SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

FEATHERSTON COMMUNITY BOARD

Agenda

NOTICE OF MEETING

An ordinary meeting will be held in Kiwi Hall, 62 Bell Street, Featherston on Tuesday, 27 April 2021 starting at 7:00pm.

MEMBERSHIP OF THE COMMUNITY BOARD

Mark Shepherd (Chair), Claire Bleakley, Sophronia Smith, Jayson Tahinurua, Councillor Garrick Emms, Councillor Ross Vickery and youth representatives Ana Souto and Isla Richardson.

PUBLIC BUSINESS

1. EXTRAORDINARY BUSINESS:

2. APOLOGIES:

3. CONFLICTS OF INTEREST:

4. ACKNOWLEDGMENTS AND TRIBUTES:

5. PUBLIC PARTICPATION:

5.1 None advised

6. ACTIONS FROM PUBLIC PARTICIPATION:

As per standing order 14.17 no debate or decisions will be made at the meeting on issues raised during the forum unless related to items already on the agenda.

7. COMMUNITY BOARD MINUTES:

7.1 Minutes for Approval: Featherston Community Board Minutes of 23 February 2021. **Pages 1-5**

***Proposed Resolution**: That the minutes of the Featherston Community Board meetings held on 23 February 2021 be confirmed as a true and correct record.*

8. CHIEF EXECUTIVE AND STAFF REPORTS:

8.1 Officers Report **Pages 6-50**

Siv Fjaerestad to present on the role of the SWDC Community Development Coordinator

8.2 Action Items Report **Pages 51-54**

8.3 Income and Expenditure Report **Pages 55-61**

8.4 Financial Assistance Report **Pages 62-66**

9. NOTICES OF MOTION:

9.1 Claire Bleakley: Alternatives to Glyphosate Based Herbicides **Pages 67-106**

10. CHAIRPERSON'S REPORT:

10.1 Chairperson Report **Pages 107-109**

11. MEMBER REPORTS (INFORMATION):

11.1 Claire Bleakley: Local Democracy **Page 110**

12. CORRESPONDENCE:

12.1 None advised

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

Featherston Community Board

Minutes – 23 February 2021

Present:	Mark Shepherd (Chair), Claire Bleakley, Jayson Tahinurua, Councillor Garrick Emms (to 8.39pm) and youth representatives Ana Souto and Isla Richardson.
In Attendance:	Mayor Alex Beijen (to 8.35pm), Russell O'Leary (Group Manager Planning and Environment) and Steph Dorne (Committee Advisor).
Conduct of Business:	The meeting was conducted in public in Kiwi Hall, 62 Bell Street, Featherston between 7:02pm and 8.58pm.
Also in Attendance:	Perry Cameron and Mike Gray.

1. EXTRAORDINARY BUSINESS

There was no extraordinary business.

2. APOLOGIES

FCB RESOLVED (FCB 2021/01) to receive apologies from Sophronia Smith.

(Moved Shepherd/Seconded Bleakley) Carried

3. CONFLICTS OF INTEREST

There were no conflicts of interest declared.

4. ACKNOWLEDGMENTS AND TRIBUTES

Mr Shepherd paid tribute to Godwell Mahowa, a SWDC staff member, who had recently passed away.

5. PUBLIC PARTICIPATION

5.1 Perry Cameron – Submission to NZTA regarding speed limits and a heavy traffic bypass

Mr Cameron informed members of a submission he made to NZTA advocating for a common speed limit through the Wairarapa towns connected by State Highway 2 and a heavy traffic bypass for Featherston's Main Street. Mr Cameron requested the Board support these proposals or an alternative solution to reduce heavy traffic through Featherston.

5.2 Mike Gray – Community Board Futures

Mr Gray spoke of the recommendations pertaining to community boards from the report 'Serving New Zealand?' - a 2018 survey conducted by Callum and David Hammond. Mr Gray expressed the view that it is important that community boards be familiar with the recommendations

of the report and be able to respond to questions on the role of community boards in local democracy and the opportunities for the future role of community boards in case of a local government restructure.

6. ACTIONS FROM PUBLIC PARTICIPATION

FCB NOTED:

Action 21: Hold a Featherston Community Board workshop with Mike Gray to discuss the role of and opportunities for the future role of community boards, FCB.

7. COMMUNITY BOARD MINUTES

7.1 Featherston Community Board Minutes – 15 December 2020

FCB RESOLVED (FCB 2021/02) that the minutes of the Featherston Community Board meeting held on 15 December 2020 be confirmed as a true and correct record subject to the correction of the minutes to record Claire Bleakley's vote against the motion under item 8.9 to adopt an eight-weekly cycle of meetings for the Featherston Community Board.

(Moved Tahinurua /Seconded Bleakley) Carried

8. CHIEF EXECUTIVE AND STAFF REPORTS

8.1 Officers' Report

Mr O'Leary responded to questions on the Featherston Tiny Homes/Brookside recourse consent in relation to the number of dwellings permitted. Members discussed dwelling density in respect to pressures on infrastructure and Mr O'Leary advised of growth planning considerations.

FCB RESOLVED (FCB 2021/03) to receive the Officers' Report.

(Moved Bleakley/Seconded Shepherd) Carried

8.2 Action Items Report

Members reviewed the actions items and Mr Shepherd updated members on progress made with the 'Welcome to Featherston' sign as outlined in the Chairperson Report.

FCB RESOLVED (FCB 2021/04) to receive the Action Items Report.

(Moved Shepherd/Seconded Tahinurua) Carried

8.3 Income and Expenditure Report

Members discussed the printing of flag designs for FlagTrax. There were some issues with printing to required specifications that were being worked through.

FCB RESOLVED (FCB 2021/05) to:

1. Receive the Income and Expenditure Statement for the period 1 July 2020 – 31 January 2021.

   (Moved Tahinurua/Seconded Bleakley) Carried

2. Approve an additional $92.39, in addition to the $600 already approved, for the Featherston Christmas Parade Traffic Safety Plan.

   (Moved Cr Emms/Seconded Shepherd) Carried

8.4 Financial Assistance Report

FCB RESOLVED (FCB 2021/06):

1. To receive the Financial Assistance Report.

   (Moved Shepherd/Seconded Tahinurua) Carried

2. To approve funding Wairarapa Gateway Business Group $480 for the cost of webhosting for the Featherston community website.

   (Moved Bleakley/Seconded Tahinurua) Carried

3. To approve funding Featherston Information Centre $400 for running expenses of the Centre on the condition that the Centre discusses with the Board its future funding plans beyond the six-month period covered by this grant.

   (Moved Cr Emms/Seconded Bleakley) Carried

4. To decline funding Greytown Junior Football Club $500 to contribute to the costs of football goals due to the limited involvement of the Featherston community.

   (Moved Bleakley/Seconded Tahinurua) Carried

8.5 Financial Assistance Accountability Report

FCB RESOLVED (FCB 2021/07) to receive the Financial Assistance Accountability Report.

(Moved Tahinurua/Seconded Bleakley) Carried

8.6 Community Boards Conference 2021 Report

Mr Shepherd advised that Council conference funding was at capacity and attendance would need to be funded from the Community Board budget. The Board elected to send one delegate and as members present had either been before or recently attended training members undertook to confirm if Sophronia Smith would like to attend. Alternatively one of the youth representatives would be offered the opportunity.

FCB RESOLVED (FCB 2021/08):

1. To receive the Community Boards Conference 2021 Report.

   (Moved Shepherd/Seconded Tahinurua) Carried

2. To agree to fund one community board member to attend the 2021 Community Boards Conference with an associated commitment of up to $2,155, to be funded from the operating budget.

   (Moved Bleakley/Seconded Shepherd) Carried

9. NOTICES OF MOTION

There were no notices of motion.

10. CHAIRPERSONS REPORT

10.1 Chairperson Report

Mr Shepherd updated members on discussions had surrounding the feasibility and cost of WiFi and security cameras along Fitzherbert Street. Members discussed costs, number of cameras, privacy considerations,

access and monitoring. Further discussions were needed with involved parties if it were to go ahead.

Members discussed the safety of the proposed wind break blinds, the potential to reuse the blinds in an alternative location should the land not remain vacant in the future, and costs of alternative designs.

FCB RESOLVED (FCB 2021/09):

1. To receive the Chairperson Report.

   (Moved Tahinurua/Seconded Bleakley) Carried

2. To agree to contribute up to $2,225, funded from the Beautification Fund, towards the cost of manufacturing roll down blinds for the Featherston Town Square.

   (Moved Shepherd/Seconded Tahinurua) Carried

   Claire Bleakley abstained

11. MEMBER REPORTS (INFORMATION)

11.1 Member Report

Mrs Bleakley requested early planning of the traffic management plan for the next Christmas parade and members discussed seeking a generic plan for future years.

Mrs Bleakley updated members of a meeting she attended to discuss effective local democracy and a workshop would be held.

Members discussed performance of Wellington Water Ltd and impacts associated with the quarry activity occurring as permitted under the Greater Wellington Regional Council resource consent.

Mayor Beijen left the meeting at 8.35pm.

Councillor Emms left the meeting at 8.39pm.

Members discussed putting their concerns surrounding the Quarry consent in writing and wanted to work with officers to address these. Mr O'Leary advised of the process for reviewing consents through judicial review.

Mrs Bleakley requested the Board accept the offer to meet with Bruce Hore to discuss the potential use of a recently approved herbicide. Members agreed and Mrs Bleakley undertook to make arrangements.

*FCB RESOLVED (FCB 2021/10) t*o receive the Member Report.

(Moved Shepherd/Seconded Tahinurua) Carried

12. CORRESPONDENCE

There was no correspondence.

The meeting closed at 8.58pm.

Confirmed as a true and correct record

……..Chairperson

……..Date

FEATHERSTON COMMUNITY BOARD

27 APRIL 2021

AGENDA ITEM 8.1

OFFICERS' REPORT

Purpose of Report

To report to the board on general activities.

Recommendations

Officers recommend that the Community Board:

1. Receive the Officers' Report.

PLANNING AND ENVIRONMENT GROUP REPORT

This report was presented to the Planning and Regulatory Committee on 17 March 2021.

1. Resource Management

1.1 Planning Summary

1.1.1. Planning

Planning receives around 200 resource consent applications a year, and normally has around 13-20 consents to assess and decide on. Consenting sits beside plan enquiries, land use compliance, growing policy work. Good, timely decision making has continued.

1.1.2. South Wairarapa Spatial Plan

The Spatial Plan is using an integrated Spatial/Long-Term Plan approach. Initial engagement, community/stakeholder sessions saw a wide mix of views captured. A matrix assessment of possible growth options for the towns was done along with site visits and workshops on town growth options. Refinement of the recommended options/compilation of a Spatial Plan Consultation Document was done in early March. To be consulted on during April.

1.1.3. Martinborough Southeast Growth Area (MSGA)

Assessment report on stormwater issues by Wellington Water was completed after Feb. 2020. From discussion at Council including work for Spatial Plan, and due to awareness of extent/costs of stormwater constraints, and mitigation, the MSGA now

on hold, including phase 2 stormwater modelling. To consider alongside Spatial Plan growth work.

1.2 District Plan Review

WCDP operative in 2011, requires review every 10 years, a plan review takes around 2 to 3 years. Boffa Miskell confirmed as the consultant. DP Review Committee and advisory group mtgs held, considering the extent, review needs of each DP chapter, plus proposed RMA reforms. The Randerson report proposes replacement of RMA by a new Regional Spatial Plan Act, new Natural Resources Act. DP review will be a mix of full review of key chapters, targeted review for some, and minor review. DP Review will be across 2021-2023 and allowing for sorting any appeals in 2024.

1.3 Dark Sky

The draft Wairarapa International Dark Sky-Outdoor Artificial Lighting Plan Change has gone through public notification. Got 10 submissions, then 2 further submissions. Wairarapa Sports Artificial Surface Trust and Genesis Energy Ltd wished to be heard. Negotiating points, may avoid a hearing, commissioner will determine this Council initiated plan change.

1.4 Review of Notable Trees Register

Hearing held in Greytown November 2020. The independent commissioner's decision was adopted, was an appeal on the listing of one Oak tree. Discussion/correspondence was undertaken by staff, and resource consent granted, the appeal has been withdrawn. Seeking final advice via commissioner for actioning the plan change.

1.5 Featherston Tiny Homes/Brookside RC

Number of units lowered from 120 to approx. 100 dwellings. Required further information on urban design aspects re intensity, info. was supplied, the application was to be publicly notified. However, the applicant has advised Council to hold the application, is now pursuing a more standard density.

1.6 Orchard Road Subdivision

A resource consent was granted to resolve an outstanding abatement notice. The applicant appealed this decision, officers still in the process of resolving issue via mediation. We have extended deadline for removal of contaminated soil from the site to 30 March 2021, matter nearly resolved.

2. Proposed Combined Council Dog Pound SWDC/CDC

The Committee on Aug. 12 strongly indicated pursuance of a combined pound facility with CDC and officers to clearly detail the costings framework of this option. However, matter has been parked awaits direction from the Shared Services group. CDC in 2020 had indicated a hesitancy regards costings aspects. Officer discussions 3 Dec, matter to go out for tender for facility costings, and tendered beginning of March. A tender is being sort from the market for a combined dog pound with Carterton as per the original plan for a combined dog pound. We would like the Committee's views as to its comfort in continuing the original plan for a combined pound if the tenders come in close to the original budget. If the tenders are considerably in excess of the budget further options will be presented to Council to confirm direction.

3. Building Services

The level of building consent applications has continued to remain quite high. Timely processing continues together with ongoing site inspections services. Over the last financial year our team processed 584 applications, usually about 60 active consent applications.

4. Environmental Services

The provision of decisions and helpful advice in the areas of food safety, alcohol, bylaws work, and dog control matters has continued. We have continued inspections work and are ahead of premise's verifications benchmark. Dog registrations are at 98%.

5. Service Levels

SERVICE LEVEL – Council has a Combined District Plan that proves certainty of land-use/environmental outcomes at the local and district levels.

RESOURCE MANAGEMENT KEY PERFORMANCE INDICATORS	TARGET	RESULT	COMMENT SOURCE AND ACTIONS TAKEN TO ACHIEVE TARGET
Ratepayers and residents' image of the closest town centre ranked "satisfied"	80%	89%	NRB 3 Yearly Survey October 2018 (2016: 87%)
The district plan has a monitoring programme that provides information on the achievement of its outcomes (AER's)		-	Consultants have established data to be recorded and stored to enable effective reporting against AER's in WCDP. A final monitoring strategy is still to be completed.

5.1 Resource Management Act – Consents (Year to date 01/07/2020-30/09/2020)

SERVICE LEVEL – All resource consents will be processed efficiently.

Resource management Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
Consent applications completed within statutory timeframes	**100%**	**100%**	**Total 139/139**
		100%	66/66 Land Use applications were completed within statutory timeframes. NCS
		100%	59/59 Subdivision applications were completed within statutory timeframes. NCS
		100%	14/14 permitted boundary activity applications were completed within statutory timeframes. NCS
s.223 certificates issued within 10 working days	100%	100%	47/47 s223 certificates were certified within statutory timeframes. NCS. Impacted by the departure of the Planning Manager and team transition from June to August 2019
s.224 certificates issued within 15 working days of receiving all required information (note no statutory requirement)	95%	100%	37/37 s224 certificates were certified. NCS.

5.2 Reserves Act – Management Plans

SERVICE LEVEL – Council has a reserve management plan programme.

Resource management Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
Council maintains, and updates reserve management plans as required.	Yes	Yes	RMP's are generally current and appropriate. It is therefore not anticipated that any updates will be undertaken this year.

Six Months Trend from 1st Sep 2020 to 28th Feb 2021		
Item	No of applications completed within the time frame over the total number of applications	% of applications processed within time frames
Land use consents	50/50 within 20 working days	100%
Subdivision Consents	46/46 in 20 working days	100%
223 Certificates	33/33 in 10 working days	100%
224 Certificates	28/28 in 15 working days	100%

5.3 Local Government Act – LIM's

SERVICE LEVEL – Land Information Memoranda: It is easy to purchase information on any property in the District.

Resource management Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
LIMs contain all relevant accurate information (no proven complaints)	100%		G:\LIMs\LIMS PROCESSED 2020-2021
Standard LIMs are processed within 10 days	100%	91.95%	137/149 standard LIMs were completed G:\LIMs\LIMS PROCESSED 2020-2021

	YTD 1st July 2020 to 28th Feb 2021	Previous YTD 1st July 2019 to 28th Feb 2020	Period 1st Dec 2020to 28th Feb 2021	Previous Period 1st Dec 2019 28th Feb 2020
Standard LIMs (Processed within 10 working days)	149	134	36	48
Urgent LIMs (Processed within 5 working)	68	57	23	28
Totals	**217**	**181**	**59**	**76**

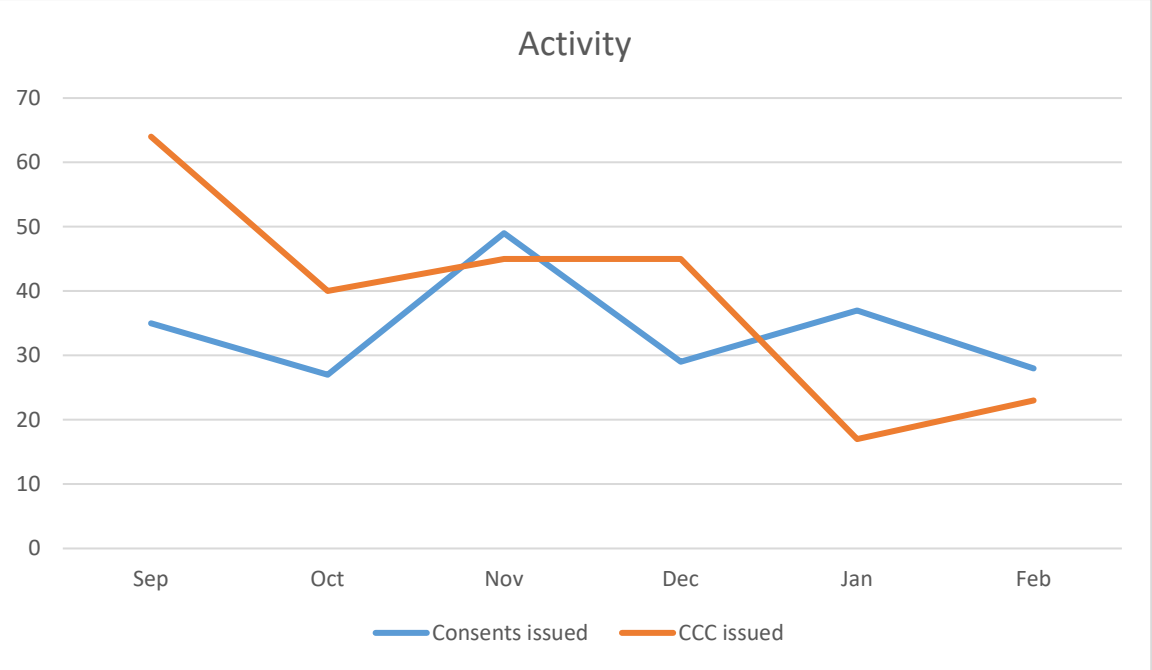
5.4 Building Act - Consents and Enforcement

SERVICE LEVEL - Council certifies all consented work complies with the building code, ensuring our communities are safe. The Council processes, inspects, and certifies building work in my district.

Public Protection Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
Code Compliance Certificate applications are processed within 20 working days	100%	98.25%	NCS – 281 out of 286 CCC's were issued within 20WD YTD – Human/technical error, process put in place to prevent this from happening in the future.
Building consent applications are processed within 20 working days	100%	98.08%	NCS – 358 consents were issued within 20WD YTD
Council maintains its processes so that it meets BCA accreditation every 2 years	Yes	Yes	Next accreditation review due January 2022. Council was re-accredited in January 2020
BCA inspects new building works to ensure compliance with the BC issued for the work, Council audits BWOF's and Swimming Pools	Yes	Yes	**Building Consents** Council inspects all new work to ensure compliance (October 2020 – 415 inspections 1st December 2020 – 28th February 2021 238 inspections **BWOF's –** Total 189 – average of 3 audits per month required,0 audit carried out December 0 audit carried out January 0 audit carried out in February **Swimming Pools –** Total 295– average of 7 audits per month required. 5 audits carried out in December

Public Protection Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
			7 audits carried out in January 4 Audits carried out in February
Earthquake prone buildings reports received	100%	N/A	Of the remaining buildings: 25 - Identified as EPB 9 - Require engineer assessment from owners 2 - Requested extension to provide engineers report

	Sept 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21
Monthly Building Consents issued	35	27	49	29	37	28
Monthly CCC issued	64	40	45	45	17	23



5.5 Building Consents Processed

Type – December 2020 – 28 February 2021	Number	Value
Commercial (shops, restaurants, rest home – convalescence, restaurant /bar / cafeteria / tavern, motel, commercial building demolition - other commercial buildings)	4	$4,082,670
Industrial (covered farm yards, building demolition, warehouse and/or storage, factory, processing plant, bottling plant, winery)	2	$117,500
Residential (new dwellings, extensions and alterations, demolition of building, swimming and spa pools, sleep-outs, garages, relocations, heaters, solid fuel heaters).	105	$25,179,115
Other (public facilities - schools, toilets, halls, swimming pools)	2	$1,203,000
Totals	**113**	**$30,582,285**

5.6 Environmental Health and Public Protection

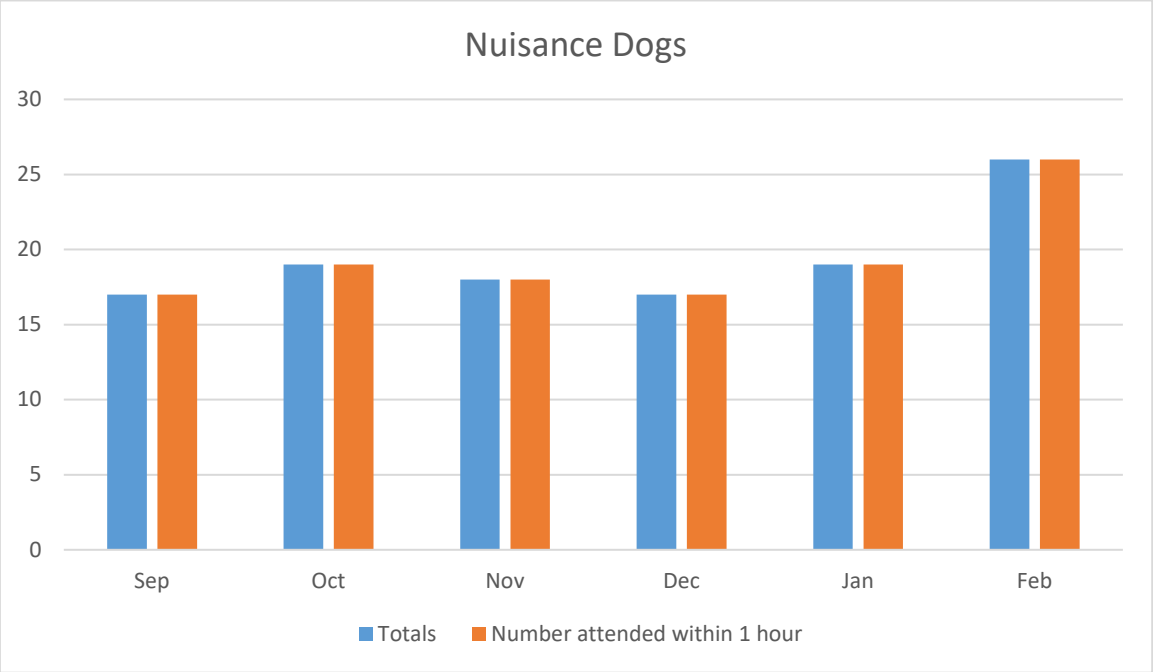
Dog Control Act – Registration and Enforcement

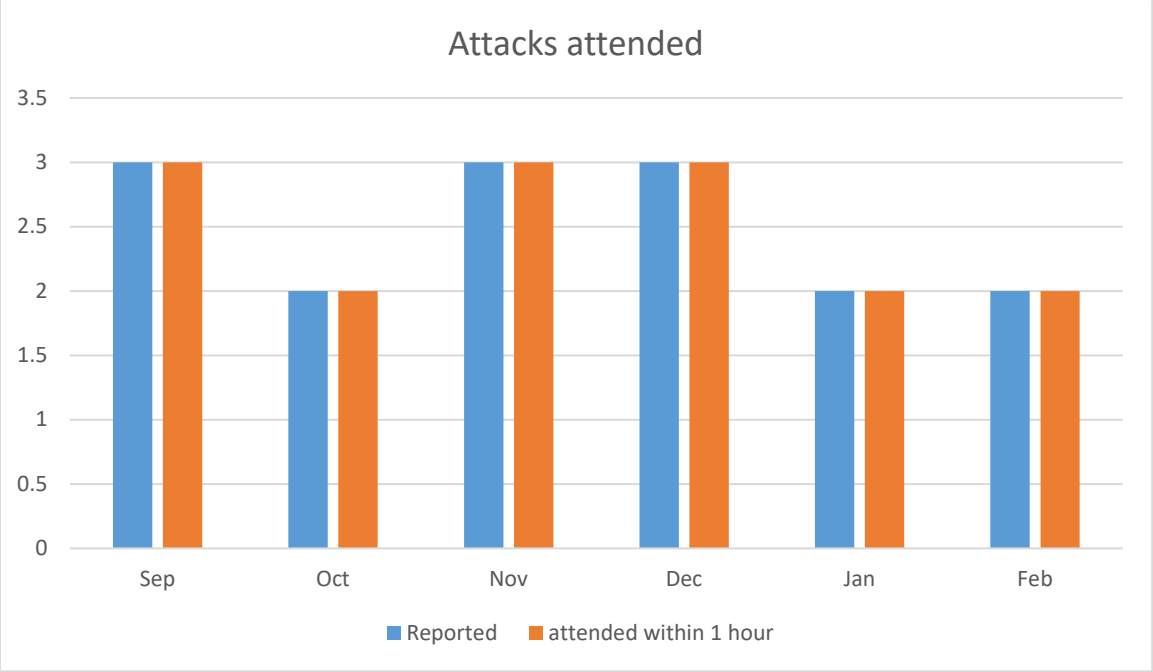
SERVICE LEVEL – Dogs don't wander freely in the street or cause menace to humans or stock.

Public Protection Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
Undertake public education, school and community visits to promote safe behaviour around dogs and/or responsible dog ownership	3 visits	0	No visits at this stage. Education is planned for at risk groups – 3 visits for March scheduled
Complaints about roaming and nuisance dogs are responded to within 1 hours	100%	100%	K:\resource\Bylaw Officers\Registers\AC Service Requests.xls 151/151
Complaints about dog attacks on persons, animals or stock are responded to within 1 hour	100%	100%	14/14

INCIDENTS REPORTED FOR PERIOD 1ST DECEMBER 2020 – 28TH FEBRUARY 2021	FEATHERSTON	GREYTOWN	MARTINBOROUGH
Attack on Pets	7	2	2
Attack on Person	3	2	-
Attack on Stock	-	-	-
Barking and whining	12	9	10
Lost Dogs	7	5	11
Found Dogs	7	5	10
Rushing Aggressive	9	1	2
Wandering	28	19	29
Welfare	-	-	-
Fouling	-	-	-
Uncontrolled (off leash urban)	1	2	2

	Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21
Nuisance dogs	17	19	18	17	19	26
Attended to within 1 hours	17	19	18	17	19	26
Attack totals	3	2	3	3	2	2
Attacks attended within 1 hours	3	2	3	3	2	2





5.7 Public Places Bylaw 2012 - Stock Control

SERVICE LEVEL – Stock don't wander on roads, farmers are aware of their responsibilities.

PUBLIC PROTECTION KEY PERFORMANCE INDICATORS	TARGET	YTD RESULT	COMMENT SOURCE, AND ACTIONS TAKEN TO ACHIEVE TARGET
Stock causing a traffic hazard is responded to within 1 hour	100%	100%	K:\resource\Bylaw Officers\Registers\AC Service Requests.xls 20/20

Public Protection Key Performance Indicators	Target	YTD Result	Comment Source, and actions taken to achieve Target
In cases where multiple stock escapes (more than 1 occasion) have occurred from a property taking compliance or enforcement or prosecution action against the property owner	100%	-	No incidents
Council responds to complaints regarding animals within 48 hours.	100%	100%	K:\resource\Bylaw Officers\Registers\AC Service Requests.xls 12/12

INCIDENTS REPORTED	Total for YTD period 1 July 2020 to 28 Feb 21
Stock	27

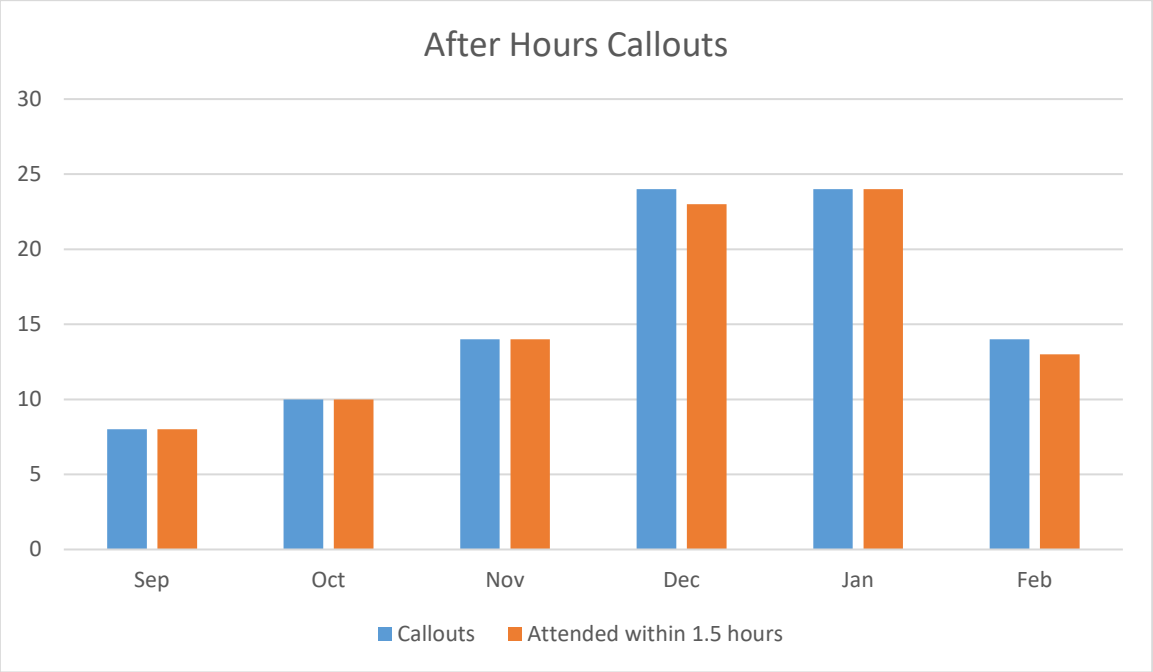
5.8 Resource Management Act – after hours Noise Control

SERVICE LEVEL – The Council will respond when I need some help with noise control.

