Streamside Vegetation Condition Evaluation (SVCE) for Melbourne Water

FINAL SUMMARY FIELD REPORT SPRING 2021

EcoFutures

EcoFutures recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium Group and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by EcoFutures Consulting Pty Ltd for Melbourne Water under the contract titled 'Streamside vegetation condition evaluation'.

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Cover image:	Myrtle Beech - photo taken by Malcolm Brown during the 2021 SVCE field surveys

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Executive Summary

The Streamside Vegetation Condition Evaluation (SVCE) Project forms a part of Melbourne Water's Healthy Waterways Strategy (HWS), to enable Melbourne Water to evaluate vegetation condition against HWS targets and vegetation responses to climate change. Understanding the condition of riparian vegetation is an essential element of the monitoring program to evaluate the success of HWS and direct future investment planning. It also supports the strategy in reflecting the importance of maintaining and restoring native vegetation within riparian zones.

This report summarises the project background, objectives and approach (section 1); project team (section 2); methods (section 3); safety, biosecurity and COVID-19 requirements (section 4); data management and quality assurance methods (section 5); summary of field survey data (section 6) and field auditing (section 7) and lessons learnt and recommendations (section 8). Further detail is provided in Appendices on methodology, safety and biosecurity management, version log of survey data, survey sites, and lessons learnt.

The vegetation condition monitoring information collected by this project will be used by Melbourne Water to:

- provide Melbourne Water with a rigorous data set to better understand how riparian vegetation is trending relative to the long-term targets in the HWS and will provide a baseline assessment for broader ecological strategic planning;
- through the detailed vegetation assessment method, assess the impacts of climate change on riparian vegetation by identifying species sensitive to the impacts of climate change and therefore useful as indicator species;
- communicate the importance of riparian vegetation to waterway and land managers and the wider community;
- improve decision making and guide investment for management of the region's waterways.

The project primarily focuses on gathering the baseline dataset to inform future data collection and future interpretation of the data, across riparian zones within Melbourne Water region. The program requires condition assessments to be completed in two spring field campaigns - one in 2021 and one in 2024. This report covers the field surveys in 2021.

A total of 508 field survey sites were randomly chosen, stratified within sub-catchment, by Melbourne Water for rapid assessment, also known as Vegetation Visions. The goal of the Vegetation Visions assessment is to provide a rapid visual estimation of vegetation condition over a large number of sites. It uses a set of descriptors for vegetation condition states to guide the assessor to one of six categories of vegetation condition.

Of the 508 sites a subset of 80 sites also had been selected for detailed assessment. These detailed assessments focus on the floristic elements to track changes in species composition; and include both qualitative and quantitative data. It is anticipated that this approach may assist in identifying indicator species of climate change. The qualitative vegetation inventory data collected within each subplot includes:

- plant species,
- canopy tree species cohorts,
- lifeforms (riparian and instream),
- substrate information (e.g., soil erosion, organic litter),
- anthropogenic vegetation removal.

The quantitative data includes the assessment of:

- canopy cover and dieback,
- number of dead trees,
- canopy height,
- large woody debris,
- canopy tree stem basal area.

The project approach centred around data collection by a field team with extensive vegetation assessment experience in the Melbourne Region, supported by strong project governance and quality-assurance processes. We partnered with experienced riparian/wetland field botanists who have between 18-40 years field experience and have utilised their strengths and intimate knowledge of vegetation and waterways to allocate them to the regions they know exceptionally well.

A total of 23 field team members from 13 sole traders and organisations were deployed in the field. Five field ecologists were also tasked to undertake the detailed assessments. High quality field assessments are also required for the 'rapid assessment' method although the level of vegetation identification skills required is not as high as for the detailed method. The key challenge with the rapid assessments was the number of assessments and achieving consistency. Our approach was to provide a team with a combination of excellent local knowledge and high reliability, complemented by with training to help calibrate the team.

Extensive project management collaboration between Melbourne Water staff and the Alluvium Group project delivery team enabled delivery of this large and complex survey project despite major challenges presented by the COVID-19 pandemic and associated lockdowns. Land access communication in particular was a collaborative effort between Melbourne Water and EcoFutures/Alluvium staff.

The project delivery team developed specific safety requirements and protocols to deliver a high safety standard. Government COVID requirements and policy changed rapidly between the initial submission of the EcoFutures bid and throughout the delivery of field assessment. These constant changes to procedure substantially increased the administrative burden of the project.

All data for the rapid assessment surveys was collected digitally using ArcGIS's Survey123. Data for the detailed assessment surveys was captured using a combination of Survey123 and a pre-formatted excel spread sheets. Data capturing methods were rigorously tested and adapted where needed to function across different software and devices. After a series of rigorous field testing, 9 versions of the Survey123 applications were created with all versions later consolidated into one file. Data was cleaned, processed and manipulated into one Feature Geodatabase. All data was subject to an automatic and manual data cleaning process to ensure consistency, accuracy, and completeness of all data sets.

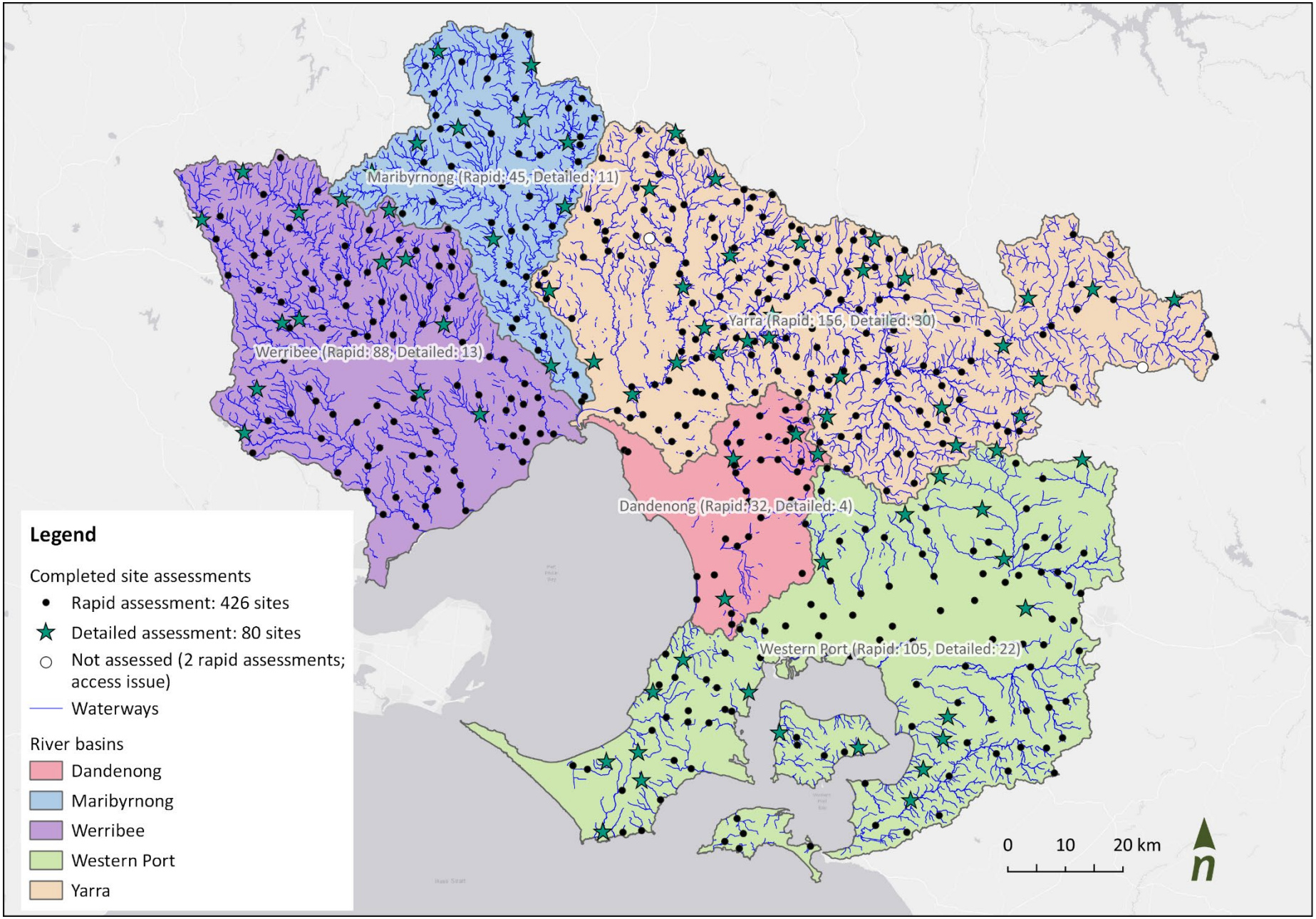
506 out of the 508 rapid assessment survey sites and all 80 of the detailed survey sites were completed (see figure below). The two rapid survey sites that were unable to be completed due to access/safety issues were both in the Yarra catchment but are not expected to affect the evaluation potential of the overall data set.

EcoFutures assessors conducted independent audits for rapid and detailed survey sites to enable a comparison for internal quality assurance as well as safety and biosecurity management purposes. Audits totalled six field team members safety audited, and quality assurance audits at four detailed sites and 20 rapid sites.

Safety and biosecurity audits showed that overall field staff were knowledgeable about the management of field risks, appropriately dressed and equipped and conducting themselves safely in the field. No near misses or safety incidents occurred and no transmission of COVID-19 between field staff occurred during the project. The safety audits enabled minor issues to be identified and quickly addressed.

Quality assurance audits of the rapid and detailed sites showed good consistency for rapid assessments and very good to variable consistency for detailed assessments between assessor and auditor data. Reasons for variation, including potential sources of error and the unavoidable impact of Covid 19 restrictions, are discussed and recommendations made to improve auditing and training in future, as well as to inform use of the data and future refinements of methodology.

Potential improvements to project delivery were identified by field and project management team members and collated at the conclusion of the field survey season into a series of key lessons learnt. A synthesised list of recommendations drawn from auditing and lessons learnt is provided in section 8 of this report, organised into recommendations for project delivery; safety, biosecurity and COVID019 requirements; data capture, consolidation and cleaning; training and data upload; methodology for rapid and detailed assessments; and auditing and interpretation of data.



Summary of field survey locations for the SVCE project.

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1 Introduction

1.1 Background

The Streamside Vegetation Condition Evaluation (SVCE) Project forms a part of Melbourne Water's Healthy Waterways Strategy[1] (HWS), enabling evaluation of vegetation condition against HWS targets and vegetation responses to climate change. The HWS sets a 50-year vision, acknowledging the complexity and diversity of the regions waterways as well as the key environmental and community values they provide. The HWS sets out performance objectives and targets for Melbourne Water's five major catchments (Figure 1) and 69 sub-catchments. It is underpinned by understanding the current condition and trajectory of each waterway, enabling partners to agree on priorities and locations requiring investment. Understanding the condition of riparian vegetation is an essential element of monitoring used to evaluate HWS success and direct future investment planning, reflecting the importance of maintaining and restoring native vegetation within riparian zones.

This report summarises the project methodology and implementation in 2021 to inform both interpretation of the collected data and future collection of data in 2024. The monitoring information collected by this project will be used by Melbourne Water to:

- provide Melbourne Water with a rigorous data set to better understand how riparian vegetation is trending relative to the long-term targets in the HWS and will provide a baseline assessment for broader ecological strategic planning.
- through the detailed vegetation assessment method, assess the impacts of climate change on riparian vegetation by identifying species sensitive to the impacts of climate change and therefore useful as indicator species.
- Communicate the importance of riparian vegetation to waterway and land managers and the wider community.
- to improve decision making and guide investment for management of the region's waterways.

[1] Melbourne Water Corporation 2018. *Healthy Waterways Strategy 2018-2028.* Available at: https://www.melbournewater.com.au/about/strategies-and-reports/healthy-waterways-strategy

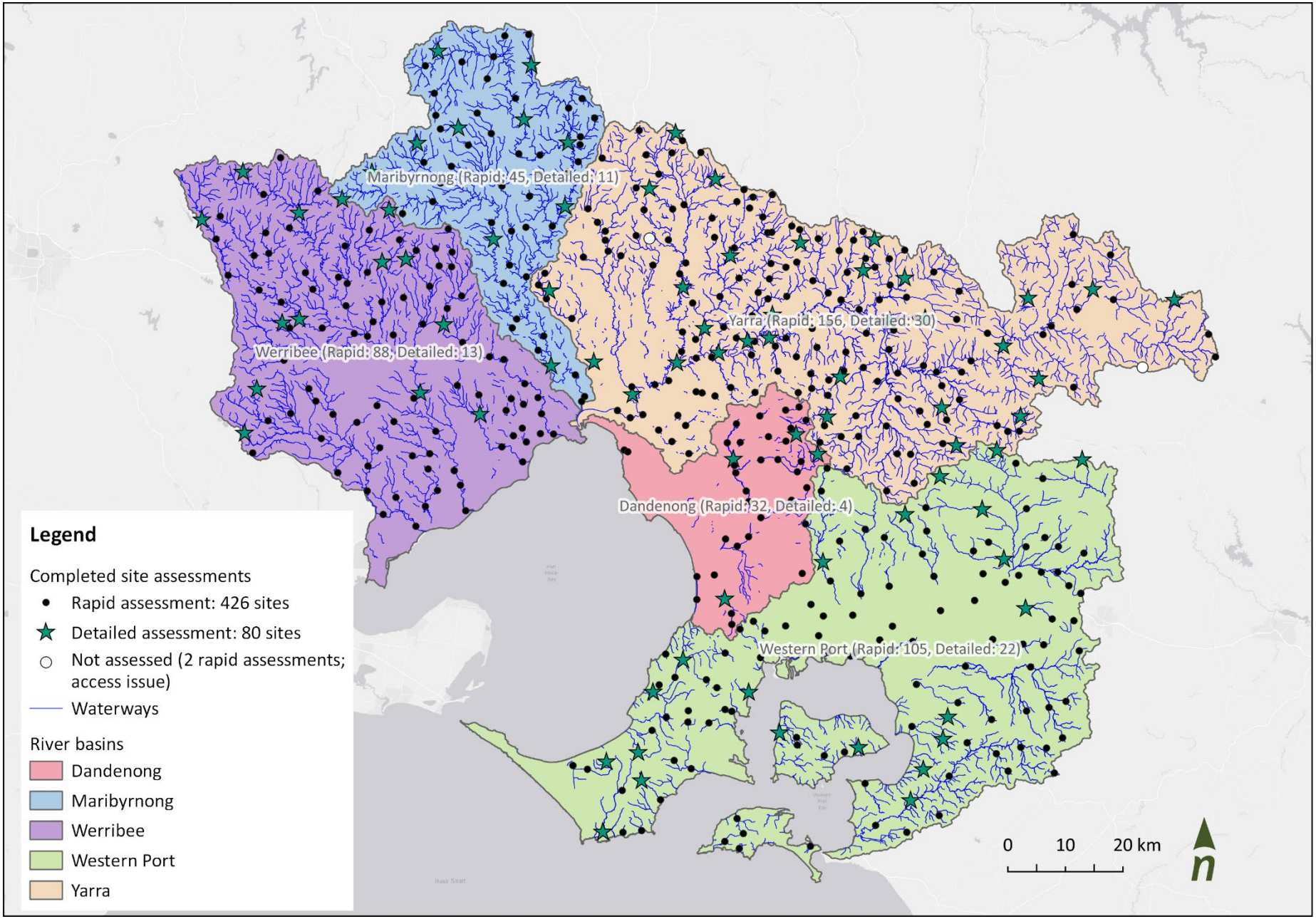


Figure 1. Summary of field survey locations for the SVCE project.

1.2 Objectives of the project

The objectives of the SVCE project were to:

1. Deliver high quality vegetation condition data that can be used to underpin management decisions and guide waterway investment across the region.
2. Complete rapid vegetation condition assessments at 508 sites.
3. Complete detailed vegetation condition assessments conducted at a subset of 80 sites.

The project requires condition assessments to be completed in two spring field campaigns (one in 2021 and one in 2024). EcoFutures and Alluvium were engaged to deliver the spring 2021 field surveys and this report presents the methodology and high-level data summary for the 2021 field campaign. This project is primarily a mechanism for data gathering to inform future data collection and future interpretation of the data.

1.3 Project approach

An overview of the project methodology utilised to deliver the project is provided in **Figure 2** below.

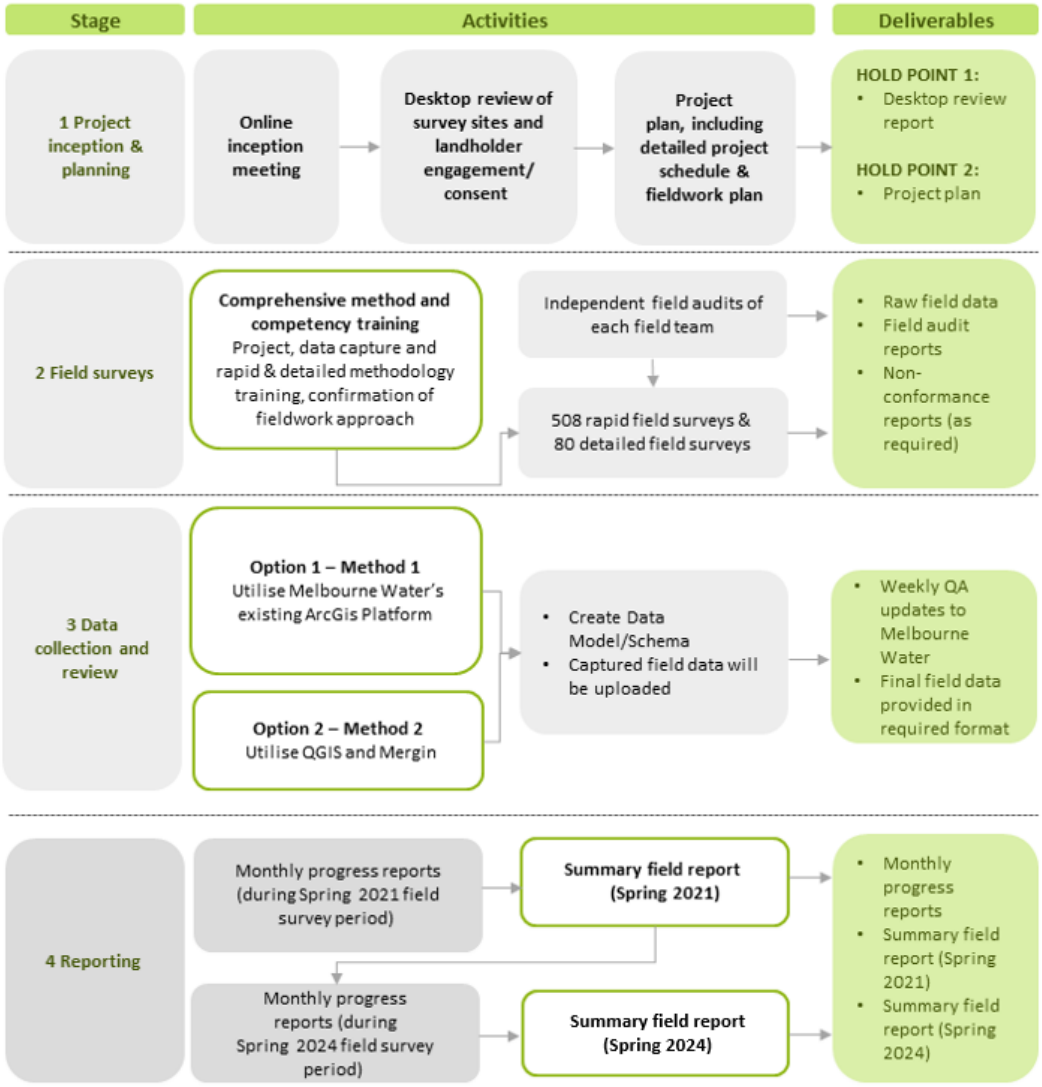


Figure 2: Project methodology

1.4 Report structure

The purpose of the report is to summarise the approach to the project, describe the methods utilised for the vegetation assessments, outline the way field surveys were delivered, data was captured, consolidated, and cleaned. The report also provides the lessons learnt from the fieldwork and recommendations for improvement for future field surveys identifying efficiencies, safety improvements, logistics, data compilation and reporting.

The outcomes of SVCE project have been addressed in the following sections of the final report:

- Section 2 – Project team: This section provides the details of the project delivery team members and field team members involved in the project.
- Section 3 – Field survey methods: This section provides an overview of the rapid and detailed field survey methods utilised for the SVCE project.
- Section 4 – Safety, biosecurity and COVID-19 requirements: This section provides an overview of the safety, biosecurity and COVID-19 requirements for the project to safety deliver the field surveys.
- Section 5 – Data capture, consolidation and cleaning methods: This section provides an overview of how data was captured from the field surveys and quality assured.
- Section 6 – Field survey summary: This section provides an overview of the field survey outcomes and results for the rapid and detailed surveys.
- Section 7 – Field auditing outcomes: This section provides an overview of the field auditing outcomes including the auditing of the rapid and detailed field survey methods, as well as compliance with safety, biosecurity, and COVID-19 requirements by subcontractors.
- Section 8 – Key lessons learnt and recommendations: This section provides a summary of the key lessons learnt from the project from the internal project team and subcontractors, as well as recommendations for improvements for future field surveys.

2 Project team

2.1 Project delivery team members

This section provides the details of the Alluvium Group project delivery team members involved in the project. Table 1 below describes the roles and contribution of each person.

The project team has been listed to allow Melbourne Water to potentially engage the same team members in future to maintain continuity of knowledge and gain efficiencies in project delivery of the spring 2024 field surveys.

Melbourne Water and expert input and collaboration

The project delivery team collaborated very closely with Melbourne Water staff to deliver this project. Melbourne Water staff provided extensive input to project management and stakeholder engagement, as well as data management. Key MW contributors included Al Danger, Paul Rees, Zoltan Kelly and Sacha Jellinek. An online training session and guidance relating to methodology was provided by external expert Dr Matt Dell (Dell Botany), who had led development of the methodology for Melbourne Water (*DellBotany 2020 Long-term monitoring of riparian vegetation condition in Melbourne Water catchments*).

Table 1. Project delivery team members (EcoFutures/Alluvium)

Team members	Role
Dr Paul Maxwell	Paul was the project director who has directed all aspects of the project. He has also provided technical expertise and guidance to ensure high quality data was captured and quality assurance processes were in place and supported the field teams to address any safety or logistical concerns.
Rob Dabal	Rob was the primary project manager and has overseen all aspects of the project including technical aspects. He has reviewed the delivery of the field surveys and reporting components of the study. Rob has reviewed all assessments to check for outliers of flora or structural determination.
Camille Oliver	Camille assisted Rob in the development of the field survey schedule, as well as field logistics, delivery of safety requirements, data management and has supported the project team for the reporting components of the project.
Alanna Main	Alanna was a part of the field team, as well as being involved in the fieldwork planning, auditing, training, landholder contact, site reallocation, and logistics. She was also a part of delivering the report and supporting data analysis.
Ying Quek	Ying developed the field surveys and supported Claudia with the data management and GIS requirements of the project. She also supported the project team to deliver fieldwork, including site allocation, auditing and reporting requirements.
Claudia Pelizaro	Claudia's main role was data management, process automation and GIS aspects of the project and supported the project team to deliver reporting requirements.
Stephanie Doumtsis	Stephanie's main role was to support the team in delivering the mapping required for the field surveys and support the project team to deliver reporting requirements.
Charlotte Williams	Charlotte's main role was to support the team in delivering the report and support Ying and Claudia with the data analysis aspects.

2.2 Field team members

Table 2 below provides details of all the sub-contractors engaged to conduct field assessments for the Spring 2021 monitoring event.

To provide the high level of botanical field experience required for the 'detailed methodology', we partnered with experienced riparian/wetland field botanists. These botanists have between 18-40 years field experience and know the vegetation and waterways of greater Melbourne exceptionally well.

High quality field assessments are also required for the 'rapid assessment' method although the level of vegetation identification skills required is not as high as for the detailed method. The key challenge with the rapid assessments was the number of assessments and achieving consistency. Our approach was to provide a team with a combination of excellent local knowledge and high reliability, complemented by with training to ensure calibration and consistency across the team. The rapid assessment team included current Stream Frontage Management Program assessors, including Damian Magner, Dean Platt, Mal Brown, and Lloyd Stanway. They were supported by additional expertise provided by Abzeco and Practical Ecology.

Table 2. Field team members in alphabetical order

Field Staff Name	Company	Role
Alanna Main	EcoFutures	Field support
Alistair Smith	Abzeco	Field support
Brian Bainbridge	Brian Bainbridge Wildlife Art and Illustration	Detailed assessment field team
Cat Clowes	Catherine Clowes	Rapid assessment field team
Colleen Miller	Practical Ecology	Field support
Damian Magner	Catchment Capable	Rapid assessment field team
Daniel Miller	Practical Ecology	Field support
Daniel Nippard	Abzeco	Field support
David Carew	Carew Environmental	Rapid assessment field team
Dean Platt	Tree Wishes	Rapid assessment field team
Dylan Osler	Ecological Perspective	Detailed assessment field team
Jade Phillipson	Abzeco	Field support
Kallista Sears	Practical Ecology	Field support
Lincoln Kern	Practical Ecology	Detailed assessment field team
Lloyd Stanway	Veryan Green Environment Services Pty Ltd	Rapid assessment field team
Lorien Firminger	Tree Wishes	Field support
Malcom Brown	Mal Brown	Rapid assessment field team
Mark Shepherd	Shepard Ecology	Detailed assessment field team
Matthew Lee	Abzeco	Field support
Rob Dabal	EcoFutures	Rapid and detailed assessment field team
Stephanie Grace	Shepard Ecology	Field support
Tserin Wright	Canopy Connections	Field support
Ying Quek	EcoFutures	Field support

3 Field survey methods

3.1 Rapid riparian vegetation condition assessment ("Vegetation Visions")

The 508 field survey sites nominated in the "RiparianVegMonitoringSitesMDDAug20" prepared by Melbourne Water Corporation (August 2021) were selected randomly for rapid assessment in this project. The goal of the Vegetation Visions assessment is to provide a rapid visual estimation of vegetation condition over a large number of sites, stratified by sub-catchment and including samples across a range of landscape contexts and condition classes. It uses a set of descriptors for vegetation condition states to guide the assessor to one of six categories of vegetation condition (see Appendix A).

All vegetation visions sites were located using a GPS, and data was recorded using the Survey123 app. The plots were established perpendicular to the waterway, with each plot equating to an area of 20m x 100m (0.2 ha) (Figure 2).

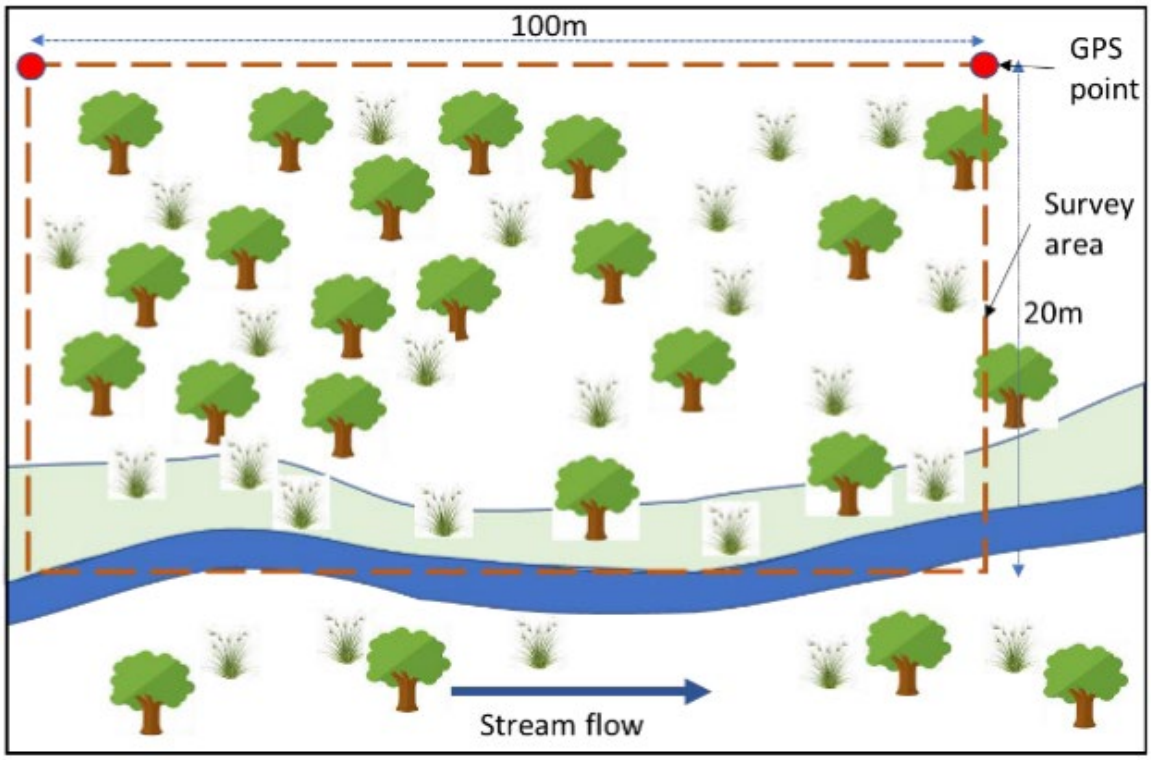


Figure 3. Survey area for the Vegetation Visions field assessment.

The methodology included a combination of qualitative and quantitative assessments of the vegetative composition within each plot. The vegetation inventory data collected at each site included (1) species richness and composition, (2) fragmentation (3) recruitment (4) invasive species (5) terrestrial and instream lifeforms and (6) observed threats (e.g. deer scats). It should be noted that this assessment was only conducted once at each site (n= 508). A description of the rapid riparian vegetation condition method can be found in Appendix A.

3.2 Detailed riparian vegetation condition assessment

Of the 508 sites a subset of 80 sites also had a detailed assessment conducted. These detailed assessments focused on floristic elements as a basis to track changes in species composition. It is anticipated that this approach may assist in identifying indicator species of climate change.

For the detailed sampling methods (n = 80), three transects were established perpendicular to the waterway, with each transect being 10m apart. A permanent metal star picket was established at the upstream end closest to the waterway. This point was referred to as T1s i.e., *transect 1 start.* The locations of the transects were

considered to accurately represent the vegetation communities present at each site. The first transect was always located upstream. Along each transect (n=3) five subplots (2 x 2m) were established at the 0, 5, 10, 15 and 20m mark (total 15 subplots within the 20 x 20 m plot). An additional four subplots were established perpendicular to the waterway at 40, 60, 80 and 100m points from T1s, if access permitted (Figure 4). Multiple parameters were collected at each plot to determine the current condition of the floristic elements of each site.

The qualitative vegetation inventory data collected within each subplot included (1) species present, (2) canopy tree species cohorts (3) lifeforms (4) invasive species (5) substrate information (e.g., soil erosion, organic litter), (6) anthropogenic vegetation removal and (7) instream lifeforms. The quantitative data collected included (1) canopy cover and dieback, (2) number of dead trees, (3) canopy height, (4) large woody debris and (5) canopy tree stem basal area. A detailed methodology for this vegetation condition assessment can be found in Appendix B.

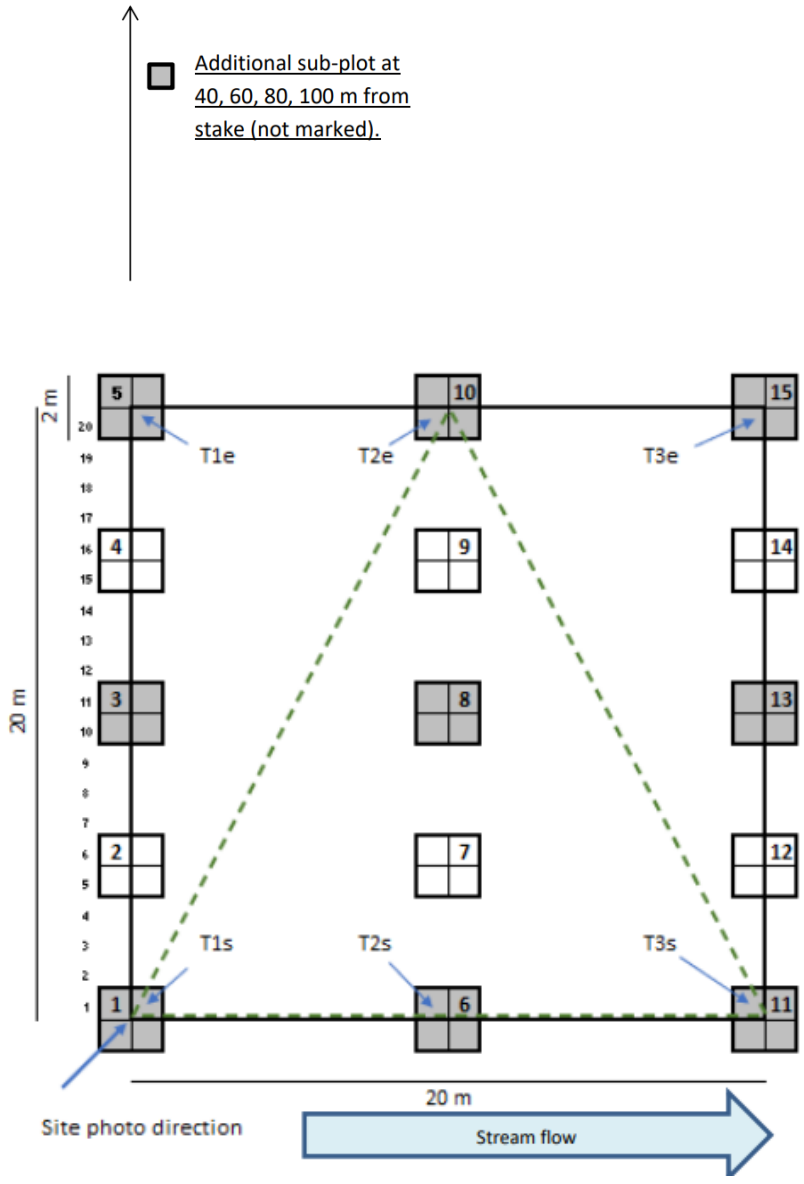


Figure 4. Detailed plot layout. The start of each transect was marked with a wooden stake, where permitted. Green triangle – large woody debris intercept transect. Grey shaded subplots are used for soil, rock and litter measurements. Further details in Appendix B.

