

Citizen Science in Major Development Assessment

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This paper investigates the role of Citizen Science in planning processes that seek to secure environmental conservation, drawing on new empirical data from Sydney, Australia, for the case of Citizen Science around the Chullora Wetlands. Through in-depth qualitative interviewing and deskwork, a detailed account is presented of the input and contestation of diverse actors within the approval processes around a major development, over the period from 1991 to 2012. The analysis demonstrates the development of Citizen Science in response to varied treatment of citizen contributors and contributions to a series of episodes of statutory processes embedded in a shifting political context. Findings highlight the importance of the creativity and relational tenacity of the particular groups of volunteers involved in achieving the wetlands in the Sydney case and leveraging additional societal benefits. More widely, the case demonstrated the importance of: independent agency of civil society organizations, which can interact with but are not dependent on statutory actors; status and legitimacy derived from scientific credentials; and collaborative work before, throughout and beyond decision-making processes.

This article examines public participation in planning processes through activities in a 'science' mode of knowledge production, and asks to what extent they conform to the expectations of current theories of 'Citizen Science'. The case is that of the Chullora Wetlands,¹ in Sydney, NSW (see figure 1). Community participation is enshrined in the New South Wales (NSW) planning system, as an objective in the State's principal planning legislation, the *Environmental Planning and Assessment Act 1979* (EP&A), and in a recent *Amendment* participation provisions were strengthened. Ecological sustainable development (ESD) and the protection and conservation of the environment are also objectives in the EP&A and the subject of community concern and participation. There is also great evidence of public and political support for public participation in the environmental field. Expressions of this participation

range from formalized engagement through to civil protest and disobedience. As a Member of the NSW Parliament, and former Planning Minister, observed during the debate on the *Amendment*, 'it must embrace order in urban development, while also understanding the important role of dissent and recognizing that effective urban planning is necessarily iterative, combative and, ultimately, a bit messy' (Stokes, 2017, p. 12). Yet there are longstanding debates about the dominant 'expert' forms of environmental knowledge (Owens, 2000), and concerns continue about how this might be a barrier to meaningful engagement and disempower communities. This opens up the question of whether a more 'scientific' form of public input could shift the power balance.

Citizen Science first appeared as a term in the literature in the 1990s (Solomon, 1993; Irwin, 1995; Bonney, 1996) to describe



Figure 1. Chullora Industrial Park, Sydney. (Source: Google)

scientific activities conducted by volunteers, generally in collaboration with or directed by professional scientists. Participation in Citizen Science has been identified as occurring at various levels (Eitzel *et al.*, 2017; Haklay, 2013a, 2013b, 2018) from crowdsourcing to place-based collaboration and co-design. These levels generally align with Arnstein's 'ladder of participation' (1969, p. 217). An example of the science that has arisen out of community concern and driven by volunteers includes Safecast, a radiation-monitoring programme established by volunteers after Fukushima (Brown *et al.*, 2016). Safecast illustrates how Citizen Science can be used to build scientific literacy, empower communities to challenge established institutions, and finally be recognized as a reliable source and alternative practice. There is a growing literature

in Citizen Science on differentiated scientific products (Wiggins *et al.*, 2018). However, volunteers producing data are referred to as Citizen Scientists regardless of their level of contribution. For example, the contribution to knowledge on frogs may only involve uploading a frog call through an app (Australian Museum, 2019). In contrast to this would be an intensive volunteer-initiated programme which included a baseline site survey, co-design of habitat, regular monitoring, and educational activities.

Citizen Science therefore continues well-known debates around power and knowledge in planning. In *Planning in the Face of Power*, John Forester (1989, pp. 152–157) discusses planning practice as communicative. He lists actions which planners can adopt to enable collaboration and the positive benefits which

flow from such approaches. However, one of the premises behind Citizen Science is that it might be possible to attain an acceptable level of robustness, accountability and transparency in the planning system, particularly given the information technology communication tools now available. This assumes an informed community, with a level of capacity that may be difficult to reach without intervention, particularly in circumstances where the State is the developer. Innes and Booher (2015, pp. 200ff) identify *community knowledge versus science* as one of four simplified dichotomies for exploring major planning issues. They discuss examples of where 'lay' knowledge has driven science and cite 'citizen science collaboration', such as the Love Canal environmental disaster and data supplied by fishermen to 'correct the assumptions' of scientists working in the San Francisco Bay (*ibid.*, p. 202).

This paper argues that Citizen Science is primarily differentiated by being volunteered while Professional Science is commissioned. The question remains as to whether the benefits, such as Citizen Scientists being able to operate with greater freedom to collaborate and communicate, outweighs the disbenefits of being 'outside' the formal processes. As will be discussed here, the Chullora case offers examples of volunteers challenging the assumptions of professionals and regulatory practice. The critical distinctions drawn between knowledge, knowledge production and implementation are examined for the period of activity. They happened within a context where there was no formal requirement for inclusion of Citizen Scientists nor recognition of Citizen Science as a community of practice within the land use planning assessment regime. On the other hand, in the recently exhibited *Community Participation Plan*, developed to support participation provisions in the *Amendment*, 'access to community knowledge, ideas and expertise' is listed as one of the reasons for encouraging community participation (NSW Department of Planning and Environment, 2018, p. 5). Notwithstanding, there

is no guidance on how assessment of community inputs occurs in conjunction with material provided by consultants and public servants, nor the place of community knowledge that is provided outside this framework. This raises questions about how and whether Citizen Science might enable a new means to engagement in development assessment.

In order to explore these issues, this paper applies Irwin's theory of Citizen Science (1995, 2001, 2003, 2015) and seeks to establish whether Citizen Scientists can be differentiated as participants within a formal planning process using the Chullora case. Irwin's Citizen Science is situated at the intersection of science, technology and citizen concerns. It recognizes the value of lay knowledge, and the power of new knowledge relationships:

We tend to think that public engagement is a kind of political activity and we can defend that in various ways. Or we think in terms of issues of knowledge and expertise ... getting the best information, the best insights we possibly can. (Irwin, 2015)

Support for what Irwin outlines is found in McAuslan's approach to advancing participatory processes within the formal land-use planning regime: 'what is needed is a commitment to work, via the creation of new legislation, new institutions, new procedures, towards new decision-making processes which will have as their aim more open government, more searching debates on major policy issues...' (1980, p. 272). This requires an exploration of spaces where participants are invited to contribute and where they might contribute beyond those boundaries. It suggests that within a formal planning process, Citizen Science would need to demonstrate 'credibility' as well as 'innovation', which remains, at least in part, an informal contribution. As expressed by Australia's Chief Scientist, 'we often focus on the 'science' part of citizen science. The 'citizen' is important as well. It reminds us that we are part of something greater than ourselves, with a duty to generations to come' (Finkel, 2018).

The rest of this article focuses on the case

study. It begins by outlining the basic case details and research methods. Then the analysis of the case is presented as findings for a series of ‘episodes of engagement in planning’. Finally, the results of the study are discussed and the implications for understanding of Citizen Science are drawn out.

Case Study Methods

The planning assessment case chosen is the Chullora intermodal freight terminal, a joint Australian and NSW Government initiative approved in 1998. The environmental impact was examined through a Commission of Inquiry (Commission) process. This provided a forum for formal public participation through submissions, hearings and a site visit. Opponents to the development were ‘fighting City Hall’ at the highest level. As part of the redevelopment of the Chullora Industrial Park, and in conjunction with the development of the terminal, a detention basin was to be constructed. After the terminal was approved in July 1998, discussions between volunteers and government officials led to the establishment of a 2 ha offline wetlands within the 5.8 ha detention basin. Volunteers remained engaged during the construction phase and thereafter co-managed the site through to 2012.

The case was examined within its historical and political context. Major organizations involved were characterized to establish whether there were opportunities available for collaboration with volunteers, and if so, how this occurred. The NSW election cycle, policy commitments and major events of the time were included to contextualize possible constraints and opportunities. The principal volunteer organizations involved, the Bankstown Bushland Society (BBS) and South West Enviro Centre (SWEC), provided access to archival documents. Some documents held by Sydney Water Corporation (Sydney Water), which is the landholder and current manager of the Chullora Wetlands, were also made available. The NSW Department of Planning and

Environment (Planning) supplied a copy of Conditions of Consent. All other documents accessed were available online or through libraries. Over 100 records produced between 1990 and 2014 by key actors, including statutory bodies, NGOs, businesses, consultants, citizens and media, were gathered for the study. The resulting documentary evidence set comprised published material cited within the text as well as other significant materials such as minutes of meetings, commissioned studies and correspondence. Those referenced have been included in Appendix A.

New South Wales Legislation

- ◆ Clean Waters Act 1970
 - ◆ Clean Waters Regulation 1972
 - ◆ Environmental Planning and Assessment Act 1979 (EP&A)
 - ◆ Landcom Corporation Act 2001
 - ◆ National Parks and Wildlife Act 1974
 - ◆ State Environmental Planning Policy No 19 – Bushland in Urban Areas 1986
 - ◆ Threatened Species Conservation Act 1995 (TSC Act)
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Figure 2. Relevant legislation in New South Wales, Australia.

