SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

ASSETS AND SERVICES COMMITTEE

Agenda

NOTICE OF MEETING

An ordinary meeting will be held in the Supper Room, Waihinga Centre, Texas Street, Martinborough on Wednesday 12 May 2020 at 10:00am. The meeting will be held in public (except for any items specifically noted in the agenda as being for public exclusion).

MEMBERSHIP OF THE COMMITTEE

Councillors Brian Jephson (Chair), Garrick Emms, Rebecca Fox, Pip Maynard, Alistair Plimmer, Ross Vickery and Mayor Alex Beijen.

Open Section

A1. Apologies

A2. Conflicts of interest

A3. 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.

A4. Actions from public participation

A5. Extraordinary business

A6. Minutes for Confirmation: Pages 1-6

Assets and Services Committee Minutes of 11 March 2021

***Proposed Resolution**: That the minutes of the Assets and Services Committee meeting held on 11 March 2021 are a true and correct record.*

***Proposed Resolution**: That the publicly released sections of the public excluded minutes of the Assets and Services Committee meeting held on 11 March 2021 are a true and correct record.*

B. Recommendations from Community Boards

B1. Recommendations from Greytown Community Board – Road Safety in Greytown Pages 7-12

C. Information and Verbal Reports from Chief Executive and Staff

D. Public Excluded Business

The general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution are as follows:

Report/General Subject Matter	Reason for passing this resolution in relation to the matter	Ground(s) under Section 48(1) for the passing of this Resolution
Public Excluded Minutes from 11 March 2021 for confirmation (not yet released)	Good reason to withhold exists under section 7(2)(b)(ii), 7(2)(h) and 7(2(i)	Section 48(1)(a)

This resolution is made in reliance on Section 48(1)(a) of the Local Government Official Information and Meetings Act 1987 and the particular interest or interests protected by section 6 or section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public are as follows:

Reason for passing this resolution in relation to the matter	Ground(s) under Section 48(1) for the passing of this Resolution
The withholding of the information is necessary to protect information where the making available of the information would be likely unreasonably to prejudice the commercial position of the person who supplied or who is the subject of the information.	Section 7(2)(b)(i)
The withholding of the information is necessary to enable any local authority holding the information to carry out, without prejudice or disadvantage, commercial activities	Section 7(2)(h)
The withholding of the information is necessary to enable the Council to carry out, without prejudice or disadvantage, negotiations (including commercial and industrial negotiations)	Section 7(2(i)

***Proposed Resolution**: That the remaining public excluded sections from minutes of the Assets and Services Committee meeting held on 11 March 2021 are a true and correct record.*

ASSETS AND SERVICES COMMITTEE
Minutes from 11 March 2021

Present:	Councillors Brian Jephson (Chair), Garrick Emms, Rebecca Fox, Pip Maynard (from 10:11am), Ross Vickery and Mayor Alex Beijen.
In Attendance:	Euan Stitt (Group Manager Partnerships and Operations), Harry Wilson (Chief Executive), Katrina Neems (Chief Financial Officer), Karen Yates (Policy and Governance Manager), and Suzanne Clark (Committee Advisor). Wellington Water: Jeremy McKibbin, Colin Crampton, Ian McSherry.
Conduct of Business:	The meeting was held in the Supper Room, Waihinga Centre, Texas Street, Martinborough and was conducted in public between 10:00am and 1:15pm except where expressly noted.
Also in Attendance:	Cr Pam Colenso and Cr Brenda West.

Open Section

A1. Apologies

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/01) to receive apologies from Cr Alistair Plimmer and lateness apologies from Cr Pip Maynard.

(Moved Cr Fox/Seconded Cr Emms) Carried

A2. Conflicts of Interest

There were no conflicts of interest declared.

A3. Public Participation

There was no public participation.

A4. Actions from Public Participation

There were no actions from public participation.

A5. Extraordinary Business

There was no extraordinary business.

A6. Minutes for Confirmation

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/02) that the minutes of the Assets and Services Committee meeting held on 16 December 2020 are a true and correct record.

(Moved Cr Emms/Seconded Cr Fox) Carried

C Information and Verbal Reports from Chief Executive and Staff

C1. Partnerships and Operations Report

Wellington Water staff discussed expenditure of government water stimulus, upcoming water and wastewater regulations and new standards, the delay to commissioning a fourth Greytown bore, performance indicators and measures, staff resource allocation and availability across the region, Long Term Plan input preparation and decarbonisation with members.

Mr McSherry tabled a presentation on building South Wairarapa capability.

The meeting adjourned at 11:15am.

The meeting reconvened at 11:30am.

Members discussed gravel build-up in Donalds Creek, drain clearing, and project updates with Council officers.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/03) to receive the Partnerships and Operations Report.

(Moved Cr Jephson/Seconded Cr Vickery) Carried

C2. Wellington Water Ltd – Verbal Reports

Water updates were provided under the previous agenda item.

C3. Action items

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/04) to receive the Action Items Report.

(Moved Cr Fox/Seconded Cr Vickery) Carried

C4. Cape Palliser Residents and Ratepayers Association

Mr Stitt advised that some of the work outlined was subject to funding being secured in the Long Term Plan so timeframes were not yet available. Cr Jephson undertook to share the report with the Association at their next meeting.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/05):

1. To receive the Cape Palliser Residents and Ratepayers Association (CPRRA) – Submission to Council
2. To note the actions being taken for the issues identified in the submission.