Public Protection Key Performance Indicators	Target 20/21	YTD Result	Comment Source, and actions taken to achieve Target
% of calls received by Council that have been responded to within 1.5 hours	100%	98.3%	K:\resource\Health\Resource Management\Noise Control Complaints 112/114 attended within timeframe YTD 24 callouts Dec 20 24 callouts Jan 21 13 callouts Feb 21 60/62 attended to within 1.5 hours

After Hours Noise Control Complaints Received	YTD 1 July 20 to 28 Feb 21	Previous YTD 1 July 19 to 30 29 Feb 20	Period 1 Dec 20 to 28 Feb 21	Previous Period 1 Dec 19 to 29 Feb 20
Total	114	115	62	46

	Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21
Calls	8	10	14	24	24	14
Attended to within 1.5 hours	100%	100%	100%	99%	100%	99%



5.9 Sale and Supply of Alcohol Act - Licensing

SERVICE LEVEL – The supply of alcohol is controlled by promoting responsible drinking.

	TARGET 20/21	YTD RESULT	COMMENT SOURCE, AND ACTIONS TAKEN TO ACHIEVE TARGET
Premises are inspected as part of licence renewals or applications for new licences.	100%	73.2% YTD	MAGIQ data. All premises inspected at new or renewal application stage (41/56*). 41/56 Number of inspections completed of licences coming up for renewal within the YTD period. 5 inspections Dec 20 10 inspections Jan 21 4 inspections Feb 21 Total number of licences is subject to change month by month as new businesses open and existing premises close.
Premises that are high risk are inspected annually, while low or medium risk premises are audited no less than once every three years.	100%	62.8% YTD	MAGIQ data. There are no high risk premises in the district. Low and medium risk premises are inspected every 3 years as part of the renewal process. There are currently 43 low and medium licenses due for renewal or new inspections in this financial year. For Dec 20, 1 inspections were done for low and medium premises. For Jan 21 6 for low and medium premises For Feb 21 2 for low and medium premises Total number of licenses is subject to change month by month as new businesses open and existing premises close. Total number of inspections done year to date 27/43
Compliance activities are undertaken generally in accord with the Combined Licencing	100%	100%	1 Controlled purchase Operation has been undertaken this YTD.

	Target 20/21	YTD Result	Comment Source, and actions taken to achieve Target
Enforcement Agencies agreement.			5 Compliance visits undertaken December 2020–February 2021. Usual practice is for the SWDC alcohol licensing inspector is to undertake identified compliance inspections at licensed premises. This is to encourage open communication with our licensees and provide support and education to help our licenced premises comply with their requirements under the Act. Covid 19 and Government lockdown put a stop to this activity in this form and the Alcohol Licensing Inspector undertook compliance through an advisory role remotely under lockdown and as business moved down levels 3, 2 and 1

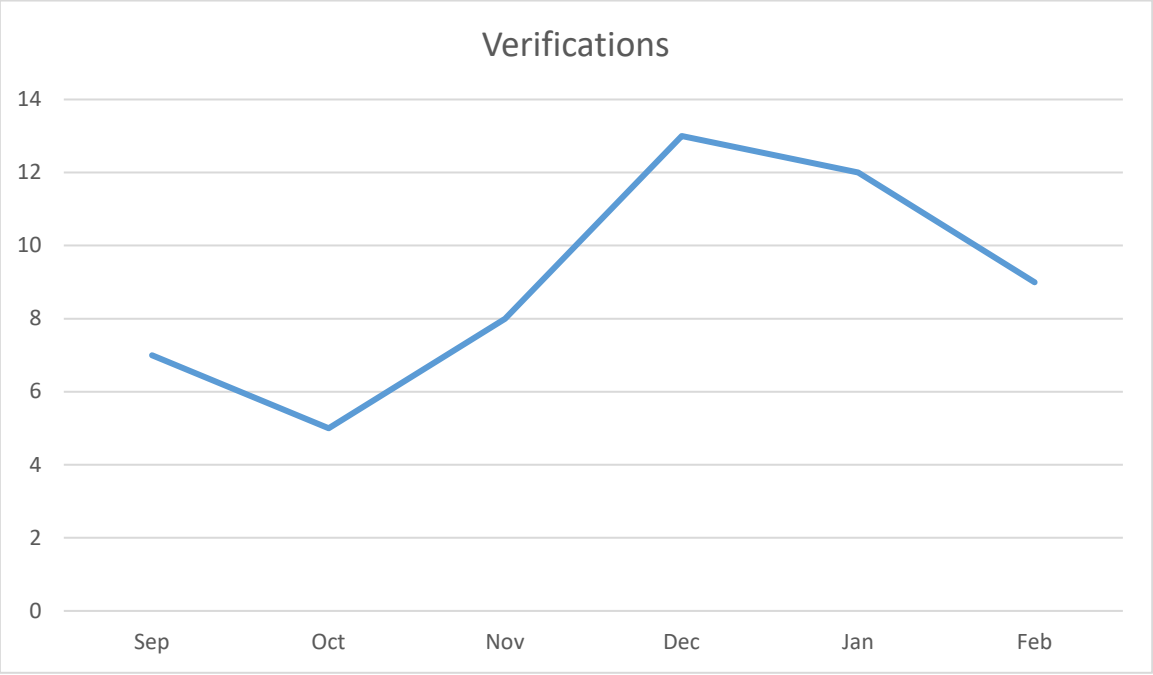
Alcohol Licence Applications Processed	YTD 1 July 20 to 28 Feb 21	Previous YTD 1 July 19 to 29 Feb 20	Period 1 Dec 20 to 28 Feb 21	Previous Period 1 Dec 19 to 29 Feb 20
On Licence	24	19	7	6
Off Licence	16	24	5	9
Club Licence	2	6	0	2
Manager's Certificate	91	104	32	43
Special Licence	22	40	10	14
Temporary Authority	3	1	1	1
Total	**158**	**194**	**55**	**75**

5.10 Health Act - Safe Food

SERVICE LEVEL – Food services used by the public are safe.

PUBLIC PROTECTION KEY PERFORMANCE INDICATORS	TARGET 20/21	YTD RESULT	COMMENT SOURCE, AND ACTIONS TAKEN TO ACHIEVE TARGET
Premises have appropriate FMP in place and meet the risk based standards set out in the Plan.	100%	100%	FHR – 0 FCP (Food Act) – 102 NP – 64 Total number of premises is subject to change month by month as new businesses open and existing premises close.
Premises are inspected in accord with regulatory requirements.	100%	73.5%	FCP verifications – 75/102 *Total number of premises is subject to change month by month as new businesses open and existing premises close. 13 verifications were undertaken in Dec 2020 12 verifications were undertaken in Jan 2021 9 verifications were undertaken in February 2021 We were able to finalise (close out) 3 premises in December 2020 7 in January 2021 and 22 in February 2021 0 outstanding corrective action food business follow ups in the period December 2020 to February 2021 In addition our EHO was the SWDC first point of contact for all the food businesses and queries to ensure compliance with Government regulations under the various Covid 19 levels.

	Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21
Verifications	7	5	8	13	12	9



6. Bylaws

Between 1 July 2020 and 28 February 2021 there were:

- **Trees & Hedges**
  55 notices were sent by Council requesting the owner/occupier to remove the obstruction from the public space.
- **Litter**
  14 litter incidents were recorded and from this, Council sent 6 notices to the identifiable people associated with these incidents, 1 resulted in an infringement.
- **Abandoned vehicles**
  There were 18 abandoned vehicles located in the SWDC area, of which 13 were removed by their owners and the remaining 5 vehicles were removed by Councils' contractor.

Contact Officer: Russell O'Leary, Group Manager – Planning & Environment

PARTNERSHIPS AND OPERATIONS REPORT

This report was presented to the Assets and Services Committee on 11 March 2021.

7. Group Manager Commentary

In conjunction with responding to the Water Reform programme Request for Information (RFI) and developing the draft Infrastructure Strategy the period since Christmas has seen no let-up of activity across the team.

There a range of projects outlined in the following report that demonstrates sound progress across the District, which is against a backdrop of increased workload and additional projects, such as those funded through the PGF, NZTA and Water stimulus funds.

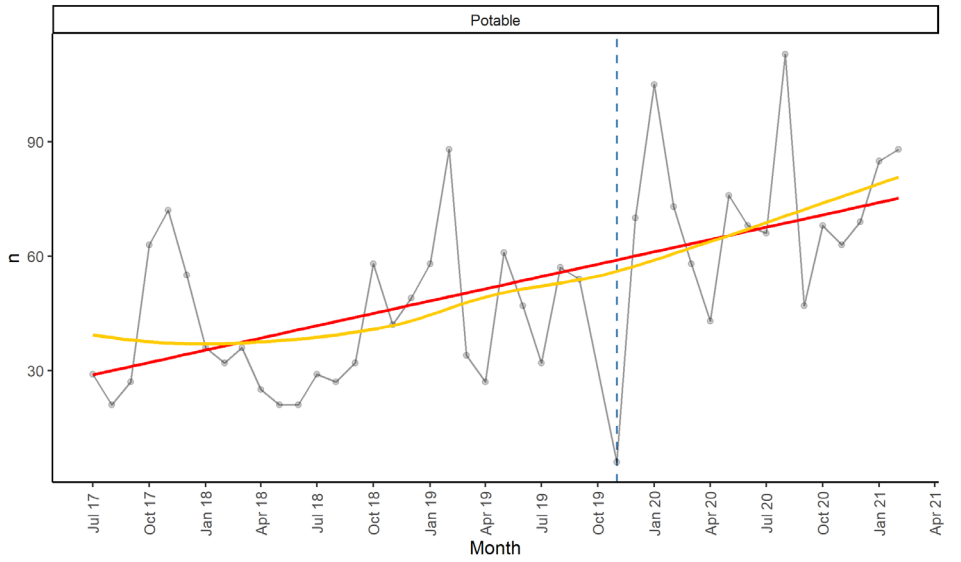
8. Water

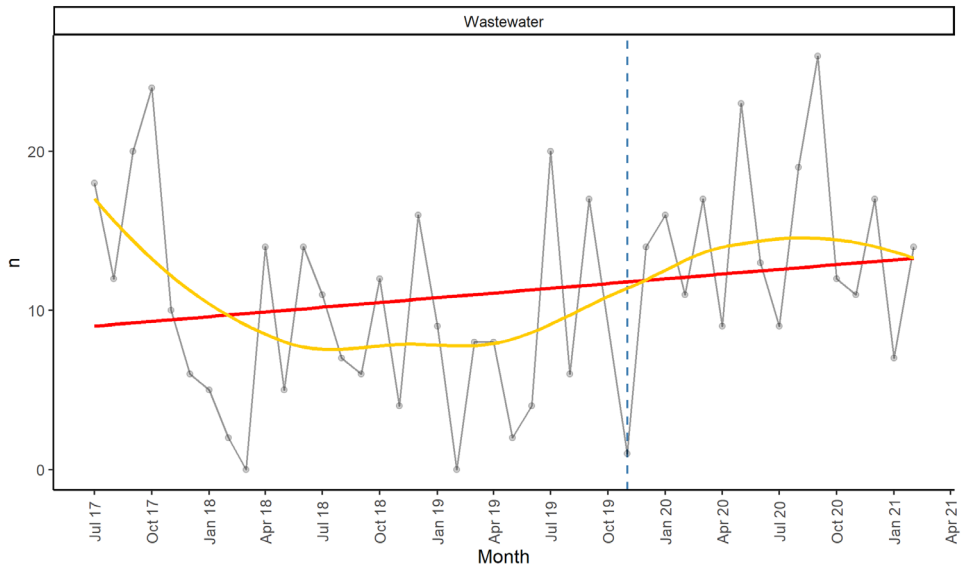
Key points:

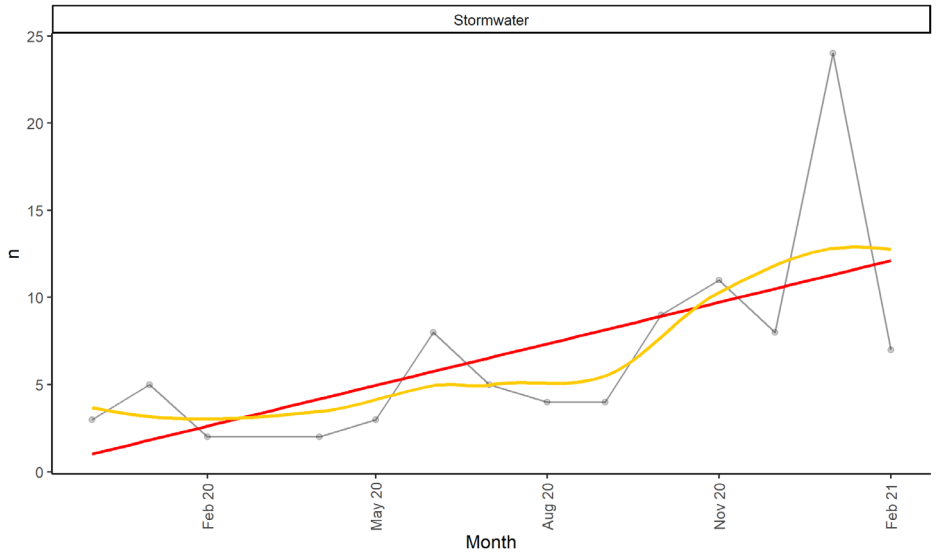
- Featherston wastewater treatment plant workshop planned
- Projects are providing opportunities for local capability development (see separate presentation
- Good progress on drinking water treatment plant upgrades

8.1 Increasing Volumes of Work

There are increasing volumes of work across the region including in SWDC the graphs below are taken from the CityCare and Wellington Water data for South Wairarapa. The blue line is when Wellington Water took over operations.







Wellington Water's Q2 performance report is attached at Appendix 1.

8.2 Reducing leakage across the South Wairarapa

Fixing leaks is a priority with a team has been set up at Wellington Water to work on this across the region including South Wairarapa. The team meets weekly to monitor progress with leak surveys and repairs, and identify any further work that may be required.

Ground surveys in Martinborough, Featherston and Greytown carried out in November and December identified 55 public leaks. Alongside leaks reported by members of the public, these were prioritised and repaired, with just 6 minor leaks remaining.

This work reduced night-time flows, which are an indication of any leakage in the network, down to normal levels.

However nightflow levels in Featherston have been climbing again recently. Another survey was carried out in February, with further leaks identified and scheduled for repair. Private leaks were also identified and the property owner contacted and asked to fix them.

8.3 Greytown and Martinborough WWTP capacities

There is little headroom for growth in Greytown without consideration of upgrade requirements and/or bringing forward upgrades outlined in future stages of the consent. The existing 35-year consent allows for the development of an additional land disposal area and ultimately a wet weather storage pond that will allow progressive reduction in discharges to the Papawai Stream. These upgrades may provide additional capacity as land disposal has the potential to sustain higher hydraulic and nutrient loads. The existing pond may also require upgrading to provide additional organic load capacity. It is noted that at the time of the 2013 consent application there was negative projected population growth in Greytown (current population is 2595 People 2019 data), however the population in Greytown is now estimated to reach 3674 by 2051. Therefore detailed upgrade assessments to accommodate growth are required.

There is no headroom for growth in Martinborough without consideration of upgrade requirements and/or bringing forward upgrades outlined in future stages of the consent. The existing 35-year consent allows for the development of an additional land disposal area and ultimately a wet weather storage pond that will allow progressive reduction in discharges to the Ruamahanga River. These upgrades may provide additional capacity as land disposal has the potential to sustain higher hydraulic and nutrient loads. The existing pond may also require upgrading to provide additional organic load capacity. It is noted that at the time of the 2014 consent application there was zero projected population growth in Martinborough (current population is 1865 People 2019 data), however the population in Martinborough is now estimated to reach 2510 people by 2051. Therefore detailed assessments to accommodate growth are required.

Financial provision for WWTP upgrades to accommodate growth have been made in the LTP and may be brought forward if needed, depending on the detailed assessments.

8.4 Key projects: Updates

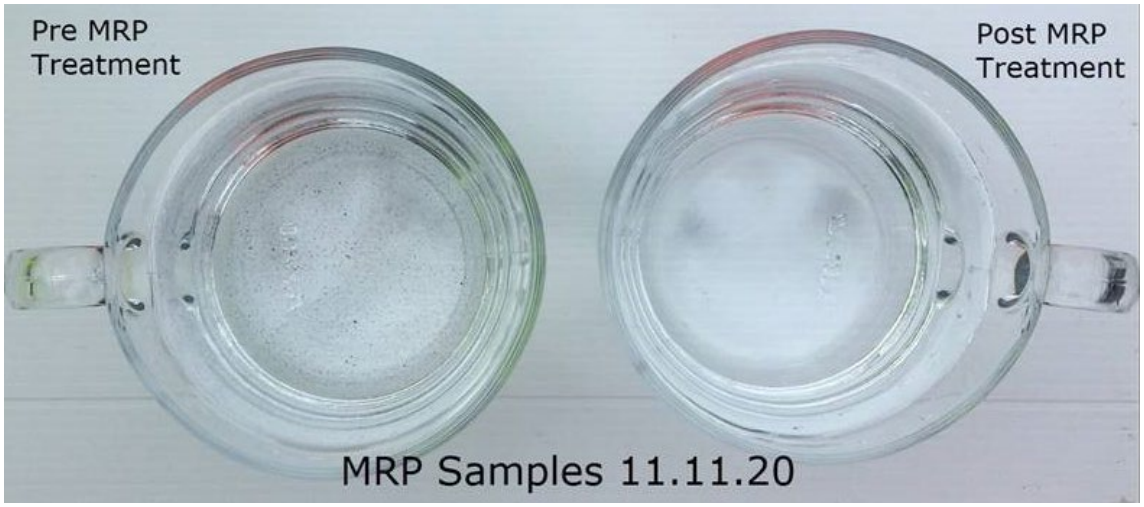
As we enter the summer demand period it becomes increasingly difficult to complete upgrades to water supply and wastewater assets.

As outlined at previous meetings, delivery of some projects has been challenging due to multiple factors, including:

- Limited accuracy or availability of full as-built information
- Project scopes being previously poorly defined
- Fragile systems with little system resilience
- Ongoing process of uncovering systemic risks requiring mitigation
- Availability of operational staff to provide input to upgrades or be trained in their use, while also responding to call volumes or issues.

8.5 Manganese Reduction Plant

The Manganese Reduction Plant (MRP) commissioning work is complete and tests verify it successfully reduces the manganese to the required levels.



The water contamination risk previously reported has been addressed and full operational testing of the plant has been completed. It has been supplying water since mid-January, meaning our ability to provide safe, clean and clear drinking water to Martinborough residents has been considerably increased.

An event to mark the formal commissioning of the plant is planned for 11 March 2021.

8.6 Waiohine Water Treatment Plant (WTP) Upgrades

The fourth bore is installed. We need to shut the treatment plant down in order to commission it; however with demand high due to hot summer weather, we haven't had the opportunity to do this yet.

Once the fourth bore is commissioned, work on the Waiohine treated water storage facility will get under way. Providing much improved resilience to supply interruptions.

This is expected to take six weeks. Procurement for the works is in progress, with the contract expected to be let in March 2021.

The installation of a temporary caustic soda treatment – to adjust the acidity of the water, and address the 'blue water' phenomenon – has been added to the work underway at the plant, and the design is currently being completed in collaboration with contractors. A similar solution is being progressed for Memorial Park. [*See appendix 4 for further update]*

8.7 Memorial Park WTP upgrades stages 2 and 3

A cost analysis has been completed to determine the most effective approach for these upgrades, which will improve water quality to fully meet drinking water standards in the most. The delivery approach has been adapted so it can go ahead without waiting for Waiohine upgrades, and at this stage we expect this work to be complete by June 2021.

Approvals under the reserve management plan are being completed in parallel with the design and construction of the containerised plant.

The installation of a temporary caustic soda treatment – to adjust the acidity of the water, and address the 'blue water' phenomenon – has been added to the work underway at the plant, and the design is currently being completed in collaboration with contractors. A similar solution is being progressed. [*See appendix 4 for further update]*

8.8 Lake Ferry WWTP driplines

The full replacement of drip lines from the Lake Ferry treatment plant is getting under way soon and should be completed by May 2021.

8.9 Featherston WWTP

Following community and mana whenua engagement the shortlist of options was shared with SWDC officers and Councillors. A workshop will be held prior to a community information day.

8.10 Enhance processes, facilities and management of WWTPs across District

An automated valve that will reduce the risk of overflow from the Martinborough plant will be installed by mid-March. Monitoring bores to ensure water quality compliance have been installed in the irrigation field at Martinborough. A health and safety assessment of sampling points and safe existing from ponds has been completed. Some physical works are expected to commence before the end of the financial year. Safe confined space entry into the Greytown pond outlet chamber is being investigated. Management plans for resource consent compliance are being reviewed.

9. Land Transport

9.1 Roading Maintenance - Ruamahanga Roads

An outline of key works completed through February 2021 is provided below:

- 268.4 km of roads were inspected and identified faults recorded in RAMM for future scheduling with 196.9 being sealed and 71.5 being unsealed.
- 8 bridges were inspected and found to be in an acceptable condition.
- 137 rural culverts were inspected, RAMM data updated including condition rating
- 110.4 km of unsealed roads were graded.
- 35 m3 of maintenance metal was applied to the unsealed roads.
- 12 sealed road potholes were identified and filled.
- 88.04 km of mechanical street sweeping was completed.
- Pre-seal repairs for the 2021-2022 sealing season have continued
- Maintenance works continued on the footpaths within the 3 towns.
- District reseals, both Urban and Rural, have been completed for the 2020-2021 season.
- Culverts were replaced and upsized on Te Awaiti and Bucks Roads.
- Bridge Abuttment repairs were carried out on Te Awaiti Bridge following damage caused by the November rains

9.2 Further activities of note

- Annual bridge inspection programme has commenced and to date no urgent faults have been identified. Types of inspection have been done as required by NZTA. This is a key programme of work and one that will continue into future years.
- Roading infrastructure input has been supplied to all subdivision resource consents.
- The Joint Carterton/South Wairarapa Roading Activity Management Plan is currently being developed and funding proposals for considerations in the LTP process are underway.

10. Amenities

10.1 Housing for Seniors

All Housing for Seniors units are fully tenanted. Recent activity includes:

- Remove garden at Cecily Martin Flats Martinborough and replace with white stones and a piece of driftwood as elderly tenant unable to maintain garden.
- Two units at Burling Flats and Matthews Flats Featherston, are having new curtains installed.
- All flats are due for inspections in March 2021. These will take place in the week of 15th – 19th March 2021.
- We are currently in talks with Age Concern to provide information packages for all our tenants. Pamphlets and brochures on courses available i.e. driving refreshers/well being/activity classes/what is available and where to go.

10.2 Pain Farm

Pain Farm Homestead and Cottage have had inspections carried out in January and February 2021, respectively. Both are being maintained and kept clean and tidy.

Trees have been trimmed on cottage driveway and outdoor maintenance takes place on a fortnightly basis by council contractor.

10.3 SWDC Playgrounds

Work has continued on upgrades and maintenance of playgrounds, including:

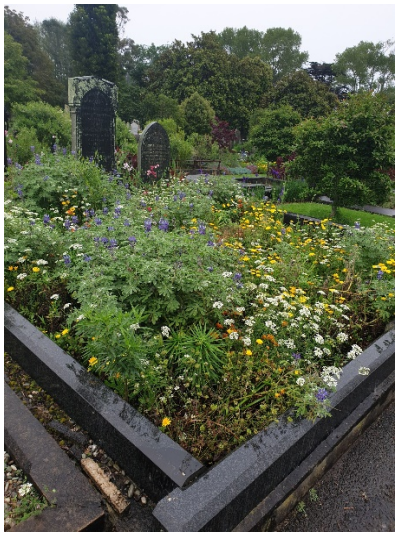
- More planting and fence to be quoted at the Martinborough Playground as more funds from the Waihinga Trust has become available.
- Featherston playground is now fully fenced and general refresh is underway with painting and new bark
- one new child/parent swing installed in Featherston.
- Parts ordered for replacement of netting for Greytown equipment

10.4 Parks and Reserves

Activity has been ongoing in maintaining our parks and reserves:

- Due to seasonal drought and fire risk current mowing placed on hold until weather breaks
- SWDC working thru Section 17a for Parks and Reserves contract of supplier
- Drought and water ban has affected traffic island gardens, plan is being made to plant more drought tolerant plants
- Tree management plan for all SWDC parks and reserves under way

- Costing for installing in three towns recycling bin hub for trial.
- Solar lights x 4 have been installed into Stella Bull Park
- Replaced Huangarua Park seat and rubbish bin as both old assets were very tired.
- Installed balancing steps in Considine Park as a trial.
- Lych gate completed and project to evolve with the Waihinga Cemetery by turning the broken and unkept graves (with permission) into gardens to make it a place to visit in Martinborough, example below.



10.5 Cemeteries:

Cemetery Activity and Burials have been busy. An Increase on plot and niche reservations have increased in all three towns.

Purchases of burial plots/niches 01/01/2021 28/02/21

	Greytown	Featherston	Martinborough
Niche	1		5
In-ground ashes Beam		1	
Burial plot	5		
Services area	1		
Total	**7**	**1**	**5**

Ashes interments/burials 01/01/2021 to 28/02/2021

	Greytown	Featherston	Martinborough
Burial	1	2	
Ashes in-ground	3	3	
Ashes wall			2
Services Area			
Disinterment			
Total	**4**	**5**	**2**

The large hedge on the north east side of Greytown Cemetery has been trimmed and the green waste is to be mulched.

10.6 Swimming Pools:

Featherston, Greytown and Martinborough pools all opened for the swim season on the 28th November 2020 and will close 14th March 2021. Entry is still free and the bookings for events and BBQs are filling fast. Monitoring of usage to inform future strategy is ongoing. Some events taking place at our pools are the Kayaks club in Greytown and Dogs in Togs in Featherston is proving very popular.

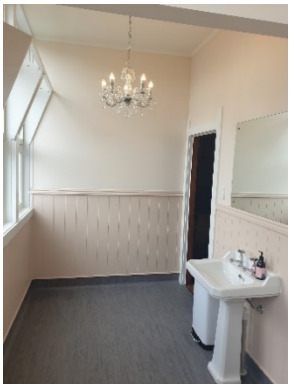
Due to the recent Covid 19 Level 2 alerts - all pools staff and lifeguards will be distancing themselves (unless there is an emergency). They will be taking registers of group visits and all staff members and visitors must scan in with the QR codes.

The lifeguards will clean and sanitise after school groups leave and before the public come in.

10.7 Further work:

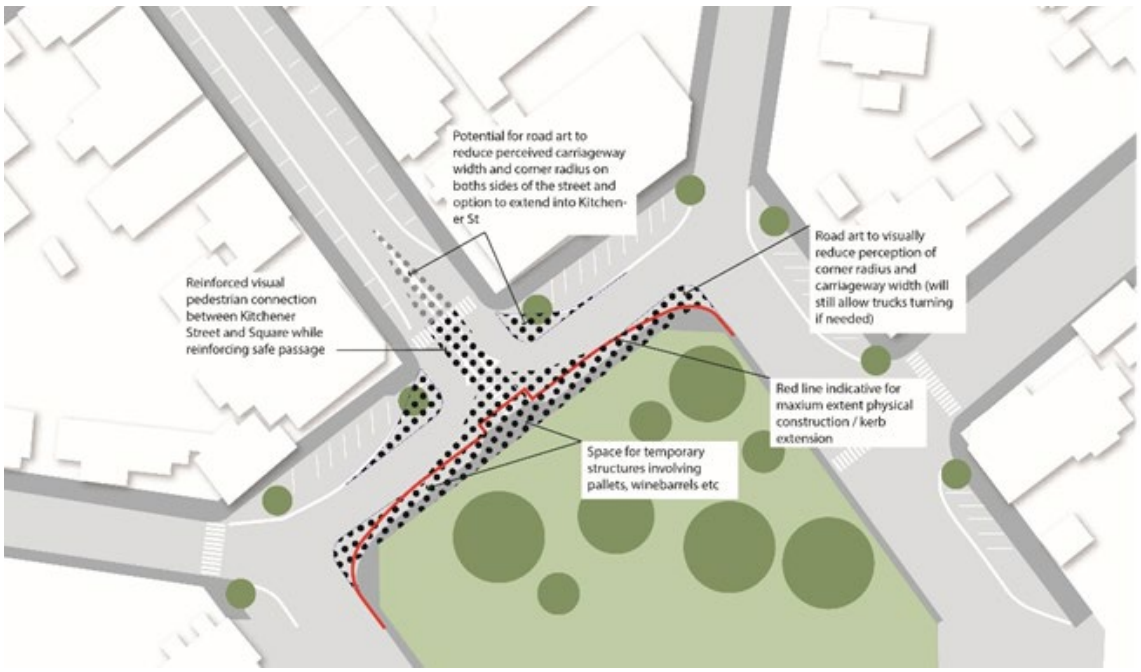
Significant additional effort has been expended in managing the delivery of the following Provincial Growth Fund (PGF) projects:

- Upgrade to facilities at Anzac Hall, Featherston completed
- Refurbishment of the Featherston War Memorial, scheduled to finish mid-March
- Supporting upgrades to the Featherston Community Centre, external painting and carpark marking to finish project.
- Supporting the Hau Ariki marae project, and
- Supporting the Tauherenikau bridge trail project.
- SWDC Building team successfully moved into 64 Main street, Greytown
- SWDC has recently taken over Mr Bicknell's house in Papawai



11. INNOVATING STREETS

The innovating Streets project is in full swing. Community and business engagement has commenced to capture local thoughts, concerns and viewpoints. Generally, people were in favour of the ideas that we talked about e.g kerb buildouts and pocket parks and we had people offering their services in one way or another. Firstly, there was a slight concern with the exact location of the trial which has resulted in moving this to the other side of the street, as per the mark-up below:



Further feedback included:

- **Space for community not just adjacent businesses** – The main concern with the current location was that this might be perceived as space that will be claimed by the adjacent businesses, while the intention is for this space to serve all of community, and not just customers of the nearby bars.
- **Alcohol ban enforcement** - Associated with the previous point is that the area will be alcohol-free, which is easier communicated if it is not immediately connected to adjacent bars.
- **Shading and sunlight** – Current location is shaded large part of the day, especially later in the season. Opposite side of the street is sunnier but still has nearby trees to provide shading.
- **Camber** – The northern edge has a steep camber and deep gutter – the southern edge of the street is much flatter, which makes implementation easier.
- **Delivery trucks** – With a trial on the other side of the street there is less impact on the deliveries made to the business on the north side.
- **Heavy vehicles** – Heavy vehicles will still need to drive through the square and require generous turning space in and out of Kitchener Street. A trial on the northern edge would not interfere with this.
- **Bridging the square** – One of the issues we identified at the start was the disconnect that currently exists between destinations around the square, with the square itself currently more acting like a visual barrier than a connector. Making the edges of the square more attractive, accessible, and comfortable promotes the use of the square and is a good catalyst for further change in the future.