Semi-structured interviews were undertaken between October and December 2018 with representatives from each of the groups of actors engaged in the case, including eight volunteers, six public servants and three consultants. Three interviews were conducted in person and others by telephone. Transcripts were anonymized and checked by informants and telephone calls and emails exchanged, to clarify or correct as well as gaining informed consent (Yin, 2018, pp. 238ff). In attributing comments, only the status of informants has been recorded: volunteer, consultant, public service position at time of event. In presenting findings, the term *volunteer* is used to identify members of BBS and SWEC, which helps indicate the distinction between paid and unpaid contribution.

As per the introduction there are three key actor types, and four types of interaction within the development assessment process as shown in figure 3. Analysis tests whether the Chullora Wetlands case might be conceptualized as the interaction of type (d), which is characterized as a planning leveraged Citizen Science project. In that scenario, volunteers, when participating as Citizen Scientists, would contribute science and innovation that is considered by all three actor types as necessary (or 'best practice') for environmental planning.

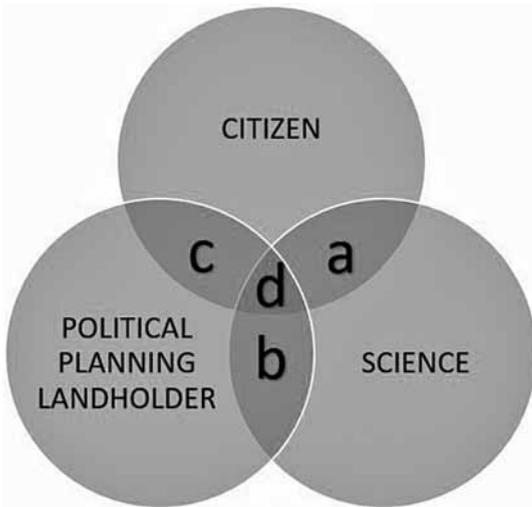


Figure 3. Citizen Science in planning assessment.

The Chullora Industrial Park

In this section the case is set out chronologically, as an evaluation of the multiple exchanges between volunteer groups and statutory actors within a series of events, central to which is a formal Commission of Inquiry. The scene is set, looking firstly at the environmental governance context and secondly at the existing environmental expertise and relations. The development of Citizen Science in the Chullora case is then followed: from the emergence of an agenda; through the Commission of Inquiry; up to the agreement of formal responsibilities post-consent.

Environmental Governance Context

The study is set between 1991 and 2012. The Chullora Industrial Park, located in NSW, Australia, is 18 km west of the Sydney CBD, 6 km south-west of Sydney Olympic Park, 25 km north-west of Port Botany and at the headwaters of the Cooks River. Prior to the creation of the Industrial Park, the site had been managed by the NSW Government's State Rail Authority (State Rail). The rail yards contained tracks, sidings, workshops, contaminated vacant land and remnant bushland. The bushland was subject to dumping and weed infestation, however the soil profile and floristic diversity remained intact. 'These remaining remnant areas are valuable because they are so rare, reflect past habitats and continue to provide sanctuaries for wildlife in the area' (Cooks River Environmental Assessment and Education Project, 2000, p. 2).

The key organizations identified are the intermodal terminal developer, National Rail Corporation (National Rail), the Chullora Industrial Park developer, Business Land Group (Landcom),² and Sydney Water (the state-owned water services provider and environmental asset manager). Bankstown Bushland Society (BBS) and South West Enviro Centre (SWEC) were the two principal volunteer groups, who had no 'amenity value' stakeholding in the area. From 1992 to 1997 BBS volunteers were engaged in restoring remnant sites and successfully applied for grants in excess of AU\$44,000 for Chullora. Fewer than ten people were involved, and as one BBS volunteer remarked: 'It was all very discouraging at the time as there was very little local interest. There was only just a few of us'. The sites within the Chullora rail yards were remote from residents, with the volunteers focused on conservation of bushland and the natural creek. This is a significant point, as they were motivated by ecological and educational values and not protection of their own amenity. As one of them emphasized, 'we've targeted conservation

priorities based on ecological knowledge' and 'we know our bushland inside out'.

Urban bushland protection in Australia traces its origins to the battle to save Kelly's Bush, a 4.8 ha remnant site in Hunter's Hill, 7 km north-west of Sydney's CBD. It occurred in 1971 when a workers' union applied a 'stop work' (known as a *Green Ban*) to support volunteer action to protect the site (Colman, 2016, pp. 56ff). In 1984, Kelly's Bush was eventually purchased for conservation by a Labor State Government. In 1986, in response to community concerns about clearing and increasing impacts the same government introduced *SEPP 19*, a planning instrument under the EP&A. It was intended to protect remnant urban bushland, wildlife corridors, landforms such as natural drainage lines and watercourses and also had an education potential.

In September 1993 Sydney's successful bid for the 2000 Olympics was based on its 'green credentials', endorsed at the time by Greenpeace (Chalkley and Essex, 1999). In the lead up questions were raised about the integrity of the remediation at the Homebush Sydney Olympic Park site (Beder, 1999, p. 10). The State Government also contributed AU\$1.2 billion to construction costs for the Olympics (Olympic Coordination Authority, 2002, p. 42) with funding coming at the expense of some election promises in health and education. There were other financial setbacks during this period. In 1997 a proposal to fund infrastructure through the sale of the State's electricity assets, was defeated at the State Labor Conference held in October (Clennell, 2015). The State Government was compelled to operate with fiscal restraint, arguably making it more difficult to achieve compensatory offsets for developments such as Chullora.

For most of the study period, from March 1995 to 2011, the Labor Party was in government. In March 1995, Bob Carr, the former Minister for Planning and Environment responsible for introducing *SEPP 19*, was elected Premier of NSW. Carr was a noted

'tree hugger' determined 'to make my name on the environment'. He appointed Craig Knowles as Planning Minister and Pam Allan as Environment Minister as they were 'committed to smoothing out the old deadlock – between forestry and national parks agencies' (Carr, 2018, pp. 228ff). Later that year Minister Allan had carriage of the *NSW Threatened Species Conservation* (TSC) Bill which in December was enacted. In a speech to urban planners in 1995, Minister Knowles noted that Cabinet was involved to a far greater degree in infrastructure co-ordination. He also stated that 'the Carr Government wants to achieve social and environmental outcomes as well' (Knowles, 1996).

Environmental Expertise in Civil Society

A civil society organization, the Bankstown Bushland Society (BBS), demonstrated an advanced level of scientific expertise, which was held in high esteem by governance actors. As described here, BBS had built up both expertise in the science relevant to ecology in the Chullora site over a significant period of time, as well as relationships of the sort anticipated by planning theory's inclusionary networks of collaborative governance (see introduction).

The reputation of the BBS was established before the Commission in 1998. Two of the BBS members were acknowledged by ecologists Benson and Howell (1995) and noted again a few years later: 'we would like to record our appreciation to those local field naturalists who have prepared comprehensive species lists of particular sites often based on many visits in different seasons, and in particular to Colin Gibson and Robert Miller of the Bankstown Bushland Society' (Benson *et al.*, 1999, p. 8). A survey which they published in 1996 (Gibson and Miller, 1996) identified significantly more species than in Muston and Associates (1991), a report commissioned by Landcom in 1991. 'Colin knows all there is to know about every weed and native. You will NEVER know as much as him.

Just accept it' (Roberts, 2010, p. 2, *original emphasis*). This opinion was echoed in interviews with two other volunteers who, like Roberts, were professionally trained in remnant bushland restoration. According to one of the professionally trained volunteers the local City Council, Bankstown, had only a small team of paid bush care staff for sites across the municipality and didn't have the capacity to apply the same rigorous standards in bushland restoration as BBS.

Over a 20-year period from 1991 to 2011, Gibson, with assistance from Miller and others in BBS, was responsible for sourcing over AU\$400,000 in grants for remnant bushland restoration. Gibson also made successful applications to the NSW Scientific Committee for the inclusion of Cooks River Clay Plain Scrub Forest (CRCPSF) as an endangered ecological community and the local population of *Wahlenbergia multicaulis* (Tadgell's Bluebell) as an endangered population under the *Threatened Species Conservation Act 1995* (TSC). Tadgell's Bluebell was finally scheduled under the TSC on 5 September 1997 and CRCPSR on 21 October 1997.

According to BBS volunteers interviewed, they enjoyed a mutually respectful working relationship with management staff in Freight Rail.³ This was evidenced in June 1995, when Freight Rail offered to erect barriers to protect the bushland area, and signage to indicate its significance. A key for a newly installed gate was also provided. At the same time Freight Rail offered to pursue transfer of ownership of a patch of bushland to BBS. As a volunteer group BBS did not have the capacity to accept and instead requested that Bankstown City Council pursue the transfer. In 1997, as developer of the Chullora Industrial Park, Landcom took over management of the site.