(Moved Cr Fox/Seconded Cr Emms) Carried

D Public Excluded Business

The general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution (A&S2021/06) are as follows:

Report/General Subject Matter	**Reason for passing this resolution in relation to the matter**	**Ground(s) under Section 48(1) for the passing of this Resolution**
Central Greytown Property Update	Good reason to withhold exists under section 7(2)(b)(ii), 7(2)(h) and 7(2(i)	Section 48(1)(a)
Purchase of Land	Good reason to withhold exists under section 7(2)(b)(ii), 7(2)(h) and 7(2(i)	Section 48(1)(a)

This resolution is made in reliance on Section 48(1)(a) of the Local Government Official Information and Meetings Act 1987 and the particular interest or interests protected by section 6 or section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public are as follows:

Reason for passing this resolution in relation to the matter	**Ground(s) under Section 48(1) for the passing of this Resolution**
The withholding of the information is necessary to protect information where the making available of the information would be likely unreasonably to prejudice the commercial position of the person who supplied or who is the subject of the information.	Section 7(2)(b)(i)
The withholding of the information is necessary to enable any local authority holding the information to carry out, without prejudice or disadvantage, commercial activities	Section 7(2)(h)
The withholding of the information is necessary to enable the Council to carry out, without prejudice or disadvantage, negotiations (including commercial and industrial negotiations)	Section 7(2(i)

Confirmed as a true and correct record

……..(Chair)

……..(Date)

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

ASSETS AND SERVICES COMMITTEE
Public Excluded Minutes from 11 March 2021

Present:	Councillors Brian Jephson (Chair), Garrick Emms, Rebecca Fox, Pip Maynard, Ross Vickery and Mayor Alex Beijen.
In Attendance:	Euan Stitt (Group Manager Partnerships and Operations), Harry Wilson (Chief Executive), Katrina Neems (Chief Financial Officer), Karen Yates (Policy and Governance Manager), Sarah Pearson-Coats (Project Officer), Bryce Neems (Amenities and Waste Manager) and Suzanne Clark (Committee Advisor).
Conduct of Business:	The meeting was held in the Supper Room, Waihinga Centre, Texas Street, Martinborough and was conducted under public excluded provisions between 12:04pm and 1:15pm.
Also in Attendance	Cr Pam Colenso and Cr Brenda West.

Open Section

A1. Apologies

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/01) to receive apologies from Cr Alistair Plimmer and lateness apologies from Cr Pip Maynard.

(Moved Cr Fox/Seconded Cr Emms) Carried

D Public Excluded Business

The general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of resolution (A&S2021/06) are as follows:

Report/General Subject Matter	Reason for passing this resolution in relation to the matter	Ground(s) under Section 48(1) for the passing of this Resolution
Central Greytown Property Update	Good reason to withhold exists under section 7(2)(b)(ii), 7(2)(h) and 7(2(i)	Section 48(1)(a)
Purchase of Land	Good reason to withhold exists under section 7(2)(b)(ii), 7(2)(h) and 7(2(i)	Section 48(1)(a)

This resolution is made in reliance on Section 48(1)(a) of the Local Government Official Information and Meetings Act 1987 and the particular interest or interests protected by section 6 or section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public are as follows:

Reason for passing this resolution in relation to the matter	**Ground(s) under Section 48(1) for the passing of this Resolution**
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The withholding of the information is necessary to enable any local authority holding the information to carry out, without prejudice or disadvantage, commercial activities	Section 7(2)(h)
The withholding of the information is necessary to enable the Council to carry out, without prejudice or disadvantage, negotiations (including commercial and industrial negotiations).	Section 7(2(i)

A1. Apologies

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/01) to receive apologies from Cr Alistair Plimmer and lateness apologies from Cr Pip Maynard.

(Moved Cr Fox/Seconded Cr Emms) Carried

C1. Central Greytown Property, Update

The meeting adjourned at 12:04pm.

The meeting reconvened at 12:14pm.

Cr Vickery left the meeting at 12:15pm.

Cr Vickery returned to the meeting at 12:18pm.

Members were in agreement not to sell or lease the land long-term as both options meant that the land would become unavailable for public use. In addition, the economic benefit and income potential for the district was minimal.

The Committee considered that the land was under-utilised and directed officers to investigate future public uses. The Greytown Menz Shed should be informed of the Committee's view.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2021/07PE):

1. To receive the 'Central Greytown Property, Update' Report and note that this report should be read in conjunction with the Council report entitled 'Central Greytown Property, Options Analysis' presented to Council in a public excluded meeting on 28 October 2020.

   (Moved Mayor Beijen/Seconded Cr Maynard) Carried

2. To recommend to Council not to sell or enter into a long-term lease at 85 and 87 West Street, Greytown at this time.

   (Moved Cr Fox/Seconded Mayor Beijen) Carried

3. To note that the Assets and Services Committee indicated two possible future uses of 85 and 87 West Street, Greytown, such as an urban park or a Council

owned amenity, and that detailed consideration of the future use of the land be incorporated into the planning for the 2024/2034 Long Term Plan.

4. Note that there will be consideration of the future use of the land by Council for the greater benefit of the South Wairarapa district.

   (Moved Cr Jephson/Seconded Cr Vickery) Carried

5. That the report and associated minutes are released from public excluded once Council has made a decision on the future of the land.