Further engagement is being planned for the 5th March in the Square and feedback will be incorporated into future trial design. This design may include pocket parks, painted pavement, widening of footpath and introduction of gathering and/or seating spaces to create a more comfortable environment and make the area around the Square more people-friendly.

Once the designs have been installed, there will be opportunities to take part in creative activities and events in the street that encourage people into the newly rearranged street space, and a chance to give feedback on how the new layouts feel.

An initial concept will be trialled on the 12th March and community feedback is sought at that point too. The next steps beyond that are, broadly:

- **Friday, 26 March**
  Implement trial design with businesses, community, designers and SWDC. This will be ongoing based on further feedback from the community – there will be further opportunity to provide feedback.

- **April - May 2021**
  We will talk with you to see what you think of the temporary solutions and based on the gathered data and determine any permanent changes.

12. SOLID WASTE

12.1 General:

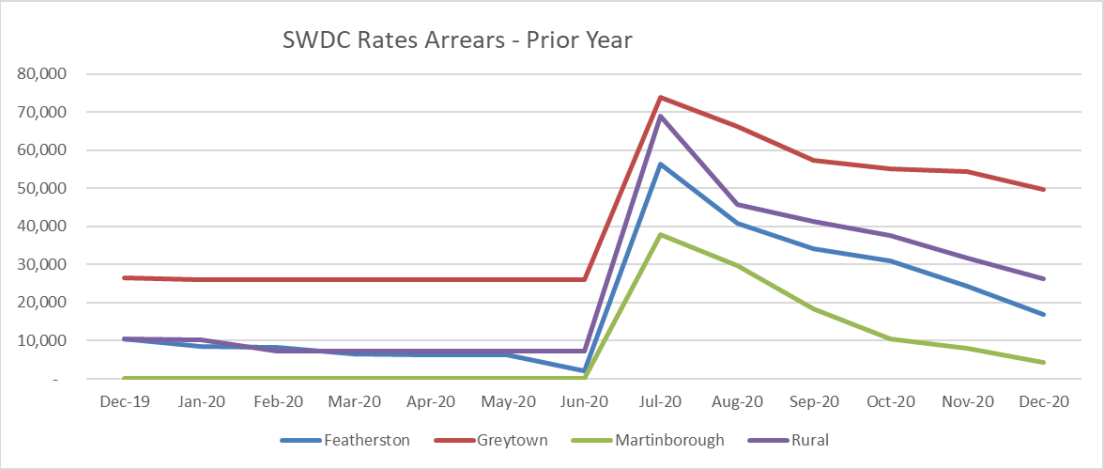
- Council Wheelie Bins Recycling collections going well
- We are processing 100% of the recycling locally
- Glass levels are at an all time low with 30T loads of glass heading out at least once per week from the Wairarapa District, normally +- 45t
- SWDC transfer stations are tidy, Green waste mulching underway in March
- Starting discussions on investigating closing Pirinoa and installing Recycling Hub in the village so seven day access for rural ratepayers and tourists.

Contact Officer: Euan Stitt, GM Partnerships and Operations

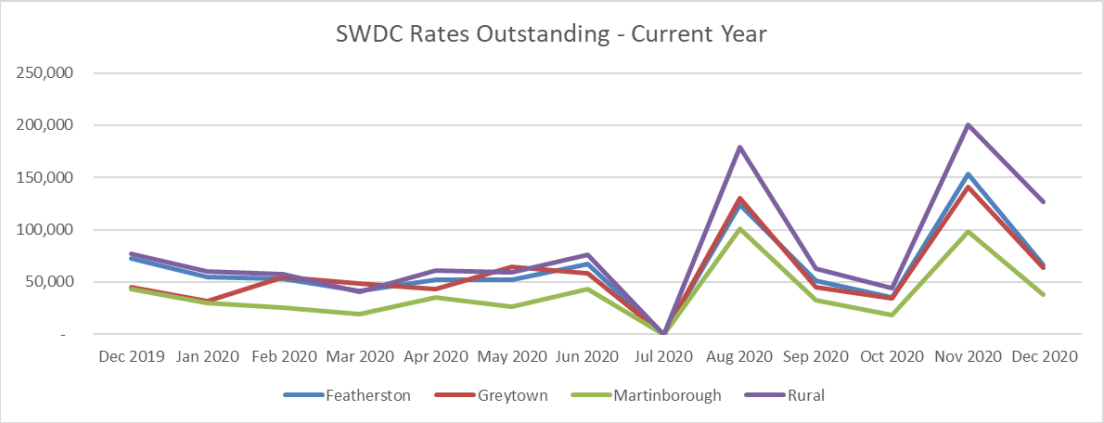
CORPORATE SERVCIES REPORT

13. Rates Arrears

The rates arrears graphs below shows an increase in amount of unpaid rates carried forward from the previous year (2019/20).



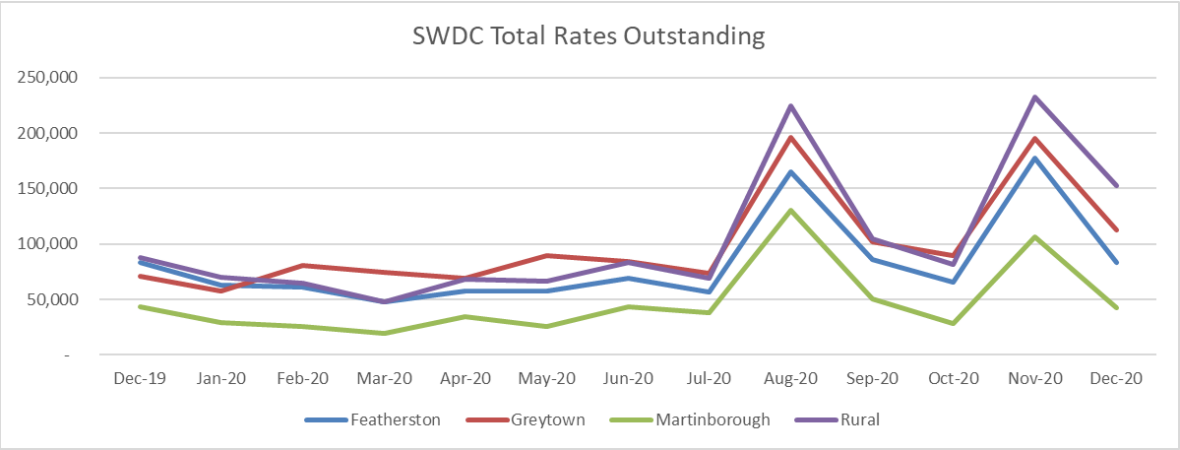
Prior years arrears have increased $49k (49%) from the same time last year.

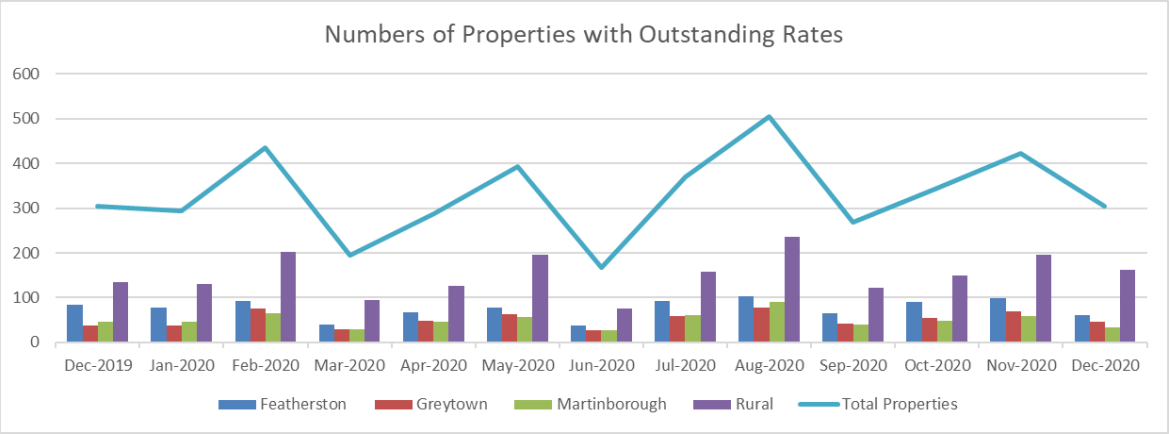


At the end of December 2020, the current years arrears amount was $295K, 20% higher than the same time last year.

Total rates outstanding have increased by $106k (37%) from the same month last year.

Outstanding rates were $391k in December 2020 to $286k December 2019.





The total number of properties with outstanding rates remain the same as December 2020 (304), however there has been an increase in the number of rural properties with outstanding rates.

The rates team continues to actively promote direct debits and payment plans to assist ratepayers with financial difficulties.

Contact Officer: Katrina Neems, Chief Financial Officer

14. Appendices

Appendix 1 – Wellington Water Q2 performance report

Appendix 2 – SWDC Greytown WWTP capacity fact sheet

Appendix 3 – SWDC Martinborough WWTP capacity fact sheet

Appendix 4 – Blue Staining update

Appendix 5 – Programme Status Reports

Appendix 1 - Wellington Water Q2 performance report

Council SWDC

2020/21 Council Performance Dashboard as at Q2

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

Wellington Water

On Track / Achieved | Off Track / Not Achieved | Not Due / Not Applicable / Not Available | Baseline

Outcome / Service		Service Objective	Performance Measure	Annual Target	YTD Status	YTD Status	In Quarter Performance Q1	In Quarter Performance Q2	Comment Ref.
Safe and healthy water	Bulk Water	To measure the quality of water supplied to residents	FTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	83.33 %				A
			GTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	50 %				B
			MTB: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	16.67 %				C
			Pirinoa: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	0 %				D
			FTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	83.33 %				E
			GTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	50 %				F
			MTB: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	16.67 %				G
			Pirinoa: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	0 %				H
	Water Supply	To measure the quality of water supplied to residents	Compliance with with resource consent conditions/water permit conditions to "mainly complying" or better	100 %	100 %				
		To achieve a high overall level of customer approval of the water service	Number of complaints per 1000 connections about: a) drinking water clarity d) drinking water pressure or flow b) drinking water taste e) drinking water continuity of supply c) drinking wat..	<70	20.33				
			Community satisfaction with water supply	>80 %	Not Due				
		To provide an appropriate region-wide firefighting water supply to maintain public saf..	Fire hydrants tested annually that meet NZ Fire Service Code of Practice	>20 %	Not Due				
Respectful of the environment	Wastewater	To maintain and promote appropriate standards of water quality and waterway health in the cit..	The number of dry weather sewerage overflows from the Council's sewerage system expressed per 1000 sewerage connections to the sewerage system	<10	1.62				
		To comply with all relevant legislation	Compliance with resource consents for discharge from its wastewater system	<2	0				
		To meet all resource consenting requirements	% of resource (wastewater) consent conditions complied with to "Mainly complying" or better	>90 %	100 %				
	Storm..	To meet all resource consenting requirements	Compliance with resource consents for discharge from its stormwater system	0	0				
	Bulk ..	To minimise demands on the region's water resources	Average drinking water consumption/resident/day	<400 L/p/d	563.67				I
	Water ..	To minimise water loss from the network	Percentage of real water loss from networked reticulation system	<30 %	22.21 %				J
Resilient networks supporting our economy	Wastewater	Median response times	Attendance time: from the time that the Council receives notification to the time that service personnel reach the site	<60	177.26 mins				T
			Attendance time: from notification to arrival on site < 1 hour	>75 %	0 %				U
			Resolution time: from the time that the Council receives notification to the time that service personnel confirm resolution of the blockage or other fault	<4	97.2 hrs				V
			Resolution time: from notification to resolution of fault < 4 hours	>80 %	0 %				W
			Proportion of urgent wastewater service requests responded to within 6 hours of notification	>95 %	50.8 %				X
		Reliability of the network	Number of blockages per 1000 connections	<10	5.08				
		To achieve a relatively high overall level of customer approval of the wastewater service	No. of complaints per 1000 connections received about sewage odour	<15	0.23				
			No. of complaints per 1000 connections received about sewage system faults	<15	0.69				
			No. of complaints per 1000 connections received about sewage system blockages	<15	5.08				
			No. of complaints per 1000 connections received about the response to issues with wastewater	<15	0.46				
			Customer satisfaction with wastewater service	>57 %	Not Due				
	Stormwater	Median response times	Median response time to attend a flooding event; measured from the time that Council received notification to the time that service personnel reach the site	N/A	0				
		To minimise the effects of flooding	Number of flooding events that occur in a territorial authority district	0	0				
			Number of habitable floors affected per 1000 stormwater connections	0	Not Due				
			% of urgent (any blockage causing extensive flooding of building or other serious flooding) requests for service responded to with 5 hours	>95 %	100 %				Y
		To achieve a high overall level of customer approval of the stormwater service	Customer satisfaction with stormwater management	>59 %	Not Due				
			Number of complaints per 1000 properties connected to the Council's stormwater system	0	Not Due				
	Water Supply	Median response times	Median response times for: attendance for urgent callouts	<60	1116.86 mins				L
			Attendance for urgent call-outs: from the time that the local authority receives notification to the time that service personnel reach the site in < 1 hour	>80 %	40 %				M
			Median response times for: resolution of urgent callouts	<8	38.16 hrs				N
			Resolution of urgent call-outs: from the time that the local authority receives notification to the time that service personnel confirm resolution of the fault or interruption in < 8 hours	>90 %	60 %				O
			Median response times for: attendance for non-urgent callouts	<48	72.36 hrs				P
			Attendance for non-urgent call-outs: from the time that the local authority receives notification to the time that service personnel reach the site in < 2 working days	>80 %	46.81 %				Q
			Median response times for: resolution of non-urgent callouts	<8	6.02 days				R
			Resolution of non-urgent call-outs: from the time that the local authority receives notification to the time that service personnel confirm in < 5 working days	>90 %	53.07 %				S

Council SWDC

2020/21 Council Performance Dashboard as at Q2

On Track / Achieved | Off Track / Not Achieved | Not Due / Not Applicable / Not Available | Baseline

A	The water quality data systems improvement work by the team over a number of months has resulted in this measure being compliant.
B	The water quality data systems improvement work by the team over a number of months has resulted in this measure being compliant.
C	There are a number of missing data points due to planned power outages or planned plant shut downs (as a result of plant upgrades and MRP commissioning), or data points that are not compliant. We are ascertaining if these can be evidenced to enable compliance to be met.
D	Water safety plan development underway to enable compliance to be met.
E	The water quality data systems improvement work by the team over a number of months has resulted in this measure being compliant.
F	The water quality data systems improvement work by the team over a number of months has resulted in this measure being compliant.
G	There are a number of missing data points due to planned power outages or planned plant shut downs (as a result of plant upgrades and MRP commissioning), or data points that are not compliant. We are ascertaining if these can be evidenced to enable compliance to be met.
H	Water safety plan development underway to enable compliance to be met.
I	General increase in water demand as expected for summer. This is due to more irrigation, particularly in Martinborough and garden watering in all towns.
J	Based on night flow monitoring: Reduced water lose due to increased leak detection in Dec, showing a decrease in leakage as repairs are completed.
L	The median Attendance Time for urgent callouts in Q2 was 20.80 hours. This represents 60% decrease from the previous quarter's result of 12.99 hours.
M	The percentage of the service personnel reaching the site on time for urgent callouts in Q2 was 26.67%. This represents 1180% increase from the previous quarter's result of 2.08%.
N	The median Resolution Time for urgent callouts in Q2 was 45.04 hours. This represents 41% increase from the previous quarter's result of 31.96 hours.
O	The percentage of the service personnel resolving urgent callouts on time in Q2 was 26.67%. This represents 80% increase from the previous quarter's result of 14.82%.
P	The median Attendance Time for non-urgent callouts in Q2 was 72.15 hours. This represents 52% decrease from the previous quarter's result of 47.46 hours.
Q	The percentage of the service personnel reaching the site on time for non-urgent callouts in Q2 was 43.06%. This represents 2% increase from the previous quarter's result of 42.24%.
R	The median Resolution Time for non-urgent callouts in Q2 was 142.88 hours. This represents 35% increase from the previous quarter's result of 105.60 hours.
S	The percentage of the service personnel resolving non-urgent callouts on time in Q2 was 43.06%. This represents 2% increase from the previous quarter's result of 42.24%.
T	The median Attendance Time for Wastewater service requests in Q2 was 2.93 hours. This represents 88% decrease from the previous quarter's result of 24.67 hours.
U	The percentage of the service personnel reaching the site within 1 hour in Q2 was 4.17%. This represents 84% decrease from the previous quarter's result of 26.28%.
V	The median Resolution Time for Wastewater service requests in Q2 was 95.88 hours. This represents 23% increase from the previous quarter's result of 78.16 hours.
W	The percentage of the service personnel resolving the faults within 4 hours in Q2 was 0%. This represents 100% decrease from the previous quarter's result of 21.16%.
X	The Proportion of urgent wastewater service requests responded to within 6 hours of notification in Q2 was 50%. This represents a slight decrease from the previous quarter's result of 51.59%.
Y	The measure was determined as per the standard for the other council districts. It included the habitable floor affected through flooding, and did not include the localised flooding on properties or detached buildings.

Appendix 2 - SWDC Greytown WWTP capacity fact sheet

Greytown Wastewater Treatment Plant Capacity Fact Sheet

Historically, based on guidelines developed in 1974, facultative (primary) ponds, without aeration, were sized based on an organic (BOD) loading rate of 1200 persons per hectare. Based on a facultative pond size of 1.85ha the Greytown treatment plant would have originally been designed for a population of approximately 2,200 people (allowing for residential waste only).

Currently the population of Greytown is estimated to be approximately 2595 people (2019 data). Therefore based on an historic approach, the plant would have already reached capacity.

Current approaches to waste stabilisation pond design and resource consenting are more complex. The capacity of a wastewater treatment plant is determined by sampling the inflow volumes and loads [(1)] and assessing the ability of the plant unit processes to treat the loads (solids, organics and nutrients), and of the consented receiving environment [(2)] to accept the treated effluent volumes and loads (residual organics, nutrients and bacteria).

Under this approach the capacity of a waste stabilisation pond is assessed to be the parameter or parameters that are causing the greatest bottlenecks on performance. Based on recent resource consent compliance monitoring the treatment plant effluent has been close to exceeding its consented ammonia and total nitrogen maximum concentration conditions when discharging to the Papawai Stream and has exceeded the maximum consented ammonia levels in the Papawai Stream after dilution. The organic (BOD) loading rate has been within the consent conditions. Therefore nitrogen loads are considered to be the greatest bottleneck.

Although there may be some moderate cost optimisation options available, there is limited ability to significantly improve the nutrient removal capability of a waste stabilisation pond system [(3)]. Therefore, based on the current approach the Greytown plant is considered to be very near its capacity (previously indicatively estimated as within approximately 10% of capacity).

There is little headroom for growth in Greytown without consideration of upgrade requirements and/or bringing forward upgrades outlined in future stages of the consent. The existing 35-year consent allows for the development of an additional land disposal area and ultimately a wet weather storage pond that will allow progressive reduction in discharges to the Papawai Stream. These upgrades may provide additional capacity as land disposal has the potential to sustain higher hydraulic and nutrient loads. The existing pond may also require upgrading to provide additional organic load capacity. It is noted that at the time of the 2013 consent application there was negative projected population growth in Greytown however the population in Greytown is now estimated to reach 3674 by 2051. Therefore detailed upgrade assessments to accommodate growth are required.

Notes

(1) There has been limited inflow load sampling conducted for Greytown

(2) In the case of Greytown the receiving environment is water and land

(3) Upgrades for pond performance improvement and disinfection were undertaken in 2007 and 2011.

Appendix 3 – SWDC Martinborough WWTP capacity fact sheet

Martinborough Wastewater Treatment Plant Capacity Fact Sheet

Historically, based on guidelines developed in 1974, facultative (primary) ponds, not including aeration, were sized based on an organic (BOD) loading rate of 1200 persons per hectare. Based on a facultative pond size of 1.63ha the Martinborough treatment plant would have originally been designed for a population of approximately 1950 people (allowing for residential waste only).

Currently the population of Martinborough is estimated to be approximately 1865 people (2019 data). Therefore based on an historic approach the plant would have capacity for approximately 85 more people.

Current approaches to waste stabilisation pond design and resource consenting are more complex. The capacity of a wastewater stabilisation pond is determined by sampling the inflow volumes and loads [(1)] and assessing the ability of the plant unit processes to treat the loads (solids, organics and nutrients), and of the consented receiving environment [(2)] to accept the treated effluent volumes and loads (residual organics, nutrients and bacteria).

Under this approach the capacity of a wastewater treatment plant is assessed to be the parameter or parameters that are causing the greatest bottlenecks on performance. Based on recent resource consent compliance monitoring the Martinborough plant effluent has exceeded its ammonia, total nitrogen, and phosphorus nutrient maximum concentration conditions when discharging to the Ruamahanga River. The plant has exceeded its weekly hydraulic loading conditions when discharging to land as the land area is limited and the existing pond does not provide significant storage. The plant has been close to exceeding its effluent organic (BOD) and bacteriological concentration limits.

Although there may be some moderate cost optimisation options available there is limited ability to significantly improve the nutrient removal capability of a waste stabilisation pond system [(3)]. Therefore, based on the current approach the Martinborough plant is considered to have reached its capacity.

There is no headroom for growth in Martinborough without consideration of upgrade requirements and/or bringing forward upgrades outlined in future stages of the consent. The existing 35-year consent allows for the development of an additional land disposal area and ultimately a wet weather storage pond that will allow progressive reduction in discharges to the Ruamahanga River. These upgrades may provide additional capacity as land disposal has the potential to sustain higher hydraulic and nutrient loads. The existing pond may also require upgrading to provide additional organic load capacity. It is noted that at the time of the 2014 consent application there was zero projected population growth in Martinborough however the population in Martinborough is now estimated to reach 2510 people by 2051. Therefore detailed assessments to accommodate growth are required.

Notes

(1) There has been limited inflow load sampling conducted for Martinborough

(2) In the case of Martinborough the receiving environment is water and land

(3) Upgrades for pond performance improvement and disinfection were undertaken in 2007 and 2011.

Appendix 4 – Blue Staining update

South Wairarapa blue staining
SWDC Councillor update

Good morning/afternoon Councillors

As you will know, last Wednesday all residents on the SWDC ratepayer email list were sent this advisory regarding the emergence of a 'blue staining' issue in Featherston and Greytown. They were further directed to this page with information on blue staining, as well as information on plumbosolvency, which is important information for all water users at all times. The advisory was also supplied to local media, resulting in an article you may have seen in the *Times-Age* later in the week. As a result, three additional customer reports of blue staining were received, taking the total to 24.

We thought it would now be timely to give you an update on our management of the issue, especially as we know some members of the community have contacted you directly about it.

On Friday, we began outbound calling all customers who had reported the issue, to get more detail on what they have experienced. All affected customers who have reported the issue to Wellington Water, or whose reports were referred through by SWDC, have now been contacted. We are developing an ongoing joint customer management approach with SWDC that ensures each organisation's resources are efficiently applied in dealing with customer queries, while providing reliable information and recommendations in response.

Most importantly, we are taking steps to alleviate the issue as soon as possible.

Our source water is naturally slightly 'soft', or acidic, as it is throughout the region and in many other parts of New Zealand. Acidity (lower pH) is one of the factors that influences cuprosolvency (copper corrosion), the underlying cause of blue staining. It can affect copper plumbing in homes and other buildings, including copper underground private lateral pipelines that connect the water main to the building's internal pumbing.

We're upgrading the pH balancing systems at the Waiohine and Memorial Park treatment plants because the previous systems were unreliable and became unsafe to operate. While this has never compromised or put the supply of safe drinking water at risk, it's likely that this has contributed to the blue staining we're seeing now.

Design and procurement for the upgraded pH balancing systems is already underway, and they are currently on track to be completed by the end of May, as part of the ongoing programme of upgrades at these plants. The top priority has always been completing the upgrades that ensure all of South Wairarapa's town water is compliant with drinking water standards via a multi-barrier approach, plus increasing our capacity to meet peak demand. By comparison, the temporary reversion of the water towards its natural pH does not affect our compliance with drinking water standards, and hence those system upgrades were scheduled to follow those directly related to health and demand.

While the vast majority of water users in South Wairarapa are unlikely to experience blue staining, we appreciate that it is a significant nuisance to those who do. For that reason, we have identified an option for installing interim pH balancing systems at the plants, until the permanent upgrades are completed, which we believe will help to alleviate the issue.

These temporary systems are expected to be installed and operational in approximately three weeks. There will be a lag of a few days as the network flushes through, after which we will be looking to see a reduction in reports of blue staining. However it is important to note that many factors which contribute to cuprosolvency are beyond our visibility and control, given that it takes place within private plumbing. As such, we will not be making hard & fast guarantees to customers, particularly with regards to timing. Blue staining typically takes time to emerge, and it may take time to be alleviated, depending on factors including usage volume in various parts of the network and in individual homes.

In the meantime, if you are contacted by residents experiencing blue staining, please ask ensure they have logged their details with the SWDC contact centre. Please also direct them to the key information via the links in the first paragraph above, in particular the standard Ministry of Health advice to flush at least 500ml of water from taps used for drinking cooking or brushing teeth first thing in the morning. This advice applies to all residents at all times, and which Wellington Water advertises throughout the region twice-yearly, in accordance with MoH requirements.

If you have any further questions, please don't hesitate to get in touch.

Appendix 4 – Programme Status Reports

SWDC Assets and Services Committee	**Programme** Water
Meeting 16/12/2020	**Period** Mar-21

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Known budget challenges exist and are being managed as per previous reports. Rework to programme and changes to approaches on some projects are bringing forward delivery in some areas. Summer demand is impacting delivery on water projects (ability to have plant offline while undertaken).
Major Projects						
Manganese Reduction Plant - Martinborough	**$2.5m**	**Nov 19 - Nov 20**				
Construct and commission a manganese reduction plant						The water contamination risk previously reported has been addressed and the MRP has completed its testing and has been supplying water since mid January. The official opening / ribbon cutting ceremony is booked for 11 March 2021.
Featherston WWTP	**$500k***	**Jul 20 - Jun 2025**				
Develop and implement a suitable wastewater solution for Featherston	↓	↓		↓	↓	Following community and mana whenua engagement the shortlist of options was shared with SWDC officers and Councillors. Concerns were raised regarding the cost of the shortlisted options and further information was requested by the Councillors. A workshop to address concerns is required before work can proceed.
Upgrade/Renewal Projects						
Papawai Road WW Upgrade	**$2.8m**	**May 2021 onwards**				
Capacity issue - upgrade pipe						Contract has been awarded with construction scheduled to commence in May 2021. Larger construction portion roll over into 21/22FY. Project schedule adjusted to allow for delivery of Memorial Park WTP upgrade works within current FY ahead of Papawai Road.
Pinot Grove WW upgrade	**$300k**	**Mar 21 - Jul21**				
Capacity issue - upgrade pipe						Construction activities are underway and are on track. Practical completion expected at end of March 2021. Project brief attached to Officers' Report
Waiohine Water Treatment Plant (WTP)	**$900k**	**Dec-20**				
a) 4th bore/pump and commissioning						4th bore is installed. Awaiting WTP shutdown in order to commission bore. Summer demand impacting on completion.
b) Treated water storage (chlorine)						Physical work scheduled to start after 4th bore commissioned, with practical completion six weeks thereafter (early March). Treated water storage procurement phase underway, award delayed to March 2021.
c) pH dosing system upgrade						Additional installation of temporary caustic soda treatment added to project scope. Work expected to be completed during March. Re-assessment of temporary fix solution to be completed prior to progressing pH dosing system scope. The design is currently being completed in collaboration with contractors. Options assessment is to be completed prior to investing in further upgrade works.
d) Site Security						Security Fencing policy (standard) to be completed prior to brief being released for pricing. Project expected to carry over to new financial year.
Memorial Park WTP upgrades stage 2	**$330k**	**Nov-20**				

Replace bore pump, new filter, additional pipework and run to waste		↓				The works have been rolled into a single stage. Existing Memorial Park pump to be replaced as soon as Waiohine 4th bore is commissioned. Emergency plan in place should pump fail prior to replacement.
Memorial Park WTP upgrades stage 3	**$1.5m**	**Apr-21**				
Chemical dosing, UV and filter upgrades		↑				A changed delivery approach for this project means it can progress without waiting for Waiohine upgrades. Design and Construct contract awarded with Brian Perry Civils and Filtec. As a result of mitigation measures implemented after safety in design and HAZOP workshops together with the contractor the completion date has moved to June 2021 based on the information from the project team. Obtaining approvals under the reserve management plan is being completed in parallel with the design and construction of the containerised plant.
Lake Ferry WWTP driplines	**$326k**	**tbc**				**D**
Renewal driplines at WWTP						Full replacement if drip lines are currently being undertaken. Contract awarded. Completion is scheduled May 2021.
WWTP Improvement Programme	**$400k**	**Dec-20**				
Enhance processes, facilities and management of WWTPs across District						The installation of an automated valve to reduce overflow risk in Martinborough is currently in progress with commissioning planned from 15th March. Monitoring bores have been installed in the irrigation field at Martinborough. A health and safety assessment of sampling points and safe existing from ponds has been completed. Some physical works are expected to commence before the end of the fiancial year. Safe confined space entry into the Greytown pond outlet chamber is being investigated. Management plans for resource consent compliance are being reviewed.
SWDC-led Projects						
Water Race User Survey	**n/a**	**Dec-20**				
Survey Water Race users and related stakeholders on use						Community engagement sessions were held in Greytown and Featherston mid-February 2021 inviting property owners with water races to come along and talk about how pending changes might affect them. Quantitative information is being gathered and quantitative information will follow after the survey period ends on 15 March 2021. https://www.swdc.govt.nz/water-races
Longwood Water Race Consent	**n/a**	**Dec-20**				
Gain consent for continued use of water race						Reporting to GW completed, awaiting outcome. Water Race continues to operate under existing consent.