Development of a Voluntary Sector Agenda (Early 1990s)

In the first years of the 1990s, BBS, in addition to private sector organizations, was interacting with a range of statutory bodies

and developing an agenda in relation to developments proposed around the Chullora site. The infrastructure development context introduced roles for National Rail, Sydney Water and Landcom in large-scale and significant changes to land use in Chullora. As discussed here, environmental concerns and citizen engagements raised public awareness generally, but more critically the third sector actors were becoming concerned about development impact and aspects of governance standards.

In the early 1990s in Australia, rail reform was a national initiative with the major focus on freight (Affleck, 2002a, 2002b). In a 1991 report, the Productivity Commission on Rail Transport recorded that the State Rail Authority (State Rail) was to redevelop its site at Enfield as the sole Sydney intermodal terminal, replacing the currently overloaded Chullora Terminal, and other smaller operations (Productivity Commission, 1991, p. 312). However, in 1994 an intermodal proposal for the Enfield Marshalling Yards, 4 km east of the Chullora Industrial Park, was withdrawn due to opposition from local residents. This marked an important change in priorities which later informed the motivations of some community participants in the Chullora development, as well as contextualizing later negotiations between volunteers and decision-makers. In the 1995 elections Labor had won government with a one seat majority. At the following election in March 1999 it was returned with a 7 per cent swing and an eight-seat majority. One of the previously held Liberal seats was Strathfield, which included the Enfield Marshalling Yards. Chullora, by contrast, was located in a safe Labor electorate.

The proposed freight modal shift from road to rail was not disputed at the Commission and regional air quality benefits were recorded by the NSW Environment Protection Authority (EPA) (Train, 1998, pp. 84ff). Two community groups supported the development: the Cooks River Valley Association which had been formed in 1951 (Tyrrell,

2018, p. 157) and the community group representing residents potentially impacted by an intermodal at Enfield.

Sydney Water became involved in the Chullora Industrial Park in 1991 when a report was commissioned into the Upper Cooks River Catchment (Binnie & Partners, 1991). As part of the redevelopment, two detention basins were recommended to address potential flooding. An artificial wetland filtration system was suggested as an option to improve water quality and the author also recommended the retention of isolated stands of *Melaleuca* on islands within such a wetland. At this point changing public attitudes were noted, as well as associated arguments that urban drainage 'should not be considered in isolation of issues such as water quality and urban planning' (*ibid.*, p.6).

In 1991, a vegetation survey, commissioned by Landcom as part of the redevelopment of State Rail lands, was undertaken by Muston and Associates (Muston and Associates, 1991). BBS became involved because of their interest in the ecological values of bushland remnants identified as *Site 2* and *Site 3*. They were also concerned about plans to concrete part of the creek that drained the area. Such action would have been inconsistent with recommendations provided to Sydney Water by Binnie & Partners (1991). To the volunteers interviewed there was a lack of coordination between government agencies, which led them to assume a role that involved keeping an eye on what they saw as the bigger ecological picture.

When plans to construct a detention basin in an area containing remnant bushland progressed, BBS wrote to Sydney Water in August 1992, to express their concerns. Sydney Water's Natural Resources Manager responded in September and arranged a site inspection in October, with herself and a colleague from Stormwater Business along with two BBS volunteers. Both parties agreed a solution that would not negatively impact remnant bushland. However, in September 1993, Sydney Water wrote to BBS to advise

that they no longer intended to acquire land at Chullora, nor to construct detention basins.

The period from 1987 to 1993 saw major change occur within Sydney Water. The Water Board Act, passed in June 1987, placed greater emphasis on commercial aspects as well as environmental requirements, including a Total Catchment Management approach. During this period Sydney Water were also required to address community anger over the impacts of sewer outfalls on Sydney beaches, most famously expressed in the 'poo marches' (McDonald, 2014, p. 5). Volunteer action was galvanized into the formation in 1989 of Clean Up Sydney Harbour, which later became Clean Up Australia (*ibid.*, p. 16) and the establishment by Sydney Water in 1990 of Streamwatch, a Citizen Science water quality-monitoring programme. Other changes included bringing planners, economists and scientists into a workforce and culture previously dominated by civil engineers (Hector, 2011; Moore *et al.*, 1993). As the lead author of a study on Sydney Water (Dowsett *et al.*, 1995) noted when interviewed, 'these were fairly brief glory days' with a CEO, Minister and Chairman collectively driving cultural change.

Minister Knowles also had responsibility for Sydney Water's operating license and within a week of signing approval for the Chullora Intermodal Terminal, Sydney Water and the Government came under public attack after high readings of *Cryptosporidium* and *Giardia* were detected in Sydney's drinking water. The crisis, which affected Greater Sydney until 19 September, caused a 'mixture of fear, cynicism and anger' in the community (Stein, 2000, p. 421) and cost an estimated AU\$33 million in lost revenue, damages, and customer rebates.

Turning to consider the role of Landcom, on 1 July 1990 the Premier, Treasurer, Minister for Administrative Services and State Rail entered a Deed of Agreement for the disposal of surplus State Rail Land with Landcom made responsible over the following years. Under a further Deed of Agreement, signed

on 5 November 1997, between Minister Knowles, Sydney Water, Technical and Further Education Commission (TAFE), Waste Recycling and Processing Service, and State Rail, Sydney Water agreed to accept responsibility for a single detention basin and trunk drainage system when works overseen by Landcom were complete. On the basis of this role, a level of flexibility was available to the organization. As Gleeson and Commissionetto note (2005, pp. 20–23), the Labor administrations saw public land development as a means for ‘inducing higher ecological standards in the design and production of the built environment’ as well as taking a ‘whole of government approach’ in the disposal of government assets. This was later captured in the NSW Landcom Corporation Act (2001) under object (b) ‘to exhibit a sense of social responsibility

by having regard to the interests of the community in which it operates’ and echoed by a Landcom employee who was interviewed: ‘often Landcom’s role involved problem solving, using its enabling legislation which contained broader objectives’. Landcom thus had a privileged position, even though volunteers interviewed for this study contested Landcom’s reputation as an ecologically sensitive organization.

In this period, third sector groups were raising awareness (see figure 4), but their concerns about governance added impetus to engage more strategically.

Engaging with the Commission of Inquiry (Later 1990s)

This section examines the planning assessment process in the lead up to the approval of the development. In this period BBS demonstrated their scientific credentials and by engaging in the processes of Inquiry with rigorous data and employing a series of strategic actions, which were unavailable to scientific staff in government agencies, they were able to prosecute a case for the science (the protection of protected bushland) as citizens. In this period the consciousness that had been raised began to be operationalized through direct action within the Inquiry. There were notable process failures such as the exclusion of volunteers from discussions, and an uncritical treatment of evidence provided by groups supporting the development. A combination of the weight of evidence brought to the Commission by BBS, and associated targeted actions carried significant weight within the Inquiry. However, the power displayed resulted in Landcom attempting to reframe their narrative and reassert authority.

In 1996 National Rail announced plans to expand the Chullora Terminal. At a meeting in December, BBS volunteers were informed by the General Manager Corporate Affairs, Dr Fred Affleck, that two new rail lines would go through *Site 2*. On 18 August 1997, Development Applications, each accom-



Figure 4. Bankstown Bushland Society and South West Enviro Centre information stall. (Source: Gary Blaschke)

panied by a Statement of Environmental Effects, were submitted to the three affected local councils, Bankstown, Strathfield and Auburn. A detention basin and off-line wetland was to be constructed by National Rail along with tracks at *Site 2*. Landcom was to become responsible for the construction of a separate Regional Detention Basin which would later include the Chullora Wetlands.

BBS were concerned about the impacts that the tracks and detention works would have on *Site 2* as they considered the area to have ecological values equivalent to or greater than *Site 3* which had previously been acknowledged by Freight Rail and formally protected by Bankstown City Council in 1992. On 21 September 1997, Minister Knowles announced that as Planning Minister he would determine the development, which was deemed State Significant. Commissioner Train was appointed on 11 October to constitute a Commission under the EP&A section 119(2). Submissions were received by the Commission prior to the first round of hearings which took place from 15 to 19 December. National Rail's consultants, Kinhill, Conell and Wagner, submitted *A Supplementary Species Impact Statement (SIS)* on 4 December. On 19 November, without notice to BBS, Landcom began work at the proposed Container Storage Park. Most of the *Acacia pubescens*, listed as Vulnerable under the NSW Threatened Species Conservation Act 1995 and later recorded in a recovery plan, were removed along with a stand of Melaleucas along Freshwater Creek (Train, 1998, p. 111). After BBS became aware of the Landcom action they wrote a complaint to Bankstown City Council which they copied to Commissioner Train.

