INFORMATION BULLETIN

Accompanying the

Ordinary Meeting of Council

15 February 2018

CHIEF EXECUTIVE OFFICERS ADVISORY COMMITTEE

INFORMATION BULLETIN

15 February 2018

(REF: D2018/00075)

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1.1 CORPORATE BUSINESS PLAN 2017/2018 - 2021/2022 PROGRESS REPORT

REFERENCE: D2018/00074

PURPOSE OF REPORT

The purpose of this report is to provide a progress report against activities identified within EMRC's Corporate Business Plan 2017/2018 - 2021/2022 for the period 1 July to 31 December 2017.

KEY ISSUES AND RECOMMENDATION(S)

- Section 5.56(1) and (2) of the *Local Government Act 1995* require that each local government is 'to plan for the future of the district', by developing plans in accordance with the regulations.
- The *Local Government (Administration) Regulations 1996* specify that a 'plan for the future' comprises of the following:
  - A Strategic Community Plan – a minimum 10 year timeframe; and
  - A Corporate Business Plan – a four to five year plan, which translates the 10 year strategic plan into operations.
- Council adopted the EMRC's Strategic Community Plan titled *10 Year Strategic Plan* 2017 – 2027 on 18 August 2016 for implementation from 1 July 2017 onwards (Ref: D2016/10193).
- Council adopted the EMRC's Corporate Business Plan 2017/2018 - 2021/2022 on 22 June 2017 (Ref: D2017/0018).
- The attachment to this report provides a progress report against activities identified within the Corporate Business Plan 2017/2018 - 2021/2022 for the period 1 July to 31 December 2017.

SOURCE OF REPORT

Chief Executive Officer

BACKGROUND

Section 5.56(1) and (2) of the *Local Government Act 1995* require that each local government is 'to plan for the future of the district', by developing plans in accordance with the regulations. The *Local Government (Administration) Regulations 1996* specify that a 'plan for the future' comprises of the following:

- A Strategic Community Plan – a minimum 10 year timeframe; and
- A Corporate Business Plan – a four to five year plan, which translates the 10 year strategic plan into operations.

Council adopted the EMRC's Strategic Community Plan titled 10 Year Strategic Plan 2017 – 2027 on 18 August 2016 for implementation from 1 July 2017 onwards (Ref: D2016/10193).

Council adopted the EMRC's Corporate Business Plan 2017/2018 - 2021/2022 on 22 June 2017 (Ref: D2017/0018).

Item 1.1 continued

REPORT

The *10 Year Strategic Plan 2017 – 2027* guides, at a strategic level, the direction that the EMRC will take over the next ten years towards achievement of its vision: *"To be a responsive and innovative leader in assisting Perth's Eastern Region to be a great place to live, work, play and do business."*

The Corporate Business Plan 2017/2018 - 2021/2022 was developed to articulate the strategic direction into operational activities. It is designed to ensure that the organisation as a whole is able to deliver on Council's high level priorities, and summarises the services, operations and projects EMRC will deliver over the next five years.

The attachment to this report provides a progress report against activities identified within the Corporate Business Plan 2017/2018 - 2021/2022 for the period 1 July to 31 December 2017.

STRATEGIC/POLICY IMPLICATIONS

Key Result Area 3 – Good Governance

3.3 To provide responsible and accountable governance and management of the EMRC

3.4 To continue to improve financial and asset management practices

FINANCIAL IMPLICATIONS

As reflected in budgets and long term financial plans.

SUSTAINABILITY IMPLICATIONS

The Corporate Business Plan 2017/2018 - 2021/2022 identifies projects, programs and services for the benefit and sustainability of Perth's Eastern Region.

MEMBER COUNCIL IMPLICATIONS

Member Council	Implication Details
Town of Bassendean	Nil
City of Bayswater	
City of Belmont	
City of Kalamunda	
Shire of Mundaring	
City of Swan	

ATTACHMENT(S)

Corporate Business Plan 2017/2018 - 2021/2022 Progress Report for the period 1 July to 31 December 2017 (Ref: D2018/01296)

PROGRESS REPORT

CORPORATE BUSINESS PLAN 2017/2018 - 2021/2022

1 JULY TO 31 DECEMBER 2017

INTRODUCTION

The Eastern Metropolitan Regional Council's (EMRC) Integrated Planning Framework has been developed to ensure that programs and services are being delivered in alignment with the strategic priorities of EMRC's key stakeholders. The **10 Year Strategic Plan 2017 to 2027** identifies the overarching outcomes that the EMRC Council aspires to achieve. The Corporate Business Plan is used to drive operational activities and is aligned to the priorities identified in the 10 Year Strategic Plan. These two comprise EMRC's Plan for the Future. Strategic high level plans guide development of actions which are prioritised during annual business planning workshops, and resourced through the annual budget.

The Corporate Business Plan is built on the foundation of three strategic Key Result Areas (KRA) identified within the **10 Year Strategic Plan 2017 to 2027**. The Corporate Plan sets out the actions that staff will undertake to deliver on Council's strategic priorities.

Reports against the Corporate Business Plan provide Council with information on progress in relation to the achievement of projects and programs developed to achieve Council's vision "*To be a responsive and innovative leader in assisting Perth's Eastern Region to be a great place to live, work, play and do business".*

PETER B. SCHNEIDER

Chief Executive Officer

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KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

1.1 TO PROVIDE SUSTAINABLE WASTE DISPOSAL OPERATIONS

1.1.1 Minimise the environmental impact of waste management operations

PROJECTS / ACTIONS	COMMENTS
Leachate Project	• Consultancy contract awarded for the design of a new leachate pond and evaporation pond. A request for tender was issued in October 2017. • Tender and contract awarded to WBHO for the construction of the leachate storage and evaporation ponds. WBHO will commence construction of the leachate ponds once the cap rock is removed by end of February 2018 once necessary approvals are obtained.
Construct Class III leachate pond	• Complete.
Construct storm water and siltation ponds	• Complete.
Coordinate the submission of EMRC's Annual Monitoring and Compliance Report to DER	• The submission of the report is scheduled for March 2018.
Rehabilitate former landfill cells	• A review of the rehabilitation practices and performance such as engineering rehabilitation design and seed mixture composition was undertaken. As part of the review, a hydro-mulch trial was undertaken with selected seed stock. • A review of the entire landfill site is being undertaken to determine new areas for rehabilitation and areas to be re assessed. • The Endemic Seed trial continues to demonstrate a higher success rate in terms of germination success, species diversity and proportion of remaining ground cover than commercial seed. Biannual monitoring will be undertaken to confirm these results.
Monitor environmental impacts from waste management operations and ensure all environmental legislative	• All environmental compliance monitoring was carried out in accordance with the regulatory requirements for the Red Hill Waste Management Facility and Hazelmere Resource Recovery Park.

PROJECTS / ACTIONS	COMMENTS
requirements are met	

1.1.2 Provide a waste disposal service at Red Hill Waste Management Facility

PROJECTS / ACTIONS	COMMENTS
Operate Red Hill Waste Management Facility	• The Red Hill Waste Management Facility continues to operate in compliance with our Department of Water & Environmental Regulation (DWER) Licence Conditions. • The DWER carried out a Landfill Levy Compliance Inspection in August 2017 and the site passed the audit with no non-compliance issues raised.
Construct Roads / Carparks	• Under review.
Construct access roads to Lots 8,9 &10	• Under review, may not be required.

1.1.3 Review and Implement the Red Hill Development Plan

PROJECTS / ACTIONS	COMMENTS
Review and update Red Hill Development Plan	• Drawings have been completed with the future staging requirements. • An update to the textual commentary is underway. • Talis Consultants have been awarded design and development of the future cells. This work will commence early 2018 for inclusion in the Red Hill Development Plan.

PROJECTS / ACTIONS	COMMENTS
Construct Class III Landfill Cell (Farm Stage 3)	• Not required this financial year
Construct Class III Cell Stage 15B	• Planned for late 2018.
Design and Construct Class IV Cell (Stage 2)	• Maintenance of Stage 2 has been moved to April 2018. • Once the leachate ponds have been completed , the leachate currently stored in the class IV cell will be relocated and the cell will be recommissioned to accept Class IV waste, estimated to be June 2018
Construct drainage diversion and earthworks infrastructure	• Largely completed in May/June, some residual works scheduled for early 2018.

1.1.4 Operate member councils' waste transfer stations where applicable

PROJECTS / ACTIONS	COMMENTS
Operate Shire of Mundaring Transfer Stations	• Ongoing and reviewed periodically with the Shire of Mundaring to optimise operations.

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

1.2 TO IMPROVE REGIONAL WASTE MANAGEMENT

1.2.1 Collect, manage and dispose of problematic waste in the Region in a sustainable manner

PROJECTS / ACTIONS	COMMENTS
Implement the Household Hazardous Waste Program	• The Household Hazardous Waste Collection Program continued at the Facility.
Implement the Battery Collection Program	• 5,030.8 kg of batteries were collected at public places and 3,496.6 kg were collected from schools. • 706.4 kg of CFL (compact florescent lighting) was collected from public places. • 3 new schools enrolled into the program – Good Shepherd, Guildford Grammar and Kalamunda SHS Education Support.

1.2.2 Continue the Waste Education Program and align this to new operations and resource recovery

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer the Waste Education Strategy)	• The 2017/18 Waste and Recycling guide distribution was completed. • Loan resources utilisation o Litter Letters were utilised at the Perth Royal Show. o Waste Sort activity and Waste and Ladders Game borrowed by Riverlands Montessori . • Events attended: o Waste Education officers attended the Royal Show with other regional councils. Earth Carer volunteers helped staff throughout the week. o Officers attended the Gidgegannup Show and the Recycling Showcase to assist the City of Swan. o Earth Carers participated in a tour of the Cleanaway MRF. o 17 event planning/network/promotion events were attended by Waste Education. • Planning to conduct a Greenwaste MGB Audit commenced. • Pages on the R-Gang website were updated in relation to the new Waste and Recycling Guide. • Re-imaging of the Rgang website was completed. • Events held

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

PROJECTS / ACTIONS	COMMENTS
	o Three events were held during National Recycling Week, 13-19 November 2017. Consisting of: ▪ Zero Waste Shopping Tour – 13 November 2017– 17 people registered and 10 attended; and ▪ Two Cleanaway Material Recovery Facility Tours – 14 November 2017 – 25 people registered and 18 attended. o Earth Carers course was run the Shire of Mundaring from 16 to 30 of November 2017. ▪ Participants toured the City of Swan Depot and Red Hill Waste Management Facility on Saturday 18 November and visited the Glen Forrest Community Garden for a composting and worm farming workshop on Saturday 25 November 2017. ▪ 16 people completed the full course. • The Waste Education team drafted up an advertorial/article and a graphic to be adapted and used by the City of Bayswater to highlight the extra contamination that happens around the holiday periods.
Review Waste Education Strategy	• The Regional Waste Education Steering Group conducted a planning session to inform the review of the Waste Education Strategy to align this with the Waste Authority's own strategy. • The Regional Waste Education Steering Group reviewed the first draft of the strategy objectives and initiatives, and added additional ones.
Promote and co-ordinate Red Hill Education Tours	• Red Hill Guided Tours and Education Centre o July 2017– 1 tour, 61 attended o August 2017 - 3 tours, 171 attended o September 2017 – 5 tours, 195 attended o October 2017 – 7 tours, 177 attended o November 2017 - 3 tours, 75 attended

1.2.3 Provide a Waste Management Advisory Service

PROJECTS / ACTIONS	COMMENTS
Prepare National Pollutants Inventory (NPI) Report	• The EMRC is required to comply with the National Pollutant Inventory (NPI) reporting requirements by reporting on substance emissions resulting from waste, fuel and electricity use associated with Red Hill operations. • The report was submitted to the Department of Waste and Environmental Regulation (DWER) via the online reporting system prior to the deadline of 30 September 2017.
Prepare National Greenhouse and Energy Report (NGERS)	• The EMRC prepared a Section 19 report for its 2016/2017 greenhouse gas emissions and energy information for the Clean Energy Regulator under the *National Greenhouse and Energy Reporting (NGER) Act 2007*. • The report includes all emissions and energy produced and consumed at Red Hill, Hazelmere Resource Recovery Park and the Ascot Place administration office. The report was submitted by 31 October 2017.
Implement Offset Program (Farm Stage 3, 4 & 5)	• Routine monitoring of fence integrity, activity in nest boxes, assessment of rehabilitation areas, identification of weed infestations and subsequent control measures continue as required in the Program. • Native seed collection commenced on site in December in preparation for planting during the winter period. • The Offsets Area Weed Management Monitoring report for the period July 2016 – June 2017 was submitted to DWER in accordance with Conditions 4 and 5 of Clearing Permit CPS 5743/2. • A weed survey was undertaken in September 2017. • Approximately 6,500 tube-stock was planted and 15 kgs of seed were sown over a 2.5 ha within Lot 82 and Lot 501 through a combination of planting efforts by CVA volunteers and staff. Monthly surveys of the revegetation is being undertaken to determine success rates and potential need for infill planting.
Coordinate Feral Animal Control Program	• Feral trapping program was undertaken at Red Hill in August prior to pups being born. The program targets foxes, feral cats and rabbits. Numbers of feral animals are down to previous trapping exercise, with only 2 foxes caught and no feral cats or rabbit activities observed. • A control event to reduce the number of feral animals on site occurred in October 2017, resulting in the trapping of one adult fox. No cat tracks were recorded and the number of foxes seems to have substantially reduced. • 2 spot lighting events took place pre and post the control event in October 2017.
Undertake contaminated sites investigations (where required)	• Contaminated sites investigations continued at Red Hill with the DWER contaminated sites audit successfully completed in September 2017.

PROJECTS / ACTIONS	COMMENTS
Provide environmental consultancy service to member Councils and other clients (where required)	• An amendment to licence L8889/2015/1 under the Environmental Protection Act 1986 was granted on 6 September 2017, subject to conditions including an additional monitoring bore which has now been completed. • Red Hill is now able to accept perfluoroalkyl and polyfluoroalkyl substances (PFAS) contaminated material. • Landfill gas well monthly monitoring came to completion at the end of this quarter for Dawson Avenue. • Consultancy services have been limited due to resourcing issues during this quarter.

1.3 TO PROVIDE RESOURCE RECOVERY AND RECYCLING SOLUTIONS IN PARTNERSHIP WITH MEMBER COUNCILS

1.3.1 Establish a Resource Recovery Facility (RRF)

PROJECTS / ACTIONS	COMMENTS
Implement Council resolution relating to RRF tender	• Member Council approval is in progress and is expected to be completed in February/March 2018.

1.3.2 Develop the Hazelmere Resource Recovery Park (HRRP)

PROJECTS / ACTIONS	COMMENTS
Review and update Hazelmere Development Plan	• A consultant was engaged to review RRF requirements and potential integration into Hazelmere Development. • A Final report has been received and is under review.
Construct and commission Community Transfer Station	• Further evaluation will follow final review of development plan in line with RRF tender outcomes. • Siting options are being explored.
Construct and commission Administration Building	• No requirement at this point in time. Will be undertaken following/during commercial entrance development
Construct and commission Community Reuse Store	• Further evaluation will follow final review of development plan in line with RRF tender outcomes
Construct and commission Site Workshop	• No requirement at this point in time. Will be undertaken following/during commercial entrance development
Construct and commission weighbridges (x2)	• Further evaluation required following review of the HRRP development plan in line with RRF tender
Construct and commission site infrastructure	• Access road works and paving around the Wood Waste to Energy plant has been completed. • Site ground works commenced - relocation of wood chip stockpile to make way for access road • Stage 2 development under revision to incorporate RRF options.
Construct Reuse Store infrastructure (car park)	• Further evaluation required following review of the HRRP development plan in line with RRF tender
Wood Waste to Energy utilities / infrastructure	• High Voltage Interconnect cable installation complete • Internal pavement and drainage works completed and HV as-constructed drawings completed • Cable Asset registered on Dial Before You Dig register

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

PROJECTS / ACTIONS	COMMENTS
	• Application to Department of Lands for S144 Easement for Cable submitted.
Wood Waste to Energy plant and equipment	• Standby diesel generator procured and installed on site • Equipment procurement and fabrication occurring at Ansac's Bunbury facility • Council resolved to authorise a loan option to Ansac to expedite the completion of the project. • Further fabrication occurring at Bunbury facility • Plant switch room fabricated – awaiting delivery to site. • Independent Superintendent being sourced to monitor contract and loan expenditure.

1.3.3 Identify and develop resource recovery products and markets in order to reduce waste going to landfill

PROJECTS / ACTIONS	COMMENTS
Develop and implement programs to increase sales of Red Hill and Hazelmere by-products	• A marketing plan has been prepared. • A business plan for acceptance of liquid waste at Red Hill is under development. • There has been some success in bringing more pallets and pure timber to Hazelmere Recovery. • Business case is under progress for buying transportation facilities like skip bin truck and skip bins. • Negotiations are ongoing on with various companies for waste supply to both the Hazelmere C & I facility and Red Hill. • The EMRC waste services has been introduced to a number of: o wood yards and timber companies. Discussions are ongoing with two companies with regards to provision of timber / wood to the Hazelmere Resource Recovery Park. o large commercial customers; and o all WA Universities, and negotiations with Curtin University have commenced. • A successful AS4454 (Mulch) audit was undertaken by Standards Australian at Red Hill.

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

1.4 TO INVESTIGATE LEADING EDGE WASTE MANAGEMENT PRACTICES

1.4.1 Undertake research into Integrated Waste Management

PROJECTS / ACTIONS	COMMENTS
Investigate feasibility of a MRF at the Hazelmere Resource Recovery Park	• Further evaluation required following review of development plan in line with RRF tender

1.4.2 Undertake research into Integrated Waste Management

PROJECTS / ACTIONS	COMMENTS
Provide input to development of a Container Deposit System (CDS) in WA	• Attended WALGA CDS Policy Forum meetings to inform DWER • Reviewed and provided comment on WALGA CDS submission • Written submission on behalf of EMRC to CDS discussion paper compiled Written Submission lodged with DWER • Further policy forum meetings arranged for Jan 2018 to discuss submissions and finalisation of the detailed design of the Scheme
Provide input to new DWER policies and regulations affecting waste disposal, composting etc.	• Contributed to the consultation on the national phase out of perflurooctane sulfonate in November 2017.
Resolve potential fire ban closure of Red Hill with the Minister of Environment	• Discussions with Mindarie Regional Council for a collaborative approach to resolving the issue of future potential Fire Ban closures at both facilities are underway.

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

1.4.3 Identify, investigate and develop new waste management practices and services

PROJECTS / ACTIONS	COMMENTS
Obtain DWER approval for disposal of PFOS/PFAS contaminated material at Red Hill	• Application for an amendment to licence L8889/2015/1 under the Environmental Protection Act 1986 was granted 6 September, subject to conditions including an additional monitoring bore which has now been completed. Red Hill is now able to accept PFAS contaminated material.
Seek approval for a reduction in water monitoring frequency.	• An application was submitted to DWER requesting a change in water monitoring frequency at Red Hill from every 3 months to every 6 months. • A Water Management Plan was submitted in December to accompany the application. Decision from DWER is pending.
Greenwaste licence amendment	• A license amendment application has been prepared to construct a new greenwaste leachate collection pond to be able to dispose of any excess greenwaste leachate via irrigation and use for dust suppression. Currently pending DWER's response.

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

1.5 TO CONTRIBUTE TOWARDS IMPROVED REGIONAL AIR, WATER AND LAND QUALITY AND REGIONAL BIODIVERSITY CONSERVATION

1.5.1 Review and implement the Regional Environment Strategy

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer Regional Environment Strategy 2016-2020)	• Confirmed EMRC support as a partner organisation for the Curtin University ARC Linkage Grant application for 'Integrating people and planet across scales for sustainable development' in relation to the Sustainable Development Goals (SDG). • Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region. • Submitted a case study of the Regional Environment Strategy 2016-2020 using the SDG as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda. • Hosted a Water Sensitive Urban Design in the Hills workshop with Urbaqua to discuss drainage and stormwater management in hills catchments and develop a way forward to improve on-ground outcomes.

1.5.2 Implement the Eastern Region Catchment Management Program (ERCMP)

PROJECTS / ACTIONS	COMMENTS
Implement priority initiatives (refer ERCMP)	• Delivered four Bush Skills for the Hills workshops, Fun with Fungi, Restoration for Reptiles, Plant Identification and Fire and Diversity workshop in the region. • Was successful in the Swan Alcoa Landcare Program grant submission. • Participated in the Swan Alcoa Landcare Program assessment panel. • Presented at the Perth NRM Seminar on "Post fire management." • An Environmental Project Officer attends the Shire of Mundaring, City of Kalamunda and City of Swan one day per week to address local landholder enquiries and assist with projects. • Attended and disseminated information from meetings, workshops and seminars including: - State NRM Conference. - NAMN Conference – Citizen Science. - DIG conference. - Aboriginal Cultural Heritage

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

PROJECTS / ACTIONS	COMMENTS
	• Compiled and distributed the Greenpage Newsletters for October – November 2017 and December 2017 – January 2018. • An Environmental Project Officer attended the Shire of Mundaring, City of Kalamunda and City of Swan one day per week to address local landholder enquiries and assist with projects. • Assisted Shire of Mundaring to receive grant funding of $32,500 to manage blackberry in sensitive watercourses • Assisted Jane Brook Catchment Group to receive grant funding of $7,700 to increase the bushland and water quality values of the Lion Mill creek. • Received grant funding of $3,343 to improve water quality and increase biodiversity at Lower Lesmurdie Falls. • Assisted catchment groups in applying for the Community Rivercare grant to improve the Helena River and Jane Brook catchments. • Held the End of Year Volunteer function for 120 guests to celebrate the year's achievements. • Steamwand was hired out to City of Bayswater, SERCUL, and the Botanic Parks and Gardens Authority. • Hosted the Helena River Assessment discussion workshop with stakeholders from the region. • Participated in the Swan Alcoa Landcare Program (SALP) assessment panel; assessed and rated SALP applications for the Perth region.
Bush Skills 4 Youth Program	• Delivered 29 Bush Skills 4 Youth workshops in the region. • Attended meetings with: - Youth Power (2) - Zig Zag Early Childhood - Youth consultation - NEYON - Belmont YMCA - Swan Youth Council. • Delivered Healthy Wildlife information kits and wildlife rescue boxes to all local primary and secondary schools in the City of Kalamunda and the Shire of Mundaring.
20 Million Trees Project	• Communicated with landholders about the importance of maintaining their revegetation sites to ensure survival. • Engaged private landholders for planting which will occur in June and July 2018.
Steaming to Success Project	• Completed the final monitoring of plots for the "Alternative weed management trial". • Completed the project report and financial acquittal for the Steaming to Success project Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations.

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

PROJECTS / ACTIONS	COMMENTS
Healthy Wildlife Project	• Delivered 9 Healthy Wildlife - Healthy Lives and Bush Skills 4 Youth combined workshops in the region. • Developed fact sheets for the Healthy Wildlife website. • Developed Healthy Wildlife Kids Kits for Schools in the region. • Finalised the project evaluation, financial acquittal and successfully concluded the Healthy Wildlife project.
Creating a Capable Community Project	• Hosted a Traditional Ecological Knowledge and Aboriginal Cultural bus tour with Dr Noel Nannup for 20 people. • Delivered training in the GRID mapping tool to community groups. • Assisted with the re-formation of Susannah Brook Catchment Group. • Delivered training in the GRID mapping tool to assist community groups complete their Community Rivercare grant applications. • Assisted Susannah Brook Catchment Group with project planning and meeting with Gidgegannup volunteer Fire Brigade and Main Roads.