Status key: *On track/achieving* *Some concern* *Off Track/Major concern*

SWDC Assets and Services Committee		**Programme**	Roading
Meeting	16-Dec-20	**Period**	Mar-21

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Programme on track overall. Spome resource constraints remain but work sprogressing well.
Current Projects						
Ruakokoputuna	**$400k**	**Oct 20 - Dec 20**				
Ruakokoputuna Seal Extension						Rrogramme completed
Sealed Road Pavement Rehab	**$220K**	**Dec 20- Feb 21**				
Western Lake Rd Area Wide						H&S risk relates to nature of road and speed. Underway with NZTA.
Sealed Road Resurfacing Local Roads	**$467.5k**	**Oct 20 - Dec 20**				
Scheduled programme of works comprising 14.5kms of resurfacing on: Shooting Butts Road, Hikinui Road, Bucks Road, Underhill Road, Boundary Road, Pa Road, Birdie Way, Eagle Place, Fairway Drive, Te Muna Road, Papawai Road, Fraters Road, Tilsons Road, Hecklers Road, Moroa Road, Kahutara Road, White Rock Road, Lake Ferry Road, East Street.						Programme complete
Sealed Road Resurfacing Special Purpose Rd	**$115K**	**Jan 21 - Jun 21**				
3.5 kms of resurfacing work on Cape Palliser Road						Programme complete
FootPath Renewals	**$177K**	**Oct 20 - Jun 21**				
Planned maintenance						Work ongoing, Bethume Street, West Street, Regent Street(maybe deferred due to UFB rollout) Replaced option Revans Street from Royal Hotel carpark to railway crossing
FootPath maintenance Extra Funding	**$375K**	**Jun 20 - Jun 21**				
Footpath Maintenance $125K per town						High level of input required by staff. Work ongoing.
Esther Street Footpath Extension	**$70K**	**Sep-20**				
Noted from AP submissions						**Works completed.**
Low Cost Low Rik Local Roads	**$345K**	**Aug 20 - jun 21**				
Culvert Extensions, safety improvements, seal widening, intersection improvements, slip stabilisation, guardrails, kerb and channel works.						Seal widening on Western Lake Road complete
Low Cost low Rick Special Purpose Rd	**$250K**	**Aug 20 - jun 21**				
Guardrail installation, Signage upgrade, Rock revetment supply						Includes $100k carry forward from 19/20
Aseet Management Plan	**$50k**	**June 20 - Nov 20**				
Plan development and RLTP funding						Joint AMP with CDC and NZTA funding request 2021.2024. Draft plan submitted for A&S input to 16/12 meeting. Fpositice feedback from NZTA. Funding included in draft LTP.
Reading Street Upgrade	**$250k**					
Upgrade Reading Street as part of Orchards Development						3rd party dependent
Speed Limit Review		**Nov 20 - Jun 21**				

Consult re speed review						Link to NZTA speed reduction and Road to Zero, Urban safety for vulnerable users etc. NZTA planned consultation dates through Nov and in discussions with NZTA on alignment.Wilkie Consultants have been engaged to manage delivery and consultation processes
Tora Farm Rd bridge beam painting x2	**$100K**	**Jan 21 - Jun 21**				
Painting steel beams on Tora Farm and Pukeamuri Bridges						Programme Completed

Status key: *On track/achieving* *Some concern* *Off Track/Major concern*

SWDC Assets and Services Committee		**Programme**	Amenities
Meeting	16-Dec-20	**Period**	Mar-21

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Overall programme progressing to schedule, other than those projects that did not receive PGF funding. These may receive funding in LTP.
Current Projects						
Featherston War Memorial	**$250k**	**tbc**				
Repair earthquake damage and structural deficiencies			↑			Expected completion mid March, steps relaid, plastering commencing once concete cured then chemical wash
Anzac Hall upgrades	**$100k**	**Nov-20**				
Toilets, roof and wall repairs						100% completed, Final report and invoicing sent to MBIE.
Featherston Community Centre	**$110k**	**tbc**				
Roof and wall repairs, asbestos removal, painting, car park and kitchen/toilet repairs						Internal completed, carpark sealed, external painting underway expected completed mid late March
Hau Ariki marae - PGF support	**$371k**	**tbc**				
Various upgrades - sprinkler systems, water storage, kitchen/toilet upgrades.		↓				Building Consent application made. Contract with MBIE depends on getting this first. Consent application been delayed by contractor availability.
Tauherenikau Bridge	**$1.36m**	**tbc**				
Construct cycle/walkway over Tauherenikau river						Finalising discussions with PGF and Greytown Trails Trust on timing and processes. Kiwirail access being discussed (delayed) and consent application submitted to GWRC.
Kuranui College Gym	**$1m**	**tbc**				
Manage delivery of gym in college and provide for community access.						Concept designs developed by MoE. Management and access arrangements being discussed with College before Council funding released.
SWDC Tree asset management	**tbc**					
Develop a long term District wide programme for tree management						Funding included in draft LTP
Stella Bull Park Lighting	**$12k**	**Nov-20**				
Install lighting for safety/security of users						COMPLETE - Lights have been installed and working well meeting Dark Sky requirements
Peace Garden, Featherston	**$120k**	**tbc**				
Construct accessible ramp and web-enabled information display with additional seating and planting						Heritage NZ to place a tender out with SWDC project management advice
Featherston Stadium	**$20k**	**tbc**				

Upgrade to kitchen, seating and ablutions						PGF declined, now in draft LTP docs
Ngawi Community Hall	**$30k**	**Dec-20**				
Upgrade septic system						Resource concent approved by GWRC,material arrived from USA. Programme starting with GT Enviromental. Delayed by consent/materials delivery.
Cemetries data project	**n/a**	**Dec-20**				
Data validation, GPS capture and database established						Data validation ongoing, GPS and photo capture commenced. Support from CDC also being provided. Project placed on hold due to staffing avaliability.
Pain Farm upgrades	**$100k**	**Sep-20**				
Upgrades to Main House and cottage to meet standards						Completed, Pain farm and cottage has also completed scheduled inspection
SWDC Lease review programme	**n/a**	**Dec-20**				
Complete review of leases						Data capture and strategy under development. Focus on Papawai and Lake Ferry leases in short-term. Multiple leases to work through
Senior Housing	**$85k**	**Oct-20**				
Heat pump/air conditioning installation and paiting (int and ext)						Work completed - under budget
Swimming Pools	**$15k**	**Oct-20**				
Upgrade to Greytown Stand and painting						Work completed - on time for new season
Martinborough Waihinga Cemetery	**$15k**	**Oct-20**				
Install Lych gate as part of anniversary celebrations						Complete - gate built and installed,
Considine Park, Martinborough	**$8k**	**Nov-20**				**and installed**
Install additional lime path						Likely Lions involvement - to be discussed at next user meeting.
Park exercise equipment	**$45k**	**Oct-20**				
Install outdoor exercise equipment in local parks						Works completed - proving popular in communities

Status key: *On track/achieving* *Some concern* *Off Track/Major concern*

SWDC Assets and Services Committee	**Programme** Other
Meeting 16-Dec-20	**Period** Dec-20

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Additional projects added to A&S dashboard for visibility. May be moved to other sheets once progressed from strategy phase. Some resource constraints limiting progress.

Current Projects

Water Reform RFI	**n/a**	**1st Feb 21**				
Respond to DIA Request for Informatio to inform Water Reform Process						Complete - data provided on time and follow up questions resolved.
Waihinga Lessons Learned	**$15k**	**tbc**				
Business Improvement - Undertake a review of the Waihinga Centre project to improve future SWDC project delivery		↓				Delayed by Water RFI and LTP work. Lower priority activity but resuming now.
Greenspace review	**$40k**	**Jul-21**				
Undertake a review of the availability and use of Council greenspace provision in Greytown						Proposed funding in draft LTP
Walking and Cycling Strategy	**tbc**	**tbc**				
Develop a District-wide Walking and Cycling strategy						Proposed funding in draft LTP
Innovating Streets - Martinborough	**$200k**	**Apr-21**				
Develop and test repurposing of car parks near square						Update provided in A&S report body
Road Stopping Policy	**$15k**	**Jan-21**				
Develop a Road Stopping Policy						Contractor engaged now funding approved. Work in progress, with draft policy being reviewed now.

Status key: *On track/achieving* *Some concern* *Off Track/Major concern*

FEATHERSTON COMMUNITY BOARD

27 APRIL 2021

AGENDA ITEM 8.2

ACTION ITEMS REPORT

Purpose of Report

To present the Community Board with updates on actions and resolutions.

Recommendations

Officers recommend that the Community Board:

1. Receive the Action Items Report.

1. Executive Summary

Action items from recent meetings are presented to the Community Board for information. The Chair may ask Council officers for comment and all members may ask Council officers for clarification and information through the Chair.

If the action has been completed between meetings it will be shown as 'actioned' for one meeting and then will be remain in a master register but no longer reported on.

2. Appendices

Appendix 1 - Action Items to 27 April 2021

Contact Officer: Steph Dorne, Committee Advisor
Reviewed By: Harry Wilson, Chief Executive

Appendix 1 – Action Items to 27 April 2021

Number	Raised Date	Action Type	Responsible Manager	Action or Task details	Status	Notes
83	25-Feb-20	Action	E Stitt	Investigate a solution for the "Welcome to Featherston" signs on State Highway 2 following notification that the location of these signs presents a risk to motorists and keep the community informed through communications.	Open	Signs removed 16th/17th March due to unresolved safety concerns. Meeting onsite on 23rd March with SWDC/NZTA/FCB/Featherston Beautification Group to agree location, materials and design of supports for the signs. 30/06/20: Progress is being made on a licence to occupy the proposed location of the signs. 30/07/20: This is still with NZTA for a licence to occupy. 15/10/20: Still working through the solution with NZTA. 8/12/20: Awaiting final drawings from FBG to proceed. 15/02/21: Progress made as per chairs report to FCB 23 Feb 21 16/04/21: SWDC to pay for reinstatement of signs. We also need to allow for ongoing maintenance in our plans. NZTA have been provided all the info and are asking us to agree an MOU rather than a licence to occupy. Awaiting draft from them, which we'll share with the Beautification Group. Also now have approval we can reinstall the signs under the existing Resource Consent from the Planning team.
158	19-May-20	Resolution	K Neems	FCB RESOLVED (FCB 2020/15): 1. To receive the Applications for Financial Assistance Report. (Moved Bleakley/Seconded Cr Vickery) Carried 2. To grant Wairarapa Citizens Advice Bureau funding of $350 to support its day to day running costs. (Moved Bleakley/Seconded Cr Vickery) Carried 3. To grant South Wairarapa Neighbourhood Support funding of $200 to assist with the costs of funding a new promotional flag and collateral. (Moved Bleakley/Seconded Smith) Carried 4. To defer granting Featherston Community Centre funding to assist with the costs of its carpark development until Council has considered the proposed partnership agreement with Featherston Community Centre.	Actioned	15/10/20: Grant from Featherston Community Centre awaiting outcome of ownership proposal. 21/12/20: Letter sent to Featherston Community Centre seeking confirmation of whether would like to proceed with the grant application. 16/4/21: Grant for carpark development no longer required (refer to correspondence to FCB 27 Apr 21) and a new application has been submitted for consideration.
275	30-Jun-20	Action	FCB	Request Featherston Community Centre provides further details on the proposal for SWDC to take ownership of the building and carry out upgrades	Actioned	11/08/20: FCB suggested they meet with Featherston Community Centre and representatives from Council to consider a way forward. Workshop held 15 July 22/09/20: FCB undertook to arrange to meet with the Featherston Community Centre and Council officers to discuss the proposal in more detail. 21/12/20: Letter sent to Featherston Community Centre seeking confirmation of whether would like to proceed with the proposal. 16/04/21: Featherston Community Centre do not wish to pursue this project for now (refer to correspondence to FCB 27 Apr 21).
276	30-Jun-20	Action	FCB	Present the proposal to have a Māori name for Featherston as Paetumokai and a pou (carving) to the Māori Standing Committee	Open	16/04/21: No update
384	11-Aug-20	Action	FCB	To clarify the process of undertaking a two-stage engagement approach to the naming of Featherston Town Square	Open	22/09/20: Members undertook to discuss this in a workshop. 16/04/21: No update
683	15-Dec-20	Resolution	K Yates	FCB RESOLVED (FCB 2020/68): 1. To receive the report. (Moved Tahinurua/Seconded Bleakley) Carried 2. Adopt eight weekly cycle for Featherston Community Board 3. Adopt a 2021 schedule of ordinary meetings for Featherston Community Board. (Moved Smith/Seconded Tahinurua) Carried 4. Delegate to the Chief Executive the ability to alter the schedule of ordinary meetings in consultation with the Community Board Chair as required. 5. Delegate to the Chief Executive the authority to update clause 9.1.4 'Timing and Frequency' of the Community Board Terms of Reference. (Moved Tahinurua/Seconded Smith) Carried 6. Agree that the 2021 Featherston Community Board meeting start time will be 7:00pm. (Moved Smith/Seconded Bleakley) Carried	Actioned	23/02/21: Community Board Terms of Reference to be updated once all boards have agreed a meeting cycle for 2021. 16/04/21: Revised Terms of Reference published.
13	23-Feb-21	Resolution	K Yates	FCB RESOLVED (FCB 2021/02) that the minutes of the Featherston Community Board meeting held on 15 December 2020 be confirmed as a true and correct record subject to the correction of the minutes to record Claire Bleakley's vote against the motion under item 8.9 to adopt an eight-weekly cycle of meetings for the Featherston Community Board. (Moved Tahinurua /Seconded Bleakley) Carried	Actioned	3/3/21: Revised minutes published

Number	Raised Date	Action Type	Responsible Manager	Action or Task details	Status	Notes
16	23-Feb-21	Resolution	K Neems	FCB RESOLVED (FCB 2021/05) to: 1. Receive the Income and Expenditure Statement for the period 1 July 2020 – 31 January 2021. (Moved Tahinurua/Seconded Bleakley) Carried 2. Approve an additional $92.39, in addition to the $600 already approved, for the Featherston Christmas Parade Traffic Safety Plan. (Moved Cr Emms/Seconded Shepherd) Carried	Actioned	
17	23-Feb-21	Resolution	K Neems	FCB RESOLVED (FCB 2021/06): 1. To receive the Financial Assistance Report. (Moved Shepherd/Seconded Tahinurua) Carried 2. To approve funding Wairarapa Gateway Business Group $480 for the cost of webhosting for the Featherston community website. (Moved Bleakley/Seconded Tahinurua) Carried 3. To approve funding Featherston Information Centre $400 for running expenses of the Centre on the condition that the Centre discusses with the Board its future funding plans beyond the six-month period covered by this grant. (Moved Cr Emms/Seconded Bleakley) Carried 4. To decline funding Greytown Junior Football Club $500 to contribute to the costs of football goals due to the limited involvement of the Featherston community. (Moved Bleakley/Seconded Tahinurua) Carried	Actioned	16/04/21: Letters sent and commitments added to I&E
19	23-Feb-21	Resolution	K Yates / K Neems	FCB RESOLVED (FCB 2021/08): 1. To receive the Community Boards Conference 2021 Report. (Moved Shepherd/Seconded Tahinurua) Carried 2. To agree to fund one community board member to attend the 2021 Community Boards Conference with an associated commitment of up to $2,155, to be funded from the operating budget. (Moved Bleakley/Seconded Shepherd) Carried	Actioned	31/03/21: Bookings have been made for Sophronia Smith to attend and commitment added to I&E.
20	23-Feb-21	Resolution	K Neems	FCB RESOLVED (FCB 2021/09): 1. To receive the Chairperson Report. (Moved Tahinurua/Seconded Bleakley) Carried 2. To agree to contribute up to $2,225, funded from the Beautification Fund, towards the cost of manufacturing roll down blinds for the Featherston Town Square. (Moved Shepherd/Seconded Tahinurua) Carried Claire Bleakley abstained	Actioned	16/04/21: Commitment added to I&E
22	23-Feb-21	Action	FCB	Hold a Featherston Community Board workshop with Mike Gray to discuss the role of and opportunities for the future role of community boards	Open	16/04/21: Claire is meeting with Mike Gray to confirm a meeting date.

FEATHERSTON COMMUNITY BOARD

27 APRIL 2021

AGENDA ITEM 8.3

INCOME AND EXPENDITURE REPORT

Purpose of Report

To present the Community Board with the most recent Income and Expenditure Statements.

Recommendations

Officers recommend that the Community Board:

1. Receive the Income and Expenditure Statement for the period 1 July 2020 – 31 March 2021.

1. Executive Summary

The Income and Expenditure Statement for 1 July 2020 – 31 March 2021 is attached in Appendix 1. The Income and Expenditure Statement for 1 July 2019 – 30 June 2020 is attached in Appendix 2.

The Chair may ask Council officers for comment and all members may ask the Council officers for clarification and information through the Chair.

Appendices

Appendix 1 - Income and Expenditure Statement for 1 July 2020 – 31 March 2021

Appendix 2 - Income and Expenditure Statement for 1 July 2019 – 30 June 2020

Contact Officer: Tania Fine, Assistant Accountant
Reviewed By: Katrina Neems, Chief Financial Officer

Appendix 1 - Income and Expenditure Report for the period 1 July 2020 – 31 March 2021

Featherston Community Board

Income & Expenditure for the Period Ended 31 March 2021

Personnel & Operating Costs

Budget

Members' salaries		11,459.96
Mileage reimbursements		500.00
Operating expenses		6,944.00
Total Personnel & Operating Costs Budget 2020-21		**18,903.96**

Expenses

Personnel Costs				
	Members' Salaries			12,719.71
	Mileage reimbursements			1,079.59
	Honorarium payment to student rep ($50 per meeting)		400.00	400.00
Total Personnel Costs to 31 March 2021				**14,199.30**
Operating Expenses				
26/08/2020	Local Government NZ	Community board levy 2020/21		216.66
23/02/2021	One Community Board Member to attend 2021 CB Conference		2,040.00	2,040.00
Total Operating Expenses to 31 March 2021				**2,256.66**

Committted funds

Resolution date		Original commitment	Spent to date	Remaining commitment
	Members' Salaries	11,459.96	12,719.71	(1,259.75)
	Mileage reimbursements	500.00	1,079.59	-
23/02/2021	One Community Board Member to attend 2021 CB Conference	2,155.00	2,040.00	115.00
Total Commitments				**(1,144.75)**

TOTAL OPERATING EXPENSE BUDGET AVAILABLE* 3,592.75

* remaining budget for personnel and operating expenses does not carry over into subsequent financial years

Grants

Income

	Annual Plan 2020-21 grant allocation		4,343.00
	Other miscellaneous income	Trust contribution to Xmas parade	782.61
Total Income for 2020-21			**5,125.61**

LESS: Grants paid out

8/07/2020	Featherston Menz Shed	3-month wireless broadband			101.74
21/07/2020	Kurunui College	First aid, safety equipment			500.00
14/08/2020	Kidz Need Dadz	Father's Day Bowling			200.00
12/08/2020	Pae tū Mōkai o Tauira	Contribution to upgrade of outbuildings			500.00
12/08/2020	Wisdom & Wellbeing	Contribution to operating costs			500.00
3/09/2020	Featherston Phoenix	Advertising for Organic Week			40.00
31/08/2020	Lamb-Peters	Signs for Organic Week			170.00
12/08/2020	C A Bleakley	Costs for Featherston Organic Week			216.33
25/09/2020	Cross Creek Railway Society	New batteries for miniature train			500.00
25/09/2020	Featherston Netball Club	Uniforms			500.00
28/09/2020	Wharekaka Trust	Assistance with Meals on Wheels			500.00
30/10/2020	REAP (Fab Feathy)	Sights of Significance documentary			400.00
23/12/2020	South Wairarapa Neighbourhood Support	Promotional flag & collateral			200.00
7/12/2020	Shepherd Traffic Management	Traffic management for Xmas Parade			1,475.00
23/02/2021	Wairarapa Gatewy Business	Webhosting FSTN Community Website	480.00		480.00
22/09/2020	Featherston Xmas Parade	Traffic management	600.00	692.39	(92.39)
23/02/2021	Featherston Xmas Parade	Traffic management	92.39		92.39
Total Grants paid out to 31 March 2021					**6,283.07**

LESS: Committted Funds

Resolution date			Original commitment	Spent to date	Remaining commitment
12/03/2019	Featherston Junior FC	Equipment & coaching in schools	500.00		500.00
19/05/2020	Wairarapa Citizens Advice Bureau	Day to day running costs	350.00	-	350.00
19/05/2020	Wairarapa Maths Association	Annual maths competition 2019-20	300.00	-	300.00
19/05/2020	Wairarapa Maths Association	Annual maths competition 2020-21	300.00	-	300.00
19/05/2020	Wairarapa Maths Association	Annual maths competition 2021-22	300.00	-	300.00
30/06/2020	Featherston Menz Shed	3-month wireless broadband	117.00	101.74	15.26
11/08/2020	Featherston Organics	Organic Week - contribution to costs	500.00	426.33	73.67
22/09/2020	Featherston Xmas Parade	Running costs	300.00		300.00
23/02/2021	FSTN Information Centre	Running Costs	400.00		400.00
Total Commitments					**2,538.93**

PLUS: Balance Carried forward from previous year 6,028.65

TOTAL GRANTS FUNDS AVAILABLE 2,332.26

Featherston Community Board

Beautification Fund for the Period Ended 31 March 2021

Income

	Annual Plan 2020-21 allocation				10,710.00
Total Income 2020-21					**10,710.00**

Beautification grants - operating

22/10/2020	St Teresa's School	Science table at Donald's Creek			1,000.00
14/12/2020	OneSource Ltd	Two sets of 15 street flags			2,304.00
23/02/2021		Roll down blinds for FSTN Town Square	2,225.00		2,225.00
Total Beautification grants - operating to 31 March 2021					**5,529.00**

Beautification grants - capital

Total Beautification grants - capital to 31 March 2021					**-**

LESS: Committted Funds

Resolution date			Original commitment	Spent to date	Remaining commitment
15/12/2020	OneSource Ltd	Two sets of 15 street flags	2,610.00	2,304.00	306.00
Total Commitments					**306.00**

PLUS: Balance Carried forward from previous year	**17,139.00**
TOTAL BEAUTIFICATION FUNDS AVAILABLE	**22,014.00**

Appendix 2 - Income and Expenditure Report for the period 1 July 2019 – 30 June 2020

Featherston Community Board						
Income & Expenditure for the Period Ended 30 June 2020						
Income						
		Annual Plan 2019/20 allocation				28,053.00
	Total Income 2019/20					**28,053.00**
Expenditure						
		Members' Salaries				12,327.46
		Mileage reimbursements				691.06
	Total Personnel Costs					**13,018.52**
	General Expenses					
	31/07/2019	Sundry expenses ex payroll	Featherston Organic Week			499.82
	30/09/2019	Wairarapa Times	Advertising - Featherston Expo			296.00
	5/11/2019	Office Max	Stationary			9.92
	7/01/2020	Sundry expenses ex payroll				17.04
	Total General Expenses					**822.78**
Grants						
	18/07/2019	Featherston Clothing Collective				418.70
	1/07/2018	Hooper N	Painting workshop costs			500.00
	3/07/2018	The Featherston	Donation to RSA			100.00
	2/09/2019	Featherston Heritage Museum	Print brochures with new logo			500.00
	2/09/2019	Pae Tu Mokai O Tauira	Assist with new signage			500.00
	3/09/2019	Lamb-Peters Print	Wairarapa Moana Trails Group banner			418.00
	11/12/2019	The Featherston	Assist with painting exterior of building			500.00
	12/10/2019	Shepherd Traffic Mgmt Sol	Featherston Xmas Parade			695.00
	3/05/2020	Life Education Trust	Financial assistance			500.00
	23/03/2020	Featherston Lions	Dr Berry's Farewell			250.00
	9/06/2020	Citizens Advice	Day to day running costs			350.00
	30/06/2020	Wairarapa Mathematics Assoc.	Annual maths competition			300.00
	Total Grants					**5,031.70**
Capital Expenditure						
	Total Capital Expenditure					-
Total Expenditure						**18,873.00**
Net Surplus/(Deficit) Year to Date						**9,180.00**
LESS: Committted Funds						
	Resolution date			**Original commitment**	**Spent to date**	**Remaining commitment**
		Salaries to 30 June 2020*		16,266.00	12,327.46	3,938.54
		Mileage to 30 June 2020*		500.00	691.06	(191.06)
	12/03/2019	Featherston Junior FC	Equipment & coaching in schools	500.00		500.00
	25/02/2020	REAP (Fab Feathy)	Sights of Significance documentary	400.00		400.00
	25/02/2020	Kuranui College	First aid, safety equipment	500.00		500.00
	19/05/2020	South Wairarapa Neighbourhood Support	Promotional flag & collateral	200.00		200.00
	30/06/2020	Featherston Menz Shed	3-month wireless broadband	117.00		117.00
	Total Commitments					**5,464.48**
Current Year Surplus/(Deficit)						**3,715.52**
PLUS: Balance Carried forward from previous year						**6,717.35**
TOTAL FUNDS AVAILABLE						**10,432.87**
	** remaining budget for salaries & mileage does not carry over into subsequent financial years*					

Featherston Community Board						
Beautification Fund for the Period Ended 30 June 2020						
Income						
		Annual Plan 2019/20 allocation				10,710.00
	Total Income 2019/20					**10,710.00**
Expenditure						
	9/08/2019	One Source	Street flags			1,186.00
	Total Capital Expenditure - Beautification					**1,186.00**
Total Expenditure						**1,186.00**
Net Surplus/(Deficit) Year to Date						**9,524.00**
LESS: Committted Funds						
	Resolution date			**Original commitment**	**Spent to date**	**Remaining commitment**
	Total Commitments					**-**
Current Year Surplus/(Deficit)						**9,524.00**
PLUS: Balance Carried forward from previous year						**7,615.00**
TOTAL FUNDS AVAILABLE						**17,139.00**

APPLICATIONS FOR FINANCIAL ASSISTANCE

Purpose of Report

To present the Community Board with applications received requesting financial assistance.

Recommendations

Officers recommend that the Community Board:

1. *Receive the Applications for Financial Assistance Report.*
2. *Note that the application from Featherston Community Centre to assist with the costs of its carpark development has been withdrawn as funding has been sourced elsewhere.*
3. *Consider the application from Featherston Community Centre for funding of $1,500 for the cost of replacing old equipment and floor covering of the Featherston Community Centre toilets and restroom complex.*
4. *Consider the application from Featherston Booktown for funding of $820 for street flags and pull up banners for Featherston Booktown events.*

1. Executive Summary

The Community Board has delegated authority to make financial decisions within the confines of the allocated and available budget.

On 19 May 2020, Featherston Community Board considered a grant application from Featherston Community Centre requesting $1,500 to assist with its carpark development. The Board resolved to defer granting funding until Council had considered the proposed partnership agreement with Featherston Community Centre (FCB 2020/15).

The Community Board received correspondence on 10 March 2021 from the Featherston Community Centre advising funds for the carpark upgrades had been sourced through the Provincial Growth Fund (correspondence attached in Appendix 1). The Featherston Community Centre has submitted a new grant application for consideration.

An application has also been received from Featherston Booktown. The applications will be provided to members in confidence.

Applicant	Amount Requested
Featherston Community Centre	$1,500
Featherston Booktown	$820

2. Criteria

The criteria of the grant are:

To be eligible, applications must be from non-profit organisations that are benefiting the local Featherston community. All grants will be considered on a case by case basis and must list all funding raised at time of application. Grants are considered at every meeting throughout the year.

1. Applicants need not be incorporated bodies, but the Board must be satisfied that they are responsible organisations which will be fully accountable for any grants they receive, have relevance to the Community and do not qualify for Creative Communities New Zealand funding.

2. Successful applicants are required to expend grants received within six months of payment being made. A request must be made, should an extension of time be needed.

3. An accountability in report form, together with evidence of the expenditure of a grant received (copies of invoices or receipts) is required within three months of a grant being expended.

4. All questions must be completed.

5. **The maximum grant will be $500 unless special circumstances are considered to exist. (GST will be added to grants approved for GST registered applicants).**

6. Applications must reach the Council not less than ten days before the relevant Community Board is to consider an application.

7. Grant applications will be considered at every meeting.

4. Accountability Reports

Applicant	Status of Accountability Forms for Previous Grants
Featherston Community Centre	No outstanding accountability forms
Featherston Booktown	No outstanding accountability forms

5. Appendices

Appendix 1 – Correspondence from Featherston Community Centre

Contact Officer: Steph Dorne, Committee Advisor
Reviewed By: Harry Wilson, Chief Executive

Appendix 1 – Correspondence from Featherston Community Centre

Featherston Community Centre
14 Wakefield Street
Featherston

Featherston Community Board

10/03/2021

Attn: Mark Shepherd
Featherston Community Board
61 Waite Street
Featherston

Dear Mark

Thank you for your letter of Dec 21 2020, asking for an update on our requests for assistance from the Council via the Community Board.

