

Article

# Visitor Satisfaction with a Public Green Infrastructure and Urban Nature Space in Perth, Western Australia

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**Abstract:** The widely applied Importance-Performance Analysis (IPA) provides relatively simple and straightforward techniques to assess how well the attributes of a good or service perform in meeting the expectations of consumers, clients, users, and visitors. Surprisingly, IPA has rarely been applied to inform the management of urban public green infrastructure (PGI) or urban nature (UN) spaces. This case study explores the visitor satisfaction levels of people using a PGI space that incorporates UN, close to the central business district of Perth, Western Australia. With diminishing opportunities to acquire new PGI spaces within ever more densely populated urban centers, understanding, efficiently managing, and continuously improving existing spaces is crucial to accessing the benefits and services that PGI and UN provide for humankind. An intercept survey conducted within the Lake Claremont PGI space utilized a self-report questionnaire to gather qualitative and quantitative data ( $n = 393$ ). This case study demonstrates how the IPA tool can assist urban planners and land managers to collect information about the attributes of quality PGI and UN spaces to monitor levels of service, to increase overall efficiency of site management, to inform future management decisions, and to optimize the allocation of scarce resources. The satisfaction of PGI users was analyzed using the IPA tool to determine where performance and/or resourcing of PGI attributes were not congruent with the expectations of PGI users (generally in the form of over-servicing or under-servicing). The IPA demonstrated that a majority of PGI users perceived the study site to be high performing and were satisfied with many of the assessed attributes. The survey identified the potential for some improvement of the amenity and/or infrastructure installations at the site, as well as directing attention towards a more effective utilization of scarce resources. Optimizing the management of PGI spaces will enhance opportunities for individuals to obtain the physiological, psychological, and emotional benefits that arise from experiencing quality urban PGI spaces. This case study promotes the important contribution that high-quality PGI spaces, which include remnant and restored UN spaces, make to the development of resilient and sustainable urban centers.

**Keywords:** biophilic design; green infrastructure; Importance-Performance Analysis (IPA); public open space; re-naturing cities; urban nature; visitor satisfaction survey; resource rationalization

## 1. Introduction

Public green infrastructure (PGI) is becoming an increasingly important and necessary part of urban life. Public green infrastructure is recognized as a mediator towards the emerging global challenges of climate change, which include global warming, extreme weather events, enhanced urban heat island effect, as well as general trends of declining public health and wellbeing [1,2]. Due to the multiple management and research disciplines that PGI intersects, a number of definitions and

interpretations appear in the literature [3–6]. Public green infrastructure can be referred to as networks of public open space, biofiltration installations, public trees, green walls, green roofs and the like [1,3]. The delineation of green infrastructure, as opposed to other categories of infrastructure (i.e., blue or grey), is accepted as being the way in which the infrastructure harmoniously, and simultaneously, delivers relief to social and environmental pressures [3]. Within this case study, PGI is restricted to describing green urban public open spaces (e.g., parks with or without urban nature (UN)) and the contribution those spaces can make to urban living.

With continued population growth in urban centers, such as Perth, Western Australia, the opportunities for creating new PGI is limited [7]. Urban lifestyles are becoming increasingly psychologically demanding, with adverse trends that are in part the result of individuals rapidly disengaging with nature and the surrounding environment [2,8]. Additionally, trends are being documented that show increased social disconnection between people and places, which can be considered to be cultural disconnection in this context [9,10], as well as disconnection between people and nature [8,11]. These negative trends have resulted in the protection of PGI sites being considered more critical than in the past [2,8]. The planning and management of these sites are largely at the behest of local and state government land owners and management authorities, at times in conjunction with each other, and occasionally with community members [12–14]. Hereafter, all those combinations of ownership and management arrangements are collectively referred to as land managers or just managers as appropriate.

In the pursuit of land managers successfully catering for the current and future psychological and physiological health needs, and general wellbeing of communities utilizing PGI spaces, a substantial effort is required to thoroughly understand the needs of PGI users, how existing PGI spaces are being used, PGI users perception of site performance, and how attributes of a PGI contribute to a successful and engaging PGI experience. After this information has been collected, analyzed, and consolidated in policy and management plans, the quality management of PGI spaces is likely to be enhanced in both the short and long term.

Life in a highly urbanized setting is often met with persistent noise, light, and tension. It can be devoid of nature, well-functioning ecosystems, and lack opportunities for individuals to experience nature [11,15]. As such, in highly urbanized settings, PGI is of increased importance as it allows individuals to recreate, socialize, exercise, engage with nature, and engage in necessary spiritual reflection, which are integral to the human psyche for general health and wellbeing [15]. It has consistently been shown, and is now widely accepted, that PGI spaces provide users with various psychological, physiological, and general wellbeing benefits at both an individual and community level [2,16]. Public green infrastructure provides city dwellers with the opportunity to engage with the natural environment and ecosystems, in line with the Biophilic Hypothesis popularized by Wilson [16]. The Biophilic Hypothesis asserts that individuals possess a deep biological need and desire to engage with nature in order to thrive as a species [16]. It is reported that without engagement with nature, the general health and wellbeing of communities begins to decline [1]. Therefore, engagement with nature and the natural environment is paramount for building and developing resilient urban communities [17]. Building resilience is an important goal and mounting requirement for cities facing emerging and morphing social, economic and environmental changes and/or challenges.