3.3 Auditing of rapid and detailed site surveys

EcoFutures assessors conducted independent audits for the rapid survey and detailed survey sites. The audits followed the same methodology that is outlined in ***Section 3.1*** and ***Section 3.2*** of this report to ensure comparison could be accurately made for internal quality assurance and safety management purposes. The coordinates from the initial field-based data collection by sub-consultants was used to ensure the correct location was assessed. Audit sites include all five catchments and at least one site conducted by each assessor. Audits encompassed both safety/biosecurity and data quality assurance aspects.

Two days of auditing were conducted in December 2021, one day in February 2022, and 3 days in March 2022. Audits total to six field team members safety audited; and four detailed sites and twenty rapid sites quality assurance (QA) audited (Table 3). A summary of QA audit results is shown in section 7.1.

Table 3. Audited subcontractors and survey sites

Subcontractor name	Detailed Survey Quality Audit	Rapid Survey Quality Audit	Safety / Biosecurity Audit
Catherine Clowes	NA	***Audit Date:*** 10/02/2022 ***Site:*** 374 ***Audit Date:*** 24/3 ***Sites:*** 55, 350, 404	-
Tree Wishes 1	NA	***Audit Date:*** 2/12/2021 ***Site:*** 383	***Audit Date:*** 2/12/2021 ***Site:*** 383
Tree Wishes 2	NA	***Audit Date:*** 2/12/2021 ***Site:*** 383	***Audit Date:*** 2/12/2021 ***Site:*** 383
Veryan Green Environment Services Pty Ltd	NA	***Audit Date:*** 10/02/2022 ***Site:*** 205	-
Practical Ecology 1	***Audit Date:*** 2/12/2021 ***Site:*** 152	***Audit Date:*** 10/12/2021 ***Site:*** 298 (rapid audit of detailed site) ***Audit Date:*** 2/12/2021 ***Site:*** 152	-
Practical Ecology 2	-	***Audit Date:*** 10/12/2021 ***Site:*** 298 (rapid audit of detailed site)	-
Practical Ecology 3	***Audit Date:*** 9/12/2021 ***Site:*** 426 ***Audit Date:*** 10/2/2022 ***Site:*** 195	***Audit Date:*** 9/12/2021 ***Site:*** 426 ***Audit Date:*** 10/2/2022 ***Site:*** 195	***Audit Date:*** 8/12/2021 ***Site:*** 250
Practical Ecology 4	***Audit Date:*** 9/12/2021 ***Site:*** 426	***Audit Date:*** 9/12/2021 ***Site:*** 426	-
Ecological Perspective	***Audit Date:*** 9/12/2021 ***Site:*** 179	***Audit Date:*** 9/12/2021 ***Site:*** 179	-
Canopy Connections	***Audit Date:*** 9/12/2021 ***Site:*** 179	***Audit Date:*** 9/12/2021 ***Site:*** 179	-
Brian Bainbridge Wildlife Art and Illustration	-	***Audit Date:*** 10/02/2022 ***Site:*** 195	-
ABZECO 1	*NA*	***Audit Date:*** 24/03/2022 ***Sites:*** 55, 350, 353, 404	-
ABZECO 2	*NA*	***Audit Date:*** 10/2/2022 ***Site:*** 205	***Audit Date:*** 9/12/2021 ***Site:*** 19
ABZECO 3	*NA*	***Audit Date:*** 22/3/2022 ***Sites:*** 41, 171	-

ABZECO 4	*NA*	***Audit Date:*** 10/2/2022 ***Site:*** 374	-
Carew Environmental	*NA*	***Audit Date:*** 24/3/2022 ***Sites:*** 292, 471	***Audit Date:*** 28/02/2022 ***Site:*** 307
Catchment Capable	*NA*	***Audit Date:*** 24/3/2022 ***Sites:*** 292, 471	-
Mal Brown	*NA*	***Audit Date:*** 22/3/2022 ***Sites:*** 41, 171	***Audit Date:*** 9/12/2021 ***Site:*** 19
Shephard Ecology 1	-	***Audit Date:*** 22/3/2022 ***Sites:*** 157, 174, 175 and 464	-
Shephard Ecology 2	-	***Audit Date:*** 22/3/2022 ***Sites:*** 157, 174, 175 and 464	-
Consultant Ecologist	***Audit Date:*** 2/12/2021 ***Site:*** 152	***Audit Date:*** 2/12/2021 ***Site:*** 152	-

4 Safety, biosecurity, and COVID-19 requirements

Ensuring the safety of landholders involved in the project, field team members and representatives of Melbourne Water involved in the field surveys was the highest priority for this project.

4.1 SVCE Safety and Biosecurity Manual and overarching Safe Work Method Statement (SWMS)

Our project delivery team developed specific safety requirements and protocols to deliver a high safety standard. The project Safety and Biosecurity Manual developed for the SVCE project is provided in Appendix C.

This SVCE Safety and Biosecurity Manual was prepared in consideration of the Melbourne Water Remote or Isolated Work Procedure (November 2019, version 17, document ID: 22297233) and remote areas mapped by Melbourne Water. While the project did not include any field work at locations mapped as 'remote' on the Melbourne Water Spatial Layer, it was considered prudent to prepare project staff working in upper catchment areas for remote work.

The SVCE Safety and Biosecurity Manual addresses the following aspects:

- Incident response framework
- Documentation requirements
- Qualifications and training required for field staff
- Personal protective equipment (PPE) requirements for field staff
- Call-in procedures
- COVID-19 fieldwork requirements
- Managing encounters with dangerous fauna and potentially violent or aggressive persons
- Management measures for field staff with anaphylaxis and asthma
- Requirements for field staff in terms of alcohol, illicit substances, and prescription medicines
- Requirements for field staff in terms of ensuring a fair and equitable workplace
- Details of the biosecurity requirements for the project
- Details of the safety and biosecurity audits for the project
- Supporting documentation was also provided, including:
    - Overarching Safe Work Method Statement (SWMS). The SWMS documents work tasks, the inherent risks of those tasks and work methods to reduce the residual risk to an acceptable level. Given the number of field sampling sites it was not feasible to do an individual SWMS for each site, so the overarching SWMS covered all potential risks and mitigation measures required to ensure the safety of field staff. All field staff were required to read, understand, and comply with the requirements defined in the SWMS at all times.
    - COVID-19 fieldwork protocols
    - Vehicle prestart checklist
    - Take 5 checklists
    - Workplace attendance register
    - Incident report forms
    - Alluvium Group Handbook and the Employee Handbook, social and environmental responsibility and diversity, anti-discrimination and equal opportunity policies.
    - COVID Safe Plan
    - First aid for snake bites in Australia and New Guinea

4.2 Auditing of field safety, biosecurity, and COVID-19 requirements for field staff

A rigorous quality assurance framework has been put into place to ensure the successful delivery of the field surveys (Figure 5 below).

Figure 5. Quality assurance framework

A checklist based on the Biosecurity and Safety Manual for the project was used to conduct safety audits (Appendix D). Sub consultants were notified that audits were to occur 24 hours prior to the field audit to enable scheduling. This meant audits could occur at the start of a site inspection to minimise disruption to the field surveys and to enable audit at the assessor's vehicles so they could demonstrate all safety equipment and protocols, including those that are vehicle-based.

Six of 21 subconsultant field team members (28%) were subject to a safety and biosecurity field audit in December 2021, or February 2022. These audits were completed by EcoFutures representatives (see Table 3 in section 3.3 for sites and audit dates). The audits ensured that staff members were complying with the safety and biosecurity requirements and enable checking of survey data to ensure data collection is in accordance with the methodologies required for the project. For each safety and biosecurity audit, an audit checklist was completed.

A summary of the safety and biosecurity audit outcomes is provided in Section 7.2.

5 Data capture, consolidation, and cleaning methods

Data management for the project was complex and given the number of sites assessed a clear data schema and strict Quality Control/Quality Assurance (QA/QC) procedures were required to ensure that the data captured consistently applied the survey methods, was accurate and repeatable for the spring 2024 surveys.

An overview of the data capture, consolidation, and cleaning methods utilised for the SVCE project are provided in Figure 6.

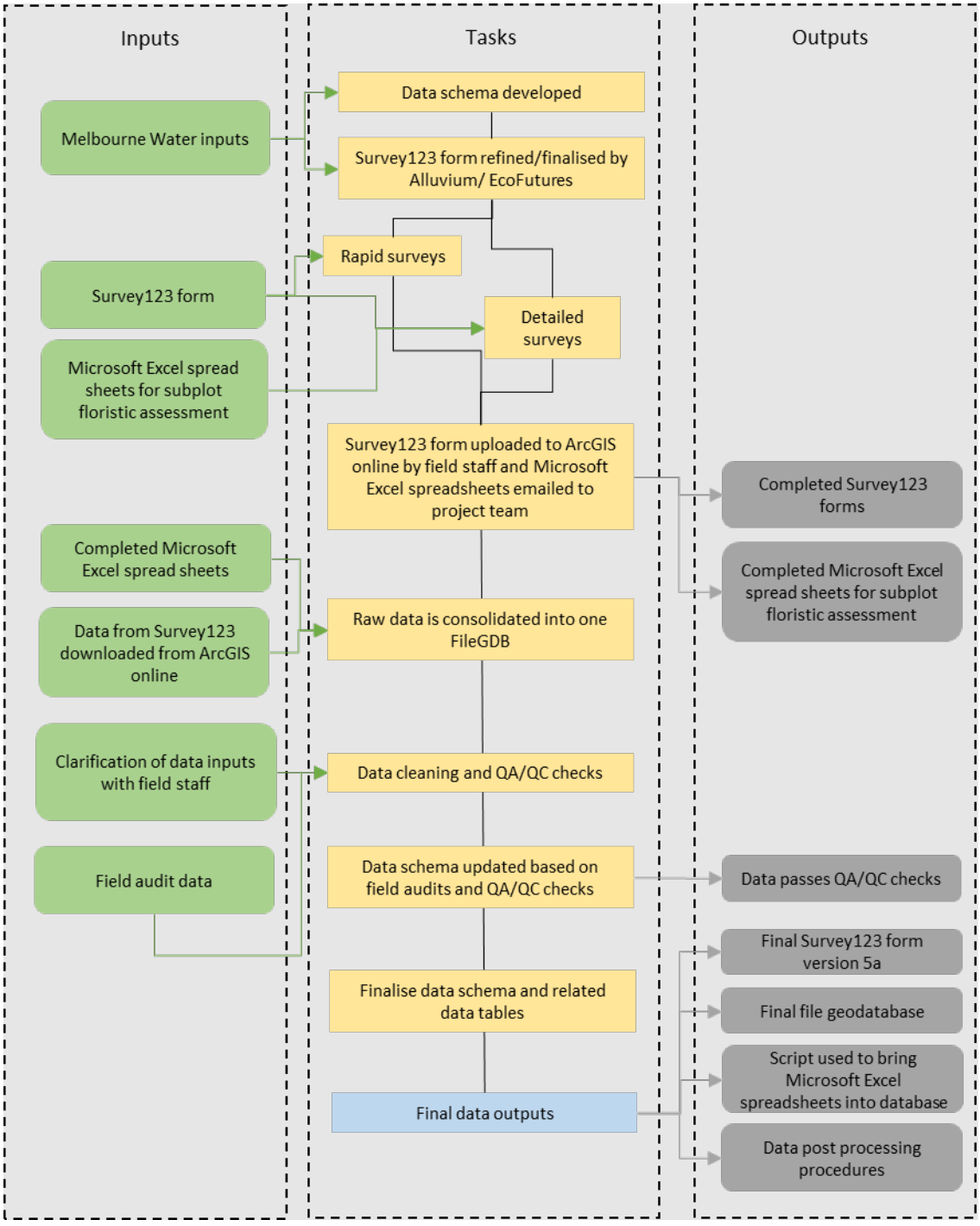


Figure 6. A flowchart outlining the steps taken to capture, consolidate and clean the data

5.1 Data capture methods

There are two main components to the data capture, the shorter rapid assessment, and the longer detailed assessment. Most data were captured digitally via ArcGIS's Survey123 application deployed to the field team. ArcGIS Survey123 application is a form-centric application that enables field workers to collect data via tablet or mobile devices. Melbourne Water has initially designed and drafted the survey in ArcGIS's Survey123 to electronically collect data for both the rapid and detailed assessments. The Alluvium team inherited the survey initially drafted by the MW team and made the necessary modifications to include updated/uncaptured aspects of the survey methods and/or adjustments to remove minor bugs or issues raised by field botanists during field data collection.

All rapid assessment data were captured using Survey 123 app and automatically stored on Melbourne Water ArcGIS Online Platform. Detail Assessment was partially collected in the Survey123 application and partially collected using pre-formatted excel spreadsheets. During the designing of the survey, there were technical limitations to fulfill the requirements set out in the detailed assessment methods which led to the assessment being split into two logical parts, Microsoft Excel spreadsheets for the lead botanists and ArcGIS Survey123 for the field support person. Figure 7 outlines the breakdown of the data capture for each survey method and platform.

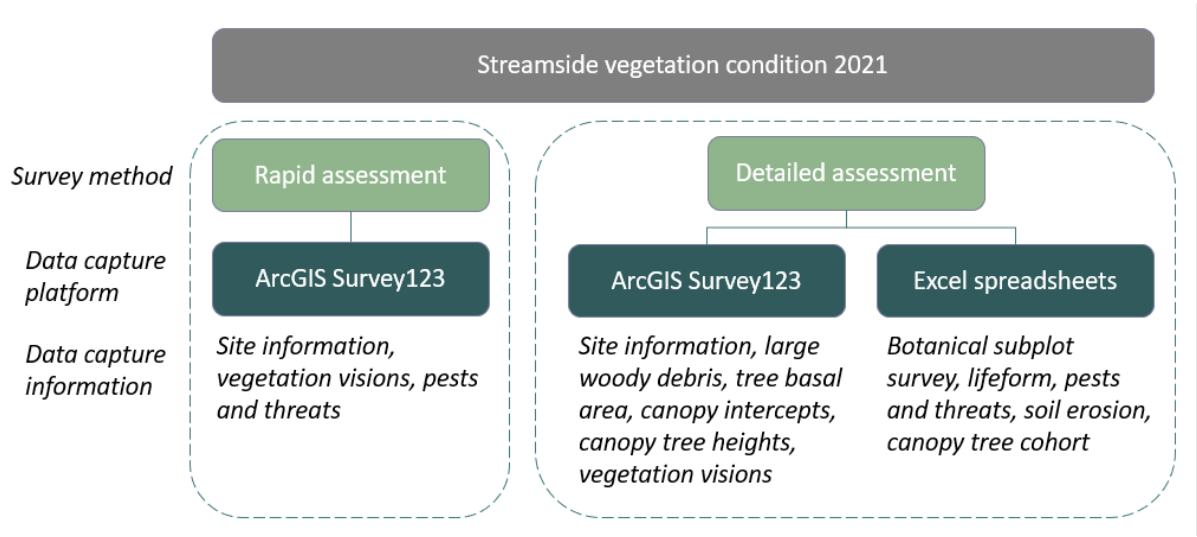


Figure 7. A schematic diagram of the data capture tools and associated information for rapid assessment and detailed assessment.

ArcGIS Survey123

ArcGIS Survey123 captures all rapid assessment information, as per the method in Section 3.1. The rapid assessment method includes the following information:

- Site information (site coordinates displayed on the map comes from the list of coordinates provided by Melbourne Water)
- Actual site coordinates (2 points)
- Species richness and composition
- Fragmentation
- Recruitment
- Invasive species
- terrestrial and instream lifeforms
- observed threats (e.g. deer scats).

ArcGIS Survey123 captures the following detailed assessment information, as per the method in Section 3.2:

- Site information (site coordinates displayed on the map are the coordinates provided by Melbourne Water)
- Actual site coordinates (6 points)
- Instream lifeforms
- Canopy cover and dieback
- Dead trees
- Canopy height
- Large woody debris
- Canopy tree stem basal area
- Anthropogenic vegetation removal
- Rapid assessment

The survey set up can be viewed in Appendix E.

Microsoft Excel spreadsheets

The excel spreadsheets for the detailed assessment captures the following information, mainly the subplot assessment:

- Species present
- Lifeforms
- Invasive species
- Substrate information (e.g. soil erosion, organic litter)
- Canopy tree species cohort

Field testing of ArcGIS Survey123 application

The streamside vegetation condition assessment began in late September 2021 with an internal project team and one external field team were deployed to test the survey123 application on their mobile devices. The field testing generated a list of errors and suggested improvements to the useability from testing the applications. In addition, the survey methods were also clarified during field testing were updated in Survey123 so it is clearly written and emphasised. Additional COVID-19 requirements were added at the front as part of the change in COVID-19 safety protocols of the assessment. These changes required several iterations of the surveys and ongoing iterations continued into late October to ensure the application was stable and functional in multiple types of mobile devices and device versions.

There are a total of 9 versions after numerous rigorous field testing by multiple field team members. Version log of the survey is captured in Appendix E. The final version is version 5a named 'Vegetation_Survey_5a'.

5.2 Data consolidation

Consolidating the datasets involved two main steps:

1) Consolidating data from different Survey123 versions into one file
2) Consolidating and ingesting detailed subplot assessment spreadsheet into Feature Geodatabase format

An automated process was set up in Python to consolidate Survey123 data and ingesting detailed subplot assessment into ArcGIS interface.

5.3 Data cleaning and QA/QC checks

A separate word document outlines the post processing checks and instructions for our spatial team to clean, process and manipulate the data into one Feature Geodatabase. QA checks were undertaken as part of the process to check for consistency, accuracy and completeness:

- Ensuring species name are consistent with the master species list (extracted from Victorian Biodiversity Atlas)

- Developing acceptable value limits for all fields
- Ensuring all required fields are entered
- Standardising any non-conforming values
- Manual checking and review of data when automated rules fail.

An automated process was set up in Python to undertake post-processing data cleaning and QA/QC checks. Where QA fail to comply with requirements specified, a review process was triggered which involved visual checking by the internal project team and iterations with responsible field botanist to clarify any anomalies unresolved by the team. The data cleaning and QA/QC process is especially extensive for the detailed assessment as there are two parts to the data collection – one being the excel spreadsheet and another being the online Survey123. Because excel does not have field type enforcement, data values could take any character, number, symbol or even left blank. Harmonisation required extensive human intervention and case-by-case assessment

It should be noted that the actual site coordinates were recorded by field botanists using an external device and entered manually in the survey form. Hence, the site location was not recorded as a point location using the device coordinates. This created a lot of issues during post processing, since no mechanism were in place to validate the correctness and precision of coordinates manually entered my field botanists. Issues with incorrected coordinates were identified and rectified during post processing. It is important to note that the site location feature class delivered in the final file geodatabase was created during post-processing using the corrected and rectified coordinates provided by field botanists.

6 Field survey summary

A total of 506 out of 508 sites were completed, with all 80 detailed sites completed. The two missing sites could not be completed because access could not be arranged within available time. Site 387 was unable to be accessed due to the landowner not providing access. Site 327 could not be safely accessed due to safety issues, namely there was an obstruction (felled tree) on the road. These two sites are from different sub-catchments and different EVCs and EVC groups: Site 327 target EVC Montane Wet Forest, Victorian Alps bioregion; Site 387 target EVC Plains Grassy Woodland, Victorian Volcanic Plains bioregion. The exclusion of these 2 rapid sites from the data set are unlikely to have any material effect on the evaluation potential of the data.

It should also be noted that the actual coordinates collected by subcontractors are saved in a related table that needs to be referred to for future analysis work. Actual coordinates also captured the updated location where sites may have been reallocated for various reasons such as accessibility, permission and safety concerns.

Catchment	Detailed sites	Rapid sites	Total
Dandenong	4	32	36
Maribyrnong	11	45	56
Werribee	13	88	101
Western Port	22	105	127
Yarra	30	156*	186*
Total	80	426	506

* Two rapid sites in the Yarra catchment could not be completed because access could not be arranged within available time (see sites 327 and 387 in Appendix F), with 156 out of 158 rapid sites in the Yarra catchment being surveyed.

It should be noted that there has been a change in scope of work to exclude the field survey summary results in this report as agreed by Melbourne Water to deliver the final datasets as the priority of this project. Therefore no initial analysis of the data is completed for this field summary report.

7 Field auditing outcomes

Field auditing outcomes are summarised below describing variation between data collected by subcontractor and EcoFutures assessors. Details of audit dates and site numbers are in Table 3 (Section 3.3).

7.1 Auditing of the implementation of the rapid and detailed survey methodologies

Four detailed sites and 20 rapid sites were QA audited. A summary of the auditing outcomes for the implementation of the rapid and detailed survey is provided below.

Rapid assessment audits

20 rapid assessment sites were audited for quality assurance by comparing the results of assessments conducted by field staff and EcoFutures auditors. The results are generally in agreement between the two, with some scores varying by one (e.g. one assessor scoring a site as "4", the other as "3"). A closer look at sub scores did not reveal a consistent pattern, although it is noted that auditors were more likely to score sites higher (by one) than Subcontractors. It is also worth noting that audits occurred at a different time point (up to 2.5 months later).

Minor differences in scores are not likely to affect the aim of the surveys and may be reflective of the high-level, rapid and qualitative nature of the Vegetation Visions method. As the program is rolled out over time, patterns may emerge which can then be addressed by refining the protocols and training to continue to improve consistency across different users over time. Covid19 restrictions meant that not all field practitioners could be present at one location at one time, and auditing was delayed, both of which may have contributed to differences. A comprehensive, whole-of-group training session and vetting of training data from all assessors at dedicated training sites before actual surveys begin would likely help to improve consistency.

Detailed assessment audits

Comparisons were made for the detailed sites of floristic (species), threats and structural vegetation data to understand variation in data between the two data sets for each site (subconsultant and auditor versions). We then explored possible explanations for any differences (potential sources of error, including impact of Covid on the field program) and recommendations to inform future improvement and use of the data.

Floristics

The list of species detected along the transect at four detailed survey sites was compared between EcoFutures auditors and subcontractors. Two sites had very good overlap of species, one had good overlap and one did not overlap well. Looking more closely at the variation, many differences in species between the subcontractor audit species were likely the result of the difference in timing between the two surveys, between one month and two and a half months at three of the sites (due to Covid restrictions in 2021). This meant that growth had progressed at several of the sites so that some herbaceous plants became detectable or undetectable (depending on the plant's life history) and some woody plants may have grown to overhang a plot, for example. The following dot points are possible explanations for discrepancies in species recorded data:

- EcoFutures botanists collected data later in the season when some life forms have progressed to the point where they can be detected
- Some differences were small herbaceous species at low frequency which could easily be overlooked by either assessor
- Differences in experience and/or specialty skills of botanists
- Larger, woody plants such as acacia may have been recruits in low frequency or a branch hanging over plot in low frequency
- Difference in survey timing meant more grasses were able to be identified in the audit (occurred later)
- Weed species e.g. Brassicaceae likely had progressed to the point that they could be detected in the audit
- Larger, woody species may have been recruits in low frequency or a branch hanging over plot in low frequency

Vegetation structure

The comparison of structural vegetation data collected in Survey123 by field support personnel included site details (e.g. coordinates, bank side and bearings), canopy height of the three tallest trees (where present), canopy cover (intercept) and dead canopy branches, canopy tree stem basal area (diameter at breast height, DBH), and large woody debris. Key findings of the comparison are:

- Site details were generally consistent with variation between GPS coordinates usually well below 5m, and bearings usually within a few degrees. Minor errors were found in bank side (incorrect by one observer at two sites) and one directional bearing measurement at one site.
- Canopy height differences between observers were variable (5-24%), potentially due to different decisions being made about which trees were selected and also measurement error perhaps due to different measurement techniques.
- Canopy intercept and proportion of observations with dead branches in view were fairly consistent at three sites (2-7% difference) with up to 15% difference at one site for each of these two measures.
- Basal area was generally consistent with the same number of stems measured at all sites, and diameter consistent at three sites (up to around 6% difference) but greater differences at one site suggesting a measurement error.
- Differences between coarse woody debris observations were variable with some measurements comparable at all sites, but others differing greatly in dimensions, or not measured by both observers.

The variation between observations found in the structural data suggest good to reasonable consistency for site location details, basal area and canopy intercept, and greater variation in canopy height and measurements of coarse woody debris. Differences may be due to use of different measurement techniques (canopy height), and varied implementation of the method, or in a few cases human error (exact reasons would depend on the type of measurement, and possibly variation in observer experience).

Threats

The results from a comparison of Eco Futures and Subcontractors data for evidence of threats (e.g., rabbit droppings, deer droppings, deer browsing, fox scat, phytophthora, woody weeds and herbaceous weeds) were very similar. There were some differences, for example, at one site the Subcontractors recorded a lot more evidence of deer droppings and browsing, whereas the EcoFutures audit recorded low amounts of browsing (and no evidence of droppings). Also, herbaceous weed evidence differed at some sites and woody weeds were detected at some sites by Subcontractors and not by EcoFutures. Where the original surveys and audit surveys differed may be explained by:

- the interval between the original survey and the audit survey (often one to two months, due to Covid lockdown constraints)
- Larger, woody weeds may have been recruits in low frequency or a branch hanging over plot in low frequency
- error in data input, due to the method of data entry (Excel spreadsheet)

Recommendations to improve detailed surveys:

- Timing of surveys and audit surveys should be within two weeks of each other (this project occurred during Covid lockdowns which delayed the roll out of fieldwork including audits)
- Surveys should be undertaken at the ideal time of year to identify all species, and this should be consistent over the years
- If species vary substantially between observers due to experience/skill and seasonal timing, then any analysis of species data needs to consider these sources of variation.
- Refinement of the definition of what acceptable bounds for vegetation condition is required – what does decline look like, and which factors are the most indicative? For example, how important are small herbaceous plants, especially those which occur in low frequency, to the condition of the site? If important, then identify which species to target in surveys (may be unique to EVC type, level of threat to EVC and/or species of interest)

- What are the objectives? Good baseline but refinement of methodology over time should be based on accumulated data, refinement of understanding of what is most important and audits. Revisit objectives of program and refining the method if needed to meet the objectives
- Training should be improved over time to improve consistency between surveyors.
- Improvements in clarity of written instructions especially for parts of the method where errors are more likely is suggested.
- Longer, more comprehensive, and rigorous training in methodology before surveys. Several days of dedicated in-person training/calibration of all field staff as a group at the same time and at the same, dedicated training sites is recommended. Vetting of data from all observers immediately after this training and prior to start of data collection at monitoring sites is also recommended. (This approach was not possible due to a few factors including the late project initiation and Covid restrictions)
- Refine the data entry to provide drop-down options which must be filled, and have in-built error messages, to reduce the chance of omissions or errors when entering data in the field (i.e. do not use Excel for free text input of floristic data).

7.2 Auditing of the safety, biosecurity and COVID-19 requirements of field staff

Six field subconsultant team members were audited in the field for safety and biosecurity procedures during December and February. These audits revealed that overall field staff were knowledgeable about the management of field risks, appropriately dressed and equipped and conducting themselves safely in the field. No near misses or safety incidents occurred during the project. No transmission of COVID-19 between field staff occurred during the project. The safety audits enabled minor issues to be identified and quickly addressed.

Safety and biosecurity field audits showed minor areas for improvement in biosecurity (boot cleaning) and contents of first aid kits, as well as some aspects of COVID-19 requirements (detailed below). These issues were generally with staff who had not attended in-person training (rapid assessors) and support staff who joined the team late in the field campaign. These staff had therefore not had their equipment sighted in-person by project staff nor an in-person demonstration of what was required. It would have been beneficial if the field audits happened earlier in the field season, so these issues could have been addressed sooner, however the issues were minor and quickly rectified.

Providing equipment and materials for COVID-19 safety and biosecurity requirements as part of in-person training meant that those staff who were trained in person were more likely to be fully compliant in implementation of safety and biosecurity protocols. However, it is acknowledged that in-person training was kept to a minimum in 2021 to manage the risks of COVID-19 transmission and comply with restrictions.

While the COVID-19 protocols for the project were successful overall (no covid transmission among field team members), compliance with some aspects was variable. Implementation of mask wearing, maintaining social distancing, and sanitising equipment/hands was challenging to implement, particularly during training when attention was focused on learning the method. Demonstration of the protocols by EcoFutures staff helped communicate expectations aiming for best practice.

It must also be acknowledged that government COVID requirements and policy also changed rapidly between the initial submission of the EcoFutures bid and the delivery of field assessment. The constant changes to procedure substantially increased the administrative burden of the project. Changed obligations were challenging to communicate and update subconsultants about. The requirement for mandatory vaccination also resulted in the loss of two subconsultants originally involved in the project.

8 Key lessons learnt and recommendations

We have gathered comprehensive information on lessons learnt from the Spring 2021 field campaign identifying potential improvements in terms of project delivery efficiencies, safety improvements, logistics, data compilation and reporting. Full details of lessons learnt from both the project team and field team members is collated in Appendix G, and from the audits in section 7 above. Key recommendations based on the comprehensive information is summarized below in Section 8.1.

Through identification of areas that worked well and areas for improvement, future rapid and detailed vegetation surveys can be improved in Spring 2024. Key lessons learnt from this project could also be considered by Melbourne Water when implementing other field and vegetation assessments more generally.

It is important to note that the Spring 2021 implementation occurred in the unusual circumstances of Covid restrictions which had unavoidable impacts on project management and field surveys. Lessons learnt and recommendations should be read with this in mind.

8.1 Recommendations

To improve future iterations of the SVCE project, we have collated key recommendations from the lessons learnt from the delivery of the 2021 field surveys below.

Recommendations for project delivery

- In future projects, more time be allowed for preparation of safety documentation and protocols, development and delivery of training, field testing of survey software, arrangement of landowner access and scheduling of fieldwork. Ideally a minimum of two months prior to the commencement of field surveys should be allowed.
- Alternative collaborative applications could be considered for document sharing and fieldwork scheduling, such as Monday.com instead of Microsoft Teams which has limited scheduling capability.
- In addition to the authorisation letter provided by Melbourne Water, provide field team members with an identification badge and an explanatory handout that can be provided to landholders during field surveys to facilitate landholder awareness and provision of access to field staff.
- Bring any access notes over from landholder contact spreadsheet and sites allocated spreadsheet to future survey rounds to minimise delays to survey due to access issues.
- Add an access comments section to Survey123 data collection form.
- Ensure Survey123 includes a clear site map and field staff are provided with a KMZ or similar that they can utilise to navigate to survey sites (i.e. an online interactive system e.g. ArcGIS for site maps).
- Provide detailed training on systems utilised for fieldwork scheduling and project documents, such as Microsoft Teams, to ensure project team members can use these systems efficiently.
- The grouping of survey sites and allocating to field team members worked well during the spring 2021 field surveys and a similar approach should be utilised for the spring 2024 field surveys. Where possible the same field teams should complete the field surveys in spring 2024 given their local knowledge and understanding of access for the sites, to maximise safety and efficiency of access.
- Survey123 forms should include a map and GPS coordinates of the sites selected for the SVCE survey now they have been refined through the Spring 2021 surveys.
- Ensure all email communication is sent to the field team using simple, clear, and succinct language.
- If tasks are changed, mass send message to all project team members using email and SMS alerts to ensure field team members receive urgent communications.
- Ensure there is sufficient time budgeted and allocated to the project to manage the complex logistics and data required for delivery. At least $200,000 (accounting for inflation and wage increases) should be included to deliver the project management aspects for the project in the spring 2024 field surveys.