The first session for witnesses at the Commission was held in the week before Christmas, 15 to 19 December 1997, including a site visit on the 17th. The second session was 3 to 5 February 1998. BBS's approach at the Commission was to present a series of experts to address the critical issues the Commissioner was required to consider: Legal and Admini-

strative, including community consultation; Fauna and Flora; Catchment Management and Flooding; Cost-Benefit Analysis; Wetlands Management; Transport; Track Alignment and Canal Engineering; and Public Interest. Their ten witnesses included engineers, an economist, a lawyer, one of the BBS native vegetation experts, and a former CEO of Sydney Water. Over ten hours were allocated to BBS at the initial hearing. At the February session, three of the volunteers from December provided *submissions in reply*.

National Rail made a critical change to the development application in its reply, announcing that it would not be constructing a detention basin and off-line wetlands and that the piping of Freshwater Creek would be reduced from 160 to 40 metres (Train, 1998, p. 106–112). BBS were not included in any discussions about the changes and were unaware of their existence until the hearing in February. Citizen Science theory highlights the central importance of 'getting the best information, the best insights' to support decision-making (Irwin, 2015), and the volunteers from BBS had demonstrated relevant expertise and a commitment to assisting and communicating about the development. As demonstrated in figure 5 and discussed in the following sections, such good practice would in fact continue long into the future. However, it appeared to disappear from the development processes at this point.

In his report submitted to Minister Knowles in March, Commissioner Train recommended approval of the development. He noted that the BBS submission to the Inquiry had been 'considerable'. Aside from the primary and supplementary submissions, there was a Fauna Survey and Impact Statement, previous fauna and flora reports within the Bankstown area, and correspondence with government staff, council, and politicians, including ministers. The Commissioner devoted five and a half pages to his summary on BBS (Train, 1998, pp. 47–52), equivalent in length to summaries for the applicant, National Rail, and longer than Bankstown City Council at one and a

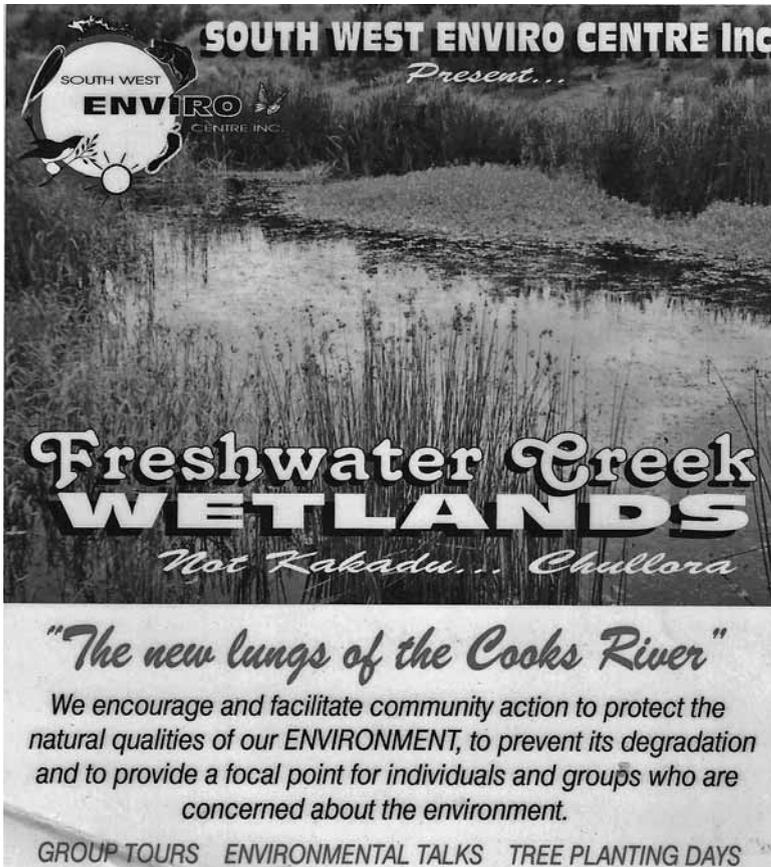


Figure 5. Chullora Wetlands promotional material. (Source: Gary Blaschke)

half pages. The deletion of the detention basin and reduction in piping of the creek was supported by the EPA and National Parks and Wildlife Service (National Parks), indicating that both agencies had been part of the negotiations from which BBS had been excluded. The Commissioner noted that this compromise had addressed 'the impasse and opposition to the covering of Freshwater Creek by the Department of Land and Water Conservation (DLWC), EPA, Bankstown City Council and other parties who consider the covering of a creek a significant impediment to consent' (*ibid.*, p. 81). As to requests for changes to operational sidings to avoid Cooks River Clay Plain Scrub Forest (CRCPSF) and Tadgell's Bluebell he remained unsympathetic, particularly to the National Parks: 'In my view such requests demonstrate a

lack of appreciation of the operational criteria and constraints which have been canvassed before the Inquiry. Had the National Parks been in attendance and reviewed all the documentation they would, in my view, have been in a position to provide constructive rather than naïve advice such as this to the Commission' (*ibid.*, p. 84).

It is notable that there was a distinction in the treatment of evidence from citizens, whereby material from the community could be evaluated on the basis of process rather than substance of their content. While the Commissioner was critical of National Parks on the basis of strength of evidence he recorded without comment statements from the Bellfield Residents Group that the bushland was 'of little value to the general public' (*ibid.*, p. 53) and the Cooks River Valley

Association ‘that there has always been the opportunity of having a propagating program to ensure the future of the genetic species’ (p. 55). In response, the Commissioner could have quoted expert opinion, such as Benson (2014). This was an example of the failure to characterize *community participation* and thereby inclusion, and arguably the ideology of participation, was elevated over scientific evidence.

BBS was aligned with National Parks in challenging the evidence of the applicant. The Commissioner also recorded that the applicant had recalculated figures for flora covered under the Threatened Species Conservation Act 1995 (TSC), namely CRCPSF, *Acacia pubescens* and Tadgell’s Bluebell, and that the ‘calculations were significantly different from the figures stated in the Applicant’s Statement of Environmental Effects and Species Impact Statement’ (Train, 1998, p. 11). Records of negotiations between the Commissioner, National Rail and Government departmental staff are not publicly available, however the evidence suggests that National Rail was required to admit that the impacts on TSC species and populations were greater than previously acknowledged. This was based on evidence provided by BBS and National Parks and was likely to have had a favourable influence on the level of compensation recommended by the Commissioner.

The input from the volunteer groups appears to have been approached in a limited way, and only considered to be relevant in negotiating detail of development rather than having any influence in the key decision on whether to grant permission, which is a phenomenon that has been seen in relation to public participation in major infrastructure regulation in the UK (Natarajan *et al.*, 2018). The *public interest* provision of the EP&A (Section 4.15(e)) was deemed to outweigh legal protections contained in the *Threatened Species Conservation Act 1995* and the *Clean Waters Act 1970*. In his Executive Summary the Commissioner stated: ‘It is then a balancing of the Regional and State benefits of

the proposal against the botanical impacts on the threatened community CRCPSF, the threatened population of Tadgell’s Bluebell and the vulnerable plant *Acacia pubescens* which is the core issue’. He went further to discuss mitigation measures, plans for managing the remaining vegetation and involvement of the community (*ibid.*, pp.vi–viii). The BBS volunteer who organized the witness line up estimated that the amount of volunteer work that went into the Commission and follow-up actions would have been equivalent to around AU\$100,000. He described the BBS approach as ‘very technically heavy with real knowledge of environmental law. We had the luxury of Col and Rob’. Notwithstanding, in his opinion the Commission was a ‘controlled device to block full scientific debate’ with ‘bureaucrats there to achieve a pre-determined outcome who regard you as a trouble-maker’. As recorded at the time, in correspondence by one of the witnesses, of the approximately 215 Commissions of Inquiry held since they were established in 1980 all but four had recommended in favour of the proponent. The best that the volunteers were likely to achieve were changes in design and compensation. Having demonstrated credibility in scientific expertise and innovation in practice, they would arguably have added value to negotiations had they been included.

A final area of concern around the treatment of the volunteers related to that of the BBS within public information about the proposed development. As discussed, the volunteer group’s position within the decision-making processes was precarious, in that they could be excluded or side-lined. The use of the BBS name in material put into the public domain, further threatened their position, as it implied that they might not be independent community actors, which could potentially have undermined local support for their activities. In the period between the Commission Report and Minister Knowles’s Determination, 20 July 1998, BBS volunteers corresponded and attended meetings with politicians

and staff from government departments. They also had letters and articles published in the local media. On 15 July, Landcom circulated a four-page coloured brochure titled 'Take a Closer Look: The Detention Basin Lot 21 Muir Road Chullora' (The Brochure) (Landcom, 1998) and wrote to BBS to inform them that the Brochure was 'compiled to let people know what is happening on the site. Early in the year, local press coverage caused some anxiety in the community when articles were published indicating that the Business Land Group was not fulfilling its legal and environmental obligations'. The Brochure was produced by an environmental planning and communications firm, Manidis Roberts. Information about the Commission was presented as regional and state benefits being put before environmental impact: 'National Rail's proposal met considerable opposition and eventually became the subject of a Commission of Inquiry over the issue of local impact versus Regional and State benefit'. In a section about remnant bushland it was suggested that two of the three areas of *Site 3* be sold to Bankstown Council and that the council arrange management with 'a suitably qualified organization such as the Bankstown Bushland Society'. BBS volunteers who were interviewed recalled the anger they felt at the time in both the way the narrative was framed and in the use of their name. It was considered their reputation was being appropriated to legitimize the recommendations of the Commission, the loss of remnant bushland, concreting of part of Freshwater Creek, environmentally insensitive clearing of vegetation for the detention basin and surrounding area, and the unsympathetic design of the basin. BBS refused to participate in the co-management of *Site 3*.