Designing PGI that meets the needs of local and wider urban communities requires careful and measured consideration. Resource saturation (offerings in excess of requirements) and resource rationalization (distribution of resources based on requirement) need to be considered to ensure opportunities are provided in an equally distributed way (equity planning), ultimately supporting and encouraging broad engagement of a range of demographic subgroups [18,19]. Needs can significantly differ among such demographic subgroups. Understanding the needs of local communities marks the first step in planning to effectively and equitably meet these needs [18]. In its many forms, PGI has the ability to cater to a wide range of PGI users pursuing a variety of activities; active, passive, social, and/or recreational. Ultimately, PGI user groups are responsible for determining the performance and efficacy in the ability of these spaces to meet their current and diverse needs. From the perspective of a

land manager, such information is valuable when seeking to deliver the psychological, physiological, and general well-being outcomes afforded by PGI spaces. Demographic and satisfaction information must be gathered through quality engagement and consultation among PGI users, stakeholder communities, and land managers.

A number of techniques may be utilized when interrogating the collected information as described above, pursuant to improving on-ground management of urban PGI. While techniques of Importance-Performance Analysis (IPA) are widely applied to determine how well the attributes of a good or service perform in meeting the expectations of consumers, clients, users, and visitors (e.g., [18,20–27]), IPA has only rarely been applied to enhancing PGI management [18,28]. The literature review of Parker and Simpson [28,29] and additional research in support of this case study, identified only four other studies that have utilized IPA techniques to investigate how PGI users perceive urban PGI spaces [30–33]. The IPA is a tool that analyses two dimensions of an experience by comparing the importance of the attributes of a product or service, urban PGI in this context, with the performance of those attributes in meeting user expectations [23,27]. In this case study, IPA was utilized to assess the importance of attributes of high quality PGI identified from the literature [28,29] against their relative performance for an urban PGI space in Perth, Western Australia. This case study demonstrated how the IPA tool was able to express the relationship between these two dimensions of experience in order to determine user satisfaction with each PGI attribute. Informed by the IPA, it was possible to identify where performance and/or resourcing of PGI attributes were not congruent with the expectations of PGI users, generally in the form of over-servicing or under-servicing. As a relatively straightforward to use and easy to interpret primary indicator, IPA is an efficient way for land managers to survey PGI users to determine evidence-based management action.

## 2. Materials and Methods

### 2.1. Study Site

Perth is a picturesque city on the south-western coast of Australia. Perth has a current population of approximately 2.6 million people [34]. Framed by natural assets, such as the Swan and Canning rivers, hundreds of kilometers of coastline, remnant native vegetation, and ancient geological features, with a mild climate, and a politically and socially stable society, Perth is among the highest ranking cities for liveability [35,36]. The population and footprint of Perth continues to grow through a combination of densification directed towards infill development and sprawling development on the urban fringe [37,38].

The locale of Perth experiences a Mediterranean climate with the indigenous vegetation being a mix of *Banksia* and eucalyptus woodlands with some *Agonis* and Tuart Forest [8,39–42]. Prior to British colonization, ‘Perth’ and the surrounding landscape was an extensive network of wetlands that supported the first nation Noongar population for at least 45,000 years [8,43,44]. Since the arrival of the British in 1829, urban development has seen many of these wetlands filled in and/or destroyed [8,43]. Within a 20-kilometer radius of the Perth city center, several significant wetlands still exist however, including Lake Claremont, Lake Monger, Bold Park, and Herdsman Lake (Figure 1) and those wetlands also contribute to the identity of Perth as an urban center [8].

The chosen study site, Lake Claremont (31.9738° S, 115.7771° E), which is a PGI and UN space covering over 60 hectares, is located approximately 10 kilometers south-west of the Perth city center. Under environmental protection policies of the Government of Western Australia, Lake Claremont is included on the list of Swan Coastal Plain Conservation Category Wetlands, the lake and the adjacent PGI are zoned as a Bush Forever site, and an Environmentally Sensitive Area in terms of the remnant and restored native vegetation [8]. The Lake Claremont site has diverse offerings and includes formal and informal active and passive recreation opportunities, as well as remnant and restored UN spaces. The site includes a Par 3 golf course, playgrounds, open turf spaces, a dog exercise area, barbecue (BBQ) facilities, and major renaturing efforts in the form of revegetation with local native species [8].

## 2.2. Field Survey

Despite large-scale visitor satisfaction surveys pertaining to PGI sites being limited in the published literature, the recognized benefits of surveying are extensive [18,45,46]. Quality surveying of PGI spaces has been shown to improve decision-making capabilities; strengthen support for infrastructure installations, upgrades, removals and prioritization; facilitate better environmental, conservation, and educational outcomes; better meet the needs and desires of the PGI users; and enhance opportunities for mental and physical wellbeing [18,29,46].



**Figure 1.** Location of the Lake Claremont public green infrastructure (PGI) space in relation to adjacent green infrastructure. The Perth Central Business District is located immediately east–north–east of the Kings Park PGI space. Adapted from the Western Suburbs Regional Organisation of Councils (WESROC) Greening Plan 2002 [47].

The associated data paper by Simpson and Parker [46] provides a detailed description of the design and implementation of the survey reported by this article. The following paragraph summarizes the information provided in the data descriptor paper.



