range of social science disciplines, all from different parts of the world, walking together by the canal raised many different research questions regarding the space, particularly as only one of our group members was from Manchester. 'We were looking for ways in which the infrastructure and the materiality of the water itself could speak to us and there were different focal points that came up through our walk' (ibid.). For some of us the interest was in how this canal with its 93 locks was maintained, who it was that performed this work, for others it was the development of the canal into a site of leisure lined with trendy bars. Our attention was also drawn to signs along the canal warning that after a night out, the canal could be a place of danger (after the bodies of two teenage boys were found in the canal on separate occasions in 2017) (BBC, 2028), and points in the river that accumulated litter.

For me the most interesting thing about the canal and its waters was the ways in which they have facilitated the industrial history of Manchester, how the connections between electricity, power and water became exposed. Signs along the riverbank were titled: Water, Coal and Power: Building an Industrial Revolution, or provided information about the Coal Wharf and the industrialist history of the different canals (Figure 28); As we started exploring the canals, I was particularly interested in the ways in which water was mobilised through the infrastructure of the canal to be both an infrastructure in itself (an enabler of flow for raw

commodities such as cotton, wool, coal, limestone, timber, salt) and an essential component of development of electricity generation in Manchester.

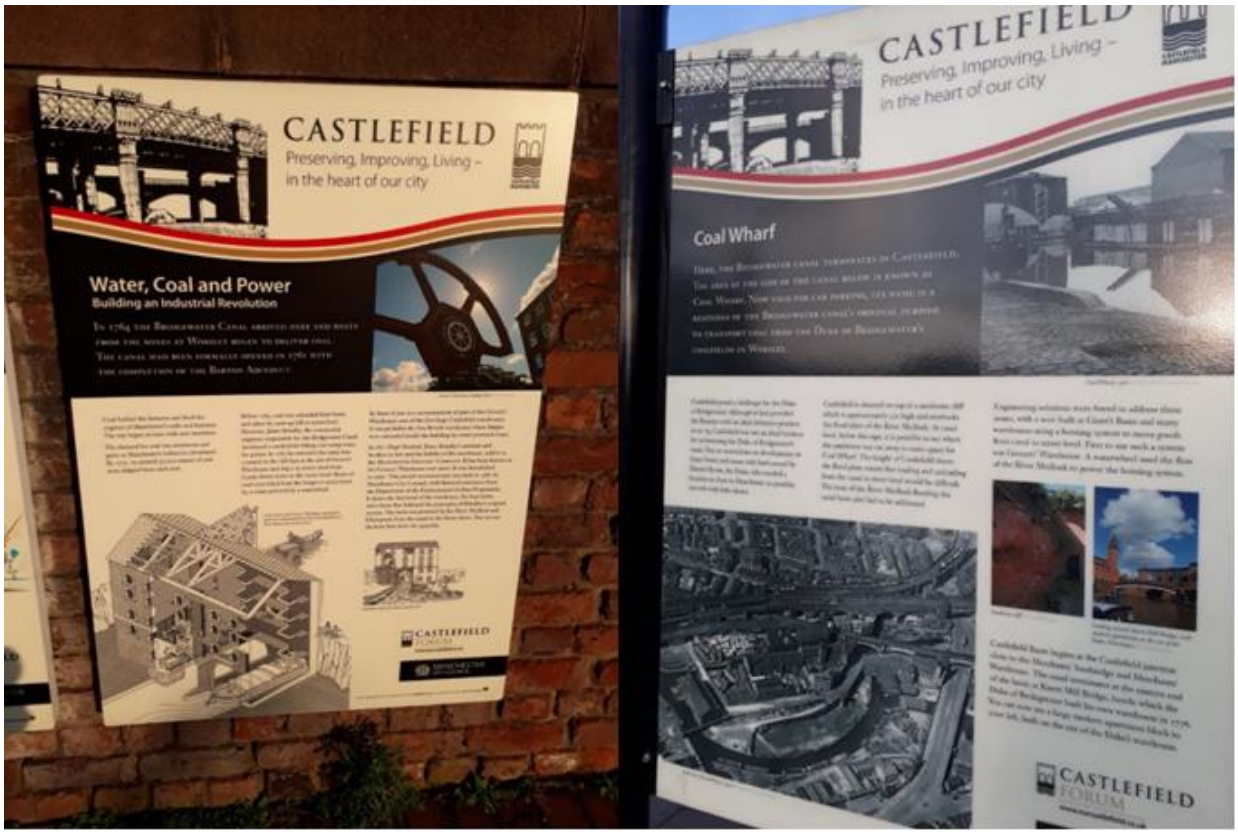


Figure 28: Information signs along the canal in Manchester

Coal fired electricity was connected to the canal, with the waterways being used to deliver coal to the power stations. The Dickinson Street Electric Light Station (since demolished) and the Bloom Street Power Station received coal deliveries directly from barges on the canal via an electric crane. Reflecting on the still-standing Bloom Street power station, Frost states:

