Onehunga Waterfront and Climate Adaptation

A Unitec Landscape/Architecture Studio

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Abstract

This paper discusses the potential of a landscape/architecture student joint studio to develop design strategies for a waterfront development that adapts to the environmental challenges of climate change. The authors developed a studio methodology to help students build collaboration and capacity to address real-world problems. The collaborative approach started with the deliberate engagement of a multiplicity of stakeholders, drawn from government agencies, practitioners, the community and mana whenua. The studio approach offered architecture and landscape architecture students the opportunity to work in teams, to conduct critical research and to address critical contemporary issues through the design process.

Using the Port of Onehunga in Auckland as a case study, this paper presents the results of students' collaboration with the Auckland Council development agency Panuku in 2019 and 2020. The selected student projects demonstrate how a collaboration between landscape architects and architects can contribute to creative solutions to address the effects of climate change. This process not only inspired innovative solutions in the first master plan phase, but also informed detailed interventions in the second building and public-space design phase.

The results of the studio work demonstrate that alternative design strategies to the current generic waterfront model could be developed. These strategies explicitly address environmental problems, such as sea-level rise, to develop a more resilient waterfront development. The results of the collaborative studio project bring valuable insights for the local community in their search for design strategies to adapt to climate change. The results of the studio also contribute to the international search for alternative solutions for the design of waterfront development projects around the world.

Introduction

Climate change poses numerous environmental and social issues for urban development in coastal areas.[1] Conventional design solutions that have been advanced by professional groups, such as landscape architects and architects, are not adequate to address the complexity of the effects of climate change. To explore a more comprehensive approach for

1. Intergovernmental Panel on Climate Change, "Summary for Policymakers Chapter," in *Climate Change 2014 Synthesis Report* (Geneva: Intergovernmental Panel on Climate Change, 2014).

climate adaptation, the School of Architecture at Unitec developed a studio model to explore the potential of multi-disciplinary collaboration to design a waterfront that could adapt to these challenges. The studio was developed as a joint design course integrating landscape architecture and architecture students. A case study, the Port of Onehunga, was used as a design site to explore how this collaboration could inspire innovative climate adaptation.

The first section of this paper introduces the site, the Port of Onehunga, and the main issues addressed in the studio. This is followed by a discussion of the studio pedagogy: multidisciplinary collaboration and its benefits. Climate-adaptive solutions are presented in two sections, the master-plan phase and the detailed design phase, to demonstrate how the collaboration contributed to the development of innovative solutions. The paper closes with a reflection on the process of students' collaboration and its potential to address climate-change-related issues in real-world practice.

The Site

The Port of Onehunga is located to the south of Onehunga between an extinct volcano, Te Hopua a Rangi, and the edge of Manukau Harbour. The 6-hectare site is part of Auckland's volcanic field adjacent to Te Hopua, with Maungakiekie to the north, Te Pane o Mataaho (Māngere Mountain) to the south, Te Tatua-o-Riukiuta (Three Kings) to the west and Rarotonga (Mount Smart) to the east. The site is easily reached from State Highway 20, enabling access to the CBD and the airport. However, the access road also acts as a barrier, isolating the port from Te Hopua and the Onehunga township.

Sitting on the edge of the Manukau Harbour, the Port of Onehunga is facing a number of environmental challenges from both sea-level rise and flooding from a large impervious urban catchment.[2] Planning a waterfront development that is resilient to the environmental effects of climate change is vital to ensure the continuing viability of the new Port of Onehunga and other post-industrial waterfronts.[3] The site has strong connections to Māori, with most of the iwi associated with Tāmaki Makaurau having a connection to the site.[4] The port was built on reclaimed land over the twentieth century and completed in 1958.[5] It served as an industrial port for a number of building products and as an active fish-processing plant.

In 2019, Panuku, the Auckland Council development agency,[6] bought the Port of Onehunga and proposed the redevelopment of the area as part of an ambitious urban master plan to revitalise Onehunga.[7] The authors have worked with Panuku for two years on developing a new kind of waterfront development model that would allow for the environmental depredation occasioned by climate change – sea-level rise[8] and pluvial flooding[9] – while at the same time ensuring the expected commercial returns.[10] Acknowledging mana whenua was a critical part of the brief.[11] The development of the site would also enhance connections to the Onehunga township and Māngere, and acknowledge the rich historical, cultural and landscape features of the site. Working with these conditions, students were asked to develop a new waterfront master-plan to imagine a redevelopment of the Port of Onehunga that proritised the environmental and cultural factors.

