Rejuvenating@Pandan

Learn, Appreciate & Bond through H_2O

Research on Active, Beautiful, Clean (ABC) Waters Programme

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1. Abstract

To strengthen Singapore's social fabric, the government has launched several projects to bring people together, one of which is the Active, Beautiful, Clean (ABC) Waters Programme. Under the ABC Waters Programme, Singapore's National Water Agency, the Public Utilities Board (PUB) has embarked on a journey to harness the full potential of our waters by integrating them with our environment. This has led to an improvement in the water quality, enhanced biodiversity, creation of new water recreational spaces for people and the development of ABC Reservoir Parks within our community. This research aims to improve Pandan Reservoir so as to increase visitation by attracting more future park users, especially families. Preliminary research regarding opinions of visitors to Pandan and Bedok Reservoir Parks has shown that the latter is better in fulfilling the goals of an ABC Waters Site as compared to the former. Hence, we suggest adapting the features and elements of Bedok Reservoir Park, together with new ideas to further enhance Pandan Reservoir Park. In the long run, we envisage that such suggestions would maximise community bonding through the integration of water activities, therefore achieving the goals of the ABC Waters Programme.

Keywords: Family, Pandan Reservoir Park, ABC Waters Programme, Community bonding, Singapore.

2. Introduction

2.1. Rationale of Research Project

The Singapore Government has been investing in the ABC Waters Programme since 2006. This programme aims to restructure many of Singapore's water bodies beyond their original utilitarian function into attractive waterscapes, and to create convenient nodes for effective community bonding (PUB, 2015). As of March 2016, 32 projects have been completed with 5 sites newly opened to the public in 2015 (PUB, 2016). Investments into the ABC Waters Programme has totaled $215.2 million in 2014 and $300.7 million in 2015 respectively (*ibid*). With such substantial investments pumped into the programme, our research project aims to evaluate the programme's effectivenes. Thus, we will identify benefits and drawbacks of the programme then propose suggestions for further enhancement to the existing schemes.

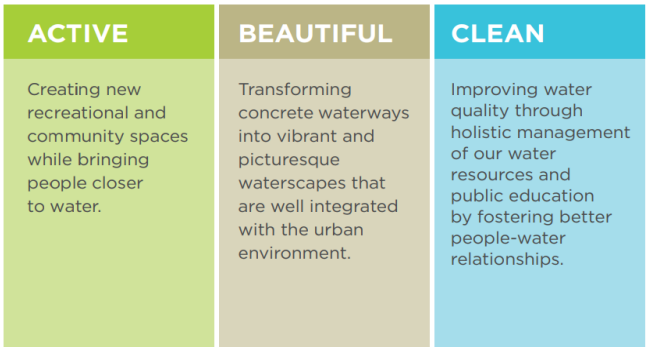


Figure 1: Overview of ABC Waters Programme by PUB (Centre for livable cities, Singapore, 2017)

2.2. Objectives of Research Project

Project Objectives:

1) To study two existing comparable ABC Waters Sites and examine which site better fulfils the purpose of bringing people together for effective community bonding.

2) To suggest the development of a future and more sustainable ABC Waters Site in order to continuously attract people so that the ABC Waters Site will be fully utilised and thus, serve their aim for a long period of time.

2.3. Our Research Hypothesis

Parks have been known for its important behaviour setting for physical activity. For example, older adults rate opportunities for physical activity as one of the most salient benefits of parks. Parks that are repleted with more facilities and supporting amenities, such as attractive landscaping, also appear more likely to attract users for active purposes (American Journal of Public Health, 2008).

Hence, our research hypothesis is: The ABC Reservoir Park with more amenities and organised water activities will bring about higher visitation, and this will increase its effectiveness in bringing people together and in community bonding.

2.4. Clarification of Key Terms

1. 'People' is defined as those living in Singapore, while 'Families' refer to those people bonded by kinship.
2. 'Park-goers' is defined as those people who visited the park at least once or more.
3. 'Companies' and 'Corporations' refer to commercial entities which are based in Singapore.
4. 'Bring people together' is defined as the presence of interaction between people at the park.
5. 'Water-related activities' or 'Water recreation' are defined as activities or events that are organised at the park that involves the use or appreciation of water bodies in their activities.
6. 'Community bonding' is when park-goers foster friendships and/or relationships.
7. 'ABC Waters Sites' refer to the collective term of various reservoirs and canals, with a total of 25 Waters Sites under the PUB's ABC Waters Programme.

3. Method of research

3.1. Data Collection

A list of existing ABC Waters Sites and selected characteristics was compiled through online and archival research which is shown in **Annex A**. Upon comparison,

Bedok and Pandan Reservoir Parks were chosen as our case studies due to a similar size but yet, vastly different amount of available water activities, amenities and vegetation surrounding them. Thus, to compare these two chosen ABC Waters Sites, an on-site survey was conducted from 18 May to 27 May 2017. **Annex B** provides more background information on these two Reservoir Parks while **Annex C** illustrates the geographical locations of both sites in Singapore.

The on-site survey concluded that Pandan Reservoir Park was ineffective in attracting park users, especially the younger families and is unable to achieve long-term aims of the ABC Waters Programme. Therefore, another survey was subsequently conducted on 20 October 2017 to assess our group's proposed ideas.

3.2. Research Investigation Process

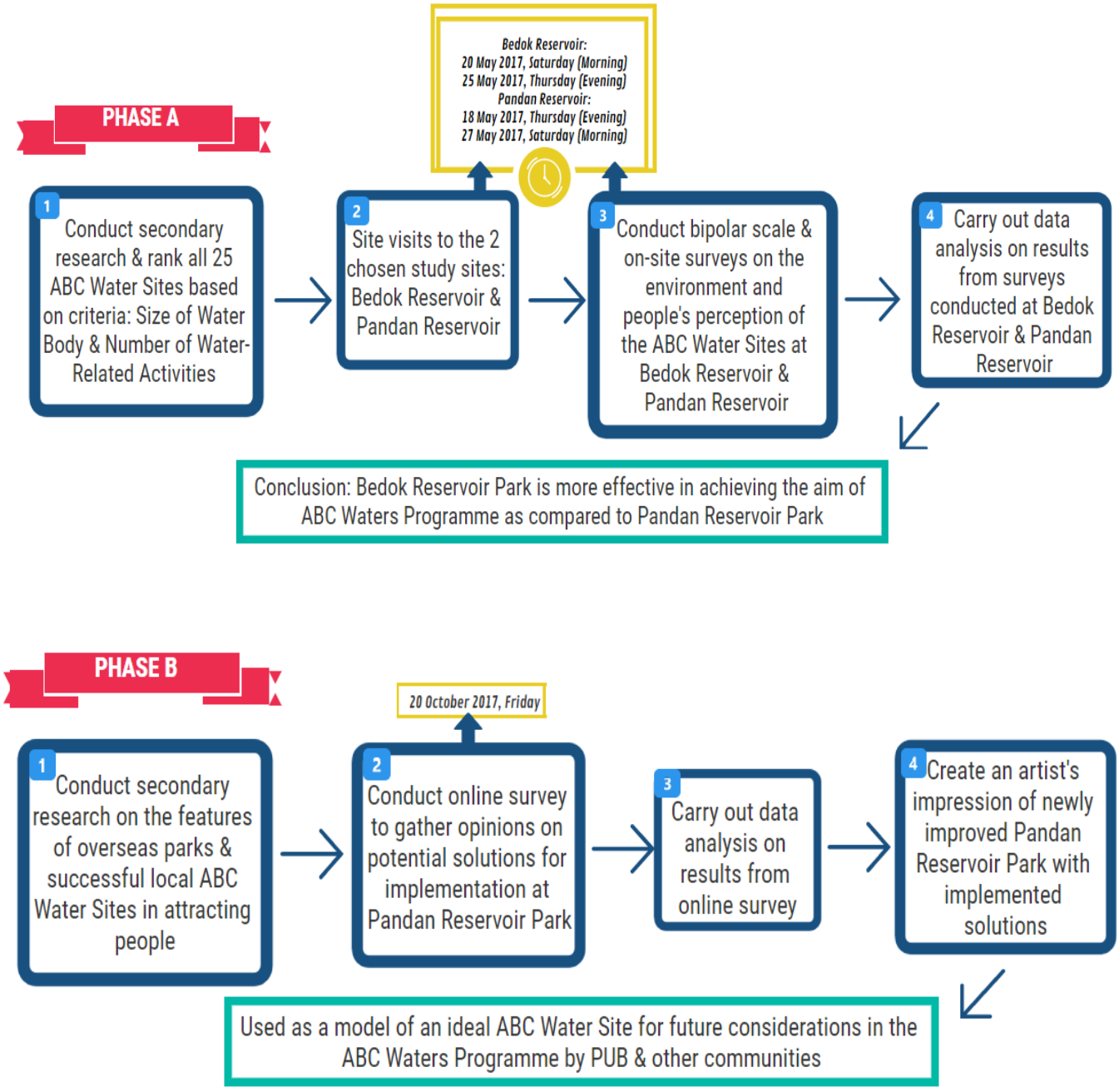


Figure 2: Schematic diagram illustrating the various phases of the research investigation process

3.3. Approach to Analysis

Table 1: Rationale for conducting surveys for Phases A and B and steps taken for survey results analysis

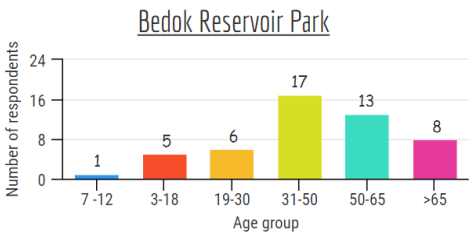
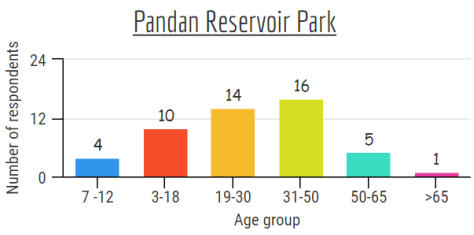
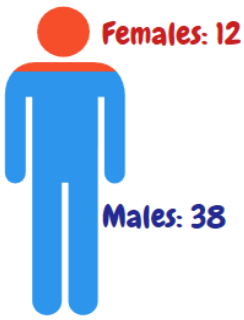
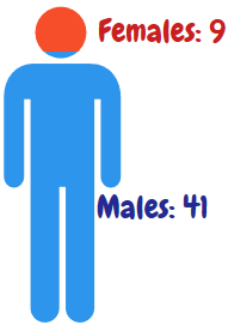
	Phase A Survey	**Phase B Survey**
Mode of Surveying	An on-site (**Annex D.1**) survey was used.	An online (**Annex D.2)** survey was used.
Rationale	The survey aims to gather information on the perception of people on water bodies, like reservoirs, in various locations in Singapore. The ultimate aim is to evaluate how effective the ABC Waters Programme is in achieving its goal, that is, to bring people together through the appreciation and usage of the water body for water-related activities. A bi-polar scale (**Annex E**) was also done to better understand the difference in environment of the two chosen Reservoir Parks.	The survey aims to obtain opinions on the suggestions for Pandan Reservoir Park. The rationale behind using the online survey was to maximise our audience, and understand the opinions of the general public. This will provide us with the views of a wider range of potential park-goers regarding our suggested solutions for implementation in Pandan Reservoir Park.
Results	Visual representations, like bar graphs and pie charts, were used to observe general trends and/or anomalies in the survey results.	
	Analysis and comparison carried out on the on-site-survey and bi-polar scale to find out relationships between the two. Conclusions drawn that provided insights for further suggestions to be implemented.	Analysis of data showcased the acceptance level with reference to the various proposed suggestions. Results were used as feedback for final suggestions.

Phase A: Comparison of 2 selected ABC Waters Sites

4. Results of Phase A Survey

4.1. Demographics of Respondents

Table 2: Demographics of respondents

	Bedok Reservoir Park	**Pandan Reservoir Park**
Age		
Gender		

4.2. Phase A Survey Key Results

The survey was carried out via random sampling at both Bedok and Pandan Reservoir Parks, with 50 respondents each. Random sampling method was chosen because it reduces biases when conducting surveys, thus leading to a fairer range of opinions from the people.