> Hidden between textiles warehouses and building of similar design, the red brick Bloom Street power station is hardly noticed by the passer-by, despite the tall chimney. The station's contribution to the everyday life of the people of Manchester was considerable – eighty-three years of power supply – and it is fitting that its tale should be recorded before it enters the limbo of forgotten things. The building remains a monument to the first electricity pioneers of this great city. (Frost, 1993, p. 27)

Figure 29: Bloom Street Power Station

See the Bloom Street Power Station (Figure 29), the reflection of which I have inadvertently photographed, not knowing what it was; there the doors into which the coal was unloaded were visible along the water level (Zero, 2019). The canal's waters were not only used to transport coal to the power stations, but also as the majority of the water input for the boilers for the steam engines. The canal was also used as a drain for the steam exhaust that was unutilised as heat (Frost, 1993).

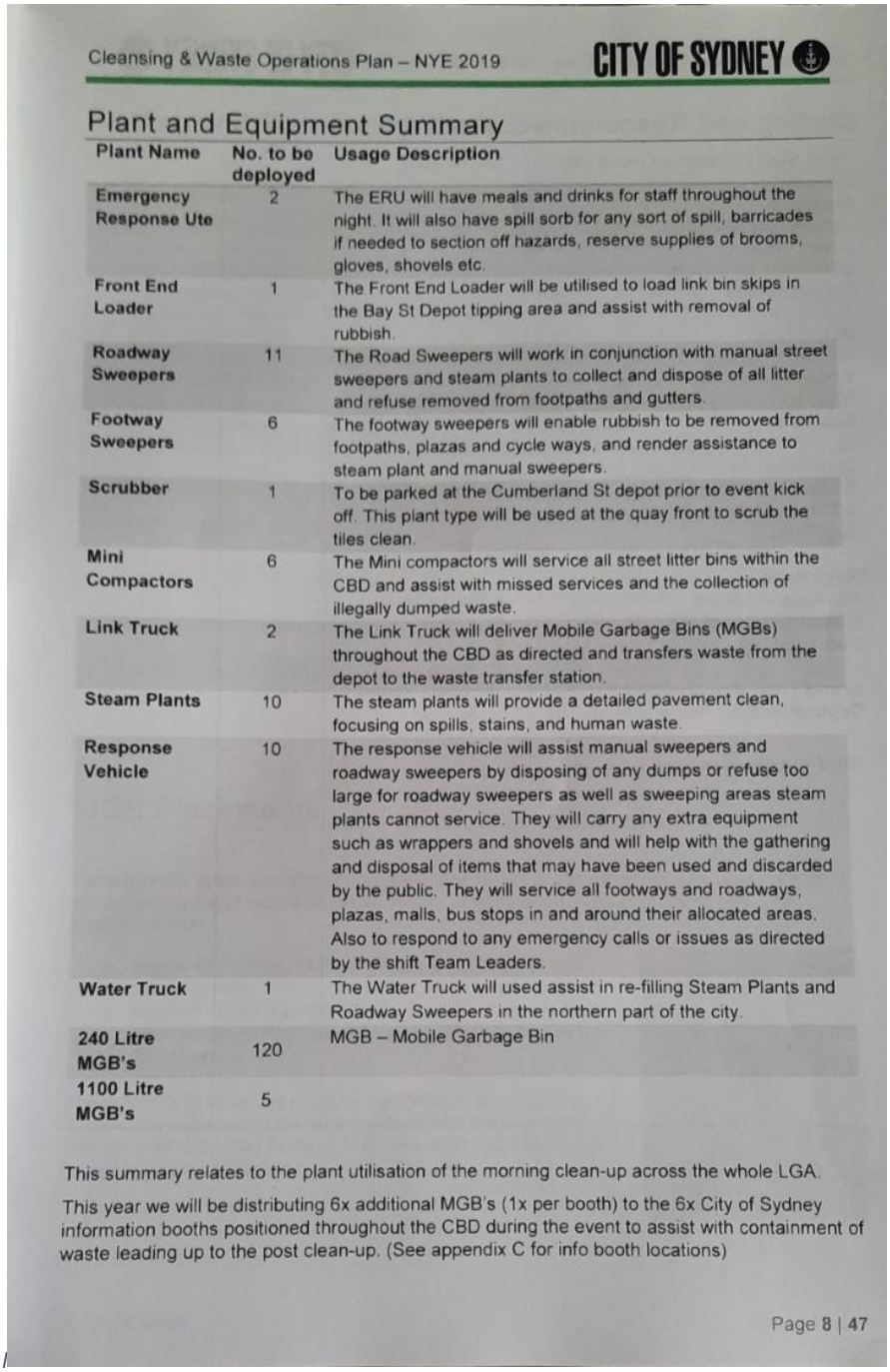
Having walked the canal from Princess Street to its joining to the Bridgewater Canal, we were at a loss as to how we might continue to explore the water infrastructure of Manchester from public access points. As it turned out, Manchester had a significant history using hydraulic power with a Hydraulic Power Network that powered the city from 1894-1972 (Science and Industry Museum, 2017). As a way of tracing these flows of water and energy through the historic legacy of the city, the next day I suggested the group meet at the People's History Museum, as part of this building is one of Manchester's former hydraulic pumping stations, which meant we were able to inhabit and investigate this infrastructure, although all the