1.5.3 Review and implement the Water Quality and Conservation Program

PROJECTS / ACTIONS	COMMENTS
Implement the Water Quality and Conservation Program for EMRC and participating member Councils	• Attended CRC for Water Sensitive Cities 3rd Conference • Facilitated Water Team Meetings with participating councils • Communicated Waterwise Council criteria changes and collected evidence for Waterwise Council reporting due in October 2017 • Worked with the Cooperative Research Centre for Water Sensitive Cities to develop a local government engagement strategy and represent the region on the Western Region Advisory Panel • Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities; hosted a Local Government Tools and Products Workshop • Completed Waterwise Council reporting for all participating member councils including applications for the program's recognition scheme (Gold status) for Town of Bassendean and City of Swan • Provided Water Report Cards for 2016/2017 data analysis • Provided information on funding available as part of the Waterwise Council Program for a Water Sensitive Cities Index Workshop • Attended and disseminated information from Water Corporation's Waterwise Business Forum 2017

1.5.4 Review and implement the Regional Climate Change Program (RCCAAP)

PROJECTS / ACTIONS	COMMENTS
Implement priority actions (refer RCCAAP)	• Progressed the Understanding and Managing Flood Risk project with risk and vulnerability information provided to consultants Attended and disseminated information on Climate Council's report 'Hot & Dry' – Australia's Weird Weather • Provided information on available funding for sustainability and environment capacity building through the Myer Foundation • Progressed the Understanding and Managing Flood Risk project with risk and vulnerability assessments undertaken by the consultants

1.5.5 Review and implement the ACEr Program

PROJECTS / ACTIONS	COMMENTS
Implement the ACEr Program for EMRC and participating member Councils	• Facilitated Quarterly Performance reviews by Planet Footprint • Managed end of financial year manual data upload to the Planet Footprint platform • Attended Bankwest Curtin Economics Centre Power to the People: WA's Energy Future report launch • Reviewed Town of Bassendean's and Shire of Mundaring's Carbon Reduction Plan/Strategy • Facilitated staff consultation workshops during November and December for Town of Bassendean and Shire of Mundaring for Carbon Reduction Plan/Strategy development • Provided participating member councils with Emissions Report Cards for 2016/2017 data analysis • Updated measures in Planet Footprint Platform • Attended and disseminated information from Bankwest Curtin Economics Centre's report: Power to the People – WA's Energy Future and WALGA's Sustainable Procurement Guide • Liaised with Western Power on behalf of Town of Bassendean and Shire of Mundaring in regards to plans for Perth's energy future including advocating on issues such as street lighting

1.5.6 Review and implement the Swan and Helena Rivers Framework

KEY RESULT AREA 1
ENVIRONMENTAL SUSTAINABILITY

PROJECTS / ACTIONS	COMMENTS
Implement priority projects	• Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project with the consultants finalising the flood hydraulic model and preparing a draft hydraulic modelling report for peer review. • A comprehensive list of vulnerable institutions within participating council areas has been provided to the consultants and the risk and vulnerability assessment is now underway using outputs from the hydraulic modelling. • Presented on the Understanding and Managing Flood Risk in Perth project at the WALGA Climate Risk and Liability event on 4 August 2017, and to University of Western Australia final year Environmental Engineering Design students on 30 August 2017. • Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project, with the final Hydraulic Modelling Report delivered and the Risk and Vulnerability Assessments undertaken

KEY RESULT AREA 2
ECONOMIC DEVELOPMENT

2.1 TO FACILITATE AND ADVOCATE FOR INCREASED INVESTMENT IN REGIONAL INFRASTRUCTURE

2.1.1 Review and implement the Regional Integrated Transport Strategy (RITS)

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer RITS)	• Priority projects implemented from the new Regional Integrated Transport Strategy 2017-2021 which was approved by Council in February 2017 include: o production of a Regional Road Safety Report Card; o development and release of a Road Safety Campaign; o advocacy for grade separations; and o Advocacy for freight, public and active transport infrastructure enhancements. • A Regional Integrated Transport Strategy Implementation Advisory Group was held on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan. • Meetings have been ongoing with member Councils and key stakeholders to discuss council transport priorities in the City Deal Proposal. This includes grade separations on key transport corridors. • The EMRC is representing the region on the Westport Taskforce Reference Group to ensure the freight and transport needs of the region are considered. • A Road Safety Campaign has been developed and shared via social media by participating local governments.

KEY RESULT AREA 2
ECONOMIC DEVELOPMENT

2.2 TO FACILITATE AND ADVOCATE FOR REGIONAL ECONOMIC DEVELOPMENT ACTIVITIES

2.2.1 Review and implement the Regional Economic Development Strategy (REDS)

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer REDS)	• The draft Regional Economic Development Strategy 2017-2021 was revised in accordance with a previous CEOAC decision. • The Regional Economic Development Strategy 2017 – 2021 was approved at Council at its meeting of 7 December 2017 and was sent to the designer to format for printing. • An Economic Development Officer Group meeting was held on 12 December 2017 during which the final review of the REDS was discussed.

2.2.2 Identify and investigate strategic regional development project and investment opportunities

PROJECTS / ACTIONS	COMMENTS
Continue to promote the region as an attractive business and investment opportunity	• The draft City Deal proposal "Connect Perth's East" for Perth's Extended Eastern Region (PEER) was the advocacy focus. • Meetings continued with member Councils and key stakeholders including government agencies and members of Parliament to discuss priorities, inform key stakeholders on the importance of the project and to finalise the "Connect Perth's East" City Deal proposal. • The final document was approved by Council at its 7 December 2017 meeting and has subsequently been sent to designers to finalise and print.

2.3 TO FACILITATE REGIONAL CULTURAL AND RECREATIONAL ACTIVITIES

2.3.1 Continue the coordination, marketing and promotion of regional events

PROJECTS / ACTIONS	COMMENTS
Co-ordinate the Avon Descent Family Fun Days	• The 2017 Avon Descent Family Fun Days were held on the first weekend of August. • The regional marketing campaign coordinated by the EMRC cost $45,000 and delivered over $95,000 in advertising value. • The 2017 Avon Descent Family Fun Days, de-brief meeting was held and the first portion of the Lotterywest Grant has been acquitted. A marketing report has been produced and the second portion of the Lotterywest Grant Acquittal is underway. Feedback has been provided to Northam's Avon Descent Association on communication and organisational matters. • A draft application for the $155,000 Lotterywest Big Ideas Grant for the 2018 Avon Descent family Fun Days has been prepared.
Co-ordinate the Perth's Autumn Festival	• The $20,000 grant acquittal for the 2017 Perth's Autumn Festival was finalised with Lotterywest. • Preparations begun for the 2018 grant application. • The $20,000 ex GST Lotterywest Community Events Grant for the 2017 Perth's Autumn Festival has been submitted.
Administer the Perth Tourism.com.au regional tourism website	• The EMRC's website perthtourism.com.au continued to be updated with information and events occurring in the region. • The Hello Spring campaign page of the website was updated with over 30 events, workshops and activities to be held in Spring 2017. • The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 Youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils. • The Hello Spring campaign concluded in December 2017.

KEY RESULT AREA 3
GOOD GOVERNANCE

3.1 TO PROVIDE ADVICE AND ADVOCACY ON ISSUES AFFECTING PERTH'S EASTERN REGION

3.1.1 Review and implement the Regional Advocacy Strategy (RAS)

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer RAS)	• Priority Projects in the Regional Advocacy Strategy were included as part of the City Deal proposal which is under development. • The City Deal project has remained the advocacy focus. The EMRC met with member Councils and key stakeholders to discuss the priorities for the City Deal proposal, "Connect Perth's East". • The proposal includes the six member Councils, two non-member Councils (City of Canning and Town of Victoria Park) and Perth Airport Pty Ltd. • The draft proposal was completed and was approved by Council for lodgement with the State Government.

3.2 TO MANAGE PARTNERSHIPS AND RELATIONSHIPS WITH STAKEHOLDERS

3.2.1 Continue to foster and enhance relationships with member councils and all key stakeholders

PROJECTS / ACTIONS	COMMENTS
Hold Stakeholders' Dinner / Cocktail Function	• Planning for the Biennial Dinner function to be held in the first half of 2018 is underway.
Co-ordinate EMRC's Community Grants Program	• The Gidgegannup Play Group received a grant under the 2017 Community Grants Program in October 2017.
Produce EMRC's Annual Report	• The Annual Report was adopted by Council in September 2017. • The production and the distribution of the 2016-2017 Annual Report was completed in October 2017.

3.2.2 Review and implement the Marketing and Communications Plan

PROJECTS / ACTIONS	COMMENTS
Implement priority initiatives (refer Marketing and Communications Plan)	• The Corporate Style Guide was approved and implemented. • The new EMRC corporate website and intranet went live on 4 December 2017.

KEY RESULT AREA 3
GOOD GOVERNANCE

3.3 TO PROVIDE RESPONSIBLE AND ACCOUNTABLE GOVERNANCE AND MANAGEMENT OF THE EMRC

3.3.1 Continue to improve organistional governance

PROJECTS / ACTIONS	COMMENTS
Review and update the Recordkeeping Plan	• The Recordkeeping Plan was reviewed and a Records Management guideline is in draft format. • A Recordkeeping Plan for the Woodwaste to Energy plant is being finalised.
Review and update Council Policies	• The Council policies will be reviewed and updated within 12 months of the Local Government Elections to be held in October 2017.
Co-ordinate Council and Committee elections	• Council elections were held at the Special Council Meeting on 9 November 2017. • Committee elections will be held at the first meeting of the committees from 16 November 2017 onwards.
Review and update Management Guidelines as required	• The Workers Compensation Management Guideline was reviewed and adopted.

3.3.2 Implement EMRC's Integrated Planning Framework

PROJECTS / ACTIONS	COMMENTS
Implement EMRC's Integrated Planning Framework	• The EMRC's new 10 Year Strategic Plan 2017 to 2027 commenced effective 1 July 2017. • The Corporate Business Plan 2016/2017 to 2021/2022 was used to implement projects and activities to deliver on Council's strategic priorities.

3.3.3 Review and implement a Risk Management Plan

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer Risk Management Plan)	• Insurance Renewal Programme was completed • The outcomes of the 2017 Internal Audit were presented to Council in September 2017 • Risk Registers continued to be reviewed and updated by all Managers • The Risk Management Steering Group continued to meet. • The Risk Management Policy has been reviewed and the first draft has been provided to Management. • Annual Risk workshops commenced.

3.3.4 Review and implement the Disability Access and Inclusion Plan (DAIP)

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer DAIP)	• The annual report against EMRC's DAIP was submitted to the Disability Services Commission in July 2017. • Designated disability parking signs were installed at the Ascot Place building • The EMRC won the Lighthouse Awards Special Commendation award for its commitment to employing people with disability • A review of the DAIP will commence in mid -2018.

KEY RESULT AREA 3
GOOD GOVERNANCE

3.4 TO CONTINUE TO IMPROVE FINANCIAL AND ASSET MANAGEMENT PRACTICES

3.4.1 Review and implement long term financial plans

PROJECTS / ACTIONS	COMMENTS
Review the 5 and 10 Financial Plans	• The 10 Year financial statements continued to be reviewed and updated as part of the annual budget deliberation process. • The start of the 2018/2019 Budget deliberations and a "first look" at the 10 year financial statements has commenced with the distribution of the financial statements to Nov'2017. • The 2018/2019 Budget timetable was distributed on 12/12/18 with the first Budget meeting set down for 31/1/18. •
Monitor and review financial investment portfolio	• The Investment Portfolio was continually monitored in order to ensure that Cash Flow requirements were met and that maximum returns were achieved on investments within the parameters of the Investment Policy and the regulations. • As at 31 December 2017 an average interest rate of 2.74% was achieved compared to a budgeted rate of 2.54%.

3.4.2 Review and Implement the Asset Management Plan (AMP)

PROJECTS / ACTIONS	COMMENTS
Implement the AMP	• The asset management plan is compiled as part of the annual budget deliberation process. • The assets management plan was last updated during the June'2017 quarter and will be next reviewed and updated as part of the budget deliberation process for the 2018/2019 financial year

3.4.3 Review and implement the Strategic IT Plan

PROJECTS / ACTIONS	COMMENTS
Implement priority projects (refer Strategic IT Plan)	• Server backup and replication software has been updated. • Security review was conducted and improvements made. • Planning and testing is in progress for Windows 10 upgrade. • Implemented Windows 2016 Domain Controllers at all sites (excludes the Transfer stations). • Deployments of Windows 10 and upgrade of existing workstations to Windows 10 under testing. • Assisted with the implementation of new corporate web sites.

KEY RESULT AREA 3
GOOD GOVERNANCE

3.5 TO IMPROVE ORGANISATIONAL CULTURE, HEALTH, WELFARE AND SAFETY

3.5.1 Review and implement the Workforce Plan

PROJECTS / ACTIONS	COMMENTS
Review Workforce Plan	• The Workforce Plan review will commence in early 2018
Implement priority projects (refer Workforce Plan)	• The rewards and recognition program continued. • The Employee of the Year was recognised at the Staff Christmas function on 25 November 2017 • Annual performance reviews were completed. • The new staff induction process was reviewed and improved. • Staff Information Sessions and Toolbox meetings continued.

3.5.2 Review and Implement the Safety Management Plan

PROJECTS / ACTIONS	COMMENTS
Co-ordinate OS&H Program	• Safety inspections were conducted at all EMRC sites and improvements implemented. • Occupational dust monitoring was conducted at Hazelmere with no issues identified. • The Health Promotion program continued.
Implement actions from the Safety Advisory Group	• Safety committee meetings continued. • Actions arising from the Safety Advisory Group were actioned.

2. REGIONAL SERVICES

2.1. REGIONAL SERVICES ACTIVITY REPORT OCTOBER 2017 TO DECEMBER 2017

REFERENCE: D2018/00357 (CEOAC) – D2018/01513

PURPOSE OF REPORT

The purpose of this report is to provide an update on the activities undertaken by the Regional Services Directorate for the period 1 October 2017 to 31 December 2017.

KEY ISSUE(S)

Achievements highlighted for the period 1 October 2017 to 31 December 2017 include:

- All activities undertaken by the Environmental Services business unit for the ensuing period; and
- All activities undertaken by the Regional Development business unit for the ensuing period.

SOURCE OF REPORT

Director Regional Services

BACKGROUND

The Environmental Services and Regional Development business units partner with member Councils and key stakeholders to facilitate strategies, projects and activities and provide services (where appropriate) for the benefit and sustainability of Perth's Eastern Region.

Three advisory groups meet regularly to consider regional economic, transport and environmental projects and initiatives and assist in guiding EMRC strategies. Representation from each participating member Council and the EMRC constitute each group's membership with an expanded membership of the Regional Integrated Transport Strategy Implementation Advisory Group including numerous key stakeholders with an interest in transport.

The three groups are:

- Economic Development Officers Group (EDOG);
- Regional Integrated Transport Strategy Implementation Advisory Group (RITS IAG); and
- Regional Environment Strategy Advisory Group (RESAG). (Group to be reconvened in 2018).

Regular progress reports are provided to advisory groups, committees and councils to ensure ongoing and effective communication.

Item 2.1 continued

REPORT

The progress report for individual member Councils, on Regional Services activity for the period 1 October 2017 to 31 December 2017, is provided below.

Town of Bassendean

- Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project, with the final Hydraulic Modelling Report delivered and the Risk and Vulnerability Assessments undertaken.
- Reviewed the Town's Carbon Reduction Plan and provided a desktop study spreadsheet which included strategic document review, measures list, carbon reduction achievements and suggested actions for the Town's new Carbon Reduction Plan.
- Facilitated a Staff Consultation Workshop on 28 November 2017 to undertake action development for the Town's new Carbon Reduction Plan.
- Provided the Town with an Emissions Report Card for 2016/2017.
- Provided notes from the Town's Planet Footprint Performance Review including water and energy anomalies.
- Uploaded updated measures into the Town's Planet Footprint Platform including estimated greenhouse gas emissions saved for most solar PV system installations.
- Completed Waterwise Council Reporting and submitted to Water Corporation for the Town's application for Gold Waterwise Council status.
- Provided the Town with a Water Report Card for 2016/2017.
- Provided information on funding available as part of the Waterwise Council program for a Water Sensitive Cities Index workshop.
- Provided information on available funding for sustainability and environment capacity building through the Myer Foundation to the Town.
- Liaised with Western Power on behalf of the Town in regards to plans for Perth's energy future including advocating on issues such as street lighting.
- Attended and disseminated information from meetings, technical reports, and seminars including:
    - Bankwest Curtin Economics Centre's report – Power to the People: WA's Energy Future
    - Climate Council's – 'Hot & Dry': Australia's Weird Winter
    - WALGA's Sustainable Procurement Guide
    - Water Corporation's – Waterwise Business Forum 2017.
- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.
- Provided assistance to the Town with hosting a Climathon in partnership with Climate KIC Australia.

Item 2.1 continued

- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 Youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Held an Economic Development Officers Group meeting on 12 December 2017 which included updates on the Regional Economic Development Strategy, Regional Services Project Funding Summary 2018/2019 and the City Deal proposal.
- The Regional Economic Development Strategy 2017 – 2021 was finalised and approved by Council at its 7 December 2017 meeting. The Strategy will be available electronically and in hard copy in early 2018.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by the Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.
- Commenced work to initiate the 2018 Business Exemplar Project.
- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.
- Submitted a Bike Week 2018 Grant Application for repairs, upgrades and a Bike Week competition for the Swan River Ramble in the Town of Bassendean, City of Bayswater and City of Belmont.
- Held a de-brief meeting for the 2017 Avon Descent Family Fun Days, acquitted the first portion of the Lotterywest grant, produced the regional marketing report, and provided feedback to Northam's Avon Descent Association on communication and organisational matters.
- Compiled the draft application for the $155,000 (ex GST) Lotterywest Big Ideas Grant for the 2018 Avon Descent Family Fun Days.
- Submitted the $20,000 (ex GST) Lotterywest Community Events Grant for the 2017 Perth's Autumn Festival.
- Received a Public Health Advocacy Institute of WA program "Children's Environment and Health Local Government Report Card Project 2017" award in the *Environments Promoting Physical Activity* category for the Swan River Ramble Project.

City of Bayswater

- Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project, with the final Hydraulic Modelling Report delivered and the Risk and Vulnerability Assessments undertaken.
- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.
- Continued to hire out the Steamwand SW700 weed control machine to the City.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.

Item 2.1 continued

- Provided information on available funding for sustainability and environment capacity building through the Myer Foundation.
- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 Youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Held an Economic Development Officers Group meeting on 12 December 2017 which included updates on the Regional Economic Development Strategy, Regional Services Project Funding Summary 2018/2019 and City Deal Proposal.
- The Regional Economic Development Strategy 2017 – 2021 was finalised and approved by Council at its 7 December 2017 meeting. The Strategy will be available electronically and in hard copy in early 2018.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.
- Commenced work to initiate the 2018 Business Exemplar Project.
- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.
- Submitted a Bike Week 2018 Grant Application for repairs, upgrades and a Bike Week competition for the Swan River Ramble in the Town of Bassendean, City of Bayswater and City of Belmont.
- Held a de-brief meeting for the 2017 Avon Descent Family Fun Days, acquitted the first portion of the Lotterywest grant, produced the regional marketing report, and provided feedback to Northam's Avon Descent Association on communication and organisational matters.
- Compiled the draft application for the $155,000 (ex GST) Lotterywest Big Ideas Grant for the 2018 Avon Descent Family Fun Days.
- Submitted the $20,000 (ex GST) Lotterywest Community Events Grant for the 2017 Perth's Autumn Festival.
- Received a Public Health Advocacy Institute of WA program "Children's Environment and Health Local Government Report Card Project 2017" award in the *Environments Promoting Physical Activity* category for the Swan River Ramble Project.

City of Belmont

- Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project, with the final Hydraulic Modelling Report delivered and the Risk and Vulnerability Assessments undertaken.
- Facilitated a Planet Footprint Performance Review for the City.
- Provided the City with an Emissions Report Card for 2016/2017.
- Provided the City with a Water Report Card for 2016/2017.
- Provided information on available funding for sustainability and environment capacity building through the Myer Foundation.
- Attended and disseminated information from meetings, technical reports, and seminars including:
    - Bankwest Curtin Economics Centre's report – Power to the People: WA's Energy Future
    - Climate Council's – 'Hot & Dry': Australia's Weird Winter
    - WALGA's Sustainable Procurement Guide
    - Water Corporation's – Waterwise Business Forum 2017.

Item 2.1 continued

- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.
- Bush Skills 4 Youth delivered three environmental workshops for youth for YMCA's The Base including working with City of Belmont Environment team doing river foreshore monitoring and planting.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.
- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 Youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Held an Economic Development Officers Group meeting on 12 December 2017, which included updates on the Regional Economic Development Strategy, Regional Services Project Funding Summary 2018/2019 and City Deal Proposal.
- The Regional Economic Development Strategy 2017 – 2021 was finalised and approved by Council at its 7 December 2017 meeting. The Strategy will be available electronically and in hard copy in early 2018.
- Lodged a submission to the Federal Government's Department of Science, Industry and innovation regarding the discussion paper titled *The Digital Economy: Opening Up the Conservation;* this included holding a facilitated forum to collate member Council views and priorities.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.
- Commenced work to initiate the 2018 Business Exemplar Project.
- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.
- Submitted a Bike Week 2018 Grant Application for repairs, upgrades and a Bike Week competition for the Swan River Ramble in the Town of Bassendean, City of Bayswater and City of Belmont.
- Held a de-brief meeting for the 2017 Avon Descent Family Fun Days, acquitted the first portion of the Lotterywest grant, produced the regional marketing report, and provided feedback to Northam's Avon Descent Association on communication and organisational matters.
- Compiled the draft application for the $155,000 (ex GST) Lotterywest Big Ideas Grant for the 2018 Avon Descent family Fun Days.
- Submitted the $20,000 (ex GST) Lotterywest Community Events Grant for the 2017 Perth's Autumn Festival.
- Received a Public Health Advocacy Institute of WA program "Children's Environment and Health Local Government Report Card Project 2017" award in the *Environments Promoting Physical Activity* category for the Swan River Ramble Project.

Item 2.1 continued

City of Kalamunda

- Delivered one Bush Skills for the Hills workshop in the region: Fire and Diversity.
- Delivered training in the GRID mapping tool to assist community groups complete their Community Rivercare grant applications.
- Received $3,343.00 from the Swan Alcoa Landcare Program grant for a project at Lower Lesmurdie Falls.
- Participated in the Swan Alcoa Landcare Program (SALP) assessment panel. Assessed and rated SALP applications for the Perth region.
- Delivered one Bush Skills 4 Youth workshop in the City: Exploring Local Bushland.
- Bush Skills 4 Youth delivered Healthy Wildlife information kits and wildlife rescue boxes to all local primary and secondary schools in the City.
- Provides an Environmental Project Officer to attend the City's office one day per week to address local landholder enquiries and assist with projects.
- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.
- Assisted catchment groups in applying for the Community Rivercare grant to improve the Helena River and associated tributaries.
- Held the End of Year Volunteer function for 120 guests to celebrate the year's achievements.
- Hosted the Helena River Assessment discussion workshop with stakeholders from the region.
- Compiled and distributed the Greenpage Newsletters for October – November 2017 and December 2017 – January 2018.
- Hosted a Water Sensitive Urban Design in the Hills workshop with Urbaqua to discuss drainage and stormwater management in hills catchments and develop a way forward to improve on-ground outcomes.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.
- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 Youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Lodged a submission to the Federal Government's Department of Science, Industry and innovation regarding the discussion paper titled *The Digital Economy: Opening Up the Conservation;* this included the outcomes from a facilitated forum to collate member Council views and priorities.
- Held an Economic Development Officers Group meeting which included updates on the Regional Economic Development Strategy, Regional Services Project Funding Summary 2018/2019 and City Deal Proposal.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.

Item 2.1 continued

- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.