- Ensure future field surveys are delivered by an experienced project manager with local knowledge of the catchments, who is supported by a project team with spatial, data capture and analysis skills, as well as a highly experienced field team with local knowledge.
- Planning survey timing should account for floristic season - surveys should be undertaken at the ideal time of year to identify all species, and this should be consistent over the years for each site

Recommendations for safety, biosecurity, and COVID-19 requirements

- The SVCE Safety and Biosecurity Manual and requirements within this document overall worked well during the spring 2021 field surveys. The SVCE Safety and Biosecurity Manual will need to be updated for the spring 2024 field surveys to reflect current legislation and Victorian government guidelines at the time of the future surveys.
- Commence safety requirements (documentation, equipment, and training) of project staff well in advance of the survey period start as this required extensive follow up and delayed the field start.
- All staff to attend in-person training including a check of safety and biosecurity equipment and materials and a demonstration/run-through of protocols such as boot disinfection.
- Safety and biosecurity audits of field staff should be undertaken within the first month of field surveys commencing to ensure any non-compliances can be quickly identified and rectified early in the season.
- Safety and biosecurity training session to be video recorded for any staff joining later in the season.
- Use the Survey123 form to ensure safety requirements are met to proceed to data collection.
- Currently the Melbourne Water remote work procedures requiring 8 people to attend these surveys would mean surveys in these areas would be financially unviable to deliver and add significant logistical challenges. Safety of staff in these regions could be managed with less staff and strict safety procedures. It is recommended that Melbourne Water review their Remote or Isolated Work Procedure (November 2019, version 17, document ID: 22297233) to determine if more practical and feasible minimum requirements could be developed to allow field surveys in these remote areas by two people.
- To allow Melbourne Water to consider climate change impacts on vegetation and develop effective strategies to manage these impacts within their catchments, surveys in remote areas are recommended in future programs. The capture of data in remote areas is important to understand vegetation communities and plant species that exist only in these areas, the importance of remote areas as refuges and changes in these areas under shifting climatic conditions.
- Future call-ins could be managed using a dedicated phone line that allows text messages and phone calls. The use of text messaging for call-ins would require a clear validation process (i.e. response to messages within 15 minutes) to allow this option to work for the field surveys.
- Ensure that operator experience is reviewed and captured in any field allocation scenario. Ensure that experienced operators are allocated to isolated or difficult to access sites and that a method to capture and rank experience is developed.

Recommendations for data capture and analysis methods

- The Survey123 form for the project (version 5a) should be updated prior to the next field survey into the new version of Survey123 to allow the capture of this data and not require a separate Microsoft Excel spreadsheet for the floristic subplot data.
- Data governance and protocols need to be established and finalised prior to fieldwork commencing.
- Allocate project budget and time for field survey testing prior to data collection stage and no overlapping of actual field survey and survey testing should occur.
- Ensure the Survey123 form is rigorously field tested and finalised prior to implementation of the field surveys. This requires assigning a couple of sites (e.g., 2-3) as field training sites only and not to be used as a data collection site.
- Provide online training on how to use Survey123, tutorials and dummy data to ensure data accuracy and extensive understanding of the program by subcontractors prior to sending them out in the field.
- Actual coordinates collected by field staff (not original reference coordinates from Melbourne Water) should be used for all analysis, visualisation, and future survey rounds. If a single reference coordinate is required, the start of transect 1 (detailed sites) and the upstream coordinate (rapid sites, even those connected to a detailed site) should be used.
- Consider providing differential GPS units to all field staff for improved accuracy of coordinates, particularly at sites where permanent marking of plots was not allowed (e.g. Parks Vic sites).

Recommendations for training on survey methods and data upload requirements

- Provide method cheat sheets for rapid and detailed field surveys prior to training in addition to the more comprehensive methodology information.
- Provide face-to-face training for all field staff (when restrictions or lockdowns are not in place) to enable more interactive learning.
- Develop a Frequently Asked Questions document to add to cheat sheets as the program progresses.
- Update training approach incorporating feedback from field team members following training.
- Provide training to all detailed assessors in one group at the same site for greater efficiency and establishing relationships across the whole group. Use upload of data from this training site as an early opportunity to check all staff are collecting data consistently and can upload data effectively.
- Explore if Microsoft Teams or another platform could be utilised to share lessons learnt and pictures after training, ensuring this is suited to the varying familiarity with such platforms.
- Prior to the next field surveys the method cheat-sheets should be updated to address the queries around lifeforms, plot layout examples, and to ensure positioning of the rapid assessment at a detailed site is the same as the 2021 data collection. Assessors should refer to the 2021 coordinates for the upstream corner of the vegetation visions assessment, not to the coordinates for the detailed transects.
- Prior to the next field surveys the master species list (used in both the Microsoft Excel subplot floristic assessment and Survey123 forms) should be updated to include life form for all species.
- Ensure field staff are provided with instructions on data upload requirements prior to ensure their understanding can be checked and they can ask questions prior to collection of field data.
- Prior to field season start, develop an agreed approach with field team members to ensure timely delivery of data, and update data upload instructions with feedback from field team members.
- Consider a hold point after the training day or day 1 of data collection to allow time for data from each field team member to be checked by project staff and any errors to be identified and rectified.

Recommendations for rapid assessment methods

- Update instructions in the Rapid Assessment Methodology (Appendix A) and Detailed Vegetation Assessment Methodology (Appendix B) to address the queries around lifeforms, and areas of greater variability between observers identified in the audit section of this report.
- Update the master species list used in both Microsoft Excel subplot floristic assessment and Survey123 forms to include life forms for all species.
- Drop the onsite EVC identification.
- Include more threat categories such as rubbish, hazardous waste, etc in the rapid assessment.
- Review vegetation categories to ensure that the broad categories are sufficient, consider refining.
- Review the rapid assessment method for some vegetation types to ensure all vegetation types are included and the scoring is reflective of the condition of the site.

Recommendations for detailed assessment methods

- Update instructions in the Detailed Vegetation Assessment Methodology (Appendix B) to address the queries around lifeforms, and areas of greater variability between observers identified in the audit section of this report.
- Update master species list for the SVCE project based on a download from Flora of Victoria online using the search function (instead of VBA), edited to include:
    - Life form for all species
    - Family and genus level names for both a single species and multiple species (e.g. *Poaceae* sp., *Poaceae* spp., *Poa* sp., *Poa* spp.)
- Ensure only species from the current master list can be entered with all uncertain names using the "other" option. Add instructions to method and training on using the master species list.
- Update instructions and data collection to ensure positioning of rapid plots at detailed sites continues to be conducted in the same area (refer to actual "upstream" coordinates recorded in 2021).
- Add an illustration of position of rapid site in relation to the detailed site to instructions (downstream of the detailed plot at some sites, centred on the detailed plot at other sites).
- Update Survey123 form to allow field staff to easily review data and correct errors prior to upload.
- Amend within Survey123 the ability to enter the transect data in either direction (entered 1-20 and/or 20-1) to help field staff when there is difficult terrain within the site.

Recommendations to improve auditing and inform use of data

- Timing of surveys and audit surveys should be within two weeks of each other (this project occurred during Covid lockdowns which delayed the roll out of fieldwork including audits with this influencing data consistency between observers)
- If species vary substantially between observers due to experience/skill and seasonal timing, then any analysis of species data needs to consider these sources of variation.
- Refinement of the definition of what acceptable bounds for vegetation condition is required – what does decline look like, and which factors are the most indicative? For example, how important are small herbaceous plants, especially those which occur in low frequency, to the condition of the site? If important, then identify which species to target in surveys (may be unique to EVC type, level of threat to EVC and/or species of interest)
- Refinement of methodology over time should be based on accumulated data, refinement of understanding of what is most important and audits. Revisit objectives of program and refine the method if needed to meet the objectives.

Appendix A – Rapid Vegetation Assessment Methodology

Rapid Riparian Vegetation Condition Assessment (Vegetation Visions)

MW Streamside Vegetation Monitoring, FINAL version EcoFutures 19th Oct 2021

The goal of the Vegetation Visions assessment is to provide a rapid visual estimation of vegetation condition over a large number of sites. It uses a set of descriptors for vegetation condition states which guides the assessor to one of six categories of vegetation condition.

The method is as follows, referring to Tables 1 to 4 below (**Note: data is to be recorded into the Survey123 app**):

1. Follow the GPS points provided to locate the Vegetation Visions site. If for some reason the site does not match the vegetation type, it cannot be assessed and/or the location needs to be moved, make a note of this and record a GPS point at the new location. Note if only conducting a rapid assessment (not as part of a detailed assessment) it is not necessary to relocate to match the expected EVC (which is considered in detailed assessment).

2. Choose an area 20m x 100m (0.2 ha) in size along one side of the waterway (Figure 1). Assessments should take between 5 and 15 min.

3. In Table 1, record the date, site name, assessor name, area being surveyed (e.g., 0.2ha, 1ha and notes on level of fragmentation) and the location of the site by recording the Eastings and Northings of the upstream and downstream point that is furthest away from the waterway (see Figure 1).

4. Determine the relevant ecological vegetation class (EVC) for the vegetation being assessed (record in Table 1). This should be based on landscape context, remnant vegetation and estimated/modelled EVC information.

5. Identify if the vegetation type (Table 1, Figure 2) you are in is either:
   i) forest and woodland,
   ii) woody non-treed vegetation (e.g., scrubs and heath), or
   iii) non-woody, non-treed vegetation (e.g., herbaceous, grassland).

Note: This may be able to be defined from the EVC you have identified, e.g., Lowland Forest under *forest or woodland*, Plains Grassland under *non-woody non-treed vegetation*, etc. If it is a forest or woodland which has been cleared of trees, it should still be assessed as that vegetation type.

6. Familiarise yourself with Table 1 and walk over the selected 0.2 ha site taking note of the composition and cover of vegetation elements (spend 3 to 5 minutes). Assign component scores (spend 2 to 10 minutes) for:
   a. Component A (one score in A1, A2 **or** A3) – See also Figure 3
   b. Component B (one score in B1, B2 **or** B3) – See also Table 3 for a list of lifeforms.
   c. Component C, D and E (giving a score to each) – See also Table 3 for instream lifeforms.
   d. Component F weediness (give a score here)

Record each of the component scores separately on the right hand side column of Table 1, and calculate the Overall Score by tallying up the individual component scores (this will be calculated automatically in Survey123). To get a Relative Score, take the Overall Score and refer to Table 2. For example, an Overall Score of 8 would get a Relative Score of 2.

7. Record the weediness of the site *separately* to the above components in the two additional rows. Refer to White et al (2019) for weeds considered as *highly invasive*.

8. Using Table 3, record the terrestrial and instream lifeforms present. Instream lifeforms can be skipped if needed e.g. due to access difficulty, visibility and safety issues due to flooding – make a note.

9. Using Table 4, record the presence or absence of any threats present in the survey area.

Understanding the different components

Structural components (A1-A3)*:* This component evaluates the total site cover (not relative cover) by monitoring the number of strata present at a site as well as the percentage cover of native species. The site needs to have >10% native vegetation cover for it to get a score above zero (see Figure 3 and Table 1).

Care should be taken to assess treeless examples of woodland EVCs under A1. Grassland and similar vegetation with a closed structure is not penalised for potential influence on plant diversity. This is regarded a short-term disturbance factor and dominance of indigenous components over weeds is preferred. Vegetation cover in escarpment or rocky outcrop EVCs is influenced by the availability of recruitment space. Total site cover should be assessed on a horizontal plane. Bryophyte and lichen cover on rock surfaces should be included in combined plant cover estimates.

Native plant species richness (B1 to B3)*:* This component evaluates the native plant species richness at a site, which is assessed independently of plant age or size. There is no requirement to record the species present at the site, but provide an estimate of the species richness (Table 1). Count only species that are indigenous to the site[1], and only include lifeforms (Table 3) that are present at the time of assessment.

Instream vegetation (C)*:* Count number of instream plant lifeforms (Table 3) or species and assign them a relevant score based on Table 1.

Patch shape and fragmentation (D): Assess the component at approximately a 1 ha scale (50 m up and downstream from the site and 50 m laterally from the waterway. A patch is contiguous native vegetation of any EVC which would gain a structure score of 2 or more within this larger area. Assign a score according Table 1.

Regeneration (E): Regeneration assesses recruitment across vascular plant lifeforms. A recruit is any plant which is estimated to be 1 to 3 years old. Current season seedlings should not be included in this evaluation as we want to record successful recruit survival. Evidence of a recruit varies depending on species and it is up to the assessor to interpret the age of plants depending on site conditions. Fertile material is a poor predictor of plant maturity and should not be relied upon on its own. Recruits may include vegetative re-sprouts which are capable of growing into a new individual.

Weediness*:* Weeds include any plant taxon which is not regarded to be indigenous to the Melbourne region. Some taxa which are indigenous but have become weedy outside of their assumed natural range may be assessed as weeds. Weed cover is assessed as relative cover (i.e. percentage of total vegetation cover at the site). Reference to 'Highly Invasive' weeds in White *et al*. (2018) is required to determine the Weediness scores, which is an estimate of the species capacity to invade and

[1] Established plantings/revegetation must be of species consistent with the EVC to be included.

persist in natural ecosystems. Relative cover of highly invasive weeds refers to approximate cover percentage across the site (not the relative proportion of total weed cover).

Woody versus non-woody: To determine if a plant is woody, at least the basal part of the main stem should be conspicuously woody (non-photosynthetic and +/- rigid). Some small shrubs in Chenopodiaceae and other families may appear herbaceous. It is therefore important that the taxon is recorded against lifeforms so that any inconsistencies can be considered in data analysis.

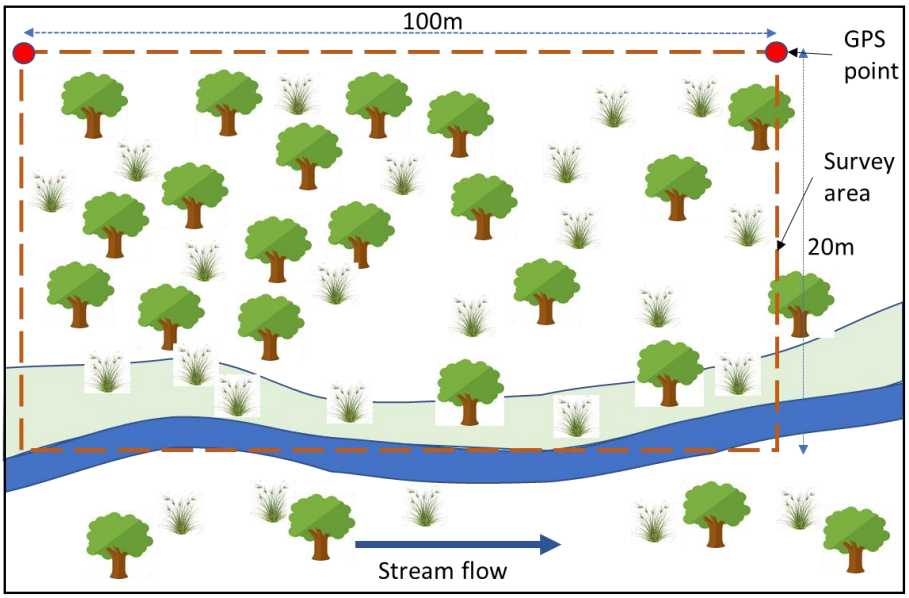


Figure 1. Survey area for the Vegetation Visions field assessment.

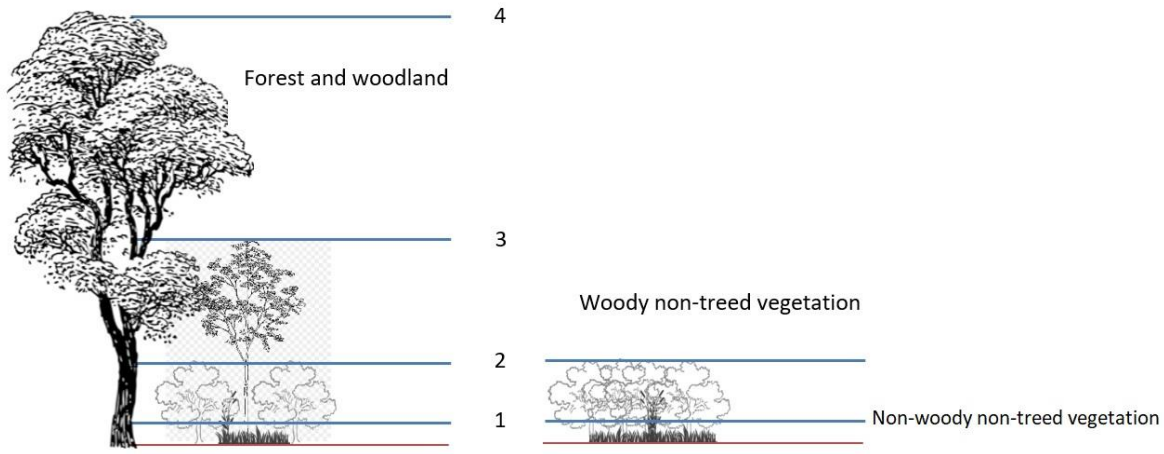


Figure 2. The different vegetation strata, from ground layer (1) and understory (2), to midstory (3) and overstory (4) vegetation. Similarly the different vegetation types, from non-woody non-treed vegetation (1 to 2), woody non-treed vegetation (2 to 3) and forest and woodland (3 to 4).

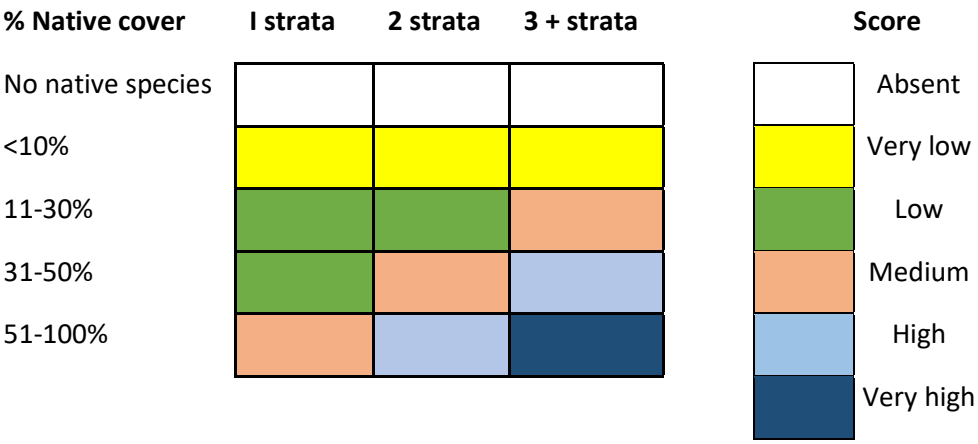


Figure 3. Scoring system for the structural components of a site (component A).

Table 1. Assessment of the different components at a site and their relative score.

Date:	**Site Name:**	**Assessor Name:**	**EVC name/number:**
Survey area (e.g. 0.2 ha)**:**	**Notes:**		
Upstream Easting:	**Upstream Northing:**	**Downstream Easting:**	**Downstream Northing:**

Components	**Quality** **Absent = 0**	**Very low = 1**	**Low = 2**	**Medium = 3**	**High = 4**	**Very high = 5**	**Score (0-5)**
A1 Structure **Forest and woodland**	Non-indigenous vegetation	Estimated combined native cover ≤10%	One to two strata with estimated combined native cover 11–30%. One stratum with estimated combined native cover 31–50%.	One stratum with estimated native cover >50%. Two strata with estimated native cover 31–50%. Three or more strata with estimated combined native cover 11–30%.	Two strata with estimated combined native cover >50%. Three or more strata with estimated combined native cover 31–50%.	Three or more strata with estimated combined native cover >50%.	
A2 Structure **Woody non-treed vegetation e.g. scrubs, heaths**	Non-indigenous vegetation	Estimated combined native cover ≤10%	Estimated combined native cover 11–25%	Estimated combined native cover 26–50%	Estimated combined native cover >50%, single stratum	Estimated combined native cover >50%, two or more strata	
A3 Structure **Non-woody non-treed vegetation e.g. grassland**	Non-indigenous vegetation	Estimated combined native cover ≤10%	Estimated combined native cover 11–25%	Estimated combined native cover 26–50%	Estimated combined native cover 51–75%	Estimated combined native cover 76–100%,	
B1 Richness **Forest and Woodland**	Non-indigenous vegetation	Very low species richness (1–3 species)	Low species richness (4–8 species)	Medium species richness (9–15 species)	High species richness (16+ species in less than 8 lifeforms)	Very high species richness (16+ species in at least 8 lifeforms)	
B2 Richness **Woody non-treed vegetation diversity e.g. scrubs, heaths**	Non-indigenous vegetation	Very low species richness (1 species)	Low species richness (2–6 species)	Medium species richness (7–13 species)	High species richness (13+ species in less than 7 lifeforms)	Very high species richness (13+ species in at least 7 lifeforms)	
B3 Richness **Non-woody non-treed vegetation e.g. grassland**	Non-indigenous vegetation	Very low species richness (1 species)	Low species richness (2–6 species)	Medium species richness (7–13 species)	High species richness (13+ species in less than 5 lifeforms)	Very high species richness (13+ species in at least 5 lifeforms)	
C **Instream vegetation composition**	None or non-indigenous vegetation	Instream vegetation of 1 species.	Instream vegetation of 2 species or lifeforms	Instream vegetation of 3 species or lifeforms	Instream vegetation of 4 species or lifeforms	Instream vegetation of 5+ species or lifeforms	

Date:	**Site Name:**	**Assessor Name:**	**EVC name/number:**
Survey area (e.g. 0.2 ha)**:**	**Notes:**		
Upstream Easting:	**Upstream Northing:**	**Downstream Easting:**	**Downstream Northing:**

Components	**Quality** **Absent = 0**	**Very low = 1**	**Low = 2**	**Medium = 3**	**High = 4**	**Very high = 5**	**Score (0-5)**
D **Patch shape and fragmentation**	Non-indigenous vegetation	Native vegetation confined to 20 m from waterway on one side only, not longitudinally contiguous.	Native vegetation confined to 20 m from waterway on both sides of waterway, not longitudinally contiguous.	Native vegetation either longitudinally or laterally contiguous with native vegetation outside of assessment area, to within 100 m from boundary.	Native vegetation longitudinally and laterally contiguous with native vegetation outside of assessment area, >100 m from boundary in one direction.	Native vegetation longitudinally and laterally contiguous with native vegetation outside of assessment area, >100 m from boundary in both directions.	
E **Regeneration**	Non-indigenous vegetation	No evidence of recruitment.	Little evidence of recruitment, few recruits present with restricted distribution.	Little evidence of recruitment, few recruits present with scattered distribution.	Recruitment clearly evident with more than a few recruits in less than half of lifeforms present. No evidence of canopy species recruitment in forests and woodlands.	Recruitment clearly evident with more than a few recruits in more than half of lifeforms present. May or may not include evidence of canopy species recruitment in forests and woodlands. ***OR*** If Recruitment clearly evident with more than a few recruits in less than half of lifeforms present, then evidence of canopy species recruitment required in forests and woodlands.	
F Weediness	Weed species >50% relative cover including highly invasive species	Weed species >50% relative cover without highly invasive species OR weed species 10-50% relative cover including highly invasive species.	Weed species 10-50% relative cover without highly invasive species	Weed species <10% relative cover including highly invasive species	Weed species <10% relative cover without highly invasive species	No weeds detected	
						Overall Score	
Weediness (separate to overall score)							
Weediness	No weeds detected	Weed species <10% relative cover without highly invasive species.	Weed species <10% relative cover including highly invasive species.	Weed species 10–50% relative cover without highly invasive species.	Weed species >50% relative cover without highly invasive species ***OR*** Weed species 10–50% relative cover including highly invasive species.	Weed species >50% relative cover including highly invasive species.	

Date:	**Site Name:**	**Assessor Name:**	**EVC name/number:**
Survey area (e.g. 0.2 ha)**:**	**Notes:**		
Upstream Easting:	**Upstream Northing:**	**Downstream Easting:**	**Downstream Northing:**

Components	**Quality**						**Score (0-5)**
	Absent = 0	**Very low = 1**	**Low = 2**	**Medium = 3**	**High = 4**	**Very high = 5**	
Weediness (Highly Invasive Species)	No highly invasive weeds.	<10% relative cover of highly invasive species	10-25% relative cover of highly invasive species	26%-50% relative cover of highly invasive species	51-75% relative cover of highly invasive species	76-100% relative cover of highly invasive species	

Table 2. Calculation of the Overall Score to the Relative Score.

																														Score
Overall Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Relative Score	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	

Table 3. Assessment of the lifeforms present at the site.

Date:	**Site Name:**	**Assessor:**
Terrestrial Lifeforms		**Presence**
Angiosperm Tree	Flowering woody plant with one main stem/trunk	
Gymnosperm tree	Conifer with one main stem/trunk	
Narrow-leaved upright Shrub*	Woody plant with multiple upright stems, leaves > 4 times longer than width or with leaves reduced and photosynthetic branches	
Broad-leaved upright shrub*	Woody plant with multiple upright stems, leaves < 4 times longer than wide	
Narrow-leaved prostrate shrub*	Woody plant with multiple stems +/- horizontally spreading, leaves > 4 times longer than width or with leaves reduced and photosynthetic branches	
Broad-leaved prostrate shrub*	Woody plant with multiple stems +/- horizontally spreading, leaves < 4 times longer than wide	
Narrow-leaved herb*	Herbaceous plant that is not a grass, sedge or rush, leaves > 4 times longer than width or without visible leaves	
Broad-leaved herb*	Herbaceous plant that is not a grass, sedge or rush, leaves < 4 times longer than wide	
Herb without leaves*	Herbaceous plant with no obvious leaves e.g. some saprophytes.	
Tufted grass, sedge or rush	Graminoid with three or more leaves arising from a common base	
Spreading grass, sedge or rush	Graminoid with no obvious tufted groups of leaves	
Climber, vine or twining plan	Any climbing, trailing or twining plant which when advanced grows on other plants/structures for vertical support	
Bryophytes or lichens	Mosses, liverworts, hornworts and lichens combined	
Tree fern	Fern with single trunk with a crown of fronds at the top	
Ground fern or fern-ally	Fern with fronds arising individually or in clumps from the ground.	
Epiphytic fern or fern-ally	Fern with fronds growing on the body of another plant (often a tree or tree fern)	
Mistletoe	Parasitic shrub often on the branches of eucalypts or wattles	
Instream plant lifeforms (for riparian applications)		**Presence**
Floating grass or grass-like plant	Free floating (but not necessarily at the surface), not attached to substrate	
Floating forb	Free floating (but not necessarily at the surface), not attached to substrate	
Emergent grass or grass-like plant	Attached to substrate with leaves or flowering stem +/- upright at or above the waterline	
Emergent forb	Attached to substrate with leaves or flowering stem +/- upright at or above the water surface	
Submergent grass or grass-like plant	Attached to substrate with leaves below water surface	
Submergent forb	Attached to substrate with leaves below water surface	
Submergent or emergent bryophytes (mosses, liverworts or hornworts combined)	Attached to substrate with leaves below, at or above water surface	
Submergent of emergent macro algae	Attached to substrate with body below, at or above water surface	
Floating macro algae	Free floating, not attached to substrate	

Note: Leaves for the purpose of this assessment are true leaves or leaf-like structures which function as leaves. The following considerations apply. Green photosynthetic branches including minute true leaves (examples occur within Casuarinaceae, Santalaceae, Polygonaceae, Cupressaceae) are treated as narrow-leaved. Phyllodes or cladodes (examples occur within Fabaceae) and assessed according to their dimensions.

Table 4. Table of threats for Vegetation Visions sites

Date:	**Site Name:**		**Assessor:**		
Threat	**Observed**	**Not Observed**	**Threat**	**Observed**	**Not Observed**
Rabbit pellets			Evidence of Phytophthora		
Rabbit warrens			Evidence of acid sulphate soils impacts		
Deer pellets			Native vegetation clearing		
Deer browsing			Stock access		
Deer wallows			Recent understory fire*		
Fox scats			Recent canopy fire*		
Encroachment^			Land slip or stream bank collapse		
Storm water/grey water discharge			Soil surface erosion		

^ Encroachment is human use *Estimated or known in <3 years. **Conspicuous rill or gully erosion by exposed soil/clay or associated sediments.

Appendix B – Detailed Vegetation Assessment Methodology

Riparian Vegetation Monitoring – summary sheet (FINAL version EcoFutures 19th October 2021)

Refer to detailed plot layout diagram (final figure of this document)
Note references to column headers or data sheet are to the original paper data sheet which is not used in 2021 (Excel and Survey123 app used).

COVID-19 instructions: comply with procedures in the SWMS and Health Dept COVID advice regarding minimum separation distance, masks, disinfection etc.

2021 sampling – ignore indicator species part of datasheet. **Refer to rapid method to complete Vegetation Visions score at all detailed sites.**

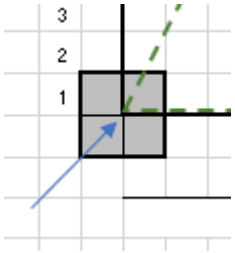
Task and equipment division

Set up

- Run tape parallel to creek (TPC) first to check site fits within 20 m MW corridor
- Establish 3 transects, 10 m apart and permanently mark both ends of each transect. GPS the location of 6 points i.e. the start and end of each quadrat (in MGA). Exactly the same coordinates recorded by Support and Botanist.
- Record header information and photograph both the site from the T1s reference stake, and the T1s reference stake to assist locating the stake. See pg 8
- On the alignment of the first transect, additional subplot measurements are taken at 40, 60, 80 & 100 m beyond T1end. These additional plots are not permanently marked. Record species presence in each 1 x 1 m cell. Record sub-plot distance for each species in the notes field of datasheet e.g. *Acacia dealbata* – Notes: 40, 80. Also record cohorts of canopy trees present at each sub-plot (see cohort info below)**.

Transect 1 start (T1s) location in corner of site – Sub-plot 1

Left- hand bank example.



Support (records data in Survey123)
Layout TPC, Transect 2 and 3
Install stakes at the start and end of Transects 1, 2 and 3 record locations.
Provide coordinates to Botanist for entry in Excel.
Take photos and record site info (seek Botanist input to site notes etc as required)

Botanist (records data in Excel)
Lay out Transect 1

Sub-plot sampling - floristics

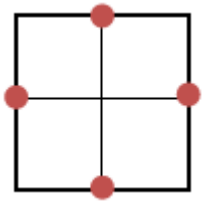
- Lay out tape measure along transect
- Place 2 x 2 m sub-plot so that centre of sub-plot is on sample points 0m, 5m, 10m, 15m and 20m. Pg5.
- Record taxon presence only in each 1 x 1 m cell. Include species overhanging each cell.
- Write total cells occupied for each species in each sub-plot on data sheet. See example right. (values 1 to 4)
- Record if fertile material observed
- Assign lifeform code
- Fill total number of cells column (sum sub-plots)

Scientific Name	Sub-plot 1	Sub-plot 2	Sub-plot 3	Sub-plot 4	Sub-plot 5	Sub-plot 6	Sub-plot 7	Sub-plot 8	Sub-plot 9	Sub-plot 10	Sub-plot 11	Sub-plot 12	Sub-plot 13	Sub-plot 14	Sub-plot 15
Acacia dealbata	3	1			2	4	1								

Sub-plot numbers are shown on the site layout diagram.

Botanist
Records all data as described in sub plots sampling florisitcs.

Support person is focused on other structural aspects described below.