Methodology

One of the key approaches used in the studio is interdisciplinary collaboration. Several authors have highlighted the advantages of an interdisciplinary learning process.[12] Hirt and Luescher mention the importance of

2. W. D. Shuster et al., "Impacts of Impervious Surface on Watershed Hydrology: A Review," *Urban Water Journal* 2, no. 4 (December 2005): 263–75, doi:10.1080/15730620500386529
3. Ibid.
4. Auckland Council, "The Hapū and Iwi of Tāmaki Makaurau," accessed September 29, 2020, https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/about-the-auckland-plan/Pages/iwi-tamaki-makaurau.aspx.
5. "Discover Onehunga's Rich History," Onehunga Business Association, accessed July 13, 2020, https://onehunga.net.nz/onehunga-history/.
6. "Who We Are," Panuku Development Auckland, accessed July 13, 2020, https://www.panuku.co.nz/about/who-we-are.
7. "Onehunga – News & Blogs," Panuku Development Auckland, accessed July 13, 2020, https://www.panuku.co.nz/onehunga.
8. Ministry for the Environment, "Adapting to Sea-Level Rise," accessed September 29, 2020, https://www.mfe.govt.nz/climate-change/climate-change-and-government/adapting-climate-change/adapting-sea-level-rise.
9. Ronnie Falconer, "Pluvial Flooding and Surface Water Management," in *5th EWA Brussels Conference* (Brussels: European Water Management and Implementation of the Floods Directive, 2009), http://www.dwa.de/portale/ewa/ewa.nsf/C125723B0047EC38/CC41A2CC77C52058C125768E0030232E/%24FILE/Pluvial Flooding and Surface Management.pdf.
10. Mike E. Miles, Laurence M. Netherton, and Adrienne Schmitz, *Real Estate Development: Principles and Process* (Washington, DC: Urban Land Institute, 2015).
11. "Te Aranga Design Principles," Auckland Design Manual, accessed October 2019, http://www.aucklanddesignmanual.co.nz/design-subjects/maori-design.
12. Sonia Hirt and Andreas Luescher, "Collaboration between Architects and Planners in an Urban Design Studio: Potential for Interdisciplinary Learning," *Architecture and Environmental Design Faculty Publications* Paper 1 (2007): 1–22, doi:10.1504/JDR.2007.016852; Tae Seo Koo, "Integrating Design Disciplines: Understanding the Potential for and Factors Affecting the Success of Interdisciplinary Design Education for Architecture and Landscape Architecture" (PhD diss., North Carolina State University, 2012); Miranda Suzanna Angelique De Hei et al., "Collaborative Learning in Higher Education: Lecturers' Practices and Beliefs," *Research Papers in Education* 30, no. 2 (2015): 232–47, doi:10.1080/02671522.2014.908407; Mi Jeong Kim, Seo Ryeung Ju, and Lina Lee, "A Cross-Cultural and Interdisciplinary Collaboration in a Joint Design Studio," *International Journal of Art and Design Education* 34, no. 1 (2015): 102–20, doi:10.1111/jade.12019.

interdisciplinary activities in the academic curriculum, indicating the benefits of a process in which learning occurs via conversation, collaboration and constructive conflict, because knowledge is constructed by social experiences.[13] The interdisciplinary experience also enhances cultural exchange and can contribute to mutual respect and a greater appreciation of diversity.[14] This active learning method brought a number of benefits to the teaching–learning environment.