Shire of Mundaring

- Reviewed the Shire's Carbon Reduction Strategy and provided a desktop study spreadsheet which included strategic document review, measures list, carbon emissions reduction achievements and suggested actions for the Shire's new Energy and Emissions Reduction Plan.
- Facilitated a Staff Consultation Workshop to undertake energy and emissions reduction target and action development for the Shire's new Energy and Emissions Reduction Strategy and Plan.
- Provided the Shire with an Emissions Report Card for 2016/2017.
- Continued to manage data and assets within the Shire's Planet Footprint Platform
- Completed the Shire's Waterwise Council Reporting document and submitted to Water Corporation.
- Provided the Shire with a Water Report Card for 2016/2017.
- Provided information on funding available as part of the Waterwise Council program for a Water Sensitive Cities Index workshop.
- Provided information on available funding for sustainability and environment capacity building through the Myer Foundation to the Town.
- Liaised with Western Power on behalf of the Shire in regards to plans for Perth's energy future including advocating on issues such as street lighting and power outages.
- Attended and disseminated information from meetings, technical reports, and seminars including:
  - Bankwest Curtin Economics Centre's report – Power to the People: WA's Energy Future
  - WALGA's Sustainable Procurement Guide
  - Water Corporation's – Waterwise Business Forum 2017.
- Delivered training in the GRID mapping tool to assist community groups complete their Community Rivercare grant applications.
- Assisted Susannah Brook Catchment Group with project planning and meeting with Gidgegannup Volunteer Fire Brigade and Main Roads.
- Delivered one Bush Skills for the Hills workshop in the region: Fire and Diversity.
- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.
- Assisted catchment groups in applying for the Community Rivercare grant to improve the Helena River and Jane Brook catchments.
- Held the End of Year Volunteer function for 120 guests to celebrate the year's achievements.
- Hosted the Helena River Assessment discussion workshop with stakeholders from the region.
- Participated in the Swan Alcoa Landcare Program (SALP) assessment panel. Assessed and rated SALP applications for the Perth region.
- Delivered six Bush Skills 4 Youth workshops in Primary Schools in the Shire. Delivered two Bush Skills 4 Youth workshops for youth community groups in the Shire.
- Bush Skills 4 Youth delivered Healthy Wildlife information kits and wildlife rescue boxes to all local primary and secondary schools in the Shire.
- Provides an Environmental Project Officer to attend the Shire Office one day per week to address local landholder enquiries and assist with projects.
- Assisted Shire of Mundaring to receive grant funding of $32,500 to manage blackberry in sensitive watercourses.
- Assisted Jane Brook Catchment Group to receive grant funding of $7,700 to increase the bushland and water quality values of the Lion Mill Creek.
- Compiled and distributed the Greenpage Newsletters for October – November 2017 and December 2017 – January 2018.

Item 2.1 continued

- Hosted a Water Sensitive Urban Design in the Hills workshop with Urbaqua to discuss drainage and stormwater management in hills catchments and develop a way forward to improve on-ground outcomes.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.
- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Held an Economic Development Officers Group meeting on 12 December 2017 which included updates on the Regional Economic Development Strategy, Regional Services Project Funding Summary 2018/2019 and City Deal Proposal.
- The Regional Economic Development Strategy 2017 – 2021 was finalised and approved by Council at its 7 December 2017 meeting. The Strategy will be available electronically and in hard copy in early 2018.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.
- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.

City of Swan

- Progressed Stages Two and Three of the Understanding and Managing Flood Risk in Perth project, with the final Hydraulic Modelling Report delivered and the Risk and Vulnerability Assessments undertaken.
- Completed Waterwise Council Reporting and submitted to Water Corporation for the City's application for Gold Waterwise Council status.
- Provided the City with a Water Report Card for 2016/2017.
- Provided information on available funding for sustainability and environment capacity building through the Myer Foundation to the Town.
- Attended and disseminated information from meetings, technical reports, and seminars including:
  - WALGA's Sustainable Procurement Guide
  - Water Corporation's – Waterwise Business Forum 2017.
- Delivered one Bush Skills for the Hills workshop in the region: Fire and Diversity.
- Delivered training in the GRID mapping tool to assist community groups complete their Community Rivercare grant applications.
- Finalised the Alternative Weed Management Trial Report summarising the trial findings and recommendations as part of the Steaming to Success grant funded project.

Item 2.1 continued

- Participated in the Swan Alcoa Landcare Program (SALP) assessment panel. Assessed and rated SALP applications for the Perth region.
- Assisted Susannah Brook Catchment Group with project planning and meeting with Gidgegannup volunteer Fire Brigade and Main Roads.
- Delivered two Bush Skills 4 Youth workshops for community youth groups in the City. Attended three youth consultation sessions with Swan Youth Council.
- Provides an Environmental Project Officer to attend the City's office one day per week to address local landholder enquiries and assist with projects.
- Assisted catchment groups in applying for the Community Rivercare grant to improve the Helena River and Jane Brook catchments.
- Held the End of Year Volunteer function for 120 guests to celebrate the year's achievements.
- Hosted the Helena River Assessment discussion workshop with stakeholders from the region.
- Compiled and distributed the Greenpage Newsletters for October – November 2017 and December 2017 – January 2018.
- Hosted a Water Sensitive Urban Design in the Hills workshop with Urbaqua to discuss drainage and stormwater management in hills catchments and develop a way forward to improve on-ground outcomes.
- Represented the region on the Western Region Advisory Panel and the IRP2 Economic Evaluation Framework Project Steering Committee of the Cooperative Research Centre for Water Sensitive Cities. Hosted a Local Government Tools and Products Workshop.
- Met with Chris Woodthorpe, representative of the UN Secretary-General in Australia, and attended a WA SDG Network Meeting to further the achievement of the Sustainable Development Goals in the region.
- Submitted a case study of the Regional Environment Strategy 2016-2020 using the Sustainable Development Goals as a framework for consideration in the Australian government's Voluntary National Review on the 2030 Agenda.
- The Perth Tourism website (perthtourism.com.au) was replaced by the newly designed Perth's Eastern Region Website (perthseasternregion.com.au). The website allows community members to view and register for Bush Skills 4 youth and Bush Skills for the Hills environmental workshops held by the EMRC, complete Swan River Ramble QR code questions, submit events to the calendar, download material such as the Greenpage Newsletter and access information on a range of event and environmental topics related to the EMRC and member Councils.
- Held a Regional Integrated Transport Strategy Implementation Advisory Group meeting on 5 December 2017 which included a presentation on Leadership Insights by Michael Hayward, Asset Manager City of Swan.
- Commenced work on the Regional Congestion Management Action Plan.
- Lodged a submission to the Federal Government's Department of Science, Industry and innovation regarding the discussion paper titled *The Digital Economy: Opening Up the Conservation;* this included the outcomes from a facilitated forum to collate member Council views and priorities.
- Met with member Councils, non-member councils, members of parliament and key stakeholders including government agencies to capture the priorities and finalise the "Connect Perth's East" City Deal proposal. The proposal was approved by Council at its 7 December 2017 meeting.

Item 2.1 continued

STRATEGIC/POLICY IMPLICATIONS

Key Result Area 1 – Environmental Sustainability

1.5 To contribute towards improved regional air, water and land quality and regional biodiversity conservation and address climate change

Key Result Area 2 – Economic Development

2.1 To facilitate and advocate for increased investment in regional infrastructure
2.2 To facilitate and advocate for regional economic development activities
2.3 To facilitate regional cultural and recreational activities

Key Result Area 3 – Good Governance

3.1 To provide advice and advocacy on issues affecting Perth's Eastern Region
3.2 To manage partnerships and relationships with stakeholders

FINANCIAL IMPLICATIONS

The funding to facilitate Regional Services projects and activities is developed and agreed with member Councils as part of the annual budget process.

SUSTAINABILITY IMPLICATIONS

The Regional Services Directorate operates to pursue environmental, economic and social growth outcomes for Perth's Eastern Region. Environmental management activities support sustainability principles and contribute towards the environmental, social, and economic benefits through water and energy savings, conservation and management of biodiversity and natural areas and community education and engagement.

MEMBER COUNCIL IMPLICATIONS

Member Council	Implication Details
Town of Bassendean City of Bayswater City of Belmont City of Kalamunda Shire of Mundaring City of Swan	Ongoing participating member Council officer time on the three advisory groups: EDOG, RITS IAG and RESAG.

ATTACHMENT(S)

Nil

2.2 ALTERNATIVE WEED MANAGEMENT TRIAL REPORT

REFERENCE: D2017/00766 (CEOAC) - D2018/01515

PURPOSE OF REPORT

The purpose of this report is to provide Council with a summary of the Alternative Weed Management Trial Report.

KEY ISSUE(S)

- The EMRC has successfully completed the alternative weed management trial and produced a report summarising the findings. The trial and report were key outputs of the Steaming to Success project funded by the Western Australian State Natural Resource Management Office.
- The trial was undertaken on the Railway Heritage Trail in Mount Helena within the Shire of Mundaring. Support was provided by the Shire of Mundaring and Jane Brook Catchment Group to complete the project.
- The project trialled a number of alternative weed management methods on different weed species. The report presented information on some of the strengths, weaknesses and applicability for each method.
- Information gained from the report will add to the existing body of knowledge on alternative weed management and will assist land managers who are investigating non-traditional methods of weed control.

SOURCE OF REPORT

Director Regional Services

BACKGROUND

The EMRC has been investigating alternative weed management techniques in response to the community's interest in integrating non-traditional methods into a more holistic weed management regime. In 2015, the EMRC held a 'Working with Weeds' seminar to present the latest research and alternative weed management methods that are being utilised locally, nationally and internationally.

REPORT

In 2016, the EMRC was successful in receiving funding from the Western Australian Government's State Natural Resource Management Program for the 'Steaming to Success' project. The project was developed to include an alternative weed management trial and an 'Innovative Weed Control Seminar and Site Tour' in order to discuss alternative weed management techniques and visit demonstration sites.

The alternative weed management trial was designed to determine the effectiveness of salt and vinegar, pine oil, pelargonic acid, super-saturated steam, competitive planting and mulch at a site alongside the Railway Heritage Trail in Mount Helena. Super-saturated steam was trialled using the EMRC's Steamwand SW700 machine purchased in 2015 with funding from the Department of Parks and Wildlife (now Department of Biodiversity, Conservation and Attractions), Rivers and Estuaries Division.

In order to determine the effectiveness of each treatment method, visual assessments of the weed percentage cover were carried out and photo monitoring was undertaken. Data was collected over a one year period to represent all of the seasons. Nine applications were applied in total to the treatment plots. A total of twenty plots were monitored. Data collected was a representation of the specific environmental conditions at the Mount Helena site.

Item 2.2 continued

The Alternative Weed Management Trial Report was developed outlining the methodology, results, analysis and recommendations from the alternative weed management trial (see attachment). Some of the key learnings from the trial include:

- The process, resources and expected outcomes of alternative techniques may differ from traditional methods, and that this is important to take into account when planning a trial;
- Mulch has been shown to be very effective at managing weeds with minimal resource requirements;
- Competitive planting in conjunction with mulch and follow-up treatment is effective at managing weeds and has the added benefits of improved aesthetics and enhanced habitat values;
- Steam is also effective at managing most weeds with the exception of mature weeds or weeds with large underground energy storage systems;
- Pelargonic acid has been shown to be effective on some weeds provided the appropriate follow-up is carried out;
- Pine oil also has the ability to manage some weeds however the trialled product did present some barriers in its use; and
- Salt and vinegar is effective at managing weeds if all parts of the plant are covered with the solution and follow-up applications are completed.

The trial has successfully shown the effectiveness of a number of alternative weed management treatments at a specific site and highlighted some of their advantages and disadvantages. The results of the report can be utilised by weed managers as a guide for future trials and to implement non-traditional methods of weed management.

The EMRC's mulch from the Red Hill Waste Management Facility is certified to AS4554 standard and as such is weed free so this product may be an attractive option.

STRATEGIC/POLICY IMPLICATIONS

Key Result Area 1 – Environmental Sustainability

1.5 To contribute towards improved regional air, water and land quality and regional biodiversity conservation and address climate change.

FINANCIAL IMPLICATIONS

Nil

SUSTAINABILITY IMPLICATIONS

The results of the report can be utilised by weed managers as a guide for future trials and to implement non-traditional methods of weed management.

Item 2.2 continued

MEMBER COUNCIL IMPLICATIONS

Member Council	Implication Details
Town of Bassendean City of Bayswater City of Belmont City of Kalamunda Shire of Mundaring City of Swan	The results of the report can be utilised by member Councils as a guide for future trials and to implement non-traditional methods of weed management.

ATTACHMENT(S)

Steaming to Success Alternative Weed Management Trial Report – December 2017 (Ref: D2018/01516)

EMRC

Protecting Perth's Eastern Region

Steaming to Success

Alternative Weed Management Trial Report

December 2017

GOVERNMENT OF WESTERN AUSTRALIA

natural resource management program

Acknowledgements

This report was prepared by the Eastern Metropolitan Regional Council (EMRC) with the generous support of many organisations and individuals. Their contributions are gratefully acknowledged.

The ‘Steaming to Success’ project was co-funded by the Western Australian Government's State Natural Resource Management Program and the EMRC. The Department of Biodiversity, Conservation and Attractions (DBCA) Rivers and Estuaries Division funded the Steamwand SW700 machine used in the Steaming to Success project.

Technical advice, on-ground assistance and support was received from the Shire of Mundaring and the Friends of Railway Trail in Mount Helena.

The following people provided support and expertise to deliver the Innovative Weed Control Seminar and Site Tour: Jeremy Winer, Director, Weedtechnics; Josh Byrne, Director, Josh Byrne and Associates; Alex Devine, Natural Area Officer, City of Bayswater; Mike Norman, Chairman and Treasurer of Joondalup Community Coast Care Forum;; and community group members, Phil Cloran and Jennifer Catalano, Blackadder Woodbridge Catchment Group.

Disclaimer

The results and recommendations of this report were compiled using data collected from visual assessment at a site under specific environmental conditions. The views and opinions expressed do not necessarily reflect those of the project funding bodies or partners.

Terminology

Application(s)	refers to each of the treatment events in the trial.
Presentation Standard	refers to the acceptable appearance of a site that is being managed for weeds (Winer, 2014) as determined by the land manager. A Presentation Standard will determine the amount of weeds that can be tolerated at a site.
Treatment(s)	refers to the collective alternative weed management treatments used in the trial: steam; pelargonic acid; pine oil; salt and vinegar solution; mulch; and competitive planting.

Table of Contents

1 Introduction

The EMRC have been investigating alternative weed management techniques in response to the community's interest in integrating non-traditional methods into a more holistic weed management regime.

In 2015, the EMRC held a 'Working with Weeds' seminar with the Weeds Network to present the latest research and alternative weed management methods that are being utilised locally, nationally and internationally. The Steamwand SW900 machine was demonstrated as one type of alternative technology. The seminar was well attended with over 80 guests representing landcare groups, local governments, state government departments, environmental contractors and consultants.

Following on from the seminar, the EMRC was successful in receiving additional funding from the Department of Parks and Wildlife (now Department of Biodiversity, Conservation and Attractions), Rivers and Estuaries Division to purchase a Steamwand SW700 steam weeding machine and to provide operator training for people to hire out the machine. To date, 63 people have completed operator training from 21 organisations, and the machine is hired out regularly.

In March 2016, in response to ongoing interest in other weed management treatments, the EMRC developed a grant titled 'Steaming to Success' which was successful in receiving funding from the Western Australian Government's State Natural Resource Management Program. The project was developed to include an alternative weed management trial and an 'Innovative Weed Control Seminar and Site Tour' in order to discuss alternative weed management techniques and visit demonstration sites. The project was finalised in October 2017.

This report provides information on the alternative weed management trial aspect of the Steaming to Success project, including methodology, results, analysis and recommendations from the trial.

1.1 Objectives of the Trial

The objectives of the trial were to:

- Assess the effectiveness of alternative (non-traditional) weed management controls/treatments over time to defined presentation standards;
- Raise awareness of alternative weed management techniques; and
- Investigate the potential of integrating these methods into mainstream weed management plans and regimes.

The results of the trial will add to existing knowledge relating to weed control and revegetation techniques.

1.2 Out of scope

Soil testing was not undertaken as it was outside the scope of the project. A cost analysis was also not undertaken as it was outside of the scope of the project.

1.3 Description of Trial Site

The trial was undertaken on a site alongside the Railway Heritage Trail in Mount Helena (Figure 1) close to Riley Road. The trail is a gravel track popular with recreational users. The trail is bordered by native bushland and non-irrigated grassy areas which are normally maintained by mowing and spraying up to three times per year.

The Presentation Standard of the site is guided by fire hazard reduction values, safety values for recreational users and aesthetic values.

The soil present is a clay loam with underlying remains of rock ballast from the railway. The average annual rainfall at the site is 863 mL (Bureau of Meteorology, 2017).

The site was selected based on ease of access for the Steamwand machine, delivery of mulch, planting and regular monitoring.

The scope of the project and the results obtained from the trial are unique to these environmental conditions. This should be taken into account when comparing the results of this report with other sites with differing environmental factors.

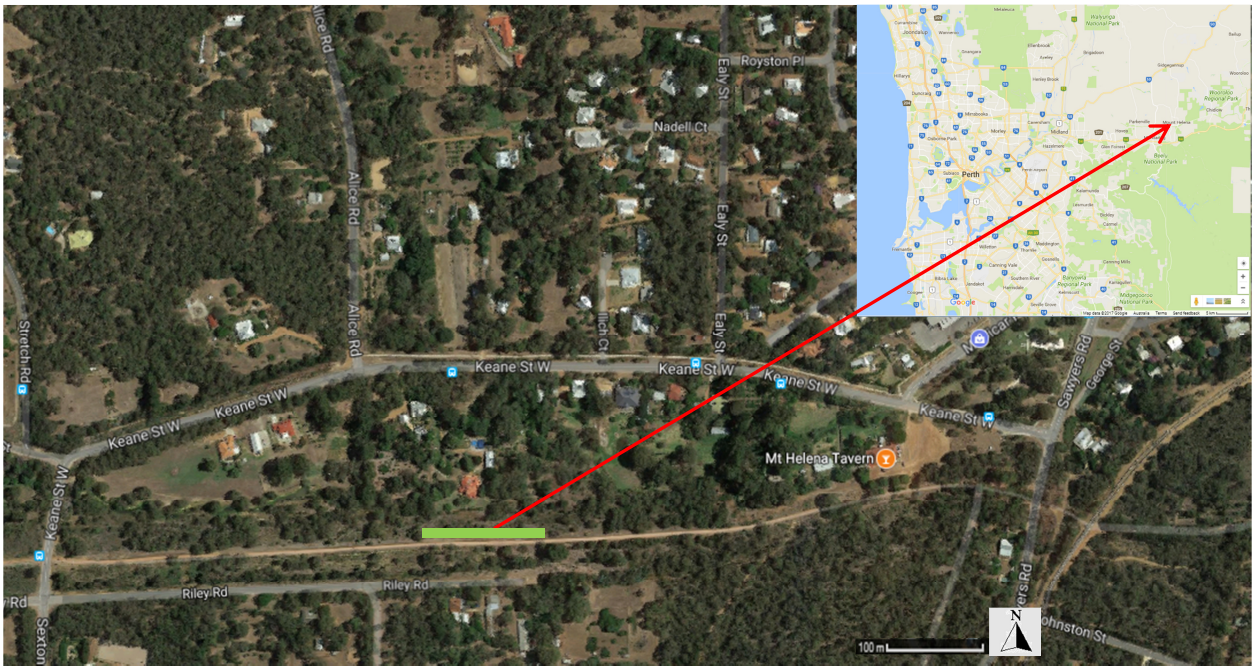


Figure 1. Alternative weed management trial site location

Common and scientific names of weeds identified within the trial plots are listed in Table 1. Common names will be used within the body of this report.

Table 1. Plant species identified within trial plots

Common name	Scientific Name
African lovegrass	**Eragrostis curvula*
Cape tulip	**Moraea sp.*
Capeweed	**Arctotheca calendula*
Caustic weed	**Euphorbia drummondii*
Dock	**Rumex sp.*
Flatweed	**Hypochaeris radicata*
Fluellen	**Kickxia spuria*
Fumitory	**Fumaria sp.*
Large clover (Trifolium)	**Trifolium sp.*
Lupin	**Lupinus cosentinii*
Native grasses	*^Austrostipa sp.*
Perennial veldt	**Ehrharta calycina*
Pimpernel	**Anagallis arvensis*
Plantain	**Plantago lanceolata*
Pom pom (Narrowleaf clover)	**Trifolium angustifolium*
Pussytail (Hare's Tail Grass)	**Lagurus ovatus*
Radish	**Raphanus raphanistrum*
Ryegrass	**Lolium rigidum*
Small clover (Trefoil)	**Lotus angustissimus*
Sow Thistle	**Sonchus oleraceus*
Staggerweed	**Stachys arvensis*
Stink weed	**Dittricha graveolens*
Storksbill	**Erodium sp.*
Tagasaste	**Chamaecytisus palmensis*
Verbascum	**Verbascum virgatum*
Vetch	**Vicia hirsuta*
Wild oats	**Avena sp.*
Wireweed	**Polygonum aviculare*

** Weed species* *^Native grasses*

2 Methodology

2.1 Alternative Treatments

The following alternative weed management treatments were used on a range of different weeds present at the trial site. They were selected as being representative of the most common alternative treatments currently available to local governments and community groups.

Salt and Vinegar Solution
Vinegar or acetic acid (at the correct concentration) has the ability to break down leaf cuticles causing them to leak and dry out. Salt has the ability to dehydrate plant cells. Salt and vinegar combined make an effective non-selective herbicide. It is important the herbicide is applied to all parts of the exposed plant.

Pine Oil
Pine oil is phytotoxic, meaning it is toxic to plants. Similarly to acetic acid, it works by desiccating plant cell walls so their contents leak and dry out. Pine oil also acts as a pre-

emergent herbicide by rendering weed seed unviable. It is important to coat all of the target plant with the herbicide to achieve the desired effect.

Pelargonic Acid
Pelargonic acid has a similar effect on weeds as acetic acid and pine oil and must be applied to all living parts of the plant to be effective. A spray solution of pelargonic acid (at the correct concentration) penetrates living plant cells and causes tissue damage leading to plant death. Pelargonic acid naturally occurs in many plants and some foods that we eat.

Please read manufacturer recommendations on product labels before using any of the above treatments.

Super-saturated Steam
The optimal temperature to control weeds using this technique is between 98°C - 103°C. The combination of saturated steam and water at 100°C delivers thermal shock to the weed. The rapid transfer of lethal heat destroys the plant cellular structure, thereby providing an effective method of weed control. Steam and hot water together will penetrate the meristematic cells of a plant (the parts where new growth occurs) to reduce the likelihood of the plant re-sprouting post-treatment (Winer, 2014).

Competitive (dense) Planting of Ground Covers
Competitive planting using native ground covers was selected as these plants spread laterally and have the potential to out-compete weeds for nutrients, moisture and space. This treatment is complemented by weed removal within the plant wells to give the ground covers the competitive advantage.

Mulch
Mulch has the ability to control weeds and suppress weed seed germination by smothering and reducing seed access to sunlight. Mulch helps retain soil moisture and protects the soil against erosion assisting native plant survival.

2.2 Trial Plot Layout

Five 3 metre x 16 metre plots were used to conduct the trial; each plot was then divided into four 3 metre x 4 metre sub-plots. Plots were measured out using a 100 metre measuring tape on a reel and marked at the corners with wooden stakes painted in yellow to increase visibility.

The trial was set up to distinguish four different combinations of each of the five treatments to assess the most effective treatment and/or combination. The five treatments being: a Control; Salt and Vinegar; Pine Oil; Pelargonic Acid; and (super-saturated) Steam. Each plot included a treatment only sub-plot and one combination sub-plot each of the treatment plus (competitive) planting; treatment plus mulch and planting; and treatment plus mulch (Figure 2).