• Search remainder of 20 x 20 m site, record presence of additional species not in sub-plots. Allocate 20 mins		
Sub-plot sampling – lifeforms • Each species has one lifeform regardless of height. • Record maximum height of each lifeform from sub-plot – to <u>nearest 10 cm</u>.	Measure height to top of vegetative material, not inflorescences. Use a height pole, not a tape measure.  Lifeform / Subplot: Angiosperm Tree; Gymnosperm tree; Narrow-leaved upright Shrub; Max. height 1: 4, 1.5 2: 1, 2.8 3: 1, 1.6 4: 5: 1, 0.8	**Botanist** Record all data as described in sub plots sampling lifeforms, including the maximum height of each lifeform from sub-plot – to <u>nearest 10 cm</u>.
Sub-plot sampling – Pest animals, weeds, other (shaded column headers) • Count number of droppings from rabbit and deer within each sub-plot and record on sheet. Exact count not required, use categories: 0-10, 11-20, 21-50, 51-100, >100. • Count number of 1 x 1 m cells occupied by remainder of threats and record on sheet.	Rabbit droppings - total count; Deer droppings - total count; Deer browsing; Fox scats; Phytophthora evidence; Woody weeds; Herbaceious weeds 12; 0; 3; 0; 0; 1; 2 First two columns are counts. Remainder are 1m^2 cells occupied.	**Botanist** record Pest animals, weeds, other (grey shaded column headers)
Sub-plot sampling – soil erosion, exposed rock and organic litter • In sub-plots 1,3,5,6,8,10,11,13,15 record: ➔ Presence of conspicuous rill or gully erosion in each 1 x 1 m cell. ➔ Presence of exposed rocks (>10cm diam.) in each 1 x 1 m cell. ➔ Number of point touches of litter (detached material to 10 mm diameter) on four edges of sub-plot. Record number of organic litter touches on data sheet. Use a pin of 5-6mm diameter.	Organic litter 3 3 4 4 2  Use 5-6mm diameter pin for litter point touches. Measure litter touches at points of sub-plot shown with red dot.	**Botanist** to record **organic litter, soil erosion and exposed rock**

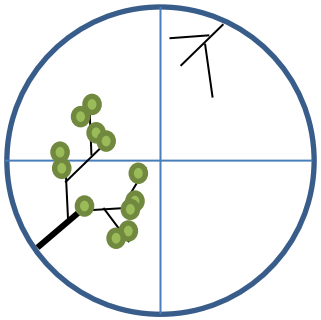
Canopy cover and dieback

Starting at T1s (Pg5), record canopy intercepts with a GRS densitometer at 1 m intervals along each transect. Record canopy intercept as either 0, 1, 2 or 3. Ie

- 0 = No intersect
- 1 = Intersect
- 2 =Tree-fern or mid-storey obstruction; canopy intersect not likely
- 3 = Tree-fern or mid-storey obstruction; canopy intersect likely

Record whether this intercept is live/dead (if 1, or 3 selected)

- Hold densitometer approx. 25cm from eye (strap firm/tight when viewing), to keep a consistent view area.
- Take 60 measurements (20 on each transect).
- Canopy cover is defined as canopy species and individuals >5 m tall.
- Do not record species of canopy tree.
- At each canopy intercept point, record whether dead branches are visible anywhere in the view of the densitometer (not just at the crosshairs).



This densitometer view shows no canopy intercepted (in cross hairs) and dead branches present in view area.

1	2	3	4	5	6	7	8	9	10	11	1
31	32	33	34	35	36	37	38	39	40	41	4

Cross numbers on datasheet with canopy intercept recorded.

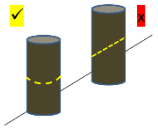
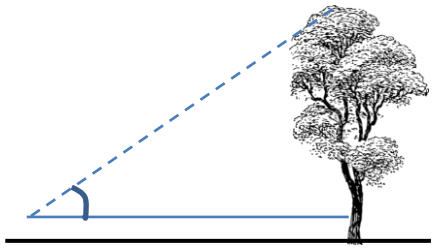
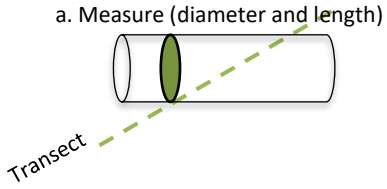
Support person

to assess Canopy cover and dieback

Vegetation removal

- Record percentage of site with evidence of anthropogenic vegetation removal that appears to have taken place in the last 5 years. Percentage is determined by percentage of sub-plot occupancy. Separate % for upper, middle and lower strata.

Support person

<table>
<tr><td colspan="2">Number of dead trees
Record total number of dead trees. Only count those >5 m tall and with DBH >10 cm.
Measure diameter from top side of the trunk (upslope).
Ensure tape is perpendicular to the axis of the trunk.
Dead trees are those with no living foliage.</td><td>  </td><td>Support person</td></tr>
<tr><td>Canopy height
Record heights of three tallest canopy trees in site (20 x 20 m area). Record all trees if fewer than three.
Only include trees with their base at ground >50% inside the site.
Use a clinometer to calculate height if laser rangefinder unavailable.
Canopy trees are >5 m tall and within 30% of the tallest tree within the site.
Measure only canopy species which are considered native to the site.</td><td>  </td><td>Support person</td></tr>
<tr><td colspan="2">Canopy tree species cohorts
Record cohorts of canopy trees present as C (canopy), Sa (sapling) and/or Se (seedlings) in 20 x 20 m site.
Do not record species.
A seedling is <15 cm tall with few leaves.
A sapling has a stem <10 cm diameter and >15 cm tall.</td><td>Botanist</td></tr>
<tr><td>Large woody debris (“logs”)
Walk the dotted line transect shown in the detailed plot layout diagram (Pg5).
Where the transect crosses a log, measure the diameter (a). If too narrow at intercept then not counted.
For the same log, measure its length (all contiguous sections >10 cm diameter).
Don’t measure a log twice. If branched, count only main intersecting part unless additional branch is intersected and >10cm in its own right.</td><td>  </td><td>Support person</td></tr>
</table>

<table>
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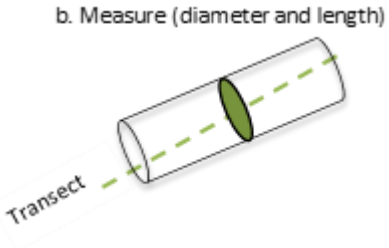
<td>

- Include contiguous length outside of 20 x 20 m site if applicable.
- If a log runs along the alignment of a transect section, measure diameter at its widest point (for the section occupied by the transect line) (b).

</td>
<td>



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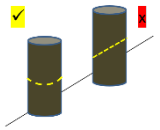
Canopy tree stem basal area (as per diagram).

- Measure DBH of all canopy species trees that are living, >5m tall and >10 cm DBH. Measure each with a DBH tape or forestry callipers.
- Measure diameter from top side of the trunk (upslope).
- Measure over bark, burls etc at 1.3 m above the ground.
- Measure all living stems of multi-stem trees >10 cm diameter noting dead stems (do not count these as dead trees).



</td>
<td>**Support person**</td>
</tr>
<tr>
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Other threats (additional information, see Table below)

- Record threats in table below as observed or not observed within the 20 x 20 m site.
- Note if inside 20 x 20 m site and / or immediately outside site (adj.).
- This is in addition to threats information recorded above in subplot.

</td>
<td>**Support in discussion with Botanist**</td>
</tr>
<tr>
<td colspan="2">

Instream plant lifeforms (see Table below)

- Record instream plant lifeforms, from instream plant lifeform table below. Species information not essential.

</td>
<td>**Support in discussion with Botanist (entered in Survey123 as part of Vegetation Visions along with Terrestrial lifeforms)**</td>
</tr>
</table>

**If there is no property access beyond 20 m from the waterway, then additional subplots may not be possible. If this is the case then write notes on the composition of the adjacent vegetation to 100 m e.g. native vegetation, pasture, approximate distance to change in vegetation type.

Threat	Observed	Not observed	Threat	Observed	Not observed
Rabbit pellets			Evidence of Phytophthora		
Rabbit warrens			Evidence of acid sulphate soil impacts		
Deer pellets			Native vegetation clearing		
Deer browsing			Stock access		
Deer wallows			Recent understorey fire*		
Fox scats			Recent canopy fire*		
Encroachment#			Land slip or stream bank collapse		
Storm water / Grey water discharge			Soil surface erosion**		

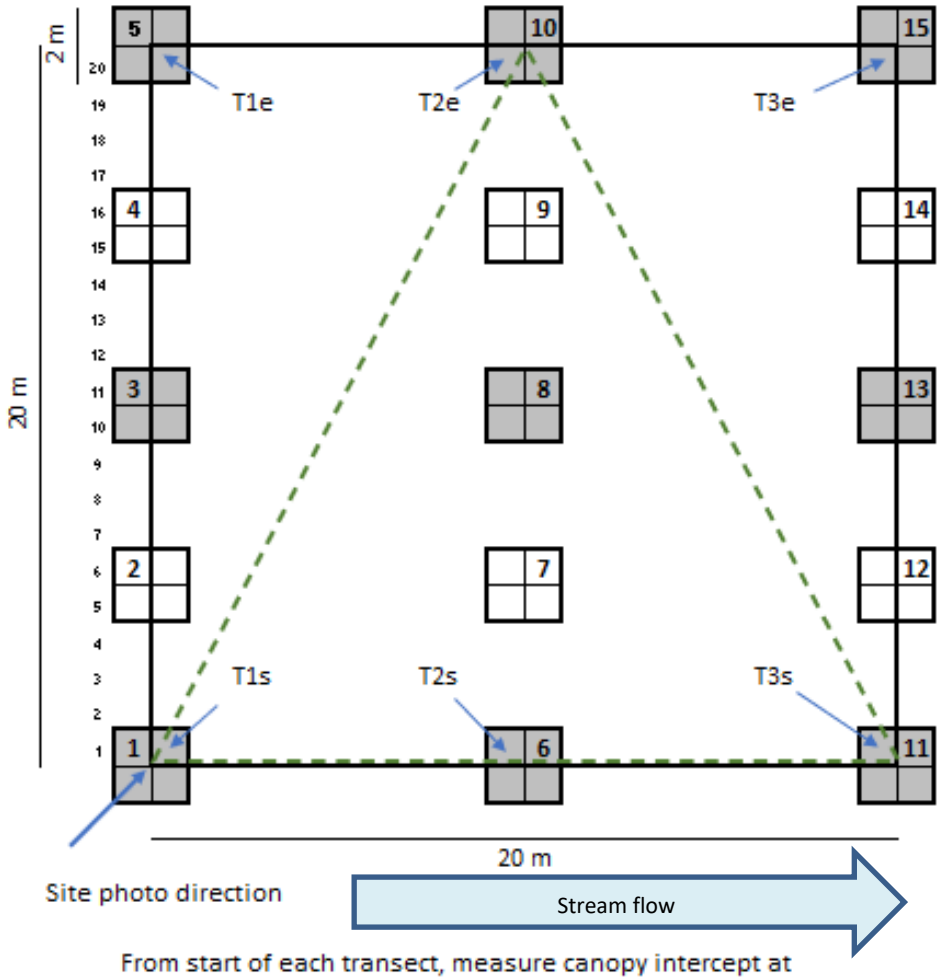
*Estimated or known <3 years. **Conspicuous rill or gully erosion evident by exposed soil/clay and associated sediments.
#Encroachment refers to anthropogenic land use e.g. extending recreational areas or veggie patches into riparian area.

Terrestrial lifeforms	
Angiosperm Tree[1]	Flowering woody plant with one main stem/trunk
Gymnosperm tree	Conifer with one main stem/trunk
Narrow-leaved upright Shrub*	Woody plant with multiple upright stems, leaves > 4 times longer than width or with leaves reduced and photosynthetic branches
Broad-leaved upright shrub*	Woody plant with multiple upright stems, leaves < 4 times longer than wide
Narrow-leaved prostrate shrub*	Woody plant with multiple stems +/- horizontally spreading, leaves > 4 times longer than width or with leaves reduced and photosynthetic branches
Broad-leaved prostrate shrub*	Woody plant with multiple stems +/- horizontally spreading, leaves < 4 times longer than wide
Narrow-leaved herb*	Herbaceous plant that is not a grass, sedge or rush, leaves > 4 times longer than width or without visible leaves
Broad-leaved herb*	Herbaceous plant that is not a grass, sedge or rush, leaves < 4 times longer than wide
Herb without leaves*	Herbaceous plant with no obvious leaves e.g. some saprophytes.
Tufted grass, sedge or rush	Graminoid with three or more leaves arising from common base
Spreading grass, sedge or rush	Graminoid with no obvious tufted groups of leaves
Climber, vine or twining plant	Any climbing, trailing or twining plant which when advanced grows on other plants/structures for vertical support
Bryophytes or lichens	Mosses, liverworts, hornworts and lichens combined
Tree fern	Fern with single trunk with a crown of fronds at the top
Ground fern or fern-ally	Fern with fronds arising individually or in clumps from the ground.
Epiphytic fern or fern-ally	Fern with fronds growing on the body of another plant (often a tree or tree fern)
Mistletoe	Parasitic shrub often on the branches of eucalypts or wattles
Instream plant lifeforms	
Floating grass or grass-like plant	Free floating (but not necessarily at the surface), not attached to substrate
Floating forb	Free floating (but not necessarily at the surface), not attached to substrate
Emergent grass or grass-like plant	Attached to substrate with leaves or flowering stem +/- upright at or above the waterline
Emergent forb	Attached to substrate with leaves or flowering stem +/- upright at or above the water surface
Submergent grass or grass-like plant	Attached to substrate with leaves below water surface
Submergent forb	Attached to substrate with leaves below water surface
Submergent or emergent bryophytes (mosses, liverworts or hornworts combined)	Attached to substrate with leaves below, at or above water surface
Submergent of emergent macro algae	Attached to substrate with body below, at or above water surface
Floating macro algae	Free floating, not attached to substrate

1. Some *Eucalyptus* trees may have more than one trunk from what appears as a common base. These should be included in angiosperm tree with the exception of mallee trees which can be included in upright shrub if appropriate.

Detailed plot layout – Left hand bank example (additional subplots extend out from transect 1 on the left in this case, at 40, 60, 80 and 100m). Entire layout will be "flipped" if on the right bank, when Transect 1 and additional subplots will be on the far right. Transect 1 is always furthest upstream. Determine left/right bank facing downstream.

T1s e.g. Transect line 1 start. Number in sub-plot are sub-plot number. GPS at 1,5,6,10,11 and 15.



From start of each transect, measure canopy intercept at 1 m intervals to 20 m (i.e. 60 measurements).
Green dashed line - large woody debris intercept transect
Grey shaded plots are used for soil, rock and litter measurement.

Appendix C – SVCE Safety and Biosecurity Manual

*Note – this document has been provided as a standalone document to Melbourne Water to reduce the size of the report.

Appendix D – SVCE Safety and Biosecurity audit checklist

Streamside Vegetation Assessment, Safety Audit 2021 – checklist of safety equipment and procedures

Subconsultant names: _____

EcoFutures auditor names: _____ Date: _____

Item No.	Equipment/Procedure	Relevant document (if applicable)	Equipment/ procedure in use? (Y/N)	Comment	If non-compliant, what action taken / instruction given? (e.g. follow-up reminder email or sent home if serious breach)
1	Provide us with copies of relevant safety documentation, for example drivers licence and COVID vaccination declarations.	All subbies have completed this.			
2	Read the current SVA Safety and Biosecurity Manual in full, including the overarching SWMS.	All subbies have read and completed the acknowledgement page.			
3	Check you have the required PPE, COVID kit and hygiene kit items				
	Biosecurity hygiene kit				
	Long sleeved shirt				
	Long trousers				
	Boots with proper ankle foot support				
	Gaiters				
	High visibility vest or shirt				
	Broad brimmed hat				

Item No.	Equipment/Procedure	Relevant document (if applicable)	Equipment/ procedure in use? (Y/N)	Comment	If non-compliant, what action taken / instruction given? (e.g. follow-up reminder email or sent home if serious breach)
	Safety glasses and/or sunglasses that provide equivalent protection				
	Pierce resistant gloves				
	Weatherproof jacket				
	Water (minimum of 2L on person when away from the car)				
	Spare water (minimum of 10L in vehicle)				
	Sunscreen				
	Insect repellent				
	COVID-19 kit – including hand sanitiser (in car and on person), gloves, mask and disinfectant wipes				
	High-risk remote area first aid kit (in car and on person when working away from the car)				
	Snake bite kit (in car and on person when working away from the car)				
	Mobile phone and car charger				
	Satellite phone and/or personal location beacon (either a SPOT device or InReach) and car charger				

Item No.	Equipment/Procedure	Relevant document (if applicable)	Equipment/ procedure in use? (Y/N)	Comment	If non-compliant, what action taken / instruction given? (e.g. follow-up reminder email or sent home if serious breach)
4	Confirm field staff are complying with COVID safe fieldwork practices	Refer to Table 3 (attached below) of the SVA Safety and biosecurity manual (EcoFutures 2021)			
5	Confirm field staff are complying with the hygiene fieldwork procedures.	Refer to Table 10 (attached below) in the SVA Safety and biosecurity manual (EcoFutures 2021)			
6	Complete the call-in register	Check call-in register is completed and accurate for the site			
7	Complete the vehicle Prestart checklist	Refer to Attachment C (attached below) in the SVA Safety and biosecurity manual (EcoFutures 2021). This should be completed weekly and one form for each field vehicle.			
8	Complete the daily Take 5 pre-task risk assessment checklist	Refer to Attachment D in the SVA Safety and biosecurity manual (EcoFutures 2021). Check completed daily (one per site) paper forms if Survey123 not in use			

Extracts from the SVA Safety and biosecurity manual (EcoFutures 2021)

Table 1. COVID safe fieldwork practices and field staff requirements

Victorian Government COVID safe workplace principles	Victorian Government COVID safe workplace recommendations	Field staff requirements
1. *Practise physical distancing*	• Where possible within the workplace, aim for workers and visitors to maintain physical distancing of 1.5 metres.	Where practical to do so, field staff will travel in individual vehicles to the field survey sites. There must be no more than two persons in a vehicle at any one time, unless there is an emergency. Field staff will maintain physical distancing of 1.5m at all times when undertaking the field surveys, unless there is an emergency and/or first aid is required to be administered.
2. *Wear a face mask*	• Face masks: must be carried at all times and must be worn indoors and outdoors by Victorians aged 12 years or over except if at home, or when visiting an intimate partner's place of residence or if an exception applies. You can remove your mask to eat and drink.	While undertaking the field surveys, all field staff will be required to adhere to current face mask requirements, as outlined at: coronavirus.vic.gov.au/face-masks Audits will be undertaken on field staff by the EcoFutures Project Manager to confirm compliance with face mask requirements.
3. *Practise good hygiene*	• Frequently and regularly clean and disinfect shared spaces, and high touch communal items. • Make hand sanitiser available for all workers and encourage regular handwashing.	• Each field staff member will be provided and carry a COVID-19 kit, which will include hand sanitiser (in car and on person), gloves, masks and disinfectant wipes to ensure effective hygiene procedures can be implemented in the field and help prevent the spread of COVID-19. Field staff are required to monitor their COVID kit supplies and restock as necessary. • Field staff must sanitise their hands prior to, during and after fieldwork. • There will be no sharing of PPE, food, or water between team members. • Sharing of field equipment will be minimised and where field equipment is required to be swapped or shared between field staff the equipment will be disinfected appropriately between uses by individuals.

Victorian Government COVID safe workplace principles	Victorian Government COVID safe workplace recommendations	Field staff requirements
		• Shared field vehicles will have disinfectant wipes and hand sanitizer present. Drivers must wipe down high touch surfaces prior to and following the use of a vehicle.
4. *Keep electronic records and act quickly*	• Support workers to get tested and stay home even if they only have mild symptoms. • Develop a business contingency plan to manage any outbreaks. • Keep records of all people who enter the workplace for contact tracing. For more information, see Victorian Government QR Code Service.	• As fieldwork is being completed at public land, farms and private residences (but not associated with operating a business) check-in via the Service Victoria QR Code app is not required[1]. • Electronic records of field staff and work locations will be maintained as part of the fieldwork schedule in the SWMS and can be provided for contact tracing if required.
5. *Avoid interactions in enclosed spaces*	• Move activity outside where practicable.	• Where practical to do so, field staff will travel in individual vehicles to the field survey sites. Field staff will maintain physical distancing of 1.5m at all times when undertaking the field surveys outside, unless first aid is required to be administered. • Where practical to do so, accommodation for field staff will be single room with ensuite and self-catering kitchen facilities. Where practical to do so, field staff will not stay in shared accommodation, with shared facilities such as bathrooms, kitchens or eating areas.
6. *Create workforce bubbles*	• Consider keeping groups of workers rostered on the same shifts at a single worksite and avoid any overlap of workers during shift changes where it is practical to do so.	• Where practical to do so, field staff will work in a team of two people and exclusively with one other field staff member. This will reduce the risk of COVID-19 transmission to multiple people, should a field staff member test positive for COVID-19. • Field staff must continually monitor COVID-19 updates on the Victorian Government website (https://www.coronavirus.vic.gov.au/), exposure sites and lockdown requirements which may affect the safe delivery of fieldwork.

[1] Refer to: https://www.coronavirus.vic.gov.au/register-to-use-vic-gov-qr-code-service

Table 2. Hygiene procedure prior to entering sites and on completion of fieldwork at each site

Step	Description
1. Check	• Thoroughly check all clothing, footwear, backpacks tools and equipment for soil, water, organic material or other debris. Where possible, have a co-worker double-check for you.
2. Clean	• Remove all soil, water, organic material and debris using a hard brush and clean water. • Remove any residual seeds from clothing, footwear, tools and equipment by hand. • Where possible, have a co-worker double-check that you have removed all seeds. • If dirty, wash hands with soap and water. • If clothing is dirty and unable to be cleaned change into a spare set of clothes prior to entering a new site. • Dispose of dirty water utilised for washing at least 50 metres away from a waterway or drainage channel, and where there is limited possibility of it running into a waterway or sensitive environmental area. • At the end of the field day, launder all clothing using detergent and warm machine wash to kill residual spores. • At the end of the field day, shower thoroughly to remove residual spores from skin and hair.
3. Disinfect	• Spray or soak potentially contaminated materials (e.g. footwear, equipment) with disinfectant (70% methylated spirits in water). Leave for 30 seconds before proceeding. • Where practical, rinse with clean water.
4. Dry	• Where practical, ensure hands, clothing, footwear, and equipment are dry before proceeding.

Attachment C – Vehicle Pre-start Checklist

Vehicle Details

Registration:		**Make:**		**Model:**	
Driver Name:					
Passenger Name(s):					

Vehicle Prestart Checklist

Before starting your vehicle, please check the following. If the vehicle is not safe to operate, turn off immediately and report to your supervisor.

	Battery	Oil Level	Water Level	Wipers & Indicators	Wheels	Spare Tyre	First Aid Kit	Seatbelt	Mirrors	Windows
✓ or X										
Remarks										

After starting your vehicle, please check the following.

	Fuel	Engine	Hand Brake	Horn	Radio / Comms	Lights & Indicators	A/C	Wipers & Sprays	Brakes	Steering
✓ or X										
Remarks										

Field staff name:		**Date:**		**Signature:**	

Attachment D – Daily Take 5 Pre-task risk assessment checklist

Stop and think through the task (please circle)

I clearly understand what is required?

Yes	No	N/A

I am appropriately trained to do the work and familiar with the equipment/task?

Yes	No	N/A

The tools and equipment are in a safe condition?

Yes	No	N/A

I am feeling well and have no symptoms of illness (e.g. sore throat, cough, runny nose, fever, etc).

Yes	No	N/A

I am not affected by drugs, prescription medication or illicit drugs

Yes	No	N/A

Do I have required and approved documentation for the task (identified in the SWMS)?

Yes	No	N/A

Have I informed others who may be affected by my work?

Yes	No	N/A

Do I have the correct PPE for the task (identified in the SWMS)?

Yes	No	N/A

Identify and assess the hazards (please complete table below)

Hazard types: Atmospheric, Chemical, Electrical, Environmental, General, Gravitational, Manual Handling, Lighting, Noise, Pressure, Radiation, Thermal, Other

Priority for action: Extreme Risk, High Risk, Medium Risk, Low Risk

Likelihood: Almost Certain, Likely, Possible, Unlikely, Rare

	Hazard 1	Hazard 2	Hazard 3	Hazard 4
Describe the hazard				
Hazard type (from list above)				
Priority for action (from list above)				
Likelihood (from list above)				
Control measure (please describe)				

Control and Monitor

Are all hazards identified controlled or removed?

Yes	No

Signature:		Signature:	

Assigned Employee		Supervisor	
Name:		Name:	

Appendix E – Version Log of Survey Data

Item	Version	Date of update	Modified by	Location/Name	Description of changes
1	3c	12/10/2021	Chandni Gupta	group_safety_preassess	Added a new first page for safety checklist. Included 'I agree' validation to ensure respondents fill in form before proceeding
2	3c	12/10/2021	Chandni Gupta	det_quad_1 to det_quad_8	Added regular expressions for applying condition of >=10 and one decimal places for all DBH measurements (DBH 1 - DBH8): regex(.,'^(?:1[1-9]|[0-9]\d|[0-9]\d{2,})\.[0-9]$')
3	3c	12/10/2021	Chandni Gupta	det_canopy_trees_height	Removed calculation: 'round(${det_canopy_trees_distance}*tan((${det_canopy_trees_angle1_top_of_tree}*pi()) div 180)+tan((${det_canopy_trees_angle2_mark}*pi()) div 180)+${det_canopy_trees_mark_eye},2)' Added regular expressions for applying condition of >5 and two decimal places for canopy tree height: regex(.,'^([6-9]|\d{2,})\.[0-9][0-9]$') or regex(.,'^([6-9]\|\d{2,})\.{0}$')
4	3c	12/10/2021	Chandni Gupta	det_geopoint_utm	Added UTM, X, Y hidden fields to extract from geopoints captured on map. Added calculation 'pulldata("@geopoint",${det_geopoint},"UTM.text")
5	3c	12/10/2021	Chandni Gupta	det_geopoint_lat	Added UTM, X, Y hidden fields to extract from geopoints captured on map. Added calculation pulldata("@geopoint",${det_geopoint},"y")
6	3c	12/10/2021	Chandni Gupta	det_geopoint_long	Added UTM, X, Y hidden fields to extract from geopoints captured on map. Added calculation pulldata("@geopoint",${det_geopoint},"x")
7	3c	12/10/2021	Ying Quek	vv_manual _easting	Change required to 'yes'
8	3c	12/10/2021	Ying Quek	vv_manual_northing	Change required to 'yes'
9	3c	12/10/2021	Ying Quek	det_canopy_trees_height	Removed as manual calculation is not needed
10	3c	12/10/2021	Ying Quek	det_canopy_trees_mark_eye	Removed as manual calculation is not needed
11	3c	12/10/2021	Ying Quek	det_canopy_trees_slope_distance	Removed as manual calculation is not needed
12	3c	12/10/2021	Ying Quek	det_canopy_trees_angle1_top_of_tree	Removed as manual calculation is not needed
13	3c	12/10/2021	Ying Quek	det_canopy_trees_angle2_mark	Removed as manual calculation is not needed
14	3c	12/10/2021	Ying Quek	det_canopy_trees_distance	Removed as manual calculation is not needed
15	3c	12/10/2021	Ying Quek	det_canopy_trees_note	Removed as manual calculation is not needed
16	3c	12/10/2021	Ying Quek	det_canopy_add_new_pts	Removed as manual calculation is not needed
17	3c	12/10/2021	Ying Quek	vv_geopoint_utm	Added hidden expression to obtain UTM coordinates from map: pulldata("@geopoint",${geopoint_user},"UTM.text")
18	3c	12/10/2021	Ying Quek	vv_geopoint_lat	Added hidden expression to obtain UTM coordinates from map: pulldata("@geopoint",${geopoint_user},"y")
19	3c	12/10/2021	Ying Quek	vv_geopoint_long	Added hidden expression to obtain UTM coordinates from map: pulldata("@geopoint",${geopoint_user},"x")
20	3c	12/10/2021	Ying Quek	vv_coordinates	Changed appearance from compact to minimal. Added hints to prompt user to select the choices carefully
21	3c	12/10/2021	Ying Quek	det_coordinates_start_end	Changed appearance from compact to minimal. Added hints to prompt user to select the choices carefully

22	3c	12/10/2021	Ying Quek	det_coordinates_notes	renamed field name from coordinates_note to 'det_coordinates_notes'
23	3c	12/10/2021	Ying Quek	repeat_det_coordinates_start_end	Added repeat_count = 2
24	3c	12/10/2021	Ying Quek	det_quad_note_2	Added an instruction for adding more observations
25	3c	12/10/2021	Ying Quek	det_quad_note	Added a null in bind::esri:fieldType

26	3c	12/10/2021	Ying Quek	det_canopy_method	Removed Clinometer and tape measure in the choices in 'canopy_method'
27	3c	12/10/2021	Ying Quek	det_canopy_method_other	Added an additional text field to allow user to type in the equipment if laser rangefinder is not used. Added '${det_canopy_method} = 'other' for compulsory answer (i.e. required) and relevant columns
1	4	18/10/2021	Chandni Gupta	det_canopy_trees_height	Changed regular expressions for applying condition of >5 and one decimal places for canopy tree height: regex(.,'^([5-9]|\d{2,})\.[1-9]$') or regex(.,'^([6-9]\|\d{2,})\.[0-9]$') or regex(.,'^([6-9]|\d{2,})\.{0}$')
2	4	18/10/2021	Chandni Gupta	det_canopy_transect	Changed Transect number for canopy: 1. Changed type from text to select_one transect_number 2. Changed hint from 'Provide the number of the transect you are assessing (e.g. Transect ID = 1)' to 'Provide the number of the transect you are assessing' 3. required = yes
3	4	18/10/2021	Chandni Gupta	det_canopy_transect_index	Deleted
4	4	18/10/2021	Chandni Gupta	vv_f_weediness_score	Changed to: 0 (Absent) - Weed species >50% relative cover including highly invasive species (Very Low) - Weed species >50% relative cover without highly invasive species OR weed species 10-50% relative cover including highly invasive species. (Low) - Weed species 10-50% relative cover without highly invasive species (Medium) - Weed species <10% relative cover including highly invasive species (High) - Weed species <10% relative cover without highly invasive species5 (Very High) - No weeds detected
5	4	18/10/2021	Chandni Gupta	det_quad_tba_live	Deleted: Is the tree alive or dead?
6	4	18/10/2021	Chandni Gupta	repeat_det_quad_tba	Added hint: 'Please measure all canopy species trees using a DBH tap as per the diagram. ' and image. (Shifted above'+')
7	4	18/10/2021	Chandni Gupta	det_coordinates_Transect_ID	Changed Transect number: 1. Changed type from 'text' to 'select_one transect_number' 2. required = yes
8	4	18/10/2021	Chandni Gupta	survey_detailed_sections	Added in hint: DO NOT UNTICK THE SELECTION ONCE YOU HAVE TICKED THEM AND FILLED IN THE INFORMATION IN SUBSEQUENT PAGES. YOU WILL LOSE DATA OTHERWISE

9	4	18/10/2021	Chandni Gupta	survey_method	Added in hint: DO NOT UNTICK THE SELECTION AFTER FILLING UP THE INFORMATION
10	4	18/10/2021	Chandni Gupta	det_canopy_transect_new_pts	Added in hint: PLEASE FILL TRANSECT NUMBER AGAIN WHEN YOU START ASSESSING NEW TRANSECT
11	4	18/10/2021	Chandni Gupta	add_transect_note	Added in hint: PLEASE FILL TRANSECT NUMBER AGAIN WHEN YOU START ASSESSING NEW TRANSECT
12	4	19/10/2021	Ying Quek	add_transect_note	Modified the hint as 'PLEASE FILL IN THE TRANSECT NUMBER AGAIN WHEN YOU START ASSESSING A NEW TRANSECT'
13	4	19/10/2021	Ying Quek	survey_method	Reword hint: CAUTION: DO NOT UNTICK AND RETICK A SELECTION ONCE YOU HAVE ENTERED DATA IN SUBSEQUENT PAGES - YOU WILL LOSE DATA.
14	4	19/10/2021	Ying Quek	survey_detailed_sections	Reword hint: CAUTION: DO NOT UNTICK AND RETICK A SELECTION ONCE YOU HAVE ENTERED DATA IN SUBSEQUENT PAGES - YOU WILL LOSE DATA.
15	4a	22/10/2021	Ying Quek	External csv: Site_Lat_Long.csv	Reorder the sites so that alternative sites are added at the back. This is to resolve the issue with subbie entering a site ID but the survey captures the wrong site ID (offset by one).
16	4a	26/10/2021	Ying Quek	det_coordinates_start_end	Removed the 'required' rule to enable people to submit the survey
17	4a	26/10/2021	Ying Quek	vv_coordinates	Removed the 'required' rule to enable people to submit the survey
18	4a	27/10/2021	Ying Quek	det_logs_diam	Changed appeareance to 'w2 numbers'
19	4a	27/10/2021	Ying Quek	det_logs_length	Changed appeareance to 'w2 numbers'
20	4a	27/10/2021	Ying Quek	det_canopy_trees_height	Removed constraint
21	4a	27/10/2021	Ying Quek	repeat_vv_coordinates	Remove 'repeat_count'
22	4a	27/10/2021	Ying Quek	repeat_det_canopy	Remove 'repeat_count'
23	4a	27/10/2021	Ying Quek	repeat_det_canopy_intercept	Remove 'repeat_count'
24	4a	27/10/2021	Ying Quek	repeat_vv_coordinates	Remove 'repeat_count'

25	4a	27/10/2021	Ying Quek	repeat_hazard	Remove 'repeat_count'
26	4a	27/10/2021	Ying Quek	det_canopy_trees_height	Remove constraint
27	4a	27/10/2021	Ying Quek	det_quad_tba_1 to det_quad_tba_8	Remove regex formula in the constraints
28	4a	27/10/2021	Ying Quek	live_dead	Changed live/dead options from 'live' and 'n/a' to 'live' or 'dead'
29	4a	27/10/2021	Ying Quek	det_logs_diam	Changed to w2 numbers
30	4a	27/10/2021	Ying Quek	det_logs_length	Changed to w2 numbers
1	5a	29/10/2021	Ying Quek	tufted_grass_sedge_or_rush	Remove comma from 'tufted_grass,_sedge_or_rush'
2	5a	29/10/2021	Ying Quek	spreading_grass_sedge_or_rush	Remove comma from 'spreading_grass,_sedge_or_rush'
3	5a	29/10/2021	Ying Quek	climber_vine_or_twining_plan	Remove comma from 'climber,_vine_or_twining_plan'
4	5a	29/10/2021	Ying Quek	vv_threats	bind::esri:fieldLength to 1000
5	5a	29/10/2021	Ying Quek	vv_lifeforms_terrestrial_multiple	bind::esri:fieldLength to 1000
6	5a	29/10/2021	Ying Quek	vv_lifeforms_instream_multiple	bind::esri:fieldLength to 1000