The collaboration in the Port of Onehunga project was twofold: the collaboration between landscape architecture and architecture students; the collaborative engagement with Panuku and mana whenua. The interdisciplinary collaboration contributed to the students' learning and created a process closer to professional reality. The collaborative work between the disciplines provided opportunities for the students to discuss the project in interdisciplinary teams. This experience can enhance students' learning through explaining ideas to peers and teachers.[15] The collaboration between students and stakeholders can also broaden the clients' development scope, offering them a number of alternative solutions that can exceed their initial expectations.[16]

As the client, Panuku contributed to the preparation of the brief, gave a project introduction and led site visits, as well as provided feedback to interim presentation and the final presentation. A number of guest critics, including landscape architects, architects and urban designers from industry, were invited during the course of the project to help students understand some of the professional constraints of these complex urban redevelopments. Māori lecturers and practitioners were also invited to help students understand the importance of mana whenua in the design process and the ways to manifest their concerns and wishes through the use of Te Aranga Principles.[17] These key engagements helped to connect students to the critical social programme that the Port project offered, helping to move beyond a generic waterfront development.

Organisation of the Studio

The Port of Onehunga project was run in Semester 1 of the 2019 and 2020 academic years. Students were organised into groups, with equal numbers from each discipline. The collaboration offered landscape and architecture students an experience that is close to what they can find in their real professional life.

The studio was divided into three phases: a research report, the master plan, and a public space/building design. In the first three weeks, students worked in groups to develop a research report. This included investigating relevant case studies, analysis of the site through GIS mapping, and identifying appropriate strategies to build environmental resilience. Based on the research report, each group then explored design solutions that responded to the challenge of climate change, making connections to the Onehunga township, and acknowledging the needs of mana whenua. Students then developed a master plan for the redevelopment of the port site. The groups then split into their respective disciplines and worked individually, each developing a detailed design for a public space or a four-to-six-storey mixed-use building.

Site Investigation

The site visit was led by the client, Panuku, represented by a senior landscape architect and an urban designer. This was to help students to understand the key features and identify issues on the port site. Students also undertook a hīkoi, which was to explore the surrounding urban landscape, the Onehunga town centre and the Taumanu Reserve. Amiria Puia-Taylor, the chairperson of a community organisation, The 312 Hub, in Onehunga and representatives of mana whenua, talked to the students about the history of both the Port and Onehunga, and contemporary issues for Māori (Figure 1). Amiria emphasised the importance of water for mana whenua, contrasting the historically pristine waters of the Manukau Harbour, especially in the Te Hopua basin, and the present-day degraded and polluted stormwater from the Onehunga town centre.

13. Hirt and Luescher, "Collaboration between Architects and Planners in an Urban Design Studio: Potential for Interdisciplinary Learning."
14. Ibid; Paulo Freire, *Pedagogia Da Indignação: Cartas Pedagógicas e Outros Escritos* (São Paulo: Editora UNESP, 2000).
15. Hirt and Luescher, "Collaboration between Architects and Planners in an Urban Design Studio: Potential for Interdisciplinary Learning"; Kim, Ju, and Lee, "A Cross-Cultural and Interdisciplinary Collaboration in a Joint Design Studio"; De Hei et al., "Collaborative Learning in Higher Education: Lecturers' Practices and Beliefs."
16. Xinxin Wang et al., "Collaborative Student and Community Design in a Time of Climate Change: Planning a Flood-Resilient Waterfront in New Zealand," *ISOCARP Review 14 – Climate Change Planning* 14, no. 1 (2018): 38–55.
17. "Te Aranga Design Principles," Auckland Design Manual.

Figure 1. Students investigate the site and Onehunga. The site visit included conversations with Panuku members and Māori representatives from the community organisation The 312 Hub. Photographs: Lúcia Camargos Melchiors

Climate Adaptation in Master-plan Phase

The impact that climate change, especially the effect of rising sea level, would have on the Onehunga waterfront was a key consideration for students. The site, like many waterfronts, is particularly vulnerable to sea-level rise. A sea-level-rise simulation shows that a one-metre water-level rise would inundate most of the wharf area. A two-metre sea-level rise would cover the entire site. Students responded to these future conditions by exploring various green strategies, including: partially raising the land to avoid flooding;[18] improving pervious surfaces' ability to absorb runoff;[19] restoring local ecologies;[20] and introducing native flora to mitigate flooding.[21]

In the development of the master plan, most groups applied combined strategies to address the challenges. One group proposed a staged retreat, with a floodable landscape to acknowledge the opportunities created by the rising water level (Figure 2). The group proposed raising the northern part of the port site as a location for the new building programme, to meet Panuku's brief for a viable real-estate development. The land between the building site and the Manukau Harbour was re-formed as terraces to mimic volcanic lava flow. Three cycling and walking paths were proposed to link the site, allowing residents to explore the old structures on the existing wharf, as well as connecting visitors to the adjacent volcanic crater, Te Hopua, and Onehunga township. These connections were future-proofed by being raised above the future sea-level datum.