   (Moved Cr Jephson/Seconded Cr Vickery) Carried

[redacted]

Confirmed as a true and correct record

……..(Chair)

……..(Date)

ASSETS AND SERVICES COMMITTEE

12 MAY 2021

AGENDA ITEM B1

RECOMMENDATION FROM GREYTOWN COMMUNITY BOARD - ROAD SAFETY IN GREYTOWN

Purpose of Report

To inform Councillors of an initiative proposed by Greytown Community Board (GCB) to improve safety of Main Road and the closure of the end of McMaster Street in Greytown to vehicles.

Recommendations

Officers recommend that the Assets and Services Committee:

1. *Receive the Road Safety in Greytown Report.*
2. *Note the issues identified by the local community and Greytown Community Board.*
3. *Consider the proposed initiative once the proposed safety improvements from Waka Kotahi, NZTA, for the SH2 corridor in Greytown are known.*

1. Executive Summary

The GCB have made a number of recommendations for the Assets and Services Committee to consider improving the safety of the Main Road in Greytown and the closure of the end of McMaster Street to vehicles. In parallel, Officers are discussing potential safety improvements with NZTA for this area, which will be put out for community consultation from July onwards.

2. Background

At its meeting on the 7th April 2021, the Greytown Community Board (GCB) heard a number of concerns expressed by local residents on the safety of State Highway 2 as it passes through Greytown, the interchange with McMaster Street and the potential for an improved pedestrian area in the centre of the town.

A summary of the discussion from the GCB is provided at Appendix 1.

At its meeting, the GCB resolved to recommend the following to this Committee:

a) *To consider the closure of the top part of McMaster Street from north of the Library carpark and the rear entrance to Pinocchio restaurant for a trial period.*
b) *To request NZTA consults in Greytown concerning raised pedestrian crossings and the removal of some car parks on Main Street to enhance visibility and safety.*
c) *To undertake a review of car and pedestrian management in Greytown.*
d) *To request NZTA is approached regarding their appetite for an Innovating Streets Programme in Greytown.*

3. Discussion

Road Safety is a particular concern for both Council and the NZTA. Officers have been discussing possible safety improvements with NZTA to alleviate areas of concern in the Main Road in Greytown and a plan is being developed that will be put out for public consultation from July. This plan may include improving sightlines at junctions and crossings, slowing traffic through the town and improved pedestrian crossings.

Further to recommendation d, above, there is no more funding available from NZTA this year for an Innovating Streets project in the area and, indeed, any new NZTA budgets will not be known until July 2021.

4. Conclusion

Given the ongoing safety planning work being undertaken with NZTA it is recommended that the Committee consider this initiative once this plan is known and suitable funding can be secured to deliver any improvements.

5. Appendices

Appendix 1 – GCB Report on Safety Issues on Main Street and closure to part of McMaster Street to vehicles

Contact Officer: Euan Stitt, GM Partnerships and Operations
Reviewed By: Harry Wilson, CEO

Appendix 1 – GCB Report on Safety Issues on Main Street and closure to part of McMaster Street to vehicles

GREYTOWN COMMUNITY BOARD

Report

Safety Issues on Main Street

And

Closure to Part of McMaster Street to Vehicles

General Introduction

On Wednesday 7th April 2021 there was a turnout of approximately 30 residents at the Greytown Community Board meeting. They engaged in the public forum section and outlined the current safety problems on Main Street Greytown and supported the closure to vehicles of part of McMaster Street.

There were four main speakers (written presentations attached). They outlined the history of the problem, present safety issues involving pedestrian crossings, car parking hindering visibility and the possibility of closing off the top end of McMaster Street for pedestrian use only.

The latter has the support of the **Greytown Heritage Trust.** In considering the visual –as well as the safety-improvement of the Town Centre, they suggested that the areas outside the Pinocchio Restaurant, the Greytown library and part of McMaster Street could be turned into a safe pedestrian centre, within the Greytown CBD.

Dinah Edridge, stated that 20 years ago her husband Max, a famous local architect, had envisioned that the closure of the top end of McMaster Street would enable this area to be a pedestrian precinct and the hub of the CBD. At that stage the owner of The Orchards on Reading Street had opposed the proposal.

With increased traffic and visitors to Greytown and the considerable associated safety issues, Dinah stated that the closure of the top of McMaster Street should now take place.

Lizzie Catherall talked about the huge changes in Greytown which is now a destination town. Successful growth has impacted hugely on traffic movements in the retailing/café section of Main Street, between the intersections of Kuratawhiti/Jellicoe Street and Hassell Street. There has been many near misses at the pedestrian crossing near McMaster Street. Cars going

North and South swing off McMaster Street into Main Street. The present bus route, with buses swinging across Main Street into McMaster, presented further accident potential. Safety issues are compounded by the proximity of this intersection to the Library, Greytown Kindergarten and Greytown School and the Greytown Lolly Jar, immediately across the crossing.

She stated that the centre of the Main Street should no longer be used by locals as a quick choice of route to local destinations and that the closure of access into and from McMaster Street was a positive solution for safety reasons.

Millie Blackwell discussed the danger of vehicles parking across the dotted yellow lines on the South side of the crossing, by McMaster Street, used as a short term parking space, which reduced the visibility of pedestrians. She suggested that if the top part of McMaster Street was closed then there should be an extension to the concrete barrier to prevent parking, thus keeping increased pedestrian traffic safe.

Craig Thorburn for Greytown Heritage Trust spoke in support of the proposal to close off the top section of McMaster Street. He voiced the need for a central point to Greytown, a pedestrian precinct and public space in the town centre. He provided examples of other towns with town centres, and potential uses of a precinct.