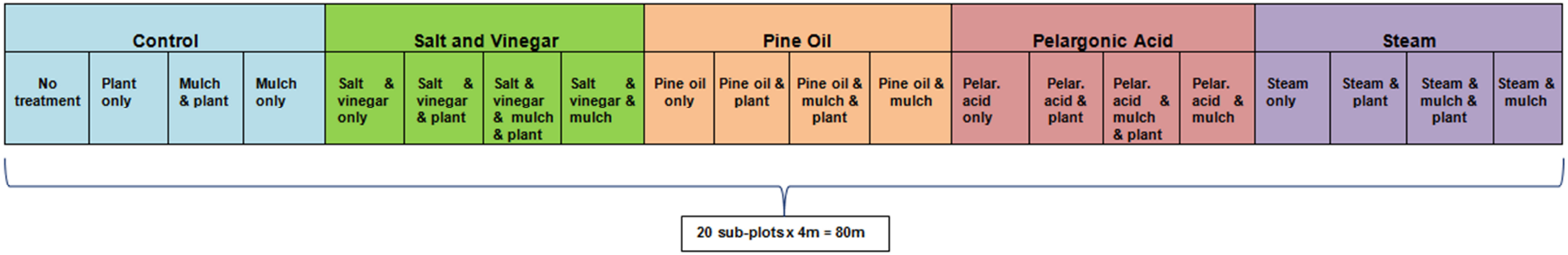


Figure 2. Alternative weed management trial plot layout

2.3 Treatment Applications

The first application of the Salt and Vinegar, Pine Oil, Pelargonic Acid and Steam treatments was applied to trial plots in the afternoon of 1 July 2016.

Mulch
Tree pruning mulch from the Shire of Mundaring was applied to the allocated mulch plots at 10 cm thickness by contract labour on 15 July 2016 (14 days after the first application of all treatments).

Competitive (dense) Planting of Ground Covers
Competitive planting sub-plots were planted by contract labour and a team of Green Army participants. The plots were planted after the initial treatments were applied and the corresponding treatment withholding period had passed (manufacturer safety and instruction labels were followed for specific withholding periods).

The following species of native ground covers, *Chorizema cordatum, Kennedia prostrata, Kennedia coccinea, Patersonia occidentalis* and *Hardenbergia comptoniana,* were planted at four plants per square metre and spaced randomly.

Control Plot
On 21 July 2016 following the mulch application, native ground cover plants were planted into one non-mulched and one mulched sub-plot.

Salt and Vinegar Solution
Trained and licenced Shire of Mundaring Landcare Officers applied a ready-to-use premixed solution of Salt and Vinegar (90g/L Acetic Acid, 40g/L Sodium Chloride) solution to the above ground parts of the weeds using a backpack sprayer. The first application was carried out on 1 July 2016 to all four sub-plots.

On 21 July 2016, native ground covers were planted into one non-mulched and one mulched sub-plot. For subsequent Salt and Vinegar solution application dates refer to Table 2.

Pine Oil
A Pine Oil concentration of 680 g/L at a mixing rate of 200 mL per litre of water was used in the trial. The product was applied by a licenced contractor using a boom spray unit mounted to a quad-bike. Only two applications were applied during the trial as per the manufacturer's recommendation which stipulated that no more than two applications per year could be applied to a treated area. The first application was completed on 1 July 2016 to all four sub-plots followed by the second and final application on 2 August 2016.

On 21 July 2016, native plants were planted into one non-mulched and one mulched sub-plot.

The final application of Pine Oil was applied to the Pine Oil Only sub-plot as the boom-spray application method does not allow spraying in between dense plantings. The mulched plots were not sprayed either as there were no weeds present.

Pelargonic Acid
The Pelargonic Acid product used contained 60% active ingredient. It was initially mixed with water at 5% (medium rate per manufacturer's instructions) and applied on 1 July 2016 by licenced Shire of Mundaring Landcare Officers using a backpack sprayer.

The initial application had little effect on the weeds present. Contact was made with the manufacturer and, per manufacturer's recommendation, the mixing rate was increased to 7% and used in the second application on 2 August 2016 and successive treatments.

Planting of the Pelargonic Acid and Plant sub-plot was delayed because the initial treatment at a rate of 5% and secondary treatment at 7% were both ineffective. It is thought that the secondary treatment of 7% was not applied as liberally as is required for the product to be effective.

The Pelargonic Acid, Plant and Mulch sub-plot was planted on 15 July 2016.

The third application of Pelargonic Acid solution (repeat of second application) was applied on 16 August 2016, delaying planting of the Pelargonic Acid and Plant sub-plot until 31 August 2016. For subsequent Pelargonic Acid solution application dates refer to Table 2.

Hand weeding of Plantain was conducted on 16 March 2017 for all Pelargonic Acid trial plots as this treatment was deemed ineffective for managing Plantain. The removal of Plantain was undertaken to allow for further observation of other weed species' response to Pelargonic Acid treatments.

Super-saturated Steam
The Steamwand SW700 machine was used throughout the trial by trained EMRC Officers to apply the Steam treatment. The machine includes a boiler, water pump and 1,000 L water tank mounted to a registered trailer. The 30 metre hose delivered super-saturated steam to the weeds through a lance with a closed head attachment fixed to the end. The vacuum-like head attachment concentrated steam to a 30 cm by 15 cm area. This allowed more area to be covered and was quicker than if the open-head attachment was used.

The first treatment was applied to all sub-plots on 1 July 2016 avoiding any native grasses present on the plot.

Native ground covers were planted on 15 July 2016 into the Steam and Plant and Steam, Plant and Mulch sub-plots. For subsequent Steam application dates refer to Table 2.

2.4 Monitoring

Two forms of monitoring were carried out during the trial:

- Photo monitoring; and
- Percentage cover using visual assessment.

Before every application photos were taken of each sub-plot facing north, east and west. At the same time, percentage cover of weeds, natives and mulch was recorded using visual assessments. The final monitoring was conducted at the end of the trial with two additional monitoring events occurring in August 2016 and February 2017. These methods were used for each of the 20 sub-plots over the course of the trial (see Table 2 for dates).

2.5 Trial Timeline

The initial baseline monitoring was conducted on the morning of 1 July 2016 with photo monitoring and percentage cover data recorded prior to the first application of each treatment. The first treatments were applied in the afternoon of 1 July 2016.

Six applications of each treatment were applied in winter 2016, spring 2016, summer 2016/2017 and autumn 2017 (see Table 2 for dates).

Monitoring was undertaken on the morning of each treatment application and intermittently throughout the trial to assess the effectiveness of the previous treatment application. A total of nine monitoring rounds were completed between July 2016 and July 2017 (Table 2) to give an accurate seasonal representation.

The final treatment was applied on 28 April 2017, with final monitoring conducted on 5 July 2017.

In line with traditional weed management techniques, the plant wells of all plots were hand weeded as required. Hand weeding of the plant wells was undertaken after the monitoring round was completed, and before the treatments were applied in the afternoons. The reason for hand weeding was to reduce spray contact with native ground cover plantings.

Table 2. Monitoring and treatment timeline detailing what occurred at each visit to the trial site

Visit	Date	Treatment application	Monitoring round (photos & %age cover)	Photo monitoring only	Notes
1	1 July 2016	1	1	-	Baseline data and first treatment application. Pelargonic Acid rate was 5%
2	5 July 2016	-	-	Yes	Photo monitoring 4 days after treatment application
3	15 July 2016	-	-	Yes	Photo monitoring before contractor mulching and planting of 'Steam, Plant and Mulch', 'Steam and Plant' and 'Pelargonic, Plant and Mulch'
4	21 July 2016	-	-	-	Green Army planted the following sub-plots 'Pine Oil, Plant and Mulch', 'Pine Oil and Plant', 'Salt and Vinegar, Plant and Mulch', 'Salt and Vinegar and Plant', 'Control, Plant and Mulch' and 'Control Plant Only'
5	2 August 2016	2	2	-	Pelargonic Acid rate increased to 7%. Second and final Pine Oil application to 'Pine Oil Only plot'.
6	16 August 2016	-	3	-	An additional application of Pelargonic Acid at 7% was applied.
7	31 August 2016	-	-	-	EMRC planted 'Pelargonic Acid and Plant' plot.
8	16 September 2016	3	4	-	Monitoring and treatment application

Visit	Date	Treatment application	Monitoring round (photos & %age cover)	Photo monitoring only	Notes
9	21 October 2016	4	5	-	Monitoring and treatment application
10	3 February 2017	-	6	-	Monitoring only
11	16 March 2017	5	7	-	Monitoring and treatment application
12	28 April 2017	6	8	-	Monitoring and treatment application
13	5 July 2017	-	9	-	Final monitoring

3 Results

3.1 Control

The Control plot was divided into four sub-plots in order to compare the effectiveness of mulch and competitive planting excluding other forms of treatment. The Control No Treatment sub-plot would be considered a 'true control' as it had no treatment at all.

3.1.1 Control - No Treatment

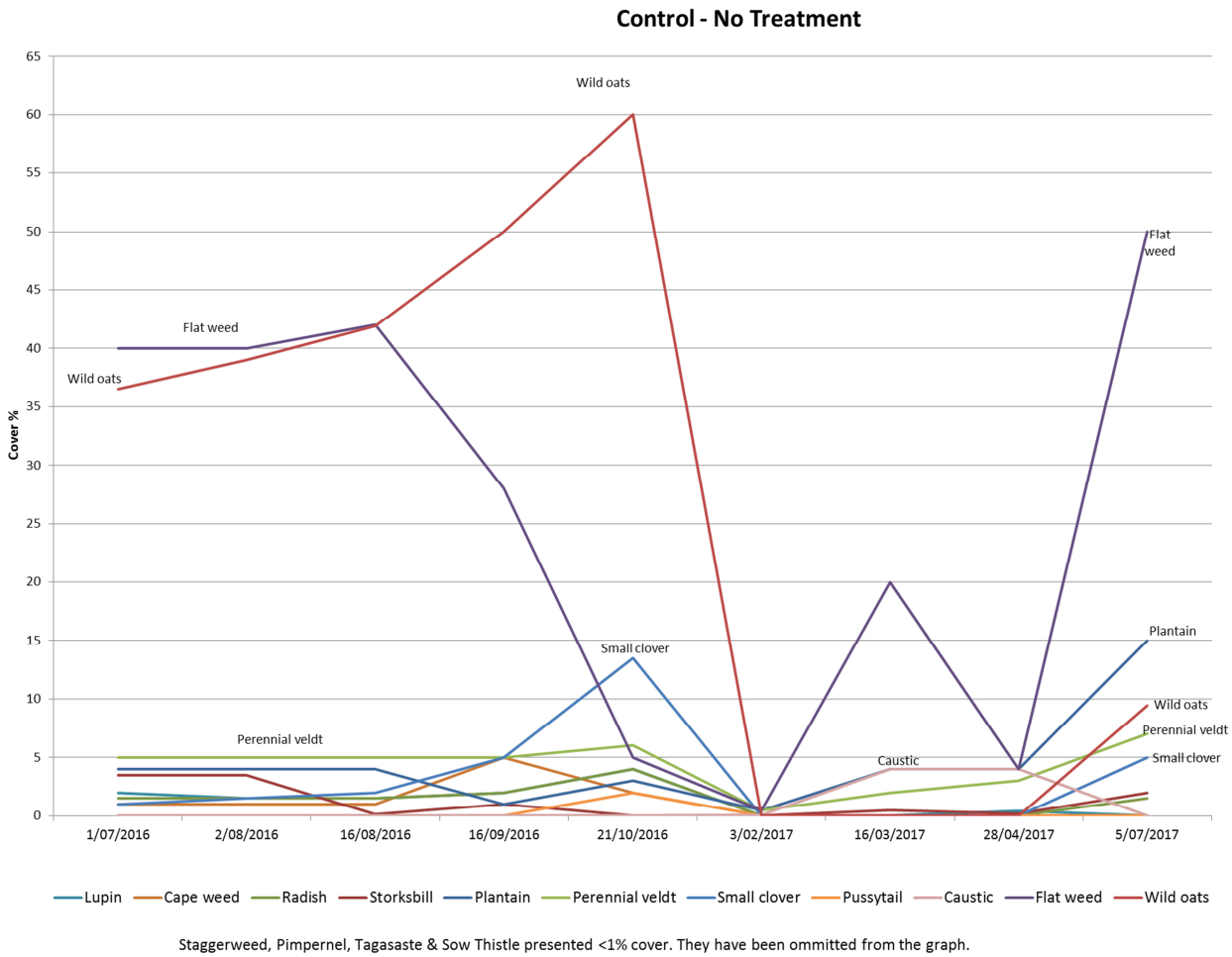
The Control No Treatment sub-plot (Figure 3) shows a high degree of variability in percentage of weed cover throughout the trial. Wild oats and Flat weed were the most prevalent weed species having the highest percentage cover throughout the trial.

In July 2016 at the start of the trial, Wild oats and Flat weed cover was 37% and 40% respectively. Wild oats cover increased to 60% by October 2016 before decreasing to 0% by February 2017. Wild oats remained at 0% cover until starting to increase again by July 2017 measuring 9%. Flat weed had increased to 42% cover by August 2016 before reducing to 0% in February 2017. Flat weed had increased to 20% cover by March 2017 then decreased to 4% before increasing again to 50% by July 2017.

All of the other weeds except Small clover were at or less than 5% cover until the last monitoring in July where a few saw a slight increase. Small clover had increased from 1-2% to 13% cover by October 2016 before showing a decrease to 0% in February and March 2017. By the end of the trial, Small clover cover had increased to 5%.

Plantain and Perennial veldt were recorded as 4% and 5% cover at the start of the trial before both decreasing to 0% by February 2017. Both species then increased in cover with Perennial veldt recorded at 7% and Plantain recorded at 15% by the end of the trial.

For photo monitoring refer to Appendix 9.2.



Staggerweed, Pimpernel, Tagasaste & Sow Thistle presented <1% cover. They have been ommitted from the graph.

Figure 3. Percentage cover of weeds at Control No Treatment sub-plot over the course of the trial

3.1.2 Control - Plant Only

The Plant Only sub-plot (Figure 4) of the Control plot had native ground covers planted on 21 July 2016. Flat weed and Wild oats were the most abundant weeds present prior to planting, at 35% and 40% cover respectively, followed by Perennial veldt at 5% cover. Small clover had increased to 10% by October 2016, then decreased to 0% before increasing to 8% cover by July 2017.

Native ground covers planted increased in percentage cover to 5% by mid-August 2016. However, throughout the trial the cover of native plants decreased steadily to 1% by July 2017.

For photo monitoring refer to Appendix 9.3.

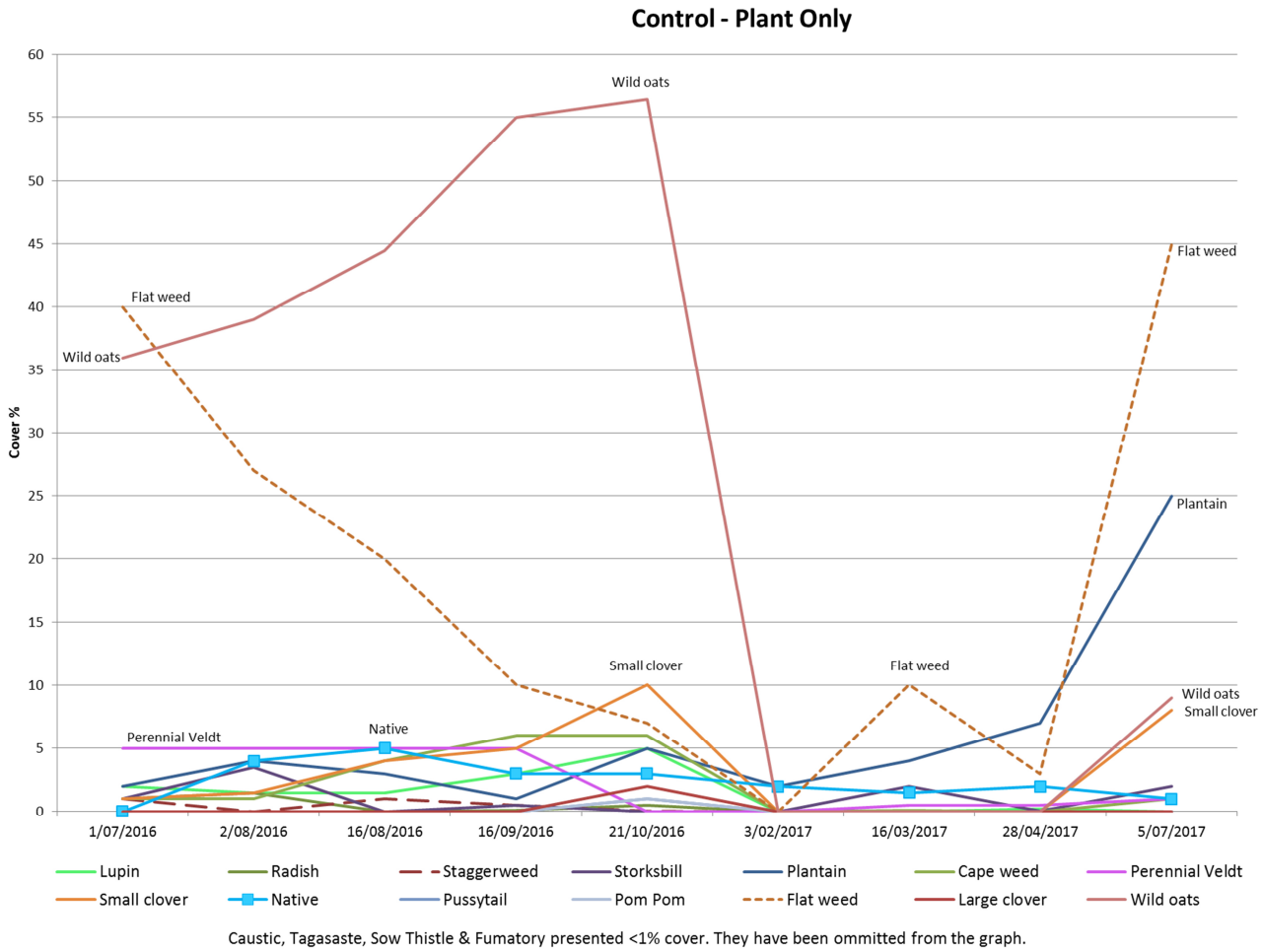


Figure 4. Percentage cover of weeds and native ground covers at Control - Plant Only sub-plot over the course of the trial

3.1.3 Control - Plant and Mulch

Wild oats and Flat weed were the most abundant weeds at the start of the trial in the Control Plant and Mulch sub-plot at 36% and 40% cover respectively (Figure 5). Following application of mulch and plants, cover of all but one weed reduced to 0%, with the exception of Plantain with less than 1% cover. Plantain had increased slightly to 4% cover by February 2017 before reducing to less than 1% as a result of hand weeding the plant wells (keeping consistency across the trial). Plantain had increased again to 5% cover by April 2017 then decreased to 4% by July 2017.

Following planting at the start of the trial, the cover of native plants was estimated to be 5% which showed a reduction to 1% in September and October 2016 before increasing again to 4% by July 2017. Flat weed had increased slightly to 2% cover recorded in August 2016 after mulching before decreasing to and remaining at less than 1% cover for the remainder of the trial.

Perennial veldt cover increased following mulching to 1% recorded in August 2016 before decreasing to 0% and again increasing to 4% by April 2017.

For photo monitoring refer to Appendix 9.4.

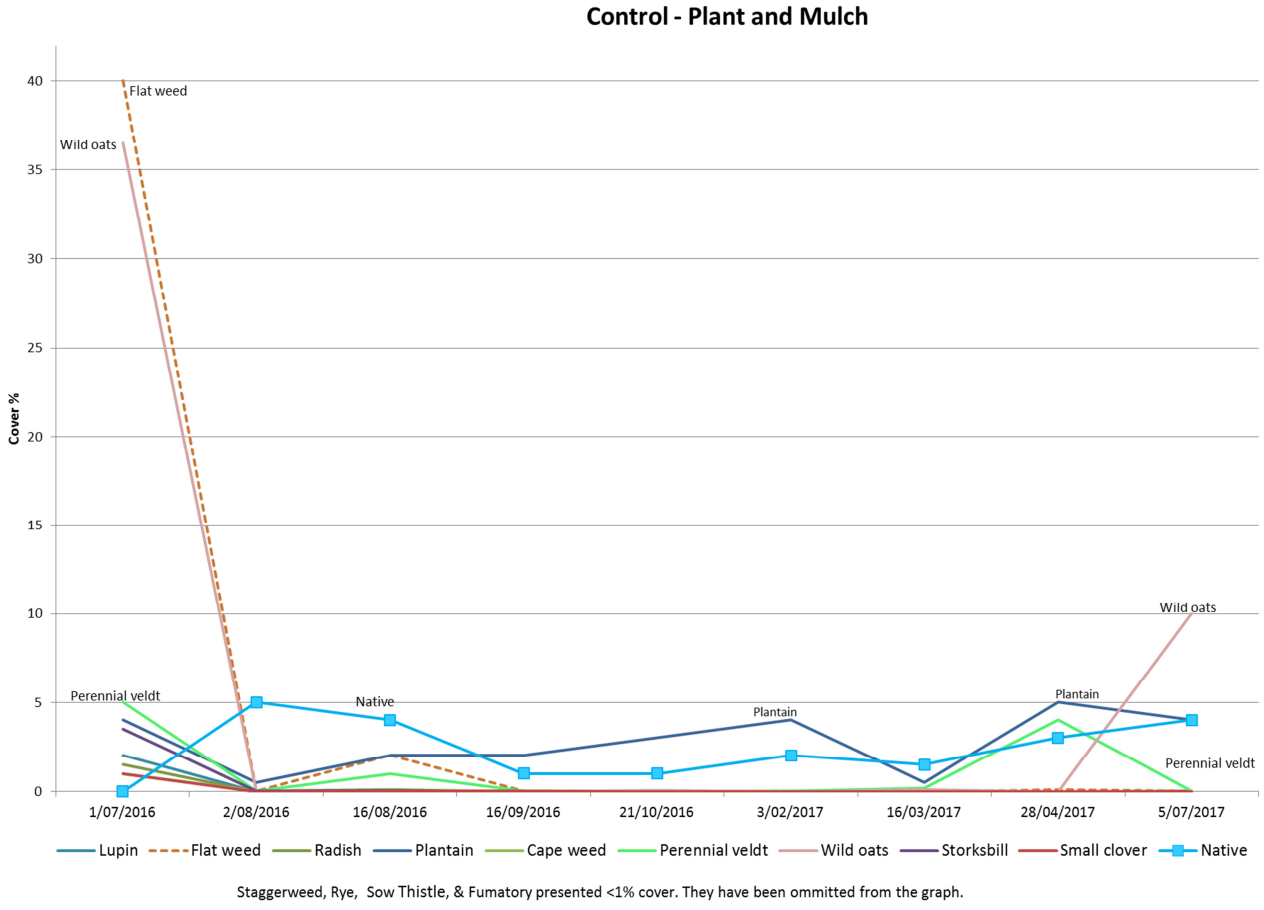


Figure 5. Percentage cover of weeds and native ground covers at Control/ Plant and Mulch sub-plot over the course of the trial

3.1.4 Control - Mulch Only

Control Mulch Only sub-plot had the highest percentage cover of Flat weed and Wild oats initially with 40% and 36% respectively (Figure 6). As evident from the graph, all weed species reduced to and remained at less than 5% cover for the remainder of the trial. Perennial veldt and Plantain increased slightly in February 2017 and were recorded at 2% and 1% cover respectively. Wild oats had increased by the end of the trial to 2% as recorded in July 2017.

For photo monitoring refer to Appendix 9.5.