18. Department of City Planning City of New York, *Coastal Climate Resilience: Urban Waterfront Adaptative Strategies* (New York: Author, 2013), www.nyc.gov/uwas.
19. Jiri Marsalek et al., eds., *Advances in Urban Stormwater and Agricultural Runoff Source Controls* (Springer Science & Business Media, 2001).
20. Myla F. J. Aronson et al., "Biodiversity in the City: Key Challenges for Urban Green Space Management," *Frontiers in Ecology and the Environment* 15, no. 4 (May 1, 2017): 189–96, doi:10.1002/fee.1480.
21. Mingteh Chang, *Forest Hydrology: An Introduction to Water and Forests*, 2nd ed (Boca Raton, FL: Taylor & Francis, 2005).

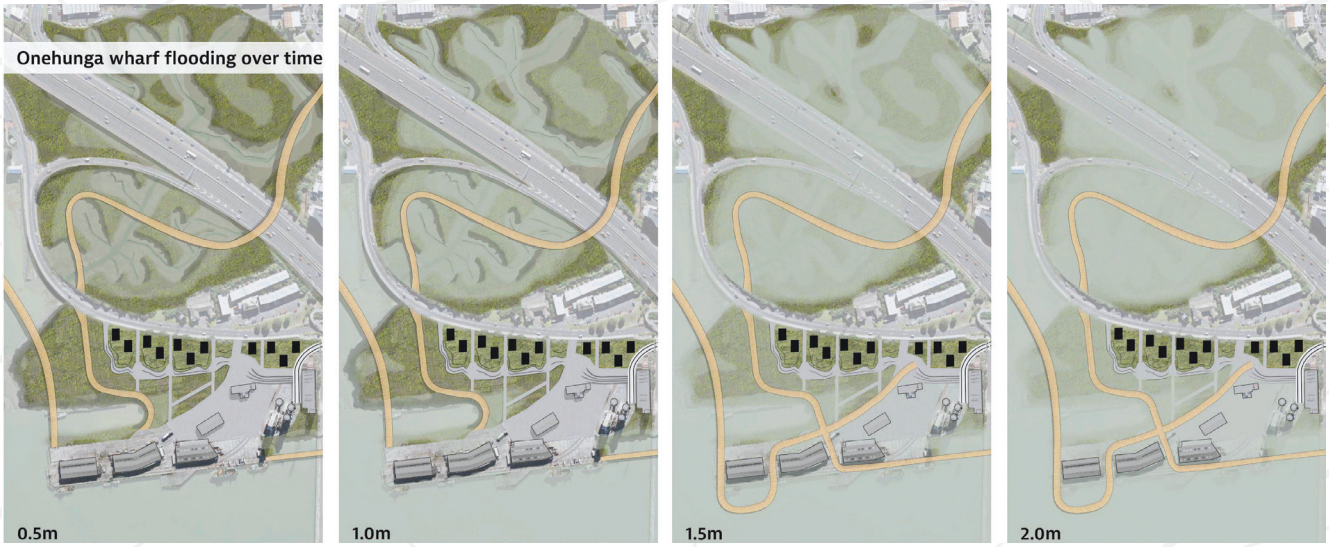

Figure 2. Staged retreat and floodable landscape in response to rising sea levels. Images: Nicholas Fortier, Christian Castle, Dilukshi Thurairajah, Xuling Zhu, Benjamin Whitehouse

Climate Adaptation in the Building/ Public Space Design Phase

The master-plan collaboration deepened the students' understanding of the complexity of building for climate adaptation. Inspired by their peers in the other discipline, students transferred their design thinking from conventional concepts to integrated solutions. Although the third phase of the project was for an individually designed building or a public space, the students kept communicating with one another and developed a number of innovative design solutions.