Table 3: Survey key results of Phase A

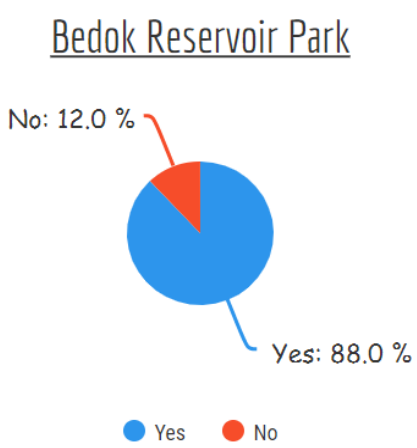
<table>
<tr><th>Bedok Reservoir Park</th><th>Pandan Reservoir Park</th></tr>
<tr><td colspan="2">Figure A: Results on whether presence of the reservoir (water body) adds to the overall appeal of the park as a location for community bonding and leisure</td></tr>
<tr><td> 

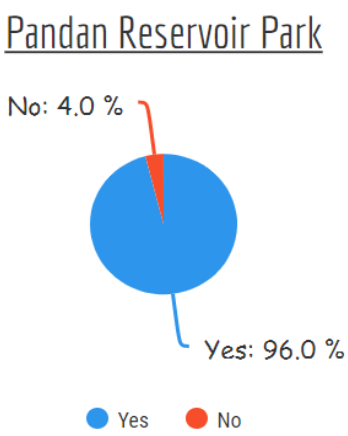
Figure A.1</td><td> 

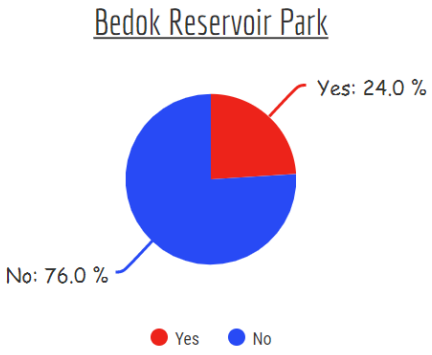
Figure A.2</td></tr>
<tr><td colspan="2">Most people enjoy being around the reservoir at both Reservoir Parks. Possible reasons for this are the cool temperature surrounding the reservoir, the surrounding scenery, and the cleanliness of the reservoir. This proves that most people already have positive opinions on the reservoirs. However, further improvements should still be made to encourage further usage of the reservoir.</td></tr>
<tr><td colspan="2">Figure B: Results on whether respondents enjoy participating in water-related activities</td></tr>
<tr><td> 

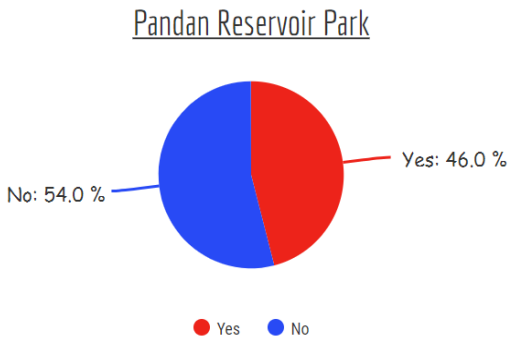
Figure B.1</td><td> 

Figure B.2</td></tr>
<tr><td colspan="2">23 individuals at Pandan Reservoir Park enjoy participating in water-related activities, as compared to just 12 at Bedok Reservoir Park. Water recreation conducted at Bedok Reservoir Park includes kayaking and dragon boating (Water Venture Programme[1]), fishing and zip line through the water body. Currently, the only water-related activity conducted at Pandan Reservoir Park is fishing. Although Bedok Reservoir Park has more water-related activities, they may not be suitable for everyone as kayaking is usually for the teenagers and middle-aged while fishing is more of a family pastime.</td></tr>
</table>

[1] Water Venture (WV) Programme: Programme started by the People's Association, that is conducted through the PA WV outlets such as dragon boating and kayaking to bring together people from various backgrounds and walks of life, fostering community bonding, promoting a healthy lifestyle and enriching the lifestyles and recreational activities of Singaporeans. Currently, there are eight WV outlets which are run by professional staff and assisted by a dedicated pool of trainers and volunteers. PAWV trainers are highly experienced and competent in the sports that they coach, with nationally recognised certifications. (People Association. 2017)

Figure C: Results on whether respondents know that the park is part of the ABC Waters Programme

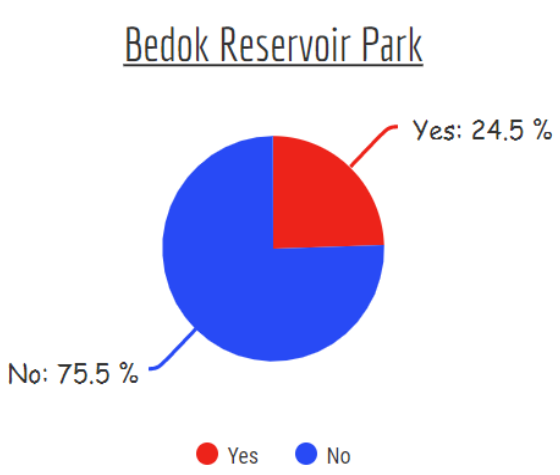


Figure C.1

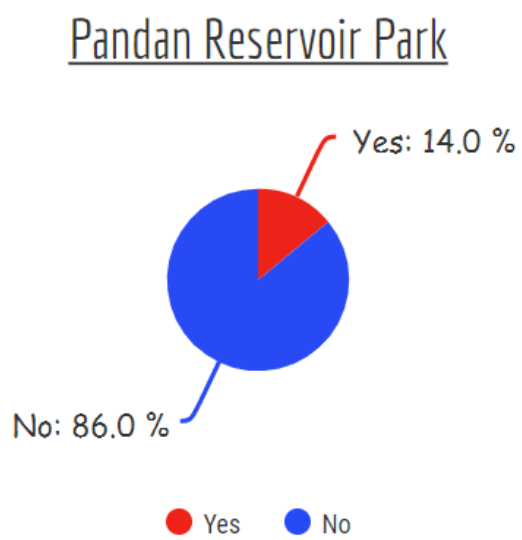


Figure C.2

Most people are unaware of the ABC Waters Programme. A possible reason for this could be the lack of publicity of the programme. Therefore, we need to raise awareness of the ABC Waters Programme so as to promote community bonding through water recreation more effectively.

Figure E: Results on a scale of 1(worst) to 5(best) on how positively presence of water body contribute to the respondents' experience at the parks

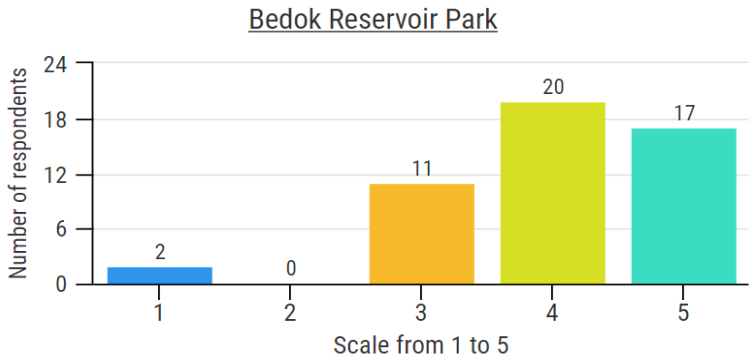


Figure E.1

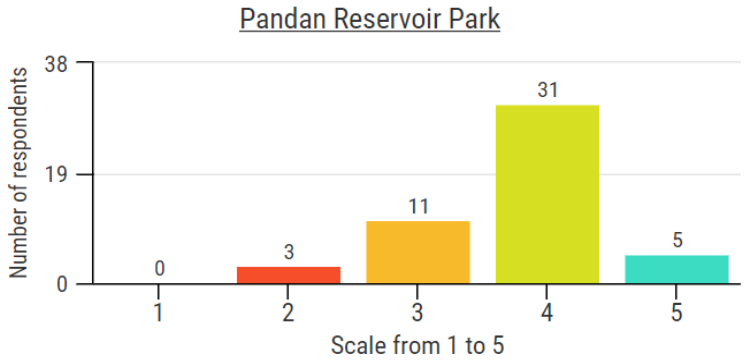


Figure E.2

More respondents at Bedok Reservoir Park rated that the presence of water body has greatly contributed to their experience at the park. This means that Bedok Reservoir Park has effectively made use of the water body to improve people's experiences while they are there, as compared to Pandan Reservoir park.

Figure F: Results on the number of people the respondents go with to visit the parks

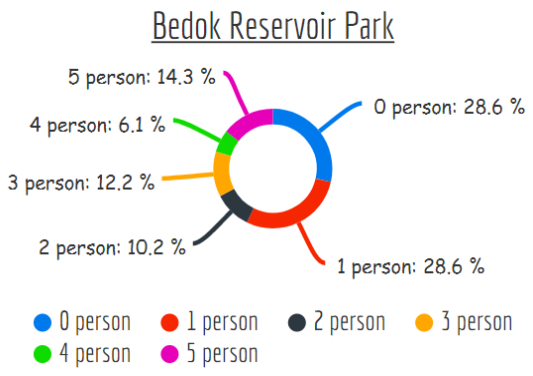


Figure F.1

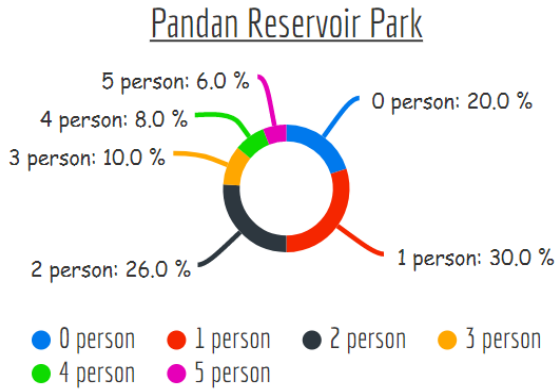


Figure F.2

It can be inferred that Bedok Reservoir Park is more effective in bringing people together as there is a higher percentage (33%) of people going to Bedok Reservoir Park in groups of 3 or more than Pandan Reservoir Park (24%).

Figure G: Results on whether people still keep in contact with strangers they interacted with at the parks

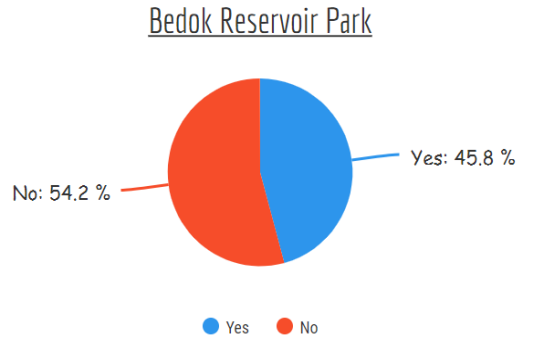


Figure G.1

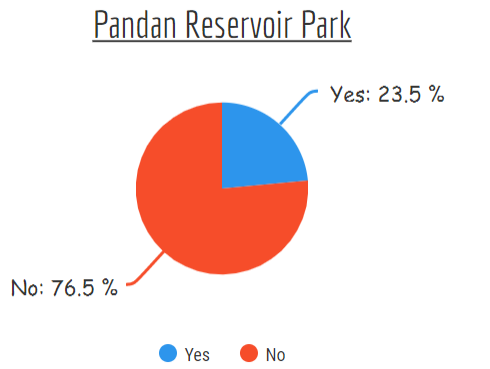


Figure G.2

Bedok Reservoir park is effective in bringing people together in the long term as there are more people who keep in contact with strangers they interacted with at Bedok Reservoir park (46%) than Pandan Reservoir park (24%).

Figure H: Results on how long the respondents spend at each Reservoir Park

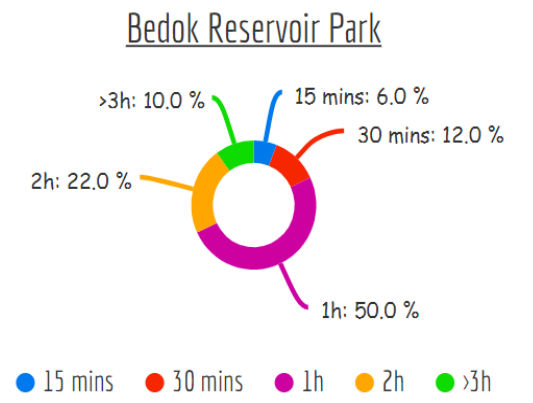


Figure H.1

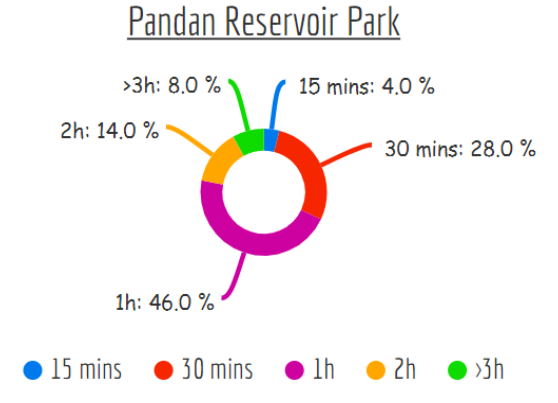


Figure H.2

It is evident that more people at Bedok Reservoir Park (82%) spend an hour or more as compared to Pandan Reservoir Park (68%). Spending more time at the park increases the people's chances of interacting with other people, thus bringing people together. This also means that the environment that is created by Bedok Reservoir Park is more conducive for people, hence they enjoy spending their time there than at Pandan Reservoir Park.

4.3. Findings from Phase A Survey Research

Bedok Reservoir Park is more developed with amenities, such as fishing areas, kayaking areas, high element courses, and even waterside bars, whereas Pandan Reservoir Park has less amenities and choices of water activities in comparison. Parks with more features were more likely to be used for physical activity (American Journal of Public Health, 2008). This is perhaps a reason why Pandan Reservoir Park is significantly less popular among park-goers.

All survey results (Figure A to H) showed that Bedok Reservoir Park has more positive responses as compared to Pandan Reservoir Park. This suggests that there are relatively more people who enjoy, support and benefit from the former. Therefore, in general, Bedok Reservoir Park is more effective in bringing people together through the usage of the water body as compared to Pandan Reservoir Park.

5. Discussion of Phase A

5.1. Is the ABC Waters Programme Successful?

Research have shown that people tend to visit parks for about 30 to 60 minutes, two to three times a week, to participate in light to moderate intensity physical activities (Henderson-Wilson, Sia, Veitch, Staiger, Davidson & Nicholls, 2017). In the case studies of Bedok and Pandan Reservoir Park, as seen from Phase A survey results, Figure H.1 and H.2, 50% of respondents generally spend an hour in Bedok Reservoir Park while 46% of respondents spend an hour in Pandan Reservoir Park, which amounts to a 4% difference. This shows that both Bedok and Pandan Reservoir Parks are capable of attracting people, thus fulfilling the minimal requirements of a park: a place for diverse active and passive recreation activities (Voigt, Kabisch, Wurster, Haase, Breuste, 2014). The parks thus attract and sustain a park-goer's interest in recreational activities. Hence, the government's initiatives of improving urban parks through the ABC Waters Programme, have indeed some success but also, a greater potential to bring people together.