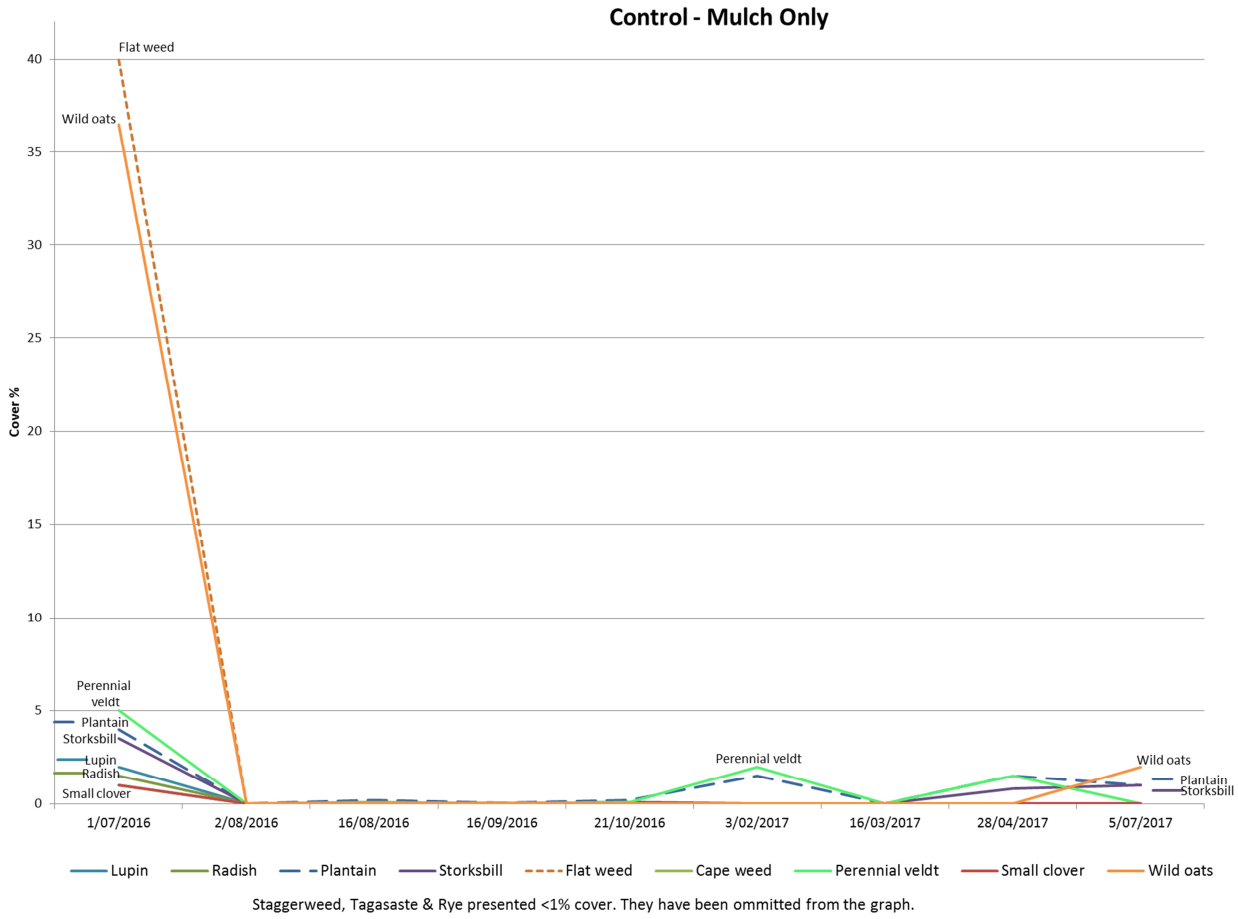


Figure 6. Percentage cover of weeds at Control/ Mulch Only sub-plot over the course of the trial

3.2 Salt and Vinegar

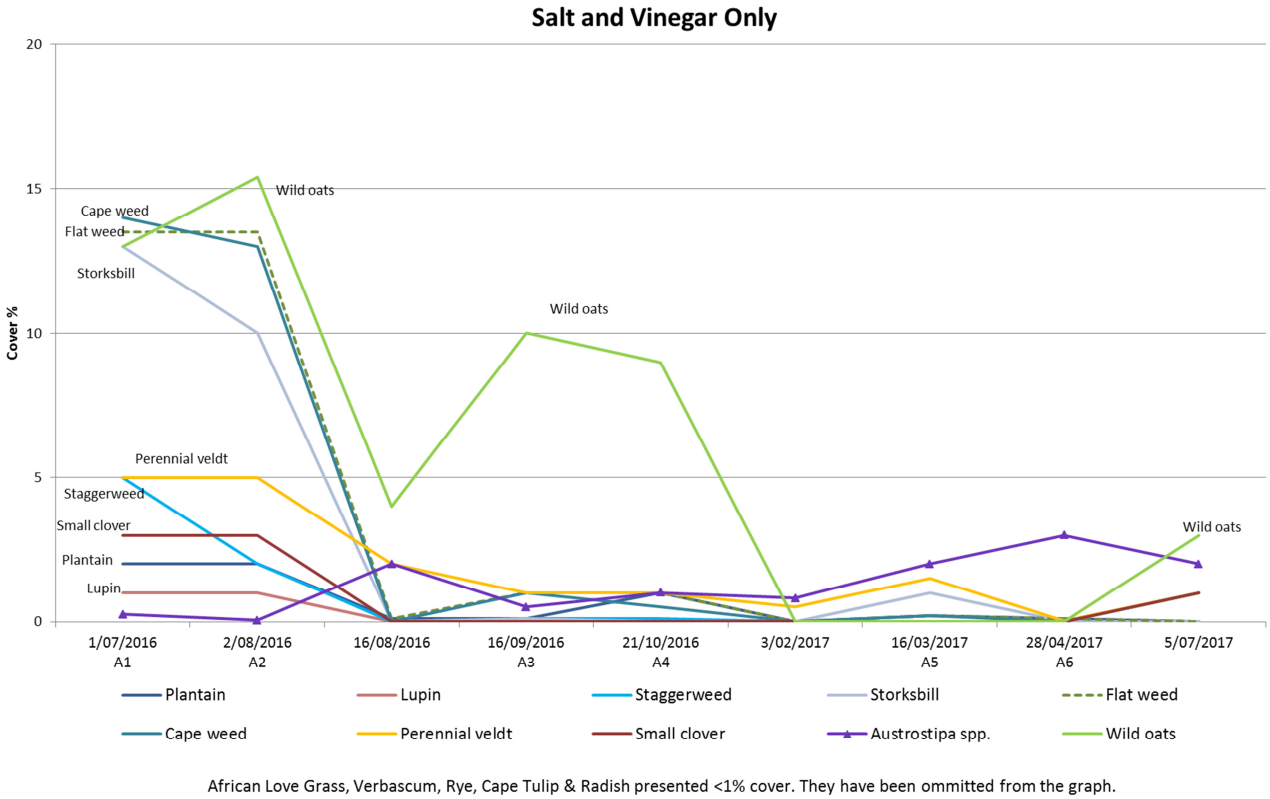
3.2.1 Salt and Vinegar Only

Salt and Vinegar Only sub-plot (Figure 7) had 14% cover of Cape weed and 13% cover each of Flat weed, Storksbill and Wild oats at the start of the trial. Perennial veldt and Staggerweed had cover of 5% each, Small clover had 3%, Plantain 2% and Lupin 1%. A degree of variability in the results was observed between the 1 July 2017, 2 August 2016 and 16 September 2016 applications, in particular with Wild oats. The results from the first application were negligible compared to the second application which proved to be very successful in decreasing Wild oats cover from 15% to 4%. A further application on 16 September 2016 had no effect on Wild oats cover as it increased to 10%. A decrease in cover to 9% was recorded on 21 October 2016. These results were observed during the active growth period for Wild oats before the natural decline was observed over summer as the species dies off.

All other weeds remained at or less than 1% cover with minor fluctuations in line with each application.

Native grasses present on the sub-plot experienced an overall increase over time measuring less than 1% cover at the start of the trial and 2% at the end of trial.

For photo monitoring refer to Appendix 9.18.



African Love Grass, Verbascum, Rye, Cape Tulip & Radish presented <1% cover. They have been ommitted from the graph.

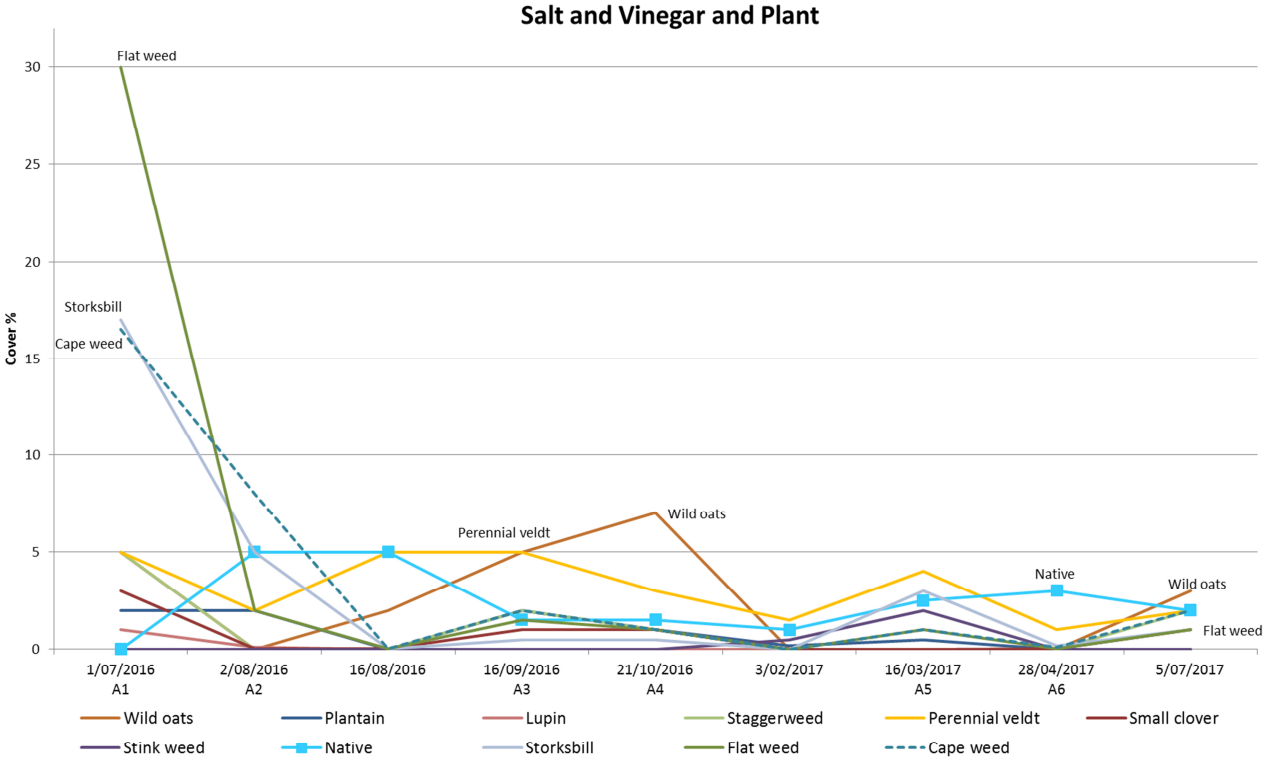
Figure 7. Percentage cover of weeds and native grasses at Salt and Vinegar Only sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.2.2 Salt and Vinegar and Plant

Flat weed was the dominant weed in the Salt and Vinegar and Plant sub-plot at the start of the trial measuring 30% cover, followed by Storksbill at 17% and Cape weed at 16%. Other weeds present were Staggerweed, Wild oats and Perennial veldt at 5% cover each, Small clover at 3%, Plantain at 2% and Lupin at 1% (Figure 8). Following the first application, all weeds except Plantain decreased. Following the second application, most weeds measured 0% cover in August 2016 (including Plantain), however Perennial veldt and Wild oats increased. Perennial veldt peaked at 5% as recorded in September 2016 and then fluctuated in line with each treatment application. Wild oats peaked at 7% cover as recorded in October 2016 before decreasing to 0% by February 2017. At the end of the trial, Wild oats was recorded at 3% cover, Perennial veldt, Staggerweed and Cape weed at 2% each, and Small clover, Storksbill and Flat weed at 1% each.

Native ground covers planted at the start of the trial increased to 5% cover by August 2016 before decreasing to 1% by February 2017.

For photo monitoring refer to Appendix 9.19.



African Love Grass, Verbascum, Rye, Cape Tulip & Radish presented <1% cover. They have been ommitted from the graph.

Figure 8. Percentage cover of weeds and native ground covers at Salt and Vinegar and Plant sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

Photo 1 shows the variable effects of Salt and Vinegar on Wild oats. Please note the grass tufts in the foreground are native grasses and were not sprayed. The first application on 1 July 2016 had negligible effect on the Wild oats as recorded on 2 August 2016. The second round of application on 2 August 2016 indicated an effective control of Wild oats as recorded on 16 August 2016.

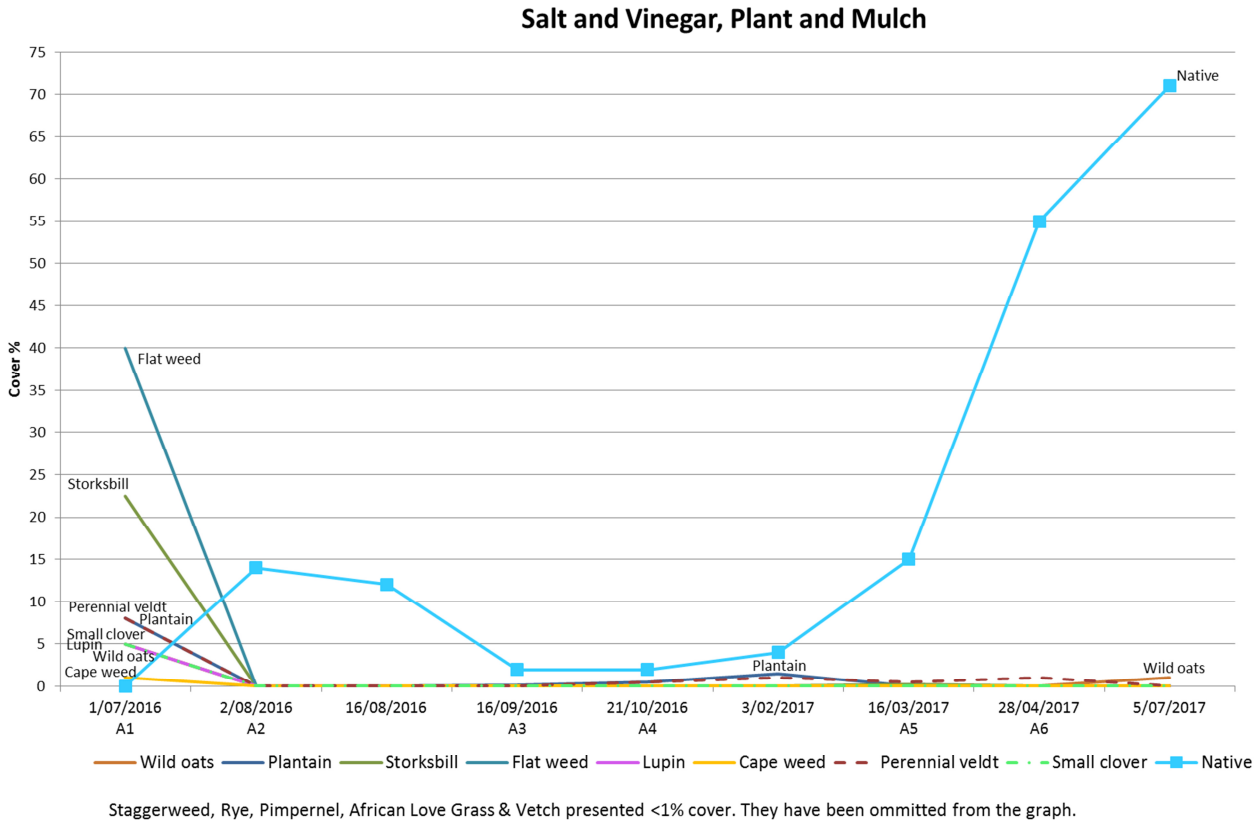
Photo 1: Effects of Salt and Vinegar on Wild oats (2 August 2016 – left, 16 August 2016 - right)

3.2.3 Salt and Vinegar, Plant and Mulch

Flat weed was the dominant weed in the Salt and Vinegar, Plant and Mulch sub-plot at the start of the trial measuring 40% cover, followed by Storksbill at 23% and Perennial veldt and Plantain at 8% each. Other weeds present were Small clover, Plantain and Wild oats at 5% cover each, and Cape weed at 1% (Figure 9). Following the first Salt and Vinegar application and application of mulch, all weeds measured 0% cover. By February 2017, Plantain cover had increased to 1.5% and Perennial veldt to 1%. By the end of the trial, Wild oats was the only weed present measuring 1% cover.

Native ground covers planted at the start of the trial increased to 14% cover by August 2016 before decreasing to and remaining at 2% as recorded in September and October 2016. From February 2017, native ground covers increased sharply, measuring 71% at the end of the trial.

For photo monitoring refer to Appendix 9.20.



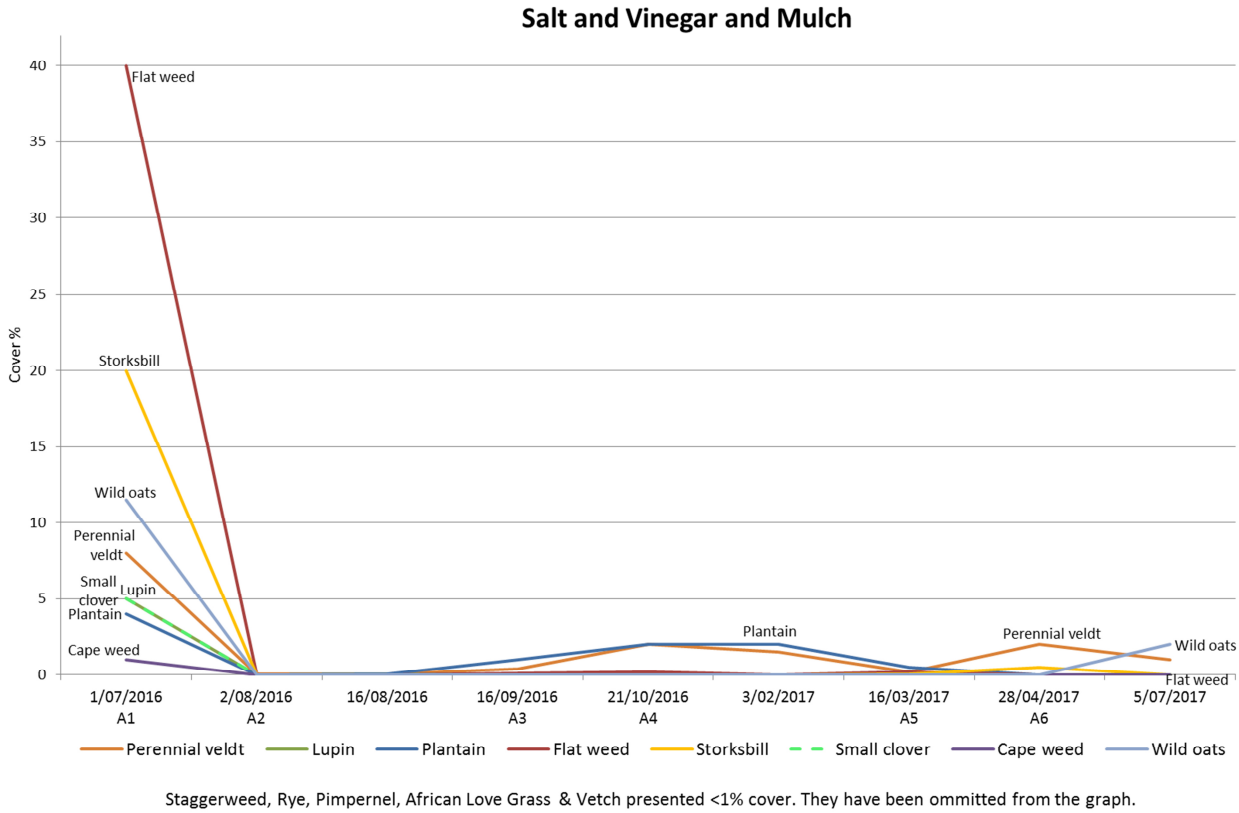
Staggerweed, Rye, Pimpernel, African Love Grass & Vetch presented <1% cover. They have been ommitted from the graph.

Figure 9. Percentage cover of weeds and native ground covers at Salt and Vinegar, Plant and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.2.4 Salt and Vinegar and Mulch

Before the first treatment application Flat weed was most abundant in the Salt and Vinegar and Mulch sub-plot measuring 40% cover (Figure 10). Storksbill was second with 20% cover, followed by Wild oats at 11%, Perennial veldt at 8%, Small clover and Lupin at 5% each, Plantain at 4% and Cape weed at 1%. Following the first application of Salt and Vinegar solution and mulch, all weeds measured 0% cover. Plantain and Perennial veldt had each increased to 2% cover by October 2016 monitoring. In March 2017, cover of Plantain and Perennial veldt had reduced to less than 1% and 0% respectively. Perennial veldt cover increased again by April 2017 to 2%. By the end of the trial, Wild oats cover had increased to 2% while Perennial veldt was measured at 1% cover.

For photo monitoring refer to Appendix 9.21.



Staggerweed, Rye, Pimpernel, African Love Grass & Vetch presented <1% cover. They have been ommitted from the graph.

Figure 10. Percentage cover of weeds at Salt and Vinegar and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.3 Pine Oil

3.3.1 Pine Oil Only

Perennial veldt and Wild oats were most abundant at Pine Oil Only sub-plot at the start of the trial with percentage cover of 15% each (Figure 11). Flatweed had 10% cover, Cape weed and Plantain 8% and Storksbill and Lupin 5% cover each. Large clover and Staggerweed were present at 2% and 1% cover respectively. Following the first application, all weeds except Cape weed and Storksbill decreased. Following the second and final Pine Oil application, all weeds decreased significantly with most presenting at 0% cover at the August 2016 monitoring, with the exceptions being Plantain at 2% and Storksbill, Cape weed and Perennial veldt at 1% each. Most weeds remained at 0% cover or had increased very slightly between August 2016 and March 2017. During this period, Wild oats, Plantain and Perennial veldt increased slightly to 7%, 4% and 3% respectively.

In March 2017, the only weeds present were Stink weed with 5% cover, Rye with 3% and Perennial veldt with 2% cover. The following month, Rye decreased to 0% cover while Stink weed increased to 15% before measuring 0% in July 2017. Perennial veldt and Plantain increased significantly at the end of the trial to 25% and 20% respectively. Flat weed and Wild oats increased slightly measuring 1% cover each in July 2017.