Public space

The landscape architecture students explored the way that making a resilient public space could support the design of a building and also adapt to the exigencies of climate change. The students found that through a close analysis of sea-level rise, a careful grading plan and a retreat strategy could be developed.

One option that students explored was to design a green buffer-zone between the buildings and the location of future sea-level rise. These spaces would also act as social spaces during fine weather and become water-retention zones during storm events. Another technique used by landscape students was to raise the building footprint above the anticipated sea-level rise. The intersection of indoor and outdoor spaces on the ground level of the building was considered, but landscape-based solutions could also be used in upper levels of the buildings. Green infrastructural devices such as green roofs[22] and rain gardens[23] could then be integrated into the design of building to mitigate the effects of climate change.

Another design solution to the effects of climate change was using a group of buildings as an elevated open public space. The design work proposed a sky garden at the second level of a building cluster (Figure 3). The sky garden not only connected the proposed apartment blocks, but also acted as a hub for pedestrians and cyclists to connect to Te Hopua, Māngere and Onehunga, even after sea-level rise. Other functions of the sky garden included the harvesting and filtering of rainwater and the provision of communal spaces for residents and visitors.

Mixed-use buildings

A number of the architecture students integrated green infrastructure techniques into the design of the mixed-use apartments. These techniques included: green roofs, permeable sidewalks and rain gardens. The architecture

22. Steven W. Peck, *Award Winning Green Roof Designs: Green Roofs for Healthy Cities* (Atglen, PA: Schiffer Publishing, 2008).
23. Nigel Dunnett and Andy Clayden, *Rain Gardens: Managing Water Sustainably in the Garden and Designed Landscape* (Portland, OR: Timber Press, 2007).