Other issues of concern

Several other comments were raised suggesting a need to review car and pedestrian management:

- Cars travelling at speed entering Greytown from the North
- The high camber of Main Street with high gutters
- Encourage Main Street workers to park away from Main Street
- Encourage Main Street residents with limited off-street parking not to park outside retail outlets
- Highlight alternative local parking facilities
- Educate public and youth on pedestrian crossing rules.

Results

There was support at the Community Board meeting for the closure of the top part of McMaster Street from North of the library car park and the rear entrance to Pinocchio restaurant.

Euan Stitt stated that NZTA would consult in Greytown from July concerning raised pedestrian crossings and the removal of car parks on the Main Street.

The Mayor stated that he would raise with NZTA the appetite for an Innovating Streets programme in Greytown.

Conclusion

It was agreed that a report of the meeting would be tabled at the Greytown Community Board meeting on 28th April 2021, to be forwarded to the next Assets and Services Committee for consideration.

ASSETS AND SERVICES COMMITTEE

12 MAY 2021

AGENDA ITEM B2

RECOMMENDATION FROM FEATHERSTON COMMUNITY BOARD - USE OF ALTERNATIVES TO GLYPHOSATE BY COUNCIL

Purpose of Report

To inform Councillors of a request from the Featherston Community Board (FCB) to investigating alternatives to Glyphosate based herbicides.

Recommendations

Officers recommend that the Assets and Services Committee:

1. *Receive the Use of Alternatives to Glyphosate by Council Report.*
2. *Note the issues identified by the Featherston Community Board.*
3. *Note that the improved environmental approaches, including the possible use of alternatives to Glyphosate based herbicides, will be considered as part of the procurement process for the next Parks and Reserves contract.*

1. Executive Summary

Community members have expressed concern at the ongoing use of glyphosate based herbicides by Council and have asked that the Assets and Services Committee consider alternatives to them for future use.

2. Background

At its meeting on the 27th April 2021, the Featherston Community Board (FCB) considered a Notice of Motion from one of its members, Claire Bleakely, and resolved:

1. To recommend that the Assets and Services Committee considers investigating alternatives to Glyphosate Based herbicides.

In addition, Officers attended a briefing by a possible supplier of an alternative herbicide on the 16th April.

3. Discussion

The Notice of Motion from the FCB, and its associated supporting research, is provided at Appendix 1.

Alternatives to glyphosate based herbicides are becoming increasingly common. Some use weed sprays that use acetic acid to kill weeds. Other alternative methods include the use of steam to reduce the environmental impact of killing weeds using glyphosate.

It should be noted that these alternatives often require repeated application and do not always effectively kill the weeds targeted and can also incur an increased cost in the short term.

However, in order to reduce the environmental impact of Council operations, Officers will include a criterion in the forthcoming Parks and Reserves tender process that will seek more environmentally friendly alternatives for weed killing from the market. This criterion will also seek other innovations for Council to consider adopting over the term of the contract.

4. Conclusion

Council will be seeking improved environmental solutions through the Parks and Reserves tender process and will include potential alternatives to glyphosate based herbicides.

5. Appendices

Appendix 1 – Notice of Motion: Alternatives to glyphosate based herbicides

Contact Officer: Euan Stitt, GM Partnerships and Operations
Reviewed By: Harry Wilson, CEO

Appendix 1 – Notice of Motion: Alternatives to glyphosate based herbicides

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

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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.

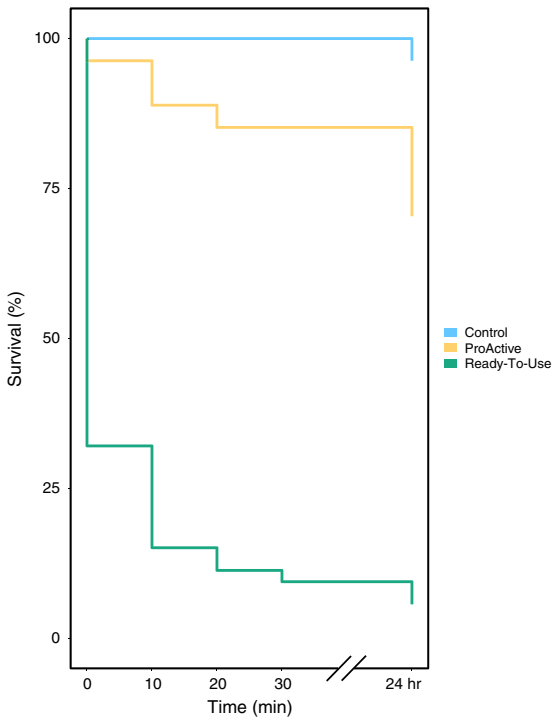

FIGURE 1 Experiment 1: Comparing the impacts of consumer and agricultural Roundup® products against the control, demonstrating high mortality with the Ready-To-Use treatment and intermediate mortality with the ProActive treatment

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.