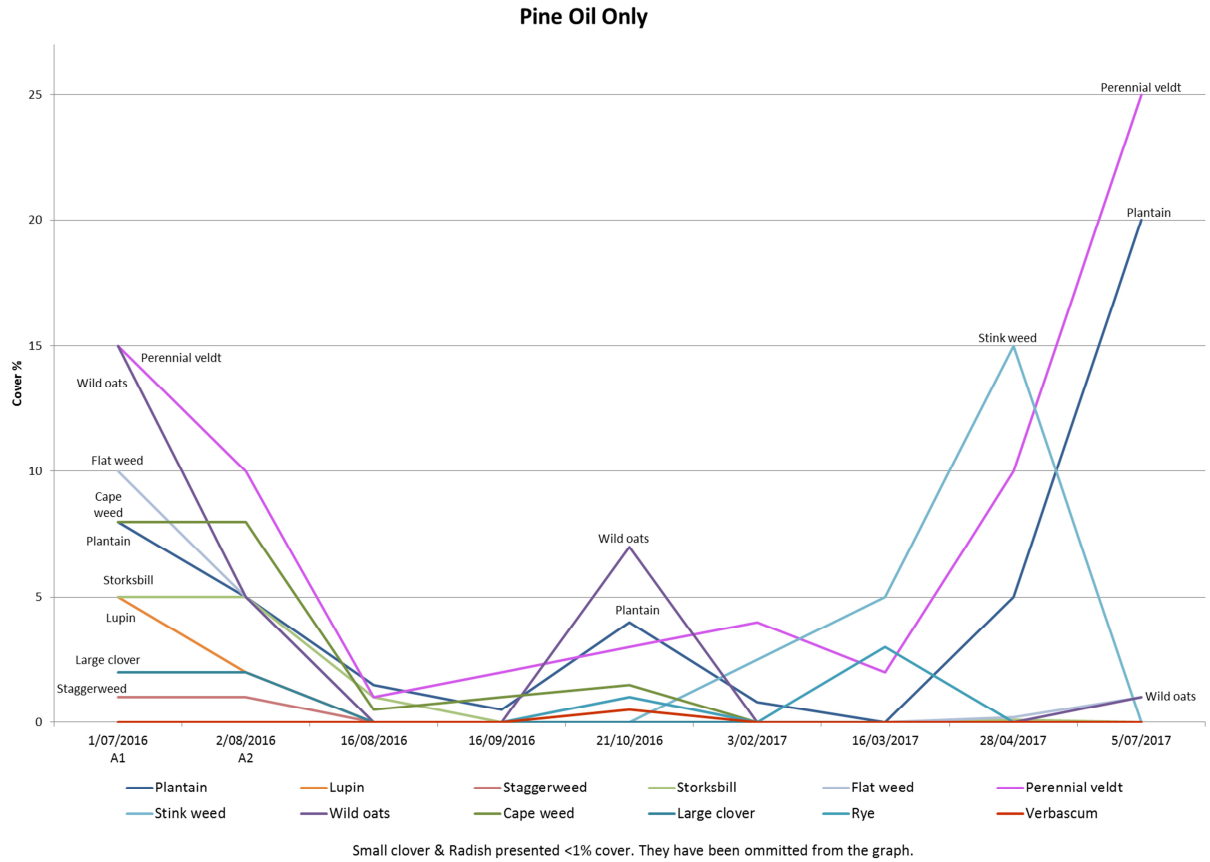


Figure 11. Percentage cover of weeds at Pine Oil Only sub-plot over the course of the trial (treatment applications represented using A1 and A2)

Photo 2 shows the Pine Oil Only sub-plot after the second and final application compared to the Pine Oil and Plant sub-plot after one application. Following this, the weeds in the Pine Oil and Plant sub-plot matured and set seed.

For photo monitoring refer to Appendix 9.14.

Photo 2: The Pine Oil Only sub-plot in the foreground and the Pine Oil and Plant sub-plot in the mid-ground

3.3.2 Pine Oil and Plant

Wild oats, Plantain and Flat weed were the most abundant weeds in the Pine Oil and Plant sub-plot at the start of the trial with percentage cover of 15%, 10% and 10% respectively (Figure 12). Storksbill and Cape weed measured 8% cover each followed by Perennial veldt at 7% and Lupin at 5%. Following both the first and final applications of Pine Oil, cover of most weeds were reduced. However Wild oats increased significantly, peaking at 40% cover in October 2016 before decreasing to 0% by February 2017. Wild oats cover at the last monitoring in July 2017 measured 1%. Plantain returned to the same level of cover as pre-treatment following the initial application and then plateaued at 10% between August and October 2016 before decreasing to 3% in March 2017. Plantain measured 5% cover at the end of the trial. Flat weed and Storksbill measured slight increases in August 2016 following the initial decrease after the Pine oil was applied. Cover of both Flat weed and Storksbill decreased to 0% cover by February 2017 before increasing to 5% towards the end of the trial.

The native ground covers increased to and remained at 5% between August and October 2016 before decreasing to 1% in February and March 2017. Cover remained 2% from April through to July 2017.

For photo monitoring refer to Appendix 9.15.

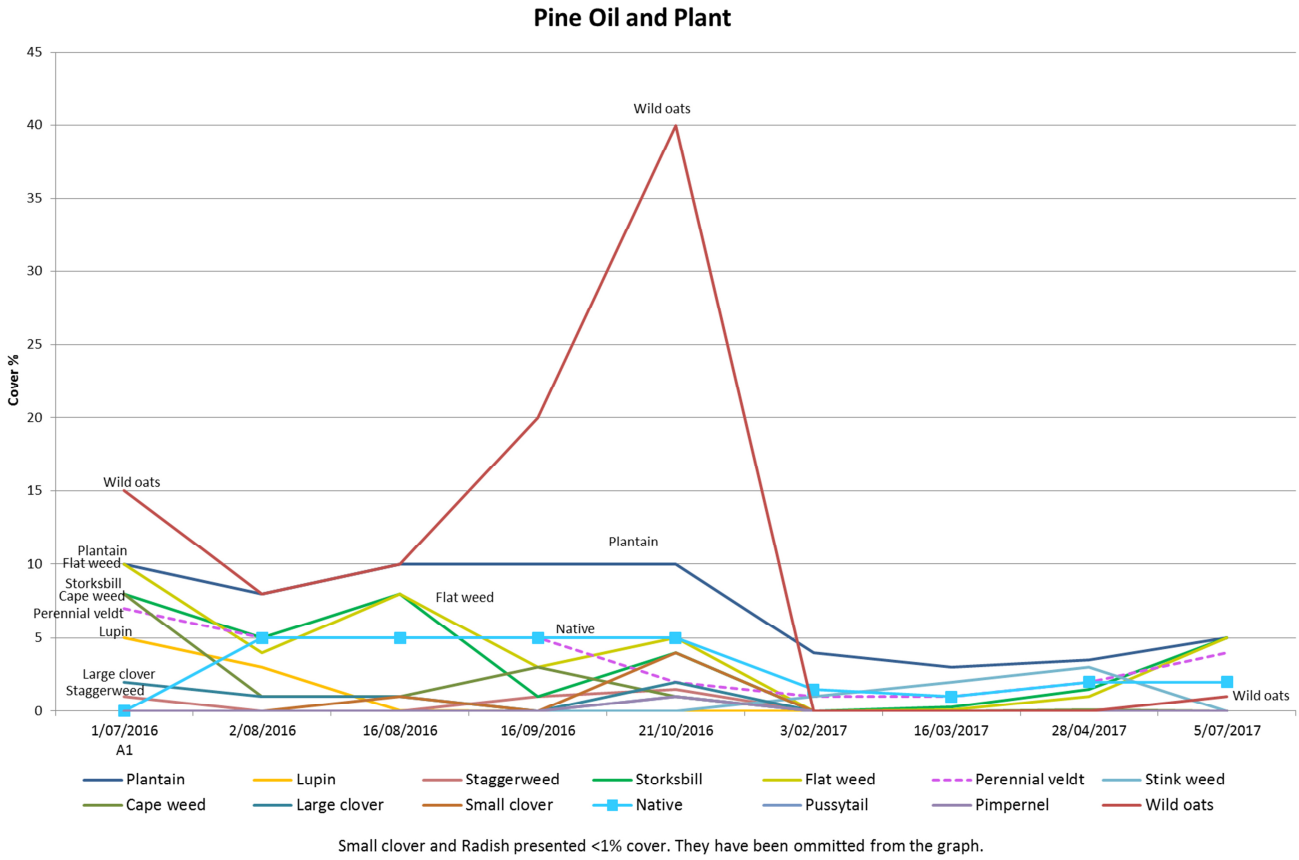


Figure 12. Percentage cover of weeds and native ground covers at Pine Oil and Plant sub-plot over the course of the trial (treatment application represented using A1)

3.3.3 Pine Oil, Plant and Mulch

Wild oats were the most abundant weed present at the start of the trial in the Pine Oil, Plant and Mulch sub-plot with 37% cover followed by Plantain, Flat weed and Cape weed with 15% each (Figure 13). Following the application of mulch and planting, all weeds with the exception of Plantain remained at less than 1% cover. Plantain cover was approximately 5% prior to hand weeding of plant wells in February 2017. Plantain cover had increased to 3% by the end of the trial. Wild oats cover was 2% and Cape weed 1% by the end of the trial.

Native ground covers increased to 5% in August 2016 and remained at this level until March 2017 when the cover increased sharply to 84% by the end of the trial.

For photo monitoring refer to Appendix 9.16.

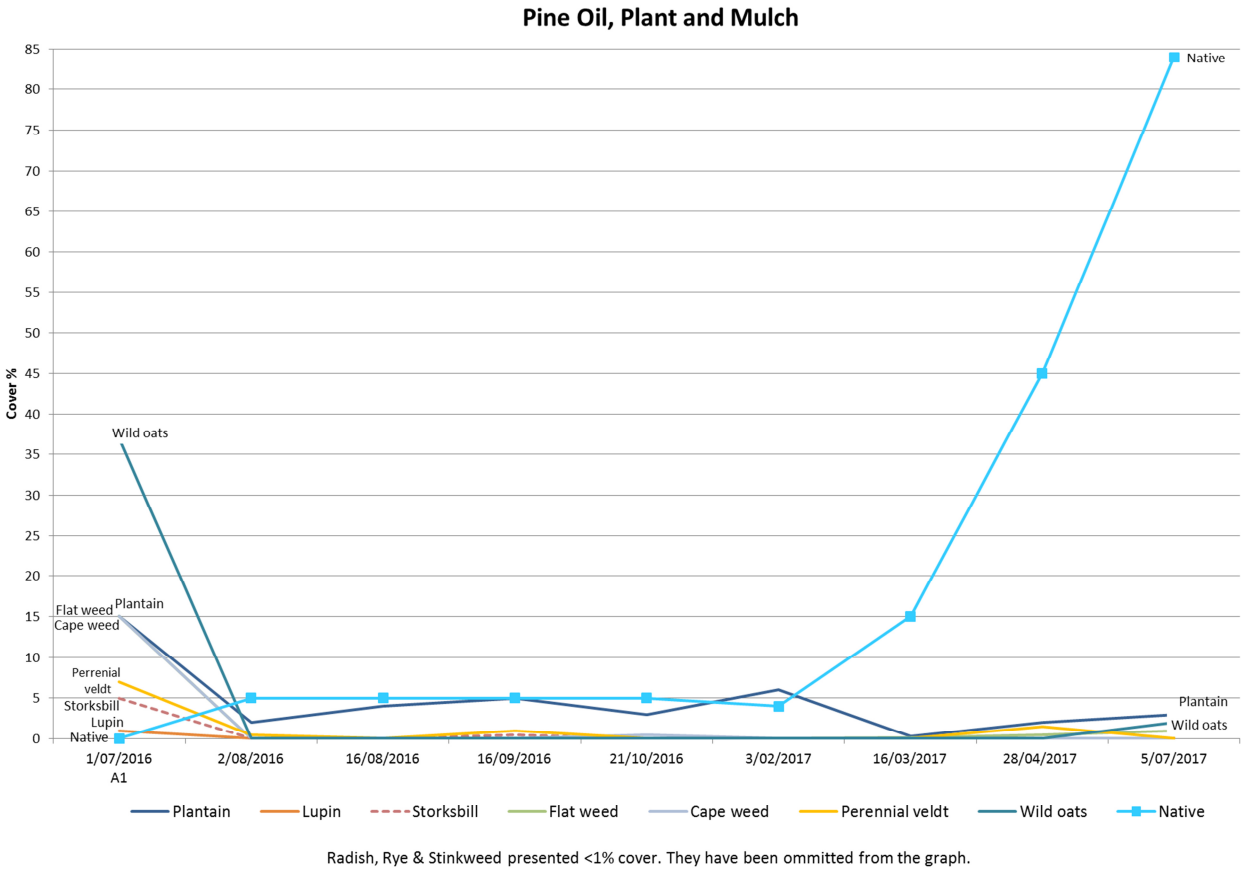
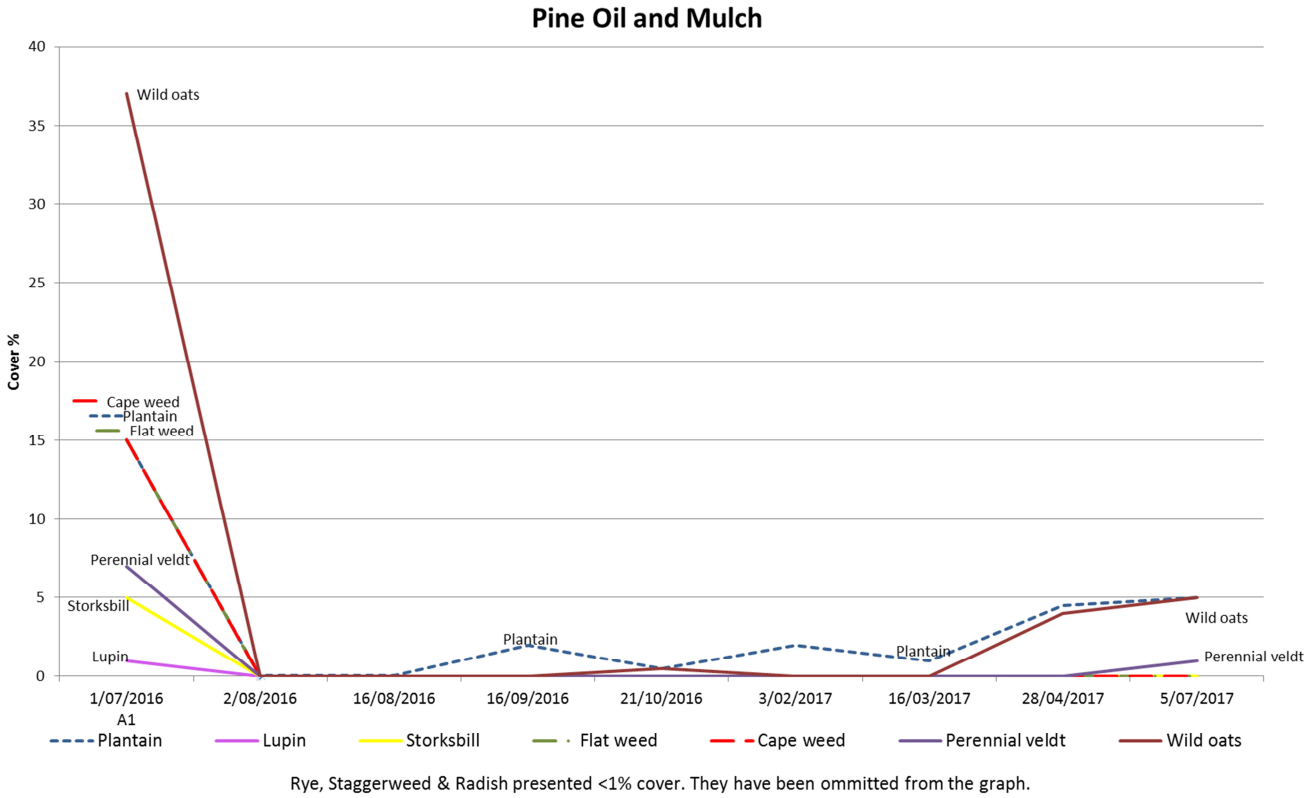


Figure 13. Percentage cover of weeds and native ground covers at Pine Oil, Plant and Mulch sub-plot over the course of the trial (treatment application represented using A1)

3.3.4 Pine Oil and Mulch

Pine Oil and Mulch sub-plot had the greatest cover of Wild oats (37%), followed by Cape weed, Plantain and Flat weed (15% each) at the start of the trial. Other weeds included Perennial veldt (7%), Storksbill (5%) and Lupin (1%) (Figure 14). Following the first and only application of Pine Oil and application of mulch in July 2016, cover of all weeds was recorded at 0% in August 2016. Plantain fluctuated between 1% and 2% before plateauing at 5% between April and July 2017. Wild oats was another weed that increased in cover to 5% by the end of the trial.

For photo monitoring refer to Appendix 9.17.



Rye, Staggerweed & Radish presented <1% cover. They have been ommitted from the graph.

Figure 14. Percentage cover of weeds at Pine Oil and Mulch sub-plot over the course of the trial (treatment application represented using A1)

3.4 Pelargonic Acid

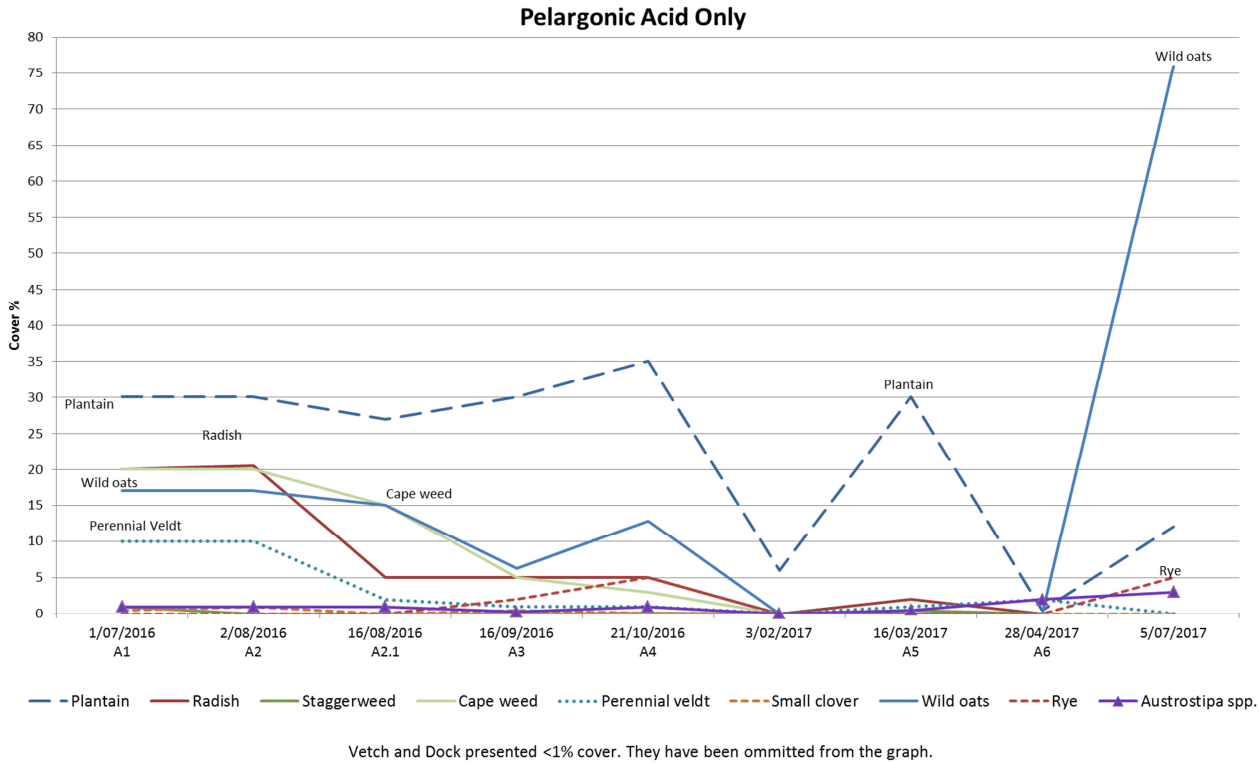
3.4.1 Pelargonic Acid Only

The weeds recorded at the Pelargonic Acid Only sub-plot prior to treatment were Plantain 30% cover, Cape weed 20%, Wild oats 20% and Perennial veldt 10% (Figure 15). These values remained the same between the first and second applications. The application rate was increased to 7% for the second application round. Following this, there was a minor decrease in Plantain, Cape weed and Wild oats cover. Radish and Perennial veldt had a more significant decrease from 20% to 5% and from 10% to 2% cover respectively. On 16 August 2016, the second application was repeated at 7% (marked as A2.1 in Figure 15).

It was thought the Pelargonic solution on 2 August 2016 was insufficiently applied. Subsequent to the additional application, Cape weed and Wild oats decreased from 15% to 5% and 15% to 6% cover respectively. Wild oats spiked in October 2017. 72 mL of precipitation was recorded in early October before this monitoring event and potentially influenced the increase in Wild oats.

Plantain increased between the February and March applications to 35% cover. The Plantain was removed (hand weeded) on 16 March 2017 shown by the steep decline in cover recorded on 28 April 2017. Wild oats had increased significantly by the end of the trial to 76% cover. There was 164.8 mL of rain recorded between the 28 April 2017 and 5 July 2017 monitoring visits (see Appendix 9.1).

For photo monitoring refer to Appendix 9.10.



Vetch and Dock presented <1% cover. They have been ommitted from the graph.

Figure 15. Percentage cover of weeds and native grasses at Pelargonic Acid sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

The effect of Pelargonic Acid on Cape weed and Wild oats are shown in Photo 3. Cape weed and Wild oats are flowering in the surrounding untreated areas suggesting the positive effect from the third and fourth Pelargonic Acid applications on these weeds. Unaffected Plantain is also prominent in both monitoring periods.

Photo 3: Pelargonic Only plot following A2.1 applications (16 September 2016, left) and following A3

3.4.2 Pelargonic Acid and Plant

Weed cover at the Pelargonic Acid and Plant sub-plot was recorded at 26% Plantain, 20% Radish, 20% Cape weed and 16% Wild oats (Figure 16) prior to treatment. There was no change in percentage cover following the first application on 1 July 2016, where Pelargonic Acid was applied at 5%. The second application of Pelargonic Acid on 2 August 2016 was applied at 7%, resulting in a slight decrease in weed cover of Plantain and Cape weed and an increase in Radish and Wild oats. A follow up application was carried out on 16 August 2016 using 7% Pelargonic Acid. Following subsequent applications, percentage cover of all four species decreased with an exception of Wild oats which increased to 30%. The fourth application reduced Wild oats to 0%. There were no Wild oats present at the time of sixth application however by the time of final monitoring Wild oats cover had increased to 76%. Of note, there was 164.8 mL of rain recorded between the 28 April 2017 and 5 July 2017 monitoring visits (see Appendix 9.1). The Plantain was removed (hand weeded) on 16 March 2017 as indicated by the steep decline in cover before the 28 April 2017 monitoring.

Perennial veldt cover was 5% at the start of the trial and remained constant until October 2016 where it increased to 7% before reducing to 1% after the fourth application. Between the fifth and sixth applications Perennial veldt cover returned to 5% and after the sixth application at the end of the trial was measured at 3%.

Native ground covers in Pelargonic Acid and Plant sub-plot were not planted at the same time as other sub-plots due to the follow-up/repeat application, as previously discussed. Native ground covers were planted on 31 August 2016, and were recorded at 4% cover on 16 September 2016. By the end of October 2016, cover of native plants had decreased to 1% and remained at 1% to the end of the trial.

For photo monitoring refer to Appendix 9.11.