We had presented a discussion document that proposed transferring ownership of the Featherston Community Centre-owned property at 14 Wakefield Street to the SWDC in return for an injection of funds from the Council-held proceeds from the sale of land in Fitzherbert Street.

Since then, we have received funding adequate for our needs from the provincial Growth Fund and so will not need to pursue this project for now.

In May, we made a request to the Community Board for funds to assist in upgrading our carpark, but now we have received adequate funding from the PGF, we would like to repurpose that request for $1500 to much-needed upgrades to our toilet and kitchen facilities.

Kind Regards

Paul Mason

Featherston Community Centre

paulm@featherstoncommunity.org.nz

FEATHERSTON COMMUNITY BOARD

27 APRIL 2021

AGENDA ITEM 9.1

NOTICE OF MOTION: ALTERNATIVES TO GLYPHOSATE BASED HERBICIDES

Motion

I, *Claire Bleakley*, move that the Featherston Community Board:

1. *Receive the information.*
2. *Recommend the Assets and Services Committee consider investigating alternatives to Glyphosate Based herbicides.*

1. Purpose

There is a need for council to consider the principles of harm to the environment, economic livelihoods and health of our communities. There is a strong correlation between the use of Glyphosate Based Herbicides and harm to all of the "Wellbeing" outcomes the SWDC Council is working toward.

2. Background

For the last few years we have had members of the public voicing their concerns over the use of Glyphosate Based Herbicides (GHB).

The distributor of an alternative herbicide product called "Local Safe" approached me to see if he could discuss the product with the community. A meeting of 25 community members was held at the ANZAC hall on 16 April 2021 at 2.30pm with Bruce Hore and Frank Getz from Contact Organics. They talked about their new product LocalSafe, a herbicide that can be safely used around the section, berms and playgrounds.

The products in the herbicide contain naturally occurring ingredients that are biodegradable, non-residual and non-toxic and a good alternative to the use of glyphosate. The first shipment of the product is expected to arrive in May 2021. Bruce will be sending up a test supply for the SWDC Amenities Manager to try on the various areas to show efficacy.

We need to move away from GBH as they are not only killing the soil, affecting the health of users but also good study showing harm to bumble bees. Also our honey has been returned by Japan due to high levels of GBH.

1. Studies have shown that long-term use kills the soil microorganisms affecting the growth and susceptibility of disease in plants.

   Glyphosate: Its Environmental Persistence and Impact on Crop Health and Nutrition.

   Although known to degrade relatively quickly in the soil following application, glyphosate and its metabolites can possibly persist in soil, water, and plant tissues in certain conditions. Research suggests that glyphosate may reach groundwater, surface water, and several other nontarget sites through processes such as leaching and surface runoff. It is also evident from several studies that glyphosate applied to cropping systems can potentially reach unintended areas and plant tissues through processes like off-target herbicide movement, spray drift, and root uptake.

   Kanissery, R., Gairhe, B., Kadyampakeni, D., Batuman, O., & Alferez, F. (2019). Glyphosate: Its Environmental Persistence and Impact on Crop Health and Nutrition. *Plants (Basel, Switzerland)*, *8*(11), 499. https://doi.org/10.3390/plants8110499

2. Economically there has been a disruption for the sale of honey to Japan, honey was rejected due to high levels of GBH. The South Wairarapa relies heavily on its honey production. The South Wairarapa has a large amount of apiaries many supplying commercial companies.

   Japan rejects NZ honey with traces of weed killer glyphosate Tina Morrison Apr 10 2021, https://www.stuff.co.nz/business/124578526/japan-rejects-nz-honey-with-traces-of-weedkiller-glyphosate

   "*Prior to this, a shipment of mānuka honey … was rejected in November last year, with a reading of 0.02ppm...Goodwin said how glyphosate got into honey was the bigger issue, and beekeepers, farmers and councils should be mindful of the use of glyphosate sprays".*

3. There is mounting evidence of chronic health effects affecting the health of workers and people using the sprays.

   What are the signs and symptoms of Round Up exposure?

   Initial Symptoms of Non-Hodgkin Lymphoma

   Some people have no initial symptoms of this disease. Others develop some of the following signs:

   - *Swollen lymph nodes in the armpits, neck, or groin, even if they do not hurt*
   - *Pain or swelling in the abdomen*
   - *Trouble breathing*
   - *Chest pain*

- *Coughing*
- *Fever*
- *Unexplained weight loss*
- *Night sweats*
- *Ongoing fatigue*

Although the malignant lymphocytes start in your lymph nodes, the cancer can spread to other aspects of the lymphatic system. These areas can include the tonsils, adenoids, spleen, bone marrow, lymphatic vessels, and thymus. Sometimes, non-Hodgkin lymphoma will migrate to other organs that are not part of the lymphatic system. https://www.tosifirm.com/defective-product-lawsuit-lawyer/roundup/what-are-the-signs-and-symptoms-of-roundup-exposure

4. Studies show serious decline in our pollinators, like bees, native ground based bees, and bumble bees.

"We found pesticides posed hazards to honey and wild bee species. However, pesticides were less likely to affect short-term visitation rates of honeybees compared with wild bee species. Thus, there is a need for changes in pesticide use at large spatial scales to reduce reliance on honeybees and maximize wild bee visitation to pollinator-dependent crops. We suggest that a multifaceted approach, involving collaborations between farmers, consumers and policymakers, will be fruitful to promote changes in pesticide use and wild bee pollinators."
Bloom, EH, Wood, TJ, Hung, K-LJ, et al. Synergism between local- and landscape-level pesticides reduces wild bee floral visitation in pollinator-dependent crops. *J Appl Ecol*. 2021; 00: 1– 12. https://doi.org/10.1111/1365-2664.13871

Bumble bees
Abstract:

- *Pollinators underpin global food production, but they are suffering significant declines across the world. Pesticides are thought to be important drivers of these declines. Herbicides are the most widely applied type of pesticides and are broadly considered 'bee safe' by regulatory bodies who explicitly allow their application directly onto foraging bees. We aimed to test the mortality effects of spraying the world's most popular herbicide brand (Roundup®) directly onto bumble bees Bombus terrestris audax.*
- *We used three Roundup® products, the consumer products Roundup® Ready-To-Use and Roundup® No Glyphosate, the agricultural product Roundup® ProActive, as well as another herbicide with the same active ingredient (glyphosate), Weedol®. Label recommended pesticide concentrations were applied to the bees using a Roundup® Ready-To-Use spray bottle.*
- *Bees exhibited 94% mortality with Roundup® Ready-To-Use® and 30% mortality with Roundup® ProActive®, over 24 hr. Weedol® did not cause significant mortality, demonstrating that the active ingredient, glyphosate, is not the cause of the mortality. The 96% mortality caused by Roundup® No Glyphosate supports this conclusion. Dose-dependent mortality caused by Roundup® Ready-To-Use, further confirms its acute toxicity. Roundup® products caused comprehensive*

matting of bee body hair, suggesting that surfactants, or other co-formulants in the Roundup® products, may cause death by incapacitating the gas exchange system.

- *These mortality results demonstrate that Roundup® products pose a significant hazard to bees, in both agricultural and urban systems, and that exposure of bees to them should be limited.*
- *Synthesis and applications. Surfactants, or other co-formulants, in herbicides and other pesticides may contribute to global bee declines. We recommend that, as a precautionary measure until co-formulant identities are made public, label guidelines for all pesticides be altered to explicitly prohibit application to plants when bees are likely to be foraging on them. As current regulatory topical exposure toxicity testing inadequately assesses toxicity of herbicide products, we call for pesticide companies to release the full list of ingredients for each pesticide formulation, as lack of access to this information hampers research to determine safe exposure levels for beneficial insects in agro-ecosystems.*
- Straw, EA, Carpentier, EN, Brown, MJF. Roundup causes high levels of mortality following contact exposure in bumble bees. *J Appl Ecol*. 2021; 00: 1–10. https://doi.org/10.1111/1365-2664.13867

3. Conclusion

I ask that the council write a report on the alternatives. Cost not being a factor as the repercussions on the use of GBH are socialised.

I ask that consideration of the Contact Organics Local Safe is also evaluated in relation to the use of sprays in the district playgrounds, child friendly places and local parks and reserves.

4. Appendices

Appendix 1 – Research Article: Roundup causes high levels of mortality following contact exposure in bumble bees

Appendix 2 – Research Article: Synergism between local-and landscape-level pesticides reduces wild bee floral visitation in pollinator-dependent crops

Appendix 3 – Research Article: Glyphosate: Its Environmental Persistence and Impact on Crop Health and Nutrition

Appendix 1 - Research Article: Roundup causes high levels of mortality following contact exposure in bumble bees

Received: 28 September 2020 | Accepted: 24 February 2021

DOI: 10.1111/1365-2664.13867

RESEARCH ARTICLE

Journal of Applied Ecology BRITISH ECOLOGICAL SOCIETY

Roundup causes high levels of mortality following contact exposure in bumble bees

Edward A. Straw | Edward N. Carpentier | Mark J. F. Brown

Centre for Ecology, Evolution & Behaviour, Department of Biological Sciences, School for Life Sciences and the Environment, Royal Holloway University of London, Egham, UK

Correspondence
Edward A. Straw
Email: EdwardAStraw@gmail.com

Funding information
Horizon 2020 Framework Programme, Grant/Award Number: 773921

Handling Editor: Ian Kaplan

Abstract

1. Pollinators underpin global food production, but they are suffering significant declines across the world. Pesticides are thought to be important drivers of these declines. Herbicides are the most widely applied type of pesticides and are broadly considered 'bee safe' by regulatory bodies who explicitly allow their application directly onto foraging bees. We aimed to test the mortality effects of spraying the world's most popular herbicide brand (Roundup®) directly onto bumble bees *Bombus terrestris audax*.
2. We used three Roundup® products, the consumer products Roundup® Ready-To-Use and Roundup® No Glyphosate, the agricultural product Roundup® ProActive, as well as another herbicide with the same active ingredient (glyphosate), Weedol®. Label recommended pesticide concentrations were applied to the bees using a Roundup® Ready-To-Use spray bottle.
3. Bees exhibited 94% mortality with Roundup® Ready-To-Use® and 30% mortality with Roundup® ProActive®, over 24 hr. Weedol® did not cause significant mortality, demonstrating that the active ingredient, glyphosate, is not the cause of the mortality. The 96% mortality caused by Roundup® No Glyphosate supports this conclusion. Dose-dependent mortality caused by Roundup® Ready-To-Use, further confirms its acute toxicity. Roundup® products caused comprehensive matting of bee body hair, suggesting that surfactants, or other co-formulants in the Roundup® products, may cause death by incapacitating the gas exchange system.
4. These mortality results demonstrate that Roundup® products pose a significant hazard to bees, in both agricultural and urban systems, and that exposure of bees to them should be limited.
5. *Synthesis and applications*. Surfactants, or other co-formulants, in herbicides and other pesticides may contribute to global bee declines. We recommend that, as a precautionary measure until co-formulant identities are made public, label guidelines for all pesticides be altered to explicitly prohibit application to plants when bees are likely to be foraging on them. As current regulatory topical exposure toxicity testing inadequately assesses toxicity of herbicide products, we call for pesticide companies to release the full list of ingredients for each pesticide formulation,

as lack of access to this information hampers research to determine safe exposure levels for beneficial insects in agro-ecosystems.

KEYWORDS
bees, contact toxicity, herbicide, inert ingredient, pesticide, roundup, surfactants, topical toxicity

1 | INTRODUCTION

Bees provide the crucial ecosystem service of pollination (Potts et al., 2016), but are under threat, with 37% of EU bee species with known trends exhibiting population declines (Nieto et al., 2014). One apparent cause of these declines is pesticides (McArt et al., 2017; Rundlöf et al., 2015; Woodcock et al., 2016). Pesticide usage is pervasive, with 4.1 billion kilograms of active ingredient applied globally in 2017, nearly double the amount used in 1990 (FAOSTAT, 2019). Pesticides have received significant attention from the public and policymakers due to their apparent detriment to non-target organisms, such as pollinators, but this attention has largely focused on insecticides. A recent systematic review found that only 29 studies had tested the effects of herbicides on bees (Cullen et al., 2019). Additionally, research into herbicides relative to insecticides is disproportionate to their usage, with, for example, 24 times more herbicide applied in the United Kingdom than insecticide in 2018 (FERA, 2019).

For most classes of pest, pesticide usage varies by crop and region, with a range of active ingredients being employed (Garthwaite et al., 2016a,b). However, herbicides are unique in that one substance, glyphosate, is applied at a far greater rate than any alternative (FERA, 2019). In 2014, 826 million kilograms of glyphosate were applied globally (Benbrook, 2016), accounting for around 20% of all pesticide application (Benbrook, 2016; FAOSTAT, 2019). Glyphosate (applied in products called glyphosate-based herbicides—GBHs) has a favourable toxicity profile as a broad-spectrum herbicide, being the only herbicide to target the shikimate pathway (Duke, 2018). Its low toxicity to the majority of non-target organisms (EFSA, 2015a), has led to most regulatory regimes placing minimal restrictions on its application (Beckie et al., 2020). Bee exposure to glyphosate is poorly characterised, although it is known to be extensive, with surveys finding that 59% of honey samples had glyphosate present above the limit of detection, with a mean of 64 ppb (Rubio et al., 2014).

High acute doses (oral and contact) of glyphosate, applied as the active ingredient (glyphosate) alone, or in a single representative formulation (MON 52276 commercially called Roundup® Bioflow in Italian markets (EFSA, 2015b; Mesnage et al., 2021), do not cause mortality in honeybee workers (EFSA, 2015b). Consequently, it has passed lower tier testing in the United States and Europe, facilitating its approval in both territories. However, GBHs contain additional components, called co-formulants, that can have serious, but systematically underestimated risks (Cox & Surgan, 2006; Mesnage & Antoniou, 2018; Mullin et al., 2016).

Co-formulants are chemical additives that increase the efficiency of the active ingredient (Hazen, 2000). Without co-formulants, pesticide formulations would be much less effective (Hazen, 2000), and more active ingredient would need to be applied, potentially leading to more environmental damage. Most co-formulants are considered 'inert' by regulatory bodies, and thus are not subject to equivalent testing to active ingredients. Consequently, there are no requirements to test their toxicity to bees (EC, 2009), meaning that potentially toxic substances are used abundantly (Cox & Surgan, 2006; Mullin, 2015; Mullin et al., 2015). As they are not tested for in food or environmental residue monitoring programmes (Mesnage et al., 2019), our understanding of their prevalence and environmental fate is highly limited. Bee exposure to these co-formulants is likely commensurate to that of active ingredients but is poorly studied.

While our understanding of co-formulant exposure is limited, studies of hazard (i.e. the damage they cause) are more informative. Nagy et al. (2019) reported that 24 of 36 studies showed formulations to be more toxic in non-target organisms than active ingredients alone. In human cell lines and rats, Roundup® products specifically were more toxic than the active ingredient alone in five of six studies, with just one study finding equivalent toxicity (Nagy et al., 2019). While only one formulation per active ingredient is typically submitted to the full range of toxicity tests in the EU (EFSA, 2015a), dozens of formulations per active ingredient are produced, each with a unique composition posing unique hazards to non-target organisms (Mesnage et al., 2019). For glyphosate in the United Kingdom there are 284 distinct consumer or agricultural formulations (Health & Safety Executive UK, 2020), making it the most formulation diverse AI in the United Kingdom. Co-formulants present in Roundup® have been found to have sub-lethal effects in human cell lines (Defarge et al., 2016; Mesnage et al., 2013), demonstrating that they present a relevant hazard to health, although almost nothing is known of their effects on bees (Mullin, 2015; Mullin et al., 2015). One class of co-formulants, surfactants (surface acting agent), were found in 100% of American honey, pollen and beeswax samples (n = 27; Chen & Mullin, 2014), demonstrating their pervasiveness.

Surfactants in herbicides like Roundup® spread the sprayed droplets out over target leaves, increasing glyphosate absorption and toxicity. Surfactants are major co-formulants in Roundup® products, typically accounting for 15% of the concentrated weight (Mesnage et al., 2019). Surfactants are environmental pollutants that have been shown to have a range of negative impacts on honey bees (Ciarlo et al., 2012; Fine et al., 2017; Goodwin & McBrydie, 2000; Moffett & Morton, 1973, 1975) and solitary bees (Artz & Pitts-Singer, 2015).

In agriculture, direct spraying of insecticides onto bees, or bee attractive flowers, is banned as part of their mitigation strategy (EFSA, 2013) in order to prevent bees contacting the pesticide as it is

being sprayed, or the residues on flowers after it is sprayed. No such restrictions apply for herbicides, with the Environmental Information Sheet for Roundup® ProActive stating "Roundup ProActive is of low toxicity to honeybees; there is no requirement to avoid application of the product when bees are foraging on flowering weeds in treated crops" (Roundup® ProActive Environmental Information Sheet, 2020). Consequently, with both glyphosate and the co-formulants/surfactants in GBHs being considered safe by regulators (EFSA, 2015a), there should not be lethal effects from GBHs when used following label guidelines. Abraham et al. (2018) however, found significant mortality through indirect exposure to a GBH, Sunphosate 360 SL (Zhejiang Xinan Chemical Industrial Group, Zhe-jiang, China), which is a generic GBH available in Ghana. The study found that honeybees *Apis mellifera* and stingless bees *Hypotrigona ruspolii* exposed to the formulation via a branch of a flowering tree *Senna siamea* that had previously been sprayed with Sunphosate 360 SL suffered 28% and 23% mortality respectively, which was significantly higher than the 4% and 6% mortality for the water control. As glyphosate does not cause such mortality via contact or oral exposure (EFSA, 2015b), the mortality seen in this experiment is likely to be driven by co-formulants.

Risk assessment of the threat a pesticide poses to bees relies on the Risk = Hazard × Exposure model, where Hazard is a measure of toxicity, and Exposure is a measure of environmental contact. GBHs are currently believed to combine low to no hazard and high exposure, because they can be directly applied to bees, making them low to intermediate risk. Here we test how hazardous a range of GBHs, including Roundup® products are to bumble bees. We use a study design that can distinguish between the effects of co-formulants and the active ingredient, to allow us to test how these factors affect mortality. We predict that the GBHs will cause moderate mortality with direct exposure, in line with Abraham et al. (2018).

2 | MATERIALS AND METHODS

Ten commercial bumble bee, *Bombus terrestris audax*, colonies were used in the experiments (Agralan). On arrival 10 workers per colony were removed and their faeces screened for micro-parasites. No infections were detected, and all colonies were thus retained in the experiment.

In all experiments over 50 bees were exposed per treatment (excluding the control treatment in Experiment 4) in groups of five or six, as detailed in Table S2. Bees were sprayed in groups for efficiency and because an even coating could still be achieved with this number of bees in a box. For each experiment multiple source colonies were used to account for inter-colony variation, allocating them evenly across treatments. Workers were moved from source colonies into clear acrylic boxes (6.7 × 12.7 × 4.9 cm), with a plastic mesh grate bottom (6.7 × 7.3 cm). Within each box, bees were only taken from one source colony and were left to acclimatise for 10 min prior to exposure.

A mortality check was carried out prior to exposure. Mortality was defined as any moribund bee being entirely unresponsive to physical agitation with a pair of forceps. Following this, the acrylic box was sprayed in a X shape from corner to corner with two squeezes of the trigger of a Fast Action Roundup® Ready-To-Use bottle (Roundup® Ready-To-Use; total exposure = 1.327 ± 0.005 ml *SE*); the spray came out as a cone of droplets which ensured consistent and even coverage across the whole box. This amount was chosen to ensure the bees were evenly coated while keeping control mortality <10%, pilot work found this methodology to deliver the treatment evenly to all bees sprayed when visually assessed. Roundup® Ready-To-Use and Roundup® No Glyphosate are sold in these spray bottles, and Weedol® in a similar bottle. Bees were sprayed under red light to prevent flying, we did not attempt to influence their behaviour beyond this, and they were exhibiting normal resting behaviour when sprayed. This methodology is not designed to replicate field realistic exposure (spraying conditions or label recommended application rates), it is instead designed to assess the lethality (hazard) the herbicide products pose to bumble bees. One investigator performed the spraying and mortality checks. A series of practice sprays were performed to ensure consistency. Mortality was recorded immediately after spraying, and at 10, 20 and 30 min. After 30 min a source of sucrose (50% w/w) and small portion of pollen (1-2 g) was added. At 24 hr post-exposure mortality was recorded for a final time. Boxes that flooded due to sugar water spillage between 30 min and 24-hr observations were excluded ($n = 2$, both in Experiment 2, Control), as were individual bees who drowned themselves in the sucrose gravity feeder ($n = 1$, Experiment 5, Control).

We used a total of four herbicide products across our experiments. Fast Action Roundup® Ready-To-Use (MAPP 14481; henceforth referred to as Roundup® Ready-To-Use), Roundup® Speed Ultra (MAPP 18692; henceforth referred to as Roundup® No Glyphosate; both Scotts Miracle-Gro Company, Surrey, UK under licence from Monsanto, Cambridge, UK), and Weedol® Gun! Rootkill Plus (MAPP 14554; henceforth referred to as Weedol®, Scotts Miracle-Gro Company, Surrey, UK) are all consumer products that can be bought in supermarkets. Consumer products require no licence or training in the United Kingdom and are intended for garden use. Roundup® ProActive (MAPP 17380, Monsanto, Cambridge, UK) can be bought online without a licence in the United Kingdom, but a licence is required to spray the substance in agriculture or horticulture (Roundup® ProActive Label, 2019). All products were purchased in 2019 online or in person in the United Kingdom (full details of all products used are provided in Table S1). Table 1 shows the glyphosate and other active ingredient concentrations, as reported on the product labels, and the dilutions for the test solutions used across experiments. For pre-mixed consumer products, we used the concentration as sold, or diluted it further as in Experiments 2 and 3. For the agricultural product Roundup ProActive we used field realistic concentrations of the treatment solutions, with the product diluted as directed on the label to produce a concentration equivalent to that used in agricultural spraying. This is distinct from the rate of application, which is the amount of substance applied per area, typically expressed

TABLE 1 The concentrations of the products used, based on the amount of water added to dilute them to, or below, label concentrations, and respective glyphosate concentrations. Concentrations of other active ingredients present in formulations given in parentheses

Experiment	Treatment	Product concentration used (%)	Glyphosate concentration g/L
All	Control	0	0.0
1	Roundup® Ready-To-Use	100	7.2
1	Roundup® ProActive	6.25	22.5
2	Roundup® Ready-To-Use 50%	50	3.6
3	Roundup® Ready-To-Use 25%	25	1.8
4	Weedol®	100	7.2 (0.02 g/L pyraflufen-ethyl)
5	Roundup® No Glyphosate	100	0.0 (60 g/L acetic acid)

as AI g/ha or L/ha of a pesticide mixture. We did not attempt to replicate field realistic application rates for the agricultural product Roundup ProActive for the following reasons. While we know the application rates for this product based on ground surface area (from 1 to 6 L/ha of formulation, 0.6%–33% product concentration and 10-400 L/ha of mixed solution), the exposure, or application rate on bees will be a function of the height from which the product is sprayed, the height of either crop or weed flowers and the height at which bees are present when the product is applied (which may be either the same as the flowers, or above or below this if bees are flying between flowers). As each of these factors will vary both within crops, and from crop to crop, and as the only one for which good data exist are crop height, it is currently impossible to extrapolate from surface area application rate to bee exposure. Similarly, in the absence of label guidance on application rates for consumer products, we cannot compare our exposure to usage in gardens. Fundamentally, our experiment was designed to enable the detection of hazardous effects from substances previously reported to be non-hazardous. More complex designs using field realistic apparatus and application rates could determine the risk these substances pose.

Controls throughout were pure distilled water and were sprayed from an identical Roundup® Ready-To-Use bottle at room temperature. Both the Weedol® and Roundup® products tested (Experiments 1 and 2) contain glyphosate at equivalent concentrations. Because Weedol® is likely to have a different co-formulant composition to the Roundup® products it served as a glyphosate control. A series of five independent experiments were conducted to answer the following questions:

Experiment 1: Are the impacts of consumer and agricultural Roundup® products comparable?

Bumble bees in three treatment groups were sprayed with either the consumer product Roundup® Ready-To-Use (at its pre-mixed concentration), the agricultural product Roundup® ProActive at the highest label recommended concentration of 6.25%, which covers a range of applications, or the water control.

Experiment 2: Does mortality still occur with a 1:1 dilution of consumer Roundup®?

Bumble bees in two treatment groups were sprayed with either the consumer product (Roundup® Ready-To-Use) diluted 1:1 with pure distilled water, or the water control.

Experiment 3: Does mortality still occur with a 1:3 dilution of consumer Roundup®?

Bumble bees in two treatment groups were sprayed with either the consumer product (Roundup® Ready-To-Use) diluted 1:3 with pure distilled water, or the water control.

Experiment 4: Does an alternative GBH (Weedol®) cause mortality?

Bumble bees in two treatment groups were sprayed with either the generic consumer product GBH Weedol® at its pre-mixed concentration, or the water control.

Experiment 5: Does the Roundup® formulation without glyphosate cause mortality?

Bumble bees in two treatment groups were sprayed with either the consumer product (and GBH alternative) Roundup® No Glyphosate at its pre-mixed concentration, or the water control.

All statistical analyses were carried out in 'R' programming software version 3.6.2 (R Core Team, 2019). Plots were produced using the package GGPLOT2 version 3.2.1 (Wickham, 2016) and SURVMINER version 0.4.6 (Kassambara et al., 2019). Mixed effects Cox proportional hazards models were used to analyse mortality, utilising 'survival' version 3.1-8 (Therneau, 2020a), 'coxme' version 2.2-16 (Therneau, 2020b) and 'MuMIn' version 1.43.17 for model averaging (Bartoń, 2020). AIC model simplification was used, with model averaging where no single model had ≥95% AIC support. The candidate set of models was chosen by adding the next best supported model until a cumulative ≥95% support was reached. Parameter estimates and 95% confidence intervals are reported. The full model used was (Survival ~ Treatment + Colony of Origin + (1|Box ID)). There was no correlation between variables. For comparisons between Roundup® Ready-To-Use concentrations in Experiments 2 and 3 Colony of Origin was not included as a variable, as it correlated with Treatment owing to different colonies being used for each experiment. Consequently, the final model was (Survival ~ Treatment + (1|Box ID)). Model parameters, AIC weights and final models are presented in Tables S3. Proportionality of hazards was checked for each

experiment to validate the Cox proportional hazards assumption, where this was violated (Experiments 4 and 5) a Chi-squared test of Independence was used with the model (Survival ~ Treatment).

3 | RESULTS

3.1 | Experiment 1: Comparing the impacts of consumer and agricultural Roundup® products

There was a significant difference in mortality between both Roundup® products (Ready-To-Use and ProActive) and the control (Cox proportional hazards model: parameter estimate (PE) = 5.17, 95% CI [3.52-6.82], and PE = 2.18, 95% CI [0.52-3.84] respectively), with 94% and 30% mortality respectively compared to 4% mortality in the control treatment (Figure 1). There was also a significant difference between Roundup® Ready-To-Use and Roundup® ProActive (Cox proportional hazards model: (PE) = 2.95, 95% CI [1.93-3.96]), with the Roundup® Ready-To-Use causing faster and higher mortality. Of the Roundup® Ready-To-Use treated bees, 38% died immediately after exposure compared to just 7% of Roundup® ProActive and 0% of control bees. Ad hoc behavioural observations also noted bees in all Roundup® treatments spent considerable time self-grooming after exposure. This may have been in response to, and potentially exacerbated, the matting of bee body hair that can be seen in Figure 4.

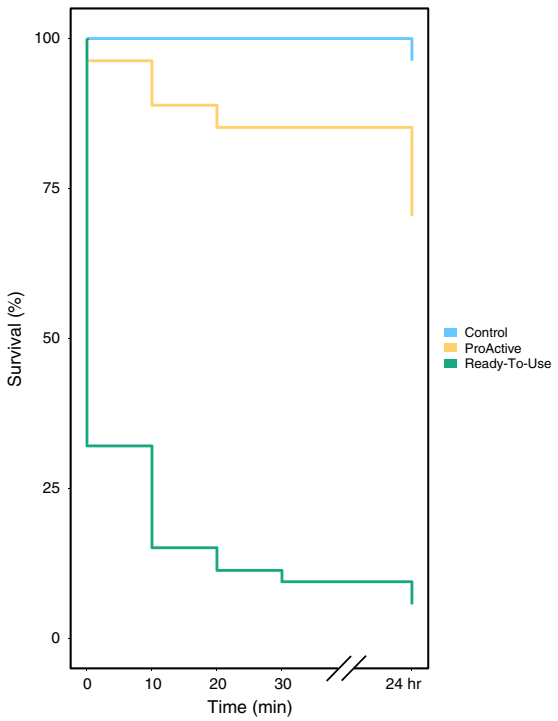


FIGURE 1 Experiment 1: Comparing the impacts of consumer and agricultural Roundup® products against the control, demonstrating high mortality with the Ready-To-Use treatment and intermediate mortality with the ProActive treatment

3.2 | Experiment 2: Does mortality still occur with a 1:1 dilution of consumer Roundup®?

The half strength Roundup® Ready-To-Use solution significantly increased mortality (Chi-squared test of Independence: $\chi^2 = 78.26$, $p < 0.0001$), with 98% mortality respectively compared to 3% mortality in the control treatment (Figure S1).

3.3 | Experiment 3: Does mortality still occur with a 1:3 dilution of consumer Roundup®?

The quarter strength Roundup® Ready-To-Use solution also produced significantly higher mortality than the control (Chi-squared test of Independence: $\chi^2 = 47.16$, $p < 0.0001$), with 78% mortality as opposed to 8% mortality in the control treatment (Figure S2). However, the mortality was less than either half or full strength (98% and 94% respectively; Figure 1; Figures S1 and S2). Furthermore, the mortality was delayed with only 10% of bumble bees dying within 30 min.