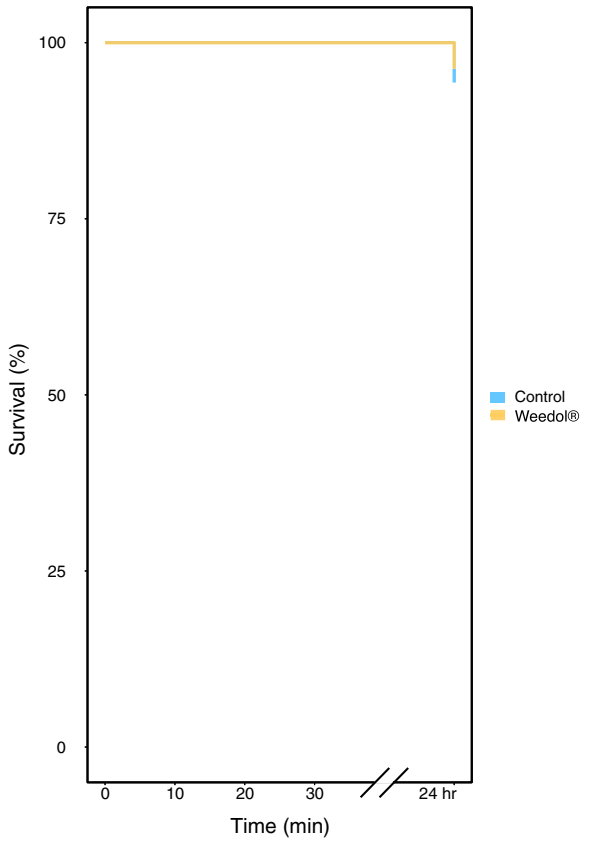

FIGURE 2 Experiment 4: Consumer product, and GBH alternative, Weedol® does not cause mortality relative to the control

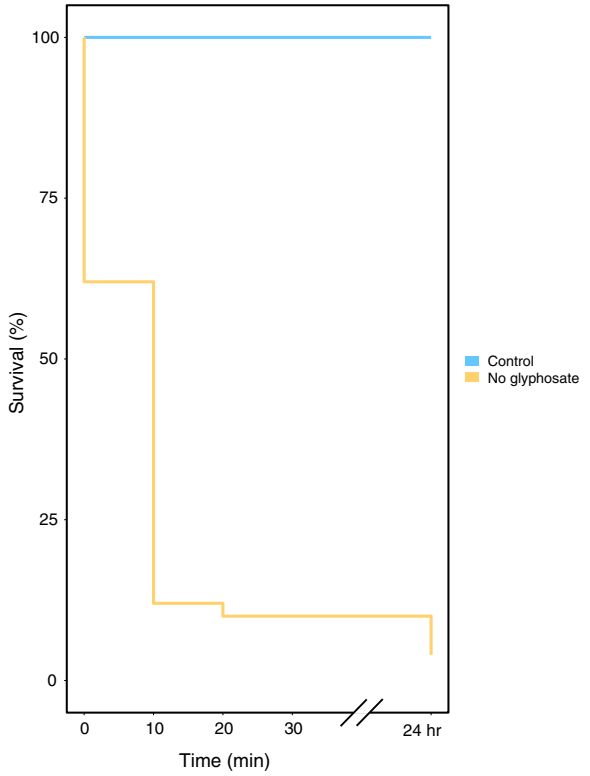

FIGURE 3 Experiment 5: The consumer product, and alternative to GBHs, Roundup® No Glyphosate causes high mortality

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

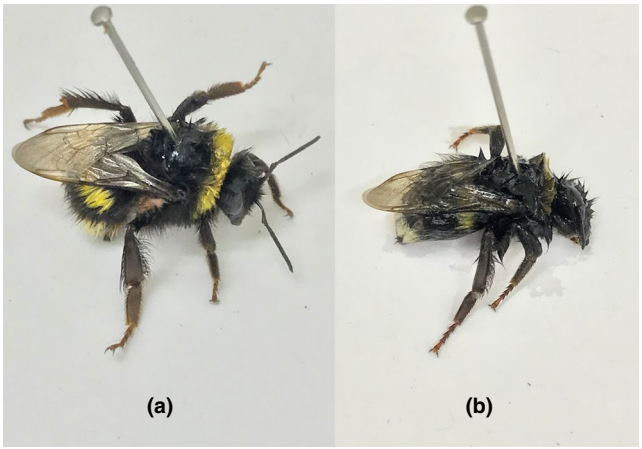

FIGURE 4 (a) Control and (b) Roundup® Ready-To-Use full concentration bumble bees sprayed and photographed within 5 min. Matting of the hairs over the bee's whole body can be seen in (b)

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.

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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.

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

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RESEARCH ARTICLE

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

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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.