Post-Consent Negotiations (to 2012)

This section examines the episode from approval of the National Rail development on 20 July 1998, through to agreement to include wetlands within the regional deten-

tion basin. Similar to previous episodes, BBS were excluded from formal negotiations on Consent Conditions, where they could have provided valuable input. However, their authority was established and finally recognized through various 'citizen actions' and they were invited to negotiate in another process, which achieved the wetlands. It is not possible to study the full extent of political exchanges, however a set of key moments highlighted by the interviewees demonstrate the continuation of the trend noted earlier. In particular, a meeting took place with the Environment Minister, and diary notes are available in BBS archives, however Minister Knowles, who had granted consent for the major development, would not meet with any of the volunteers. In April and May 1998, one of the witnesses at the Commission sent letters to a political colleague, requesting she discuss concerns with the Minister. A list of ten key points drawn up by this witness and a former head of Sydney Water were included. As discussed earlier, there were political considerations, with the government preparing for an election to be held in nine months and a major water crisis unfolding. Landcom also had flexibility. As one former staff member who was involved at the time commented 'it was thought ... there would have been trouble down the line if agreement had not been reached'.

As in the previous stage, BBS scientific credentials were recognized but the organization was excluded from critical processes. The Conditions of Consent provided with Ministerial Approval (Knowles, 1998) included the appointment of a Community Consultation Committee and Bushland Management Steering Committee to oversee the Bushland Management Plan (BMP). Both committees were to meet for 5 years. The Steering Committee was to comprise two representatives from National Rail, and one of each of Bankstown City Council, Planning and BBS. The BMP detailed actions required to protect, rehabilitate and re-establish Cooks River Clay Plain Scrub Forest (CRCPSF), Tadgell's Bluebell

and *Acacia pubescens*. BBS was referred to under Section 3.3(b)x 'outline access protocols for research or studies of the CRCPSF to be undertaken by a member of the scientific community or the Bankstown Bushland Society' (*ibid.*, p.10). A bank guarantee of AU\$100,00 was required from the applicant as well as AU\$40,000 to assist National Parks in preparing recovery plans for Tadgell's Bluebell and CRCPSF. An annual compliance audit was also specified. Although their scientific credibility is recognized in these conditions, BBS had not been part of the discussions and refused to be part of either committee and their volunteer expertise was foregone. Separate recovery plans were not published, and the funds were instead directed to the Cumberland Plain Recovery Plan published in 2011.

Again, BBS continued to challenge the content and processes of decision-making. On the day following Ministerial approval, 21 July, BBS issued a press release challenging Landcom's 'claimed commitment to responsible environment management', questioning the legality of clearing that had occurred in December 1997 and pointing out that the EPA had to issue a notice to address loss of containment of contaminated sediments and runoff. While the contents of the media release were not published, a meeting, also attended by volunteers and planning staff, was convened by Landcom shortly afterwards on 24 July. A diary entry from BBS archives and the accounts of four participants indicates that the meeting was 'robust'. Volunteers expressed displeasure over the 'environmentally insensitive design' of the detention basin, the excessive concreting of the creek, as well as the appropriation of the Society's name in the Brochure. It was at this meeting that they raised the concept of a wetlands within the detention basin and recommended contacting an established wetlands' expert, Geoff Sainty. On 5 August, the Bankstown Canterbury Torch published an article titled 'Destruction of the Cooks River' in which quoted sources attacked the Carr Labor Government. The

Chair of the State's peak environmental group, the New South Wales Nature Conservation Council stated that 'Sydney is losing the Cooks River Forest because Labor has broken its election commitments'. The Cooks River Coalition called on the Premier and Craig Knowles 'to reverse their decision' and Auburn Greenspace commented that 'while the government trumpets its green credentials at the Olympic site, less than three kilometers away they are bulldozing some of the last of the Cooks River Forest' (Wilson, 1998).

In continuing to engage, advise and negotiate, the volunteers worked towards a solution to achieve the wetlands. On 17 August a wetlands concept design was faxed to Landcom by Sainty and Associates. Landcom accepted the plan and engaged Hunt and Associates as engineers. BBS volunteers provided advice on the provenance of species and plantings but as an association ceased to take part after this. The cost of the detention basin was estimated at AU\$5.5 million (*Bankstown Canterbury Torch*, 1998) with the wetlands costing an additional AU\$1.3 million (West, 2013, p. 3). Finally, discussions with volunteers had occurred and a way forward was found which formally involved them as partners, albeit as another entity.

South West Enviro Centre (SWEC) and the Chullora Wetlands

This section examines the range of scientific activities engaged in by volunteers and examples of innovation in collaboration, under the new arrangement of SWEC, the South West Enviro Centre. When SWEC was registered on 19 October 1998, it comprised some of the BBS volunteers as well as Gary Blaschke who had participated at the Commission and been involved in negotiations for the wetlands. Until 2012, he was SWEC's spokesperson and the principal contact for anyone interested in the wetlands. Some of the activities, such as the Streamwatch programme are officially recognized Citizen Science pro-

grammes. Partnerships with neighbouring businesses and institutions are examples of Industrial Ecology and Environmental Innovation that SWEC brought to the Chullora Industrial Park. Although the early relationship with Landcom was less successful because the organization did not negotiate based on scientific credibility, this changed after the wetlands were agreed and it was accepted that volunteers would assume an active leadership role.

The Wetlands (see figure 6) were officially opened on 9 June 2000 and under the headline 'Natural cleansing' it was reported that 'Landcom had transformed a degraded and contaminated industrial site' (Tremain, 2000). Two members of SWEC, a Landcom staff member and Geoff Sainty were pictured adjacent to a sign reading 'Freshwater Creek Wetlands'. It was a positive environmental message three months before the opening of the Sydney 'Green' Olympics. Landcom remained publicly

committed, with Bill Mutton, the project manager since 1997, commenting 2 years later that they were 'very pleased with the results' (O'Rourke, 2002).

The value of the community partners to delivery was recognized by the two consultants who worked on the design and were interviewed. This had been a major project for them with details later shared at an international conference in 2000 (Sainty *et al.*, 2000). Both consultants spoke about the compromises required because of site limitations as well as problems of on-going maintenance. Constrained budgets, limited capacity within Sydney Water, and lack of consistency in protocols employed by site contractors were noted. However, as one of them put it 'you've got habitat, some water quality and some peak flow control. It was the best in terms of social values with some water quality benefits and demonstrated community action. The key is having the community involved as they



Figure 6. Chullora Wetlands under construction. (Source: Gary Blaschke)

will do the lobbying. If you have a champion in the volunteers you will get results'. This sentiment was echoed by a former CEO of Sydney Water and one of the Sydney Water employees who attended meetings at that time: 'Chullora was not seen as desirable ... only a few were interested ... Gary was one person who galvanized it'.

Volunteer leadership required significant effort and capacities, including communications and relational work. Chullora Wetlands did have a community champion and a small but dedicated team who, aside from managing an extensive environmental programme of works and education, also continued to lobby Landcom and Sydney Water for the maintenance regime recommended by the consultants. At the request of Geoff Sainty, a meeting was held on 21 May 2002 between Landcom, Sydney Water, Sainty and Associates, Bankstown City Council and SWEC to discuss a range of issues such as fish ladders for glass eels, inappropriate species overshadowing the wetlands, pest species, and the mechanism controlling stormwater entering the wetland during high flow events. Persistence was required and volunteers, unlike public servants, had the freedom and agility to persist. In 2005 the stormwater control mechanism was raised again by SWEC. Other matters brought to attention included noxious weeds growing in a Sydney Water easement in a neighbouring property. As the wetlands are located at the headwaters of the Cooks River, the SWEC approach was catchment-based. One example of this, and an illustration of how relationships were leveraged, occurred when Gary Blashke and Geoff Sainty lead the NSW Opposition Leader on a tour of the Cooks River to advocate the introduction of filtration towers (Stephen, 2006).

At the same time the scientific capacities were essential in co-management of the wetlands over the longer period. Water quality monitoring was established in November 2002 under Sydney Water's Streamwatch Citizen Science Program. As part of the sampling the following year the volunteers reported

collecting yabbies, damsel fly larvae, baby eels and native fish. Two pollution events were reported to the EPA, with one related to dead eels later found downstream. Students from a local high school were introduced to the Streamwatch programme in 2005 (Tyrrell, 2018, p. 214). In the 1991 Sydney Water Binnie report, the authors commented that little water quality data was available in the area (Binnie & Partners, 1991 p. 24). This was an example of where volunteers had taken a lead in addressing the shortfall and it was testament to their success that in 2014 the wetlands were rated the best of ten sites along the Cooks River (CTEnvironmental and Wright, 2014, p. 5). Fauna surveys were regularly undertaken. In 2002, fifty-four species were recorded. By June 2003 the figure had risen to seventy-four and by 2011, it was ninety-nine. Aside from print media and newsletters which recorded tree planting and clean up days, they featured on a national television programme *Totally Wild*.