5.2. Shortcomings of Pandan Reservoir Park

From observations, Pandan Reservoir Park has significantly lesser water activities than Bedok Reservoir Park, despite having more respondents stating that they enjoy partaking in water activities. This proves that Pandan Reservoir Park cannot fully cater to the wants of its visitors. In addition, many do not know how they can participate in water activities in Bedok Reservoir Park, as the area containing the equipment is exclusive to certain groups. Thus, more accessible water recreational activities are needed.

5.3. The need for Phase B

Bringing 'people' to 'people' refers to the willingness of people to communicate and interact with another unrelated person, so as to widen one's own social circle and hone one's social skill. This is necessary for interaction and rapport as it emphasises on interpersonal relations in public places, a key component of the social bond (Madani Pour, 2010). It is a complex concept comprising human feelings and attachment to the environment, the result of adapting to a place (Falahat, 2006). According to the results of Phase A, as seen in Figure G.1 and G.2, 46% of respondents stated that they will keep in touch with strangers in the park while only 24% stated so in Pandan Reservoir Park. This shows that currently, Pandan Reservoir Park is not able to effectively forge new bonds between people. As urban parks are sites where different ethnic groups can mingle, they can bring people together through informal and cursory interactions which stimulate social cohesion (K. Peters, B. Elands & A. Buijs, 2010). Furthermore, being involved and concerned with urban parks can facilitate attachment to these places, as everyday experiences can be shared and negotiated with a variety of people (*ibid*). Hence, urban parks are capable of promoting social cohesion, and should be made to do so. Therefore, Phase B will explore the opportunities to bond people in Pandan Reservoir Park, especially families. Through the integration of water activities, Phase B would address the shortcomings of Pandan Reservor Park to ensure the long-term success of the ABC Waters Programme.

Phase B: Improvement of Pandan Reservoir Park

6. Overview of Proposed Solutions

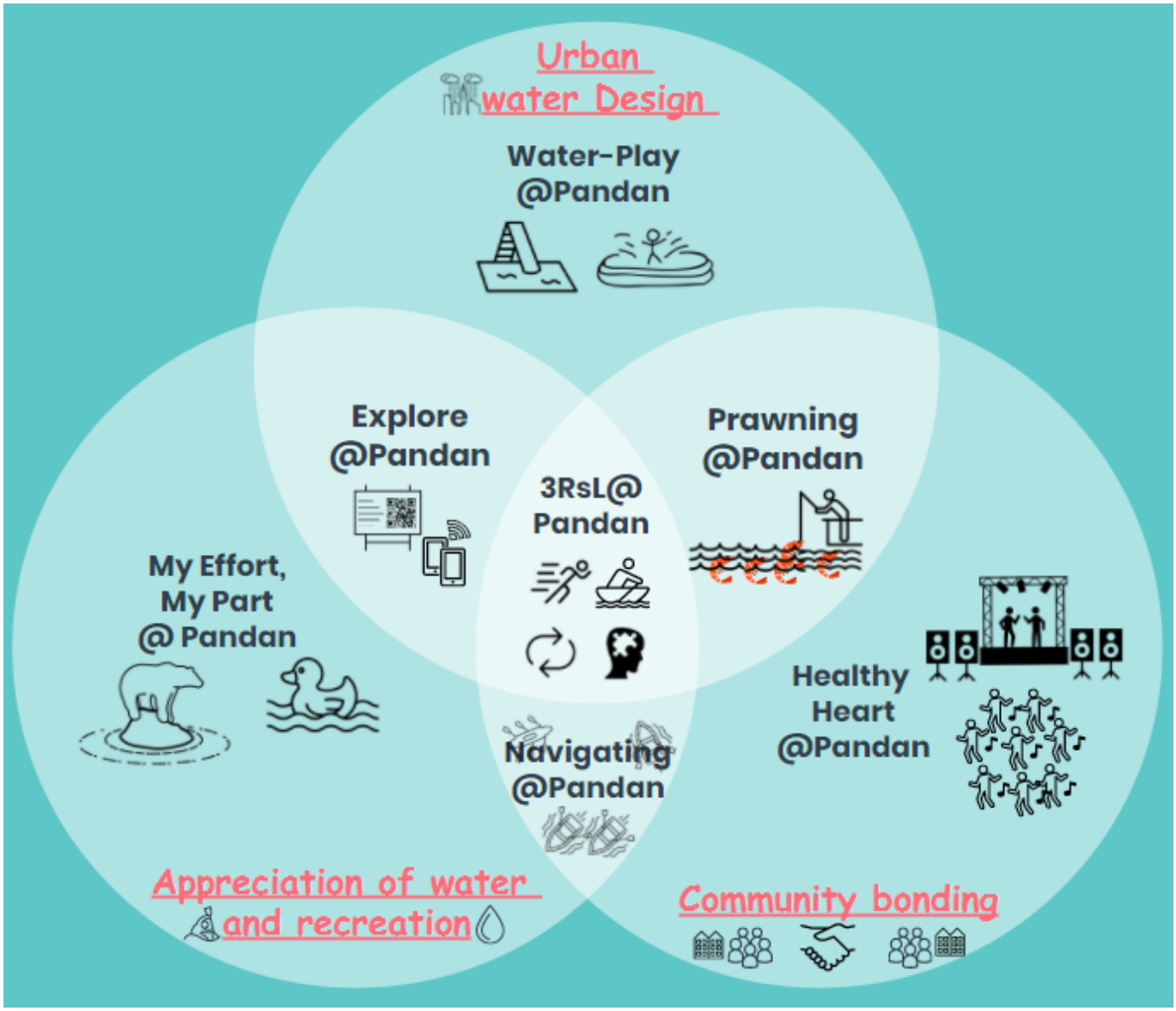


Figure 3: Schematic diagram showing an overview and categorisation of proposed suggestions

Table 4: Overview of proposed solutions

Suggestions	**What is it about?**
3RsL@Pandan	3RsL is an acronym for Run, Row, Repeat and Learn. It is an aquathlon with elements of running around the track, rowing the kayak, repeating both of these actions and learning about water conservation by participating in environmental-themed mini games throughout the aquathlon. Participation in these games will allow the participants to earn 'Wally points', which can be exchanged for prizes. This annual event will be organised for charitable reasons and can be participated individually or as a family, thus bringing people together.
Prawning@Pandan	An urban prawn breeding farm built within the reservoir. This facility allows people to catch prawns as a family. Through conducting such an activity at the reservoir, park-goers will better appreciate the water. Additionally, the conditions and survivability of the prawns serves as a biological indicator for the water quality of the reservoir.
Healthy Heart@Pandan	A series of enriching community events, such as Zumba By The Bay and environmental seminars hosted by experts that are held at Pandan Reservoir Park. This allows families to participate in educational events, and interact with one another and people around them.

Navigating@Pandan	A boat and kayak rental shop that provides park-goers with an opportunity to carry out water recreation activities in the reservoir. Limited festive designed boats are also available for rent.
My Effort, My Part @Pandan	An initiative which provides a platform for people to consciously do their part in saving the environment. To participate, people can choose to donate money to fund environmental campaigns, or invest their time in causes that benefit the environment. This will be recognised from an engravement of the individual's or company's name on a sculpture displayed on a floating platform in the reservoir. Families, schools and companies will be encouraged to participate in this initiative.
Explore@Pandan	State-of-the-art technology, a mobile application that makes use of augmented reality to showcase the physical appearance of a specimen, will be used. Park-goers will use the application to scan the QR codes printed on information banners located around Pandan Reservoir. Either a virtual specimen or a mini game will appear on the device. Points, which can be exchanged for incentives, can be obtained from learning about biodiversity and playing mini games about environmental conservation.
Water-Play@Pandan	An unconventional water-themed playground that extends out into the reservoir. It targets both the young at heart and families. With the unique environment and amenities, families will be encouraged to visit the area. This strengthens intra-family camaraderie and allows for interaction between individuals, through the fun activities that the playground provide.

7. Rationale for Formulating Solutions

7.1. Demographics of Teban Gardens

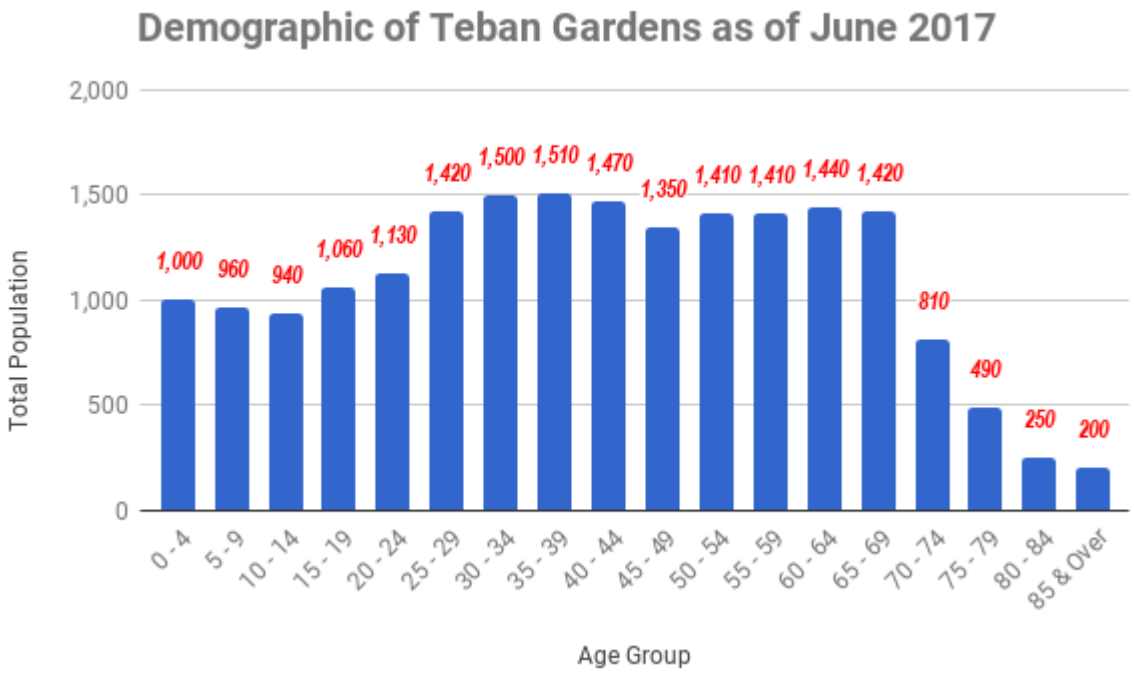


Figure 4: Demographics of residents living in Teban Gardens, a subzone nearest to Pandan Reservoir Park

Teban Gardens, a subzone of Jurong East, is the housing estate nearest to Pandan Reservoir Park. The ratio of the young to the middle-aged to the elderly is relatively even, which can be seen in Figure 4. As such, it is important to have 3-Generation amenities that cater to people of all age groups. Through common activities and spaces, people would thus be brought together.

7.2. Urban Water Design

Urban water design is an amalgamation of infrastructural improvements in water spaces with technology. It is not only used for the maintenance of water quality in the reservoir, but also to develop amenities to cater to tangible and intangible needs of humans. Given that Singapore is striving to become a smart city, leveraging on technology in our daily lives can bring convenience and incorporating it with the environment will be a good solution to increase visitation of parks. Singapore is a highly urbanised city-state, with a population of 5,612,300 and growing (Department of

Statistics Singapore, 2017). Thus, using urban water design in amenities to attract people to visit the ABC Waters Sites is a direction which Reservoir Parks in Singapore should take.

7.3. Community Bonding

Community bonding has always been Singapore's focus for the maintenance of her social fabric. Singapore is a multi-racial society, with people of multitudes of ethnicities and nationalities all living on the same island. Moreover, Singapore's ever changing demographic composition have made it necessary to cater to people of different age groups, and to bring them together to foster social interactions. It has been found that the built environment and community bonding are highly interrelated, and are both associated with social sustainability (Cho, 2017). As such, an area in close proximity to residential areas would be effective for fostering of greater human interaction between different people living in the same neighbourhood. For this, a variety of methods should be used, including enhancing the physical design and social activities (*ibid*). Thus, plans to implement both infrastructural improvements and uniquely designed activities have to be made.

According to Figure F.2 (Phase A Survey Key Results), only 24% of the respondents at Pandan Reservoir Park visit the park in groups of three or more. This illuminates that the community bonding in Pandan Reservoir Park and its neighborhood to be relatively weak. Therefore, plans to strengthen community bonding should be implemented so as to achieve the penultimate aim of ABC Waters Programme to bring people together.

7.4. Appreciation of Water and Recreation

Singapore's water usage per household was 148 litres in 2016, a number which the country hopes to reduce to 140 litres by 2030 (PUB, 2018). With such a goal, it is essential for citizens to understand the importance of water conservation, and how they can contribute. Intended thinking can affect people's behavior and perception on things (Armor & Taylor, 2001). Thus, for the intended action of water conservation, an appreciation for water should be fostered.

Additionally, as a country with scarce water resources and limited land space, there is a necessity to make productive use of existing spaces. Reservoirs which collect and store water for household and industrial use can also be used for recreational activities. While this is already common around the nation, there is a need for such amenities to be made more accessible. This would allow more people to enjoy such recreational activities, not just specific groups of individuals. The convenience of such amenities will also be attractive to the residents, encouraging them to lead a healthy lifestyle while appreciating the tranquil environment that the water body provides.

Furthermore, according to Phase A survey-Section C (Q5) (refer to Annex D.1), 57% of the respondents' opinions were that the water body or the reservoir provides a space for recreational activities. This means that generally, the people who visit the park sees the water body as a potential area to conduct and partake in water-related recreational activities. Hence, this will attract more people to visit the Reservoir Park, reinforcing the community bonding in the Reservoir Park and thus moving closer to achieving the ABC Waters Programme's aim of bringing people together through the use and appreciation of the water body.