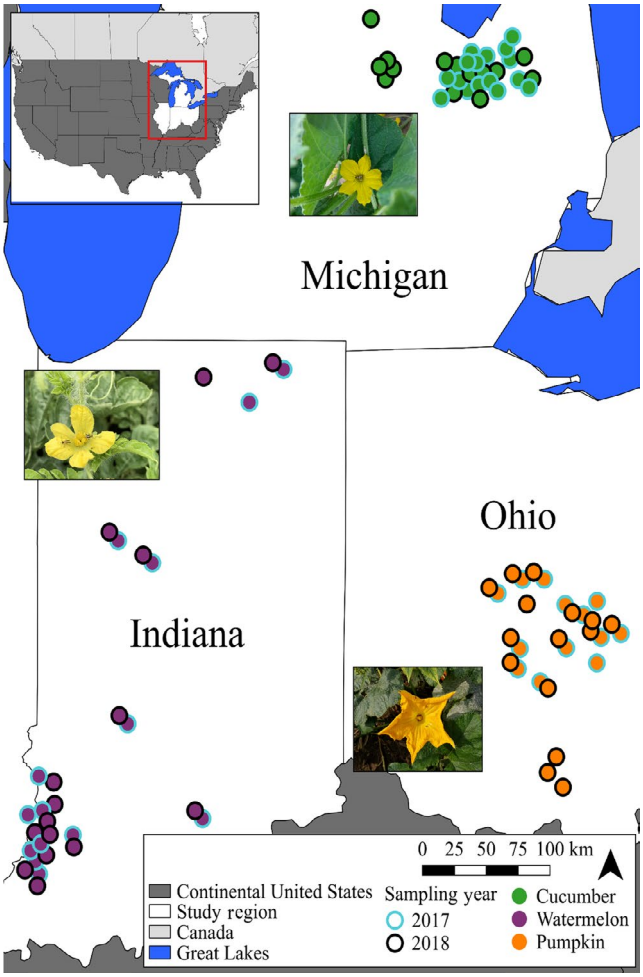

FIGURE 1 Map of the study region showing the distribution of sites. Orange, purple and green points are from pumpkin, watermelon and cucumber sites respectively. Blue and black circles around points are sites sampled in 2017 and 2018 respectively. The study region is located in the Midwest United States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

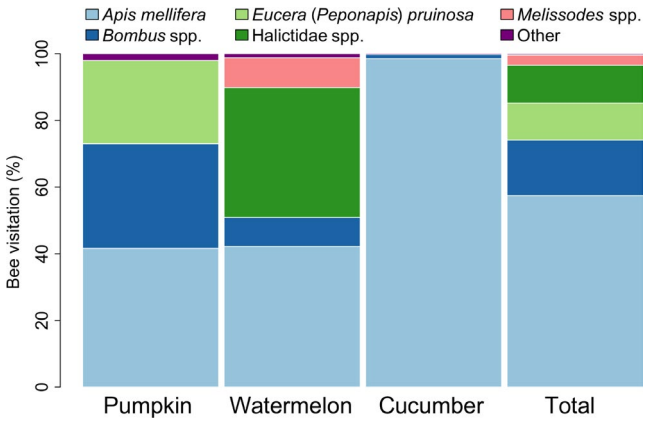

FIGURE 2 Relative proportion of wild and honeybee visitation events observed by crop and across all crops (total). Identifications of wild bees were classified into the lowest taxonomic level possible for observations made in the field. Those listed as 'other' constituted less than 0.4% of visitation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

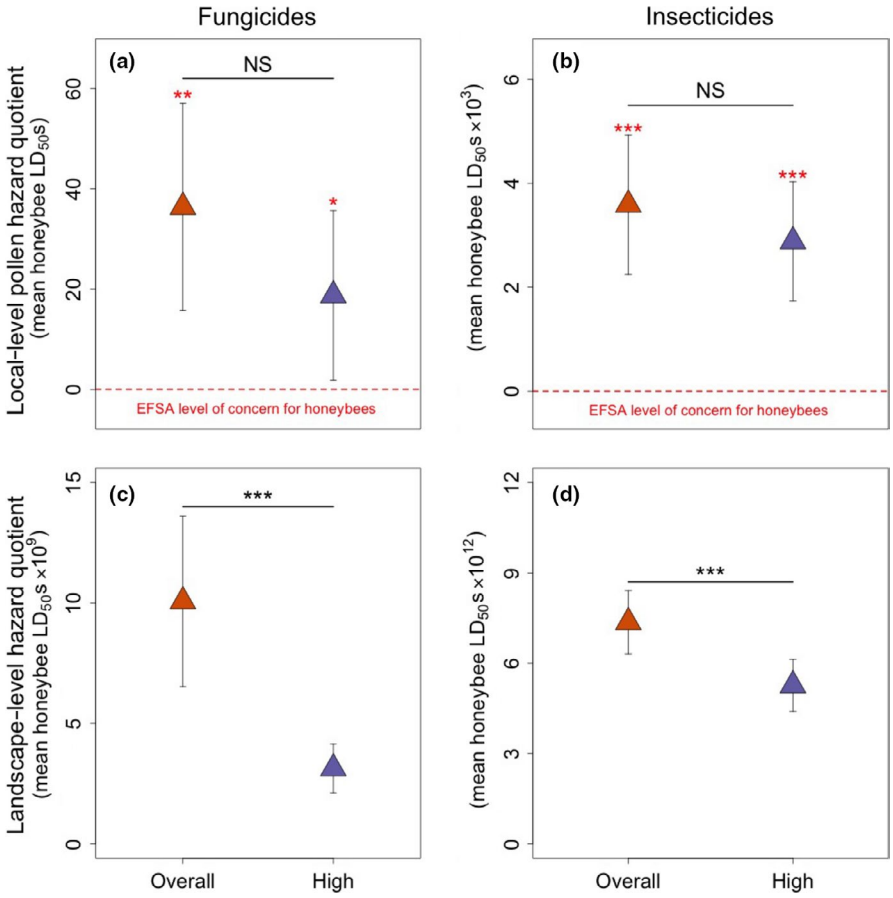

FIGURE 3 The mean and 95% confidence interval for hazard quotients at the (a, b) local and (c, d) landscape level. Local-level hazard quotients were generated from pollen analysis. 'Overall' values account for all pesticides while the 'high' values are pesticides found in the highest concentration in 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