Appendix F – Field Survey Point Locations

Site ID	Catchment	Vegetation Assessment Type	Easting	Northing	Latitude	Longitude	Field Staff
1	Westernport	Rapid	389862.962	5749338.922	-38.39739	145.73874	Mal Brown
2	Westernport	Rapid	387816.9628	5752353.923	-38.36997	145.7158	Mal Brown
3	Westernport	Rapid	366822.9588	5739885.929	-38.47942	145.47318	Mal Brown
4	Westernport	Detailed	375130.962	5749570.927	-38.39337	145.57012	Ecological Perspective & Canopy Connections
5	Westernport	Rapid	373132.9643	5757085.927	-38.32538	145.5486	Mal Brown
6	Westernport	Rapid	364993.9611	5747174.93	-38.41348	145.45362	Mal Brown
7	Westernport	Rapid	397905.9618	5748983.919	-38.40155	145.83078	Mal Brown
8	Westernport	Detailed	372923.9603	5744199.927	-38.44144	145.54388	Ecological Perspective & Canopy Connections
9	Westernport	Rapid	377875.9595	5741614.926	-38.46543	145.60016	Mal Brown
10	Westernport	Rapid	392071.9633	5753467.921	-38.36046	145.76466	Catchment Capable
11	Westernport	Rapid	395898.9779	5800170.92	-37.94008	145.81529	Mal Brown
12	Westernport	Rapid	391690.9726	5783344.922	-38.09121	145.76487	Mal Brown
13	Westernport	Rapid	389370.9722	5782126.922	-38.1019	145.73823	Mal Brown
14	Westernport	Rapid	384036.9712	5778983.924	-38.12955	145.67689	Mal Brown
15	Westernport	Rapid	369752.9697	5774502.928	-38.16798	145.51315	Mal Brown
16	Westernport	Rapid	367543.969	5772119.929	-38.18912	145.48749	Mal Brown
17	Westernport	Rapid	400431.9721	5781553.919	-38.10835	145.86428	Mal Brown
18	Westernport	Rapid	398487.9728	5783894.92	-38.08704	145.84244	Mal Brown
19	Westernport	Rapid	374963.9737	5787047.927	-38.05568	145.57481	Mal Brown
20	Westernport	Rapid	403044.9739	5787216.918	-38.05761	145.89485	Mal Brown
21	Westernport	Rapid	402503.9717	5780210.918	-38.12068	145.88772	Mal Brown
22	Westernport	Detailed	402765.9789	5803417.918	-37.91159	145.89386	Practical Ecology
23	Westernport	Detailed	387914.9794	5805041.923	-37.89524	145.7252	Practical Ecology
24	Westernport	Rapid	391218.9787	5802817.922	-37.91568	145.76244	Catchment Capable
25	Westernport	Rapid	396259.9747	5789916.92	-38.03252	145.81791	Mal Brown
26	Westernport	Rapid	392969.9742	5788315.921	-38.04657	145.78019	Mal Brown
27	Westernport	Rapid	375571.9762	5795115.927	-37.98307	145.58314	Mal Brown

28	Westernport	Rapid	398595.9742	5788339.92	-38.047	145.8443	Mal Brown
29	Westernport	Rapid	383839.9739	5787581.924	-38.05206	145.67604	Mal Brown
30	Westernport	Rapid	402503.9717	5780210.918	-38.12068	145.88772	Mal Brown
31	Westernport	Detailed	378000.9779	5800518.926	-37.93472	145.61171	Practical Ecology
32	Westernport	Detailed	385370.9762	5794771.924	-37.98747	145.69464	Ecological Perspective & Canopy Connections
33	Westernport	Rapid	393062.9762	5794933.921	-37.98695	145.78224	Catchment Capable
34	Westernport	Rapid	386464.9744	5789100.923	-38.0387	145.7062	Mal Brown
35	Westernport	Rapid	385498.9727	5783618.924	-38.08798	145.69431	Mal Brown
36	Westernport	Rapid	375705.975	5791042.927	-38.01979	145.58396	Mal Brown
37	Westernport	Detailed	389140.9735	5786149.922	-38.06562	145.73623	Ecological Perspective & Canopy Connections
38	Westernport	Rapid	358389.9783	5801951.932	-37.91897	145.3889	Carew Environmental
39	Westernport	Rapid	357371.977	5797985.932	-37.95454	145.37654	Carew Environmental
40	Westernport	Rapid	358961.9721	5782353.932	-38.09562	145.39156	Mal Brown
41	Westernport	Rapid	362850.9703	5776420.931	-38.14967	145.43475	Mal Brown
42	Westernport	Rapid	354621.9752	5792286.933	-38.00545	145.3441	Carew Environmental
43	Westernport	Detailed	357684.9732	5785641.932	-38.0658	145.37765	Practical Ecology
44	Westernport	Rapid	360563.9743	5789291.931	-38.03336	145.41117	Mal Brown
45	Dandenong	Detailed	356752.9791	5804376.933	-37.89686	145.37077	Practical Ecology
46	Dandenong	Rapid	342518.978	5801160.937	-37.92348	145.20824	Catherine Clowes
47	Dandenong	Rapid	340735.9744	5789662.938	-38.02675	145.18542	Carew Environmental
48	Dandenong	Rapid	342765.974	5788425.937	-38.03825	145.20827	Carew Environmental
49	Dandenong	Rapid	346695.9811	5811051.936	-37.83509	145.25785	Practical Ecology
50	Dandenong	Rapid	353210.978	5801339.934	-37.92366	145.32988	Practical Ecology
51	Dandenong	Rapid	354720.9809	5810309.933	-37.84309	145.34886	Practical Ecology
52	Dandenong	Rapid	352083.9805	5808909.934	-37.85528	145.31862	Practical Ecology
53	Dandenong	Rapid	342617.9806	5809677.937	-37.84677	145.21123	Catherine Clowes
54	Dandenong	Rapid	341030.9796	5806387.938	-37.87614	145.19247	Catherine Clowes
55	Dandenong	Rapid	343287.9796	5806454.937	-37.87592	145.21814	Catherine Clowes
56	Dandenong	Rapid	344776.9764	5796171.936	-37.96882	145.23285	Practical Ecology
57	Dandenong	Detailed	342090.9787	5803499.937	-37.90234	145.20389	Practical Ecology

58	Dandenong	Rapid	349837.9787	5803465.935	-37.90396	145.29196	Practical Ecology
59	Dandenong	Rapid	346877.9787	5803407.936	-37.90398	145.2583	Practical Ecology
60	Dandenong	Rapid	353871.9787	5803128.934	-37.90765	145.33776	Practical Ecology
61	Westernport	Rapid	368348.9745	5789927.929	-38.0288	145.49997	Mal Brown
62	Dandenong	Rapid	323124.9791	5805121.943	-37.88424	144.98868	Catherine Clowes
63	Dandenong	Rapid	323736.9791	5804822.943	-37.88705	144.99556	Catherine Clowes
64	Westernport	Detailed	363840.9631	5753396.93	-38.35725	145.44162	Shepherd Ecology
65	Westernport	Rapid	361414.9628	5752635.931	-38.36373	145.41371	Shepherd Ecology
66	Westernport	Rapid	357893.9626	5752015.932	-38.36877	145.3733	Shepherd Ecology
67	Westernport	Rapid	353211.9632	5753855.934	-38.35144	145.32011	Shepherd Ecology
68	Westernport	Rapid	353074.9636	5755164.934	-38.33962	145.31882	Shepherd Ecology
69	Westernport	Detailed	350121.9639	5755954.935	-38.33201	145.28521	Shepherd Ecology
70	Dandenong	Rapid	335736.9711	5779138.939	-38.12066	145.12607	Carew Environmental
71	Dandenong	Rapid	341758.9703	5776714.937	-38.14357	145.1942	Carew Environmental
72	Dandenong	Rapid	338783.9724	5783417.938	-38.08266	145.16178	Carew Environmental
73	Dandenong	Rapid	341821.9698	5774819.937	-38.16065	145.1945	Carew Environmental
74	Werribee	Rapid	292514.991	5843537.953	-37.53182	144.6518	Tree Wishes
75	Werribee	Rapid	293188.9898	5839527.953	-37.56808	144.65829	Tree Wishes
76	Werribee	Rapid	302181.9839	5820854.95	-37.73824	144.75498	Catherine Clowes
77	Werribee	Rapid	293087.989	5836972.953	-37.59107	144.65642	Tree Wishes
78	Werribee	Rapid	308122.9819	5814234.948	-37.79912	144.82061	Catherine Clowes
79	Werribee	Rapid	308732.9811	5811435.948	-37.82446	144.82679	Catherine Clowes
80	Werribee	Rapid	290306.99	5840135.954	-37.56195	144.62585	Tree Wishes
81	Werribee	Rapid	294857.9874	5831901.952	-37.63713	144.67503	Veryan Green Environment Services Pty Ltd
82	Werribee	Rapid	292331.9867	5829741.953	-37.65602	144.64581	Abzeco
83	Werribee	Rapid	305822.9827	5816651.949	-37.77687	144.79515	Catherine Clowes
84	Werribee	Rapid	290928.989	5837132.953	-37.58914	144.63203	Tree Wishes
85	Westernport	Rapid	386978.9647	5758293.923	-38.31635	145.70716	Mal Brown
86	Westernport	Detailed	379375.9648	5758696.925	-38.31173	145.62028	Ecological Perspective & Canopy Connections
87	Westernport	Rapid	373927.9666	5764391.927	-38.25967	145.559	Mal Brown

88	Westernport	Rapid	393777.9676	5767420.921	-38.23494	145.78628	Mal Brown
89	Westernport	Rapid	396542.9632	5753327.92	-38.36225	145.81581	Mal Brown
90	Westernport	Rapid	402231.9686	5770229.918	-38.21059	145.88325	Mal Brown
91	Westernport	Rapid	399927.9658	5761445.919	-38.28949	145.8557	Mal Brown
92	Westernport	Rapid	396974.9654	5760383.92	-38.29872	145.82178	Mal Brown
93	Westernport	Rapid	399330.9638	5755112.919	-38.34648	145.84797	Mal Brown
94	Westernport	Rapid	393065.9652	5759777.921	-38.30372	145.777	Mal Brown
95	Westernport	Rapid	381133.9656	5761213.925	-38.28928	145.6408	Mal Brown
96	Werribee	Rapid	303461.9819	5814050.949	-37.79979	144.76766	Catherine Clowes
97	Werribee	Rapid	305389.9802	5808919.949	-37.84642	144.78816	Catherine Clowes
98	Werribee	Rapid	308536.4449	5807971.825	-37.85562	144.82365	Catherine Clowes
99	Werribee	Rapid	306094.9795	5806526.949	-37.86812	144.79552	Catherine Clowes
100	Werribee	Rapid	283060.9806	5810069.956	-37.83102	144.53493	Catherine Clowes
101	Werribee	Rapid	289015.978	5801827.954	-37.90664	144.60013	Catherine Clowes
102	Werribee	Rapid	270444.1705	5807127.833	-37.85442	144.39076	Abzeco
103	Werribee	Detailed	259243.9823	5815700.963	-37.77435	144.26644	Brian Bainbridge Wildlife Art and Illustration
104	Werribee	Rapid	278552.9781	5802348.957	-37.89946	144.48138	Catherine Clowes
105	Werribee	Rapid	288535.976	5795343.954	-37.96492	144.59277	Catherine Clowes
106	Werribee	Rapid	281200.9755	5793933.956	-37.97587	144.50892	Catherine Clowes
107	Werribee	Rapid	265114.6264	5811475.606	-37.81392	144.33166	Abzeco
108	Werribee	Rapid	268274.9823	5815787.96	-37.7759	144.3689	Abzeco
109	Werribee	Rapid	272475.9809	5811331.959	-37.81708	144.41516	Abzeco
110	Werribee	Rapid	261192.9805	5810225.963	-37.82416	144.28674	Tree Wishes
111	Werribee	Detailed	257094.9798	5808053.964	-37.84263	144.2395	Brian Bainbridge Wildlife Art and Illustration
112	Westernport	Detailed	319406.9583	5738721.944	-38.48156	144.92956	Shepherd Ecology
113	Westernport	Detailed	319406.9583	5738721.944	-38.48156	144.92956	Shepherd Ecology
114	Westernport	Rapid	322761.9606	5745964.943	-38.417	144.96983	Shepherd Ecology
115	Westernport	Rapid	322893.9583	5738681.943	-38.48262	144.9695	Shepherd Ecology
116	Westernport	Detailed	320029.9621	5750929.944	-38.37173	144.93982	Shepherd Ecology
117	Maribyrnong	Rapid	314621.9832	5818185.946	-37.76488	144.89539	Catherine Clowes

118	Maribyrnong	Rapid	316226.982	5814426.945	-37.79906	144.91265	Catherine Clowes
119	Maribyrnong	Rapid	315711.9817	5813570.946	-37.80667	144.90658	Catherine Clowes
120	Maribyrnong	Detailed	290742.0007	5874427.954	-37.25322	144.64049	Consultant Ecologist
121	Maribyrnong	Rapid	309111.9853	5824941.948	-37.7029	144.83465	Catherine Clowes
122	Maribyrnong	Rapid	290093.9984	5867128.954	-37.31881	144.63112	Tree Wishes
123	Maribyrnong	Rapid	304205.9981	5866252.949	-37.32978	144.79004	Tree Wishes
124	Maribyrnong	Rapid	313442.9976	5864563.946	-37.34689	144.89381	Tree Wishes
125	Maribyrnong	Rapid	290350.9972	5863294.954	-37.35339	144.63294	Tree Wishes
126	Maribyrnong	Rapid	297550.9973	5863687.951	-37.35145	144.71428	Tree Wishes
127	Maribyrnong	Rapid	299993.9962	5860138.951	-37.38395	144.74088	Tree Wishes
128	Maribyrnong	Detailed	305680.9969	5862534.949	-37.36358	144.8057	Consultant Ecologist
129	Maribyrnong	Detailed	294271.9965	5861101.952	-37.37402	144.67657	Practical Ecology
130	Maribyrnong	Rapid	291157.9964	5860928.953	-37.37488	144.64138	Tree Wishes
131	Maribyrnong	Rapid	296008.9956	5858115.952	-37.4013	144.69535	Tree Wishes
132	Maribyrnong	Rapid	304777.9951	5856601.949	-37.41683	144.79395	Tree Wishes
133	Maribyrnong	Rapid	313002.9957	5858335.947	-37.4029	144.88727	Tree Wishes
134	Maribyrnong	Rapid	308457.9951	5856388.948	-37.41951	144.83545	Tree Wishes
135	Maribyrnong	Rapid	293059.9944	5854428.953	-37.43385	144.66102	Tree Wishes
136	Maribyrnong	Rapid	294894.0001	5872579.952	-37.27078	144.68676	Tree Wishes
137	Maribyrnong	Rapid	291197.9935	5851540.953	-37.45944	144.63917	Tree Wishes
138	Maribyrnong	Detailed	274075.9926	5848662.959	-37.48133	144.44487	Consultant Ecologist
139	Maribyrnong	Detailed	279254.994	5853367.957	-37.44022	144.5048	Consultant Ecologist
140	Maribyrnong	Detailed	312813.9923	5847418.947	-37.5012	144.88237	Practical Ecology
141	Maribyrnong	Rapid	289836.9925	5848286.954	-37.48844	144.62287	Tree Wishes
142	Maribyrnong	Rapid	306503.0016	5877342.949	-37.23037	144.81884	Tree Wishes
143	Maribyrnong	Rapid	284559.9918	5846222.955	-37.50581	144.56263	Tree Wishes
144	Maribyrnong	Rapid	303516.9909	5843176.949	-37.53748	144.77613	Tree Wishes
145	Maribyrnong	Rapid	310611.9912	5844031.947	-37.53126	144.8566	Tree Wishes
146	Maribyrnong	Rapid	300401.0003	5873476.951	-37.2639	144.74906	Tree Wishes
147	Maribyrnong	Rapid	299307.9992	5869659.951	-37.29805	144.73572	Tree Wishes
148	Maribyrnong	Rapid	303189.9891	5837264.95	-37.59065	144.77084	Tree Wishes

149	Maribyrnong	Rapid	302128.9881	5834089.95	-37.61902	144.75797	Tree Wishes
150	Maribyrnong	Rapid	288263.9947	5855117.954	-37.42656	144.60705	Tree Wishes
151	Maribyrnong	Rapid	288528.9998	5871909.954	-37.27539	144.61484	Tree Wishes
152	Maribyrnong	Detailed	306951.9999	5871982.948	-37.27874	144.8225	Consultant Ecologist
153	Maribyrnong	Rapid	306087.9885	5835234.949	-37.60955	144.8031	Catherine Clowes
154	Maribyrnong	Detailed	310409.9836	5819737.947	-37.75004	144.84801	Practical Ecology
155	Westernport	Detailed	333351.9678	5768622.94	-38.21495	145.09641	Shepherd Ecology
156	Westernport	Rapid	329181.9663	5764306.941	-38.25304	145.04777	Shepherd Ecology
157	Westernport	Rapid	334253.965	5759814.94	-38.29445	145.10465	Shepherd Ecology
158	Westernport	Rapid	330428.9646	5758677.941	-38.30398	145.06066	Shepherd Ecology
159	Westernport	Rapid	334182.9643	5757837.94	-38.31225	145.10338	Shepherd Ecology
160	Westernport	Rapid	327949.9639	5756401.942	-38.32401	145.03177	Shepherd Ecology
161	Westernport	Detailed	325532.9626	5752536.942	-38.35835	145.00318	Shepherd Ecology
162	Westernport	Rapid	314200.962	5750287.946	-38.37633	144.87297	Shepherd Ecology
163	Westernport	Rapid	316721.9617	5749636.945	-38.38271	144.90164	Shepherd Ecology
164	Westernport	Detailed	328129.966	5763026.942	-38.26437	145.03544	Shepherd Ecology
165	Westernport	Rapid	362483.9681	5769305.931	-38.21372	145.42919	Shepherd Ecology
166	Westernport	Rapid	357735.9702	5776278.932	-38.15016	145.37637	Mal Brown
167	Westernport	Rapid	339223.9662	5763818.938	-38.25929	145.16237	Shepherd Ecology
168	Westernport	Rapid	351170.9696	5774556.934	-38.16461	145.30111	Mal Brown
169	Westernport	Rapid	345575.9699	5775352.936	-38.1565	145.23744	Mal Brown
170	Westernport	Rapid	329422.9601	5744335.941	-38.43297	145.04569	Shepherd Ecology
171	Westernport	Rapid	356919.9692	5772857.932	-38.18085	145.36637	Mal Brown
172	Westernport	Detailed	326108.9612	5747662.942	-38.40236	145.00857	Shepherd Ecology
173	Westernport	Rapid	334763.9618	5749735.939	-38.38533	145.10812	Shepherd Ecology
174	Westernport	Rapid	347561.9694	5773675.935	-38.17195	145.25974	Shepherd Ecology
175	Westernport	Rapid	358650.9683	5769986.932	-38.20699	145.38556	Shepherd Ecology
176	Werribee	Rapid	305463.9785	5803063.949	-37.89917	144.78742	Catherine Clowes
177	Werribee	Rapid	297826.982	5814702.951	-37.79269	144.70388	Catherine Clowes
178	Werribee	Detailed	298036.981	5811304.951	-37.82334	144.70532	Brian Bainbridge Wildlife Art and Illustration
179	Westernport	Detailed	371967.9758	5793901.928	-37.99351	145.5419	Ecological Perspective &

							Canopy Connections
180	Westernport	Rapid	365018.975	5791349.93	-38.0155	145.46231	Mal Brown
181	Westernport	Rapid	364258.9715	5780149.93	-38.11629	145.45152	Mal Brown
182	Werribee	Rapid	252870.0266	5845749.173	-37.50214	144.20431	Abzeco
183	Werribee	Detailed	282240.992	5846800.956	-37.50006	144.53658	Practical Ecology
184	Werribee	Rapid	273439.9884	5835167.959	-37.60269	144.43352	Veryan Green Environment Services Pty Ltd
185	Werribee	Rapid	264899.991	5843728.962	-37.52347	144.33961	Abzeco
186	Werribee	Rapid	260773.9907	5842889.963	-37.52996	144.2927	Abzeco
187	Werribee	Rapid	278796.9909	5843338.957	-37.53042	144.49661	Veryan Green Environment Services Pty Ltd
188	Werribee	Rapid	252154.9904	5841788.965	-37.5376	144.19489	Veryan Green Environment Services Pty Ltd
189	Werribee	Detailed	266561.9918	5846327.961	-37.50049	144.35923	Brian Bainbridge Wildlife Art and Illustration
190	Werribee	Rapid	284039.9904	5841665.955	-37.54673	144.55541	Abzeco
191	Werribee	Rapid	286932.0822	5839819.999	-37.56402	144.58758	Veryan Green Environment Services Pty Ltd
192	Werribee	Rapid	258758.9895	5838933.963	-37.56506	144.26862	Veryan Green Environment Services Pty Ltd
193	Werribee	Rapid	261309.9897	5839309.963	-37.56234	144.29759	Veryan Green Environment Services Pty Ltd
194	Werribee	Detailed	281030.9892	5837781.956	-37.58099	144.52022	Brian Bainbridge Wildlife Art and Illustration
195	Werribee	Detailed	285156.9893	5838263.955	-37.57763	144.56704	Brian Bainbridge Wildlife Art and Illustration
196	Werribee	Rapid	254243.8455	5835494.712	-37.59483	144.2164	Veryan Green Environment Services Pty Ltd
197	Werribee	Rapid	267675.9886	5835937.961	-37.59432	144.36853	Abzeco
198	Werribee	Rapid	278461.9886	5836019.957	-37.59625	144.49061	EcoFutures
199	Werribee	Rapid	289277.5716	5833589.105	-37.62068	144.61232	Abzeco
200	Werribee	Rapid	284732.9873	5831623.955	-37.63732	144.56029	Abzeco
201	Werribee	Detailed	263654.9858	5827188.962	-37.67207	144.3202	Consultant Ecologist
202	Werribee	Rapid	288091.3126	5827037.476	-37.67941	144.59699	EcoFutures
203	Werribee	Rapid	270604.5272	5826328.062	-37.68159	144.39865	Veryan Green Environment Services Pty Ltd
204	Werribee	Rapid	279441.986	5827412.957	-37.67399	144.49911	Abzeco
205	Werribee	Rapid	278475.9852	5824898.957	-37.69639	144.4874	EcoFutures

206	Werribee	Rapid	286795.7652	5821703.156	-37.72714	144.58075	Veryan Green Environment Services Pty Ltd
207	Werribee	Rapid	263936.9839	5820739.962	-37.73021	144.32131	Abzeco
208	Werribee	Rapid	280132.3462	5812839.996	-37.80538	144.50252	Abzeco
209	Yarra	Rapid	357936.9806	5809348.932	-37.85225	145.38521	Catchment Capable
210	Werribee	Rapid	290340.9801	5808380.953	-37.84793	144.6171	Catherine Clowes
211	Werribee	Rapid	276173.9853	5825382.958	-37.69147	144.46146	EcoFutures
212	Werribee	Rapid	263482.1694	5830829.494	-37.63925	144.31942	Abzeco
213	Werribee	Rapid	274941.2431	5834085.655	-37.61281	144.45018	Abzeco
214	Werribee	Detailed	256836.994	5853424.964	-37.43408	144.25167	Consultant Ecologist
215	Werribee	Rapid	260390.9928	5849544.963	-37.46995	144.29054	Abzeco
216	Werribee	Rapid	269850.9931	5850154.96	-37.46686	144.3976	Abzeco & Tree Wishes
217	Werribee	Detailed	249698.9914	5845113.966	-37.507	144.16826	Brian Bainbridge Wildlife Art and Illustration
218	Westernport	Rapid	343823.9583	5738469.937	-38.48844	145.2093	Mal Brown
219	Westernport	Rapid	342735.9591	5741072.937	-38.4648	145.19741	Mal Brown
220	Westernport	Rapid	401305.9702	5775458.919	-38.16337	145.8734	Mal Brown
221	Westernport	Rapid	369688.9685	5770484.929	-38.20417	145.51168	Mal Brown
222	Westernport	Rapid	373277.9689	5771854.927	-38.19234	145.5529	Mal Brown
223	Westernport	Rapid	392446.9688	5771384.921	-38.19907	145.77168	Mal Brown
224	Westernport	Rapid	387184.9691	5772203.923	-38.19104	145.71173	Mal Brown
225	Westernport	Detailed	392909.9708	5777578.921	-38.14331	145.7779	Ecological Perspective & Canopy Connections
226	Westernport	Rapid	396048.9688	5771274.92	-38.20048	145.81279	Mal Brown
227	Yarra	Rapid	368747.9771	5798016.929	-37.95598	145.50599	Catchment Capable
228	Yarra	Rapid	335523.9851	5824362.939	-37.71323	145.13397	Catherine Clowes
229	Yarra	Rapid	328461.9827	5816467.942	-37.78306	145.05202	Catherine Clowes
230	Yarra	Rapid	358676.9831	5817298.932	-37.78074	145.39517	Catchment Capable
231	Yarra	Rapid	355547.9834	5818383.933	-37.77048	145.35987	Catchment Capable
232	Yarra	Rapid	361284.9836	5818920.931	-37.76653	145.42508	Catchment Capable
233	Yarra	Detailed	317842.9839	5820419.945	-37.7454	144.9325	Practical Ecology
234	Yarra	Rapid	345228.9844	5821663.936	-37.73924	145.24345	Catherine Clowes
235	Yarra	Rapid	373800.9865	5828162.928	-37.68507	145.56875	Catchment Capable

236	Yarra	Rapid	354567.9864	5828228.934	-37.68162	145.35071	Catchment Capable
237	Yarra	Rapid	367300.9863	5827561.93	-37.68956	145.49494	Catchment Capable
238	Yarra	Rapid	309578.9873	5831428.947	-37.64456	144.84164	Catherine Clowes
239	Yarra	Rapid	351372.9876	5831834.935	-37.64862	145.31523	Catherine Clowes
240	Yarra	Detailed	371893.9887	5834993.928	-37.62325	145.54832	Ecological Perspective & Canopy Connections
241	Yarra	Detailed	364668.989	5836305.93	-37.61039	145.46672	Ecological Perspective & Canopy Connections
242	Yarra	Rapid	330794.9906	5841662.941	-37.55653	145.08435	Catherine Clowes
243	Yarra	Rapid	316820.9922	5847071.945	-37.50513	144.92758	Tree Wishes
244	Yarra	Rapid	325721.9964	5860683.943	-37.38423	145.03145	Catherine Clowes
245	Yarra	Detailed	332054.9963	5860229.941	-37.38949	145.10284	Practical Ecology
246	Yarra	Rapid	331413.9953	5856775.941	-37.42049	145.09482	Catherine Clowes
247	Yarra	Rapid	326914.9951	5856422.942	-37.42284	145.04392	Catherine Clowes
248	Yarra	Rapid	333250.996	5858911.94	-37.40158	145.11605	Catherine Clowes
249	Yarra	Rapid	329120.9941	5853081.942	-37.45335	145.06806	Catherine Clowes
250	Yarra	Detailed	338999.9939	5852184.938	-37.4632	145.1795	Practical Ecology
251	Yarra	Rapid	325187.9933	5850695.943	-37.47411	145.02305	Catherine Clowes
252	Yarra	Rapid	343928.9933	5850393.937	-37.48018	145.23483	Catherine Clowes
253	Yarra	Rapid	345499.9929	5849090.936	-37.49219	145.25232	Catherine Clowes
254	Yarra	Detailed	327499.9933	5850539.942	-37.47595	145.04915	Practical Ecology
255	Yarra	Rapid	348859.9931	5849521.935	-37.48886	145.2904	Catherine Clowes
256	Yarra	Rapid	356845.9908	5841857.933	-37.55919	145.3792	Catherine Clowes
257	Yarra	Rapid	401192.9911	5842587.919	-37.55843	145.88129	Catchment Capable
258	Yarra	Rapid	381361.988	5832729.925	-37.64492	145.65522	EcoFutures
259	Yarra	Rapid	333512.9925	5847769.94	-37.502	145.11649	Catherine Clowes
260	Yarra	Rapid	353628.9912	5843427.934	-37.54453	145.34311	Catherine Clowes
261	Yarra	Rapid	348061.991	5842892.936	-37.54845	145.28001	Catherine Clowes
262	Yarra	Rapid	338402.9918	5845445.939	-37.52381	145.17127	Practical Ecology
263	Yarra	Rapid	319816.991	5843164.944	-37.54091	144.9605	Tree Wishes
264	Yarra	Rapid	326561.9922	5846870.942	-37.50882	145.03768	Practical Ecology
265	Yarra	Rapid	347213.9919	5845628.936	-37.52366	145.27098	Catherine Clowes

266	Yarra	Rapid	318454.9915	5844704.945	-37.52678	144.94547	Abzeco
267	Yarra	Rapid	344923.9923	5847181.937	-37.50929	145.2454	Catherine Clowes
268	Yarra	Rapid	352251.9914	5844052.934	-37.53868	145.32765	Catherine Clowes
269	Yarra	Detailed	353752.9905	5841113.934	-37.5654	145.34405	Ecological Perspective & Canopy Connections
270	Yarra	Rapid	342249.9902	5840253.937	-37.57125	145.21367	Catherine Clowes
271	Yarra	Rapid	371875.9901	5839869.928	-37.57931	145.54897	Practical Ecology
272	Yarra	Rapid	316021.9896	5838654.946	-37.58079	144.91644	Tree Wishes
273	Yarra	Rapid	407670.9901	5839036.917	-37.59111	145.95418	Catchment Capable
274	Yarra	Rapid	365091.9897	5838426.93	-37.59134	145.4719	Catchment Capable
275	Yarra	Rapid	348617.9893	5837545.935	-37.59672	145.28519	Catherine Clowes
276	Yarra	Rapid	369203.9897	5838361.929	-37.59252	145.51845	Catherine Clowes
277	Yarra	Rapid	333796.9893	5837652.94	-37.5932	145.11741	Catherine Clowes
278	Yarra	Rapid	320318.9899	5839688.944	-37.57232	144.96533	Tree Wishes
279	Yarra	Rapid	376933.989	5836069.927	-37.61424	145.6056	Practical Ecology
280	Yarra	Rapid	366712.9892	5836909.93	-37.60525	145.48998	Catchment Capable
281	Yarra	Detailed	341533.9897	5838853.938	-37.58374	145.20527	Practical Ecology
282	Yarra	Rapid	332758.9755	5835750.899	-37.61014	145.10522	Catherine Clowes
283	Yarra	Rapid	348365.9885	5834872.935	-37.62076	145.28179	Catherine Clowes
284	Yarra	Rapid	343077.9885	5835006.937	-37.61867	145.22192	Practical Ecology
285	Yarra	Rapid	309317.9886	5835853.948	-37.60465	144.83983	Catherine Clowes
286	Yarra	Detailed	333333.988	5833386.94	-37.63154	145.1112	Ecological Perspective & Canopy Connections
287	Yarra	Rapid	308214.9881	5833832.948	-37.62263	144.82682	Catherine Clowes
288	Yarra	Rapid	367175.983	5817062.929	-37.78414	145.49161	Catchment Capable
289	Yarra	Rapid	378507.9797	5806244.926	-37.8832	145.61844	Catchment Capable
290	Yarra	Rapid	391821.9805	5808417.922	-37.86529	145.77014	Catchment Capable
291	Yarra	Rapid	363850.98	5807499.93	-37.86982	145.45206	Catchment Capable
292	Yarra	Rapid	360817.98	5807457.931	-37.86974	145.41758	Catchment Capable
293	Yarra	Rapid	372910.9791	5804387.928	-37.89916	145.55449	Catchment Capable
294	Yarra	Rapid	370602.9791	5804475.928	-37.89805	145.52826	Catchment Capable
295	Yarra	Rapid	328115.9891	5837261.942	-37.59568	145.053	Catherine Clowes