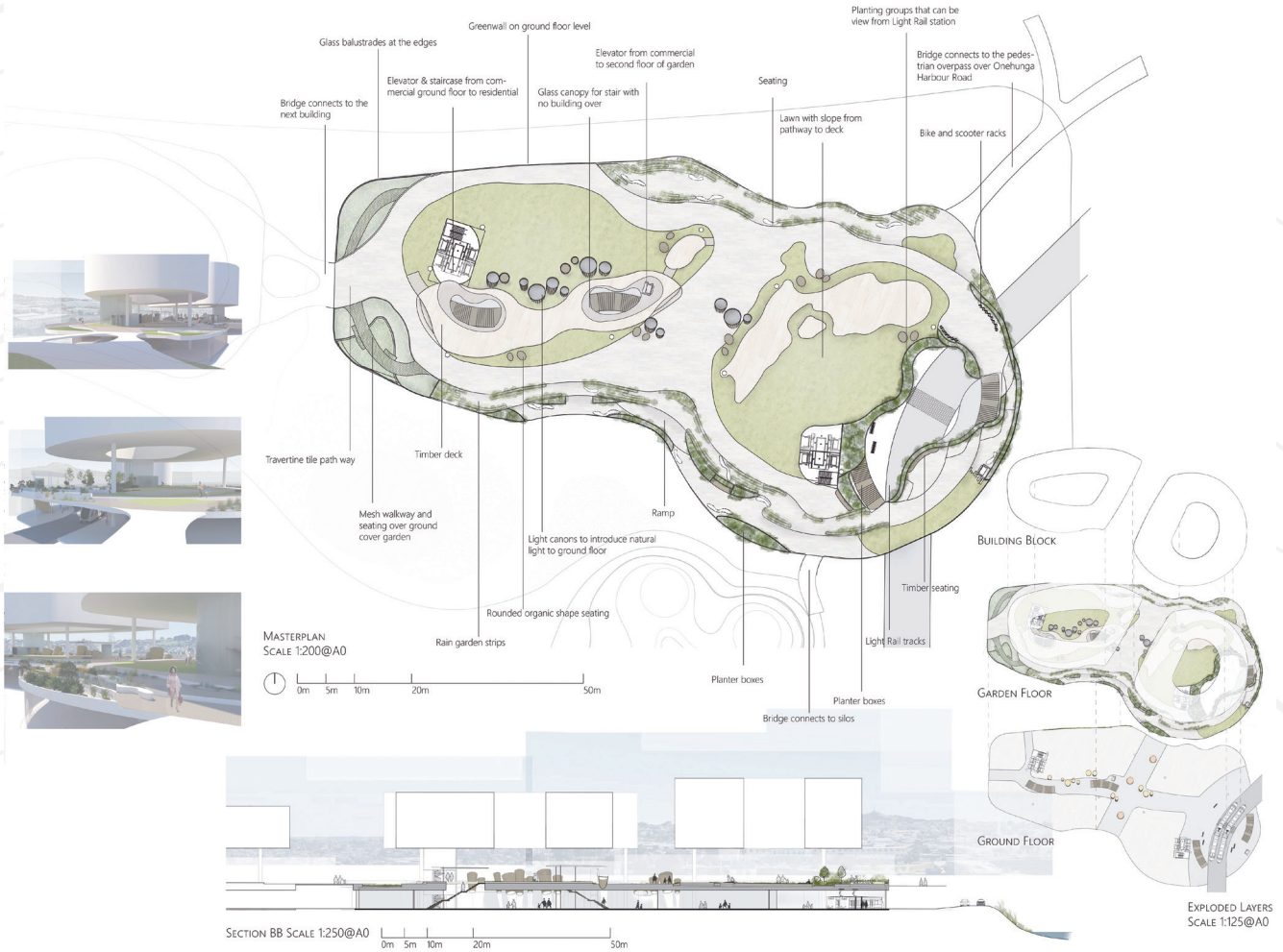

Figure 3. Integrating building with public space design. Image: Suyi Gan

students considered key elements of passive design, responding to the context and solar orientation, winds, shading and cross ventilation. Some projects proposed the use of roofs as both green and community spaces; improving stormwater management, retaining and delaying runoff and creating recreational areas for residents. Green roofs can also help to mitigate the effect of the urban heat island, creating cooler surfaces for the building envelope and helping with thermal efficiency.[24]

Other projects responded to the larger landscape, especially the Manukau Harbour, by acknowledging the extraordinary views through the design of private and communal outdoor spaces and organic materials. Figure 4 shows a building that emphasises the use of timber, a traditional element used in New Zealand's residential architecture, as cladding and brise-soleil (sun protection). A combination of private balconies and terraces responded to the views of the port and the surrounding volcanoes. These transitional spaces offered an opportunity for residents to relax and at the same time to help reduce the temperature of the building.

Integrated public space and buildings

Some groups worked collaboratively throughout the detailed design phase, and adjusted their design work to complement the others' projects. Many of the architectural decisions, such as the placement and orientation of the buildings, were informed by specific landscape decisions