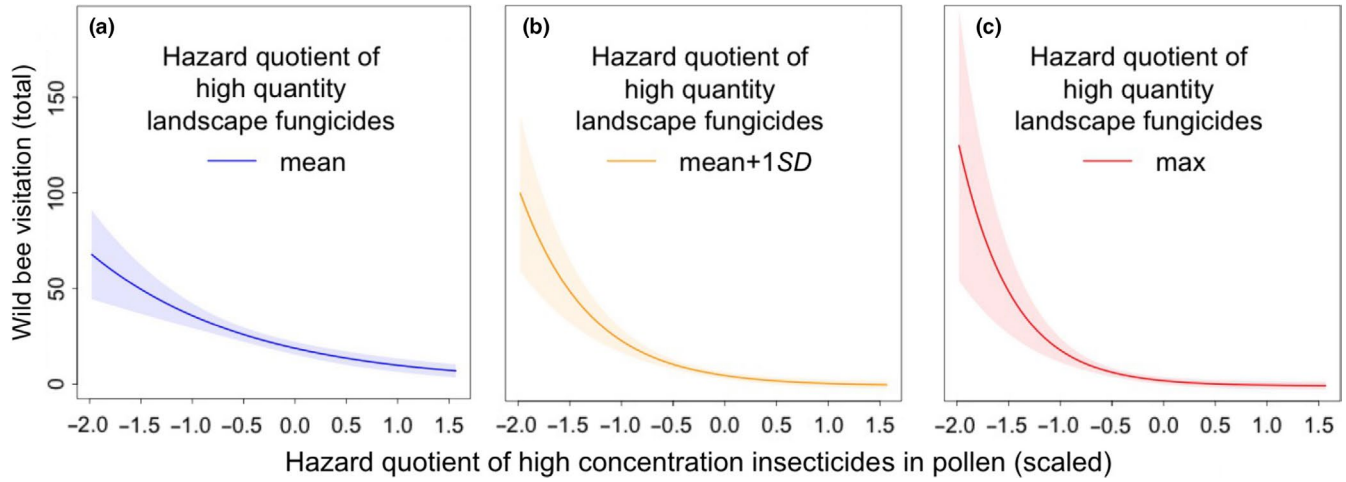

FIGURE 4 Model-averaged predictions and standard errors showing the response of wild bees to an increasing pollen hazard quotient (PHQ) mediated by high concentration insecticides at the (a) mean, (b) mean + 1 *SD* and (c) maximum hazard of fungicides applied in the highest quantities within 2 km of 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.

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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.

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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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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

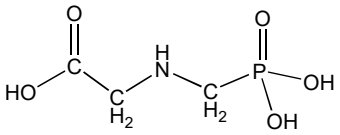
Glyphosate (*N*-(phosphonomethyl) glycine), after its introduction in the 1970s, became a popular herbicide among farmers because of its broad-spectrum weed control. The use of glyphosate as a "burn down" application alone, or in combination with other pre- or postemergent herbicides, became standard 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).

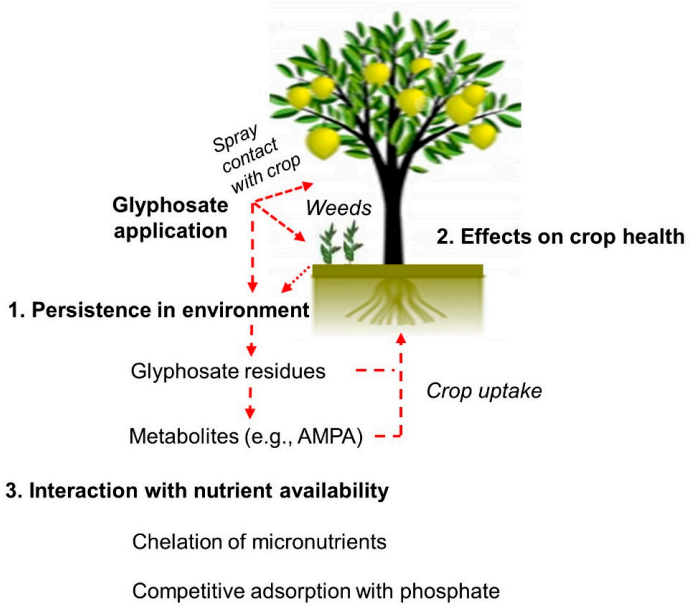


Figure 1. Schematic representation of the potential effects of glyphosate in crop production.

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].