There was a significant difference between full-strength and both half and quarter-strength Roundup® Ready-To-Use solutions in their effects on mortality (Cox proportional hazards model: (PE) = 1.23, 95% CI [0.766-1.70], and 2.33, 95% CI [1.54-3.20] respectively), with the highest and fastest mortality in the whole strength treatment, followed by the half strength.

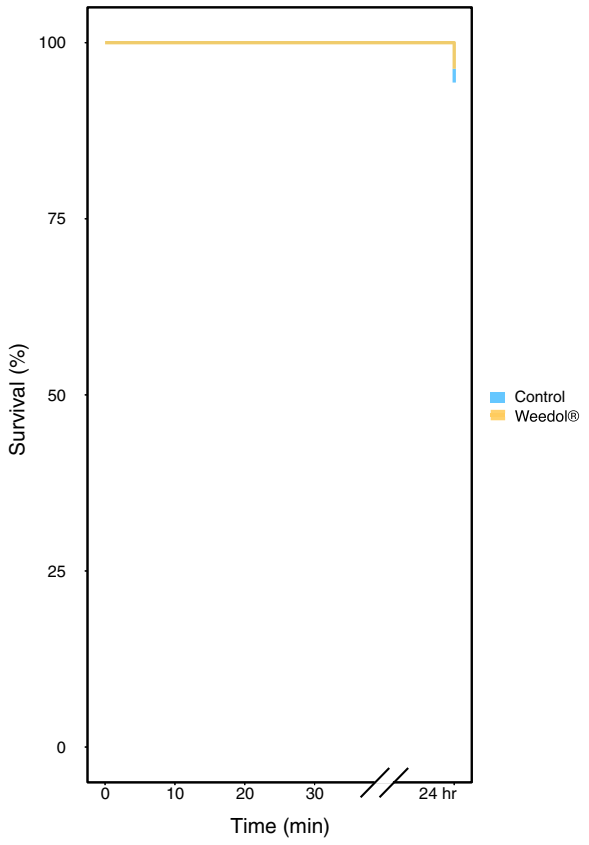


FIGURE 2 Experiment 4: Consumer product, and GBH alternative, Weedol® does not cause mortality relative to the control

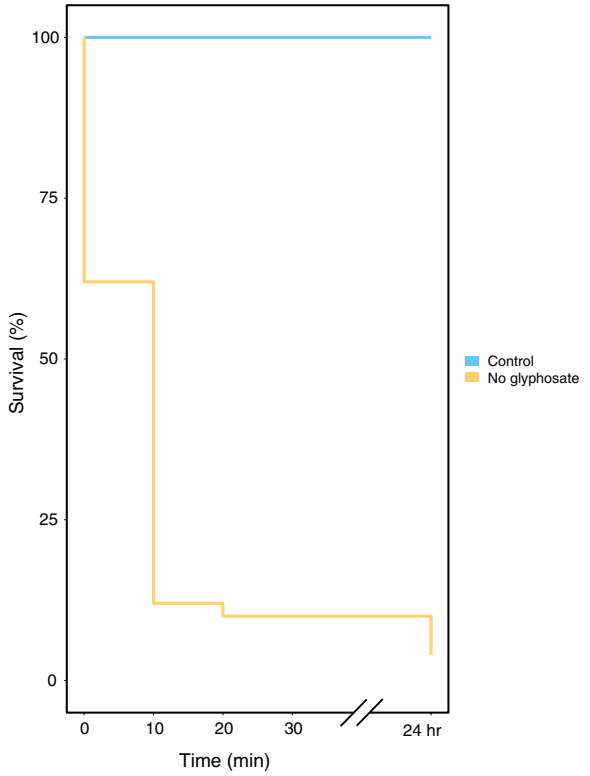


FIGURE 3 Experiment 5: The consumer product, and alternative to GBHs, Roundup® No Glyphosate causes high mortality

3.4 | Experiment 4: Does an alternative GBH (Weedol®) cause mortality?

Weedol® did not cause a significant difference in mortality relative to the control.

(Chi-squared test of Independence: $\chi^2 = 0.00$, $p = 0.983$), with 4% and 6% mortality respectively (Figure 2).

3.5 | Experiment 5: Does the roundup® formulation without glyphosate cause mortality?

Roundup® No Glyphosate produced significantly higher mortality than the control (Chi-squared test of Independence: $\chi^2 = 87.51$, $p < 0.0001$), with 96% mortality respectively compared to 0% mortality in the control treatment (Figure 3).

4 | DISCUSSION

Our results are the first to show that contact exposure to either consumer or agricultural Roundup® products at label recommended concentrations can cause high levels of mortality in bumble bees. The consumer product Roundup® Ready-To-Use caused 94% mortality at the pre-mixed concentration, and still caused significant mortality at a quarter strength. The agricultural product Roundup® ProActive also caused significant mortality, although over a longer time period. Interestingly, Roundup® No Glyphosate caused 96% mortality while the generic GBH Weedol® did not significantly increase mortality. Together, this demonstrates that the co-formulants in these Roundup® products, not the active ingredient glyphosate, are driving mortality. We suggest that the mechanism driving this mortality may be surfactants in the formulations blocking the tracheal system of the bees, which is essential for gas exchange. Given the hazard demonstrated here with all tested Roundup® products, and the extensive exposure of bees to such GBHs world-wide, GBHs may pose a high risk to bees, and thus may be an as yet unidentified driver of the bee declines that are occurring around the globe.

At a quarter strength, the consumer product Roundup® Ready-To-Use still caused 78% mortality, demonstrating that the formulation is sufficiently toxic to cause mortality despite being 75% water. The dose dependency shown in our experiments confirms the products' toxicity and aids our understanding of how to use them safely. At a quarter strength the mortality seen is equivalent to the double strength Sunphosate 360 SL used in Abraham et al. (2018), suggesting that Roundup® Ready-To-Use would also cause indirect contact mortality as even exposure to a severely reduced concentration caused high mortality. While consumer herbicides are unlikely to be applied directly to bees, they are likely to be applied to bee-attractive weeds which could drive mortality, with the Roundup® Ready-To-Use label even advising 'Treat established perennial weeds at the start of flowering to give best results' (Roundup® Ready-To-Use Label, 2019). Consequently, label restrictions should explicitly caution against application to flowering plants. While the agricultural product Roundup® ProActive requires a licence to spray, and has clear label instructions, the product label of Roundup® Ready-To-Use has no guidance pertaining to bees. A first step should be to amend household product labels to reflect the hazard posed to bees. Finally, whether consumers need access to potent pesticides, especially when nearly half of consumers either do not follow or take no notice of label recommendations (Grey et al., 2005), requires revisiting by policymakers; consumer pesticide products should not be overlooked in policy initiatives to reduce pesticide use.

The consumer product Roundup® Ready-To-Use caused more and faster mortality than the agricultural product Roundup® ProActive, but the latter still caused 30% mortality over 24 hr. The Material Safety Data Sheet (MSDS) for Roundup® ProActive MSDS (2020) lists Nitroryl (CAS no. 226563-63-9) and Alkylpolyglycoside (CAS no. 68515-73-1) as ingredients, possibly acting as a surfactants (US Patent 20100113274A1, 2010; US Patent 5266690A, 1993), although we do not know what, or if, other surfactants are in the formulation. If these substances are driving the mortality in the Roundup® ProActive treatment, this would be concerning as they are common in recently introduced products (Mesnage et al., 2019). We would suggest that the topical toxicity of these substances be assessed by regulatory agencies, to allow judgement to be made on their safety for inclusion in products bees are exposed to. This Roundup® ProActive driven mortality is in contrast to the guidance in the product's UK Environmental Information Sheet stating, "Roundup ProActive is of low toxicity to honeybees; there is no requirement to avoid application

of the product when bees are foraging on flowering weeds in treated crops" (Roundup® ProActive Environmental Information Sheet, 2020). This means that on-label guidance explicitly allows application directly onto bees, along with spraying onto flowering weeds, which are frequently visited by bees (Wood et al., 2019). This means that the exposure bees will face is incredibly high, with no attempt being made to mitigate their exposure. Furthermore, in the United States, Roundup® products can be directly applied to genetically modified glyphosate resistant (Roundup® Ready) crops, in order to knockdown weeds growing among the crop (Roundup® Ready Plus Information Sheet, 2020). For Roundup® Ready Soybeans this includes allowing application to the crop during flowering (Roundup® Ready Plus Information Sheet, 2020). As soybean flowers are an attractive floral resource for bees (EFSA, 2013), this will lead to direct exposure of bees to Roundup® products, which we have shown can drive significant mortality. Exposure through such herbicide tolerant crops is likely to be significantly higher than through flowering weeds, with herbicide tolerant soybeans covering 84.5 million hectares globally in 2014 (James, 2014 cited in Benbrook's, 2016, Supporting Information). Agricultural labels should preclude application to flowering plants or bees to reduce exposure.

Previous studies have examined the contact toxicity of surfactant adjuvants and Roundup® products. Results vary for studies testing similar surfactant spray adjuvants, with Goodwin and McBrydie (2000) finding 100% mortality below label recommended concentrations, while Donovan and Elliott (2001) found no mortality even in their highest treatments. This is likely explained by the different methodologies, with the former using a Potter spray tower which is close to field realistic spray conditions and the latter using pipette application using OECD 214 (OECD, 1998). Following OECD 214 1–2 μl of a solution is pipetted onto the backs of anaesthetised bees and then mortality assessed for 48 hr (OECD, 1998). This protocol is appropriate to assess the toxicity of AI, particularly potent insecticides, but inappropriate for assessing the toxicity of more dilute surfactant solutions. Due to EU law protecting co-formulant composition (EC, 2009), we do not know if the components of the adjuvants used in either study are present in any of the formulations tested here.

Our study diverges from the previously described results of Abraham et al. (2018) by using direct application onto bees, rather than indirect exposure (spraying flowers for the bees to then visit). We also used bumble bees, not honeybees or stingless bees, and still found high mortality suggesting the effects of GBH formulations on bees is widespread. The results presented here expand our understanding of how GBH formulations can cause mortality through contact exposure by isolating the co-formulants as driving the mortality and suggesting a mechanism behind the mortality. Recent work suggests similar mortality impacts in honey bees using a different Roundup® formulation (Motta et al., 2020).

The only regulatory studies of contact mortality with GBHs have used honey bees and the protocol OECD 214 (see above, OECD, 1998). This protocol does not accurately assess contact toxicity for formulations like Roundup® products, which can be sprayed directly onto bees. Regulatory testing should assess the contact toxicity of all formulations prior to approval/renewal using more field realistic methodologies than OECD 214, incorporating label recommended spraying apparatus and concentrations.

Our results clearly show that Weedol® does not produce higher mortality than the water control, and together with results from regulatory assessments (EFSA, 2015b), this confirms that the mortality seen in our experiments is not driven by glyphosate. This is supported by the findings of Motta et al. (2020), who found spraying honeybees with glyphosate did not cause mortality. Furthermore, Roundup® No Glyphosate caused 96% mortality, which demonstrates that the co-formulants in Roundup® products are toxic, and that the mortality we see does not derive from an interaction between co-formulants and glyphosate. This is encouraging, as it indicates the mortality could be eliminated entirely with a change to the co-formulants, without affecting the active ingredient content. The contrast between Weedol® and Roundup® products, which both use glyphosate as their active ingredient, demonstrates that co-formulants and formulations as well as active ingredients should be tested and regulated individually. This is especially true as active ingredient registrations have been greatly outstripped by novel formulation production, as pesticide manufacturers improve the efficiency of their products through changes to their co-formulants (Green & Beestman, 2007). That two of the three GBH's tested here produced significant mortality is concerning given that there are 281 other GBH's currently licenced for use in the United Kingdom.

The three Roundup® substances tested produced significant mortality, which shows that the current regulatory testing for contact toxicity is inadequate to detect mortality effects. While the testing performed here was not agriculturally field realistic, it highlights that these products pose a legitimate hazard that requires risk assessment through field realistic testing. These results contradict the regulatory assessment that GBHs are entirely bee-safe and do not require mitigation measures. Finally, for each active ingredient only a single representative formulation is mandated for testing at an EU level (EFSA, 2013). The only contact toxicity testing on bees with whole formulations presented in the EFSA, 2015 renewal assessment report is on the original version of Roundup® (MON 2139) in 1972 and the representative formulation Roundup® Bioflow (MON 52276), which lacks the alkylamine ethoxylates common in other GBH's, instead using a quarternary ammonium compound (EFSA, 2015b).

While we have not explicitly tested the mechanism through which this mortality is generated, we suggest that the surfactants in the formulations are interfering with the action of the spiracles, or tracheal system more broadly. Insects conduct gas exchange through the tracheal system, with spiracles (surface holes on the thorax and abdomen) enabling airflow into the tracheal system, and the tracheae carrying air to tissues and cells where gas exchange occurs (Bailey, 1954). Our observations show that the Roundup® products are spreading the formulation over the surface of the bumble bees, possibly limiting gas exchange. This spread may have been exacerbated by the self-grooming behaviour observed in the Roundup® treatments, and future research should formally assess

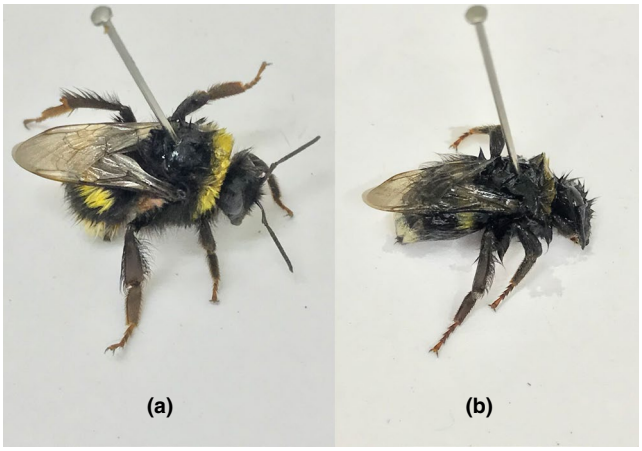


FIGURE 4 (a) Control and (b) Roundup® Ready-To-Use full concentration bumble bees sprayed and photographed within 5 min. Matting of the hairs over the bee's whole body can be seen in (b)

this. This could be through a range of mechanisms, either by matting hairs down over the spiracles and physically smothering them, by blocking narrow sections in the respiratory system, or by coating the surface of the whole system in a non-permeable lining (see Figure 4; Figure S3). Stevens (1993) noted that insect spiracles are similar in size to plant stomata, which GBHs are designed to penetrate, and suggested therefore that the surfactants allow water penetration into the tracheal system, causing drowning. It is unlikely that the immediate mortality seen most prominently in the standard strength Roundup® Ready-To-Use treatment is caused by oral ingestion as even high doses of potent insecticides require several hours to produce mortality (Edward Straw, pers. obs.). We do not know if the mechanism driving the 38% immediate mortality in the Roundup® Ready-To-Use treatment is the same mechanism driving the further 56% mortality in the 30 min to 24-hr timeframe. Surfactant driven mortality in honeybees, which typically act as a sentinel for all beneficial insects, is unlikely to have been detected by beekeepers as the knockdown of bees is so fast they are unlikely to return to the hive before dying; this would mean the only symptom beekeepers would see is a reduced worker population (Goodwin & McBrydie, 2000).

Further work is required to elucidate the mechanism by which these products produce mortality. However, a significant difficulty in isolating this mechanism is that formulation composition is protected under EU law (EC, 2009), preventing researchers from knowing the identity and concentration of the surfactants involved, or what other co-formulant groups are present (Cox & Surgan, 2006). This severely impedes our ability to understand what mechanism(s) is/are at play and hinders academic testing of relevant ecological pollutants. If the MSDS that accompanies a product included a list of all the components, then each component could be tested individually to isolate the compounds (or interaction of compounds) causing the observed mortality. We suggest that the necessity to properly test pesticide effects on wildlife outweighs company rights to withhold proprietary information.

ACKNOWLEDGEMENTS

Thanks to A. Linguadoca, R. Riesch, S. J. Portugal, S. G. Potts, J. R. de Miranda, S. Hodge, J. C. Stout, three anonymous reviewers, and the editors for their comments on the manuscript, to E. Leadbeater for her comments on the manuscript and analysis, O. P. Vaughan for translating the abstract and to L. J. Thompson, V. L. Blanchard and J. Abraham for discussing the project. This project received funding from the European Horizon 2020 research and innovation programme under grant agreement no.773921.

AUTHORS' CONTRIBUTIONS

E.A.S. and E.N.C. carried out the experiment, and E.A.S. performed the statistical analyses; E.A.S., E.N.C. and M.J.F.B. designed the experiment and wrote the paper; E.A.S. and M.J.F.B. conceived the project. All authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

Data available from the Dryad Digital Repository https://doi.org/10.5061/dryad.80gb5mkqn (Straw et al., 2021).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Straw EA, Carpentier EN, Brown MJF. Roundup causes high levels of mortality following contact exposure in bumble bees. *J Appl Ecol*. 2021;00:1–10. https://doi.org/10.1111/1365-2664.13867

Appendix 2 - Research Article: Synergism between local-and landscape-level pesticides reduces wild bee floral visitation in pollinator-dependent crops

Received: 2 April 2020 | Accepted: 24 February 2021

DOI: 10.1111/1365-2664.13871

RESEARCH ARTICLE

Journal of Applied Ecology BRITISH ECOLOGICAL SOCIETY

Synergism between local- and landscape-level pesticides reduces wild bee floral visitation in pollinator-dependent crops

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Funding information
National Institute of Food and Agriculture, Grant/Award Number: 2016-51181-25410 and 2017-68004-26323

Handling Editor: Tim Diekötter

Abstract

1. The hazard pesticides pose to pollinators are well-understood from laboratory studies. However, the field-level response of pollinators to pesticide use in agro-ecosystems is not well-established, nor is it clear if synergisms between pesticides affect pollinator visitation to crops.
2. Here, we evaluated if fungicide and insecticide use posed a hazard to wild and honeybees at 87 cucurbit—pumpkin, cucumber, watermelon—farms in the Midwestern United States. We also evaluated if synergisms between local- (i.e. focal cucurbit field) and landscape-level (i.e. surrounding crops) pesticide use influence wild and honeybee visitation to crop flowers.
3. We found that bees were exposed to pesticides above regulatory levels of concern and that synergisms between a few local insecticides and landscape-level fungicides reduced wild bee visitation to cucurbit flowers. Honey and bumblebee visitation to crops was not strongly influenced by synergisms between pesticides used at the local and landscape level.
4. *Synthesis and applications*. We found pesticides posed hazards to honey and wild bee species. However, pesticides were less likely to affect short-term visitation rates of honeybees compared with wild bee species. Thus, there is a need for changes in pesticide use at large spatial scales to reduce reliance on honeybees and maximize wild bee visitation to pollinator-dependent crops. We suggest that a multifaceted approach, involving collaborations between farmers, consumers and policymakers, will be fruitful to promote changes in pesticide use and wild bee pollinators.

KEYWORDS

honeybees, local and landscape level, managed bees, pesticides, pollinator-dependent crops, pollinators, synergisms, wild bees

1 | INTRODUCTION

Pesticides threaten ecosystem services by reducing the abundance and diversity of beneficial arthropods, including pollinators, in agro-ecosystems (Carvalho, 2017). Pesticide use can result in hazards to honeybees *Apis mellifera* L. and wild bee species, and is considered a factor contributing to pollinator decline (Zioga et al., 2020). These non-target effects reduce crop visitation, disrupt pollination and can reduce yields (Stanley et al., 2015). However, the impacts of pesticides on pollinators are rarely studied beyond the focal field, or local level, despite the fact that some bees forage widely (Greenleaf et al., 2007) and thus pesticide exposure occurs at a larger spatial

scale (Douglas et al., 2020; McArt et al., 2017). Studies that integrate local- and landscape-level pesticide exposure data are rare, but ultimately needed to guide pesticide use policy and promote pollination services.

Many wild and managed bees forage widely across cropping systems, exposing them to combinations of pesticide active ingredients (Long & Krupke, 2016). Multiple pesticides are often applied within the foraging range of pollinators (up to 2 km across diverse bee taxa; David et al., 2016; Greenleaf et al., 2007), resulting in a diversity of pesticide residues from local- and landscape-level crops detected in bee collected pollen (Wood et al., 2019). This movement and co-exposure make it challenging to disentangle the individual and combined effects of multiple pesticides, which mediate pollinator health due to chemical synergies (non-additive effects), notably between insecticides and fungicides (David et al., 2016). Agricultural landscapes also vary in their synergistic potential depending on crop diversity, field sizes and pesticide use practices (Douglas et al., 2020).

Within farms, pollinators are exposed to combinations of pesticides when insecticides and fungicides are co-applied to manage pathogens and insect pests (Schmuck et al., 2003). Pesticide co-application is a common practice on farms because pesticides are inexpensive compared to potential yield losses (Ternest et al., 2020). Thus, adding an 'insurance' insecticide when spraying fungicides is a conservative strategy to mitigate pest threats. Co-applications that mediate pesticide hazards may also occur when systemic compounds end up in the pollen and nectar (Sanchez-Bayo & Goka, 2014). For instance, pre-planting applications of pesticide-treated seeds can include insecticides and fungicides that reduce bee survival via synergisms (David et al., 2016; Douglas et al., 2020).

Much of the evidence shaping predictions for how pesticides impact pollinator health is based on honeybees. Yet, bee species respond differently to single pesticides (Arena & Sgolastra, 2014) and pesticide combinations (Heard et al., 2017; Robinson et al., 2017). Most bee species are small and insecticide toxicity is thought to be inversely proportional to body weight (Arena & Sgolastra, 2014). Thus, many wild bees (excluding bumblebees) may be more susceptible to insecticides than honeybees. Foraging behaviour across bee taxa could also mediate pesticide hazards. Honeybees are generalists, forage widely and have a long foraging season. Compared to bumble and honeybees, most wild bees have specialized diets, shorter foraging ranges and nesting periods (Wood et al., 2018). These differences in foraging behaviours could give bumble and honeybees greater opportunities to avoid contaminated resources (Kessler et al., 2015). Lastly, bumble and honeybees have eusocial colonies that can buffer losses to foragers (via demographic regulation) more easily than wild bees with smaller, primitively social or solitary populations (Henry et al., 2015).

Compared with wild bees, pesticides may also be less detrimental to honeybees because of human management. Farmers stock their fields with honeybee colonies whose health is monitored by beekeepers. Colonies are provided with resources when forage is limited and treated for pests (e.g. Varroa mite *Varroa destructor* Anderson & Trueman), reducing stress and making them less susceptible to insecticides (Tosi et al., 2017). High stocking rates in fields may also buffer pollination provided by honeybees against forager losses. As a result, insecticide and fungicide use, while likely affecting colony health, are unlikely to change short-term flower visitation rates by honeybees.

Herein, we evaluate the influence of pesticide use on pollinators, with an emphasis on identifying pesticide synergisms. We assess the response of wild and honeybees to fungicide and insecticide use at 87 cucurbit farms in the Midwestern United States, which are predominantly surrounded by row crops, such as corn *Zea mays* L. and soybean *Glycine max* (L.) Merr. (USDA, 2019). These crops use different pesticides from cucurbits and contribute to pesticide hazards at the landscape level (Long & Krupke, 2016). We then assess the response of wild and honeybees to: (a) local hazards of fungicides and insecticides quantified from cucurbit pollen; (b) landscape hazards of fungicides and insecticides estimated from crops surrounding cucurbit fields; and (c) synergisms between insecticides and fungicides at the local and landscape scale.

2 | MATERIALS AND METHODS

2.1 | Study systems

Our study was conducted on 87 cucurbit farms (hereafter, sites) in the Midwest, United States in 2017 and 2018 (Figure 1). Cucurbits are rotated annually, therefore site locations varied by year, with 43 and 44 unique sites in 2017 and 2018 respectively. Bee visitation at focal fields within sites was measured in three crops: cucumber *Cucumis sativus* L., watermelon *Citrullus lanatus* (Thumb.) Matsum. & Nakai and pumpkin *Cucurbita pepo* L. Cucurbits have imperfect flowers relying on bees for pollen transfer and fruit production (McGregor, 1976). Most sites managed honeybee and a subset managed bumblebee colonies to promote pollination. Honeybee management varied within and across crops (see Appendix S1).

Farmers were not asked to vary their pesticide management; instead, variation in pesticide use was driven by the farmer, pest pressures and standard practices for each crop (MWVG, 2020). Details on pesticide application method (e.g. foliar application, seed coating), active ingredient and frequency of use can be found in Appendix S1.

Sites were selected to promote independence of pollinator observations (see Table S1). The average foraging distance of bees is approximately 2 km (Greenleaf et al., 2007); thus, we assumed pollinator visitors at sites were independent (Table S1). We also used a 2-km buffer (see below) to estimate landscape-level pesticide use around sites. As a result, we selected sites that minimized overlap in the buffers created to characterize the landscape, which was largely dominated by pesticide-treated corn and soybean fields (Meehan & Gratton, 2016). Additional site metrics are documented in Table S1.

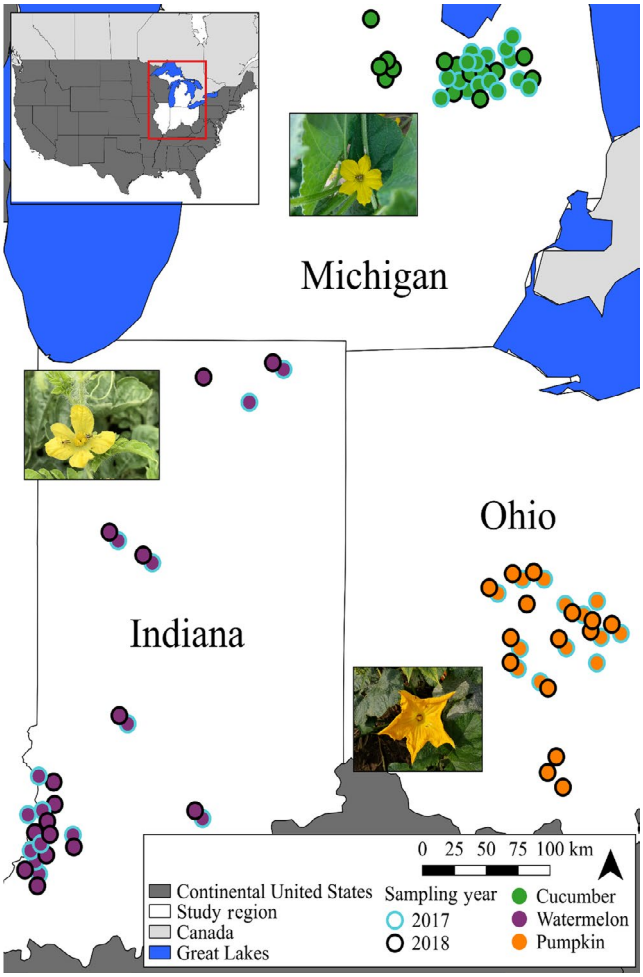

FIGURE 1 Map of the study region showing the distribution of sites. Orange, purple and green points are from pumpkin, watermelon and cucumber sites respectively. Blue and black circles around points are sites sampled in 2017 and 2018 respectively. The study region is located in the Midwest United States and covers >180,000 km^2

2.2 | Pollinator surveys

We recorded the number of bee visits to cucurbit flowers in each crop. Surveys were conducted with temperatures >10°C (although temperatures were typically higher than this), no precipitation, minimal cloud cover and low wind speeds. To conduct surveys, we walked transects perpendicular to the field margin, stopping to observe 1 m^2 floral patches. Two surveys were performed per site year^{-1} during peak bloom (see Table S1 for peak bloom period). Each survey lasted ca. 1 hr with 3 min of observation per point along the transect (e.g. 3 min × 16 points = 48 min of observations per transect; Table S1). Points along transects where observations took place were evenly spaced, field edges were avoided to reduce edge effects and the area of observation was similar regardless of farm size to avoid variation in sampling intensity. Bees were identified by sight to taxonomic groups by observers trained in regional bee fauna. Observations were summed across surveys per site year^{-1} by two bee groups, honeybees and wild bees, resulting in 87 independent observations per bee group (Table S2). Additional protocols for transects and bee identification are given in Appendix S1.

2.3 | Local-level pesticide hazards

To quantify local-level pesticide exposure, we collected synandrium-bearing pollen (hereafter, pollen) during each site visit (see Appendix S1 for methods). Pollen collections coincided with pollinator observations. Each crop used a unique suite of pesticides to manage pests. We used a priori knowledge of these practices to limit our evaluation of insecticide and fungicide residues in the pollen (Tables 1 and 2). By limiting our evaluation, we quantified the residues known to be applied at the local level by farmers. Residues were extracted from pollen using a modified QuEChERS protocol and the concentration of pesticides per sample was quantified by LC-MS (Appendix S1; Anastassiades et al., 2003). Concentrations of each compound were averaged across surveys resulting in one concentration per chemical for each site year^{-1}.

To determine the hazard of pesticide residues in cucurbit pollen to bees at the time of sampling, we calculated the pollen hazard quotient (PHQ; Stoner & Eitzer, 2013). We summed each average pesticide residue concentration (μg/kg) and divided by the respective acute oral honeybee LD_{50} (μg/bee) for each site, grouped by fungicides and insecticides:

$$PHQ = \sum_{i=1}^{n} \left(compound_i \div LD50_i\right), \quad (1)$$

where $compound_i$ in Equation 1 is the average concentration of each pesticide in the pollen and $LD50_i$ is the concentration of each pesticide that would kill 50% of a test honeybee population (McArt et al., 2017). Our approach only evaluates oral exposure and not contact exposure, which is an additional mechanism contributing to pesticide hazards (Zioga et al., 2020). Toxicity data used in Equation 1 (LD_{50} values) were obtained from the Pesticide Properties Database (Douglas et al., 2020, see Appendix S1 for methods).