8. Results of Phase B Survey

Phase B survey was conducted online and was completed by respondents of all ages to solicit their opinions and acceptance towards our suggestions to improve the environment of Pandan Reservoir Park. A total of 66 respondents' opinions were obtained from the survey.

8.1. Demographics of Respondents

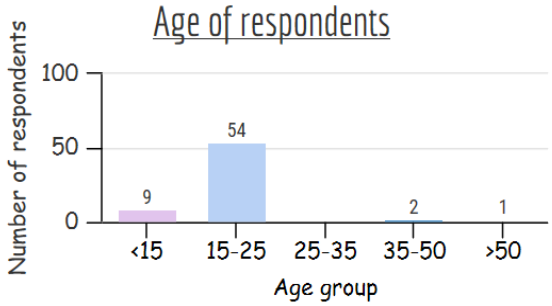


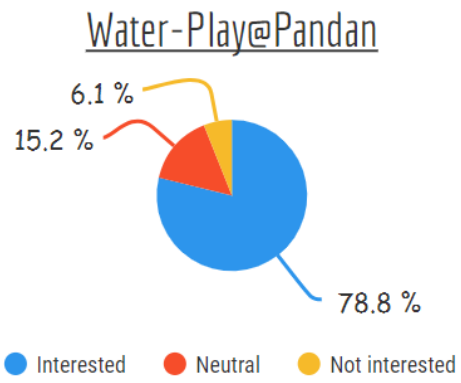
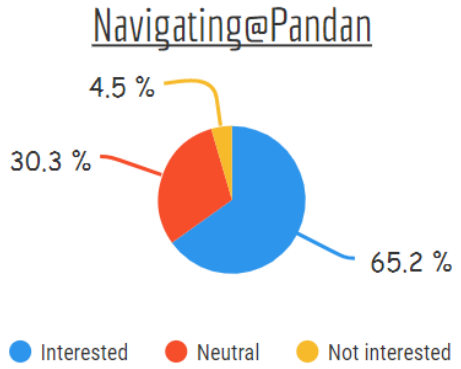
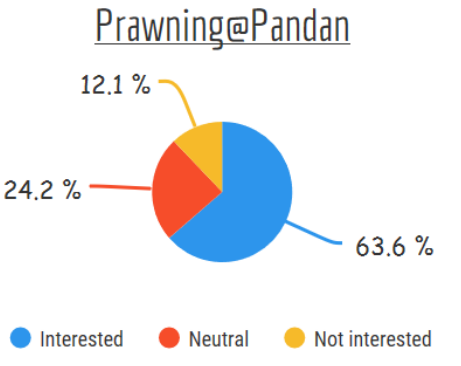
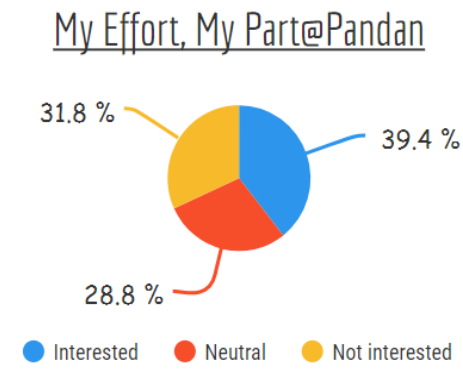
Figure 5: Graph of demographics of respondents

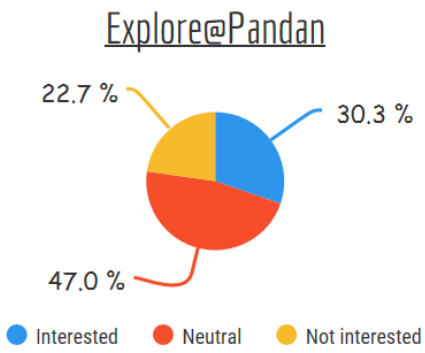
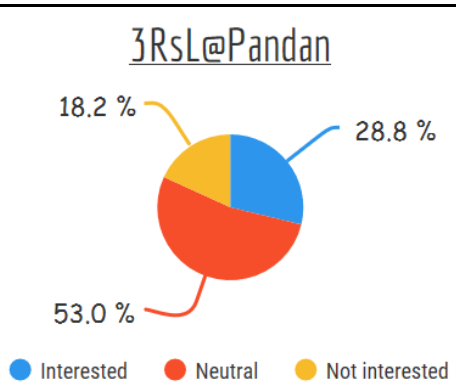
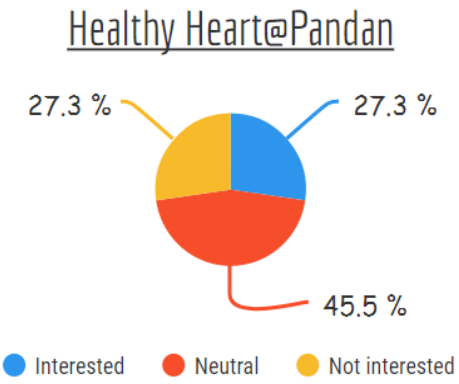
Figure 5 shows that most of the respondents were young people, from ages 15-25 years old while the rest were collated from older adults and those under the age of 15 years old.

8.2. Phase B Survey Key Results

The table below shows the ranking of the suggestions to be made at Pandan Reservoir Park according to the most percentage of people who indicated their interest (blue portion of graph) in partaking in the suggested activities.

Table 5: Survey Key Results of Phase B

	Features	Figures
1.	Water-Play@Pandan	
2.	Navigating@Pandan	
3.	Prawning@Pandan	
4.	My Effort, My Part@Pandan	

5.	Explore@Pandan	
6.	3RsL@Pandan	
7.	Healthy Heart@Pandan	

8.3. Findings from Phase B Survey Research

Many of the respondents have high acceptance to the suggestions to improve Pandan Reservoir Park, as the suggestions have an average of two-thirds of the people being the most interested in. The suggestion with the least number of people interested in is 'Healthy Heart@Pandan' but this only accounts for one third of the respondents. Hence, we can infer that most people are interested in these suggestions to improve Pandan Reservoir Park. This also means that they hope to see the positive changes that can improve their experience and time spent there as well.

With the majority of the respondents being young people, the survey results hence reflects the feasibility of these suggestions as young people will be the future park users and with increasing interest in partaking in these activities, this should encourage more people to visit Pandan Reservoir Park in future.

As more people frequent Pandan Reservoir Park, not only will this increase 'people to people' interaction and reinforce greater community bonding, it can also promote more participation in the activities available in Pandan Reservoir Park through word of mouth.

9. Suggestions Chosen for Implementation

The following suggestions are chosen based on the positive feedbacks from the respondents. These suggestions have been changed to blend seamlessly into the existing landscape of the Pandan Reservoir.

9.1. Community Bonding

9.1.1. 3RsL@Pandan

3RsL@Pandan is a signature programme that incorporates Run@Pandan, an infrastructural initiative that features an elevated running track over the reservoir. The 3Rs stand for Run, Row and Repeat. In short, 3RsL@Pandan is an aquathlon. Instead of swimming, participants must kayak across the reservoir. The L refers to learn. Water conservation and environmental activities would also be held during the aquathlon. Wally points, points of a reward system, would be awarded accordingly.

3RsL@Pandan is an initiative targeted at athletes, families and individuals of all ages, especially the young. It incorporates the proposed suggestions (i.e. elevated running track and kayaking shop), which aims to promote healthy lifestyle among park-goers. Research has shown that landscape aesthetics provides a critical linkage between humans and ecological processes (Gobster, 2007). Hence, the elevated running track is able to immerse the park-goers in the place as they can get a clearer view of the reservoir during their run.

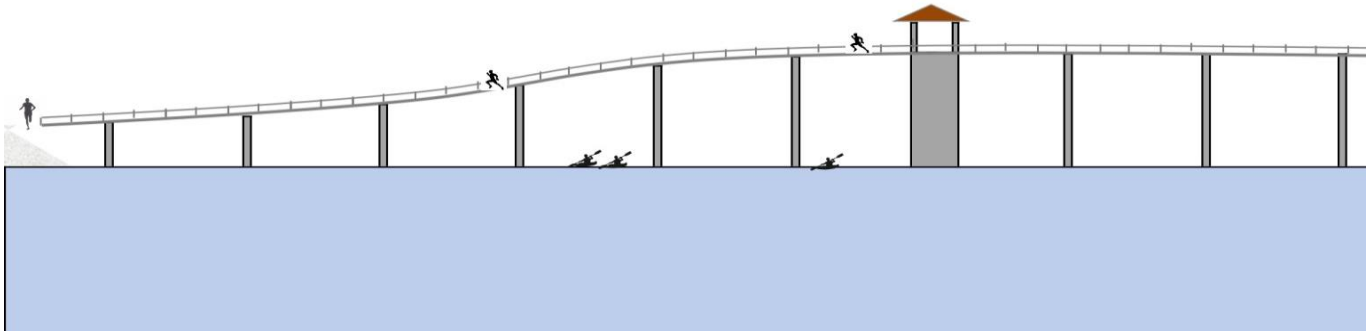


Figure 6: Artist's impression of Run@Pandan

The aquathlon will be an annual event, which can pique and maintain the interest of the participants. Upon completion of the aquathlon, participants will be given a medal which takes into consideration of their accumulated Wally points, as well as the time they took to complete the aquathlon. To promote family bonding, 3RsL@Pandan can be completed as a pair/couple, or as a family. The family category would involve members taking turns to partake in different segments of the aquathlon. This is similar to Ekiden[2], a famous long distance relay in Japan, in which a sash is passed from one member of the team to another as each of them take turns to complete the race (Japan Info, Inc, 2015). T-shirts and goodie bags would be given out before the event as incentives to encourage participation. A carbohydrate party and a carnival would also be held after the aquathlon. To attract sponsors for this event, the aquathlon can be held for a charitable cause, such as breast cancer or the disabled. Examples of potential sponsors include Standard Chartered Bank, DBS Bank Ltd and the National Cancer Institute. Fundraising and volunteer opportunities will also available be as part of this event. Spectators can support their friends and family from the sidelines. Real time footage of the event will be captured with an aerial drone, and posted on social media platforms for the collection of memories and added publicity.

The introduction of 3RsL@Pandan will not only provide participants with the opportunity to bond with their family, it also allows them to learn more on water conservation and the environment, both of which part of the aims of the ABC Waters Programme. The aquathlon is not a mere test of speed and sporting ability. It is also about the knowledge of water conservation and the environment. This encourages participants to lead a healthy lifestyle, and at the same time, learn about Singapore's scarce water resources and biodiversity in the reservoir.

Figure 7: Figure showing a Wally point (adopted from PUB)

9.1.2. Prawning@Pandan

Prawning@Pandan is an urban prawn breeding farm to be built within the reservoir. By utilizing a microfiltration membrane, water from the reservoir would be recirculated in and out of the prawn farm, resulting in the maintenance of the water quality within the farm. Metabolic waste produced from the prawns would be decomposed and used as fertiliser in the soil. Furthermore, as prawns tend to accumulate more metals ions due to their differences in evolutionary strategies (Phillips & Rainbow, 1993), large scale mortality in prawn breeding farms are often attributed to water contamination (Hashmi, 2001). Hence, the survival rate and health status of the prawns can be used as a proxy feedback of the water quality of the reservoir, giving rise to further steps of purifying the water, if needed. This integrates the solution

[2] Ekiden is a 42.195km long marathon. (Mizuno Ekiden Race Information. 2017.)

with the environment, thereby making good use of existing spaces. As prawning is a community activity that encourages interaction between individuals, this will build strong interrelationships between people, hence being suitable for families and people of all ages. Close family bonding will be fostered. As of now, there are several prawning facilities in Singapore. However, they are mostly in man-made conditions or located within the city. This includes "Fish@Bugis+[3]", "East Coast Prawning[4]" and "Farmart Centre[5]". Thus, integrating prawning facilities with a reservoir within the heartlands will attract families to spend a fulfilling day there. Moreover, Prawning@Pandan also allows people to be closer to the reservoir, allowing them to better appreciate the ecosystem. Hence, Prawning@Pandan is aligned to the aim of ABC Waters Programme: making use of the water body to bond people together.