The benefit of the citizen science capacities were also harnessed for educational tours (see figure 7), which were provided on request and a range of groups participated. 'Tonight, Terrill will show us the large number of frogs that have since returned to this once degraded site' recorded the Frog and Tadpole Society (FATS, 2003). Another FATS tour and Cumberland Bird Observers Club Tour were documented in 2004. The Friends of the Royal Botanic Gardens scheduled three tours. After another with the Wollie Creek Preservation Society (2005), the Society wrote that it had 'taken a lot of pushing at State bureaucracies and pulling of cash from their coffers'. While the cost of the wetlands was published, there were no calculations for the BBS contribution to the Commission, the cost of the promotional Landcom brochure, nor the time politicians, their staff and public servants invested. Had volunteers been included earlier in discussions on achieving better environmental outcomes there may have been savings, not only monetary but also reputational.

Citizen Science, as demonstrated by the



Figure 7. SWEC guided tour of the Chullora Wetlands. (Source: Gary Blaschke)

Chullora volunteers, had features that distinguished it from the professional science provided by public servants and consultants, namely the freedom to produce and/or seek out knowledge as required; the freedom to disseminate that knowledge; and the freedom to associate with whomever could assist. It was also a holistic, integrated place-based practice described here as *stewardship*. A visit to test water quality might also include checking for noxious weeds and surveying for birds as well as being alert to the unknown, and if required reporting to authorities such as the EPA and Sydney Water.

In 2003 SWEC submitted a draft Plan of Management to Sydney Water with a proposal to contribute 430 volunteer hours annually in addition to tours, flora and fauna surveys, rainfall and water quality monitoring. They also proposed that Sydney Water control noxious weeds, litter and rubbish removal as well as maintain the fish ladder and Gross

Pollutant Trap. Landcom, State Rail and Sydney Water, however, were at that time still negotiating the handover of ownership from State Rail. That agreement was finally signed on 2 September 2004 and registered as a transfer in December. The agreement between Sydney Water and SWEC was not finalized until 2007 under a *License to Occupy, 1st July 2007 to June 2012*. Community activities listed in the agreement included Site Education Tours; Water Quality Monitoring (including macroinvertebrate sampling); Rainfall Monitoring; Stormwater Education; Habitat Assessment; Avifauna and Fauna Surveys; Replanting/Bush Regeneration; and Complementary Terrestrial Weed Management.

In 2004 an agreement was reached with the neighbouring Bankstown Technical and Further Education (TAFE) to develop student collaborations. An environmental monitoring report was commissioned to investigate heavy metals in soils and examine an orange

sludge deposit. The researchers reported that the sludge was due to leaching from iron filings buried near the boundary and made recommendations regarding vegetation, water quality and soil contamination. The recommendations were pursued by SWEC volunteers.

When in 2003 George Weston Foods made an application to construct the largest bakery in the southern hemisphere at Chullora, SWEC wrote to Minister Knowles and contacted the developer. 'Early in the planning stages, SWEC became involved in creating a good neighbour protocol with George Weston and through meetings with the developer, we were able to work together in protecting what frogs existed on their development site' (Blaschke, 2004, p. 3). The developer donated AU\$5000 towards the creation of new frog habitat at the entrance to the wetlands site. As one of the consent conditions in approval of this State Significant Development, the developer was required to construct a pond and monitor for rare and threatened Green and Golden Bell Frogs. The agreement between the developer and SWEC was also formally recognized.

In 2010, Volkswagen Australia constructed a warehouse, with an approximate value of AU\$28 million, on a site bordering the wetlands. In 2011, in correspondence with the recently appointed Liberal Planning Minister, SWEC outlined impacts that had occurred during construction and informed him that they had not received prior advice. The ecological assessment that had been required contained a reference to the wetlands as 'managed by Sydney Water' and it recorded the existence of a stand of *Acacia pubescens* and the potential impact of runoff on the neighbouring 'Wildlife Sanctuary'. However, there was no reference to SWEC. Bankstown City Council, which was responsible for briefing the planning panel determining the application, also failed to acknowledge SWEC's management of the site. In the Council's report a Vegetation Management Plan for *Acacia pubescens* was recommended as part of consent conditions. Not only had they not facili-

tated a good neighbour protocol, but SWEC had been excluded from providing input on a stand of *Acacia pubescens* which members in conjunction with BBS had worked to protect. SWEC negotiated directly with the developer for repairs and replacement frog habitat at the wetlands to address the damage, and for replacement frog habitat plantings on the developer's site.

The George Weston and VW developments were handled differently by planners. The Weston case demonstrated the value in intervention, in this case alerting the volunteers to the proposed development thereby allowing them to negotiate environmental enhancement and establish a good neighbour relationship. In the Volkswagen case the volunteers were not alerted prior to development and unnecessary environmental damage occurred at a cost to Volkswagen and detrimental to relationships between all parties.

In their Employment Lands Development Study, Bankstown City Council (2009, pp. 7–30) referred to the Chullora Industrial Estate and to strengthening its role as a key freight and logistics hub. In a section on 'Industrial Ecology and Environmental Innovation' (*ibid.*, p. 62), reference was made to research into 'Green Theme' development and for such industrial hubs to incorporate restored habitat, nature trails and wetlands along with strict environmental standards. The recommendation was to investigate such innovations, however there was no reference to the work undertaken by SWEC nor how it could be used as a model. In the Council's Local Environment Plan the wetlands remain zoned as General Industrial indicating that Industrial Ecology and Environmental Innovation have not been incorporated.

Conclusions

The analysis demonstrates the development of Citizen Science in response to varied treatment of citizen contributors and contributions to a series of episodes of statutory processes embedded in a shifting political context. Prior

to negotiation for the wetlands, the planning process was controlled and limited in the way volunteer scientific expertise was addressed and this was in contrast to relationships that had been established previously with key players, Freight Rail and Sydney Water. Findings highlight the importance of the creativity and relational tenacity of the particular groups of volunteers involved in achieving the wetlands in the Sydney case and leveraging additional societal benefits. Although volunteer expertise was acknowledged by the Commission and later through consent conditions, nevertheless power continued to be exercised through exclusion and in defensive action as exemplified by the production and distribution of the 'Landcom Brochure.' This approach in turn prompted innovative responses from volunteers prosecuting the environmental case, in ways denied professional scientists. At the conclusion of the formal process all that was offered to volunteers, was a role on committees. The shortcomings of a committee process, in the absence of tangible benefits, is summed up by one of the volunteers committed to 'action science': 'I've been on various committees and what makes Chullora unique is it wasn't just words'. More widely, the case demonstrated the importance of: independent agency of civil society organizations, which can interact with but are not dependent on statutory actors; status and legitimacy derived from scientific credentials; and collaborative work before, throughout and beyond decision-making processes. It was further acknowledged in documents and in comments from volunteers and professionals interviewed that the ecological and educational values of both the detention basin and surrounding area were enhanced as a result of the contributions of volunteers. In this respect a positive link was established between objectives of *community participation* with *conservation* and *environmental protection* as contained in the EP&A. For the purposes of interaction type, as outlined in figure 2, the study established the wetlands as a planning leveraged Citizen Science project.

This case study tested Irwin's theory of Citizen Science (1995, 2001, 2003, 2015), drawing on *Collaborative Planning Theory* (Forrester, 1989; Innes and Booher, 2015). It established and described scope for differentiating community participants in the planning process as Citizen Scientists, using the empirical case of the Chullora Wetlands. In this case it depended on those participants providing scientific contributions of 'credible value' which they exemplified via evidence of their scientific contributions as measured by experts, and within the Commission process. Examples of innovation were given as they occurred within and outside the Commission process, and in the negotiation for, and later management of, the wetlands where a stewardship role was adopted. As such the case demonstrated the potential for a type of activism, which unsettles the role both of community and of 'expert scientists' within planning theory.

NOTES

1. The Chullora Wetlands is used throughout this paper as the name clearly situates this environmental asset within the industrial park and maintains its association with the freight terminal. Chullora was originally an estate within Liberty Plains, an area of land given to the first European free settlers arriving in Sydney in 1793, 5 years after the First Fleet. The word Chullora has been attributed to the original inhabitants and recorded during the period 1788–1791 by Dawes (Steele, 2005, p. 92). The wetlands were also known as the Freshwater Creek Wetlands by volunteers who used this name in signage and promotional material. In 2017 at the request of The Cooks River Alliance (a group of local councils) and Sydney Water, the wetlands were officially re-named Yana Badu Wetlands (NSW Government Gazette, 2017, p. 7467).