In preliminary analyses, we determined that only pesticides found in the highest concentrations influenced pollinator visitation. Thus, rare compounds did not correlate with visitation and had little impact on the hazard mediated by pesticides in pollen. Therefore, in the analysis presented here, we subset our data and select the commonest fungicides and insecticides as those found in the 'highest concentration' in the pollen and recalculated the PHQ for these pesticides separately using Equation 1. Separating out the pesticides in the highest concentrations also allows for practical considerations. For example, if pesticides found in high concentrations influence bee visitation, then farmers could focus on reducing those pesticides rather than all pesticides. Furthermore, evidence suggests that particular high-use pesticides may be those responsible for landscape-level extinctions of bumble-bee populations (McArt, Urbanowicz, et al., 2017). Methods to subset pesticide concentrations are provided in Appendix S1.

TABLE 1 The mean, median and range of concentrations for insecticide active ingredients detected in pollen across two sampling dates during peak bloom in three different cucurbit crops across 2 years (2017 and 2018)

		Cucumber		Pumpkin		Watermelon	
Compound	LD_{50} (μg/bee)	% of samples detected ($n = 30$)	Mean, median, range (ppb)	% of samples detected ($n = 28$)	Mean, median, range (ppb)	% of samples detected ($n = 29$)	Mean, median, range (ppb)
Acetamiprid	14.53	—	—	—	—	17.86	4.92, 0.0, (0.0–107.61)
Carbaryl	>0.21	ND	ND	14.29	2.02, 0.1 (0.0–36.99)	—	—
Clothianidin	0.004	100.00	11.66, 9.01 (1.52–35.82)	50.00	0.33, 0.15 (0.0–1.76)	42.86	0.97, <LOQ, (<LOQ–5.82)
Imidacloprid	0.0037	ND	ND	17.85	1.17, <LOQ (<LOQ–19.04)	21.43	0.86, <LOQ, (<LOQ–9.50)
Thiamethoxam	0.005	100.00	82.20, 73.72 (14.47–172.21)	39.29	0.49, <LOQ (<LOQ–4.05)	39.29	1.53, <LOQ, (<LOQ–37.45)

Note: '—' and 'ND' indicates the insecticide was not evaluated or detected respectively; LOQ, limit of quantitation; > indicates unbounded LD_{50} estimate.

TABLE 2 The mean, median and range of concentrations for fungicide active ingredients detected in pollen across two sampling dates during peak bloom in three different cucurbit crops across 2 years (2017 and 2018)

		Cucumber		Pumpkin		Watermelon	
Compound	LD_{50} (μg/bee)	% of samples detected ($n = 30$)	Mean, median, range (ppb)	% of samples detected ($n = 28$)	Mean, median, range (ppb)	% of samples detected ($n = 29$)	Mean, median, range (ppb)
Azoxystrobin	>25	ND	ND	3.57	0.69, <LOQ (<LOQ–19.22)	55.17	79.54, 11.79, (<LOQ–1,014.08)
Chlorothalonil	>40	40.00	3,308.69, <LOQ (<LOQ–22,366.58)	ND	ND	17.24	3,125.18, <LOQ, (<LOQ–52,968.79)
Cyazofamid	>151.7	96.67	902.63, 834.25 (<LOQ–2,108.61)	ND	ND	68.97	7.09, 6.20, (<LOQ–62.91)
Fludioxonil	>100	ND	ND	ND	ND	6.90	12.79, <LOQ, (<LOQ–366.55)
Mefenoxam	>97.3	ND	ND	ND	ND	ND	ND
Oxathiapiprolin	>40.26	66.67	149.37, 3.73 (<LOQ–1,290.40)	ND	ND	13.79	12.65, <LOQ, (<LOQ–324.26)
Pyraclostrobin	>110	ND	ND	3.57	0.32, <LOQ (<LOQ–9.17)	31.03	10.26, <LOQ, (<LOQ–100.28)
Quinoxyfen	>100	—	—	46.42	2.01, <LOQ (<LOQ–37.87)	6.90	1.34, <LOQ, (<LOQ–21.25)
Thiophanate-methyl	>114.7	—	—	ND	ND	10.34	18.07, <LOQ, (<LOQ–183.97)
Trifloxystrobin	>110	ND	ND	ND	ND	3.45	1.59, <LOQ, (<LOQ–46.24)
Zoxamide	>147	70.00	7,073.28, 160.84 (<LOQ–98,355.61)	ND	ND	89.66	22.42, 25.98, (<LOQ–48.80)

Note: '—' and 'ND' indicates the fungicide was not evaluated or detected respectively; LOQ, limit of quantitation; > indicates unbounded LD_{50} estimate.

2.4 | Landscape-level pesticide hazards

To quantify landscape-level pesticide exposure, we downloaded data on the weight of pesticides applied in the United States through the US Geological Survey (USGS) Pesticide National Synthesis Project (USGS, 2014). Using the USGS estimates and the 2017 and 2018 US Cropland Data Layers (USDA, 2019), we extracted per-pixel application rates (each pixel representing a 30 × 30 m area) for fungicides

and insecticides applied by state and year across eight pixel classes (corn, soybean, wheat, alfalfa, orchards and grapes, vegetables and fruit, pasture and hay, other crops; McArt, Urbanowicz, et al., 2017; see Appendix S1 for further details).

The landscape-level hazard within a 2-km buffer of each site was found by summing the weight of each compound applied (kg/pixel) and dividing by the respective acute oral honeybee LD_{50} (kg/bee), grouped by fungicides and insecticides (Equation 1; Douglas et al., 2020; Greenleaf et al., 2007). Sites were buffered from field edges excluding landscape classes within the site. Similar to McArt, Urbanowicz, et al. (2017), we identified the pesticides applied in the 'highest quantities' around sites and recalculated the landscape hazard quotient for these pesticides separately (see Appendix S1 for methods). These landscape hazard quotient values can be viewed as the total toxic load where our estimates are the cumulative, landscape-scale insecticide and fungicide hazards to bees (Douglas et al., 2020).

Landscape-level pesticide hazards may be collinear with other metrics. For example, pesticide use is positively colinear with cropland, which is negatively colinear with natural areas that promote bees (Meehan & Gratton, 2016; Ricketts et al., 2008). To control for this, we determined the proportion of cropland and natural habitat within 2 km of each site as the count of cropland and natural pixel classes divided by the total number of all pixels. Natural habitat pixel classes were defined as forest (deciduous, evergreen, mixed), shrubland, grassland and wetland (woody, herbaceous). These parameters were included in our model selection approach.

2.5 | Evaluating the hazard of pesticide use for bees

To evaluate if pesticide residues were hazardous to bees, we compared the mean values of the PHQ for the overall and high concentration groups for fungicides and insecticides to the European Food Safety Authority (EFSA) level of concern for chronic oral exposure for adult honeybees (exposure/toxicity = 0.03) with one sample *t*-tests (EFSA, 2013). We also conducted Welch's two sample *t*-tests by fungicides and insecticides to examine differences between the overall and high concentration groups for the PHQ and the overall and high quantity groups at the landscape level. Details on the EFSA level of concern are in Appendix S1.

2.6 | Model selection

Prior to model selection, we measured multicollinearity among our variables (see Appendix S1 for methods; Figures S1 and S2). The final set of variables is listed in Table 3. Next, to evaluate the response of bees to: (a) pesticide hazards and (b) pesticide synergisms, we constructed sets of generalized linear mixed-effects models each with a negative binomial error distribution and log link function which included interactions between the parameters that characterized the hazard of local and landscape-level pesticides. We used a negative

TABLE 3 Model set considered in the analyses of covariates wild and honeybees. Fixed effects included: (i) pollen hazard quotient (PHQ) of all insecticides (listed as 'Overall local insecticides'), (ii) PHQ of all fungicides (listed as 'Overall local fungicides'), (iii) hazard quotient of all insecticides used within 2 km of sites (listed as 'Overall landscape insecticides'), (iv) hazard quotient of all fungicides used within 2 km of sites (listed as 'Overall landscape fungicides'), (v) PHQ of insecticides found in the highest concentrations (listed as 'High concentration local insecticides'), (vi) PHQ of fungicides found in the highest concentrations (listed as 'High concentration local fungicides'), (vii) hazard quotient of insecticides applied in highest quantities within 2 km of sites (listed as 'High quantity landscape insecticides'), (viii) hazard quotient of fungicides applied in highest quantities within 2 km of sites (listed as 'High quantity landscape fungicides'), (ix) proportion of natural habitat within 2 km of sites (listed as 'Natural landscape proportion') and pairwise interactions among these variables

Model	Fixed effects included in model
1	Overall local insecticides
2	Overall local fungicides
3	Overall landscape insecticides
4	Overall landscape fungicides
5	High concentration local insecticides
6	High concentration local fungicides
7	High quantity landscape insecticides
8	High quantity landscape fungicides
9	Natural landscape proportion
10	Overall local insecticides × Overall local fungicides
11	Overall local insecticides × Overall landscape insecticides
12	Overall local insecticides × Overall landscape fungicides
13	Overall local insecticides × Natural landscape proportion
14	High concentration local insecticides × High concentration local fungicides
15	High concentration local insecticides × High quantity landscape insecticides
16	High concentration local insecticides × High quantity landscape fungicides
17	High concentration local insecticides × Natural landscape proportion
18	Overall local fungicides × Overall landscape insecticides
19	Overall local fungicides × Overall landscape fungicides
20	Overall local fungicides × Natural landscape proportion
21	High concentration local fungicides × High quantity landscape insecticides
22	High concentration local fungicides × High quantity landscape fungicides
23	High concentration local fungicides × Natural landscape proportion

(Continues)

TABLE 3 (Continued)

Model	Fixed effects included in model
24	Overall landscape insecticides × Overall landscape fungicides
25	Overall landscape insecticides × Natural landscape proportion
26	High quantity landscape insecticides × High quantity landscape fungicides
27	High quantity landscape insecticides × Natural landscape proportion
28	Overall landscape fungicides × Natural landscape proportion
29	High quantity landscape fungicides × Natural landscape proportion
30	Null

binomial error distribution because it is suitable for discrete data, and preliminary analysis suggested our data suffered from overdispersion, indicating the negative binomial would provide better parameter estimates than the Poisson (Zuur et al., 2009).

We used honey and wild bee visitation as response variables to nine explanatory factors, including the proportion of natural habitat around sites, and all two-way interactions among these variables to test for synergisms (30 explanatory factors × 2 bee groups = 60 models; Table 3). Thus, there were two models sets, one per bee group, where each set had 30 models. We excluded interactions between the variables for overall pesticide use and those that test the response of bees to pesticides found in high concentrations in the pollen and used at high quantities in the landscape, which we assumed to be colinear (see Appendix S1). This allowed us to separately evaluate the response of wild and honeybees to overall pesticide use and a few high concentration and quantity pesticides found at the local and landscape level respectively. Our model sets were balanced such that each covariate appeared in the same number of models. Crop and year were used as random effects. In a supplemental analysis, we split wild bees into counts of bumble and solitary bees and evaluated their response to the explanatory variables (Table 3). We also explored additive models in model sets. These models did not qualitatively change our results, and they were excluded from the final analysis.

Models were ranked based on Akaike's information criterion adjusted for small sample size (AICc), and competing models identified based on ΔAICc < 2.0 (Burnham & Anderson, 2002; Grueber et al., 2011). We also calculated Akaike weights (ω) and model-averaged partial regression coefficients for each covariate based on the 95% confidence set (Burnham & Anderson, 2002), with 1 being most important and 0 the least. Akaike weights were summed for each model in which the variable appeared then normalized adding to 1. We considered covariates important if they appeared in top models (ΔAICc < 2.0), had a high weight ($\omega \geq 0.6$) and the unconditional 95% confidence interval did not overlap 0 (Grueber et al., 2011; Kennedy et al., 2013). To approximate a normal distribution and enhance model stability, variables were log transformed as needed and mean-centred using a generic function prior to model fitting. All analyses were performed in R (R Core Team, 2019) with packages MASS (Venables & Ripley, 2002), GLMMTMB (Brooks et al., 2017) and MuMIn (Bartoń, 2019).

3 | RESULTS

3.1 | The pollinator community

From 87 sites, we recorded 2,856 and 3,854 wild and honeybee visitation events respectively. The bee community varied by crop, with ≈50% of all visits from honeybees. The most abundant wild bees were bumblebees *Bombus* spp. Latreille, which contributed ≈16% of visits to flowers. Sweat bees *Halictidae* spp. Thomson and squash bees *Eucera* (*Peponapis*) *pruinosa* Say each contributed ≈11% of visits. The remaining wild bee visits were from two genera (*Melissodes* spp. Latreille and *Ceratina* spp. Latreille) and two species (*Xylocopa virginica* L. and *Eucera* (*Xenoglossa*) *strenua* Cresson). We were unable to identify ≈0.1% of wild bees beyond confirming that these individuals were not honeybees and we counted these observations as 'unidentified' (Figure 2; Table S2).

3.2 | Local and landscape pesticide hazards

In cucurbit pollen, we documented five insecticides and 11 fungicides (Tables 1 and 2). Insecticides at the highest concentrations were thiamethoxam, acetamiprid and carbaryl in cucumber, watermelon and pumpkin respectively (Table 1). The fungicides with the highest concentration in the pollen were zoxamide, chlorothalonil and quinoxyfen in cucumber, watermelon and pumpkin respectively (Table 2). Sixty fungicides and 33 insecticides were estimated to be used within 2 km of sites. Across the eight landscape pixel classes, 2 years and four states in our study, 11 insecticides (Table S3) and

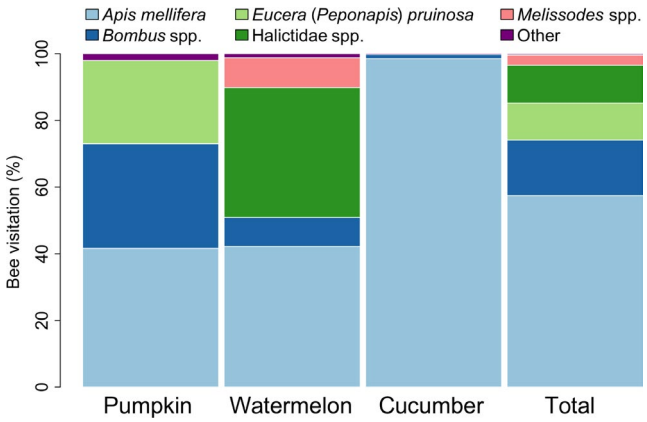

FIGURE 2 Relative proportion of wild and honeybee visitation events observed by crop and across all crops (total). Identifications of wild bees were classified into the lowest taxonomic level possible for observations made in the field. Those listed as 'other' constituted less than 0.4% of visitation events across all crops

eight fungicides (Table S4) were identified as those applied in the highest quantities at the landscape level.

Mean PHQ values for insecticides and fungicides were above the EFSA level of concern (exposure/toxicity > 0.03; Figure 3a,b), irrespective of whether the hazard quotient accounted for all pesticides or only those found in the highest concentrations (Table 4). However, insecticides were approximately 100 times more hazardous to bees than fungicides (see *y*-axis scales for Figure 3a,b). When compared, PHQ values that accounted for all fungicides or only fungicides found in the highest concentrations were similar ($t = 1.50$, $df = 165.57$, $p = 0.13$; Figure 3a). The mean PHQ value that accounted for all insecticides was also similar to insecticides in the highest concentrations ($t = 0.91$, $df = 168.09$, $p = 0.36$; Figure 3b).

At the landscape level, the mean hazard quotient value for all fungicides was ≈70% greater than fungicides used in the highest quantities ($t = 4.30$, $df = 99.96$, $p < 0.001$; Figure 3c). Similarly, the mean hazard quotient value for all landscape-level insecticides was ≈30% greater than insecticides applied in the highest quantities ($t = 3.51$, $df = 165.99$, $p < 0.001$; Figure 3d).

3.3 | Effects of pesticides on bee visitation

By assessing our model set (30 models total, Table 3), we found that wild bee visitation was not influenced by the proportion of natural habitat, overall pesticide use at either spatial scale, or interactions between these covariates (Table S5). The top model indicated wild bee visitation was mediated by an interaction between 'High concentration local insecticides' and 'High quantity landscape fungicides' (Table S5). Specifically, wild bee visitation decreased exponentially with concurrent increases in the hazard of: (a) three local-level insecticides (thiamethoxam, acetamiprid

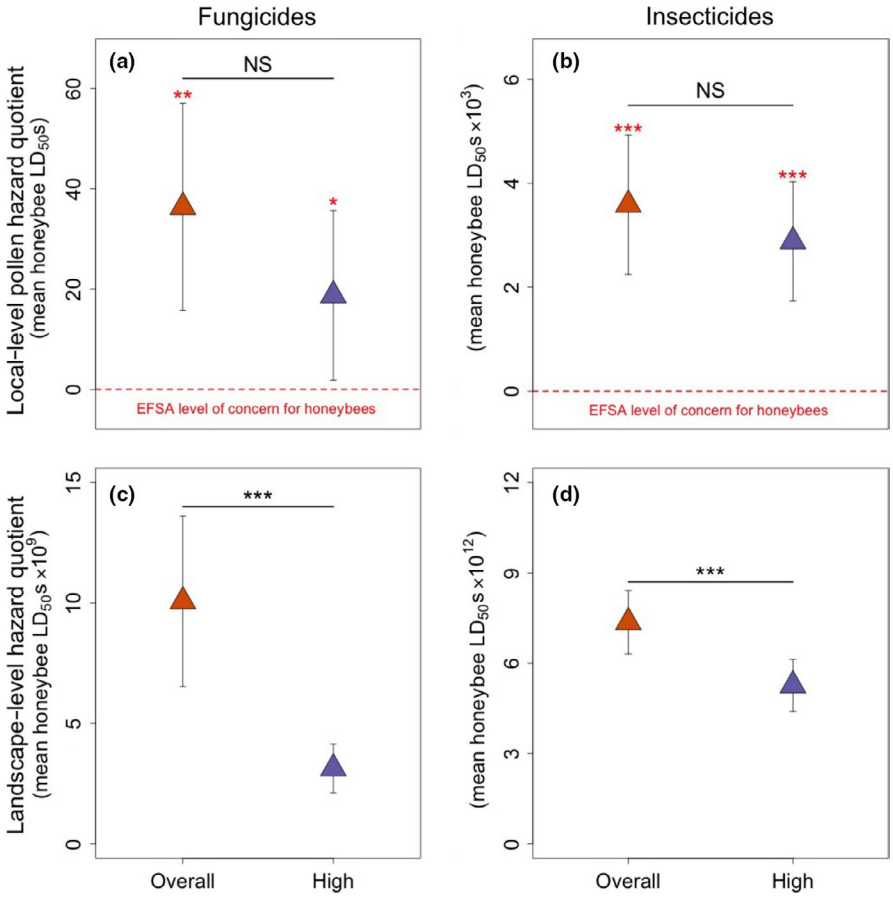

FIGURE 3 The mean and 95% confidence interval for hazard quotients at the (a, b) local and (c, d) landscape level. Local-level hazard quotients were generated from pollen analysis. 'Overall' values account for all pesticides while the 'high' values are pesticides found in the highest concentration in cucurbit pollen (local level, panels 'a, b') and applied in the highest quantities within 2 km of sites (landscape-level, panels 'c, d') for (a, c) fungicides and (b, d) insecticides. Dashed red lines in panels 'a, b' correspond to the EFSA level of concern for honeybees (exposure/toxicity = 0.03) and asterisks above points in panels 'a, b' indicate values exceeding the EFSA level of concern. Bars over triangles in all panels indicate the difference between the 'overall' and 'high' values. *, **, *** indicate significance at the 0.05, 0.01 and 0.001 level respectively

TABLE 4 Results of one-sample *t*-tests comparing mean pollen hazard quotient values for the 'overall' and 'high concentration' groups for fungicides and insecticides to the EFSA level of concern (mean of 0.03)

Variable	Mean	*t*	*df*	*p*-value	95% CI	
Fungicides						
Overall	36.39	4.02	86	0.0012	18.42	54.36
High concentration	18.75	2.53	86	0.013	4.03	33.48
Insecticides						
Overall	3,587.63	6.10	86	<0.001	2,419.03	4,756.22
High concentration	2,882.49	5.72	86	<0.001	1,880.39	3,884.59

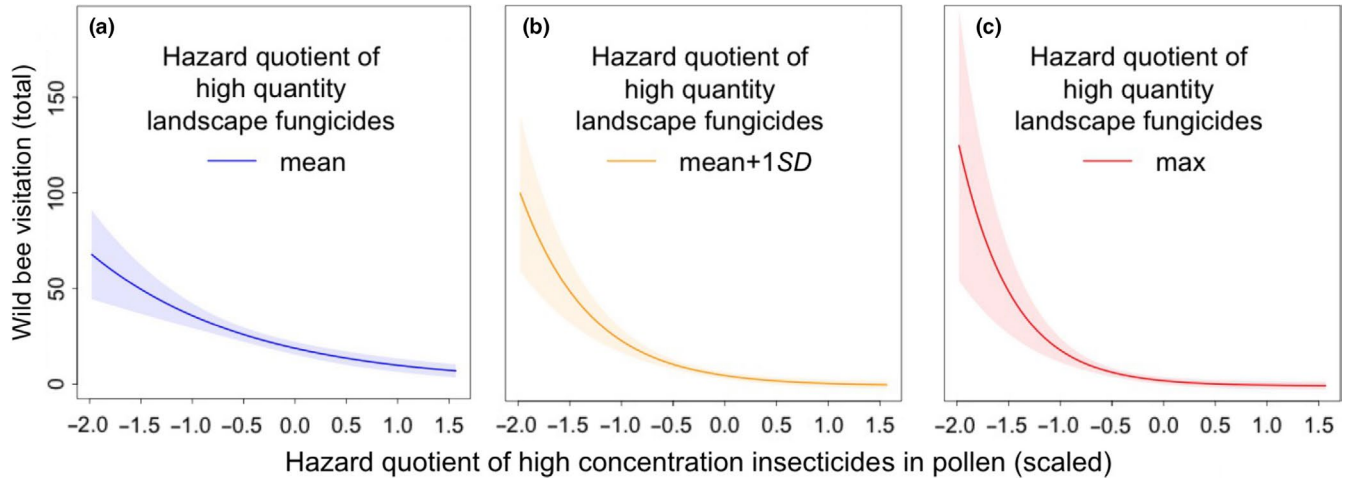

FIGURE 4 Model-averaged predictions and standard errors showing the response of wild bees to an increasing pollen hazard quotient (PHQ) mediated by high concentration insecticides at the (a) mean, (b) mean + 1 *SD* and (c) maximum hazard of fungicides applied in the highest quantities within 2 km of sites. In panel 'a', the relationship between wild bee visitation and the PHQ of high concentration insecticides is approximately linear. However, in panels 'b' and 'c' the hazard of fungicides applied at the highest quantity within 2 km of the farms increases, and the relationship between wild bee visitation and the PHQ of high concentration insecticides becomes nonlinear

Covariate	β	95% CI	*Z*	*p*
High concentration local insecticides	−0.59	−1.03 to −0.16	1.65	0.0080
High quantity landscape fungicides	−1.42	−1.83 to −1.03	6.97	<0.0001
High concentration local insecticides × High quantity landscape fungicides	−0.95	−1.52 to −0.39	3.30	0.0010

TABLE 5 Model-averaged partial regression coefficients (β), conditional 95% CIs, *Z*-statistics and *p*-values from the top model (Table S5) of wild bee visitation in relation to local-level and landscape-level pesticide use. Variables are described in Table 3

and carbaryl) in the pollen and (b) the mean to maximum values for eight landscape-level fungicides (azoxystrobin, captan, chlorothalonil, mancozeb, metam, picoxystrobin, propiconazole and pyraclostrobin; trigamma R^2_c = 0.21; *c* = conditional; 'trigamma' = function used to compute the R^2 for models with a log link and random effects; Bartoń, 2019; Figure 4a–c; Tables 1 and 5; Tables S4 and S5). There was also variation in the intercept across model predictions as landscape-level fungicide hazards increased (Figure 4a–c). For the model set used to evaluate honeybee visitation (30 models, Table 3), none of the factors strongly influenced visitation (Tables S6 and S7), though the top model suggested a weak positive correlation between honeybee visitation and the hazard of landscape fungicides.

In our supplemental analysis, we split visitation events for wild bees into bumble and solitary bees (two model sets each with 30 models; Table 3). The top model for solitary bees was the same as that for all wild bees, indicating that an interaction between 'High concentration local insecticides' and 'High quantity landscape fungicides' mediated the loss of solitary bee visitation (Tables S8 and S9). No factors we assessed strongly influenced bumblebee visitation (Tables S10 and S11), though the top model suggested a weak negative correlation between bumblebee visitation and the hazard of landscape fungicides.

4 | DISCUSSION

We observed exponential decreases in wild bee visitation with concurrent increases in local insecticides and landscape-level fungicides. Of the interacting pesticides, two of the three local insecticides (thiamethoxam and acetamiprid) and five out of eight landscape fungicides (pyraclostrobin, mancozeb, chlorothalonil, azoxystrobin and picoxystrobin) are known synergists (van Dyke et al., 2018). Our results also indicate that the strength of local pesticide interactions is relatively weak, demonstrating the need to expand testing to landscape-scale pesticide combinations (David et al., 2016). Furthermore, the proportion of natural landscape within 2 km of a site did not buffer the effects of pesticides on wild bees (Park et al., 2015). Thus, the benefits of these 'refuges' may be offset by the continued use of pesticides at large scales. Due to the scale of the synergies we identified, policy could focus on creating pollinator 'safe' zones where pesticides are managed at an extent that mirrors bee foraging ranges (≈2 km; Greenleaf et al., 2007). This would require a decision support tool giving farmers information to isolate fields from high fungicide use areas. Such a tool already exists, http://app.beescape.org/, helping beekeepers place colonies at low-pesticide sites.

Wild and honeybees were also exposed to pollen-containing pesticides in concentrations thousands of times above oral LD_{50}

values (McArt, Fersch, et al., 2017). Moreover, we show that ≈80% of the local hazard posed by insecticides were due to a select few compounds. To gain further insights, we compared spray records to our analysis. In cucumbers, bee visitation and pesticide hazards were mediated by thiamethoxam, a neonicotinoid insecticide applied as a seed treatment. Neonicotinoids are known to negatively impact pollinator populations (Stanley et al., 2015; Woodcock et al., 2016). For cucumbers, harvest ranges from 45 to 50 days post-seeding; therefore, concentrations of thiamethoxam remain high in plant tissues until harvest, requiring no further insecticides. However, watermelon and pumpkin require a minimum of 80 and 120 days, respectively, to reach harvest. Consequentially, insecticide concentrations decline over the life of the plant, and farmers apply follow-up interventions during bloom to reduce pests. Insecticides applied as a foliar spray (carbaryl) and via chemigation (acetamiprid) in pumpkin and watermelon, respectively, mediated pesticide hazards and wild bee visitation in these systems.

Bees are not exclusively exposed to insecticides via crop pollen. There are many routes of pollinator pesticide exposure, including plant guttation fluid (Reetz et al., 2011) and soils where wild bees nest (Main et al., 2020). However, insecticide concentrations in environmental matrices such as soils tend to be correlated with levels in plant tissues (Olaya-Arenas et al., 2020). Thus, while we cannot pinpoint the route of exposure, pollen can be viewed as a surrogate for local insecticide hazards for pollinators.

By leveraging our results, growers could adopt an integrated pest and pollinator management (IPPM) program, reducing pesticide hazards without sacrificing yields (Egan et al., 2020; Ternest et al., 2020). Since the method of pesticide application and chemistries varied across our study systems, crop-specific IPPM programs will need to be designed. For cucumber, an IPPM approach that reduces reliance on thiamethoxam seed coatings may prove beneficial to promoting pollinator visitation while maintaining yields. The practicality of this approach depends on how pest populations respond. The primary pest in this crop, the striped cucumber beetle *Acalymma vittatum* Fabricius, is the target of these applications and this species was virtually absent from sampled fields, illustrating the power of seed treatments to manage pests and opening the possibility to relax this intervention. Indeed, heightened local and landscape-level pesticide use has eliminated both pests and wild bee pollinators in cucumber farms in Michigan, a factor potentially mediating our results. Approaches like action thresholds, selecting more bee-friendly chemistries or modifying spray timing to avoid pollinators are promising alternatives. Technologies are also emerging that use aggregation pheromones to attract and kill cucurbit pests (Weber, 2018). Greater adoption of these technologies may be useful for promoting pollinator visitation without sacrificing yields. For example, yields may increase if pollinator limitation is occurring (Reilly et al., 2020). Moreover, late-season insecticide applications in watermelon and pumpkin are used to prevent aesthetic damage unrelated to yield. Thus, changing consumer perceptions of pest damage may help to relax insecticide use and reduce pressures on farmers to grow blemish-free crops.

Landscape context was also found to mediate bee visitation in our study. This result is consistent with previous research showing that landscape-level insecticides and fungicides influence pollinator populations (McArt, Urbanowicz, et al., 2017; Woodcock et al., 2016). Approximately 3.3 billion kg of fungicides are applied in our study region annually, with vegetable and fruit crops applying ≈66% of all fungicides (USGS, 2014). However, these crops are rare, constituting ≈8% of all pixels within 2 km of our sites. This indicates that while specialty crops contribute highly to pesticide use, this use is spatially restricted. Instead, bees may be more likely to encounter crops that are planted extensively (e.g. corn and soybean), which, while using less fungicides, are known contributors to pesticide residues in bee collected pollen (Long & Krupke, 2016). This aspect of fungicide use merits study as it would determine if high levels of localized use or expansive use in row crops drive pollinator population declines.

When assessing pollinator groups, we found wild and honeybees responded differently to pesticide use. This pattern was mainly driven by solitary bees, indicating that pesticide interactions are particularly damaging to bees that are unable to avoid local insecticide applications. Wild bees that specialize on cucurbits (e.g. squash bees) may be disproportionately impacted, since honeybees and some bumblebees are known to avoid cucurbit pollen due to fitness trade-offs (Brochu et al., 2020). When parsed from solitary bees, we found modest evidence indicating that bumblebee visitation was reduced by landscape-level fungicide hazards. Whether these patterns represent population declines, as found by McArt, Urbanowicz, et al. (2017), or a change in behaviour, remains unknown. We also found some evidence indicating that honeybee visitation may increase in landscapes with higher fungicide hazards. This may represent a concentration effect, whereby fungicide use in the landscape serves to localize honeybees within farming systems. The use of radio-frequency identification tags to track honeybee movement could be an elegant test of this localization mechanism. Indeed, honeybees could preferentially avoid landscape-level foraging through learned associations (Henry et al., 2012).