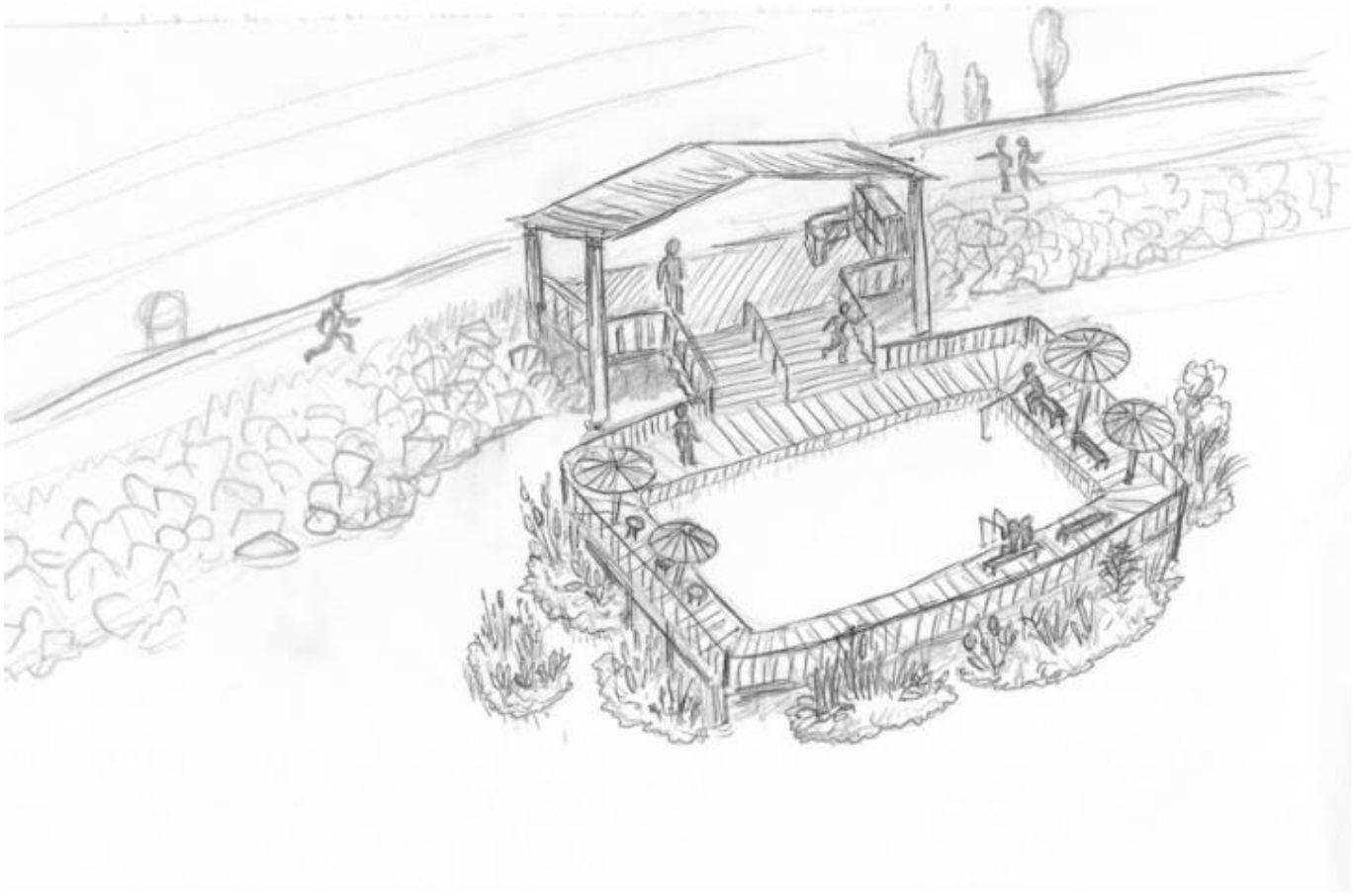


Figure 8: Artist's impression of Prawning@Pandan

9.1.3. Healthy Heart@Pandan

Healthy Heart@Pandan is a series of exciting and enriching activities planned throughout the year for the public. These community events include Line Dancing, Zumba By The Bay, environmental seminars hosted by experts, and many more. For instance, Zumba is a form of lively dance accompanied by rhythmically enticing groove music that forges communal bonds when the participants feel truly connected by their essential humanity (Schommer, 2016). Zumba is also a powerfully positive mode of cultural experience, expression, and engagement (*ibid*). Furthermore, most of the community events are free of charge. If the programme requires logistics or special manpower, only a nominal fee is required to partake in these events. Hosting such community events would maximise the use of the large sheltered space at Pandan Reservoir. Currently, such community events are mostly held in the community centres or areas within the heartlands. However, they are rarely held in parks, let alone reservoirs. Healthy Heart@Pandan will be a collaborative effort with the Grassroots leaders at Teban Gardens (GRC) to serve as a collective platform to launch and bring forward community events. This provides many opportunities for people to socialize, thus forging new friendships with people from the same neighbourhood (i.e. Teban Gardens). This focus on community bonding, which also aligns to the aim of the ABC Waters Programme.

[3] Fish@Bugis+ is a new air-conditioned outlet which allows people to prawn and fish for big head prawns and freshwater lobsters from the pond of Fish@Big Splash. (FamilystaysgTeam, 2016)

[4] East Coast Prawning can be conducted and people can get fresh water prawns via village-inspired longkang fishing. People can also get free BBQ essentials. (*ibid)*

[5] Farmart Centre is a place with farm animals which also consist of man-made prawning areas for people. *(bid)*

9.2. Appreciation of Water and Recreation

9.2.1. Navigating@Pandan

Currently, there is a storage area for kayaks and canoes at Pandan Reservoir. However, only select groups of individuals and specific organizations have open access to them. Pre-booking is required for the activities at Pandan Reservoir (Singapore Canoe Federation, 2018). It is thus difficult for the public to obtain such equipment. Acknowledging that young people are becoming increasingly interested in partaking in such adventurous water activities, as proven by the popularity of the rental facility at Singapore Sports Hub, it will be a crucial element in attracting young people to the area. This will bring participants physically closer to water, as well as serve as a form of recreational activity for people of all ages.

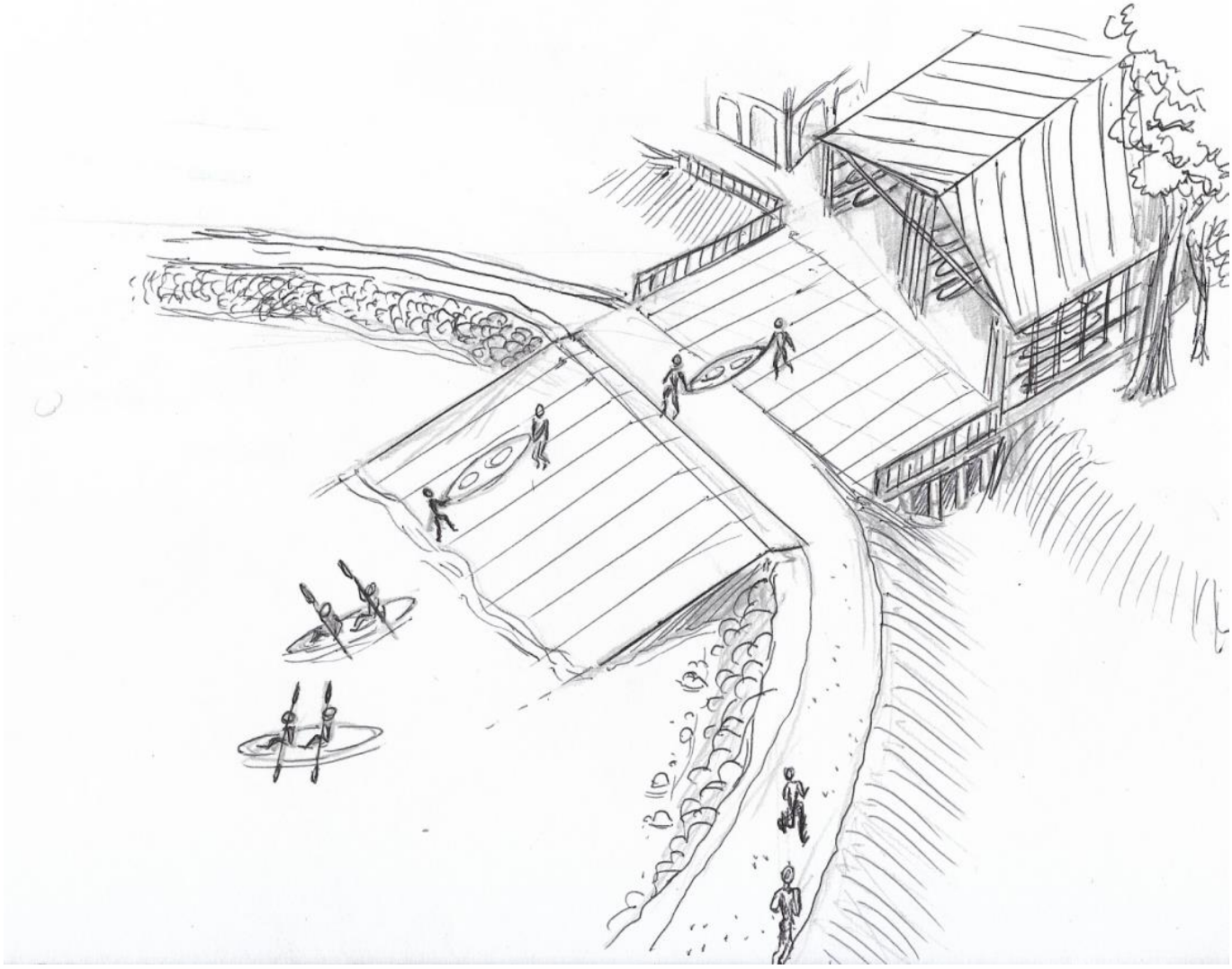


Figure 9: Artist's impression of Navigating@Pandan

Pedal boats with unique designs can be rented out during limited periods of time throughout the year. This is in accordance to the prevailing festivals and public holidays. For example, during the Mid-Autumn Festival, lantern shaped boats will be made available. Those with no or little experience in rowing or kayaking will be able to obtain just in time training by professionals to pick up the necessary skills for leisure kayaking. This incorporates recreational activities with the water body. Since such an activity is suitable for people of various age groups, and families can take part in it together. This will strengthen ties within the family, allowing for the aim of the ABC Waters Programme to be achieved.

9.2.2. My Effort, My Part@Pandan

My Effort, My Part@Pandan is an initiative which provides a platform for people to consciously do their part in saving the environment. As the attention to ecological quality can be influenced by the perceived aesthetic value of landscapes (Gobster, 2007), My Effort, My Part@Pandan aims to encourage people to carry out environmental friendly events and positively influencing others, whom have not participated in My Effort, My Part@Pandan to kick start their very own environmental event. Targeted at individuals, families, schools, organisations and corporations, it helps in strengthening the camaraderie between people, and encourages increased appreciation and care for the natural surroundings. To participate, people can choose to donate

money to fund environmental campaigns, or invest their time to care for the environment. For example, they can plant trees or promote water conservation by hosting roadshow events. To recognise their environmental efforts, limited-edition sculptures designed based on their contributions would be placed in Pandan Reservoir. For example, a company which manages to reduces their carbon dioxide emissions levels to a set goal would be allocated a 'polar bear on ice' logo that would be engraved on the sculpture with their company name. This sculpture would be allowed to float on the reservoir water.

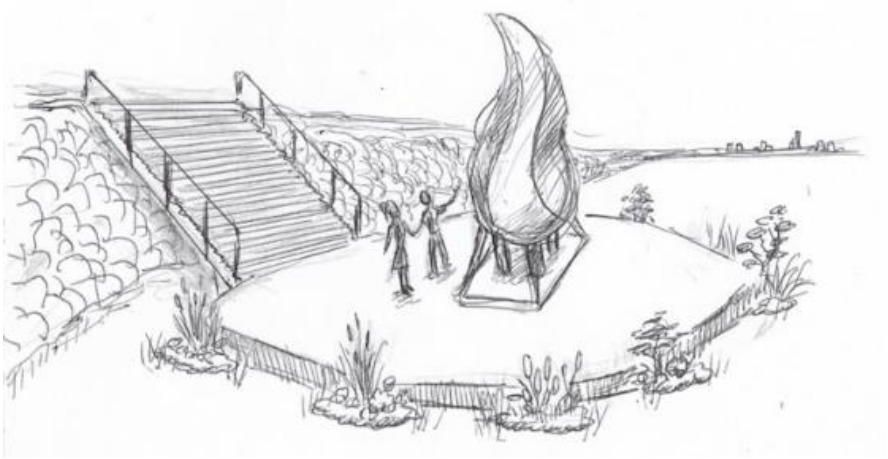


Figure 10: Artist's impression of My Effort, My Part@Pandan sculpture

Sculptures placed on the reservoir are not only for aesthetic purposes. They also serve to educate park-goers of the ongoing environmental efforts. This can inspire more individuals to do their part for the environment. Moreover, this initiative also encourages interaction between families and residents. Through their various proposed activities, individuals would be able to bond with others. Thus, My Effort My Part@Pandan complements the aim of ABC Waters Programme of bringing people together.

9.3. Appreciation of Water through Urban Water Design

9.3.1. Explore@Pandan

Currently, Pandan Reservoir lacks engaging education set-ups. Targeted at families and people of all ages, especially young people, Explore@Pandan is a mobile application that makes use of augmented reality to showcase the physical appearance of a specimen. Park-goers will use the application to scan the QR codes printed on information banners located around Pandan Reservoir. When an information board describing an organism is scanned, a virtual specimen will appear on their phones. If information boards with environmental tips are scanned, a mini game will appear. Bonus points for the park-goers can be earned through playing these games and finding out more about specimens by scanning the QR Code. The points on the application then be exchanged for shopping vouchers. Since smartphones have become commonplace both locally and globally, Explore@Pandan would be accessible and simple to use by both locals and tourists. By using shopping vouchers as an incentive, people will be more willing to use the application, allowing them learn more about the biodiversity at Pandan Reservoir and how they can play their part in environmental conservation.

Figure 11: An example of how the QR code looks like at the park which is printed on a wooden signboard placed around Pandan Reservoir Park (Source: author's own taken from Jurong Eco Garden)

We find value in spearheading this program of Explore@Pandan as Pandan Reservoir is home to a plethora flora and fauna, and many locals are currently unaware of them. With Singapore becoming a Smart Nation, leveraging on smart technology will allow for greater engagement of visitors of all ages. By incorporating this with learning, there will be an increased appreciation of the biodiversity and knowledge of environmental conservation. Therefore, Explore@Pandan is an innovative initiative that will appeal to the park-goers. This aligns to the goals of an ABC Water Site of appreciation of water.