2. Business Land Group was formed in 1989 to manage the State's property portfolio and after 1991 it was responsible primarily for industrial surplus land. After the election of the Labor government in March 1995, it came under the Department of Urban Affairs and Development and Minister Knowles. In 2002 it was incorporated into Landcom, under the Landcom Corporation Act 2001.

3. Freight Rail, which was part of the State Rail Authority, was corporatized in July 1996 to become Freight Corp.

REFERENCES

- Affleck, F. (2002a) National Rail, 1991–2001: investing in policy reform, in *25th Australasian Transport Research Forum*. Canberra: Australian Government Bureau of Transport and Regional Economics.
- Affleck, F. (2002b) A decade of rail reform. *Transport Engineering in Australia*, **8**(1), pp. 35–50.
- Arnstein, S. (1969) A ladder of citizen participation. *Journal of the American Institute of Planners*, **35**(4), pp. 216–224.
- Australian Museum (2019) *Frog ID App*. Available at: <https://www.frogid.net.au>.
- Bankstown Canterbury Torch (1998) Sediment controls. 11 March.
- Bankstown City Council (2009) Employment Lands Development Study: Strategic Directions. Available at: <http://online.bankstown.nsw.gov.au/Docs/Common/Output/document.aspx?id=csYX8CzcC6Q%3D>.
- Beder, S. (1999) Green gloss over toxic Olympics site. *Canberra Times*, 23 September.
- Benson, D. (2014) Submission to Independent Biodiversity Legislation Review Panel. 5 September.
- Benson, D. and Howell, J. (1995) *Taken for Granted: The Bushland of Sydney and its Suburbs*. Kenthurst: Kangaroo Press.
- Benson, D., Ondinea, D. and Bear, V. (1999) *Missing Jigsaw Pieces: The Bushplants of the Cooks River Valley*. Sydney: Royal Botanic Gardens.
- Binnie & Partners (1991) *Upper Cooks River SYDNEY WATER No. 38: Catchment Management Study*. Sydney: Water Board.
- Blaschke, G. (2004) A frog's world. *News-Link*, June.
- Bonney, R. (1996) Citizen science: a lab tradition. *Living Bird*, **15**(4), pp. 7–15.
- Brown, A., Franken, P., Bonner, S., Dolezal, N. and Moross, J. (2016) Safecast: successful citizen-science for radiation measurement and communication after Fukushima. *Journal of Radiological Protection*, **36**, pp. S82–S101.
- Carr, R. (2018) *Bob Carr: Run for Your Life*. Melbourne: Melbourne University Press.
- Chalkey, B. and Essex, S. (1999) Sydney 1000: the 'Green Games'? *Geography*, **84**(4), pp. 299–307.
- Clennell, A. (2015) Former premier Bob Carr crashed in on the debate over privatization of electricity networks. *Daily Telegraph*. 6 March. Available at: <https://www.dailytelegraph.com.au/news/nsw/former-premier-bob-carr-crashes-in-on-the-debate-over-privatization-of-electricity-networks/news-story/7cd5cd343d9186dbaa8fe806ecf103a>.
- Cooks River Environmental Assessment and Education Project (2000) *Final Report: Bringing the Cooks River to Life*. Sydney: New South Wales Government Stormwater Trust.
- Colman, J. (2016) *The House That Jack Built: Jack Munday Green Bans Hero*. Sydney: University of NSW Press.
- CTEnvironmental and Wright, I. (2014) *Cooks River Catchment 2013/14 River Health Monitoring Technical Report*. Prepared for the Cooks River Alliance. Available at: https://cooksriver.org.au/.../CRA-2013_14_River_Health_Technical_Report_FINAL_w...
- Dowsett, B., Mather, G., Mercer, C., Pearson, B. and Vincent, D. (1995) *A New Course for Sydney Water: The Final Report of the Sydney Water Project*. Sydney: Sydney Water Project.
- Eitzel, M.V., Cappadonna, J.L., Santos-Lang, C., Duerr, R.E., Virapongse, A., West, S.E., Kyba, C.C.M., Bowser, A., Cooper, C.B., Sforzi, A., Metcalfe, A.N., Harris, E.S., Thiel, M., Haklay, M., Ponciano, L., Roche, J., Ceccaroni, L., Shilling, F.M., Dörler, D., Heigl, F., Kiessling, T., Davis, B.Y. and Jiang, Q. (2017) Citizen science terminology matters: exploring key terms. The theory and practice. *Citizen Science: Theory and Practice*, **2**(1). Available at: <https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.96/>.
- Finkel, A. (2018) How a German migrant planted citizen science in Australia – and why it worked. *The Conversation*, 8 February. Available at: <http://theconversation.com/how-a-german-migrant-planted-citizen-science-in-australia-and-why-it-worked-91385>.
- Forester, J. (1989) *Planning in the Face of Power*. Berkeley, CA: University of California Press.
- Frog and Tadpole Study Group of NSW (FATS) (2003) Frog call. *Newsletter*, **67**, September.
- Gibson, C. (2006) *Bushland Bulletin*, **51**, Winter.
- Gibson, C. and Miller, R. (1996) *Freshwater Creek Bushland, Upper Cooks River, Chullora – Survey of Remnant Flora*. Report for the Environmental Protection Authority Rivers Reborn Program 1995.
- Gleeson, B. and Commissionacetto, E. (2005) Public land agencies in Australia: the key to positive planning? *Griffith University Urban Research Program*, **5**.

- Haklay, M. (2013a) Citizen science and volunteered geographic information – overview and typology of participation, in Sui, D.Z., Elwood, S. and M.F. Goodchild (eds.) *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice*. Berlin: Springer, pp. 105–122.
- Haklay, M. (2013b) *The Explosion of Citizen Science*. UCL Global Health, Video, You Tube. Available at: <https://www.youtube.com/watch?v=rbMleGc8TXo>.
- Haklay, M. (2018) Participatory citizen science in Hecker, S., Haklay, M., Bowser, A., Makuch, Z., Vogel, J. and Bonn, A. (2018) *Citizen Science: Innovation in Open Science, Society and Policy*. London: UCL Press, pp. 52–62.
- Hector, D. (2011) Sydney's water sewerage and drainage system. *Journal and Proceedings of the Royal Society of New South Wales*, **144**, pp. 3–25.
- Innes, J. and Booher, D. (2015) A turning point for planning theory? Overcoming dividing discourses. *Planning Theory*, **14**(2), pp. 195–213.
- Irwin, A. (1995) *Citizen Science: A Study of People, Expertise and Sustainable Development*. London: Routledge.
- Irwin, A. (2001) Constructing the scientific citizen: science and democracy in the biosciences. *Public Understanding of Science*, **10**, pp. 10–18.
- Irwin, A. and Michael, M. (2003) *Science, Social Theory and Public Knowledge*. Philadelphia, PA: Open University Press.
- Irwin, A. (2015) Citizen Science, Scientific Citizenship: Same Words Different Meanings? Presentation at Joint Research Centre, EU Science Hub, 15 October, with Jerome Ravetz and Silvio Funtowicz. YouTube video.
- Knowles, C. (1996) The NSW State Government's urban management. *Australian Planner*, **33**(2), pp. 67–69.
- Knowles, C. (1998) Determination of the Development Applications for the Redevelopment of the National Rail Corporation's Sydney Freight Terminal, Chullora, Sydney.
- Landcom website <https://www.Landcom.com.au/>.
- Landcom (1998) *Take a Closer Look: The Detention Basin, Lot 21 Muir Road Chullora*. 15 July.
- McAuslan, P. (1980) *The Ideologies of Planning Law*. Oxford: Pergamon Press.
- McDonald, E. (2014) *Love the Coast*. Sydney: Sydney Coastal Councils Group. Available at: https://www.sydneycoastalcouncils.com.au/sites/default/files/Love_the_Coast_web.pdf.
- Moore, T., Wilson, B., and Harley, D. (1993) *Doing the Vision Thing ...* Submission to the Joint Select Committee upon the Sydney Water Board, July. Sydney: Tim Moore, Bob Wilson and David Harley.
- Muston and Associates (1991) *Redevelopment of Surplus STATE RAIL Lands at Chullora – Ecological Assessment of Remnant Vegetation*. Report for Land Systems EBC Pty Ltd.
- Natarajan, L., Rydin, Y., Lock, S.J. and Lee, M. (2018) Navigating the participatory processes of renewable energy infrastructure regulation: a 'local participant perspective' on the NSIPs regime in England and Wales. *Energy Policy*, **114**, pp. 201–210.
- NSW Department of Planning and Environment (2018) *Community Participation Plan: The Department of Planning an Environment Exhibition Draft*. Available at: <https://www.planning.nsw.gov.au/-/media/Files/DPE/Plans-and-policies/community-participation-plan-draft-2018-10.PDF>.
- NSW Gazette (2017) *Government Gazette of the State of New South Wales*, No 129, 1 December. Available at: https://gazette.legislation.nsw.gov.au/so/download.w3p?id=Gazette_2017_2017-129.pdf.
- Olympic Coordination Authority (2002) *The Sydney 2000 Olympic and Paralympic Games: A Report on the Financial Contribution by the NSW Government to the Sydney 2000 Games*. Available at: <https://www.parliament.nsw.gov.au/la/papers/DBAssets/tables/paper/webAttachments/937/Financial%20Contribution%2031-03-02.pdf>.
- O'Rourke, C. (2002) Wetlands' lungs breathes life into a river dying from pollution. *Sydney Morning Herald*, 30 December.
- Owens, S. (2000) 'Engaging the public': information and deliberation in environmental policy. *Environment and Planning A*, **32**(7), pp. 1141–1148.
- Productivity Commission (1991) *Rail Transport*. Canberra: Australia Government Publishing Service, 21 August. Available at: https://www.pc.gov.au/_data/assets/pdf_file/0006/156714/13rail.pdf.
- Roberts, S. (2010) Working for Colin. *The Bushland Bulletin*, 60.
- Sainty, G., Hunter, G., Allchin, J., Bluett, D. and Hunt, D. (2000) Managing Stormwater Runoff with an Off-line Wetland Treatment System. Paper delivered to 40th Annual meeting and International Conference, The Aquatic Plant Management Society, Inc, San Diego, California 16–20 July.