A convenience intercept survey was implemented at the Lake Claremont PGI space on several days in December 2016 and January 2017 to coincide with the peak holiday and recreation period of the Austral summer [18,22,48]. The anonymous pen and paper self-report questionnaire used for the survey had categorical demographic questions as well as the question and paired Likert scales required for an IPA assessing 22 attributes of quality PGI spaces identified from the literature [18,28,29,46]. The IPA asked PGI users “How important are the following features of Lake Claremont to you and how satisfied are you with their management?” Participants could provide their importance ranking for each of the 22 attributes related to the quality PGI space using a 5-point Likert scale that ranged from 1 = *Not At All Important* to 5 = *Extremely Important*. Participants provided their performance rankings using a modified 6-point Likert scale that started at 0 = *Unable To Report* and then spanned from 1 = *Not At All Satisfied* to 5 = *Extremely Satisfied*. See Simpson and Parker [46] for further discussion on the setting of these values for the Importance and Performance Likert scales.

### 2.3. Data Analysis

De-identified data from the  $n = 393$  returned questionnaires were transposed to a Microsoft Excel spreadsheet. That data is available as a .csv file attached to the data descriptor of Simpson and Parker [45]. Microsoft Excel 2016 was also used to analyze and graph the data presented in this article.

While demographic data from all PGI users who participated in the survey is reported in the Results section below, only data from PGI users who could or choose to report on the performance of the attributes associated with the study site were included in the IPA. Hence, importance data from PGI users who provided no response or a zero score regarding the performance for an attribute was excluded from the IPA.

As per Oh [21] and Taplin [27], the assumption of a correlation between the importance and performance rankings were checked for each of the 22 PGI attributes assessed by determining the significance of the Pearson correlation coefficient [49]. The absence of a correlation between the importance and performance rankings for a PGI attribute suggests the potential for a difference in how subgroups of PGI users perceive the performance of that attribute [50,51].

Scale-Centered IPA (SC-IPA), Data-Centered IPA (DC-IPA), and Gap Analysis IPA (GA-IPA) were performed [20,27,52]. The SC-IPA is presented graphically as a grid with four quadrats (see Results, Figure 2) that are centered on the midpoints of the importance and performance scales, where the measures switch from not important or not satisfactory to being important or performing satisfactorily [22,27,53]. For this reason, it is critical that the Likert scales used to gather the importance and performance data are equivalent in the span of the measurement categories **and** that the midpoint of those scales is a neutral value [27,53]. While the midpoint may be implicit for a Likert Scale with an even number of categories, a majority of researchers recommend using Likert scales with an odd number of categories with the neutral value being explicit in the response options provided to participants [18,22,53–56]. In scenarios where IPA attributes are assessed as high performing on the SC-IPA, then the enhanced DC-IPA and GA-IPA can provide insights that may facilitate management actions to address attributes that may have declining performance or attributes that are being over-served and are therefore consuming scarce resources with no perceived benefit for PGI users [18,22,27].

Similar to the SC-IPA, the DC-IPA is also presented graphically as a grid with the four quadrats *Keep Up Good Work*, *Focus For Management*, *Low Priority*, *Possible Over-servicing*. The grid for the DC-IPA is however centered on the grand mean of the importance and grand mean of the performance of all the attributes assessed [22,53,57]. Focusing the grid on the means of the importance and performance ratings provides greater clarity for the prioritization of management action on those attributes that may be performing below the expectations of PGI users, especially for high-quality PGI that may have all attributes located in the *Keep Up Good Work* quadrat of the SC-IPA.

The GA-IPA was completed by determining the differences between the performance and importance rankings (i.e.,  $\text{Gap} = \text{Performance} - \text{Importance}$ ) by each participant for each attribute, checking that the performance gaps for all participants approximated a normal distribution for each

attribute, calculating the mean of the gaps for each PGI attribute, and checking if the mean gap for all responses was significantly different from zero (i.e., Performance  $\neq$  Importance) using a one sample t-Test [22,23,27]. Consistent with to the approach of Smolčić Jurdana et al. [24–26] and Taplin [27], this study presents both the IPA grid for the DC-IPA and the GA-IPA on the same figure provided in the Results. The greater the gap in the performance of an attribute, which is represented by its distance from the line of parity (Performance = Importance) in the graphical representation, the higher the management priority to implement corrective action [18,22]. The graphical prioritization of management actions can be further enhanced by combining the grids from the DC-IPA and GA-IPA, as demonstrated in Parker [18] and Taplin [27].

Soldić Frleta [23] and Taplin [27] report that the larger the gap is between the importance and performance rankings, the lower the satisfaction is likely to be with that PGI attribute. With additional rationalization, management action can then focus on improving the performance of attributes with a negative gap in order to meet the expectations of PGI users. Attributes with positive gaps, where performance exceeds the expectation of PGI users, could also require action to reduce over-servicing and more effectively allocate scarce resources available for PGI management.

### 3. Results

#### 3.1. Demographic Data

The demographic profile of the study site users in the Austral summer of 2016–2017 is shown in Table 1. The approximately 2:1 ratio between PGI users who identified as female or male is consistent with ocular-based gender counts performed during the survey.