9.3.2. Water-Play@Pandan

A water-themed playground is to be situated on a floating platform near the edge of the reservoir. It is suitable for children, families and young people. This will not only bring people closer to water, it will also allow interactions between people using the amenity, thus allowing for greater opportunities for community bonding. It would be a unique addition to the park as the playground would be extended out to the reservoir, which is currently non-existent in reservoirs in Singapore. This unconventional playground is unlike the usual ones on land and being situated within the reservoir allows for a natural touch, especially as teens are often overlooked in the planning of typical park and playground design (Wood, Marin, Carter, 2011). This will attract more young visitors to visit the area, in particular, those who seek thrill.

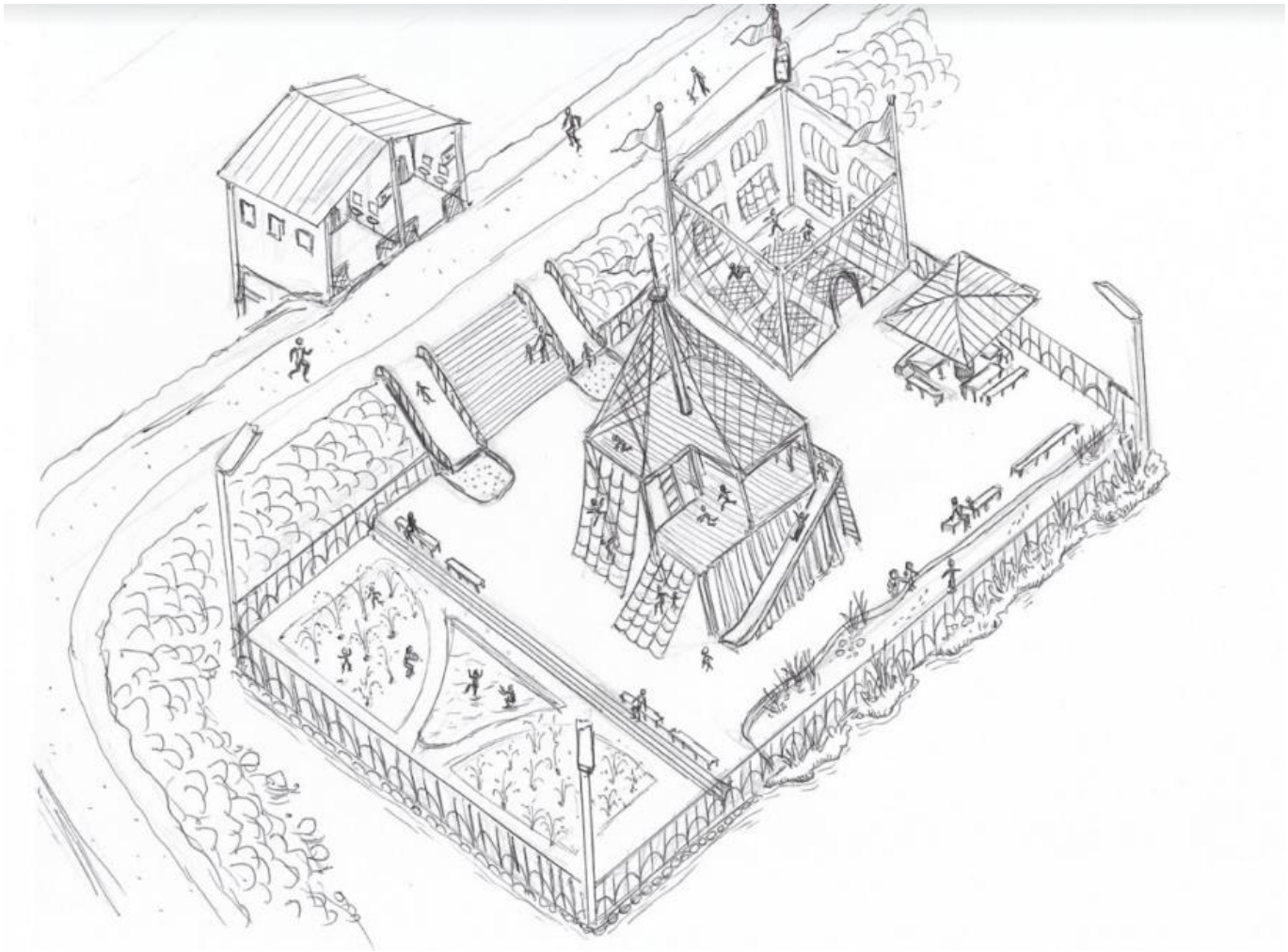


Figure 12: Artist's impression of Water-Play@Pandan

Water-Play@Pandan will be a festival-themed event to sustain the interest of children and families. Families will get to spend more time with one another and take a break from their hectic routines, as they immerse in the play and bonding activities planned at the water-themed playground. This program also helps to actualise the goal of the ABC Waters Programme. Plastered around the playground will also be various fun facts about water usage and water conservation, allowing people of all ages, especially the younger generation, to learn through play. This will allow them to better appreciate the water resources in our country, encouraging them to conserve water.

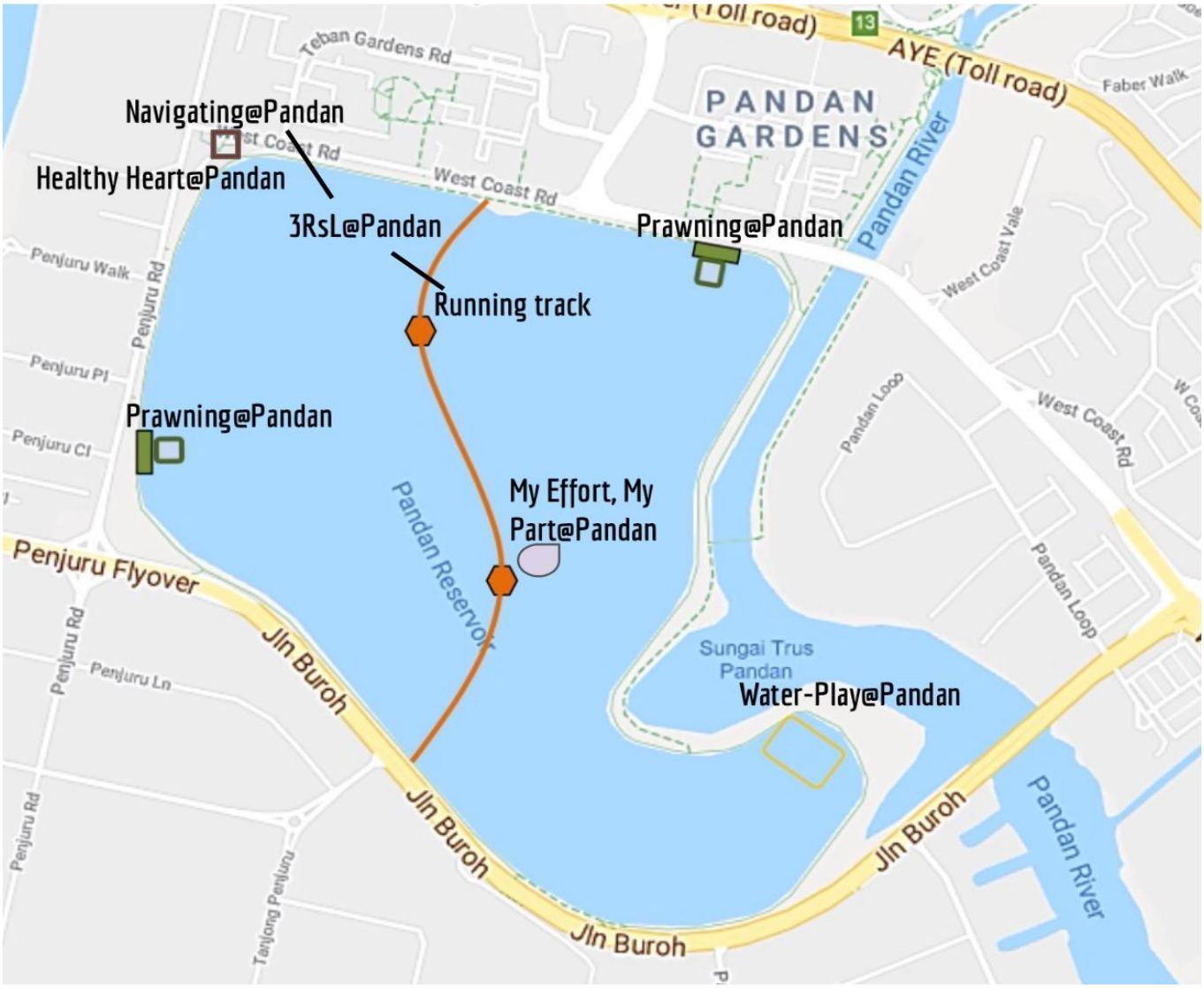


Figure 13: Map of Pandan Reservoir Park with suggested solutions

10. Areas for Improvement

10.1. Limitations of Research

10.1.1. Environment Impact Assessment (EIA)

While we have weighed the pros and cons of the suggestions to be implemented in Pandan Reservoir Park, we have yet to properly consider a comprehensive Environment Impact Assessment (EIA) of our suggested improvements and installations. The EIA is the process of examining the anticipated environmental effects of a proposed project, from consideration of environmental aspects at design stage, through consultation and preparation of an EIA Report (EPA, 2018).

The whole process, which encompasses public response to the decision, has to be carried out by a recognised authority (*ibid*). Without meeting the criteria for this assessment, our proposed solutions will not be able to proceed. We acknowledge this to be a significant limitation to our research proposals.

Table 6: Possible negative impacts from proposed solutions

Proposed Suggestion	Impact	Cause	Significance
Building a running track across the reservoir	Noise and dust	Construction activities	Short term
	Construction waste	Construction activities	Short term
	Biodiversity	Some land, that has once been a habitat for flora and fauna, may be reclaimed for construction activities	Long term
All seven solutions	Litter	Increase in visitorship leads to increase in amount of litter, which are usually in light fractions	Short term
- 3RsL@Pandan - Navigating@Pandan - Water-Play@Pandan - Prawning@Pandan - My Effort My Part@Pandan	Natural resource contamination	Having more water related activities on the reservoir increases the risk of polluting the water body.	Long term
All seven solutions	Phytotoxicity	Increase in human activities	Long term
Water-Play@Pandan	Health and Safety Hazards	Material used may be biologically harmful and chosen design/layout of playground may pose a danger for park-goers	Long term
All seven solutions	Noise	An increase in participation of activities will lead to an increase in noise level, affecting the residents staying around Pandan Reservoir Park, i.e. Residents of Teban Gardens	Long Term

The Singapore Environmental Consultancy and Solutions (SECS) offer an EIA service whereby they can collaborate with a panel of multi-disciplinary consultants to identify environmental receptors before, during and after construction of the proposed development. This includes development on land, water and in air (SECS, 2018).

10.1.2. Economic Sustainability

Economic sustainability of a park is another area of consideration and review. Ensuring the economic sustainability of parks and recreation agencies helps to mitigate the negative consequences and assures the continuation of the agencies public purpose (Gallagher, 2012). Hence, in the case of Pandan Reservoir Park, the economic sustainability of the park mostly depends on the Navigating@Pandan because the park-goers' willingness to rent boats and carry out water recreational activities will be a long-term determinant of the viability of the proposed ideas. If the expected sales figures are not reached, this proposed suggestion may end up burdening the entire operations of Pandan Reservoir Park as budget and funds have to be reallocated from other sectors to ensure the continuity of Navigating@Pandan. This research proposal did not take into account the long-term economic sustainability of the suggestions, mainly Navigating@Pandan.

10.1.3. Online survey

The key limitation of an online survey is that respondents tend to base their responses on their past experiences. It is affected by their emotions when doing the survey itself. An impatient respondent may not take time to think about his past experiences, resulting in his answers to the questions being less reliable. (Evans, Mathur, 2005) Hence, the information collected via online survey is affected by the external environment, and may not be the most accurate. On the contrary, the on-site survey enabled the garnering of opinions from those who were experiencing the environment first-hand, making the on-site investigation more reliable. It allowed for deeper understanding of the opinions of each of the respondents. Some respondents even further elaborated on topics related to the improvement of ABC Waters Sites.

The on-site survey targets those who were present at the field sites. Through quota sampling, respondents were chosen based on intuition and feelings. An effort was made to get a wide range of respondents from various demographics ensuring better spread of data. This data collection method has debatable accuracy. On one hand, it allowed us to obtain responses from a seemingly diverse group of people. On the other hand, it involves personal biases, which may cause us to miss out on invaluable opinions from the people we had failed to ask. As such, we acknowledge that such a sampling methodology may not have been the most fair. However, we also felt that such a method was the most suitable one at the data collection phase of our research project as we needed responses from a wide target audience.

10.2. Areas for Further Study

10.2.1. Improvements in Water Quality

Firstly, with the respondents feedback given pertaining to some issues of water quality at Pandan Reservoir, future research can look into coming up with more effective methods to improve and maintain the quality of the water body. While current measures can mitigate problems such as the presence of rubbish and oil, there are no solutions to chemicals which can adversely impact water quality and the composition of biodiversity in the reservoir. Our aesthetic experience intertwines with our feelings of pleasure and the landscape of Pandan Reservoir Park has a direct correlation to it. Hence, the water quality at a location have a positive correlation to the experience of people at the park, due to its visual appeal and the species it houses, suggesting that it is important to maintain good water quality to allow people to truly enjoy their time at the parks.

10.2.2. Effectiveness of Proposed Suggestions

Secondly, studies can be done regarding the effect of the proposed amenities on the quality of the water body. Both added human interference and construction of the amenities will bring about a certain amount of side effects to the water body and the biodiversity in and around it. While we look to engage people with attractions, amenities and activities, it is still of utmost importance that the original water body is maintained such that the ramifications of our proposed solution is minimized. Such a study will hence allow for problems to be sieved out, and relevant mitigation measures to be put in place.