24. Kelly Luckett, *Green Roof Construction and Maintenance* (New York: McGraw-Hill Education, 2009).

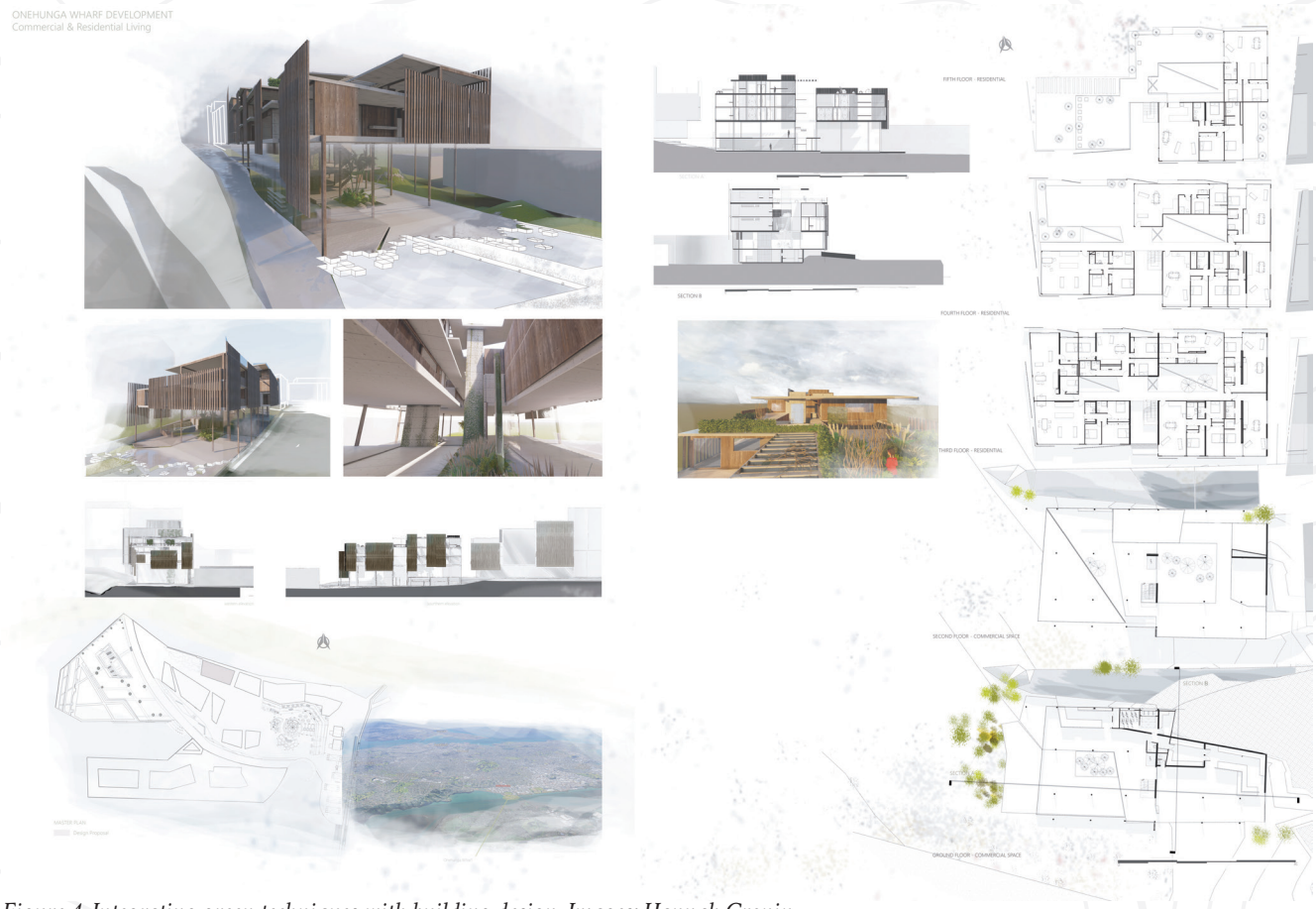

Figure 4. Integrating green techniques with building design. Images: Hannah Cronin

such as the grading of the landform, the creation of view shafts to the surrounding volcanoes and the transition from private to public spaces. For the landscape students, some of the landscape solutions were influenced by the building design: the proximity of the landscape to building entrances; the shade created by the height of neighbouring buildings; and the function of the spaces between buildings.

Two students demonstrated how the landscape and architecture disciplines could continue to contribute to each other's design work in the development of individual projects (Figure 5). The landscape architecture student proposed the use of north–south view shafts to connect the building platform to the surrounding maunga. In this way the historical Māori landscape of Tāmaki Makaurau is acknowledged. This positioning also helped the architecture student to orientate the apartment's location. The landscape architect also designed a terrace on the southern side of the building. The terrace worked in two ways: firstly, to raise the site above the potential sea-level rise and secondly, to mimic the surrounding volcanic topography. The buildings, designed by the architecture student, took advantage of the specific solar orientation and carefully located the apartments to allow for a harbour view for most of the residents. The apartments have a container-like building form, reflecting the industrial heritage of the port. By partially opening up the ground floor, the architect created a fluid transition between the ground-floor indoor spaces and the grass terraces.