**Table 1.** Demographic profile for PGI users at Lake Claremont (n = 393) in the Austral summer of 2016–2017.

Gender Profile		
Categories	Responses	Percentage $\pm$ 95% Confidence Interval
Female	241	61.3 $\pm$ 4.8
Male	144	36.6 $\pm$ 4.8
Other	3	0.8 $\pm$ 0.9
Prefer not to Disclose	1	0.2 $\pm$ 0.5
No Response	4	1.0 $\pm$ 1.0
Age Profile		
Categories	Responses	Percentage $\pm$ 95% Confidence Interval
18–24	17	4.3 $\pm$ 2.0
25–34	29	7.8 $\pm$ 2.6
35–44	64	16.3 $\pm$ 3.6
45–54	95	24.2 $\pm$ 4.2
55–64	85	21.6 $\pm$ 4.1
65+	99	25.2 $\pm$ 4.2
No Response	4	1.0 $\pm$ 1.0
Usual Place of Residence		
Categories	Responses	Percentage $\pm$ 95% Confidence Interval
Surrounding Suburbs (< 5 km)	305	77.6 $\pm$ 4.1
Other Metropolitan Suburbs	66	16.8 $\pm$ 3.7
Regional Western Australia	8	2.0 $\pm$ 1.4
Other Australian States	9	2.3 $\pm$ 1.5
International	5	1.3 $\pm$ 1.1

#### 3.2. Importance Performance Analysis

The quantitative values for the IPA are provided in Table 2 and in Figures 2 and 3. With the exception of Attribute 8\* (*High-quality European-/English-themed spaces and areas*), users of the study site

perceived attributes to be performing in the Keep Up Good Work quadrat (Figure 2) of the SC-IPA recommended by Martilla and James [20]. Having the analyzable attributes (excluding Attribute 8\*) located in the top right quadrant of the SC-IPA demonstrates that the study site is, overall, perceived to be a high quality PGI space that is meeting the expectations of the majority of PGI users.

With 120 unanalyzable responses (30.5%), Attribute 8\* had the highest rate of invalid or blank responses for the 22 attributes tested by the IPA questions and, while significant ( $p = 0.0409$ ), there was only weak correlation between the importance and performance rankings for that attribute (12%). In addition, that attribute created a high degree of confusion and questioning by survey participants. For those reasons, Attribute 8\* was excluded from the enhanced IPA analyses reported for this study.

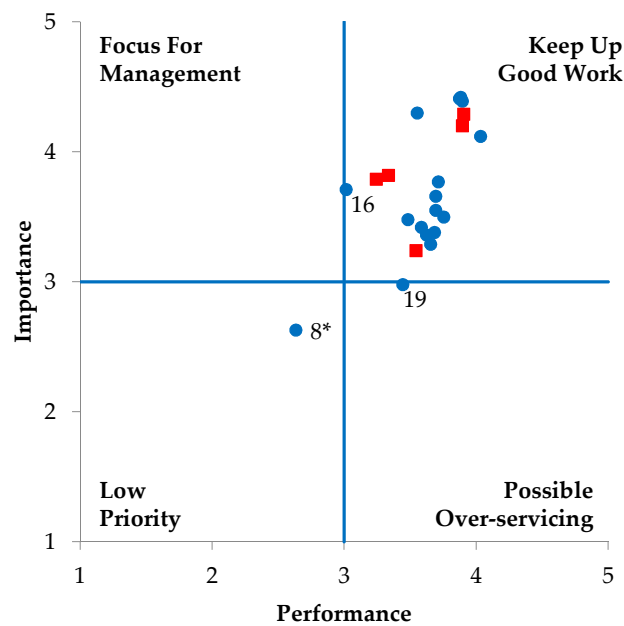
**Table 2.** The importance of attributes of quality PGI spaces for users of the Lake Claremont site and the performance of those attributes with respect to meeting user expectations (i.e., visitor satisfaction). Attribute numbers relate to the data labels used in the Importance-Performance Analysis (IPA) plots (Figures 2 and 3).

Attribute Number	Attribute	n	Mean Imp.	Mean Per.	Sig. Corr.	Gap (P-I)	Sig. Gap
1	Availability of shade—Trees or Structures	357	4.20	3.89	0.1379	−0.31	***
2	Bird watching infrastructure—Observation Deck, Rotunda	310	3.38	3.68	***	0.31	***
3	Children’s playground(s)	306	3.55	3.69	***	0.14	0.0612
4	Directional signs within the park	312	3.24	3.54	0.2978	0.30	***
5	Dog exercise area	306	3.79	3.24	0.0556	−0.55	***
6	Ease of access to and around site	339	4.12	4.03	***	−0.10	0.0702
7	Fencing	323	3.36	3.62	***	0.26	***
8*	High-quality European/English themed spaces and areas	273	2.63	3.50	*	0.87	***
9	High-quality infrastructure—Paths, Lights, Toilets, barbecues (BBQs), Benches	347	3.82	3.33	0.0834	−0.49	***
10	High-quality lake water body	341	4.30	3.55	***	−0.75	***
11	High-quality nature spaces and areas	338	4.42	3.88	***	−0.54	***
12	High-quality services—Café, Gym, Golf Club	321	3.66	3.69	***	0.03	0.6386
13	High-quality turf	316	3.29	3.65	***	0.36	***
14	Interpretive information and signs	326	3.48	3.48	**	0.00	0.9599
15	Native fauna presence and activity	343	4.41	3.87	***	−0.54	***
16	Off-leash dog exercise	300	3.71	3.01	***	−0.70	***
17	On-leash dog walking	307	3.77	3.71	***	−0.07	0.4174
18	Other sporting installations—Aquatic Center, Cricket, Hockey, Tennis	305	3.50	3.75	***	0.25	***
19	Par 3 Golf Course	281	2.98	3.44	***	0.46	***
20	Park exercise equipment	316	3.42	3.58	***	0.15	*
21	Personal safety	347	4.29	3.90	0.5912	−0.38	***
22	Tree management	341	4.39	3.89	***	−0.50	***