296	Yarra	Rapid	369343.9882	5833809.929	-37.63356	145.51923	Catchment Capable
297	Yarra	Rapid	358582.9878	5832417.932	-37.64451	145.39704	Catchment Capable
298	Yarra	Detailed	310099.9877	5832795.947	-37.63236	144.84789	Practical Ecology
299	Yarra	Rapid	372202.9876	5831674.928	-37.6532	145.55124	Catchment Capable
300	Yarra	Rapid	408171.9877	5831262.917	-37.66122	145.95888	Catchment Capable
301	Yarra	Rapid	346410.9877	5832508.936	-37.64173	145.25915	Catherine Clowes
302	Yarra	Detailed	348316.9853	5824592.935	-37.71337	145.27909	Ecological Perspective & Canopy Connections
303	Yarra	Rapid	380924.9865	5827849.925	-37.68884	145.64947	EcoFutures
304	Yarra	Rapid	401823.9871	5829551.919	-37.67598	145.88669	Catchment Capable
305	Yarra	Rapid	348102.9874	5831392.936	-37.65207	145.27808	Catherine Clowes
306	Yarra	Rapid	363961.9869	5829564.931	-37.67103	145.45746	Catchment Capable
307	Yarra	Detailed	404591.9882	5833011.918	-37.64509	145.91852	EcoFutures
308	Yarra	Detailed	393337.9877	5831502.921	-37.65745	145.79076	Ecological Perspective & Canopy Connections
309	Yarra	Rapid	335013.9872	5830669.94	-37.65632	145.12961	Practical Ecology
310	Yarra	Rapid	345364.9865	5828459.936	-37.67804	145.24644	Catherine Clowes
311	Yarra	Detailed	375462.9865	5827967.927	-37.68705	145.58756	Ecological Perspective & Canopy Connections
312	Yarra	Rapid	314011.9862	5827989.946	-37.67645	144.89098	Catherine Clowes
313	Yarra	Rapid	397363.9862	5826671.92	-37.70144	145.83571	Catchment Capable
314	Yarra	Rapid	333237.9856	5825650.94	-37.70122	145.10834	Practical Ecology
315	Yarra	Rapid	395935.9857	5825195.921	-37.71458	145.81931	Catchment Capable
316	Yarra	Detailed	418773.9877	5831186.914	-37.6629	146.07906	Ecological Perspective & Canopy Connections
317	Yarra	Rapid	365206.9857	5825433.93	-37.70843	145.47081	Catchment Capable
318	Yarra	Rapid	355791.9859	5826255.933	-37.69959	145.3642	Catchment Capable
319	Yarra	Rapid	369975.9858	5825960.929	-37.70437	145.52499	Catchment Capable
320	Yarra	Detailed	337049.9857	5826267.939	-37.69634	145.1517	Ecological Perspective & Canopy Connections
321	Yarra	Rapid	383433.9842	5820612.924	-37.75437	145.67676	Catchment Capable
322	Yarra	Rapid	351238.9853	5824598.935	-37.71379	145.31223	Catherine Clowes

323	Yarra	Rapid	345783.9851	5823996.936	-37.71831	145.25024	Catherine Clowes
324	Yarra	Rapid	342605.9853	5824605.937	-37.71229	145.21433	Practical Ecology
325	Yarra	Detailed	344535.9851	5824019.937	-37.7179	145.23609	Ecological Perspective & Canopy Connections
326	Yarra	Rapid	361654.9846	5822157.931	-37.73742	145.4299	Catchment Capable
327	Yarra	Rapid	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed
328	Yarra	Rapid	424715.9859	5825238.912	-37.71701	146.14581	Catchment Capable
329	Yarra	Rapid	425925.9846	5821318.911	-37.75244	146.15913	Catchment Capable
330	Yarra	Detailed	389033.9851	5823176.923	-37.73197	145.74071	Ecological Perspective & Canopy Connections
331	Yarra	Rapid	333077.9845	5822248.94	-37.73183	145.10575	Practical Ecology
332	Yarra	Rapid	369128.9848	5822597.929	-37.73455	145.51478	Catchment Capable
333	Yarra	Detailed	324523.9821	5814747.943	-37.7978	145.00691	Ecological Perspective & Canopy Connections
334	Yarra	Rapid	338321.9842	5821269.939	-37.74159	145.16501	Practical Ecology
335	Yarra	Rapid	336647.9822	5815056.939	-37.79727	145.14462	Catherine Clowes
336	Yarra	Rapid	335618.9842	5821107.939	-37.74257	145.13431	Practical Ecology
337	Yarra	Rapid	370665.9835	5818504.928	-37.77165	145.53149	Catchment Capable
338	Yarra	Detailed	332282.9839	5820265.94	-37.74955	145.09627	Ecological Perspective & Canopy Connections
339	Yarra	Rapid	364700.9837	5819475.93	-37.76204	145.46396	Catchment Capable
340	Yarra	Rapid	381785.9836	5818678.925	-37.77159	145.65774	Catchment Capable
341	Yarra	Rapid	375138.984	5819781.927	-37.76077	145.58248	Catchment Capable
342	Yarra	Rapid	386273.9857	5825424.924	-37.71137	145.70974	Catchment Capable
343	Yarra	Detailed	369314.9863	5827577.929	-37.68971	145.51778	Ecological Perspective & Canopy Connections
344	Yarra	Rapid	377406.9836	5818672.926	-37.77107	145.60803	Catchment Capable
345	Yarra	Detailed	339507.9844	5821990.938	-37.73531	145.17862	Ecological Perspective & Canopy Connections
346	Yarra	Detailed	360673.9833	5817815.932	-37.77639	145.41794	Ecological Perspective & Canopy Connections
347	Yarra	Rapid	341656.9826	5815987.937	-37.78976	145.20169	Catherine Clowes
348	Yarra	Rapid	401253.9829	5816037.919	-37.7977	145.87839	Catchment Capable

349	Yarra	Rapid	378341.9829	5816305.926	-37.79252	145.61825	Catchment Capable
350	Yarra	Rapid	330838.9829	5817181.941	-37.77707	145.07917	Catherine Clowes
351	Yarra	Rapid	358542.9823	5814634.932	-37.80472	145.39313	Catchment Capable
352	Yarra	Rapid	370723.9821	5814033.928	-37.81194	145.53135	Catchment Capable
353	Yarra	Rapid	338892.9821	5814522.938	-37.80248	145.16999	Catherine Clowes
354	Yarra	Detailed	378327.9817	5812465.926	-37.82712	145.61744	Ecological Perspective & Canopy Connections
355	Yarra	Rapid	381414.9821	5813876.925	-37.81481	145.65274	Catchment Capable
356	Yarra	Rapid	379172.981	5810373.926	-37.84608	145.62669	Catchment Capable
357	Yarra	Rapid	374524.9815	5811900.927	-37.83169	145.57415	Catchment Capable
358	Yarra	Rapid	363397.9812	5811081.931	-37.83747	145.44759	Catchment Capable
359	Yarra	Detailed	392052.4446	5810967.261	-37.84235	145.77314	Ecological Perspective & Canopy Connections
360	Yarra	Rapid	368714.9806	5809314.929	-37.85418	145.50767	Catchment Capable
361	Yarra	Rapid	387959.9807	5809389.923	-37.85607	145.72639	Catchment Capable
362	Yarra	Rapid	389800.9804	5808355.922	-37.86561	145.74716	Catchment Capable
363	Yarra	Rapid	375807.9807	5809582.927	-37.85276	145.58832	Catchment Capable
364	Yarra	Rapid	361838.9782	5801860.931	-37.92032	145.42811	Catchment Capable
365	Yarra	Rapid	373528.9776	5799358.927	-37.94456	145.56063	Catchment Capable
366	Yarra	Rapid	353043.9843	5821339.934	-37.74345	145.33204	Catchment Capable
367	Yarra	Rapid	321932.9813	5811996.944	-37.82208	144.97682	Catherine Clowes
368	Yarra	Rapid	340402.9859	5826487.938	-37.69495	145.18976	Practical Ecology
369	Yarra	Detailed	366623.9907	5841689.93	-37.56217	145.48984	Ecological Perspective & Canopy Connections
370	Yarra	Rapid	326349.9811	5811273.942	-37.82944	145.02681	Catherine Clowes
371	Yarra	Rapid	364622.9911	5843111.93	-37.54906	145.46746	Catherine Clowes
372	Yarra	Rapid	339755.9875	5831805.938	-37.64693	145.18359	Practical Ecology
373	Maribyrnong	Rapid	308136.9845	5822463.948	-37.72501	144.82294	Catherine Clowes
374	Maribyrnong	Rapid	303638.9857	5826354.949	-37.68901	144.77299	Catherine Clowes
375	Yarra	Rapid	338816.9907	5842080.938	-37.5542	145.17522	Practical Ecology
376	Yarra	Detailed	348899.9865	5828576.935	-37.67757	145.28653	Ecological Perspective & Canopy Connections

377	Yarra	Rapid	353113.9894	5837773.934	-37.59539	145.33615	Catherine Clowes
378	Yarra	Detailed	395184.9833	5817479.921	-37.78403	145.80967	Ecological Perspective & Canopy Connections
379	Yarra	Rapid	360488.9901	5839786.932	-37.5784	145.42004	Catherine Clowes
380	Yarra	Rapid	348768.991	5842969.935	-37.54788	145.28802	Catherine Clowes
381	Yarra	Rapid	358720.9861	5827100.932	-37.69244	145.39757	Catchment Capable
382	Yarra	Rapid	360825.9874	5831149.932	-37.65628	145.42221	Catchment Capable
383	Maribyrnong	Rapid	302348.0015	5877111.95	-37.23157	144.77197	Tree Wishes
384	Yarra	Rapid	362989.9907	5841602.931	-37.56242	145.4487	Catherine Clowes
385	Maribyrnong	Rapid	317962.9971	5862835.945	-37.36336	144.94438	Tree Wishes
386	Maribyrnong	Rapid	315511.9961	5859571.946	-37.39227	144.91591	Tree Wishes
387	Yarra	Rapid	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed
388	Maribyrnong	Rapid	315791.9981	5866208.946	-37.33254	144.92072	Tree Wishes
389	Maribyrnong	Rapid	300055.9913	5844637.951	-37.52357	144.73738	Tree Wishes
390	Yarra	Rapid	331537.9922	5847001.941	-37.50857	145.09398	Catherine Clowes
391	Yarra	Rapid	342705.9926	5848292.937	-37.49891	145.22056	Catherine Clowes
392	Maribyrnong	Rapid	304422.9861	5827896.949	-37.67529	144.78229	Catherine Clowes
393	Westernport	Rapid	382451.9676	5767536.924	-38.23249	145.65692	Mal Brown
394	Maribyrnong	Detailed	300382.9905	5841736.95	-37.54977	144.74029	Practical Ecology
395	Yarra	Rapid	325183.9908	5842396.943	-37.54887	145.02103	Catherine Clowes
396	Maribyrnong	Detailed	287112.9957	5858428.955	-37.39648	144.59501	Consultant Ecologist
397	Westernport	Rapid	397525.9703	5775765.92	-38.16018	145.8303	Mal Brown
398	Werribee	Rapid	282958.6527	5825129.818	-37.69538	144.53827	Abzeco
399	Werribee	Rapid	274725.9868	5830206.958	-37.64768	144.44654	Tree Wishes
400	Dandenong	Rapid	351180.9814	5812065.935	-37.8267	145.309	Practical Ecology
401	Werribee	Rapid	299698.9841	5821345.951	-37.73327	144.72696	Catherine Clowes
402	Werribee	Rapid	295006.9849	5823851.952	-37.70967	144.67446	Veryan Green Environment Pty Ltd
403	Dandenong	Rapid	353512.9816	5812605.934	-37.82221	145.3356	Practical Ecology
404	Yarra	Rapid	335619.9823	5815254.939	-37.7953	145.13299	Catherine Clowes
405	Dandenong	Rapid	344739.9745	5790057.936	-38.02389	145.2311	Carew Environmental
406	Werribee	Rapid	259629.2534	5832945.329	-37.6192	144.2765	Abzeco

407	Werribee	Rapid	310830.0557	5807913.189	-37.85663	144.84968	Catherine Clowes
408	Dandenong	Rapid	346872.9755	5793371.936	-37.9944	145.2561	Carew Environmental
409	Dandenong	Rapid	352203.9765	5796393.934	-37.96806	145.31741	Carew Environmental
410	Werribee	Detailed	291733.9858	5826895.953	-37.68151	144.63823	Brian Bainbridge Wildlife Art and Illustration
411	Dandenong	Rapid	342276.9784	5802451.937	-37.91181	145.20577	Catherine Clowes
412	Westernport	Rapid	340602.9579	5737093.937	-38.50027	145.17207	Mal Brown
413	Dandenong	Rapid	344319.977	5798000.937	-37.95226	145.22804	Catherine Clowes
414	Westernport	Rapid	337846.9643	5757704.938	-38.31411	145.14523	Shepherd Ecology
415	Westernport	Rapid	340666.9681	5769842.938	-38.20528	145.18021	Shepherd Ecology
416	Westernport	Detailed	344769.966	5762997.936	-38.26766	145.22555	Shepherd Ecology
417	Westernport	Rapid	341814.965	5759709.937	-38.29676	145.19105	Shepherd Ecology
418	Westernport	Rapid	340637.965	5760031.938	-38.29365	145.17767	Shepherd Ecology
419	Dandenong	Rapid	354867.9772	5798585.933	-37.94874	145.34817	Carew Environmental
420	Westernport	Rapid	355495.9577	5736265.933	-38.51027	145.34262	Mal Brown
421	Dandenong	Rapid	354062.9726	5783679.933	-38.0829	145.33598	Carew Environmental
422	Werribee	Rapid	305591.9815	5813077.949	-37.80901	144.79157	Catherine Clowes
423	Yarra	Rapid	400985.9884	5833908.919	-37.63662	145.87778	EcoFutures & Carew Environmental
424	Yarra	Rapid	319273.9949	5855862.945	-37.42643	144.95748	Tree Wishes
425	Yarra	Rapid	319819.9905	5841582.944	-37.55517	144.96015	Tree Wishes
426	Dandenong	Detailed	340593.9711	5779207.938	-38.12091	145.18147	Practical Ecology
427	Werribee	Rapid	278426.9768	5798012.957	-37.93847	144.47862	Catherine Clowes
428	Werribee	Rapid	283417.9764	5796893.956	-37.94975	144.53503	Catherine Clowes
429	Yarra	Rapid	322517.9897	5838897.944	-37.57988	144.99002	Tree Wishes
430	Westernport	Rapid	343124.9575	5735882.937	-38.51162	145.20071	Mal Brown
431	Yarra	Rapid	349388.9849	5823167.935	-37.72638	145.29096	Catherine Clowes
432	Werribee	Rapid	276635.9297	5809928.844	-37.83074	144.46194	Abzeco
433	Werribee	Rapid	280584.9791	5805518.956	-37.87141	144.50544	Catherine Clowes
434	Westernport	Rapid	369186.9719	5781453.929	-38.10527	145.50796	Mal Brown
435	Werribee	Rapid	273308.9778	5801194.959	-37.90856	144.42143	Abzeco
436	Dandenong	Rapid	335753.9723	5783130.939	-38.0847	145.12718	Carew Environmental

437	Werribee	Rapid	286884.9749	5791878.954	-37.99573	144.57297	Catherine Clowes
438	Werribee	Rapid	258520.9788	5804613.963	-37.87398	144.25454	Tree Wishes
439	Westernport	Rapid	363442.9683	5770047.93	-38.20718	145.44028	Shepherd Ecology
440	Werribee	Rapid	269492.9816	5813616.96	-37.79576	144.38203	Veryan Green Environment Services Pty Ltd
441	Dandenong	Rapid	348201.9799	5807447.935	-37.86781	145.2742	Practical Ecology
442	Dandenong	Rapid	351232.9797	5806663.934	-37.87537	145.30848	Practical Ecology
443	Yarra	Rapid	353363.9823	5815109.934	-37.79963	145.33442	Practical Ecology
444	Yarra	Rapid	349838.9835	5818832.935	-37.76551	145.29516	Catherine Clowes
445	Yarra	Rapid	360799.9874	5831227.932	-37.65557	145.42193	Catchment Capable
446	Yarra	Rapid	361888.9889	5836000.931	-37.61273	145.43518	Catchment Capable
447	Maribyrnong	Rapid	315430.9956	5858190.946	-37.4047	144.91465	Tree Wishes
448	Yarra	Rapid	355916.9884	5834553.933	-37.62485	145.36725	Catherine Clowes
449	Maribyrnong	Rapid	306651.9929	5849253.949	-37.4834	144.81318	Tree Wishes
450	Maribyrnong	Rapid	306017.9912	5843849.949	-37.53194	144.80459	Tree Wishes
451	Westernport	Rapid	337391.9667	5765200.939	-38.24651	145.14176	Shepherd Ecology
452	Werribee	Detailed	287652.9821	5815034.954	-37.78739	144.58852	Brian Bainbridge Wildlife Art and Illustration
453	Yarra	Rapid	336440.9953	5856847.939	-37.42074	145.15161	Practical Ecology
454	Werribee	Rapid	286537.9819	5814119.955	-37.79537	144.5756	Catherine Clowes
455	Werribee	Rapid	301838.9792	5805678.95	-37.87484	144.74694	Catherine Clowes
456	Maribyrnong	Rapid	308383.994	5853063.948	-37.44945	144.83375	Tree Wishes
457	Werribee	Rapid	294089.9825	5816347.952	-37.77704	144.66194	Catherine Clowes
458	Maribyrnong	Rapid	315113.9947	5855232.946	-37.43128	144.91033	Abzeco
459	Maribyrnong	Detailed	313328.9957	5858530.946	-37.40121	144.891	Practical Ecology
460	Maribyrnong	Rapid	313235.9942	5853436.946	-37.44708	144.88866	Tree Wishes
461	Yarra	Rapid	356618.9849	5822964.933	-37.72937	145.37293	Catchment Capable
462	Westernport	Rapid	330327.9681	5769656.941	-38.20507	145.06214	Shepherd Ecology
463	Yarra	Detailed	358394.9811	5810859.932	-37.83871	145.39071	Ecological Perspective & Canopy Connections
464	Westernport	Rapid	331933.9668	5765613.94	-38.24179	145.07951	Shepherd Ecology
465	Werribee	Rapid	293554.9779	5801558.952	-37.9101	144.65165	Catherine Clowes
466	Werribee	Rapid	293554.9779	5801558.952	-37.9101	144.65165	Catherine Clowes

467	Werribee	Rapid	294632.9771	5799026.952	-37.93315	144.66318	Catherine Clowes
468	Westernport	Rapid	343259.9695	5773986.937	-38.16841	145.21072	Mal Brown
469	Westernport	Rapid	395638.9728	5783898.92	-38.08668	145.80996	Mal Brown
470	Yarra	Rapid	345851.9823	5815147.936	-37.79805	145.24913	Practical Ecology
471	Yarra	Rapid	355723.9826	5815831.933	-37.7935	145.36136	Catchment Capable
472	Yarra	Rapid	331405.9796	5806607.941	-37.87242	145.08314	Catherine Clowes
473	Yarra	Rapid	324432.9826	5816107.943	-37.78553	145.00621	Catherine Clowes
474	Yarra	Rapid	357127.9797	5806450.933	-37.87824	145.37544	Practical Ecology
475	Yarra	Rapid	333787.9805	5809394.94	-37.84776	145.11085	Catherine Clowes
476	Yarra	Rapid	329091.9802	5808598.941	-37.85406	145.05732	Catherine Clowes
477	Yarra	Rapid	332439.981	5811153.94	-37.83166	145.09595	Catherine Clowes
478	Westernport	Rapid	346802.9679	5769048.936	-38.2135	145.25008	Shepherd Ecology
479	Westernport	Rapid	355586.9709	5778291.933	-38.13168	145.35226	Mal Brown
480	Westernport	Rapid	378116.9706	5777215.926	-38.1447	145.60906	Mal Brown
481	Westernport	Rapid	376955.9725	5783178.926	-38.09082	145.59685	Mal Brown
482	Yarra	Detailed	380847.9796	5805889.925	-37.8867	145.64499	Ecological Perspective & Canopy Connections
483	Westernport	Rapid	382731.9634	5754245.924	-38.35227	145.65792	Mal Brown
484	Yarra	Rapid	334354.979	5804502.94	-37.89193	145.11617	Catherine Clowes
485	Westernport	Rapid	372250.9585	5738690.928	-38.49098	145.53517	Mal Brown
486	Werribee	Rapid	302573.9812	5812014.95	-37.81794	144.75702	Catherine Clowes
487	Westernport	Detailed	378548.9636	5754850.926	-38.34627	145.61016	Ecological Perspective & Canopy Connections
488	Werribee	Rapid	290638.9769	5798105.953	-37.94053	144.6175	Catherine Clowes
489	Werribee	Rapid	286289.2496	5804123.42	-37.88533	144.56982	Catherine Clowes
490	Dandenong	Detailed	353007.9801	5807793.934	-37.86548	145.32889	Ecological Perspective & Canopy Connections
491	Werribee	Rapid	289287.9788	5804486.954	-37.88276	144.604	Catherine Clowes
492	Werribee	Rapid	263361.9948	5855924.962	-37.41327	144.32615	Abzeco
493	Werribee	Rapid	267553.997	5863070.961	-37.34998	144.37571	Veryan Green Environment Services Pty Ltd
494	Westernport	Rapid	379624.9616	5748455.925	-38.40403	145.62138	Mal Brown

495	Werribee	Rapid	303847.9798	5807598.949	-37.85798	144.77029	Catherine Clowes
496	Werribee	Rapid	274573.8876	5840598.097	-37.55408	144.44802	Abzeco
497	Werribee	Detailed	266633.9861	5827850.961	-37.66687	144.35416	Consultant Ecologist
498	Maribyrnong	Rapid	301859.9934	5851006.95	-37.4666	144.75949	Tree Wishes
499	Werribee	Rapid	268972.9877	5833054.96	-37.62061	144.3823	Veryan Green Environment Services Pty Ltd
500	Werribee	Rapid	272993.9843	5822383.959	-37.7177	144.42449	Tree Wishes
501	Werribee	Rapid	280964.556	5830848.067	-37.64342	144.51739	Veryan Green Environment Services Pty Ltd
503	Yarra	Rapid	295549.9758	5794581.952	-37.97338	144.67234	Catherine Clowes
504	Westernport	Rapid	351221.9892	5836886.935	-37.60308	145.31454	Catherine Clowes
505	Westernport	Rapid	326141.9584	5738980.942	-38.48057	145.00679	Shepherd Ecology
506	Werribee	Rapid	331786.9623	5751168.94	-38.37187	145.07439	Shepherd Ecology
507	Yarra	Rapid	264954.9856	5826332.961	-37.68011	144.33465	Abzeco
508	Yarra	Rapid	367466.9875	5831255.929	-37.6563	145.4975	Catchment Capable
509	Yarra	Rapid	324154.9808	5810731.943	-37.83391	145.00175	Catherine Clowes

Appendix G – Lessons learnt

Lessons learnt from project team members

The project delivery team members (detailed in Section 2.1), undertook an internal workshop following the completion of the field surveys and data analysis tasks to have a debrief on the SVCE project and identify aspects that worked well and areas for improvement.

Lessons learnt for project delivery

Lessons learnt for project delivery are summarised in the Table 5 below.

Table 4. Lessons learnt for project delivery from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Microsoft Teams for document sharing and document control	Microsoft Teams was utilised during the project to upload project documents, including fieldwork scheduling and call-in registers. Microsoft Teams was utilised as it allows multiple users to be in the same document at the same time which was important given the number of subcontractors who were involved in the project. Having documents on Microsoft Teams also ensured document control by always having current documents available. A 'How to guide' document for Microsoft Teams was developed for the project for the project team and subcontractors who were not familiar with Microsoft Teams, and this included details on where to save relevant forms and data for the project.	Many of the subcontractors involved in the project had limited experience using Microsoft Teams and initially found it difficult to navigate the program. One on one online training through screen sharing was utilised to overcome these challenges and by the end of the project all subcontractors were comfortable with accessing documents through this system. Microsoft Teams has limited functionality or options for scheduling field dates and sites for multiple contractors. We examined different applications including Dynamics 365 Field Service and Shifts, but these applications were complicated and not easy for the subcontractors to use. Instead, we adopted a Microsoft Excel Spreadsheet for subcontractor availability (refer to Figure 8), where subcontractors nominated days, they were available, and we partnered them with support staff (as required).	In future projects, more time will be allowed to prepare safety documentation and protocols, development and delivery of training, arrangement of landowner access and scheduling of fieldwork. Ideally a minimum of two months would be allowed in the project schedule prior to the commencement of field surveys to do this. In addition, alternative collaborative applications could be considered for document sharing and fieldwork scheduling, such as Monday.com.
Landholder access	Private landholders were advised in writing by Melbourne Water of the program with contact details for both MW and EcoFutures staff. This	Access issues were completely unknown in 2021 as this was the first round of data collection for the	Landholder letters to be sent earlier.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	enabled landholders to contact us with concerns and identify and address any additional access requirements. Landholder contact was recorded in a spreadsheet which enabled multiple staff to check what contact had been made and to follow up with landholders and assessors. Where necessary sites were reallocated to an alternative location and a method for doing this was developed (Appendix H). Two project staff involved in landholder contact and multiple contact numbers provided enabled this responsibility to be shared.	program. Access and landholder contact information from 2021 will be valuable for future survey rounds. Access issues/requirements were not recorded in survey data. Landholder contact was initiated part way through the survey season leading to landholders contacting staff late in the season. Landholder contact was more time consuming than anticipated. This required daily input and project staff were flooded with calls from landholders which was a challenge to juggle with other project tasks.	Subconsultant team members provided with a letter to show landholders to minimise access issues. Bring any access notes over from landholder contact spreadsheet and sites allocated spreadsheet to future survey rounds to enable improved staging of site visits and minimise delays to survey due to access issues. Add an access comments section to Survey123 data collection form. Plan for more time and resources to landholder contact.
Site maps	Maps for each site were generated for field staff. These maps included EVC polygons, public land parcels, nominated site locations and labels, roads, major towns, contours, and waterway lines. Local knowledge of the survey sites was important as some of the sites required a fair amount of walking to get to. Field staff were selected due to their extensive experience and knowledge of the regions they were surveying.	If relying on maps alone it would be difficult for field staff to access some sites.	Field staff should have local knowledge of the area and where possible the survey site to ensure efficient and safe access and delivery of field surveys. In the future, it is worthwhile considering a map-based survey app such as ArcGIS Field maps to enable map capabilities. This could bring efficiencies to the process, including transparency and efficiency of site allocation and project team's management time.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Master Microsoft Excel site list for allocations	A master Microsoft Excel spreadsheet was generated by the EcoFutures project team for all the sites provided by Melbourne Water including the easting and northing, site ID, whether it was a detailed or rapid site, site address, whether it was public or private land, nearest hospital and address, nearest police station and address, LGA, bioregion, EVC group, target EVC, EVC group name, survey date, whether the inspection was complete, whether data was uploaded to Survey123 or spreadsheet was provided. This master spreadsheet was important as it allowed the allocation of sites to the field team, tracking of sites completed and also the reallocation of sites where field staff were unable to complete surveys at original coordinates (refer to Figure 9 for an example of site tracking utilised). Access was restricted to the master spreadsheet to the project delivery team members to ensure that data was not corrupted. A copy of the master spreadsheet was provided to the field team to be utilised for the call-in register.	The master spreadsheet was required to be manually updated by the EcoFutures project team as field surveys were completed. This was time consuming and at times resulted in minor errors, meaning the master spreadsheet had to be cross referenced against Survey123 data to cross check it's accuracy. Field team members sometimes became confused due to the size of the master spreadsheet and sometimes required clarification of site allocations.	Future surveys should aim to integrate the detail assessment with the vegetation vision and avoid fragmentation in the data collection process. Consolidation of data and consistency across systems can be time consuming and complicated.
Communication with field team	Throughout the project there was a consistent project delivery team coordinating the field surveys and developing the data schema and capture requirements. The project delivery	The project was undertaken within a COVID-19 pandemic and lockdowns and restrictions severely	Ensure all email communication is sent to the field team using simple, clear, and succinct language.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
members and field work scheduling	team had clear tasks and subcontractors knew who to contact for advice on sites selected and reallocations required (Rob Dabal), equipment issues (Alanna Main), fieldwork safety requirements and scheduling (Camille Oliver) and Survey123 technical support (Ying Quek). Regular phone and email contact between the project management team and field team members as well as use of the subcontractor availability and sites allocated spreadsheets and field maps enabled effective coordination of field work scheduling.	limited face-to-face interactions between project team and field team members. Some complex emails were required to be sent to field team members which lead to confusion on their requirements and information to be provided to the EcoFutures project team members at times during the projects. Some team members also did not like to access documents through Microsoft Teams and wanted copies of documents to be sent via email. Emails were utilised to convey messages; however, some field team members did not respond to email messages as they were often in the field which made it hard to communicate project updates with all field team members efficiently.	If tasks are changed, mass send message to all project team members using email and SMS alerts to ensure field team members receive urgent communications.
Spatial grouping of field survey sites to allocate sites to field team members	To allow the most efficient delivery of the field surveys site locations were grouped based on the following: • Catchment • Rapid sites on public land (6 sites closest together per day) • Rapid sites on private land (5 sites closest together per day) • Detailed sites (2 sites closest together per day). The groupings were undertaken by an EcoFutures GIS spatial analyst, and the field staff were then allocated a list of sites for	Some field survey sites took longer than expected or were unable to be accessed due to being too difficult to access or lack of landowner approval. A decision to reallocate sites often had to be made very quickly in the field, however, given the very capable field team and project team this was completed efficiently, and often field teams could complete the survey on the same day. A total of 197 sites had to be reallocated due to issues with access, no permission to the site or unsafe. Reallocation was captured under the question 'Does the site need reallocation?'	The grouping of survey sites and allocating to field team members worked well during the spring 2021 field surveys and a similar approach should be utilised for the spring 2024 field surveys. Where possible the same field teams should complete the field surveys in spring 2024 given their knowledge and understanding of access for the sites.

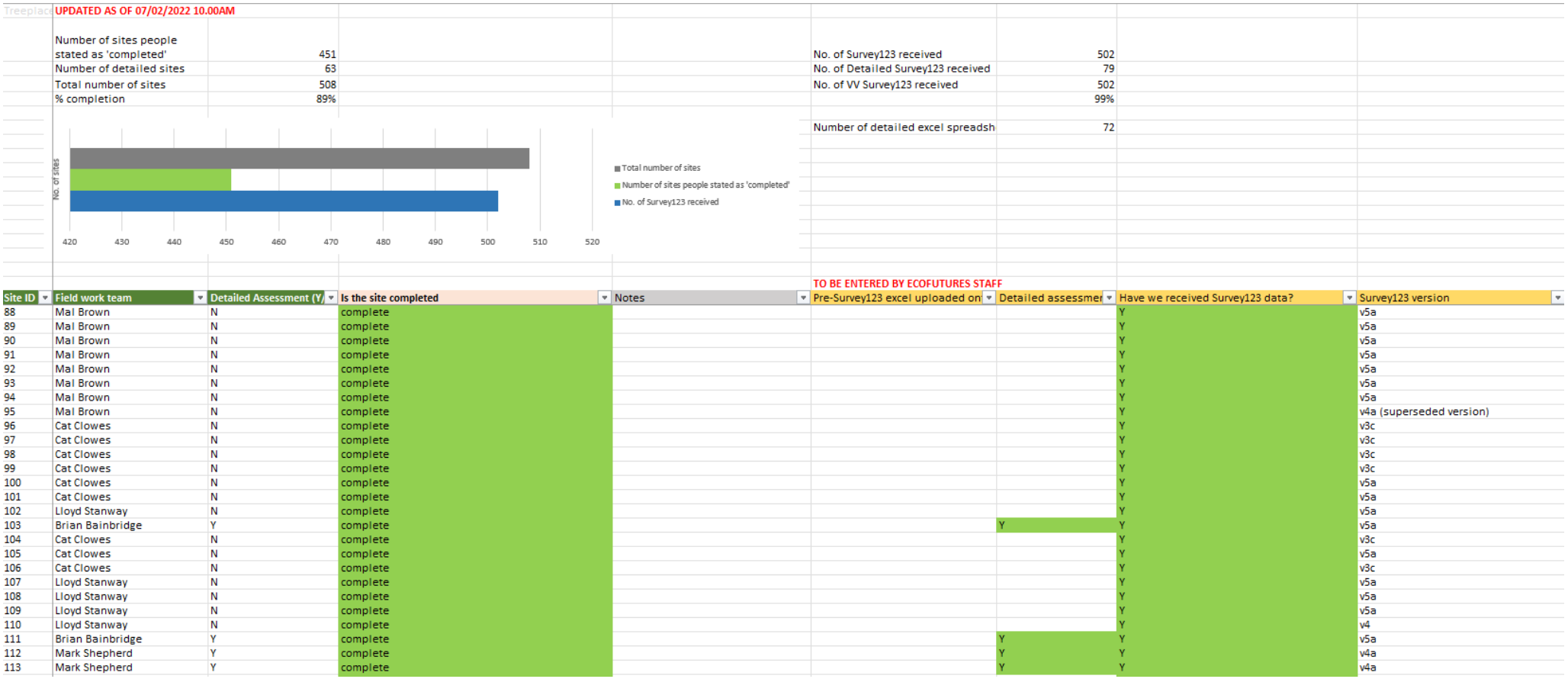
Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	them to complete between September to December 2021. Field staff could determine the order in which they completed the sites but notified the EcoFutures project delivery team of which sites they were completing each day as part of the call-in register.		
Reallocation of sites, where sites inaccessible or unsuitable	There were situations where landowners didn't grant access for the SVCE surveys, or the site was unsuitable when field staff arrived at the site (i.e. site had been recently cleared or safety risks due to burnt trees from bushfires). There were also sites where landowners communicated to MW or EcoFutures that access was not granted/possible. The EcoFutures project team local knowledge of the catchments combined with spatial expertise allowed reallocations to be undertaken quickly while field staff were on site to minimise time lost. See appendix H for approach used to reallocate sites.	The reallocation of sites sometimes was required to happen very quickly, and the updated GPS site location was often not recorded within the master spreadsheet of the site locations. However, the reallocation was noted in the master spreadsheet and the actual GPS location was recorded as part of the survey.	Survey123 forms should include a map and GPS coordinates of the sites selected for the SVCE survey now they have been refined through the Spring 2021 surveys.
Overall project management of the project	The EcoFutures project team ensured the smooth management of the project through setting up the project in Microsoft Project and clear allocation of tasks to the delivery team. Field staff engaged in the project have extensive experience working with Melbourne Water and decades of local catchment knowledge. They were instrumental in decisions about the allocation of sites. Field	The time required to manage the project, logistics and data management took a lot longer than expected. Liaising with landowners regarding access to private properties and organising access to closed catchments through Melbourne Water took a month long than expected and delayed the implementation of field surveys. Reallocation of sites where access was not permitted also took significant time in some instances for MW and EcoFutures staff to liaise with landholders,	Ensure there is sufficient time budgeted and allocated to the project to manage the complex logistics and data required for delivery. At least $200,000 (accounting for inflation and wage increases) should be included to deliver the project management aspects for the project in the spring 2024 field surveys.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	staff were supported by the project manager (Rob Dabal) who has a solid working knowledge of the study area. Rob was in-turn supported by the strong team of EcoFutures and Alluvium staff who assisted in the organisation of field equipment, spatial analysis and maps, safety documents and training, liaison with landowners and Melbourne Water, data capture and clearing, as well as the delivery of reporting. Subcontractors engaged for the project were also extremely professional, hardworking and were engaged throughout the project from inception to delivery. Subcontractors were passionate about completing the field surveys to an extremely high standard given the objectives of the project ultimately to underpin management decisions and guide waterway investment across the region by Melbourne Water.	field teams, prepare new maps and update safety documents (i.e., call in register).	Ensure future field surveys are delivered by an experienced project manager with local knowledge of the catchments, who is supported by a project team with spatial, data capture and analysis, as well as a highly experienced field team.