machinery had since been moved. As most of us only had a short time in Manchester, in the afternoon a few of us prioritised going to the Science and Industry Museum, where we split up and looked as various things of interest. I was particularly keen to visit the museum, because I had found out that the hydraulic pump from the pumping station we had visited earlier in the day was stored and displayed there. However, when I got to the room where these machines were kept, I was disappointed to find that it was indeed under restoration. By coincidence, the main exhibit at the Science and Industry Museum at the time was titled, 'Electricity: The spark of life which examined 'how scientists experimented with electricity to understand and control it, and how mass generation and distribution changed our lives' (Science Museum Group, 2018).

My participation in this workshop reinforced how the practice of walking along the water infrastructure of the city could be enacted as a methodological thinking tool. In particular, this thinking tool revealed what these canals and their waters had once mobilised, and the ways in which these logics and materials were currently mobilised or could be communicated through these infrastructures as they remained. With my primary research interest being neither water nor energy, it came as somewhat of a surprise that both of these materials would be primary concerns within these workshops (particularly in the case of the latter). However, this interest would ultimately come to be focused and applied in the context of waste and legacy contamination in my experiment with fieldwork and place-based methods of two former gasworks sites in Sydney (Duncan, 2019). Prior still, in 2018, I experimented with walking as method of attunement in a field visit to Sydney Water's Waste Water Treatment Plant at North Head, resulting in a written blog-post for the Sydney Environment Institute (Duncan, 2018). My methods emerged as a collaborative practice of attuning between, around and with various water bodies situated within communities of thinkers looking at experimental research methods. In this way, water became a way to think with flows and infrastructure, both concepts critical to thinking with waste.

Appendix 2: Plant

An overview of the plant and machinery utilised by the City of Sydney's (CoS) Cleansing and Waste Services fleet is a good starting point for discussion. In this context, plant is defined as all machinery and equipment that assists in the collection and containment of waste. The general term used by the CoS to refer to these types of machinery is *plant* (see Figure 30, which includes a summary of commonly used plant and equipment). In some cases, plant is used in order to clean and maintain spaces too (the Scrubber, Steam Plant and Water Truck are often used to assist in the dispersal of 'spills, stains and human waste' and to handle general grime on tiles and pavement). The CoS operates various types of plant to clean the city. The term 'plant', when applied in this context, seems anachronistic, as though it were a nod to the natural environment in a human-made mechanical context.