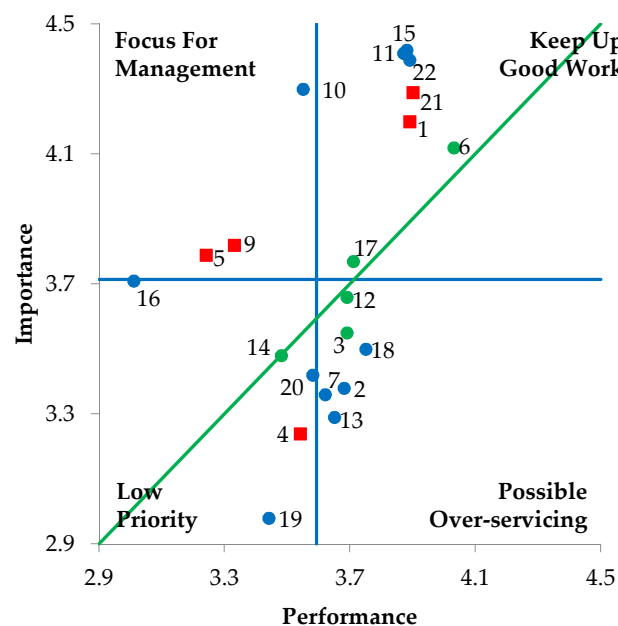
n = Sample Size = Number of analyzable responses. Mean Imp. = Mean value of the importance rankings for that attribute. Mean Per. = Mean value of the rankings of visitor satisfaction with the performance of that attribute. Sig. Corr. = Outcome for the test for statistical significance of the Pearson correlation between importance and performance rankings. Gap = Mean Performance – Mean Importance. Sig. Gap = Outcome for statistical test for significance of the Gap being > 0 (i.e., Performance  $\neq$  Importance). Outcomes of statistical test are reported as the  $p$ -value or as \* for  $p < 0.05$ , \*\* for  $p < 0.01$ , or \*\*\* for  $p < 0.001$ .

Even the preliminary SC-IPA level of analysis provides additional insights for the management of the study site. Positioned on the quadrat boundaries, performance of Attribute 16 (Off-leash dog exercise) and Attribute 19 (Par-3 Golf Course) could easily slide into the Focus For Management quadrant and the Possible Over-servicing quadrant respectively [22,27]. Further insights relating to those two attributes are provided by the DC-IPA and GA-IPA presented below.

As noted in the Methods section, the enhanced DC-IPA and GA-IPA can assist managers of high-quality PGI sites to prioritize management actions to address attributes that are performing below the expectations of PGI users and to review the allocation of scarce resources to attributes that PGI users perceive as being over-serviced. The combination of the DC-IPA and GA-IPA approaches presented in Figure 3 highlights that a number of the attributes of the study site are meeting the expectations of PGI users with an appropriate level of resourcing. The enhanced IPA provided in Figure 3 also provides other insights for the study site managers that are explored below.



**Figure 2.** Scale-centered IPA. Attributes shown as a red square if there was not a significant correlation between the Importance and Performance ratings, which suggests possible differences in opinion between subgroups of PGI users regarding that attribute.



**Figure 3.** Combination Data-Centered and Gap Analysis Importance-Performance Analysis. Attributes are shown as a red square shown if there was not a significant correlation between the Importance and Performance ratings. For attributes shown as a green dot Performance = Importance. Attributes shown as a blue dot have non-zero gaps and Performance  $\neq$  Importance.

The GA-IPA demonstrates that the study site users are satisfied with the performance and resourcing of Attribute 14 (*Interpretive information and signs*), Attribute 3 (*Children's playground(s)*), Attribute 12 (*High-quality services—Café, Gym, Golf Club*), Attribute 17 (*On-leash dog walking*), and Attribute 6 (*Ease of access to and around the site*). Although, with a  $p$ -value of 0.0612 and a location in the lower right Possible Over-servicing quadrant of the DC-IPA, there is potential for the provision and servicing of children's playgrounds at the Lake Claremont site to exceed the need perceived by the community.



The upper left Focus For Management quadrant of the DC-IPA reveals that a majority of users of the study site perceive that Attribute 10 (*High-quality lake water body*) as performing below average and having the largest gap of the GA-IPA ( $-0.75$ ) is evidence that the majority of PGI users perceive the water quality of Lake Claremont to be the worst performing site attribute and the attribute most in need of management action.

Remaining focused on the upper left quadrant of the DC-IPA also reveals that Attribute 5 (*Dog exercise area*) is partnered with Attribute 16, meaning that two aspects of dog management at the study site are performing significantly below the expectations of PGI users. Further, off-leash dog walking (Attribute 16) with a gap of  $-0.70$  is the second worst performing attribute of the study site, after the perceived quality of the lake waterbody. In addition, there was not a significant correlation between the importance and performance ratings for Attribute 5, which suggests possible differences in opinion between subgroups of PGI users regarding management of dog exercise at the study site. The responses for Attributes 5 and Attribute 16 are in stark contrast with the uniform satisfaction of all PGI users with on-lead dog walking at the study site (Attribute 17).

Attribute 9 (*High-quality infrastructure—Paths, Lights, Toilets, BBQ, Benches*) is also position in the top left Focus For Management quadrant of the DC-IPA, is located significantly above the line of parity for the GA-IPA, and also lacks correlation between the importance and performance rankings of PGI users, hence that attribute should also be a focus for management to determine what elements related to the broad scope of PGI infrastructure are perceived to be underperforming by the subgroups who use the study site.