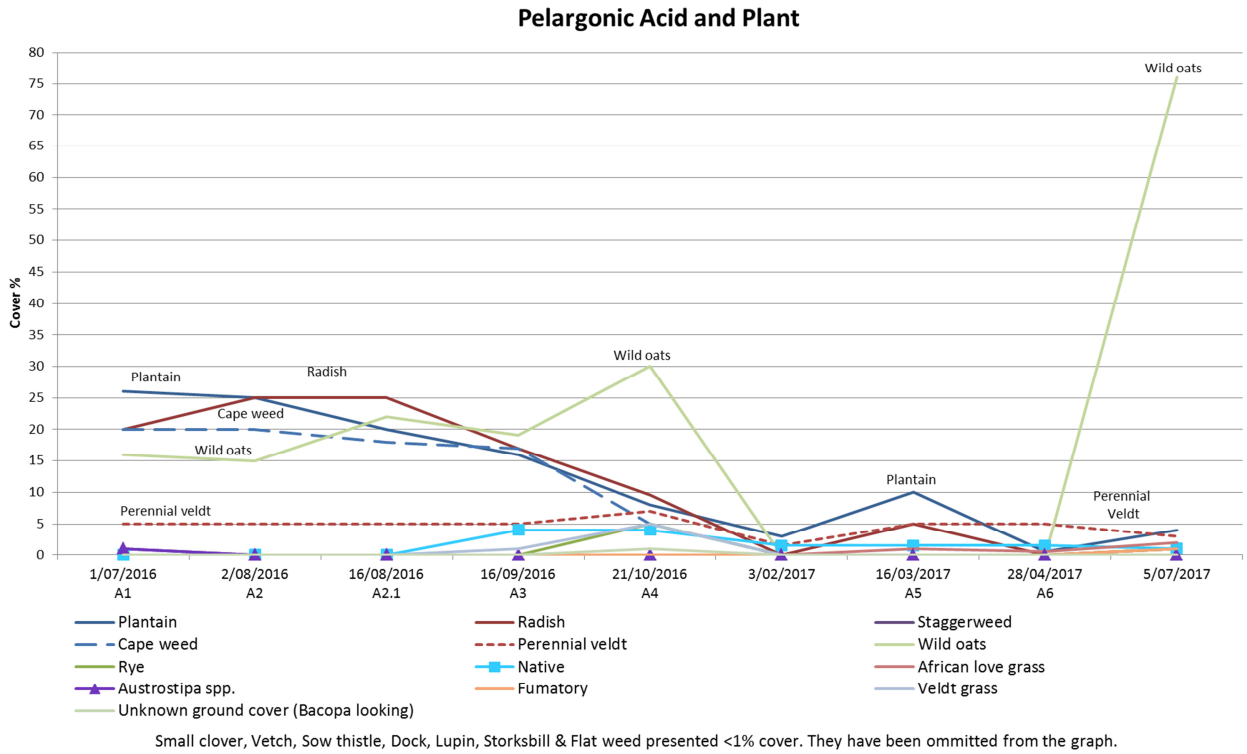
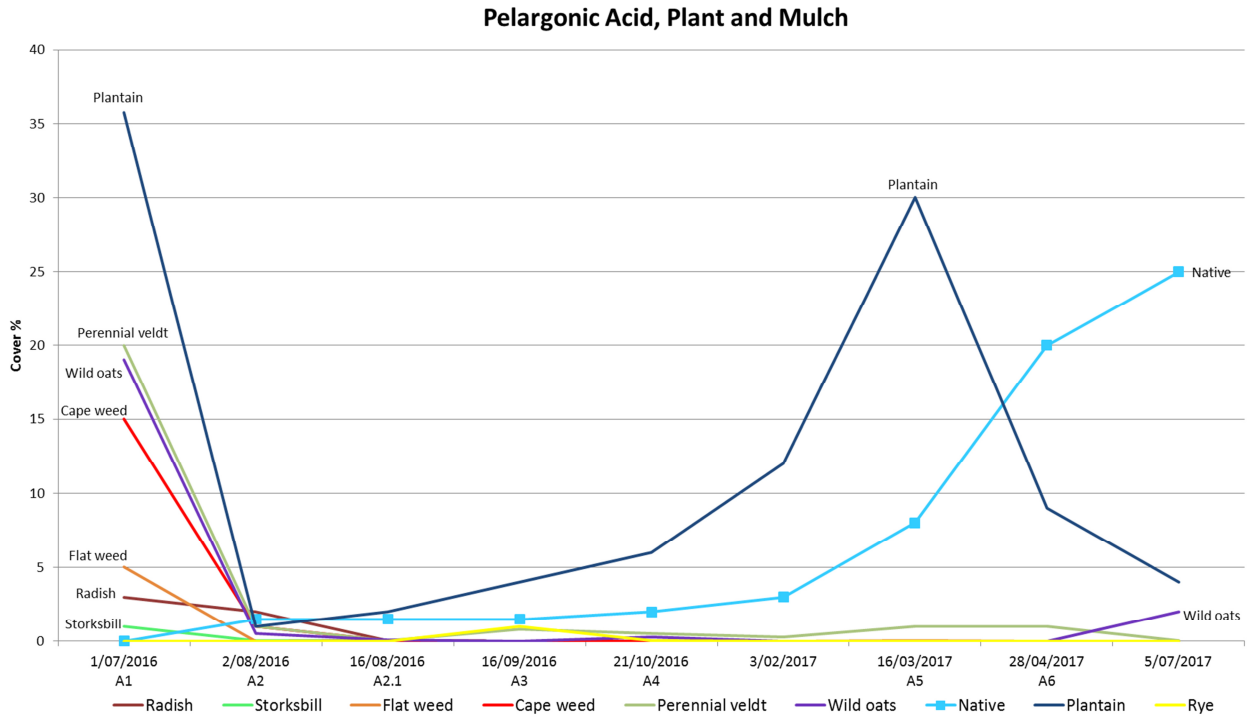


Figure 16. Percentage cover of weeds, native grasses and native ground covers at Pelargonic Acid and Plant sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.4.3 Pelargonic Acid, Plant and Mulch

Plantain was the most abundant weed present in the Pelargonic Acid, Plant and Mulch sub-plot at the start of the trial with 36% cover, followed by Perennial veldt 20%, Wild oats 19% and Cape weed 15% (Figure 17). Following the first application of Pelargonic Acid and mulch application, most weed cover was measured at 0%, however Radish was still present at 2% and Plantain, Cape weed and Perennial veldt at 1% each. Following the second application, Plantain continued to increase to 30% cover by March 2017. Hand weeding of Plantain was carried out after the monitoring was completed on 16 March 2017 before the fifth application. Following the hand removal of Plantain, the native ground covers increased significantly to 25% cover by the end of the trial in July 2017. During the last monitoring session, cover of Wild oats was recorded at 2%.

For photo monitoring refer to Appendix 9.12.



Lupin, Staggerweed, Verbascum, African love grass, Sow thistle & Fumitory presented <1% cover. They have been ommitted from the graph.

Figure 17. Percentage cover of weeds and native ground covers at Pelargonic Acid, Plant and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.4.4 Pelargonic Acid and Mulch

Prior to treatment, the Pelargonic Acid and Mulch sub-plot had greatest cover of Plantain and Wild oats at 30% and 20% respectively, followed by Cape weed and Radish at 10% and 8% respectively (Figure 18). Following the first application of Pelargonic Acid and application of mulch, most weed cover reduced to 0% with the exception of Radish which was recorded at 1% and Plantain and Perennial veldt at less than 1%. Most weeds remained at less than 1% cover throughout the trial with exception of Plantain and African lovegrass. Plantain continued to increase in cover to 12% by March 2017.

Hand weeding of Plantain was carried out after the monitoring was completed on 16 March 2017 before the fifth application. African lovegrass had increased to 2% cover by February 2017, then fluctuated between 2% and 3% cover to the end of the trial. Wild oats percentage cover increased slightly to 2% by the end of the trial.

For photo monitoring refer to Appendix 9.13.

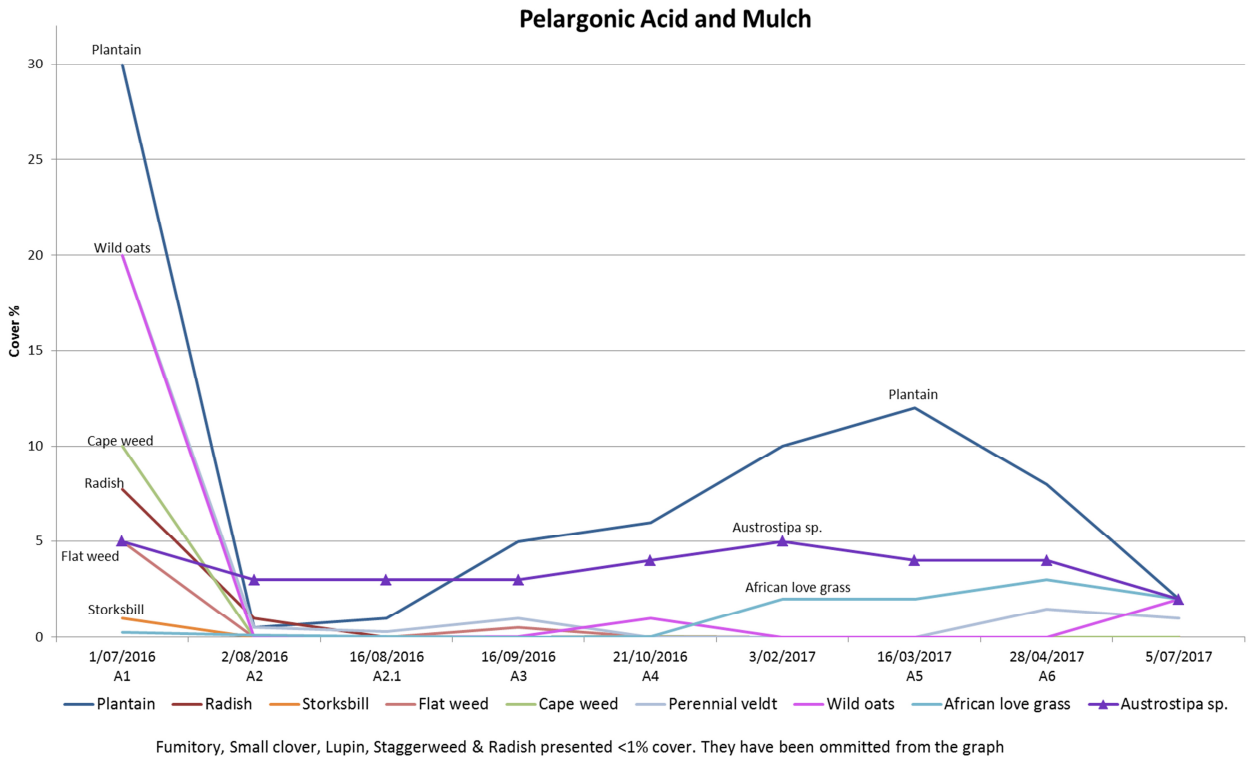


Figure 18. Percentage cover of weeds and native grasses at Pelargonic Acid and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.5 Steam

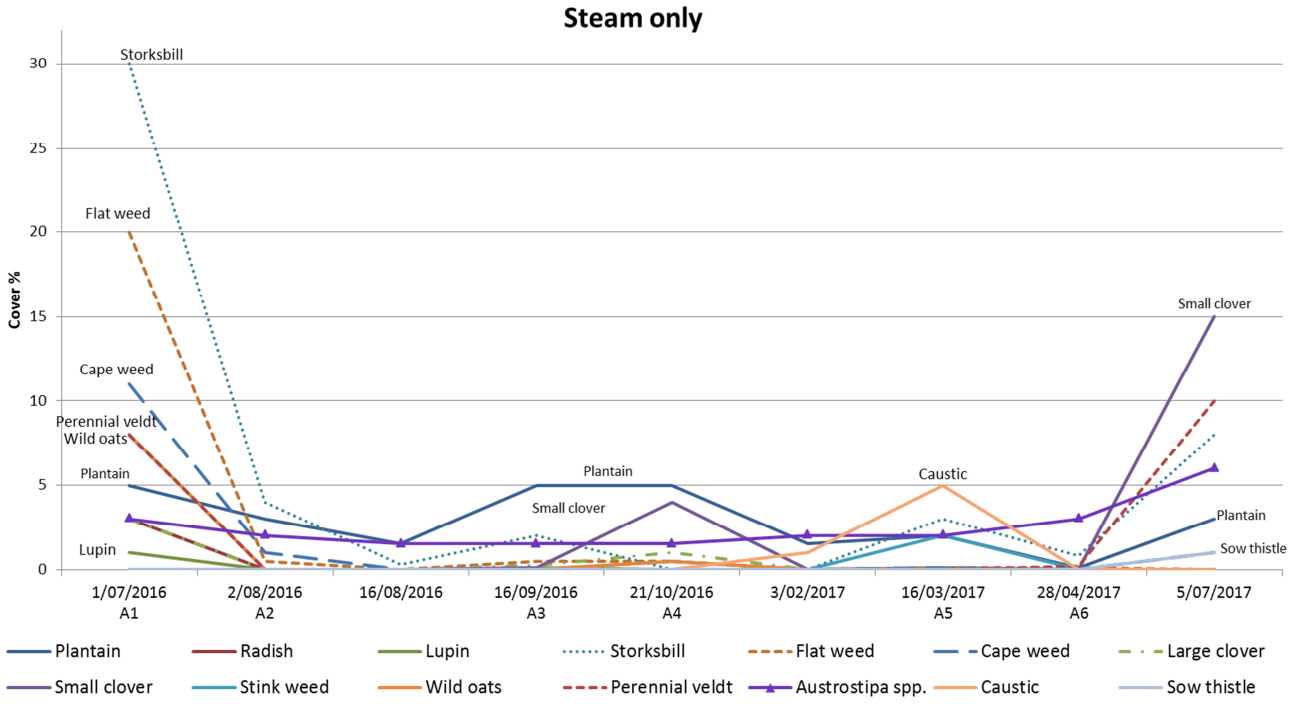
3.5.1 Steam Only

Before the treatment was applied to the Steam Only sub-plot, Storksbill had the highest cover at 30%, followed by Flat weed at 20% and Cape weed at 11% (Figure 19). Weeds with cover between 5% and 10% were Perennial veldt, Small clover, Wild oats and Plantain, with other weeds present with cover less than 5%, were Radish, Lupin and Large clover. Native grasses were also present at 3% cover.

The first Steam application reduced all weeds except Plantain and Storksbill to less than 1% cover, with the exception of native grasses which were avoided in the treatment process. Plantain was reduced to 1% by mid-August after the second application, however it increased to 5% between the second and third application. Following the fourth application, Plantain decreased to 1% cover reducing further to 0% by April 2017, then by July 2017 had increased to 3% cover.

Small clover increased to 4% by October 2016 then reduced to 0% after the third treatment; by July 2017 it had increased to 15% cover. Native grasses cover increased over the course of the trial with 6% recorded at the last monitoring event. Perennial veldt increased to 10% by the end of the trial from 0% cover after the first Steam application.

For photo monitoring refer to Appendix 9.6.



Wireweed, Fluellen, Fumitory, Cape Tulip, Verbascum, Rye & Staggerweed presented <1% cover. They have been ommitted from the graph.

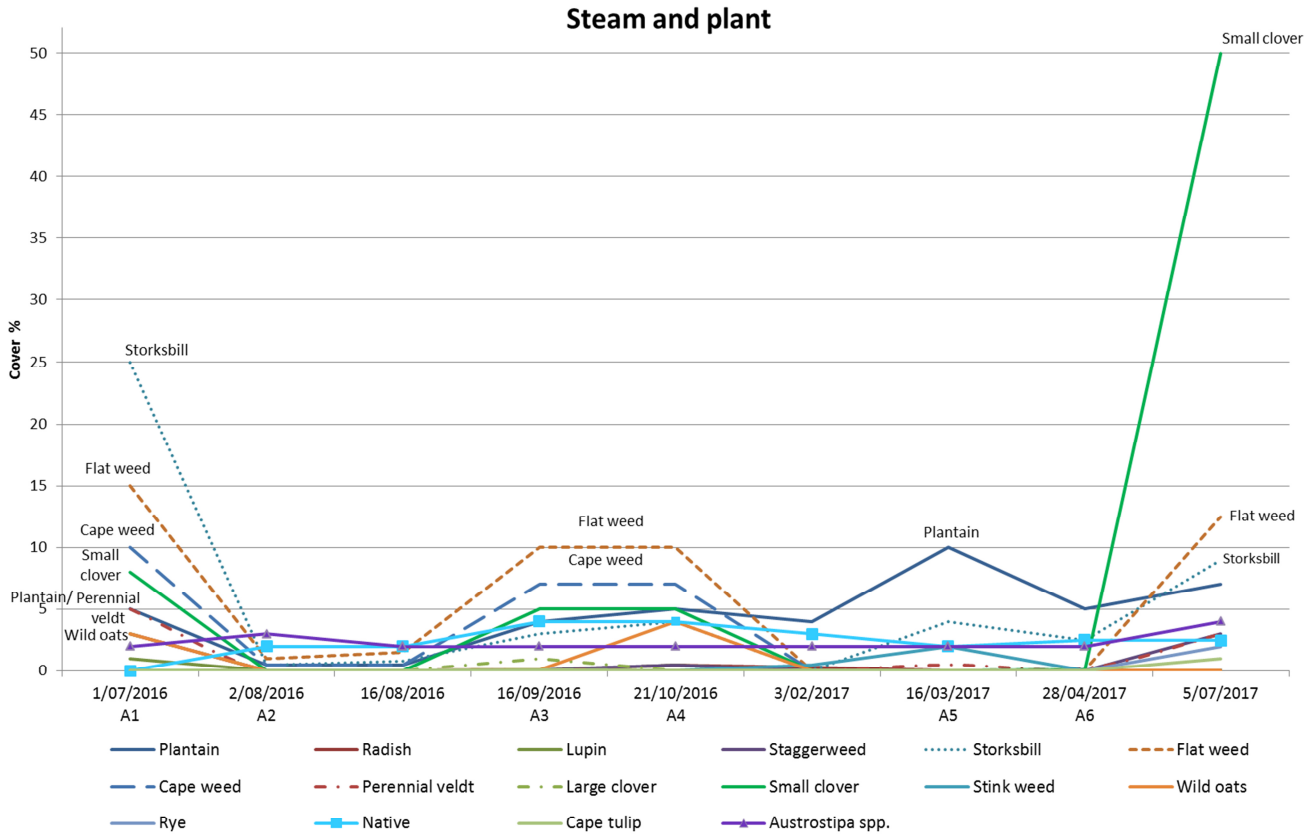
Figure 19. Percentage cover of weeds and native grasses at Steam Only sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.5.2 Steam and Plant

High variability was observed in the Steam and Plant sub-plot with Storksbill and Flat weed having the greatest percentage cover at 25% and 15% respectively (Figure 20). Cape weed and Small clover followed at 10% and 8% respectively. One month after the first application, all weeds were measured at 0% cover with Flat weed, Cape weed and Small clover returning to 10%, 7% and 5% cover respectively by September 2016. Storksbill also returned, however only to 4% cover compared to 25% before the first application. Plantain cover increased to 5% by October 2016 and did not show significant decrease following the October application. Plantain continued to increase to 10% cover in March 2017 before decreasing to 7% by the end of the trial.

Native ground covers planted at the start of the trial increased to 4% by September 2016 before decreasing to 2% by March 2017. Flatweed, Storksbill and Plantain cover increased again by the end of the trial, being 2% higher than the same time in the previous year. Storksbill cover was significantly reduced from 25% at the start of the trial to 9% at the end of the trial.

For photo monitoring refer to Appendix 9.7.



Wire Weed, Veldt Grass , Verbascum, Caustic & Fluellen presented <1% cover. They have been ommitted from the graph.

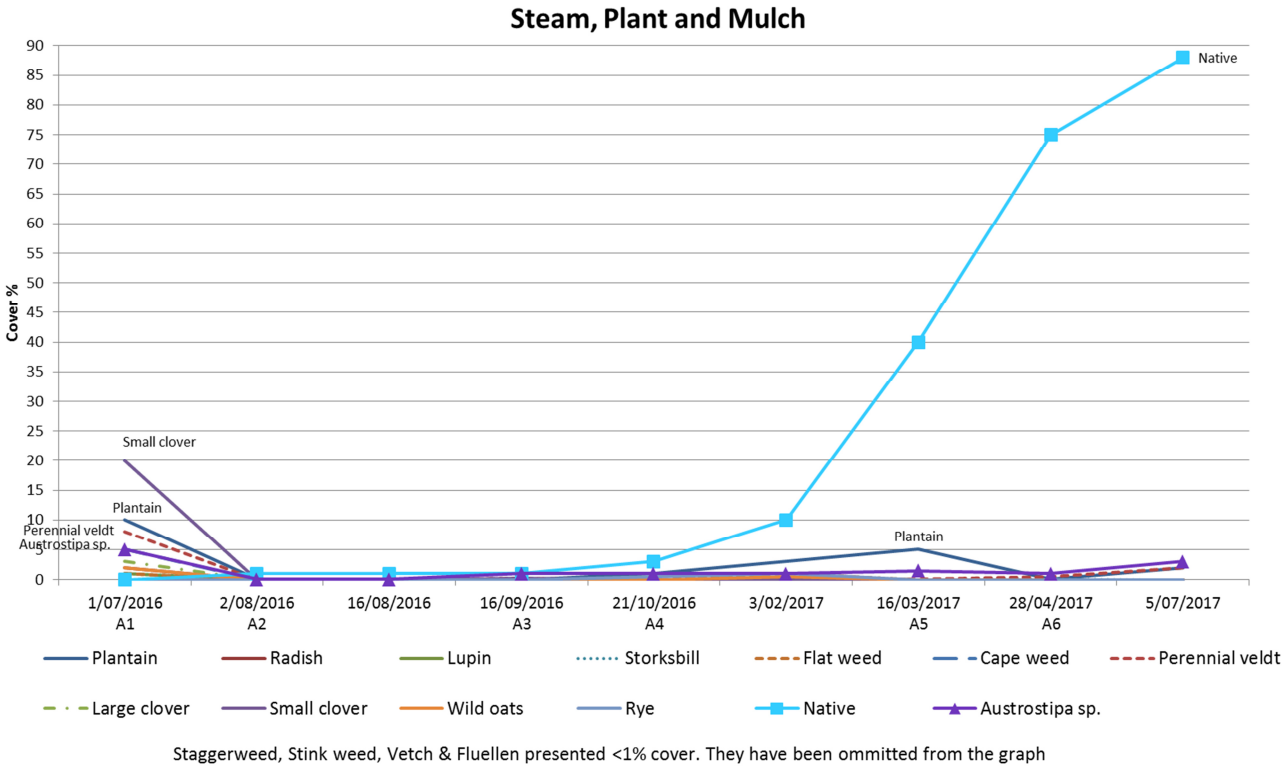
Figure 20. Percentage cover of weeds, native grasses and native ground covers at Steam and Plant sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.5.3 Steam, Plant and Mulch

Steam, Plant and Mulch sub-plot shown in Figure 21 shows a sharp increase in percentage cover to the end of the trial for the native ground covers planted.

Small clover and Plantain were the most abundant at the start of the trial with 20% and 10% cover respectively, with Perennial veldt cover of 8%. Following the first Steam application in July 2016 and with the application of mulch and planting of native ground covers, percentage cover of all the weeds present reduced to 0% and remained there until September 2016 when Small clover, Perennial veldt and Storksbill were measured at less than 1%. Flatweed and Rye increased slightly to 1% and Wild oats to less than 1%. Plantain had increased to 5% by March 2017 then decreased to 0% by April 2017 following a fifth application of Steam and hand weeding in the plant wells.

For photo monitoring refer to Appendix 9.8.