Conclusion

The collaboration of landscape and architecture studio provides a successful model for the development of a resilient waterfront in response to the environmental effects of climate change. Interdisciplinary collaboration has been proven to be an effective teaching–learning

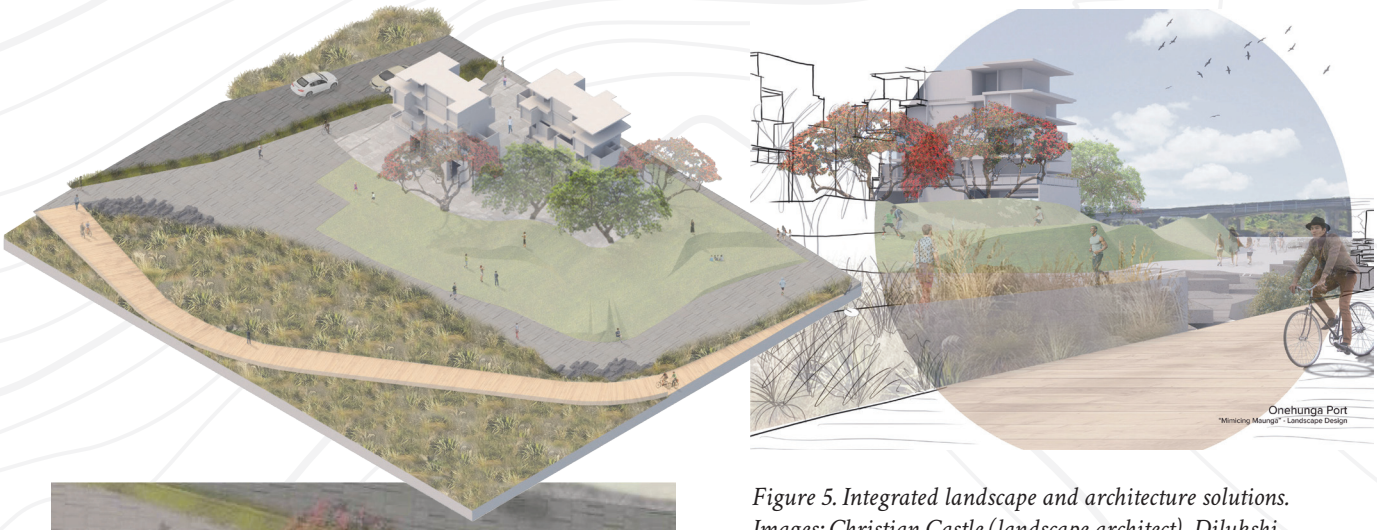

Figure 5. Integrated landscape and architecture solutions. Images: Christian Castle (landscape architect), Dilukshi Thurairajah (architect)

method through the case study of the Port of Onehunga; this not only gives students an opportunity to engage with real-world stakeholders, but also to learn from sharing different views through peer discussion. The studio was organised to respond to contemporary issues in Auckland, New Zealand, specifically climate change and associated social impacts.

The Port of Onehunga presented the opportunity of a future waterfront development that was used to demonstrate the benefits of this studio teaching model. Through the teaching–learning methods and design process, students were able to reflect on both environmental issues and acknowledging mana whenua. Students also were able to acknowledge the interests of mana whenua through a number of design strategies at different scales. The importance of the Te Aranga Design Principle of Tohu (mana whenua significant sites and cultural landmarks are acknowledged) was accomplished by acknowledging the larger landscape, the Manukau Harbour and the maunga of Tāmaki Makaurau. At a closer scale, the principle of Taiao (the natural environment is protected, restored and/or enhanced) was acknowledged by restoring the indigenous ecology of the harbour edge and replanting indigenous vegetation. The principles of Mauri Tu (environmental health is protected, maintained and/or enhanced) was acknowledge by both architects and landscape architects in ensuring that the contaminated stormwater produced by site development was cleaned before being discharged into the Manukau.

Through collaborative research and design throughout the studio project, students were able to propose alternative design solutions to address complex problems, such as sea-level rise, in both the master-plan phase and building/open-space design phase.

Beyond the immediate objectives of each studio, the interdisciplinary collaboration demonstrated several advantages, including exchanging experiences and starting to develop an interdisciplinary dialogue that will continue in professional life. As a case study of the development of an alternative waterfront model, this project not only provides valuable insights into climate adaptation in the Auckland context, but also contributes to a model, applicable to other coastal areas around the world. The design outcomes have clearly connected to developing design strategies for building waterfront resilience to the effects of climate change.

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