For GA-IPA related to commercial operations, the management focus is always directed towards attributes located significantly above the line of parity, where the expectations of paying customers are not being met. The rationale for this focus being that the larger the gap between importance and performance of those attributes, then the lower the customer satisfaction with their experience [23,27]. In contrast, the management of PGI spaces requires the balancing of scarce resources against the service expectations of PGI users. For that reason, we recommend that PGI managers next consider those attributes below the line of parity, particularly those attributes that are located in the bottom right Possible Over-servicing quadrant of the DC-IPA, which are generally ignored in most IPA studies. That review may identify scarce resources that can be reallocated to address poorly performing attributes located significantly above the line of parity.

As previously mentioned, the level of service provided by the Par 3 Golf Course (Attribute 19) was the attribute of the study site that PGI user perceived to be most over-serviced with the largest positive gap ( $0.46$ ) between perceived performance and its importance rankings. In priority order for management consideration, based on PGI user perceptions of over-servicing, the following attributes should be reviewed: Attribute 13 (*High-quality turf*), Attribute 2 (*Bird watching infrastructure—Observation Deck, Rotunda*), Attribute 4 (*Directional signs within the park*), Attribute 7 (*Fencing*) and Attribute 18 (*Other sporting installations—Aquatic Center, Cricket, Hockey, Tennis*). Reviewing the potential over-servicing regarding the directional signs in the park (Attribute 4) would be complicated by the lack of correlation between the importance and performance rankings, suggesting different perceptions of the signage among subgroups of PGI users.

Having investigated the potential to reallocate resources from attributes that may be over-serviced, the land managers should return their attention to the attributes located in the upper right Keep Up Good Work quadrant that are significantly above the line of parity. After the water quality of the study site (Attribute 10), then the worst performing attributes in priority order under the GA-IPA are Attribute 15 (*Native fauna presence and activity*), Attribute 11 (*High-quality nature spaces and areas*), and Attribute 22 (*Tree management*). The significant correlation between the importance and performance ratings for those three attributes provides evidence that a majority of PGI users at the study site perceive the management of those attributes to be underperforming. Attribute 21 (*Personal safety*) and Attribute 1 (*Availability of shade—Trees or Structures*) are both performing significantly below PGI user expectations, but again the lack of correlation between the importance and performance rankings for these attributes, is evidence for a difference of

opinion between subgroups of PGI users at the study site, which would complicate the management actions required to address the perceived underperformance in those attributes.

## 4. Discussion

### 4.1. Demographic Profile of Public Green Infrastructure (PGI) Users

Researchers commonly report that understanding PGI user experiences, expectations, and satisfaction levels is of great value to inform the actions and decisions of land managers [58–61]. Meeting physical, psychological, spiritual, or other community needs and also providing abundant social, economic, and environmental opportunities are primary services delivered by urban PGI spaces [59]. Creating and enhancing the synergy between PGI users and land managers is critical to improved site management. While adjusting and adapting to the evolving needs and desires of PGI users is difficult, doing so is, however, confirmed as a best practice approach.

The age distribution of the survey participants for the PGI space investigated in this study did not match the current local or regional distributions reported by the Australian Bureau of Statistics and summarized in Tables S1 to S11 that are provided as supplementary material [62,63]. The age of the survey participants was moderately skewed towards an older population. The implications of the age distribution should be considered in the planning and management of PGI spaces. Researchers such as Johnson and Glover [61] suggest that passive-park attributes such as resting spaces, viewing infrastructure, and attributes that support flora and fauna experiences are more likely to draw visits from older PGI users. A known prevalence of older PGI users also requires consideration of attributes such as safe access, correctly graded paths, support rails, and more passive park attributes that may require higher levels of service or prioritization. There may also be less demand for attributes like playgrounds that engage younger PGI users and, therefore, such attributes could require a lower level of service.

Similarly, the gender distribution of the surveyed population was moderately skewed towards females. The gender distribution also did not match current local or regional distributions [62,63], which potentially indicates different values and choices of PGI users towards leisure/recreation activities and other attributes of the study site. A similar trend has been reported in studies such as Siu et al. [64]. As for the skewed age distribution, knowing a higher number of females visit the site has implications for the site managers. Items such as sense of safety, lighting, seating, and other infrastructure may require higher levels of service [64]. Understanding the demographic information of urban PGI users is valuable on several levels and this value can be realized through the hierarchy of benefits listed in Table 3.

**Table 3.** Hierarchy of benefits to be gained from understanding the demographics of PGI users.

Benefits to be Gained
Ensuring the strategic direction and future planning of the PGI by the land manager is aligned and congruent with the site users.
Considering the current strategic direction for the PGI and to better allow for estimates of future PGI user demographics.
Assessing proposals for infrastructure installations, upgrades, removals and prioritization.
Assessing maintenance/operating budgets and their ability to service the needs and desires of the site users.
Creating the basis for further investigations, such as quantifying and qualifying the importance and satisfaction levels of the site users.

### 4.2. Outcomes of Importance-Performance Analysis (IPA)

While prioritization and implementation of management actions related to any PGI space requires a holistic approach that incorporates other factors, such as financial, social, cultural and political implications and constraints as well as ecological values and environmental services, in the decision-making processes, the key findings of the IPA reported in this case study can be summarized as follows.