Primary task		Subcontractor name	Tuesday 19/10/21	Wednesda 20/10/21	Thursday 21/10/21	Friday 22/10/21	Saturday 23/10/21	Sunday 24/10/21	Monday 25/10/21	Tuesday 26/10/21	Wednesda 27/10/21	Thursday 28/10/21	Friday 29/10/21	Saturday 30/10/21	Sunday 31/10/21
Rapid only		ABZECO person 1 - Michael Cirone	Available for support	Available for support	Available for support	Available for support				Available for support	Available for support	Available for support	Available for support		
Detailed and rapid		ABZECO person 2 - Alistair Smith	Available for support	Available for support	Available for support	Available for support			Stanway and Alistair S	Available for support	Available for support	Available for support	Available for support		
Detailed and rapid		ABZECO person 3 - Matthew Lee	Matthew L Available for support	Matthew L Available for support	Matthew L Available for support	Matthew L Available for support			Matthew L Available for support	Matthew L Available for support	Matthew L Available for support	Matthew L Available for support	Matthew L Available for support		
		ABZECO person 4 - Jade Philipson	Jade P Available for support	Jade P Available for support	Jade P Available for support	Jade P Available for support			Jade P Available for support	Jade P Available for support	Jade P Available for support	Jade P Available for support	Jade P Available for support		
		ABZECO person 5 - Daniel Nippard	Cat Clowes/Daniel N	Cat Clowes/Daniel N	Cat Clowes/Daniel N										
		Catherine Clowes	Cat Clowes/Daniel N	Cat Clowes/Daniel N	Cat Clowes/Daniel N										
		Damian Magner													
		Dean Platt			Dean Platt and Llyod Stanway	Dean Platt and Llyod Stanway									
		Llyod Stanway			Dean Platt and Llyod Stanway	Dean Platt and Llyod Stanway				Lloyd Stanway and Matt (ABZECO)		Lloyd Stanway and Matt (ABZECO)	Lloyd Stanway and Matt (ABZECO)		
		Mal Brown		Mal Brown and David Carew	Mal Brown and David Carew				Mal Brown and David Carew	Mal Brown and David Carew					

Subcontractor name	Monday 01/11/21	Tuesday 02/11/21	Wednesda 03/11/21	Thursday 04/11/21	Friday 05/11/21	Saturday 06/11/21	Sunday 07/11/21	Monday 08/11/21	Tuesday 09/11/21	Wednesda 10/11/21	Thursday 11/11/21	Friday 12/11/21	Saturday 13/11/21	Sunday 14/11/21	November Monday 15/11/21	Tuesday 16/11/21	Wednesda 17/11/21
ABZECO person 1 - Michael Cirone		C Available for	Available for support	C Available for	C Available for												
ABZECO person 2 - Alistair Smith		Available for support	Available for support	Available for support	Stanway and Alistair S				Stanway and Alistair S	Available for support	Stanway and Alistair S	Stanway and Alistair S			Stanway and Alistair S	Stanway and Alistair S	Available for support
ABZECO person 3 - Matthew Lee		Matthew L Available for support	Matthew L Available for support	Matthew L Available for support	Matthew L Available for support												
ABZECO person 4 - Jade Philipson		Jade P Available for support	Jade P Available for support	Jade P Available for support	Jade P Available for support			Jade P Available for support	Jade P Available for support	Jade P Available for support							
ABZECO person 5 - Daniel Nippard			Cat Clowes/Daniel N		Cat Clowes/ Daniel N						Dan N to support Cat						
Catherine Clowes			Cat Clowes/Daniel N		Cat Clowes/ Daniel N						Dan N to support Cat						
Damian Magner															David Carew and Damian Magner		Mal Brown and Damian Magner
Dean Platt												Dean Platt + Lorien					
Llyod Stanway					Llyod Stanway and Alistair S or Dean Platt				Llyod Stanway and Matt (ABZECO)		Llyod Stanway and Matt (ABZECO)						
Mal Brown			Mal Brown and David Carew					Mal Brown and David Carew								Mal Brown and David Carew	

Figure 8. Subcontractor availability spreadsheet



UPDATED AS OF 07/02/2022 10.00AM

Number of sites people stated as 'completed'	451
Number of detailed sites	63
Total number of sites	508
% completion	89%

No. of Survey123 received	502
No. of Detailed Survey123 received	79
No. of VV Survey123 received	502
	99%
Number of detailed excel spreadsh	72

TO BE ENTERED BY ECOFUTURES STAFF

Site ID	Field work team	Detailed Assessment (Y/	Is the site completed	Notes	Pre-Survey123 excel uploaded on	Detailed assessmer	Have we received Survey123 data?	Survey123 version
88	Mal Brown	N	complete				Y	v5a
89	Mal Brown	N	complete				Y	v5a
90	Mal Brown	N	complete				Y	v5a
91	Mal Brown	N	complete				Y	v5a
92	Mal Brown	N	complete				Y	v5a
93	Mal Brown	N	complete				Y	v5a
94	Mal Brown	N	complete				Y	v5a
95	Mal Brown	N	complete				Y	v4a (superseded version)
96	Cat Clowes	N	complete				Y	v3c
97	Cat Clowes	N	complete				Y	v3c
98	Cat Clowes	N	complete				Y	v3c
99	Cat Clowes	N	complete				Y	v3c
100	Cat Clowes	N	complete				Y	v5a
101	Cat Clowes	N	complete				Y	v5a
102	Lloyd Stanway	N	complete				Y	v5a
103	Brian Bainbridge	Y	complete			Y	Y	v5a
104	Cat Clowes	N	complete				Y	v3c
105	Cat Clowes	N	complete				Y	v5a
106	Cat Clowes	N	complete				Y	v3c
107	Lloyd Stanway	N	complete				Y	v5a
108	Lloyd Stanway	N	complete				Y	v5a
109	Lloyd Stanway	N	complete				Y	v5a
110	Lloyd Stanway	N	complete				Y	v4
111	Brian Bainbridge	Y	complete			Y	Y	v5a
112	Mark Shepherd	Y	complete			Y	Y	v4a
113	Mark Shepherd	Y	complete			Y	Y	v4a

Figure 9. Master spreadsheet of SVCE site allocations and details of site surveys completed. This spreadsheet allowed us to cross reference with Survey123 results and chase up subcontractors as required to upload survey data to ArcGIS.

Lessons learnt for data capture, consolidation and cleaning

Lessons learnt for data capture, consolidation and cleaning are summarised in the Table 5 below.

Table 5. Lessons learnt for data capture, consolidation, and cleaning from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Microsoft Excel spreadsheets for subplot floristic assessment	Microsoft Excel spreadsheets were utilised to capture the subplot floristic assessment data for the detailed surveys as Survey123 did not have the ability to capture this type of transect data. The structure of the spreadsheet helps subbies to view each species across each subplot quickly and easily, adding efficiency to field botanists	The biggest challenge was getting the completed excel files sent by field botanists in a timely manner. Inconsistency in data collection remains a major issue during the post processing of data. While the Microsoft Excel spreadsheet included a good amount of validation rules, data received from botanists and support persons had corrupted validation rules and templates(templates were manipulated). There was many variations of the document template and data values which made it difficult and complex to automate post-processing tasks. It also required many iterations with botanists to achieve required consistency, completeness, and/or accuracy of data. Extensive human intervention and effort were required to manipulate the excel spreadsheets to keep an acceptable level of consistency to enable automation of the data ingestion into the mainFile Geodatabase. Despite detailed, and clear instructions provided to subcontractors to not change the excel template provided, this still happened more often than expected. Hence, automation was long and complex to include the exceptions and variations identified in the template and data values.	Survey123 has been recently updated to allow the capture of the subplot floristic assessment data. The Survey123 form for the project (version 5a) should be updated prior to the next field survey into the new version of Survey123 to allow the capture of this data and not require a separate Microsoft Excel spreadsheet.
Survey123	Survey123 was utilised to capture rapid field assessment data and some of the detailed field assessment data. Due to constraints within Survey123 the subplot floristic	Survey design in Survey123 was complex, challenging and time consuming given the complexity of the survey methods.	Data governance and protocols need to be established prior to fieldwork commencing.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	assessment data was unable to be captured (refer to Microsoft Excel spreadsheets above). The use of Survey123 was supported by Melbourne Water and EcoFutures as it allowed the efficient collation of data over the large number of survey sites. The capture of data in this manner also allowed data rules to be in place to improve the quality of the data collected. The data schema for the rapid surveys was quickly developed and not as complex and worked well for the project in Survey123.	Survey 123 is not bug free. The initial deployment had rules for required values input, acceptable data value ranges, and other rule-based approach to enforce data consistency, quality, and completeness during data capture. However, many of those mechanism created issues for field works to sync their field observations into the cloud. The survey developer had to relax a lot of those rules to achieve a smoother data syncing process. As this technology is relatively new to both data team and the field workers, it is not well understood if the issues encountered were related to bugs, poor implementation or field workers' lack of familiarity with the technology. Possibly a combination of all. Moreover, the project did not have sufficient time to enable proper testing of the survey before releasing for field work. As issues would be reported by field workers, new versions of the survey had to be released. . Multiple survey versions and delays in data syncing created frustrations across the team. But once the issues were resolved and the survey became more stable, the general feeling was efficiency. Some of the issues encountered were: - Bugs occurred and prevented users from submitting the survey when a question was set as 'required' within a repeat function, and 'repeat_count' is fixed to a number (e.g. Maximum of 20 observations). The 'required' function was then removed to allow smoother transition and allow users to successfully submit their survey - Cascading selects in Survey123 can perform differently in different devices. There are a	Ensure the Survey123 form is rigorously field tested prior to implementation of the field surveys. This means that a proportion of the budget and time should be allocated for survey field testing prior to collecting the actual survey data. This will reduce data cleaning time and chance of errors occurring during the post processing time. Provide an online training on how to use Survey123 and provide tutorial and dummy data to upskill subcontractors prior to sending them out in the field. Original reference coordinates from Melbourne Water for sites sit within the main data table from Survey123, with the actual coordinates sitting within a related table. It is important that spatial display or analysis and future site surveys use the actual coordinates in the related table and not the original draft coordinates from Melbourne Water.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
		few errors encountered by some subcontractors that cascading select function was not working properly. - Adding a function to limit a value range, e.g. at least 10cm long and 1 decimal place precision, resulted in a survey bug that prevented user from entering data - Geopoint calculation (generation) does not work properly to display the coordinates on the map when reading the coordinates from a list (provided by Melbourne Water) - Appearance has been changed to 'numbers' for fields that require numerical inputs. Bugs occurred on Android devices when numbers were entered that have decimal places if appearance was not set to 'numbers'. Multiple versions of Survey123 forms also meant more post-processing work was required than initially anticipated. The way the Survey123 form was set up meant that the actual site coordinates surveyed are within a related table and not within the main data table. This has caused considerable and extensive human interventions to ensure the actual coordinates are reflected on the map.	

Lessons learnt for safety, biosecurity, and COVID-19 requirements

Lessons learnt for safety, biosecurity and COVID-19 requirements for the project are summarised in the Table 7 below.

Table 6. Lessons learnt for safety, biosecurity and COVID-19 requirements from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Provision of equipment and materials for COVID safety and biosecurity requirements	Safety and biosecurity field audits of staff revealed that overall field staff were knowledgeable about the management of field risks, appropriately dressed and equipped and conducting themselves safely in the field. There were no safety incidents reported during the project and no transmission events of COVID-19 between field staff during the project. The safety audits enabled minor issues to be identified and quickly addressed.	Providing equipment and materials for COVID safety and biosecurity as part of in-person training was only provided to detailed assessors, with these available on request to other field staff (some field staff already had required materials/equipment and all items were easily available from supermarkets/hardware stores and were reimbursable through the project). Other subcontractors were provided with safety materials and inductions via online platforms (i.e. meeting online via Microsoft Teams or over the phone to talk through requirements).	All staff to attend in-person training including a check of safety and biosecurity equipment and materials and a demonstration/run-through of protocols such as boot disinfection. Safety and biosecurity training session to be recorded so that staff joining later in the season can watch the recording. Providing all equipment and materials for COVID-19 safety and biosecurity as part of in-person training for all assessors is recommended (not possible in 2021 due to COVID risk).
Safety documentation	All project staff met the safety documentation requirements relevant to their role.	The project was undertaken during peak fieldwork periods for staff involved in the project, which meant they were very busy and had limited time to complete additional tasks required for the project, including provision of safety documents and completion of field training. Required safety documentation took a lot of time to chase up with many subcontractors and this delayed the delivery of field surveys in some cases. Some field team members didn't have the minimum safety requirements, for example first aid training, and needed time to complete training prior to the project being delivered. We were surprised that some sub-consultants who work for the Stream Frontage	Commence safety requirements (documentation, equipment, and training) of project staff well in advance of the survey period start as this required extensive follow up and delayed the start of data collection. Also require all contractual and safety documents and requirements be completed before field start

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
		Management Program did not have current first aid and advise that Melbourne Water review its training and tracking of Stream Frontage assessor First Aid qualifications.	
Safety and biosecurity audits	Providing equipment and materials for COVID safety and biosecurity as part of in-person training meant that those staff who were trained in person were more likely to be fully compliant in implementation of safety and biosecurity protocols. Safety and biosecurity field audits of staff revealed that overall field staff were knowledgeable about the management of field risks, appropriately dressed and equipped and conducting themselves safely in the field. There were no safety incidents reported during the project and no transmission events of COVID-19 between field staff during the project. The safety audits enabled minor issues to be identified and quickly addressed.	Safety and biosecurity field audits showed minor areas for improvement in biosecurity (boot cleaning) and contents of first aid kits, as well as some aspects of covid safety (details below). These issues were generally with staff who had not attended in-person training (rapid assessors) who had therefore not had their equipment sighted in-person by project staff nor a demonstration of what was required, and also support staff who joined the team late in the season. It would have been better if the field audits happened earlier in the field season, so these issues could have been addressed sooner.	Field safety and biosecurity auditing to occur early and throughout the field season to enable issues to be identified and remedied earlier.
COVID-19 requirements	The COVID-19 safe fieldwork practices and field staff requirements (detailed in Table 3 of the Safety and biosecurity manual, Appendix C), were encouraged through the field manual, field protocol agreement, online safety induction, provision of materials/equipment and in-person training (detailed survey teams only), and field auditing. While these protocols were successful overall (no covid transmission	The ever-changing COVID-19 requirements was a challenge for the project. We were required to update our COVID-19 Safe Plan twice over the duration of the surveys to ensure that Victorian government requirements were met. Implementation of mask wearing, maintaining distance, and sanitising equipment/hands appeared to	COVID-19 fieldwork practices and field staff requirements worked well for the project and will need to be updated for the spring 2024 field surveys to reflect Victorian government requirements at the time of the surveys.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	among field team members), compliance with some aspects was variable.	be difficult to implement in the field for some field team members.	
Central phone number for call ins and dedicated call-in project team member	Given the number of subcontractors were in the field we established a dedicated phone number where subcontractors were required to call for their call ins. This allowed the responsibility for monitoring field staff movements in the call-in register to be shared between senior project delivery team members of Rob Dabal, Camille Oliver, and Paul Maxwell. It also ensured where a senior project delivery team member was unavailable (i.e. due to illness or being away), field team member call ins would always be answered and monitored. Senior project delivery team members made note of call-in times required for field team members as a Microsoft Outlook calendar reminder to ensure call in times were not missed. There were two instances of failed call-ins for field teams where field teams didn't call in on time. The senior project delivery team members followed the escalation procedure in both instances and were able to contact the field teams within 20 minutes of the failed call in. In both instances the field team members had been distracted doing fieldwork and simply forgot to call in. By having a dedicated person monitoring call ins, and a clear escalation procedure in the case of a failed call-in, the project delivery team ensured the	When the central phone number was initially established some field team members directly called the mobile numbers of project delivery team members rather than the dedicated call-in phone number. However, once the field staff were aware of the number and procedure the central phone number was consistently used. Some field team members preferred texting rather than calling. Our telecommunication company only allowed a phone line with either text messages or phone calls due to being a VPN system. We nominated phone calls to ensure that if there was an incident that the field team could easily and quickly contact the project delivery team.	Future call-ins could be managed using a dedicated phone line that allows text messages and phone calls.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
	safety of field team members throughout the delivery of the fieldwork.		
Remote fieldwork restrictions	Melbourne Water has a Remote or Isolated Work Procedure (November 2019, version 17, document ID: 22297233) and locations mapped as 'remote' on the Melbourne Water Spatial Layer. Remote work was not attempted for this project as field staff working on foot in challenging and remote terrain who are more than 60 minutes from an extraction point must be in a group of not less than 8 people, including at least two wilderness first aiders have been classified as medically fit to DELWP's "Category B Firefighter Arduous", and carry a wilderness first aid kit, stretcher and reliable form of communication.	Melbourne Water's remote work procedure severely restricts SVCE field surveys in areas mapped as 'remote'. This may impact on the SVCE results as certain EVC's and plant species present in these areas may be underrepresented during the surveys. Vegetation communities in remote areas are more likely to be in better condition and offer refuge areas for some plant species under changing climatic conditions.	Currently the Melbourne Water remote work procedures requiring 8 people to attend these surveys would mean surveys in these areas would be financially unviable to deliver and add significant logistical challenges. Safety of staff in these regions could be managed with less staff and appropriate safety procedures. It is recommended that Melbourne Water review their Remote or Isolated Work Procedure (November 2019, version 17, document ID: 22297233) to determine if more practical and feasible minimum requirements could be developed to allow field surveys in these remote areas by two people. To allow Melbourne Water to consider climate change impacts on vegetation and develop effective strategies to manage these impacts within their catchments, surveys in remote areas are recommended in future programs. The capture of data in remote areas is important to understand vegetation communities which exist only in these areas, the importance of remote areas as refuge areas and ongoing changes to certain plant species which only exist in

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
			these areas under changing climatic conditions. Rather than applying generic spatial constraints to the definition of remote work a more considered approach that accounts for the experience and capacity of the assessor is suggested. Field operators with 10-20 years' experience in difficult steep terrain are well versed in operating safely in difficult environments. Increasing procedures and protocols will not make their work materially safer. A system that ranks operator experience as a filter for their suitability to conduct field work is advised. Deploying field staff with insufficient experience in difficult terrain is risky even if they follow all the correct procedures. A ranking system where field staff gain 'experience credits' for work in difficult environments could be considered.

Lessons learnt for training on survey methods and data upload requirements

Lessons learnt fort training on survey methods and data upload requirements are summarised in Table 8 below.

Table 7. Lessons learnt for training on survey methods and data upload requirements from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Online training for rapid and detailed survey methods	Training provided by Dr Matt Dell to a selected number of field staff at the commencement of the project was useful in introducing the background and methodologies and providing a forum for questions from field team members.	Method cheat sheets were developed after the online training. Additional follow up support was required with some confusion remaining around some items in the methodology. Gathering everyone in the field in a single group for in-person training would have allowed more thorough demonstration and exploration of the method, however, COVID-19 restrictions and lockdowns during the field surveys prevented this from occurring during the spring 2021 monitoring period.	Provide method cheat sheets, with benchmark examples for rapid and detailed field surveys prior to training in addition to the more comprehensive methodology information. Provide face-to-face training for field staff (when restrictions or lockdowns are not in place) to enable more interactive learning. Develop a Frequently Asked Questions document which can be added to the cheat sheets as the program progresses. Update training approach incorporating feedback from field team members following the delivery of face-to-face training.
Face-to-face training	EcoFutures staff were trained by key field team members who had field-tested the method for Dr Matt Dell. This enabled EcoFutures staff to then train all other detailed assessors in pairs to minimise COVID-19 transmission risk.	Conducting training separately for different field pairs required greater time investment by project staff than anticipated at the project inception. Training of all staff as one group would enable more efficient training delivery and provide opportunity to share questions and lessons learnt and develop relationships across the group.	Initiate project well before (preferably at least two months before) the commencement of field surveys to enable timely planning of training in-person. Provide training to all detailed assessors in one group at the same site for greater efficiency and establishing relationships

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
			across the whole group. Use upload of data from this training site as an early opportunity to check all staff are collecting data consistently and can upload data effectively. Explore if Microsoft Teams or another platform could be utilised to share lessons learnt and pictures after training, ensuring this is suited to the varying familiarity with such platforms.
Instructions (method cheat-sheets)	Method cheat-sheet for both rapid and detailed assessment methods were provided to the field team for quick reference in the field with illustrations to help guide consistent data collection. These documents assisted in the collection of consistent data.	Some questions during the field season indicated some items in the instructions could be made clearer including: • Which lifeform applies to which species with examples (there were queries around what lifeform should apply to non-graminoid species like *Dianella* spp., and scrambling species like *Rubus parvifolia*) • Which lifeforms required height data, and which count data (0-4)? • Illustration of the plot layout with a left bank example and a right bank example. • Illustration of position of rapid site in relation to the detailed site (downstream of the detailed plot at some sites, centred on the detailed plot at other sites).	Prior to the next field surveys the method cheat-sheets should be updated to address the queries around lifeforms, plot layout examples, and to ensure positioning of the rapid assessment at a detailed site is the same as the 2021 data collection. Assessors should refer to the 2021 coordinates for the upstream corner of the vegetation visions assessment, not to the coordinates for the detailed transects. Prior to the next field surveys the master species list (used in both the Microsoft Excel subplot floristic assessment and Survey123 forms) should be updated to include life form for all species.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Data upload requirements	Instructions were provided for when and how data upload was required, and data was delivered by the field team members via email and was available on the Microsoft Teams site. A Microsoft Excel spreadsheet was used by the field team to record when site surveys were completed, and data was uploaded to ArcGIS Online (for Sruvey123 forms) and emailed to the EcoFutures project team (Microsoft Excel subplot floristic assessment data).	The email with instructions for upload was sent after online training occurred due to the time constraints on the project initiation. Data upload weekly was not possible for some field team members and significant time was required in following up to ensure data was uploaded. A range of factors may have contributed to this e.g. field team members needed to spend time after the field visits to finalise some data items e.g. species names.	Ensure field staff are provided with instructions on data upload requirements prior to training and field surveys to ensure they have a clear understanding of what they need to do and ask any questions they may have. Prior to field season start, develop an agreed approach with field team members to ensure timely delivery of data, and update data upload instructions with feedback from field team members. Consider a hold point after the training day or day 1 of data collection to allow time for data from each field team member to be checked by project staff and allow any errors to be identified and rectified for future field surveys.

Lessons learnt for rapid assessment methods

Lessons learnt for the rapid assessment methods for the project are summarised in Table 9 below. This section is complemented by information from auditing in section 7.1.

Table 8. Lessons learnt for rapid assessment methods from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Vegetation visions method overall	The rapid 'vegetation visions' method provides a repeatable and rapid assessment of vegetation condition which is easily learned and applied by field team members.	Minor issues with applying lifeform categories to some species.	Update instructions in the Rapid Assessment Methodology (Appendix A) to address the queries around lifeforms.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
			Update the master species list used in both Microsoft Excel subplot floristic assessment and Survey123 forms to include life forms for all species.

Lessons learnt for detailed assessment methods

Lessons learnt for the detailed assessment methods for the project are summarised in Table 10 below. This table is complemented by the detailed field audit findings in section 7.1.

Table 9. Lessons learnt for detailed assessment methods from project team members

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Detailed assessment	Equipment, training and methodology enabled structural, floristic and disturbance data to be collected by multiple assessors.	Minor issues with methodology were identified during the initial field surveys and addressed through discussions between Melbourne Water, Dr Matt Dell and the EcoFutures project team resulting in very minor changes to the methodology (Appendix I captures the change log comparing the original data sheet and report by Dr Matt Dell and the method as implemented in 2021). Variable consistency in data collected by different observers for some aspects of the data (see section 7.1 for details)	Future rounds of data collection should utilise the updated detailed assessment methods utilised for the spring 2021 field surveys. More comprehensive and in-person training (limited in this round by Covid) and vetting of assessor accuracy should be implemented prior to field surveys to improve consistency. See section 7 for more details.
Life forms	Life form dropdown menus utilised for the Rapid Assessment Methodology (Appendix A) and Detailed Vegetation Assessment Methodology (Appendix B).	Minor issues were identified during the implementation of field survey with applying lifeform categories to some species. For example we noted that species like *Dianella tasmanica* Tasman Flax Lily were entered as either a spreading grass/sedge/rush, tufted grass/sedge/rush or occasionally as a narrow leaf herb. *Eleocharis acuta* Common Spike-sedge was entered as	Applying a uniform lifeform category to all species may not be appropriate as many species can present in a number of lifeforms depending on location, environmental attributes and phenotypic variation across a range.

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
		both a spreading grass/sedge/rush and a submerged grass. This variation is to be expected and may reveal changing strategies in flora structure over time in response to environmental pressure. It is also likely that some errors were made with inaccurate lifeforms applied. Where possible we applied post processing filters to account for this variation, but it is unlikely that all errors have been identified. Manual carryover from the 'vegetation' data sheet to the 'lifeform' data sheet was required, in some case assessors misapplied lifeform.	Update instructions in the Detailed Vegetation Assessment Methodology (Appendix B) to address the queries around lifeforms. Automating the process whereby lifeform selected in the 'vegetation' worksheet preselected into the 'lifeform' worksheet would overcome this issue
Master species list		There were inconsistencies between the species master list extracted from the Victorian Biodiversity Atlas[2] (VBA) provided by Melbourne Water and utilised for the project compared to the Flora of Victoria species list. Further post processing is likely to be required to rectify this inconsistency. Field assessors and botanists were asked to use names as applied in the Flora of Victoria as stated in the project methodology however some still applied VBA names. The list limitation and the use of free text in the Excel proforma for data collection meant that there may be some nomenclature errors compared to current name in the Flora of Victoria which can be rectified post processing. In any case the Flora of Victoria list must be used in future iterations rather than the VBA list. Post processing will rectify this issue. Where	Update master species list for the SVCE project based on a download from Flora of Victoria online using the search function (instead of VBA), edited to include: • Life form for all species • Family and genus level names for both a single species and multiple species (e.g. *Poaceae* sp., *Poaceae* spp., *Poa* sp., *Poa* spp.) Ensure only species from the current master list can be entered with all uncertain names using the "other"

[2] https://www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
		uncertainties have been identified we have crossed checked with botanists to clarify nomenclature.	option. Add instructions to method and training on using the master species list.
Vegetation visions assessment within detailed assessment	Incorporation of the rapid assessment enables detailed and rapid site data to be compared, as well as the 80 detailed sites to be included in assessment of overall condition trends across the entire Greater Melbourne region.	Rapid plot positioning in relation to detailed plots at detailed sites was left up to the assessor to decide what was appropriate, resulting in some being positioned centred on the detailed plot and some downstream of the detailed plot.	Update instructions and data collection to ensure positioning of rapid plots at detailed sites continues to be conducted in the same area (refer to "upstream" coordinates recorded in the vegetation visions assessment 2021). Add an illustration of position of rapid site in relation to the detailed site to instructions (downstream of the detailed plot at some sites, centred on the detailed plot at other sites).

Other

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
Rapid assessment	Rapid assessment of over 500 sites was achieved.	Minor issues with methodology were identified during the initial field surveys and addressed through discussions between Melbourne Water, Dr Matt Dell and the EcoFutures project team resulting in very minor changes to the methodology. Appendix I describes the change log comparing the original data sheet and report by Dr Matt Dell and the method as implemented in 2021).	Future rounds of data collection should utilise the updated detailed assessment methods utilised for the spring 2021 field surveys, as described in Appendix I More comprehensive and in-person training (limited in this round by Covid) and vetting of assessor accuracy should be implemented prior to field surveys to

Project component	What worked well?	Any issues or areas for improvement?	Future project recommendations
			improve consistency. See section 7.1 for more details.
Overall score for rapid assessment	Auditing of data at 20 sites shows good consistency between observers with overall vegetation visions scores varying by a maximum of 1 level. See section 7.1 for more details.	The rapid method appears under score some sites that would be viewed as being of very high quality and largely undisturbed. Scores for recruitment and instream vegetation cannot achieve a maximum score in some vegetation communities where recruitment is episodic and reliant on disturbance which occurs at long time intervals. For example Wet Forest, this community might only receive a high score for regeneration after a catastrophic fire. Recruitment is only ever episodic unlike most other communities where over storey recruitment is seasonally (rather than disturbance) driven. Sites also scored below very high where instream vegetation is poorly developed, however some stream forms, e.g. rocky headwater streams that are shaded will not support a high diversity of instream species. Once again this is relevant to Wet Forest and Cool Temperate Rainforest in particular although rocky headwaters in drier forest types to the west of Melbourne may also see a reduced score driven by geomorphic setting rather than vegetation characteristics.	A scoring approach that does not 'penalise' EVCs of lower diversity or species richness is proposed. Similarly to how grassland communities are not scored 'low' because of an absence of trees, Wet Forest and Cool Temperate Rainforest could have a default setting that enables a high score when a lower threshold is reached.

Lessons learnt from subconsultants

An online survey using Survey Monkey was developed to complete at the end of the fieldwork to gauge their satisfaction with the methods utilised, data capture and upload requirements, as well as safety and biosecurity protocols. The survey was provided to the 23 subconsultants who participated in field surveys in January 2022 and a copy of the survey questions is provided in Appendix J. We provided the consultants with two weeks to provide a response to the survey.

We received responses from 7 of the subconsultants and results of these responses are summarised below.

Most respondents had completed between 10-30 or over 30 surveys, so they were well placed to provide insight into what worked well and areas for improvement in relation to the project (Figure 10).