Cleansing & Waste Operations Plan – NYE 2019 CITY OF SYDNEY

Plant and Equipment Summary

Plant Name	No. to be deployed	Usage Description
Emergency Response Ute	2	The ERU will have meals and drinks for staff throughout the night. It will also have spill sorb for any sort of spill, barricades if needed to section off hazards, reserve supplies of brooms, gloves, shovels etc.
Front End Loader	1	The Front End Loader will be utilised to load link bin skips in the Bay St Depot tipping area and assist with removal of rubbish.
Roadway Sweepers	11	The Road Sweepers will work in conjunction with manual street sweepers and steam plants to collect and dispose of all litter and refuse removed from footpaths and gutters.
Footway Sweepers	6	The footway sweepers will enable rubbish to be removed from footpaths, plazas and cycle ways, and render assistance to steam plant and manual sweepers.
Scrubber	1	To be parked at the Cumberland St depot prior to event kick off. This plant type will be used at the quay front to scrub the tiles clean.
Mini Compactors	6	The Mini compactors will service all street litter bins within the CBD and assist with missed services and the collection of illegally dumped waste.
Link Truck	2	The Link Truck will deliver Mobile Garbage Bins (MGBs) throughout the CBD as directed and transfers waste from the depot to the waste transfer station.
Steam Plants	10	The steam plants will provide a detailed pavement clean, focusing on spills, stains, and human waste.
Response Vehicle	10	The response vehicle will assist manual sweepers and roadway sweepers by disposing of any dumps or refuse too large for roadway sweepers as well as sweeping areas steam plants cannot service. They will carry any extra equipment such as wrappers and shovels and will help with the gathering and disposal of items that may have been used and discarded by the public. They will service all footways and roadways, plazas, malls, bus stops in and around their allocated areas. Also to respond to any emergency calls or issues as directed by the shift Team Leaders.
Water Truck	1	The Water Truck will used assist in re-filling Steam Plants and Roadway Sweepers in the northern part of the city.
240 Litre MGB's	120	MGB – Mobile Garbage Bin
1100 Litre MGB's	5	

This summary relates to the plant utilisation of the morning clean-up across the whole LGA.

This year we will be distributing 6x additional MGB's (1x per booth) to the 6x City of Sydney information booths positioned throughout the CBD during the event to assist with containment of waste leading up to the post clean-up. (See appendix C for info booth locations)

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Figure 30: Cleansing & Waste Operations Plan –NYE 2019, p. 8

Meaning and etymology

In an industrial sense, the word 'plant' is commonly used in two ways. The first is as 'a place where an industrial or manufacturing process takes place', while the second is 'machinery used in an industrial or manufacturing process' (Soanes & Stevenson, 2006, p. 1096). Industry is premised on the logic of growth: industrial plants can be places from which things grow, such as plastic manufacturing plants, nuclear power plants, oil refineries, chemical plants, fertiliser plants and metal manufacturing plants. The second usage of the term is often in

regard to equipment and machinery utilised in an industrial or commercial setting (the use of the term being particularly common in Australia) (ibid.).

Though these meanings are distinct, there is perhaps a shared basis in their evolution. First, the term plant was used to refer to a site of commerce, industry and process. Then, the machinery and equipment within that space – utilised in order to achieve the aims – came to be referred to by the same name. This general and adaptive meaning is interesting, and is perhaps evidence of the social and economic context in which the word/s arose – the beginning of the Industrial Revolution and the need for specific words to address new processes.

The use of the word plant in industrial contexts: an etymological mystery

The first known appearance of the term plant can be traced back to 1789. In its original context, the term was used solely to describe the land on which commercial or industrial activities were carried out. Interestingly, the word had already begun to be used before its meaning was sought out by Welsh-born diarist and traveller Hester Lynch Thrale Piozzi. This is perhaps a result of the significant influence of Lombard culture in matters of banking and accounting within England, specifically as the Industrial Revolution was dawning. As Piozzi noted in her travelogue of northern Italy in the late-1700s:

> This place (Verona, during the Lombard-era) has afforded me an opportunity of discovering what the people meant, who called a large portion of ground in Southwark some years ago a plant, above all things. The ground was destined to the purposes of extensive commerce, but the appellation of a plant gave me much disturbance, from my inability to fathom the meaning of it. I have here found out, that the Lombards call many things a plant; and say of their cities, palaces, etc. in familiar discourse—*che la pianta è buona, la pianta è cattiva* [The plant is a good or a bad one]. (Piozzi, 1789)

STS plastics scholar Rebecca Altman has also reflected on the use of the term within industrial contexts, alluding to the mystery and an inability to 'nail down' the etymological history of the term:

> According to the Oxford English Dictionary, calling factories plants predates the conversion of US plantations into petrochemical production. I put the question to an environmental historian, several sociologists, a linguist, two science and technology scholars, and a plastics expert – all of whom uncovered pieces of its origins, but were otherwise stumped by how factories became plants. Might it have a Latin root? Does

it refer to how the first factories converted plants (such as cotton) into commodities? Was it a clever metaphor – to plant a business, to sow profit – that spread organically? Did its use emerge in that chasm between technological change and the evolution of adequate terminology to describe it?