While potentially a difficult issue to address, because of differing views among subgroups of PGI users, dog exercise and off-leash dog walking at the study site should be a priority for management

action as both those attributes were performing significantly below the expectations of PGI users. Those findings are in stark contrast to on-leash dog walking at the site, which a majority of PGI users perceive to be satisfactory.

It may be possible to reallocate funding and other scarce management resources from attributes that PGI users perceive to be over-serviced to those attributes that PGI users report to be underperforming. Attributes at the study site that PGI users perceived to be over-serviced (i.e., have significant positive gaps) are the Par-3 golf course and other sporting installations, the bird watching rotunda and observation deck, and the conservation and/or safety fencing at the site. Potentially, the playgrounds for children could also enter this category and any future allocation of resources to that attribute would need to be carefully considered.

The four most poorly performing attributes in terms of the GA-IPA (i.e., largest negative gaps) are related to the environmental values and services of the site. The quality of the lake waterbody, the presence and activity of native fauna, the quality of the nature spaces, and tree management should all receive additional management action to ensure that the performance of those attributes meets the expectations of PGI users. After the combination of dog exercise and off-leash dog walking, addressing the real or perceived poor quality of the lake waterbody should be the next highest priority for management action. While significantly underperforming and in need of action, the other three environmental attributes are all located in the Keep Up Good Work quadrant of the DC-IPA, which is fortuitous as improving the performance of those three attributes is likely to require consistent, focused effort for an extended period of time, spanning into years, if not decades [65,66].

#### *4.3. Changing Values and Expectations*

While Australia is a wealthy nation, it has only been in recent times that the community has come to place a relatively high value on natural assets [8]; however, the expectations of PGI users reported in the literature [8,29,58] are generally being met by the study site. The expectations of PGI users towards the attributes such as interpretive information and signs, children's playgrounds, high-quality services like café and gym, and on-leash dog walking are being fully met. Based on discussions and interactions with and responses from survey participants, some emerging and changing values were observed at the study site. These included the desire for increased protection of local native vegetation, enhancement of lake water quality, the desire to increase opportunities to view the lake, enhancing the quality and protection of indigenous fauna, removal of ecological threats, protection and retention heritage markers, as well as a balanced approach to dog management. These findings are consistent with the changing values reported by Jones and Newsome [35] and Simpson and Newsome [8]. Some of these emerging community values present complex challenges based on the individual positions and the potential for conflicting expectations and perceptions of PGI users (e.g., protection of native vegetation and enhancement of views to the lake body requiring removal of renatured vegetation). Values may also be difficult to quantify and measure, which can result in difficulty assessing their ongoing performance. To understand emerging and changing values across PGI spaces, targeted site-specific research is required to further quantify the preliminary findings of this case study.

#### *4.4. Land Manager Responsibilities*

This case study demonstrates the need for land managers to adopt a flexible and evolving approach when managing urban PGI spaces. This will facilitate better harnessing of opportunities, supporting quality engagement of PGI users, and result in a reduction of resources required to yield the same (perceived) quality space. This approach to management will also allow PGI spaces to improve in performance and offerings for users. Land managers should be cautious not to become complacent with well performing spaces, rather opportunities should always be sought to improve urban PGI spaces, commensurate with the valuable community assets that they are. These opportunities are most likely to arise from engagement with the community.

#### 4.5. Frequency of Surveying

With the intensification of PGI user needs, desires, and expectations, land managers must respond quickly, with an evidence-based approach, if the quality and value of PGI spaces is to be retained and improved. Frequency of surveying PGI users must be determined to maintain a confident understanding of the expectations of PGI users and satisfaction levels with a PGI space. The published literature is largely silent on frequency for surveying PGI satisfaction; however, informed by the literature review of Parker and Simpson [28,29], some factors to consider when determining frequency are provided in Table 4. After considering these factors (as well as other site specific factors), a suitable survey frequency can be determined. A suitable time period between surveys is generally considered to be between two and five years. The changing status of the PGI space itself as well as the urban landscape in which the PGI space exists may also be responsible for increasing the frequency of surveying.

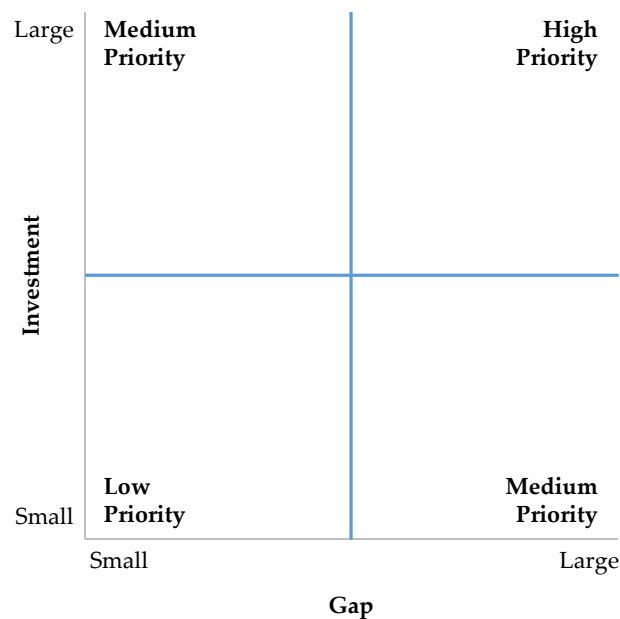
**Table 4.** Factors to be considered in determining a suitable survey frequency to facilitate evidence based management of urban PGI spaces.