10.2.3. Promoting Ecotourism Within the Heartlands

Thirdly, promoting Pandan Reservoir Park as a site for ecotourism is an area in which further research can be conducted. Pandan Reservoir Park is located in the western area of Singapore, where the future hub for ecotourism will be at. Tourist attractions to do with nature, such as the Jurong Bird Park, will be relocated to join the Singapore Zoo in the Mandai area, complete with a resort to be developed by Banyan Tree Holdings, an international hospitality brand that manages resorts (MediaCorp Press Ltd, 2017). With such a prominent ecotourism spot at such close proximity, Pandan Reservoir Park, which has its own unique biodiversity, will potentially be able to attract such nature lovers to visit the area. Singapore would then have its own unique Gardens By The Bay located within the heartlands, a green lungs within the city, one that people of all ages as well as tourists can immerse in the habitual and serene environment. For this to happen, research has to be done on how to publicize the park as a natural attraction, as well as the impacts of tourism on the area.

10.2.4. Extending to Different Localities

Lastly, transboundary studies can be done to find out how the suggested solutions can be implemented in parks with water bodies in other countries. The suggestions mentioned should not merely be limited to Pandan Reservoir Park. They should also be used to add value to various parks around the world, so that more communities can experience the benefits of urban water design, community bonding, as well as appreciation of water. However, it is important to note that for the suggestions to be safely implemented, background checks should be done on the quality, depth and other factors of the water body which may compromise the safety of both the park-goers and livability of the biodiversity living in it.

11. Conclusion

The initial aim of our project was to compare between two ABC Waters Sites and evaluate their effectiveness in achieving the goal of ABC Waters Programme - to bring people together through appreciation and usage of the water body for water-related activities. We conclude that Bedok Reservoir Park is currently more effective in achieving the goal as compared to Pandan Reservoir Park, as demarcated in Phase A of this research project.

In Phase B, our group leveraged on the identified strengths of Bedok Reservoir Park and proposed seven suggestions for Pandan Reservoir Park, which aims to add greater vibrancy and excitement to the lives of the residents staying in Teban Gardens as well as other park-goers. According to a subsequent survey conducted, these suggestions of to enhance the Reservoir Park into a modern park have shown to be appropriate and highly accepted by the survey respondents. To further enhance future ABC Waters Sites for a more conducive and habitual environment to visit, we have also considered carrying out transboundary studies to analyse if our suggestions could possibly be extended to foreign parks. If possible, we hope to send our suggestions to PUB for their consideration.

12. Acknowledgement

We would like to thank River Valley High School's The Environmentally Sustainable Leadership Academy (TESLA) for providing us with this valuable learning opportunity. We are highly indebted to our mentor, Assistant Professor Diganta Kumar Das, from the Humanities and Social Studies Education (HSSE), National Institute of Education (NIE) and our teachers-in-charge, Mr Eric Ng, Mr David Toh, Ms Jane Chee and Ms Rachel Kho, from the Geography Department, River Valley High School, for their unwavering support and patient guidance. We would also like to offer our appreciations to our parents and friends who have stood by us throughout this journey and have willingly helped us out in one way or another.

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14. Appendix

Annex **A**: Criteria Table for Choosing Reservoir to Compare

A.1

Table 7: First Criteria table: finding the size of all 25 ABC Waters Site

ABC Water Sites	Size of Water Sites
Bedok Resevoir	88 Ha
Jurong Lake	70 Ha
Lower Seletar Reservoir @ Family Bay	200 Ha
Lower Seletar Reservoir @ Tower Bay	160 Ha
MacRitche Resevoir	390 Ha
Pang Sua Pond	3.3 Ha
Geylang River	1.3 Ha
Kolam Ayer ABC Waterfront	1.9 Ha
Kranji Reservoir	450 Ha
Pandan Resevoir	90 Ha
Bishan-Ang Mo Kio Park	50 Ha
Lorong Haluts Wetlands	11 Ha
Yishun Pond	2.3 Ha
Sengkang Floating Wetlands	21 Ha
Sungei Pandan	3.7 Ha
Sungei Whampoa @ Kim Keat Rd	2.8 Ha
Kallang River @ Bishan-Bradell	1.2 Ha
Sungei Api Api	33 Ha
Sungei Tampines	15 Ha
Sungei Ulu Pandan	3.7 Ha
Sungei Whampoa @ St George's Lane	2.1 Ha
Kallang River @ Upper Boon Keng-Sims Avenue	1.6 Ha
Kallang River @ Potong Pasir	0.9 Ha
Siglap Outfall	4.6 Ha
Sungei Kallang-River Vista	2.9 Ha

A.2

Table 8: Second Criteria Table: Shortlisting out the ABC Waters Site with size from 88 Ha (Hectares) to 450 Ha and further research on the number of water-related activities conducted.

ABC Water Sites	Size of Water Sites	Number of water related activities	
Bedok Resevoir	88 Ha	4	Kayaking and dragonboating (Water Venture Programme), Fishing, Nature lovers can catch animals along the water body, Zipline through the water body
Jurong Lake	70 Ha	2	Kayaking and dragonboating (Water Venture Programme), Fishing
Lower Seletar Reservoir @ Family Bay	200 Ha	2	Kayaking and dragonboating (Water Venture Programme), Fishing
Lower Seletar Reservoir @ Tower Bay	160 Ha	2	Kayaking and dragonboating (Water Venture Programme), Fishing
MacRitche Resevoir	390 Ha	1	Fishing
Kranji Reservoir	450 Ha	1	Fishing
Pandan Resevoir	90 Ha	1	Fishing

Annex **B**: Background Information for Selected Sites

B.1 Bedok Reservoir Park

1. Current:

Bedok Reservoir Park is one well received by runners and water sports enthusiasts who reside in the east area of Singapore. Once a sand quarry, the park now holds a large 88-hectare reservoir, an excellent place for water sports. Meetups between water sports enthusiasts and adrenaline junkies are common at the park. Dragon boating, kayaking and wakeboarding are some of the more adventurous water sports found at the park, while fishing is a peaceful activity for park-goes to enjoy the tranquility of the surroundings. Fitness enthusiasts, schools and organisations routinely carry out activities at the park's 4.3 km track, such as cross-

country and yoga. Alternatively, one can also relax and enjoy the scenery from the benches that are placed at every nook and cranny of the park, or the floating deck which allows for an unobstructed view of the sunrise.

With more than 14,000 wetland plants added along the reservoir as part of the Active, Beautiful, and Clean (ABC) Waters Programme, Bedok Reservoir Park features a myriad of biodiversity. A sanctuary for bird watching, nature lovers can catch a glimpse of swallows having fun in the water, little herons wading along the banks of the water body, and kingfishers diving for their piece of trout.
Source: https://www.nparks.gov.sg/gardens-parks-and-nature/parks-and-nature-reserves/bedok-reservoir-park

1.2km away from Bedok Reservoir Park, lies Bedok Reservoir MRT Station (DT30), an underground station along Stage 3 of the Downtown Line (DTL). Built underneath Bedok North Avenue 3, near the PIE flyover and junction with Bedok Reservoir Road, the station's purpose is to serve residential areas in the vicinity.
The station has been named after Bedok Reservoir in recognition of it significance as a park in Singapore. The station serves Bedok Reservoir Park, Bedok Town Park, multiple schools such as Damai Secondary School and Yu Neng Primary School, as well as residents near Bedok Reservoir.
Source: http://landtransportguru.net/bedok-reservoir-station/

In an attempt to achieve the goal of a car lite society, a major cycling network dubbed the Outdoor Play Corridor has been constructed at the end of 2017. Running along the East Coast, the cycling network will connect residents with major amenities such as MRT stations and schools. It will also provide connection between Bedok Town Centre, East Coast Park and Bedok Reservoir Park, via dedicated cycling and walking paths. Construction has commenced in the second half of 2017.
Source: http://www.propertyguru.com.sg/property-management-news/2015/1/79574/5-things-for-bedok-residents-to-look-forward-to-by-2017

2. Pictures

Figure 14: Bedok Reservoir

Figure 15: Running Track

Figure 16: Park at Bedok Reservoir

Figure 17: Forest Adventure
Source (Figure 1.4):
https://singaporemotherhood.com/articles/2018/02/forest-adventure-bedok-review/

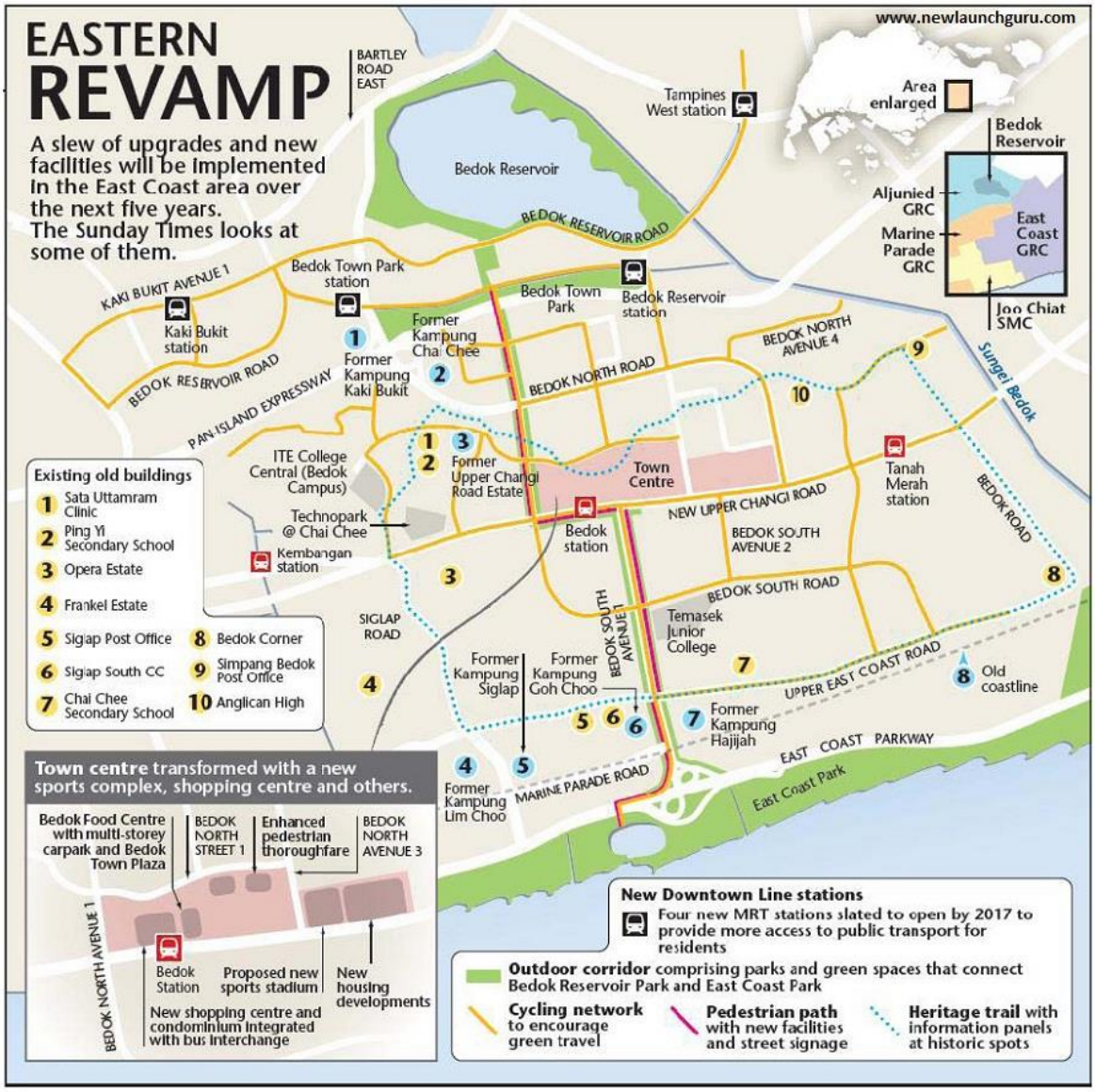


Figure 18: Future Plans for new amenities around the Bedok Reservoir area
Source (Figure 1.5): http://www.agentexpat.com/bedok-residences/

B.2 Pandan Reservoir Park

1. Current:

The man-made Pandan Reservoir primarily serves as competitive water sports. The area was formed through the construction of a 6.2-kilometer-long earthen dike that is approximately 4 meters higher than the road level. Pandan Reservoir provides some wonderful opportunities for development as a major water-based recreation center in the western part of Singapore, filled with vibrancy and activity. It can be the place to learn or improve water sports skills, fish, indulge in remote control model boating, learn about mangrove habitats, or simply enjoy a waterside picnic.
Source: http://www.justrunlah.com/2015/01/07/running-guide-to-pandan-reservoir-singapore/

2. Future:

In future, Pandan Reservoir Park will be increasingly active through various infrastructural improvements, including a viewing deck, car parks, public toilets, and changing rooms. Additionally, there will also be new rowing and kayaking lanes for training and competition. Areas for fishing, sailing and remote-control boating will also be increasingly available. Additions to enhance the reservoir's more beauty include a floating island to serve as a marked land and 500 meter racing lanes for the athletes who kayak and canoe in the water. Other enhancements include softscaping the harsh rock embankments, landscaping as well as shelters. There are also lans for a cleaner water body through the addition of rock pools along the Ulu Pandan canal. This also serves as a place for fish to hide and breed, while providing a safe wading area for the public.
Source:
http://www3.apwa.net/Resources/Reporter/Articles/2008/2/Bringing-water-to-the-people-and-people-to-the-water-in-Singapore