More broadly, we observed that honeybee visitation to crop flowers was relatively unaffected by pesticides in the crops we studied over short time periods (≈2 w), thus they may serve as an important investment for farmers in pollination services under scenarios where solitary and bumblebees decline. However, our approach does not account for honeybee mortality, which is likely, as a result of the pesticide hazards we found. Our results further suggest that some farms may become completely dependent on honeybees. While honeybees are suitable pollinators for crops that do not require specific pollinators, the yields in many crops benefit from interactions with co-evolved species (e.g. squash bees; Tepedino, 1981) or wild bees in general (Garibaldi et al., 2013), underscoring the importance of reducing pesticide use to promote crop productivity. However, cucurbits can be adequately pollinated by honeybees (McGregor, 1976), thus farmers may continue to use pesticides and receive optimal pollination, if honeybees are stocked and maintained by beekeepers.

Globally, patterns of pesticide use threaten wild and honeybee pollinators and pollination services (Carvalho, 2017). According to our results, reducing the use of pesticides at the local and landscape scale is needed to promote wild bee visitation to pollinator-dependent crops. Given the global need for agricultural pollination (Klein et al., 2007), we suggest that future pesticide regulation focus on landscape-level monitoring of pesticides (Milner & Boyd, 2017). Landscape-level pesticide recordkeeping is underway in some areas of the United States (e.g. the California Department of Pesticide Regulation); however, expanded testing is needed to evaluate the fate of pesticides in the environment. Caps are also likely needed for landscape-level industrial applications to limit the amount of pesticide used and the environmental damage tolerated (Milner & Boyd, 2017). Change, however, must also come from consumers and producers, since we found that many pesticide applications were unrelated to those needed to enhance yields and rather driven by aesthetics. Farmers must be offered IPPM tools that are simple, effective and provide season-long pest protection. Therefore, it is likely that a multifaceted approach including farmers, consumers and policymakers is needed to promote a future with less pesticide use that does not imperil pollinators and pollination services.

ACKNOWLEDGEMENTS

The authors thank their farmer collaborators and beekeepers for their support, and T. Vernon, J. Conrad, E. McCormick, M. Butler, G. Mcdowell, G. Galley, K. Huizenga, R. Gingerich, R. Deckmann, A.H. Jannasch, Y. Han-Hallet, A.B. Leach, P. Olaya-Arenas, D.Z. Chu, T.E. Cheney, K.L. Harder, M.E. O'Flynn, H. Van Zant, E. Custer, A. Fredenburg, P., W. Hunter and B. Bergefurd for assistance with sampling, specimen processing and project logistics. This project was funded by USDA NIFA grant numbers 2016-51181-25410 and 2017-68004-26323.

AUTHORS' CONTRIBUTIONS

I.K., K.G. and Z.S. conceived the study; T.J.W., K.-L.J.H., J.J.T. and L.L.I. collected field data; E.H.B. collected landscape data and performed the analyses; E.H.B., I.K. and Z.S. led the manuscript writing. All the authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

Data available via the Figshare Digital Repository https://doi.org/10.6084/m9.figshare.14135516 (Bloom et al., 2021).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Bloom EH, Wood TJ, Hung K-LJ, et al. Synergism between local- and landscape-level pesticides reduces wild bee floral visitation in pollinator-dependent crops. *J Appl Ecol*. 2021;00:1–12. https://doi.org/10.1111/1365-2664.13871

Appendix 3 - Research Article: Glyphosate: Its Environmental Persistence and Impact on Crop Health and Nutrition

plants

MDPI

Review

Glyphosate: Its Environmental Persistence and Impact on Crop Health and Nutrition

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Received: 24 September 2019; Accepted: 7 November 2019; Published: 13 November 2019

Abstract: Glyphosate-based herbicide products are the most widely used broad-spectrum herbicides in the world for postemergent weed control. There are ever-increasing concerns that glyphosate, if not used judiciously, may cause adverse nontarget impacts in agroecosystems. The purpose of this brief review is to present and discuss the state of knowledge with respect to its persistence in the environment, possible effects on crop health, and impacts on crop nutrition.

Keywords: glyphosate; herbicide degradation; crop health; nutrient availability

1. Introduction

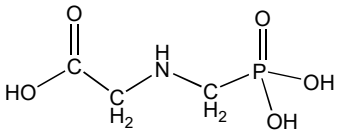
Glyphosate (*N*-(phosphonomethyl) glycine), after its introduction in the 1970s, became a popular herbicide among farmers because of its broad-spectrum weed control. The use of glyphosate as a "burn down" application alone, or in combination with other pre- or postemergent herbicides, became standard practice in cropping systems throughout the world. Glyphosate is a nonselective, postemergent herbicide known to control more than 150 weed species, including mono- and dicotyledonous plants of annual or perennial nature [1]. Glyphosate is the active ingredient in many herbicide products (for example, Roundup) and is commercially available in its various salt forms, such as isopropylamine, ammonium, potassium, and trimesium salt. It is used to manage annual broadleaf weeds, grasses, and sedges in various field and row crops around the globe. Furthermore, its usage has expanded to urban and natural areas, pastures, forestry, and aquatics.

Generally applied to foliar parts of weeds, glyphosate can enter plants through four potential routes: the leaves or other green tissues, the roots, the trunk, or shoots emerging from the root or the trunk [2]. After entering the plants, it is rapidly translocated to regions of active growth within the plant. The mechanism of action of glyphosate is to block the activity of the enzyme called 5-enol-pyruvyl-shikimate-3-phosphate synthase (EPSPS), which catalyzes the sixth step in the shikimic acid pathway [3,4]. By blocking the enzyme, it prevents the biosynthesis of aromatic amino acids, viz. phenylalanine, tyrosine, and tryptophan, produced through the shikimate pathway [5]. Plants treated with glyphosate normally die within a period of 1–3 weeks, and because of its even distribution in the plant, no plant parts can survive [6].

Chemically, glyphosate is a phosphonomethyl derivative of the amino acid glycine [7]. It is a white and odorless crystalline solid having one basic amino group and three ionizable acidic sites (Table 1) [8]. Glyphosate is a nonvolatile chemical, does not undergo photochemical degradation, and is stable in air. Glyphosate has been considered a relatively safe compound in the environment because

of its rapid inactivation in soil by adsorption and degradation [9]. However, owing to its extensive use, concerns and studies on the behavior of glyphosate in plant and the environment are growing.

Table 1. Selected physical and chemical properties of glyphosate.

Chemical structure	
CAS number	1071-83-6
Chemical name	*N*-(phosphonomethyl) glycine
Empirical formula	$C_3H_8NO_5P$
Molecular weight (g mol^{-1})	169.08
Water solubility (mg L^{-1} at 25 °C)	10,000 to 15,700 [10]
Octanol–water coeff. (*Kow*)	−4.6 to −1.6 [10]
Vapor pressure (mm Hg at 25 °C)	4.3×10^{-10} [10]
Freundlich adsorption coeff. (*Kads*) (L Kg^{-1})	0.6 to 303 [11]
Degradation half-life in soil (T1/2) (days)	7–60 [12]
Photolysis half-life (days)	Not substantial
EPA maximum contamination level (μg L^{-1})	700 [10]

Especially due to improper application practices and excessive spray, the widespread presence of glyphosate has been observed in the aquatic and terrestrial environments [13]. In many studies, glyphosate has been detected in soil, crop products, animals that feed on crop products, humans, freshwater, and the organisms that live there [14]. Despite favorable evaluations of weed control efficacy and environmental risks of glyphosate, an increasing number of more recent observations suggest a relationship between extensive glyphosate application and adverse nontarget effects in agroecosystems [15]. The more significant among these concerns are (1) persistence in the environment, (2) effects on crop health, and (3) interaction with crop nutrition (Figure 1).

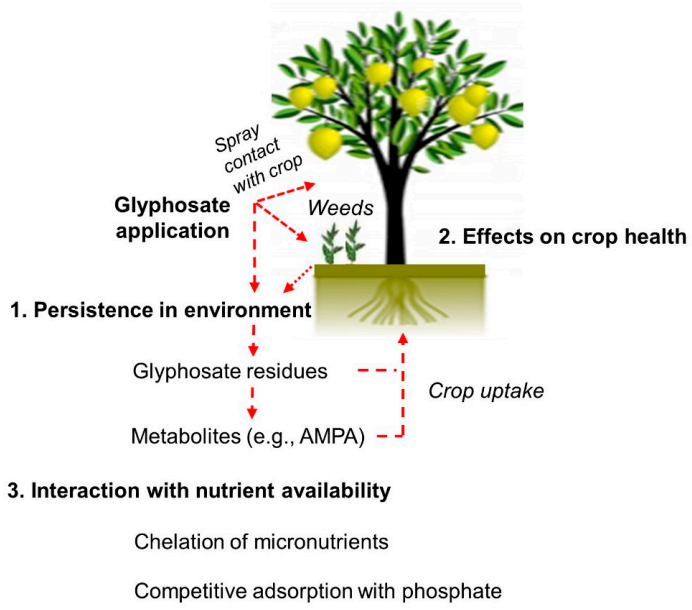


Figure 1. Schematic representation of the potential effects of glyphosate in crop production.

2. Glyphosate Persistence in the Environment

Applied as foliar spray to control weeds, glyphosate may end up in different soil pools and nontarget sites (Figure 2). Wash-off from the foliage or undirected spray drift [16], death and decay of glyphosate-treated plant residues, and exudation from the roots [17] may transport glyphosate to the soil. The release of glyphosate may even occur as exudates from undamaged roots of glyphosate-tolerant crops [18].

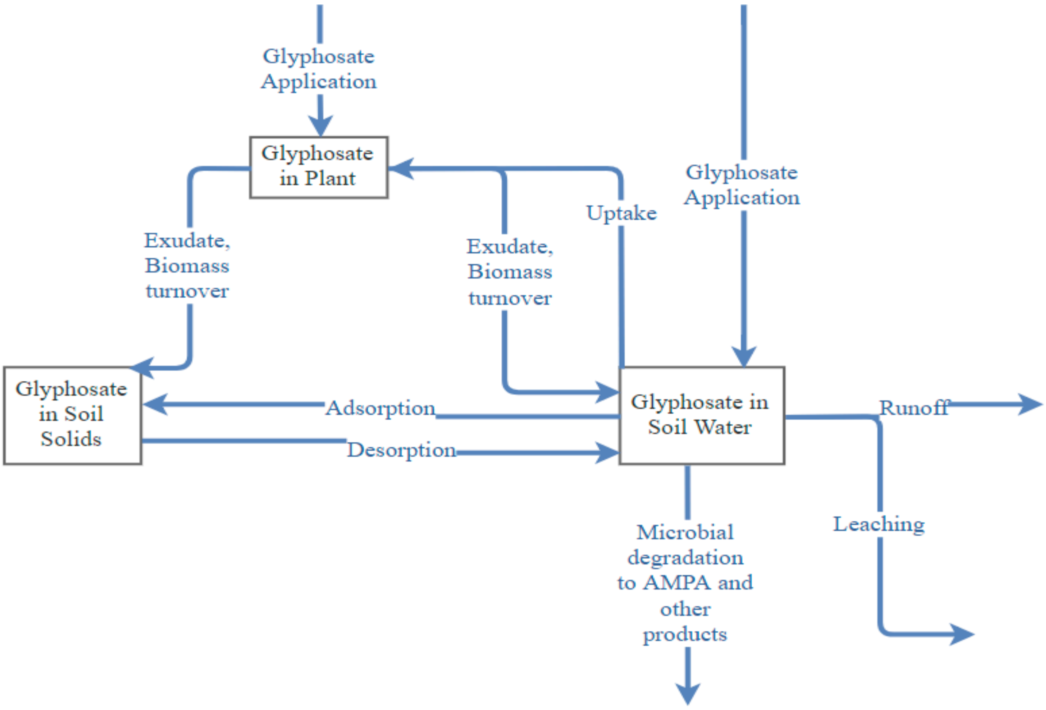


Figure 2. Fate and movement of glyphosate in different pools.

Figure 2. Fate and movement of glyphosate in different pools.

Glyphosate has an affinity to bind to soil particles and thus mostly accumulates in the top-soil layers. Processes like surface runoff, drift, and vertical transport in soil may transport it to groundwater, surface water, and water sediment [19–21]. The mobility and leaching of glyphosate have been tested in laboratory, lysimeter, and field conditions [11]. In a study on glyphosate leaching and movement conducted in a field site in Denmark, glyphosate, despite its high binding tendency on soil, was found to transport deep into the soil and leach out with drainage water [22]. Furthermore, there are several water monitoring reports that provide information on the occurrence of glyphosate in groundwater. Glyphosate was detected in 36% of a total of 154 water samples collected from Midwestern U.S. states, where glyphosate is extensively used on corn [23]. However, the glyphosate concentration in the detected samples was well below the maximum contaminant level for this herbicide. Beyond its presence in the groundwater, glyphosate has also been detected in surface water [24–26]. The predominant occurrence of glyphosate in surface water could be potentially attributed to surface water runoff [11]. Owing to extensive usage, this chemical may pose chronic and remote hazards to the ecological environment [27]. The major route of degradation of glyphosate from soil is microbial-mediated degradation or biodegradation [28].

Glyphosate degradation is a mainly microbial-mediated process [29,30], and the pathway has been widely studied in laboratories [31]. It degrades at a relatively rapid rate in most soils, with half-life estimated between 7 and 60 days [12]. Many studies have indicated that the presence of glyphosate in the soil can enhance microbial activity [32,33], while some studies have also shown the toxic effects of glyphosate on soil microorganisms [34].

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The extent and rate of glyphosate biodegradation are influenced by processes such as adsorption and desorption in soil, along with other chemical, physical, and biological factors. Both aerobic and anaerobic conditions favor the degradation of glyphosate, even though anaerobic degradation is generally slower than aerobic degradation [35]. Similarly, soil temperature can also play an important role in determining glyphosate degradation [36]. The rate of mineralization of glyphosate was found to be correlated with the abundance of *Pseudomonas* spp. in soil by Gimsing et al. [30]. They also found that the addition of phosphate in the soil stimulates glyphosate mineralization. Lancaster et al. [37] compared the amount of $^{14}CO_2$ production from mineralization of ^{14}C-glyphosate in single herbicide application versus repeated applications. They found reduced production of $^{14}CO_2$ from multiple applications, suggesting that long-term herbicide treatment did not favor acclimation of glyphosate-mineralizing microorganisms.

Glyphosate appears to be biodegraded cometabolically [38] as microorganisms are not able to utilize it as a source of carbon [39]. Cometabolic involvement of microbes in the degradation of this chemical is also denoted by the fact that glyphosate degradation and general microbial activity in the soil are correlated. Another evidence presented for cometabolic degradation of glyphosate is the absence of lag phase in soil [28], which implies that the degrading enzymes must already be present in the soil before glyphosate application. On the contrary, a few studies have shown that microbes can utilize glyphosate as a substrate for carbon [33,40], phosphate [39], or nitrogen [32].

Degradation or mineralization of glyphosate has been found to have a negative correlation with the soil adsorption capacity for glyphosate [41], possibly because of low bioavailability. Despite being highly water-soluble, glyphosate has limited movement within the soil profile because of strong adsorption to soil particles [42]. Adsorption of glyphosate to soil is determined by the amount of clay,

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Glyphosate degradation by microbial activity has been broadly studied, and bacterial species involved in the degradation have been isolated and characterized [48]. Bacteria are considered to be the main drivers behind its degradation in soil, even though the fungi have also been found to play an important role [49]. Degradation studies of glyphosate as a source of phosphorus (P) in the pure culture and soil media seem to show differences in the degradation kinetics. Furthermore, the rate of glyphosate degradation also varies when different microorganisms are used [50]. A slow lag phase followed by accelerating phase was observed in the degradation of glyphosate by a pure culture, while no lag phase was seen in the soil [50]. Results from such studies imply that pure culture studies may yield important information on degrading potential of microbes, but the application of such information to in situ conditions requires further investigations.

Primarily, there are two pathways of microbial degradation of glyphosate [39]. In one pathway, the intermediate compound formed is aminomethylphosphonic acid (AMPA), and in the other, sarcosine and glycine are formed. However, AMPA is considered to be the most common metabolite of glyphosate degradation as it accounts for more than 90% of the reported metabolites. The enzyme glyphosate oxidoreductase breaks the C–N bond in glyphosate to produce AMPA and glyoxylate [51]. The bacterial enzyme glyphosate oxidoreductase employs flavine adenine dinucleotide (FAD) as a cofactor, which is crucial in the degradation pathways of glyphosate. The FAD is believed to be reduced at the active site by glyphosate. Glyphosate oxidoreductase enzyme is inserted into the plant genomes for making glyphosate-tolerant Roundup Ready® crops [52].

3. Glyphosate's Effects on Crop Health

Among several concerns pertaining to unintended effects of glyphosate, its negative effects on nontarget plants are of serious concern among producers. Glyphosate applied to control weeds can reach the nontarget areas through several routes. The primary route is through undirected spray applications or "spray drift", which can directly carry the herbicide chemical to crops. Research has demonstrated that off-target movement or drift of glyphosate during application can be up to 10% of the applied rate in crops like soybean and cotton [16,53]. Although herbicide exposure during application drift would be considered sublethal, response can be potentially severe for susceptible crops. For instance, drift from glyphosate has been found to cause distorted fruit (often termed as "cat-facing") to develop in tomatoes at sublethal rates of exposure [54].

Another potential route for glyphosate accumulation and stabilization in soils is represented by the release of glyphosate from plant residues of glyphosate-treated weeds. As glyphosate is fairly stable and not immediately metabolized in many plant species, substantial amounts can be extensively translocated to regions of active growth and accumulate, particularly in young tissues [55]. After weeds eventually die, it ends up in the soil following the decay of plant parts. More intensive evaluations have revealed that glyphosate is translocated within plants, accumulated in roots, and eventually released into the rhizosphere [56–58]. From the soil, glyphosate may also be reabsorbed by the target or nontarget plants back through the roots after the initial application. There are a few studies that have investigated the effects of root-zone exposure of glyphosate on crops, including cotton [59], maize [60], and rapeseed [61]. These studies indicate there is a likelihood for glyphosate's root absorption into crops. However, most of the conclusions were drawn from observations in hydroponic nutrient solutions, and hence additional research would be valuable for better understanding the uptake of glyphosate from soils and its ensuing effects on crop functioning.

Glyphosate blocks the synthesis of essential amino acids through binding and subsequent inactivation of an enzyme (EPSPS) that is critical in the shikimate pathway [28]. An array of phenolic compounds that play a significant role in plant immunity are derived from the same metabolic pathway. By disrupting the synthesis of such defense compounds in plants, glyphosate predisposes the crops to attack by soil-borne pathogens [62]. Hence, it could be argued that continuous crop exposure to glyphosate may increase plant susceptibility to diseases [15,63]. Excessive glyphosate application has been linked to disease development in many crops. For instance, glyphosate applications were found to be the main factor in the development of diseases such as Fusarium head blight in agronomic crops [64]. There are documented reports of increased colonization of pathogen in wheat and barley roots correlated with burndown applications of glyphosate before planting [65]. Moreover, the effects of sublethal doses of glyphosate on perennial plants sometimes take a year after exposure to appear and continue for two or more years [66]. Glyphosate can also predispose plants to diseases indirectly by reducing the overall growth and vigor of the plants, modifying soil microflora that affects the availability of nutrients required for disease resistance, and altering the physiological efficiency of plants.

The root uptake and translocation of glyphosate in nontarget plants have been studied. In one such experiment to understand the consequences of glyphosate residues on plant species used in ecological restoration, test plants were grown in nonadsorbing media continuously treated with glyphosate. Observations suggested that nonadsorbed glyphosate residues can cause potential phytotoxicity to sensitive plants through root uptake and subsequent translocation to other parts of the plant [67]. However, the study system utilized in this work is comparable to a spray application situation that has a risk of high herbicide delivery rate, regardless of the label recommendation. The uptake, translocation, and metabolism of glyphosate in nontarget tea plants were examined in a hydroponic system by Tong et al. [68]. The highest content of glyphosate was observed in the plant roots, where it was also metabolized to AMPA. The glyphosate and its metabolite were transported from the roots through the xylem or phloem to the stems and leaves. The results from this study indicated that plant-available glyphosate could be continuously absorbed by roots, metabolized, and transported into edible tea leaves [68]. Glyphosate uptake into nontarget plants is suggested when the herbicide

and its degradation products (e.g., AMPA) are found in plant tissues and seeds of crops like soybean and corn [69] and tree foliage [20] following application of glyphosate to manage weeds in farms and adjacent areas.

Another potential side effect of glyphosate that needs to be discussed is its effect on root formation. Bott and coworkers [70] demonstrated glyphosate's ability to inhibit root elongation, lateral root formation, and root biomass production in soybeans. It was even demonstrated that glyphosate released from dead weeds could be absorbed through the roots of growing citrus plants [17]. After entering the plant system, glyphosate is rapidly translocated to young growing tissues of roots, where it can accumulate and inhibit growth [71]. By blocking the production of tryptophan, glyphosate prevents the synthesis of a major growth promoter called indole acetic acid (IAA), which can explain the reduction in root growth of plants [15].

There are also some concerns about the deleterious effects of glyphosate on fruit retention in tree crops, such as citrus. Fruit drop in citrus is a natural phenomenon, but an increase in fruit drop has been reported after glyphosate application, especially in late summer and fall for early-season oranges and grapefruits [72,73] with an impact on fruit yield. The reason for this glyphosate-linked drop is far from understood as it is not even consistent across different seasons. However, it is known that glyphosate enhances ethylene production in plant tissues, and ethylene exposure of mature citrus fruit may result in early abscission and fruit drop. More research is needed to understand the causes of this fruit drop and the exact role of glyphosate in this process.

4. Glyphosate's Interaction with Crop Nutrition

Glyphosate's interaction with soil occurs when a foliar spray hits the soil surface or when glyphosate is released from decomposing weed tissue [17]. Glyphosate in the soil will be immobilized by adsorption or binding to the soil colloids and hence persists in the soil. The adsorption characteristics of glyphosate are different from most other herbicides. Adsorption of glyphosate on the soil is influenced more by soil minerals rather than organic matter [74]. Glyphosate is a divalent metal cation chelator and has been purported to reduce the uptake and translocation of nutrients in crops. Recent evaluations on the chelating ability of glyphosate highlighted it as a key factor in nutrient deficiencies in crops. These reduced availabilities of nutrients as a result of external (in the soil) or internal (in the plants) interaction of glyphosate with cationic nutrients are observed in production systems that heavily rely on glyphosate for weed management. For instance, Eker et al. [75] found that glyphosate residues or drift may reduce the uptake and translocation of micronutrients, such as Mn and Fe, in nontarget plants and suggested glyphosate−metal complex formation in plant tissues and/or plant rhizospheres. These poorly soluble chelated complexes of glyphosate with micronutrients hinder their root uptake and translocation by the crops. There are many similar studies that link the ability of glyphosate to inhibit the acquisition of micronutrients, such as Mn, Fe, Zn and B, in plants exposed to glyphosate, either through spray drift [76,77] or root uptake [78]. Such interactions of glyphosate with plant nutrition may potentially pose consequences on crop health. For instance, in tree crops like citrus, it is well known that these micronutrients are involved in disease, particularly Huanglongbing (HLB), resistance mechanisms [79,80].

The mechanism of binding of glyphosate and phosphate compounds to the soil solids and adsorption sites have been found to be similar [81]. Thus, the mobility of P in the soil is affected by the presence of glyphosate. The interaction between glyphosate and P in soil was reported shortly after the herbicide was launched into the market [20]. Many of the studies conducted later have verified that P and glyphosate compete for adsorption in the soil, and the competition substantially differs in various kinds of soils [75,82,83]. Therefore, the competition between glyphosate and P for adsorption sites in soil seems to be vital and makes a significant impact on mobility and crop availability aspects of P as a crop nutrient. Unfortunately, there is sparse information in the literature that demonstrates the noteworthy effect of such competition on P nutrition of crops, and thus further investigation is required.

5. Conclusions and Future Direction

Glyphosate has often been termed as a "once-in-a-century herbicide" because of its tremendous impact on weed management and the crop production industry. Although known to degrade relatively quickly in the soil following application, glyphosate and its metabolites can possibly persist in soil, water, and plant tissues in certain conditions. Research suggests that glyphosate may reach groundwater, surface water, and several other nontarget sites through processes such as leaching and surface runoff. It is also evident from several studies that glyphosate applied to cropping systems can potentially reach unintended areas and plant tissues through processes like off-target herbicide movement, spray drift, and root uptake. While such exposure of crops to glyphosate would be considered sublethal, it would seem wise to comprehend the consequent impacts on the health and nutrition of crops.

The best way to prevent these adverse crop effects related to glyphosate use is to avoid the "off-target" movement or "spray drift" of this herbicide to unintended areas from the application site. Furthermore, soil analysis for residual content of glyphosate is beneficial to detect whether the affected soils contain herbicide residues above the threshold that leads to root uptake and related crop effects. Clearly, further research is needed to understand crop risks related to glyphosate residues in soils, particularly in soil settings with low adsorption capacity and at very high rates of herbicide application.

Owing to the relatively high mobility of glyphosate, the likelihood of a rise in surface and groundwater content in tandem with herbicide use is high. Hence, potential routes of exposure into the environment, as well as the consequent implications on animals and humans, need to be explored more thoroughly. Moreover, there is an increasing concern toward the existence and concentration of glyphosate residues in a variety of crops produced for human and animal consumption. This necessitates an advanced dietary risk assessment of glyphosate resulting from its exposure.

In a nutshell, the extensive use of glyphosate and the environmental risks associated with it warrant awareness among its users about its judicious utilization and necessitate further intense investigations to mitigate, avoid, or remove the problems resulting from its use.

Author Contributions: R.K., B.G., D.K., O.B. and F.A. contributed to the writing and editing of this review article.

Funding: Funding was provided by the University of Florida.

Conflicts of Interest: The authors declare no conflicts of interest.

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27 APRIL 2021

AGENDA ITEM 11.1

CHAIRPERSON REPORT

Recommendations

The chairperson recommends that the Community Board:

1. *Receive the Chairperson Report.*
2. *Considers the draft Featherston Community Board Long Term Plan and Spatial Plan submissions (to be tabled) and make suggestions for adjustments as deemed necessary.*
3. *Resolves to either:*

A. *Approve the Featherston Community Board submissions to the 2021/31 Long Term Plan and Spatial Plan; or*

B. *Delegate to the Featherston Community Board Chair the ability to submit the submissions to the 2021/31 Long Term Plan and Spatial Plan based on the draft submissions presented and updated to incorporate feedback from the Community Board.*

1. Meetings and Events

Date	***Past meetings or events***
13th Mar	Opening of Windy Wheels Bike Track at Featherston School
17th Mar	Long Term Plan and Spatial Plan Workshop
20th Mar	Dogs in Togs
25th Mar	Met with Siv Fjaerestad, SWDC Community Development Coordinator, regarding the Mayors Taskforce for Jobs

2. Windy Wheels

This was the first stage (basis track) of three stages which offers cycling education along with bicycle repairs. This includes all three South Featherston Schools along with the Featherston community.

Stage 2, which is the Skills track, is being discussed with a start date yet to be confirmed.

3. Long Term Plan and Spatial plan

A good meeting was held to discuss and explain the Spatial and Long Term Plans.

Featherston Community Board submissions to these plans will be tabled for the meeting.

4. Dogs in togs

Another good community event including local clubs and businesses.

5. Meeting with SWDC Community Development Coordinator

I met with Siv Fjaerestad, Community Development Coordinator of South Wairarapa District Council (SWDC), where she explained that she wanted the Community Board to be involved with the Mayors Taskforce for Jobs (MTFJ). I asked Siv how many Featherston youth had been employed, and how many Featherston businesses had received financial assistance but to date haven't received anything from her. The only information I have received to date was from Alan Maxwell stating that three Featherston youth had been placed into roles in the Pilot scheme back in June/July 2020. Back then, no Featherston businesses had received any financial assistance.

Siv also spoke about holding a Community/Business event to ascertain which local businesses or youth needed employment assistance so I am just waiting to get further details from her to see what assistance we are able to give.

6. Anzac flags

Esther Bunning approached all three Community Boards regarding the purchase of Anzac designed flags to be displayed on the FlagTrax systems in all three towns. There was also discussion from Ann Rainford (Greytown Community Board Chair) to also possibly display Māori Battalion flags. My concerns were:

1. The initial time frame given to order the flags which meant an unrealistic opportunity to communicate with our local RSA to get their input.

2. Not using our local supplier which meant higher prices.

3. Not involving the local RSA branches to get their input.

After discussions with Community Board members and our appointed Council members it was agreed we would not take up the offer, with a preference of meeting with our local RSA and Māori Battalion representative to get agreeance on future flags.

7. Appendices

Appendix 1 – Submissions to the SWDC 2021/31 Long Term Plan and Spatial Plan

Report compiled by Mark Shepherd
Chair
Featherston Community Board

Appendix 1 - Submissions to the SWDC 2021/31 Long Term Plan and Spatial Plan

MEMBER REPORT
for
Featherston Community Board Meeting
27 April 2021

Member Name	Claire Bleakley
Group Name	Featherston Community Board
Meeting Date	27 April 2021
Specific item/s for Board/Committee consideration	To sort out a date for Mike Gray to run a workshop
General	**Effective Local Democracy Group** Mike Gray, Warren Woodgyer and Perry Cameron. I have been attending regular meetings held in Everest Café discussing the importance of "strong, effective, democratic communities. We had a meeting with Mike Reid on Thursday 15 April about local democracy. We discussed the challenges the local communities had in the future and the uncertainty that any long-term decision could have until the three-water reform review is published. It appears there might be no opt out option. The South Wairarapa is one of the largest GDP in horticulture, dairy, sheep and fishery and forestry in New Zealand. Local Government has a massive responsibility to maintain the economic livelihoods and recreational areas of the region. A Local Government Discussion Paper is being released in June. The terms of reference are being prepared by three Commissioners. The paper will look to the future focus of councils.