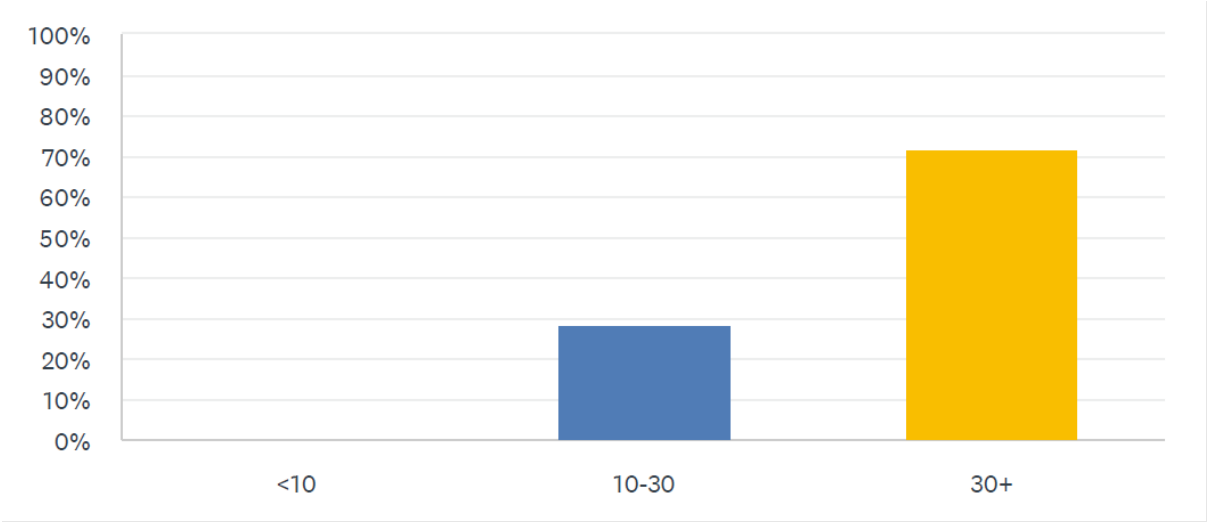


Figure 10. Survey responses received in relation to question: "How many surveys did you complete or provide field support for?"

Overall, 43% of participants surveyed were 'very satisfied' and 57% were 'satisfied' with working on the project (Figure 11). One respondent commented: "It was a great project, everyone on the team were super friendly and easy to deal with and for a big project, it was run really well."

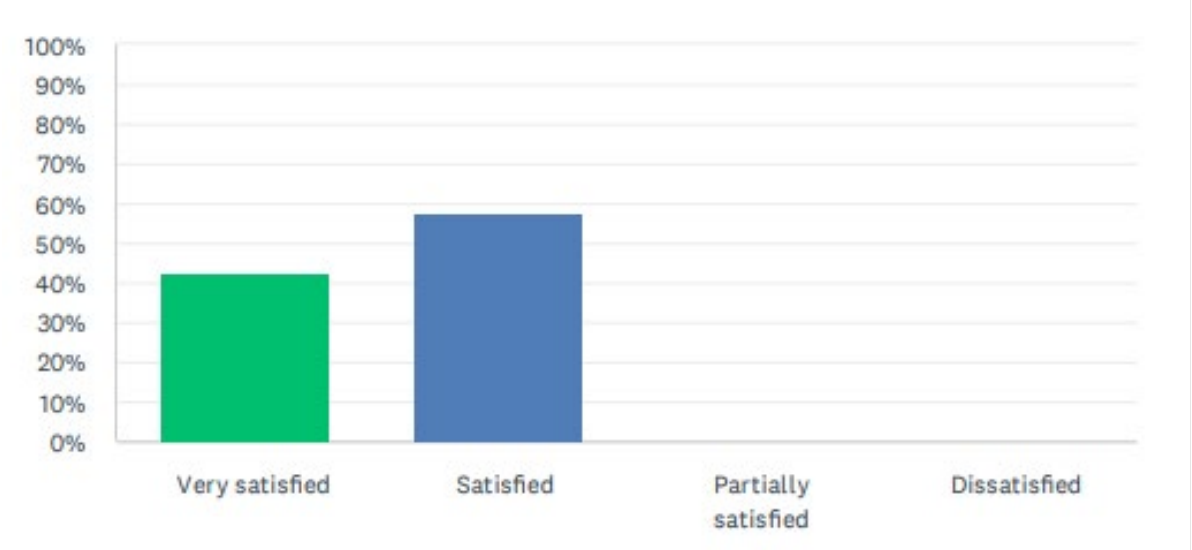


Figure 11. Survey responses received in relation to question: 'How would you rate your overall project satisfaction working on this project?"

Lessons learnt for organisation and coordination of the field surveys

Overall, field survey participants thought the organisation and coordination of the field surveys was 'highly effective' (29%), 'effective' (57%) or 'partly effective' (14%) (Figure 12).

Positive feedback received in relation to the organisation and coordination of field surveys included:

- Survey respondents outlined that the EcoFutures staff were approachable and provided the equipment needed to allow them to complete surveys.
- "Mostly just being left to do the job, once set up. I liked that I was provided with bulk site coordinates, and I could work out myself, the best way to tackle a batch of sites each day."
- "Checking in each day was good, people were easy to contact."

Potential areas for improvement included

- It would have been good for field surveyors to have "an authorisation letter or maybe an explanatory handout, especially in locations where SP Ausnet transmission towers are planned to assuage any possible landholder concerns on private land."
- "Addresses supplied were at times very inaccurate. If there was no local knowledge, some sites would have been very hard to find."
- "Having [call-in and field site allocation] spreadsheets on the Microsoft Teams was useful but the number of spreadsheets was a minor issue".
- Some comments around the mapping we: "Better mapping would be good" and "Include all sites on one map."
- "I don't love Teams. I find it a bit clunky. So having to use teams each night to organise my field work as time consuming for me."
- Ensure the Survey123 app is field tested prior to the field surveys and "ensure the app doesn't lose all data if there is a keystroke error."

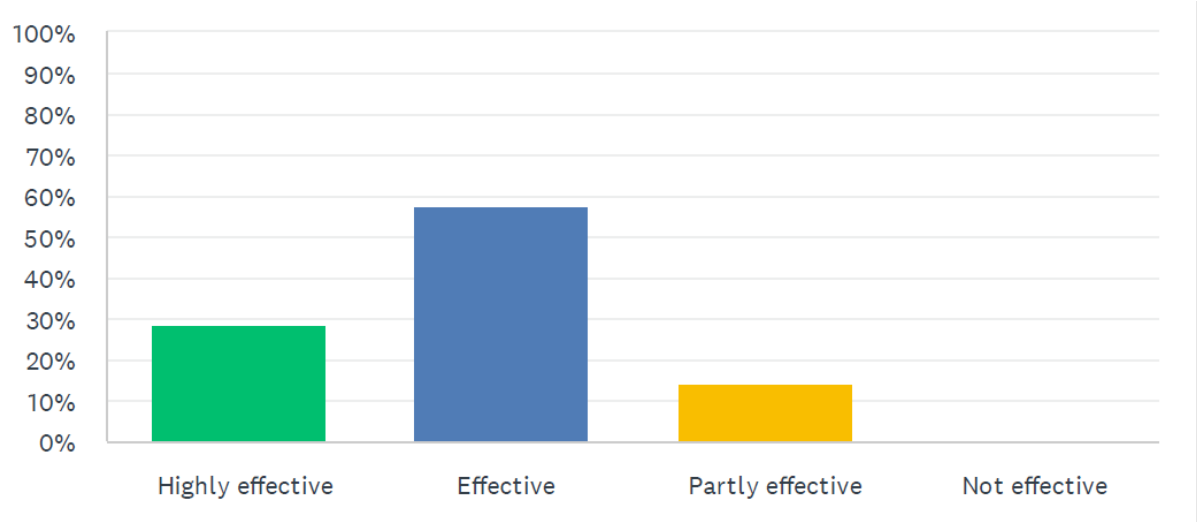


Figure 12. Survey responses received in relation to question: 'How would you rate the overall organisation and coordination of the field surveys?"

Lessons learnt for safety, biosecurity, and COVID-19 requirements

Overall, 43% of participants surveyed were 'very satisfied' and 57% were 'satisfied' with the safety, biosecurity, and COVID-19 requirements for this project (Figure 13).

Comments in relation to these requirements were very positive and some comments in relation to what work well during the project included:

- "All of it."

- "All fine re; COVID, safety etc. Using a check-in, check out system via WhatsApp may have worked as an alternative to the sat phone when entering a site without phone service."
- "Call in procedures, safety, easily contactable, helpful co-ordinators."
- "The morning and afternoon check ins."

One respondent stated that the safety, biosecurity, and COVID-19 requirements for this project "were a bit over the top at times." Some areas for improvement identified by respondents included:

1) Formal identification card or badge for the project as some landowners "did not know we were coming" as they didn't receive the notification "or didn't read or believe them."
2) The Survey123 app could be amended to ensure that safety requirements need to be met to proceed to the next stage of the survey.
3) Look at the option of using text message instead of phone calls for call in arrangements.
4) Completion of the call-in register was "time consuming" at times, identify potential efficiencies in how this is done for the next field survey.

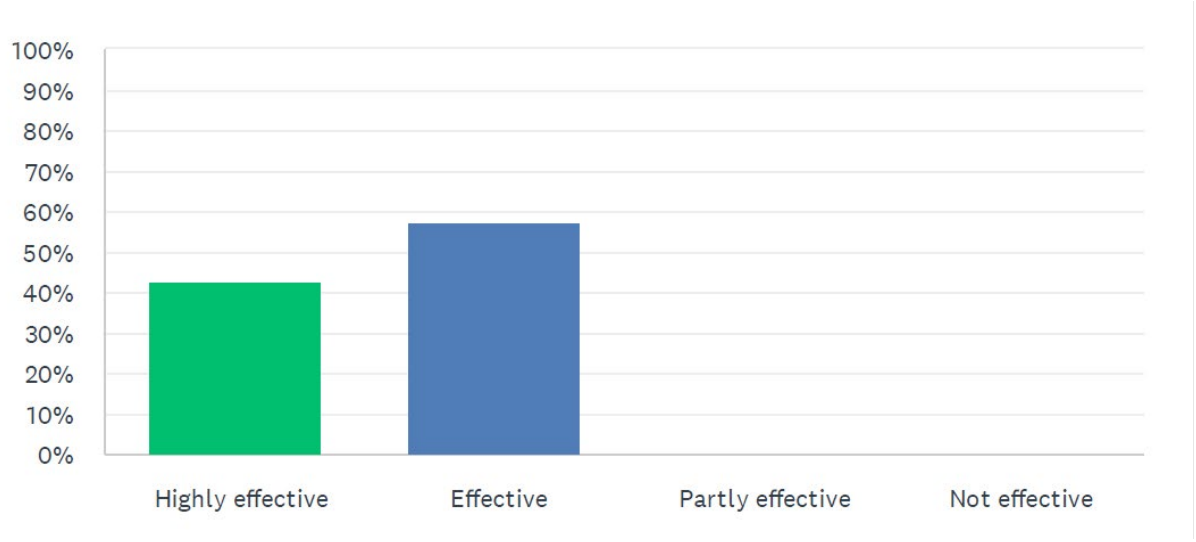


Figure 13. Survey responses received in relation to the question: "How would you rate the safety, biosecurity and COVID requirements for this project?"

Lessons learnt for training on survey methods and data upload requirements

Overall, 29% of respondents stated that the training on the survey methods and data upload requirements for the project were 'highly effective', whilst 57% thought they were 'effective' and '14%' thought they were 'partially effective' (Figure 14).

Respondents to the survey commented that the Survey123 app was "quick and easy to use" and another respondent stated that "I liked the app and thought it was useful".

However, some areas for improvement in training were identified by respondents, comments included:

- "Some of the documentation explaining the surveying could be clearer. Although the training and ability to contact staff quickly to clarify aspects when surveying was great."
- "It would have been good to do the survey methods training in the field instead of online. But I think that was limited because of COVID/lockdowns. A quick in-field session to learn to use the app would have been good too. But I understand it was still under development so that makes it tricky for training."
- "Drop the onsite EVC identification."
- "Maybe include a photo if space is available."

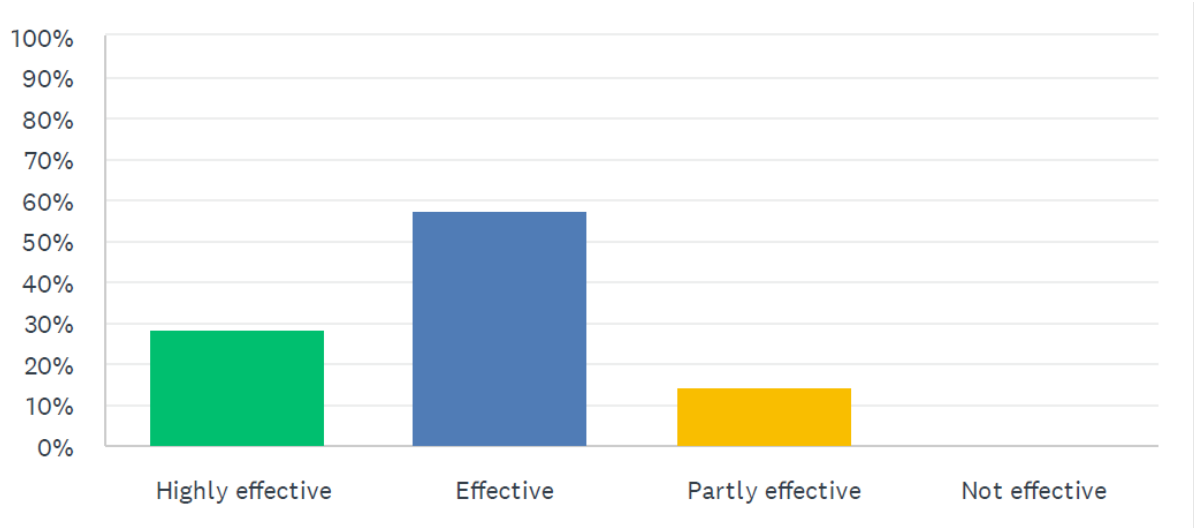


Figure 14. Survey responses received in relation to the question: "How would you rate your training on the survey methods and data upload requirements for this project?"

Lessons learnt for rapid assessment methods

Field survey participants who responded to the survey stated that the rapid assessment method overall was 'highly effective' (29%) or 'effective' (71%) to inform assessment of vegetation condition (Figure 15).

Positive feedback was received on the rapid assessment method from many of the field survey staff, including:

- "All aspects were pretty valuable."
- "I thought the method was fine and gave a good outline of streamside attributes in a short period of time."
- "The broad categories enabled rapid assessment to be undertaken with confidence."
- "I thought the app and its process to be pretty good. It seemed to flow through the different stages."

However, areas for improvement in the rapid assessment method were identified by field survey staff, including:

- "On occasions, sites were very difficult to access due to topography, difficult road access, etc making some not rapid at all. Possibly could have re-allocated some of those at an earlier time to streamline. Minor issue though, the EcoFutures project team was very good at reallocating when alerted to any issue."
- Categories were "perhaps too broad to be confident that a fair site comparison was being obtained. Some tweaking of some scoring and ranking may help here."
- The method was maybe not suitable for some vegetation types, such as damp or wet forest where there was naturally not much instream vegetation. "This dropped the score for the site, even though the site was in really good condition. And, for these sites, often ferns were and sometimes shrubs were instream. But there was no option in the lifeforms category to record them instream."
- It would beneficial if the method included some more threat categories. One field survey participant stated that: "I hardly ever saw deer pellets, but I saw deer tracks all the time." In addition, the rapid assessment method should be able to note the presence of rubbish (dumping or collecting), hazardous waste (i.e. asbestos or tyres).
- "Try and locate sites closer to roads/tracks (some were but a lot weren't). A lot of time was wasted accessing remote sites."

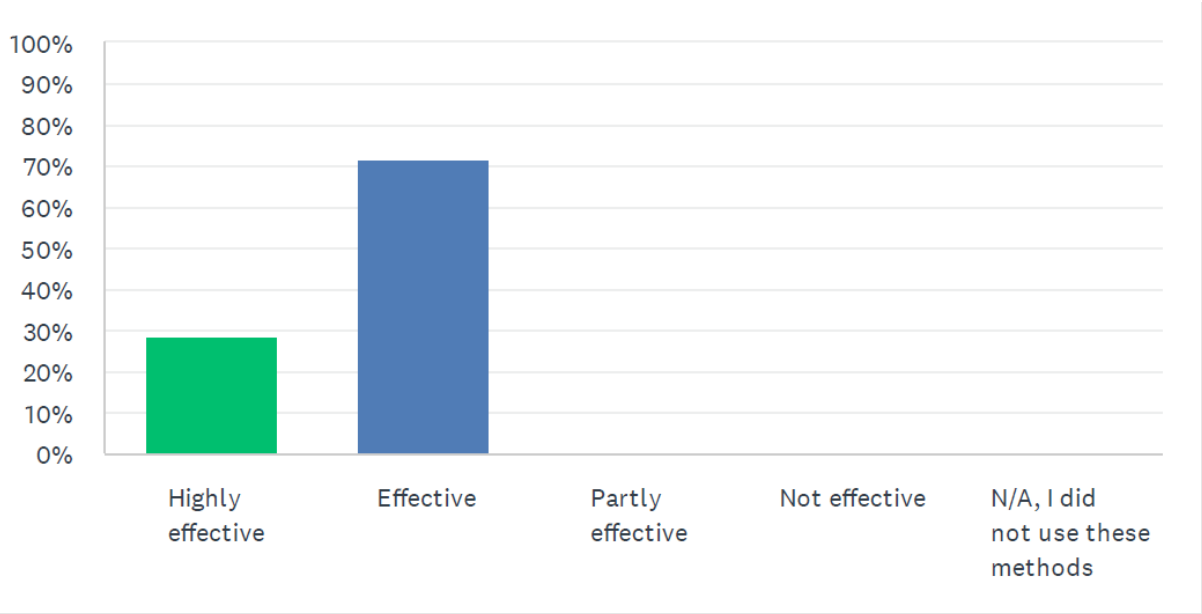


Figure 15. Survey responses received in relation to the question: "How would you rate the rapid assessment method overall to inform assessment of vegetation condition?"

Lessons learnt for detailed assessment methods

Field survey participants who responded to the survey stated that the detailed assessment method overall was 'highly effective' (29%) to inform assessment of vegetation condition (Figure 16), with the remaining respondents (71%) not utilising these methods.

One of the respondents stated that the detailed methods worked well as it "picks up a high proportion of species that is reflective of the site's conditions", but another respondent stated that the "densitometer was difficult to use at times (e.g., windy conditions) and I wasn't convinced of its reproducibility".

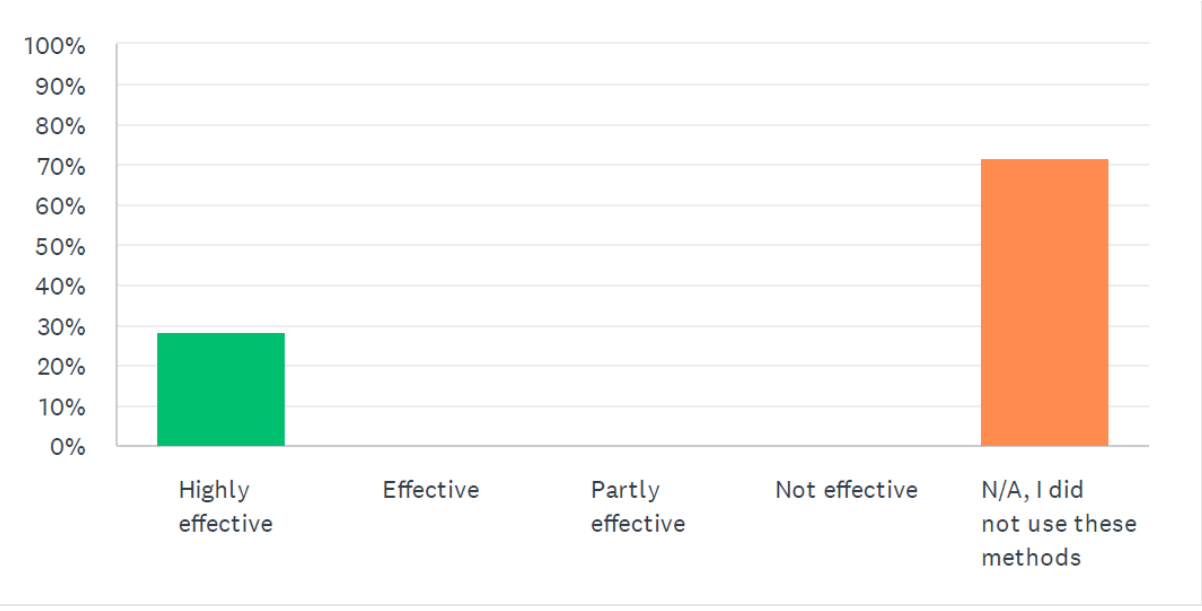


Figure 16. Survey responses received in relation to the question: "How would you rate the detailed assessment method overall to inform assessment of vegetation condition?"

Lessons learnt for the methods and systems used for data recording (on Survey123 and Excel) and data upload utilised for the project

Overall, survey respondents rated the methods and systems used for data recording and data upload as being 'highly effective' (14%) or 'effective' (71%), the remaining respondents hadn't used the methods or systems (15%).

Positive feedback was received in relation to both the method and systems for data recording and upload. Some respondents' comments included:

- "Quick and easy to use."
- In terms of Survey 123: "It was quite effective once teething problems were worked out" and "It was good to complete the survey on the spot, upload it and move on to the next site."

However, there were some issues and areas for improvement identified:

- Ensure the Survey123 app is field tested prior to the roll out of surveys in the future.
- Include a map of the site location where the survey is at.
- It would be good to have the option of hardcopy of the field survey in areas where phone service was patchy and there were concerns regarding data being lost during upload using Survey123.
- The Survey123 app should have the ability to export the data to the field survey team to "so you can check it quickly and easily". The Survey123 app "is good for collecting data but not for checking it."
- "Ability to accidently clear entered data was a stress."
- "Transect data had to be entered 1-20. It would help if it could also be entered 20-1 (e.g., when there's a steep difficult section within the plot - to avoid climbing up/down multiple times)"

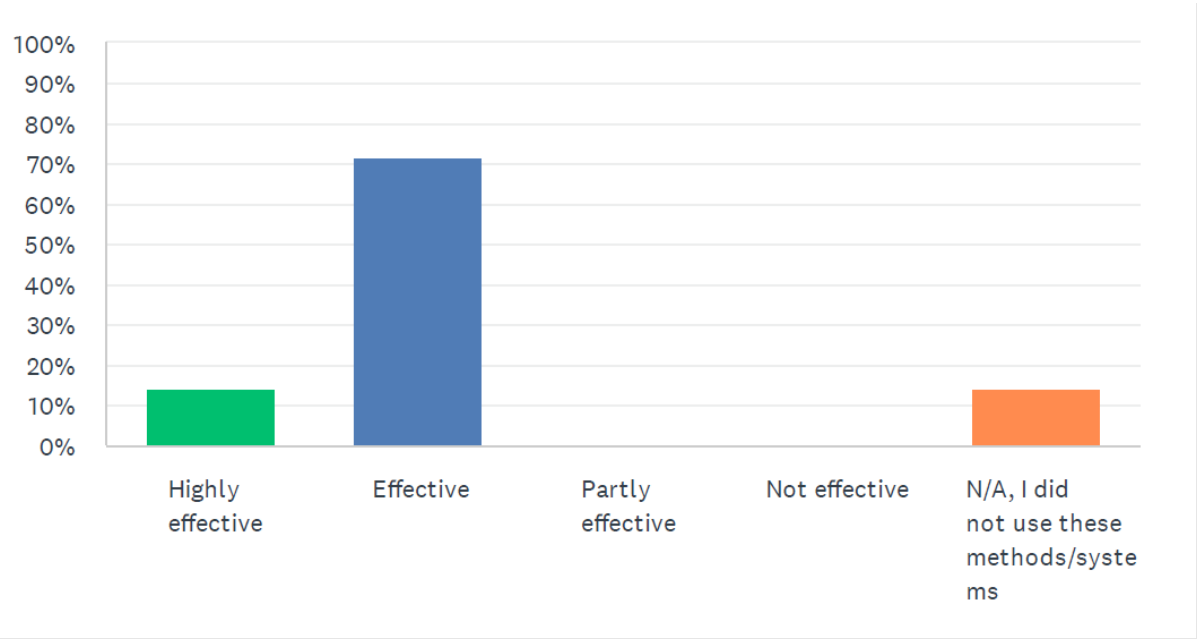


Figure 17. Survey responses received in relation to the question: "How would you rate the methods and systems used for data recording (on Survey123 and Excel) and data upload utilised for the project?"

Appendix H – Site reallocation to alternative locations

A number of sites had to be reallocated during the 2021 field season due either to access issues (both rapid and detailed) or the actual vegetation on site not being the target EVC (most relevant for detailed sites). Many of these reallocations were minor with an accessible spot nearby being selected that met reallocation criteria. The aim of using criteria to guide reallocation was to maintain planned replication across EVCs, broad vegetation groups, and sub-catchments as much as possible.

Project staff (Rob and Alanna in communication with subconsultants, landholders and Al Danger at Melbourne Water) used the following information sources:

- Sites allocated spreadsheet
- Landholder contact spreadsheet (landholders denying access was often the cause for reallocation)
- QGIS project with sites, EVC mapping etc
- Table A3.2 from Dell Botany (2020)
- Nearmaps aerial imagery
- Google maps and street view
- Local knowledge (Rob, subconsultants, Landholder, Al)

Criteria for reallocation, developed in consultation with Matt Dell:

1. Same EVC (if possible), if not go to 2 and 3
2. Same broad vegetation group (if possible) Table A3.2 (Dell Botany 2020)
3. Same sub-catchment (must be met)
4. Must be no closer than 1km from another site (must be met)

Additional criteria

5. Time spent reallocating shouldn't be more than assessment would take and the reallocation needs to be practical in terms of site accessibility (consider public/private access, walk in time, etc).
6. "Don't chase a remnant that's not there" – don't search for a higher quality remnant to reallocate to for rapid sites (otherwise we risk overrepresenting higher quality remnants in the landscape, we also need data on depauperate, compromised and threatened riparian vegetation)
7. For detailed sites, reallocating to site with the same EVC and ideally of good condition/quality is warranted because higher quality sites were prioritised deliberately in the climate change monitoring design
8. If access to a site has been denied but assessors have good existing relationships with adjacent properties and have gained permission to an alternative site that fulfils the above criteria 1-7.

Reallocation approach varied somewhat between rapid sites and detailed sites due to the differing objectives of the data collection (modelling condition from rapid site data, climate change monitoring from detailed site data).

When reallocating rapid sites, it is less crucial to try and find the same EVC. As those are about measuring general condition, they should sample across a broad range of condition types. For those sites, find an accessible reach near the original point in one of the broad vegetation types. Reallocation of rapid sites was often done by subconsultants in the field where an alternative could easily be found nearby. If not, reallocation was done by EcoFutures staff using additional information sources.

When reallocating detailed sites, more effort is appropriate to reallocate to the same EVC, quality etc and generally additional information was required. Occasionally it was not possible to reallocate a detailed site within the same broad vegetation group in the sub-catchment. In consultation with Matt Dell, a few sites were reallocated to a different broad vegetation group and different EVC, because no remnants of the target EVC or BVG could be found in the sub-catchment. In those cases, an exception was made to reallocate to the closest vegetation type available within the sub-catchment and of reasonable quality.

Examples of reallocation:

- Where reallocation is required, it can be difficult to find the same EVC within sub-catchment especially where sites are near boundaries. E.g., in the Upper Plenty, 2 rapid sites (EVCs Cool-temperate Rainforest, and Wet Forest both needing reallocation due to tree-fall risk preventing access) were reallocated to EVC Damp Forest further down the waterways in same sub-catchment.
- In the Yarra, a detailed Floodplain Riparian Woodland site had to be reallocated to a different BVG (Riparian Forest EVC) but was within the same catchment.

Appendix I – Method change log

Minor changes and clarifications were made to the methodologies in *DellBotany (2020) Long-term monitoring of riparian vegetation condition in Melbourne Water catchments*.

Permanent stakes at the start of each transect is the centre of the first subplot in each transect (not the bottom left corner of the subplot as stated in DellBotany 2020).

Canopy intercept values: were initially assigned as either: one (1) if canopy is intercepted or zero (0) if sky is intercepted, was expanded to use:

- 0 = sky intercepted
- 1 = canopy intercept
- 2 = sky (uncertain due to screening by undergrowth)
- 3 = intercept (uncertain due to screening by undergrowth)

Large woody debris intercepts: the length of each log measured includes the length that extends outside the 20x20m plot.

Organic litter cover is recorded at a subset of subplots (instead of all 15 subplots as stated in DellBotany 2020).

Appendix J – Subconsultant survey

Survey description

In Spring 2021 you were engaged by EcoFutures to complete field surveys as part of the Streamside Vegetation Condition Assessment project for Melbourne Water.

We greatly value your contribution to the project, and we wish to collect feedback from all field team members about this fieldwork and associated logistics, methods, safety, and training. Lessons learnt and recommendations from the recent field sampling will feed into the Summary Field Report as well as the improvement of the second round of field surveys in Spring 2024.

Rating system criteria

1 – Highly successful / Highly effective / Highly efficient / Very satisfied

2 – Successful / Effective / Efficient / Satisfied

3 – Partly successful / Less effective / Less efficient / Partially satisfied

4 – Unsuccessful / Ineffective / Inefficient / Dissatisfied

5 – N/A

Questions

1. How many surveys did you complete or provide field support for?

    - <10
    - 10-30
    - 30+

2. How would you rate the **overall organisation and coordination** of the field surveys?

    - Highly effective
    - Effective
    - Partly effective
    - Not effective

3. What worked well with the organisation and coordination of the field surveys? (Optional)
4. Were there any issues and are there any suggestions or improvements to be made for future projects? (Optional)

5. How would you rate the **communication** provided by the EcoFutures project team throughout the project?

    - Highly effective
    - Effective
    - Partly effective
    - Not effective

6. What worked well with the communication provided by the EcoFutures project team? (Optional)
7. Were there any issues and are there any suggestions or improvements to be made for future projects? (Optional)

8. How would you rate the **implementation of survey methods** for the **rapid assessments in the field**? (please focus on implementation here, separate questions follow on the methodology more generally)

- Highly effective
- Effective
- Partly effective
- Not effective
- N/A, I did not use these methods

9. What worked well for the rapid assessments in terms of the implementation of the survey method in the field? (Optional)
10. Were there any issues and are there any suggestions or improvements to be made for the field implementation of rapid assessment method? (Optional)

11. How would you rate the **rapid assessment method overall** to **inform assessment of vegetation condition**?

- Highly effective
- Effective
- Partly effective
- Not effective
- N/A, I did not use these methods

12. What worked well with the rapid assessment method and aspects that you think were of value? (Optional)
13. Were there any issues, data gaps and are there any suggestions or improvements to be made to the rapid assessment method to improve the capture of vegetation condition? (Optional)

14. How would you rate the **implementation of survey methods** for the **detailed assessments in the field**? (please focus on implementation here, separate questions follow on the methodology more generally)

- Highly effective
- Effective
- Partly effective
- Not effective
- N/A, I did not use these methods

15. What worked well for the detailed assessments in terms of the survey method implementation in the field? (Optional)
16. Were there any issues and are there any suggestions or improvements to be made for the detailed assessment method implementation? (Optional)

17. How would you rate the **detailed assessment method overall** to **inform assessment of vegetation condition**?

- Highly effective
- Effective
- Partly effective
- Not effective
- N/A, I did not use these methods

18. What worked well with the detailed assessment method and aspects that you think were of value? (Optional)
19. Were there any issues, data gaps and are there any suggestions or improvements to be made to the detailed assessment method to improve the capture of vegetation condition? (Optional)

20. How would you rate the methods and systems used for **data recording (on Survey 123 and Excel) and data upload** utilised for the project?

- Highly effective
- Effective

- Partly effective
- Not effective
- N/A, I did not use these methods/systems

21. What worked well during this process and any aspects that you think were of value? (Optional)
22. Were there any issues and are there any suggestions or improvements to be made for future projects? (Optional)

23. How would you rate the **safety, biosecurity and COVID requirements** for this project? *Please note that we were required to comply with Melbourne Water requirements during the project.

    - Highly effective
    - Effective
    - Partly effective
    - Not effective

24. What worked well during the project and any aspects that you think were of value to ensure your safety during the project? (Optional)
25. Were there any issues and are there any suggestions or improvements to be made for future projects in terms of safety, biosecurity and COVID requirements? (Optional)

26. How would you rate **your training** on the survey methods and data upload requirements for this project?

    - Highly effective
    - Effective
    - Partly effective
    - Not effective

27. What worked well during the project and any aspects that you think were of value? (Optional)
28. Were there any issues and are there any suggestions or improvements to be made for future projects? (Optional)

29. How would you rate your overall satisfaction working on this project **overall**?

    - Very satisfied
    - Satisfied
    - Partially satisfied
    - Dissatisfied

30. We would love any further general feedback you have on the project. What aspects worked well? Are there any other areas relating to this project which could be improved? Please add any additional comments below. (Optional)
31. Did you get any great photos during the fieldwork? We would love you to share these and upload them here. By uploading your photos, you provide permission for EcoFutures Pty Ltd to utilise and reproduce these photos with acknowledgement of your name in any reproductions.

Thank you for your feedback and contribution on the project. We greatly appreciate your time in providing this feedback so we can continue to improve in the future. We look forward to working with you again soon.

Estimated survey length: 5-13 minutes