- Solomon, J. (1993) *Teaching Science, Technology and Society*. Philadelphia, PA: Open University Press.
- Steele, J. (2005). The Aboriginal Language of Sydney: A Partial Reconstruction of the Indigenous Language of Sydney based on the Notebooks of William Dawes 1790–91, informed by Other Records of the Sydney and Surrounding Languages to c. 1905. Thesis, University of Sydney.
- Stein, P. (2000) The great Sydney water crisis of 1998. *Water Air, and Soil Pollution*, 123, pp. 419–436.
- Stephen, J. (2006) Choked river: neglect of ‘sick’ Cooks River has to be stopped. *Bankstown Canterbury Torch*, 26 April.
- Stokes, R. (2017) *Environmental Planning and Assessment Amendment Bill 2017, 2nd Reading Legislative Council*. New South Wales Parliament, Hansard. Available at: <https://www.parliament.nsw.gov.au/Hansard/Pages/HansardResult.aspx#/docid/HANSARD-1323879322-99686/link/38>.
- Train, W. (1998) *Report to the Honorable Craig Knowles, Minister for Urban Affairs and Planning and Minister for Housing: Proposed Redevelopment of National Rail Corporation’s Sydney Freight Terminal, Chullora*. Sydney: Commissioners of Inquiry for Environment and Planning.
- Tremain, J. (2000) Natural cleansing. *Bankstown Canterbury Express*, 22 June.
- Tyrrell, I. (2018) *River Dreams: The People and Landscape of the Cooks River*. Sydney: University of NSW Press.
- West, D. (2013) The Freshwater Creek wetland. *The Bushland Bulletin*, 69, Spring, p. 3.
- Wiggins, A., Bonney, R., Lebuhn, G., Parrish, J. and Weltzin, J. (2018) A science products inventory for citizen-science planning and evaluation. *BioScience*, 68(6), pp. 436–444.
- Wilson, J. (1998) Destruction of Cooks River. *Bankstown–Canterbury Torch*, 5 August.
- Wolli Creek Preservation Society (2005) *Wolli Creek Update*. September.
- Yin, R. (2018) *Case Study Research: Design and Methods*, 6th ed. London: Sage.

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APPENDIX A

Bankstown Bushland Society (BBS)

Information available online at <https://bankstownbushlandsociety.com/> including most copies of the newsletter, *The Bushland Bulletin*.

Correspondence and Media Releases Referenced

Press Release addressed to Joy Wilson, journalist at the Bankstown and Canterbury Torch, 21 July 1998.

Letter regarding Commission to Liverpool Councilor, from BBS witness at Commission, 6 May 1998.

Letter regarding Commission to Liverpool Councilor, from BBS witness at Commission, 28 April 1998.

Letter to BBS to accompany from Business Land Group. *Take a Closer Look: The Detention Basin, Lot 21 Muir Road Chullora*, 15 July 1998.

Deed of Agreement between Business Land Group, Sydney Water and State Rail: Trunk Drainage – Chullora, 5 November 1997.

Letter to Bankstown City Council: Land Title to State Rail Land, Chullora, 10 June 1996.

Letter to Bankstown Bushland Society: *Chullora Bushland Rehabilitation (Freshwater Creek Area)* from Freight Rail, 27 June 1995.

Letter to Bankstown Bushland Society regarding Detention Basins from Sydney Water, 29 September 1993.

Letter to Director Sydney Water Board regarding Detention Basin, 10 August 1992.

Letter to Bankstown Bushland Society regarding Detention Basins, from Sydney Water, 24 September 1992.

South West Enviro Centre (SWEC)

Newsletter: News-Link, 18 issues published 2000–2006

Correspondence, Plans, Agreements and Reports Referenced

Letter to NSW Minister for Planning, 25 May 2011.

Email to Sydney Water re Chullora Fish Ladder, 2008.

Agreement to occupy land between Sydney Water Corporation and South West Enviro Centre Inc. 1 July 2007–30 June 2012.

Letter to Sydney Water: Stormwater Channel at rear of Waste Services complex in Chullora. 2 February 2006.

Letter to Sydney Water Wetland Property Muir Road Chullora, from Landcom, 24 May 2005.

Chullora Wetlands: Environmental Monitoring Report by Dennis, Y., Hartog, K. and Camilleri, M. from NSW TAFE Bankstown, 2005.

Letter to Cooks River Coalition Wetland Property – Muir Road, Chullora, from Landcom, 12 September 2004.

Annual Report 2003–2004, 11 October 2004.

State Rail, Sydney Water Corporation and Landcom Deed of Variation of Deed of Trunk Drainage – Chullora, 2 September 2004.

Letter to Minister for Infrastructure and Planning on State Significant Development at 9 Muir Road, from Secretary, I. Jones, 1 August 2003.

Draft Management Plan for Freshwater Creek Wetlands Detention Basin, Chullora: A Joint Project between Sydney Water and the South West Enviro Centre Inc., June 2003.

Chullora Wetlands, Minutes of a meeting convened by Business Land Group, 21 May 2002, Bankstown City Council offices.

President's Annual Report 2001–2002, 9 September 2002.

Constitution, 12 October 1998.

Technical Reports: A Selection Referenced

Ecological and Catchment Assessments and Determinations for Planning Purposes

AECOM (2010) Ecological Assessment 24 Muir Road, Chullora. Available at: <https://www.jrpp.gov.au>

nsw.gov.au/Portals/0/JRPP_Documents/230/Ecological%20Assessment_24%20Muir%20Rd%20Chullora_22June2010.pdf.
Bankstown City Council (2010) Development Assessment Report to the Joint Regional Planning Panel for Warehouse/Distribution Centre & Offices – Volkswagen Group Australia, Lot 38 DP 1031735, 24 Muir Rd, Chullora. Available at: https://www.jrpp.nsw.gov.au/Portals/0/JRPP_Documents/230/2010SYW026%20Business%20papers.pdf.

James, T. and Anderson, J. (2003) *Updated Flora and Fauna Assessment for No 9 (Proposed Lot 372) Muir Road, Chullora*. Report to Landcom.

New South Wales Minister for Infrastructure and Planning (2003) *Determination of a Development Application for State Significant, Non-Designated and Integrated Development, George Weston Foods Ltd.*

James, T. (1999) *Chullora Industrial Estate: Vegetation Review and Survey of Area 3, September*. Commissioned by NSW Business Land Group.

Kinhill, Connell and Wagner (1997) *Redevelopment of Sydney Freight Terminal*. Chullora: Statement of Environmental Effects, August.

Cook's River TCM Committee (1991) *Cooks River Draft Total Catchment Management Action Plan Volume II: Task Group Reports*. Sydney: Soil Conservation Service of NSW.

Threatened Species Conservation Act associated documents

New South Wales Department of Environment, Climate Change and Water (2010) *Submissions Report: Cumberland Plain Recovery Plan*.

New South Wales National Parks & Wildlife Service (National Parks) (2003) *Acacia pubescens: Recovery Plan*. Sydney: Threatened Species Unit.

New South Wales Scientific Committee (1997) *Cooks River Clay Plain Scrub Forest: Notice of Final Determination and Amendment of Schedule 1 to Threatened Species Conservation Act 1995 No 101*, 21 October.

New South Wales Scientific Committee (1997) *Wahlenbergia multicaulis (Tadgell's Bluebell) population, Auburn, Bankstown, Strathfield and Canterbury local government areas – Endangered Population Listing, Final Determination as an Endangered Population on Part 2 of Schedule 1 of the Threatened Species Conservation Act, 1995*, 5 September.

New South Wales Parliament (1995) *Threatened Species Conservation Bill 1995, 2nd Reading*. Legislative Assembly. Hansard.