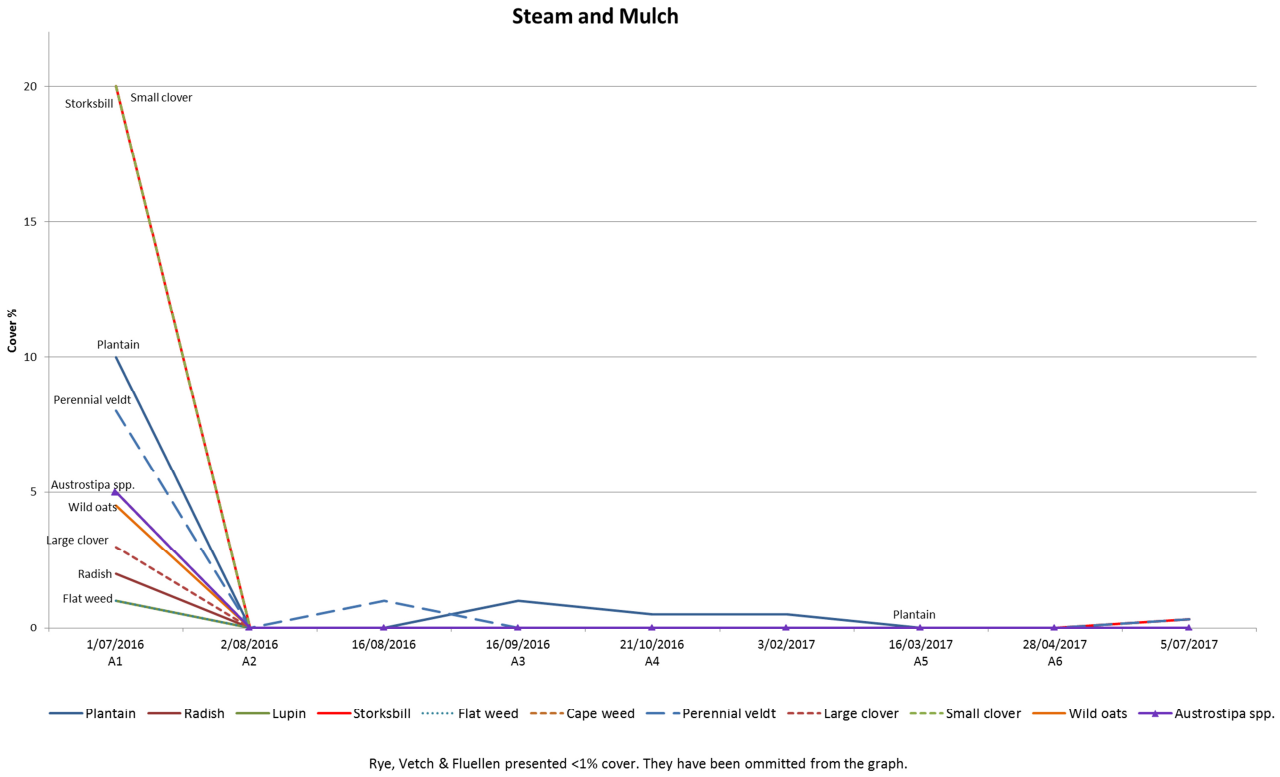
Staggerweed, Stink weed, Vetch & Fluellen presented <1% cover. They have been ommitted from the graph

Figure 21. Percentage cover of weeds, native grasses and native ground covers at Steam, Plant and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

3.5.4 Steam and Mulch

Steam and Mulch sub-plot (Figure 22) had Storksbill and Small clover as the most abundant weeds at the start of the trial with 20% cover each. Plantain was at 10% cover and Perennial veldt at 8%. Following the first Steam application and after the mulch was applied in August, all weeds were recorded at 0%. Fourteen days after the second application of Steam, Perennial veldt was recorded at 1% cover. However, after the third application it reduced to 0% cover where it remained until the end of the trial. Plantain was recorded at 1% cover in September 2017 then remained at less than 1% until March 2017. One month after the last application, Plantain and Perennial veldt were the only weeds present at less than 1% cover each.

For photo monitoring refer to Appendix 9.9.



Rye, Vetch & Fluellen presented <1% cover. They have been ommitted from the graph.

Figure 22. Percentage cover of weeds and native grasses at Steam and Mulch sub-plot over the course of the trial (six treatment applications represented using A1, A2, A3…)

4 Analysis of Results

Variability of growth and abundance of plant and weed species is expected in natural systems due to seasonal and environmental factors. Therefore the results shown in the table below should be used as a general guide only.

It should also be noted that the results obtained from the trial are unique to the environmental conditions present at the trial site. This should be taken into account when comparing the results of this report with other sites with differing environmental factors.

Weed species and abundance varied across the length of the trial. There was a small presence of native grasses and bare areas in sub-plots which could have influenced the results.

The effectiveness of the treatments has been averaged over the course of the trial and is shown in Table 3 . The baseline monitoring results were excluded from the averages.

The analysis shows that Mulch either by itself or in combination with a treatment and competitive planting has proven to be very effective in maintaining average weed cover.

The effectiveness of competitive planting is illustrated in Table 4. It shows weed versus native ground cover percentage over a one year period. Steam, Mulch and Plant sub-plot had the highest percentage cover of native ground covers (88%), followed by Pine Oil, Mulch and Plant with 84% native ground cover at the end of the trial.

Table 3. Effectiveness of all treatment trials presented as average weed percentage cover of all weeds over the course of the trial

	Control Only	Control & Plants	Control Mulch & Plants	Control & Mulch	Steam Only	Steam & Plants	Steam Mulch & Plant	Steam & Mulch	Pelargonic Only	Pelargonic & Plant	Pelargonic, Mulch & Plant	Pelargonic & Mulch	Pine Oil Only	Pine Oil & Plant	Pine Oil, Mulch & Plant	Pine Oil & Mulch	S & V Only	S & V & Plant	S & V, Mulch & Plant	S & V Mulch
Average % weed cover	67	59	5	2	11	24	2	1	51	56	10	8	20	30	4	3	13	11	1	2
Best sub-plot per treatment	Control & Mulch				Steam & Mulch				Pelargonic & Mulch				Pine Oil & Mulch				S & V, Mulch & Plant			

Note: The baseline monitoring round was excluded from these averages. Averages were taken from the results of the 2 August 2016 monitoring round until the 5 July 2017 monitoring round.

Table 4. Percentage cover totals of weeds and native plants as at 5/7/2017

	Control Only	Control & Plants	Control Mulch & Plants	Control & Mulch	Steam Only	Steam & Plants	Steam Mulch & Plant	Steam & Mulch	Pelargonic Only	Pelargonic & Plant	Pelargonic, Mulch & Plant	Pelargonic & Mulch	Pine Oil Only	Pine Oil & Plant	Pine Oil, Mulch & Plant	Pine Oil & Mulch	S & V Only	S & V & Plant	S & V, Mulch & Plant	S & V Mulch
Weed % cover	90	91	14	4	38	38	4	1	93	88	6	7	47	20	6	11	6	12	1	3
Native ground cover %	-	1	4	-	-	2	88	-	-	1	25	-		2	84	-	-	2	71	-
Best sub-plot per treatment	Control & Mulch				Steam & Mulch				Pelargonic, Mulch & Plant				Pine Oil, Mulch & Plant				S & V Mulch & Plant			

Note: Native grasses totals were excluded from the totals shown in the table as these were pre-existing not planted and do not reflect the results of the competitive planting of native ground covers trial.

5 Discussion

5.1 Mulch

Mulch has proven to be very effective at supressing weeds. As shown in Figure 6 (the Control and Mulch Only sub-plot), weeds have been maintained less than 5% over the course of the trial. Radish, Lupin, Staggerweed, Flat weed, Cape weed and Small clover were all effectively suppressed by mulch.

There were some mature Plantain, Perennial veldt and Storksbill weeds that did emerge through the mulch during the trial; however the coverage of these species did not exceed 2% at any stage of the trial. When the mulch was applied to the larger weeds, the mulch may not have provided complete coverage giving the weed access to sunlight and space thereby enabling it to emerge through the mulch. Additionally, the root systems of these weeds have stored energy available to be able to emerge through the mulch.

The results of the trial suggest that using mulch on its own to manage weeds is just as effective as using mulch in conjunction with other treatment options. As shown in Table 3 the Control and Mulch sub-plot maintained an average of 2% weed coverage throughout the trial. The most successful treatment and mulch sub-plot was the Steam and Mulch sub-plot with 1% average weed coverage.

Further studies would need to be conducted to validate the effectiveness of mulch alone and mulch in conjunction with another treatment as a weed suppressor. Baseline monitoring at the site identified variabilities in weed species and coverage across the length of the trial site. This should be taken into account when reviewing the mulch effectiveness results in this trial.

5.2 Competitive Planting

Best performing plot

The results of the trial suggest that competitive planting with native ground covers used as a treatment on its own or with mulch is mostly ineffective. The effectiveness substantially increased when planting was used in conjunction with mulch and another treatment.

This result was consistent across all of the plots with plants and mulch except for the Control and Steam plots. It has been observed that digging the holes to plant the ground covers in the Control and mulch plot exposed the weeds allowing them to grow through the mulch. The mulch did not have sufficient time to smother the weeds before the sub-plot was planted. If there was a longer period of time between mulching and planting, it is believed that the Control, Mulch and Plant plot would have been more effective at managing weeds than the Control and Mulch plot.

The success of the Steam, Mulch and Plant plot was also inconsistent with the other results. When applying Steam, it was a challenge to treat the weeds without the hot water flowing into the plant wells and impacting the native plants. Therefore, applying Steam in both of the planted plots was limited in order to protect the ground covers. As such, the Steam and Mulch plot received a better result for weed cover over the Steam, Mulch and Plant plot.

Challenges

Managing weeds amongst the planted plots was difficult because of the density of native ground covers planted. Avoiding contact with native plants when applying a treatment was a challenge requiring a more careful application technique. Particularly challenging was applying the Pelargonic Acid and Salt and Vinegar treatments as they required a liberal application to be effective. As a consequence, some of the native plants were impacted by drift spray. Steam treatment sent hot water flowing into the plant wells which also impacted the plants.

Observations

The health of the native plants increased with the addition of mulch, which was most likely due to the moisture retention qualities of mulch and the suppression of weeds that would otherwise compete with the plants for nutrients and moisture.

The health of native ground covers significantly decreased in plots where there were patches of bare soil exposed to the hot drying sun. Consequently, many plants died in these plots. In the Control plot it appeared that the dead Wild oats provided shelter from the sun and some protection from rabbits when compared to adjoining plots where native plants were more exposed to the elements and not growing as vigorously.

By the end of the trial, the native plants in the mulched plots were more established providing more amenity, low weed cover and some habitat values.

5.3 Salt and Vinegar

Salt and Vinegar was very effective at managing Staggerweed, Storksbill, Flat weed, Cape weed, Small clover and Lupin. Following two treatments these weeds were maintained at 1% or less than 1% throughout the trial.

There were notable differences in the levels of Wild oats weed cover following each treatment. This is most likely attributed to differences in the application technique together with increased weed vigour and germination rates in the active growth season. A number of spray operators applied the Salt and Vinegar over the course of the trial, therefore the amounts of solution and coverage of weeds per treatment may not have been consistent resulting in a steep decline in Wild oats following the 2 August 2016 application and the negligible impact following the 16 September 2016 application.

The frequency of applications may have been insufficient in the active growing season for Wild oats allowing the more mature plants to regenerate post-treatment. Of note, there was rain in early October 2016 that may have germinated dormant Wild oats seeds.

It is unclear if Plantain was effectively managed using the Salt and Vinegar treatment. The cover was reduced from 2% to less than 1% over the course of the trial, however it is not certain if the Plantain was regrowth from treated weeds or new seedlings. Regardless, the photos suggest treatment was successful in preventing the original plants from flowering or setting seed.

5.4 Pine Oil

Pine Oil is very effective at managing Lupin, Staggerweed, Flat weed, Large clover, Wild oats and Storksbill. After two applications these weeds were reduced to 1% or less. Maintaining the weed cover at this level was however compromised by the product's restriction to two

applications per year. As a consequence, new Wild oats and Stink weed seedlings as well as re-sprouting Perennial veldt and Plantain populated the sub-plot.

The two applications of Pine Oil did have an effect on Perennial veldt and Plantain but with the lack of a follow up treatment, the plants were able to regenerate and establish a larger presence by the end of the trial.

It does not seem that the addition of mulch or competitive planting assisted in maintaining the initial Pine Oil treatment over and above what mulch alone achieved. This outcome may have differed if the two initial Pine Oil applications were applied before the mulch and competitive planting.

Pine Oil can only be applied with a boom spray unit. This prevented a follow up application to the competitive planting plots. Subsequently, most of the weeds were able to regenerate in the Pine Oil and Plant plot compared to the decline in weed cover after the follow up treatment in the Pine Oil Only plot.

Pine Oil has a strong smell that lingers post-treatment.

5.5 Pelargonic Acid

Results from the trial suggest that Pelargonic Acid treatment was most effective for controlling Wild oats, Perennial veldt and Cape weed. Two careful applications and one quick application using variable dilution rates were used to gain desired results. More investigation is required to establish the treatment regime required to achieve the desired result. The trial has indicated that the 7% solution is more effective than a 5% solution. This treatment method was shown to be effective at managing Wild oats, Perennial veldt and Cape weed.

The large spike in Wild oats recorded at the last monitoring round is believed to be a result of the rainfall experienced between the April and July 2017 visits causing new seedlings to germinate. Additional applications during this time most likely would have reduced the Wild oats coverage recorded at the July 2017 monitoring round.

Mature Radish was significantly reduced using Pelargonic Acid as shown between the July 2016 to September 2016 application rounds. There was some Radish that produced flower and set seed but it is unclear if this was incorrectly treated or if it was regrowth post-treatment.

Pelargonic Acid was ineffective at managing Plantain due to the stored energy in the tap root allowing it to regenerate post-spray. There was some visible leaf die-off of Plantain leaves immediately after a Pelargonic acid treatment was applied, but the plants quickly regenerated. After five unsuccessful treatments, it was decided that Plantain was preventing other results from being obtained so the Plantain was removed (hand weeded) from all four sub-plots where Pelargonic acid was being trialled.

After two applications of Pelargonic Acid, Radish seedlings decreased from 2% to less than 1% in the Pelargonic Only sub-plot during its active growing season. This result was also observed in the Pelargonic and Plant plot with a reduction from 5% reduction to less than 1%.

Variable results were achieved using this treatment; this was attributed to different spray operator techniques when applying Pelargonic Acid to the weeds. The best results were achieved when a more liberal and careful application was given to the plants allowing the physical mode of action (breakdown of cellular structure) to have an effect on the whole plant so it could not regenerate. Ensuring a good coverage of the spray is important when using this method.

5.6 Steam

The results of the trial suggest that Steam is an effective management technique for Radish, Lupin, Perennial veldt, Clover, Wild oats, Stink weed and Caustic weed. Just one Steam treatment was required to manage these weeds successfully and prevent seed set. Steam did have a significant impact upon Storksbill, Flat weed and Cape weed after two treatments. Storksbill did register a slight increase at the September 2016 monitoring visit and it is assumed that some of the weed was missed by the operator during in the second treatment.

The spike in Clover and Caustic weed cover were from new germinates taking advantage of the bare ground in the sub-plots. The spike occurred in the active season for these species.

Steam was not as effective in managing mature Plantain. Plantain has stored energy in the tap root that allowed the plants to re-sprout post treatment. Smaller seedlings were treated successfully.

6 Recommendations

It is recommended that weed managers use this report as a guide only when incorporating alternative weed management treatments into a weed strategy or regime. Each site has its own specific environmental conditions; therefore the treatments applied in this trial may not provide the same results in different environmental conditions.

Before a trial of a new weed management technique is commenced, it is recommended to first clearly outline the reasoning, objectives, expectations and Presentation Standards to be applied and to communicate this with all levels of management and on-ground staff. It is also recommended to keep the community informed throughout the process to ensure transparency and therefore gain trust and support.

It is of note that the treatment, process, resources and expected outcomes (both negative and positive) of alternative techniques may differ from traditional methods.

It is important to establish what the Presentation Standards are for each site, as these may be higher or lower than the standards that have been normalised over time. For example, an area that is often in the public eye may have a Presentation Standard of no more than 5% weed cover but a verge on a busy road or in a bushland reserve may have a Presentation Standard of no more than 20% weed cover.

Ensuring that the application methodology and recommendations of the product being trialled is well known by management and on-ground staff is vital for a successful trial. Only trial a product on the type of weeds that the product recommends will work. Avoid trying to use Pine Oil on a mature woody weed, for example. Alternative weed management methods often require a more thorough application than traditional chemicals. Misapplication can mean that only partial die off is observed which can lead to unsatisfactory results early on in a trial.

It is recommended to maintain a close relationship with operators applying the treatments. This will help ensure there is consistency in the application technique and appropriate feedback is provided on any challenges or obstacles that may be able to be overcome. This is important when transitioning to new methods that are different from traditional techniques.

If the above factors have been taken into account and communicated well, a balanced trial will result which will assist with determining if an alternative method is appropriate for the site.

6.1 Mulch

Using mulch alone is very effective at managing weeds. The trial demonstrated that mulch alone is almost as effective as using mulch with another treatment. More investigation is required to confirm this result; however this study has shown a positive result for mulch as a solo treatment over an annual cycle.

Where mulch alone is less effective is on the more persistent weeds such as Perennial veldt and Plantain. This may be overcome if pre-treatments are applied to these weeds before mulch is spread. Some weeds were re-establishing after the mulch had been present for an annual cycle. Annual top-ups of mulch could combat this in the lead up to the season when the most germination occurs at the site being managed.

Lessons learnt from the trial are that mulch should be applied early before the planting season to allow time for the mulch to smother the existing weeds; applying additional treatments to existing weeds before applying mulch will deter persistent weeds from pushing through the mulch; and lastly more work is required to determine the optimum amount of ground covers per metre to allow for follow up weed control while still achieving the competitive coverage of plants.

6.2 Competitive Planting

Competitive planting is effective at managing weeds when used in conjunction with mulch and another treatment. Although negligible, there will be some weeds that persist using this method. Due to the density of plantings required, follow-up weed control may be more difficult. If the Presentation Standard permits some weed coverage, this method is recommended. This method is favourable when aesthetic and habitat values are to be considered in conjunction with weed control.

6.3 Salt and Vinegar

Salt and Vinegar has proven to be very effective at managing Staggerweed, Storksbill, Flat weed, Cape weed, Small clover and Lupin.

It is recommended to increase the frequency of applications during the active growing season of the target weed species. This will increase its success rate, prevent re-growth and control any new seedlings. To achieve optimum results, it is vital to coat all parts of the plant with the solution. More attention to detail is required when applying this spray when compared to traditional methods. More investigation is required to determine the minimum applications required in the active growth period to achieve desired results.

The successful result of the treatment on Plantain was surprising; more investigation is needed to confirm if Salt and Vinegar can manage this persistent weed within acceptable levels.

6.4 Pine Oil

Pine Oil has been shown to be very effective after two applications. Lupin, Staggerweed, Flat weed, Large clover, Wild oats and Storksbill were specifically impacted by the Pine Oil treatment. The product's restriction of two applications per year did impact the maintenance of the initial results. To combat this, another treatment could be utilised in conjunction with Pine oil to maintain the Presentation Standards achieved by the initial two Pine oil applications.

The product used in this trial required it to be applied with a boom-spray. With this product it is best used in large areas where a boom-spray can manoeuvre around existing vegetation. It is recommended not to use Pine Oil in highly trafficked areas as it has a strong persistent odour that may be an irritant to some people.

Other Pine Oil products are available that can be applied using a knapsack and less restrictions on the number of treatments applied. More investigation will be required to determine the efficacy of this method.

6.5 Pelargonic Acid

Pelargonic Acid has been shown to be effective at managing Wild oats, Perennial veldt and Cape weed. Young Radish seedlings were also reduced using Pelargonic Acid. It is unclear the minimum number of applications required to achieve these results, however the 7% application rate has shown to be the most effective.

To achieve the best results, it is vital that the solution covers all above ground parts of the weed during application. This will give the active ingredient the best opportunity to break down the weed cellular structure and therefore reduce the likelihood of the plant re-sprouting. It is important to ensure that operators are consistent with the application as this technique is different to traditional methods. It is also recommended to have discussions with the product's manufacturer before and while undertaking a trial.

More applications during the active growth period of target weeds will help to reduce regrowth of treated weeds.

It is not recommended to use Pelargonic Acid on mature plants with large underground energy storage systems, such as Plantain.

6.6 Steam

Steam has been shown to be effective at managing most weeds with the exception of mature weeds with a large underground storage system that have the ability to regrow post-treatment. For this reason it is not recommended to treat Plantain with Steam unless they are young seedlings.

It is recommended to use Steam to manage Radish, Lupin, Perennial veldt, Clover, Wild oats, Stink weed, Caustic weed, Storksbill, Flat weed and Cape weed. For this method to be effective, it is recommended to undertake more regular follow-up treatments in late winter and spring during the active growth season. This will ensure any regrowth from weeds such as Storksbill and Cape weed is managed and any new seedlings are treated.

7 Conclusion

The trial has successfully shown the effectiveness of a number of alternative weed management treatments, both alone and in combination with other treatments, at a specific site and highlighted some of their advantages and disadvantages. The results of the report can be utilised by weed managers as a guide for future trials and to implement non-traditional methods.

Mulch has been shown to be very effective at managing weeds with minimal resource requirements. Competitive planting in conjunction with mulch and follow-up treatment is effective at managing weeds and has the added benefits of improved aesthetics and enhanced habitat values. Steam is also effective at managing most weeds with the exception of mature weeds or weeds with large underground energy storage systems. Pelargonic Acid has been shown to be effective on some weeds if the appropriate follow-up is undertaken. Pine Oil also has the ability to manage some weeds however the product's restriction to two applications per year in the same area did reduce the effectiveness of this treatment. Salt and Vinegar is effective at managing weeds if all parts of the plant are covered with the solution and follow-up applications are completed.

It is recommended that this report is used as a guide only when incorporating alternative weed management treatments into a weed strategy or regime. Each site has its own specific environmental conditions; therefore the treatments applied in this trial may not provide the same results in different environmental conditions. The findings of this report are a reflection of the specific environmental conditions at the Railway Heritage Trail in Mount Helena.

8 References

Bureau of Meteorology, Commonwealth of Australia, Daily Rainfall Mount Helena, Retrieved 17 November 2017, from: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dailyDataFile&p_nccObsCode=136&p_stn_num=009202&p_c=-17117122&p_startYear=2017

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9 Appendices

9.1 Precipitation

	2016								2017						
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1st	0	0	0	3.4	1.6	7.2	0	0	0	16.6	0	0	0	0	7.2
2nd	0	0	0	0	0	8.6	0	0	0	0	6.2	0	0	0	39.4
3rd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4th	0	10.4	0.2	2.8	0	4.2	0	1.4	0	0	0	0	0	0	3
5th	0	0	0	0.6	0	0	0	0	0	0	0	0	8	0	3
6th	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	12
7th	18	13.6	0	15.4	10.6	0.2	0	0	0	9	0	0	0	0	11.2
8th	2	0	15	20	12	19.6	0	0	0	0	0	0	0	0	0.2
9th	0	0	18	12		16.8	0	0	0	10.4	0	0	1.4	0	0
10th	0	0.6	28	2.8	0	0	0	0	0	64.2	0	0	0	0	0
11th	0	0.6	0.4	3	0	0	1.4	0	0	23.6	0	0	0	0	0
12th	0	0	0	0	0	0	0	9.4	0.4	0.2	0	0	0	0	10
13th	0	21.4	0	0	0	0	0	3.4	0	1.2	13	0	0	0	9.2
14th	5.2	0	0	0	0	0.8	0	0	0	7	2	0	0	8.4	0
15th	0.2	0.6	0	0	0	8.2	0	0	0	0	2.2	0	4.8	0	0
16th	0	0	0	7	5.2	1	0	0	0	0	0	0	8.2	0	11.4
17th	0	0	38.8	1.4	0	0	13	0	0	0	0	0	0	0	0
18th	0.4	0	10.2	33	0	0	0	0	0	0	0	0	0	0	0
19th	0	0	0	0	14	0	0	0	0	0	0	0	3.4	0	7
20th	0	2.6	0	7.8	0	5.4	0	0	0	0	0	0	5.8	0	25.4
21st	36.8	3.2	21.4	1	0	0	0	0	0	1.6	0	0	29.4	0	3.8
22nd	26.1	1.2	9.4	3.6	0	0	0	0	0	0	5.2	0	7	23.2	10
23rd	1	2.4	0	0	8.2	0	0	0	0	0	1.6	0	3.4	8.2	2
24th	20	0.2	0.4	0	1	0	0	0	0	0	0	0	3	0	9.4
25th	0.8	2.4	0.2	0	3.8	0	0	0	0	0	0	0	1	0	4.4
26th	5.6	6.2	0	0	0	0	0	0	0	0	1.6	0	0	0	0.4
27th	0.4	0.2	0	34	2.4	0	0	0.6	0	0	0	0	0	0	7.6
28th	4.6	0.2	0	7.8	13	0	0	0.2	0	0	0	0	0	0	13.6
29th	0.4	10.8	0	0	0	2.2	0	0	0.6		0	0	0	0	13.4
30th	0	0.2	3.6	0	0	1.4	0	0	11.6		0	0	0	0	12
31st	0		11.8	6.2		0		0	48.2		0		0		0
Highest Daily	36.8	21.4	38.8	34	14	19.6	13	9.4	48.2	64.2	13	0	29.4	23.2	39.4
Monthly Total	121.5	76.8	157.4	162.4		75.6	14.4	15	60.8	133.8	31.8	0	75.4	39.8	215.6

Source: Commonwealth of Australia, Bureau of Meteorology