3. Pictures:

Figure 19: Pandan Reservoir

Figure 20: Running Track

Figure 21: Fishing Area

Figure 22: Existing Kayaking Area

Figure 23: Plan for Dragon Boat and Rowing Lanes to be put in place

Source (Figure 23): http://www3.apwa.net/Resources/Reporter/Articles/2008/2/Bringing-water-to-the-people-and-people-to-the-water-in-Singapore

Annex C: Map of Field sites

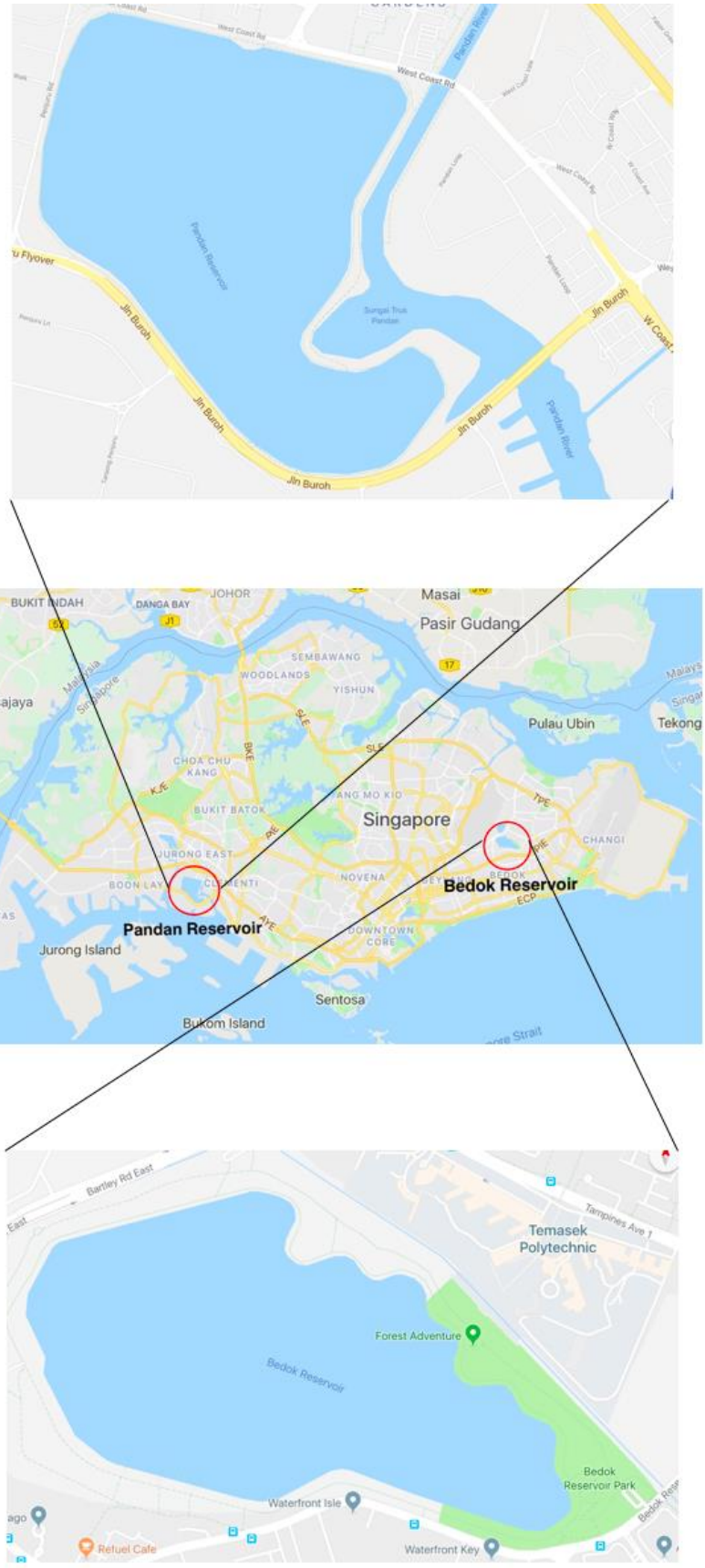


Figure 24: Map showing field sites in the Singapore Map (Taken from Google Maps)

Annex **D:** Survey Questions

D.1 Sample of on-site survey (Bedok and Pandan Reservoir) (Phase A survey):

N.B. Both survey at both sites are similar in nature.

Table 9: **Survey on the ABC Waters Programme**

Hello! We are a group of geography students from River Valley High School, ELSTAR@TESLA gathering information on the perception of water bodies (e.g. reservoirs) in various locations in Singapore, ultimately aiming to evaluate the effectiveness of the ABC Waters Programme in achieving its goal, that is, to bring people together through the appreciation and usage of the water body for water-related activities. This survey will take you a few minutes. Thank you for taking time off to complete our survey! Rest assured that your privacy will be adhered to and data would strictly be used for educational purpose only.
Section A: Personal Information 1. Age Range ● 7-12 ● 13-18 ● 19-30 ● 31-50 ● 50-65 ● Above 65 2. Gender ● Male ● Female
Section B: Introduction 1. Does the presence of the reservoir (water body) adds to the overall appeal of the park as a location for community bonding and for leisure? Yes/No 2. Do you enjoy partaking in water related activities such as kayaking and fishing? Yes/No 3. Do you know what is 'Active, Beautiful and Clean' (ABC) Waters Programme? Yes/No

Section C: Perspective of the Park (Pandan/Bedok)

1. Do you know that Pandan Reservoir Park is part of the ABC Waters Programme? Yes/No
2. How often do you go to Pandan Reservoir Park?

- Never
- Once per year
- Once in 3 months
- Once in a month
- Once in 2 weeks
- Every week
- Everyday

3. What do you do at the Pandan Reservoir Park? You can choose more than 1 option.

- Project (Fieldwork)
- Family time (taking a stroll)
- Exercise with family
- Exercise with friends
- Take a breather
- Enjoy scenery
- Take part in Water-related activities
- Marathons
- Hangout spot (to do entertainment activities: play game, etc.)
- Others: _____
- No I don't visit the park.

4. On a scale of 1-5, how would you rate your overall experience at the park? (1 being the worst and 5 being the best)
5. In your opinion, which of the factors below describe the purpose of the water body in the park?

- It beautifies the area.
- It provides a more natural and relaxing environment.
- It provides a space for recreational activities.
- Others:_____

6. On a scale of 1-5, does the presence of water body have a positive contribution to your experience at the park? (1 being least positive and 5 being most positive)
7. Do you have any suggestions on how the usage of the water body can be improved? ____
8. Will the presence of water related activities (e.g. fishing, kayaking) encourage to you to visit the park or do it more often? Please explain. ____

Section D: Understanding what people usually do at parks

1. How many people do you usually go to the park with?

- 1 person
- 2
- 3
- Others: ____

1. How long do you spend at the park with the people that you go with? (If applicable)

- 5 minutes
- 15 minutes
- 30 minutes
- 1 hour
- Others: ____

3. Do you interact with strangers at the park? Yes/no
4. (If yes,) Do you still keep in contact/ meetups with those people? Yes/no
5. Does the presence of the water body in the park enhance your sense of belonging to the neighbourhood? Yes/No
6. Explain your answer to the previous question. ___

D.2 Sample of Online-survey (Phase B survey):

Table 10: **Investigation on People's perception on Reservoir Parks in Singapore**

Hello! We are a group of geography students from River Valley High School, conducting an investigation on what motivates young people to visit reservoir parks in Singapore.
This survey will take you about 3 minutes. Thank you for taking time off to complete our survey! Your responses are valuable to our cause.

Section A: Personal Information

1. Age Group
- 12 years old and below
- 13-16 years old
- 17-20 years old
- 21 years old and above

2. Gender:
- Male
- Female

Section B: Introduction

3. You enjoy going to reservoir parks in Singapore?
- Strongly disagree (directed to section C)
- Disagree (directed to section C)
- Agree (directed to section D)
- Strongly agree (directed to section D)

Section C: Does not enjoy going to reservoir parks

1. Why do you not enjoy going to reservoir parks in Singapore? (You may choose more than one option)
- Unpleasant weather (Temperature & Humidity)
- Unpleasant Environment (Presence of annoying insects & too many rubbish)
- Lack of attractions (no/not enough water activities or inability to partake in activities due to lack of equipment)
- Lack of quality food & beverage (no/not enough cafes & restaurants)
- Convenience (far from home/not accessible)

Section D: Enjoy going to reservoir parks

1. Why do you enjoy going to reservoir parks in Singapore? (You may choose more than one option)
- Good weather (Temperature & humidity)
- Environment (Little rubbish)
- Many attractions (sufficient facilities to partake in activities & or sufficient water activities to partake)
- Quality food & beverages
- Convenient

Section E: Opinions on features to be implemented in Pandan Reservoir Park

1. Please state your level of interest in the following features. Interested, Neutral, Not interested

a. 3RsL@Pandan - An aquathlon involving Running, kayaking (Rowing), and Repeating these actions, as '3Rs' suggest. The L stands for Learn, as water conservation and environmental conservation will be brought out during the aquathlon.

b. Water-Play@Pandan - A playground floating on water that has themes according to the season. (E.g. Winter wonderland during Christmas) It will also have fun facts about water conservation plastered on it.

c. Healthy Heart@Pandan - A series of activities, including Zumba, line dancing and environmental seminars carried out by the waters.

d. Explore@Pandan - An augmented reality application. Scan a QR code, and it will show either a specimen and description of a water organism, or a mini game on environmental tips allowing you to win points which can eventually be used to redeem prizes.

e. My Effort, My Part@Pandan - Pledge to do environmental activities (eg. save 100 litres of water), and have your name and picture on a polar bear sculpture to be floating on the reservoir water for a period of time.

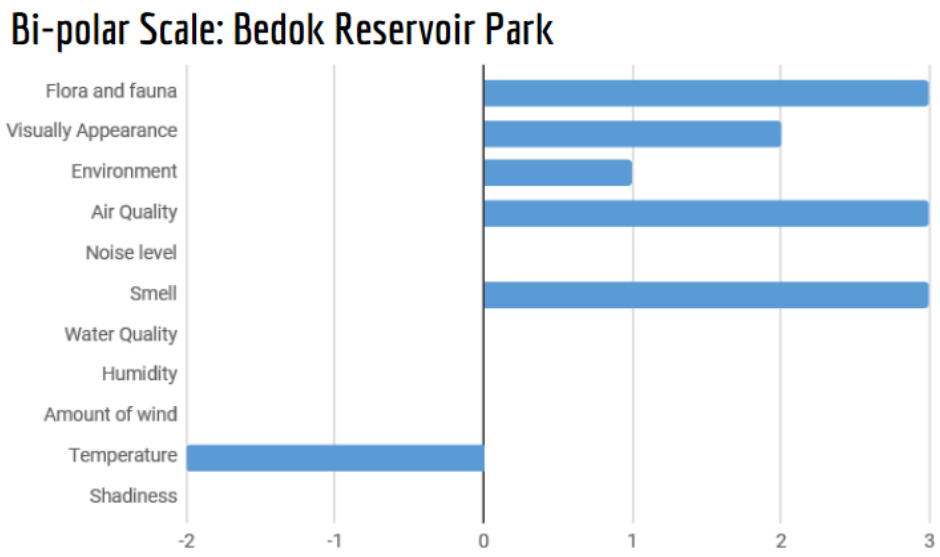
f. Navigating@Pandan - A kayak rental shop open to walk-in rentals by the public. Seasonal boats will also be available for rent. (E.g. Reindeer boats during Christmas)

g. Prawning@Pandan - An urban prawn breeding farm which allows the public to fish for prawns in a natural environment.

h. Run@Pandan - A planned out route that allows the park-goers to run past all the amenities at Pandan Reservoir via a running track that cuts across the water.

Annex **E**: Bi-polar scale
N.B. Left side of the scale means negative whereas the right side of the scale means positive.

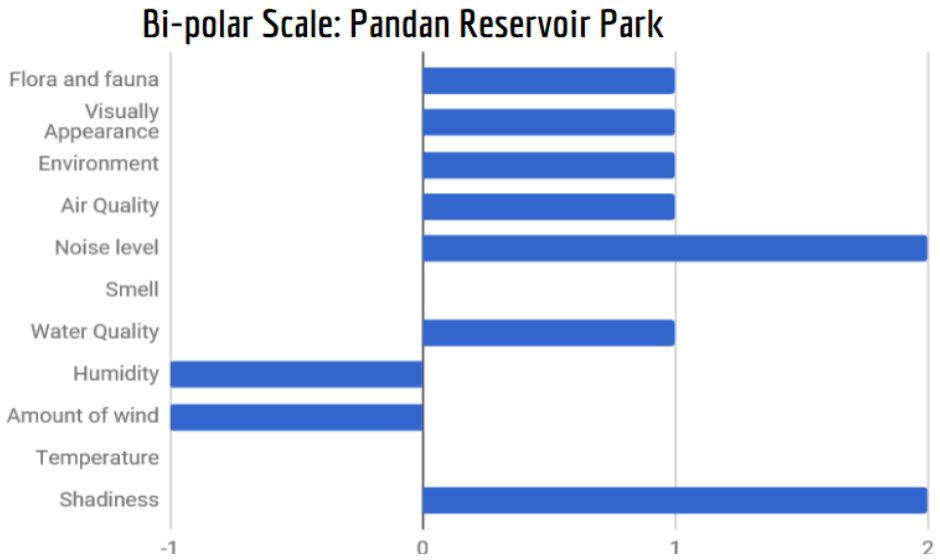
E.1 Bedok Reservoir Park



Total score: 10

Figure 25: Bi-polar Scale of Bedok Reservoir Park

E.2 Pandan Reservoir Park



Total score: 5

Figure 26: Bi-polar Scale of Pandan Reservoir Park