Determinants of Survey Frequency
1. Development within and around the site, including new installations, upgrades, removal of assets.
2. Maturity of the space; spaces in their infancy would likely require an increased surveying frequency as opposed to more mature spaces.
3. Changes in the patronage of the site—a substantial increase or decrease in patronage (i.e., 20%) can be considered cause for increased surveying frequency.
4. Changes in political pressures or support for the space, particularly those that could affect (financial or otherwise).
5. Resource changes, including grant opportunities or changes in financial constraints.
6. Social pressures, including changes in social values.
7. Future planning around development or re-zoning.
8. Availability of skills, funding and other resource required for future surveying.

Source: Informed by systematic literature review of Parker and Simpson [20,21].

#### 4.6. Limitations and Lessons

This case study demonstrates that from the perspective of a land manager, IPA can reveal much information and provide direction when attempting to correct resourcing misallocations, generally in the form of over-servicing and/or underperformance/under-servicing of attributes that are failing to meet expectations of PGI users. While the majority of the current IPA literature (e.g., [21,23,27]) recommends that management action be directed to underperforming attributes before considering over-serviced items, this may not give the complete picture in the case of PGI management, because resourcing is generally scarce. Considerations should also be made towards the original financial investment and maintenance requirements of each attribute of the PGI space when prioritizing management actions. For example, an attribute may deviate from the line of parity substantially, but may not attract a large financial investment, and therefore a case can be made to balance the deviation from the line of parity in conjunction with the level of financial investment to determine correct order for management action. Such was the rationale for a lower prioritization for management action in relation the attributes associated with the nature spaces, native fauna, and trees provided previously in Section 4.2 of this Discussion. This balanced approach will produce a more reliable and robust methodology when prioritizing management action (Figure 4). Such an approach is also likely to gain financial savings more rapidly, which can be reallocated to expedite the correction of underperforming attributes more readily.



**Figure 4.** Conceptual model for the prioritization of corrective management action by balancing investment in an attribute and the gap in performance with respect to the expectations of PGI users.

#### 4.7. Further Research

The case study and IPA findings reported by this article assume that all PGI attributes impact equally upon the experience of a PGI user. In reality, different attributes may affect different PGI users to different degrees. This could be further developed with research to determine the relative weighting of attributes for subgroups of PGI users in an attempt to account for differences in impact for common PGI attributes.

Further research utilizing IPA on PGI assets could include temporal analysis of repeat IPA surveys in an attempt to identify trends for issues emerging at the site, allowing for land managers to address the issues in their infancy before they become more complex and expensive to address.

It is important to consider what PGI attributes PGI users choose to engage with while on site. Such information is important when considering the availability, service levels, and opportunities provided by the attributes of high-use areas within PGI spaces. Further research with respect to how people utilize the study site would provide insight into any differences in the values, satisfaction, and perceptions of attribute and management performance among different subgroups of PGI users. Information on activity engagement is also useful when undertaking cost-benefit analysis of future infrastructure proposals or installations.

In addition, it has been observed within this case study and the supporting literature review of Simpson and Parker [28,29] that the PGI user needs have intensified, thus alternate or more detailed performance analysis may be required in order to better understand the implications there in. A planned program of repeat surveys at intervals of three to five years would contribute to that understanding.

## 5. Conclusions

Public green infrastructure in urban centers is invaluable. These spaces are invaluable because they provide the opportunity for PGI users to connect with and experience nature, as a locally accessible asset and experience that cannot be found in any other way. Experiencing and connecting with nature provides humankind with positive psychological and physiological benefits and spiritual well-being. Which are facets of citizen life that are being lost with each generation as humanity and the planet become ever more urbanized.



Given the benefits and soulful contribution that resourcing PGI provides for the betterment of the local community and society as a whole, it is even more important to appropriately allocate, protect, rationalize, and maximize the return of these resources. The IPA tool has not been widely utilized in PGI planning and management, however this case study demonstrates its applicability to inform management and maximize the return on scarce PGI resource allocations. This case study further demonstrates how IPA can assist in the prioritization and rationalization of resources and the drive that land managers can show towards equity planning for the wider community to access PGI assets.

For each of the 22 attributes of the Lake Claremont PGI space, the majority of which are directly transferrable to other urban PGI spaces, this case study revealed those attributes that were meeting the expectations of PGI users, those attributes that PGI users perceived to be underperforming, and those attributed that were or had the potential to be over-serviced. In contrast to other applications of IPA, this PGI-focused case study promotes land managers investigating attributes that PGI users perceive as being over-serviced to determine the potential for generally scarce resources to be reallocated to improve underperforming attributes. Furthermore, the correlation analysis utilized in this case study revealed several attributes of the Lake Claremont PGI space about which subgroups of PGI users may have different perceptions regarding the level of performance of those attributes and recommends that land managers undertake additional investigation before deciding on any course of action regarding those attributes.

This research advocates equity planning in all demographic ranges having access to PGI spaces that meets local needs. This quality, regardless of the PGI attributes desired, should be somewhat comparable, regardless of social and economic status, population density, and management affluence. Importance-Performance Analysis is one tool that assesses and confirms the performance of PGI attributes and thus supports equity planning through suggestion of resource need and rationalization.

**Supplementary Materials:** The following are available online at <http://www.mdpi.com/2073-445X/7/4/159/s1>, Tables S1 to S11 Demographic Data.

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