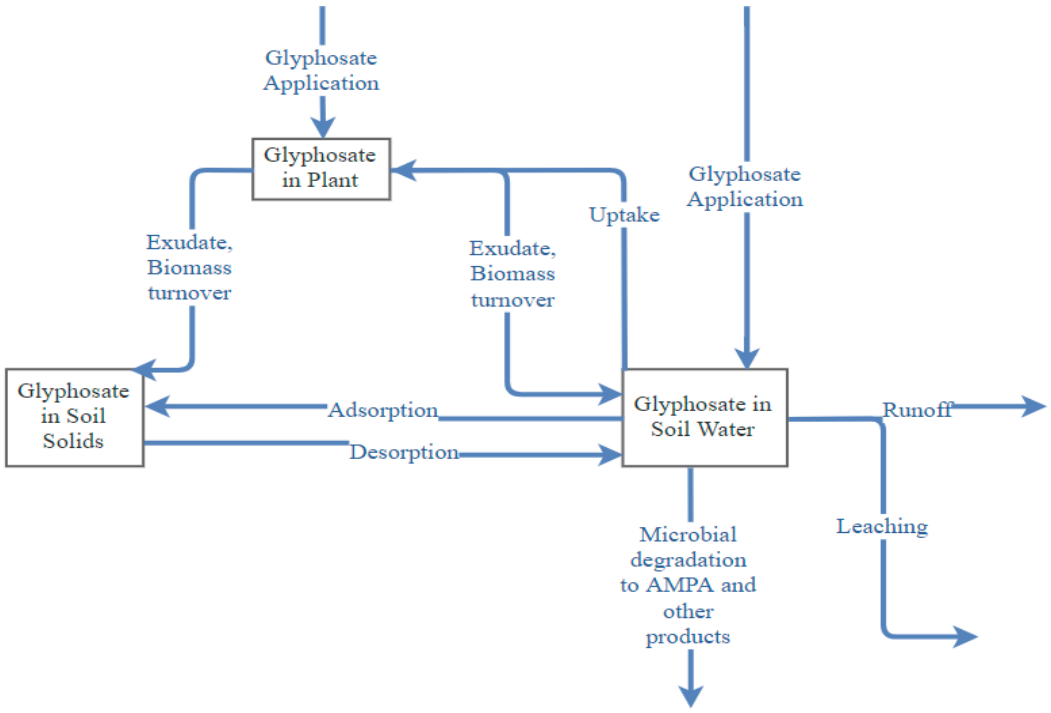


Figure 2. Fate and movement of glyphosate in different pools.

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].

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, organic matter, and iron and aluminum oxides present in soil [43,44]. Soil processes, such as adsorption/desorption, may control the glyphosate degradation rate as strong adsorption by soil solids, such as iron and aluminum oxides, may prevent microbial access to the compound [45,46]. There have been several studies on the adsorption characteristics of glyphosate, but only a few have studied the effect of adsorption on glyphosate bioavailability in soil. Sorensen et al. [41] found limited bioavailability of glyphosate in higher depths of sandy soil profile, where high adsorption and low desorption of glyphosate corresponded with negligible mineralization. On the other hand, in a study by Schnurer et al. [47], adsorbed glyphosate was found to be microbially degradable, even though the microbial activity was reduced in the presence of the herbicide.

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.

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AGENDA ITEM C1

KURANUI COLLEGE GYM – FUNDING AND AGREEMENTS

Purpose of Report

To inform members of the Concept Design, draft Memorandum of Understanding (MOU) with Kuranui College and Casual Use Agreement for community access to the proposed Kuranui College Gym.

Recommendations

Officers recommend that the Assets and Services Committee:

1. *Receive the Kuranui College Gym – Funding and Agreements Report.*
2. *Note the proposed concept design of the facility, and the content of the draft MOU and Casual Use Agreements.*

1. Executive Summary

As part of its 20/21 Annual Plan, Council agreed to provide $1m to part fund the construction of a gymnasium facility at Kuranui College, in conjunction with the College and the Ministry of Education (MoE). This funding is to be provided on the condition that the wider community can access and use the facility.

To enable this a draft MOU and Casual Use Agreement has been developed and will require Council approval prior to the release of funding. It is intended that these agreements will be submitted for full Council approval at its meeting on the 2 June 2021.

2. Background

On the 30th June 2020, as part of its 2020/21 Annual Plan deliberations, Council resolved to:

13. *Contributes $1 million towards the Kuranui College gymnasium replacement, subject to finalising the detail of the proposal and completing due diligence to Council's satisfaction.*

Officers have been liaising with Kuranui College and MoE staff to develop a draft MOU and Casual Use Agreement and the drafts of these documents are provided for consideration prior to the release of the funding by Council.

3. Discussion

3.1 Concept Design

The concept design, as developed by the MoE, is based in similar facilities provided by schools and colleges across the country. It includes a full size netball court, facilities for other sports, changing rooms, storage, toilet and shower facilities, and a mezzanine viewing area.

The concept design is provided at Appendix 1 for information.

3.2 MOU

The draft MOU is provided at Appendix 2 of this report and is intended to be agreed between Kuranui College and Council. Key provisions for Committee to note are:

- Establishment of a facility management group, which will include an SWDC and Greytown Sports and Leisure representatives to oversee use, access and any ongoing management issues.

- Maintenance (including cleaning, repair, security, utility provision, planned upgrades and insurance) of the facility all sit with Kuranui College and the MoE.

- Under H&S legislation, PCBU responsibility sits with the College.

- Community access is proposed to be between 5pm and 10pm during termtime and at other times, as agreed with the College, which would include daytime access out of term time and weekend use.

- Booking administration is proposed to be completed by the existing College Booking administrator and current system.

It is also intended to develop a Fair Use policy to ensure equitable access of the facility for a variety of groups.

3.3 Casual Use Agreement

The Casual Use Agreement will be between the College and the group booking the facility and Council will not be party to these agreements. The proposed template is provided at Appendix 3 for information and mirrors the College's existing agreement used for its other facilities that are made available for public use.

3.4 Legal Implications

Council will seek legal review before agreeing to the MOU.

3.5 Financial Considerations

Once agreed by Council, the $1m will be released to the MoE.

4. Conclusion

The Concept Design, draft MOU and Casual Use Agreement have been drafted based on similar facilities built and provided for community access. They provide further detail required before Council funding can be released.

5. Appendices

Appendix 1 – Kuranui College Gym Concept Design

Appendix 2 – Draft MOU

Appendix 3 – Draft Casual Use Agreement

Contact Officer: Euan Stitt, GM Partnerships and Operations
Reviewed By: Harry Wilson, CEO

Appendix 1 – Kuranui College Gym Concept Design

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN
CONCEPT
NOVEMBER 2020

designgroup
stapleton elliott

Site Plan

DATE. NOVEMBER 2020

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN

1

PROJECT No. M675

Site Plan
SCALE @ A3 - 1 : 1000 SCALE @ A1 - DOUBLE SCALE

NORTH

designgroup
stapleton elliott

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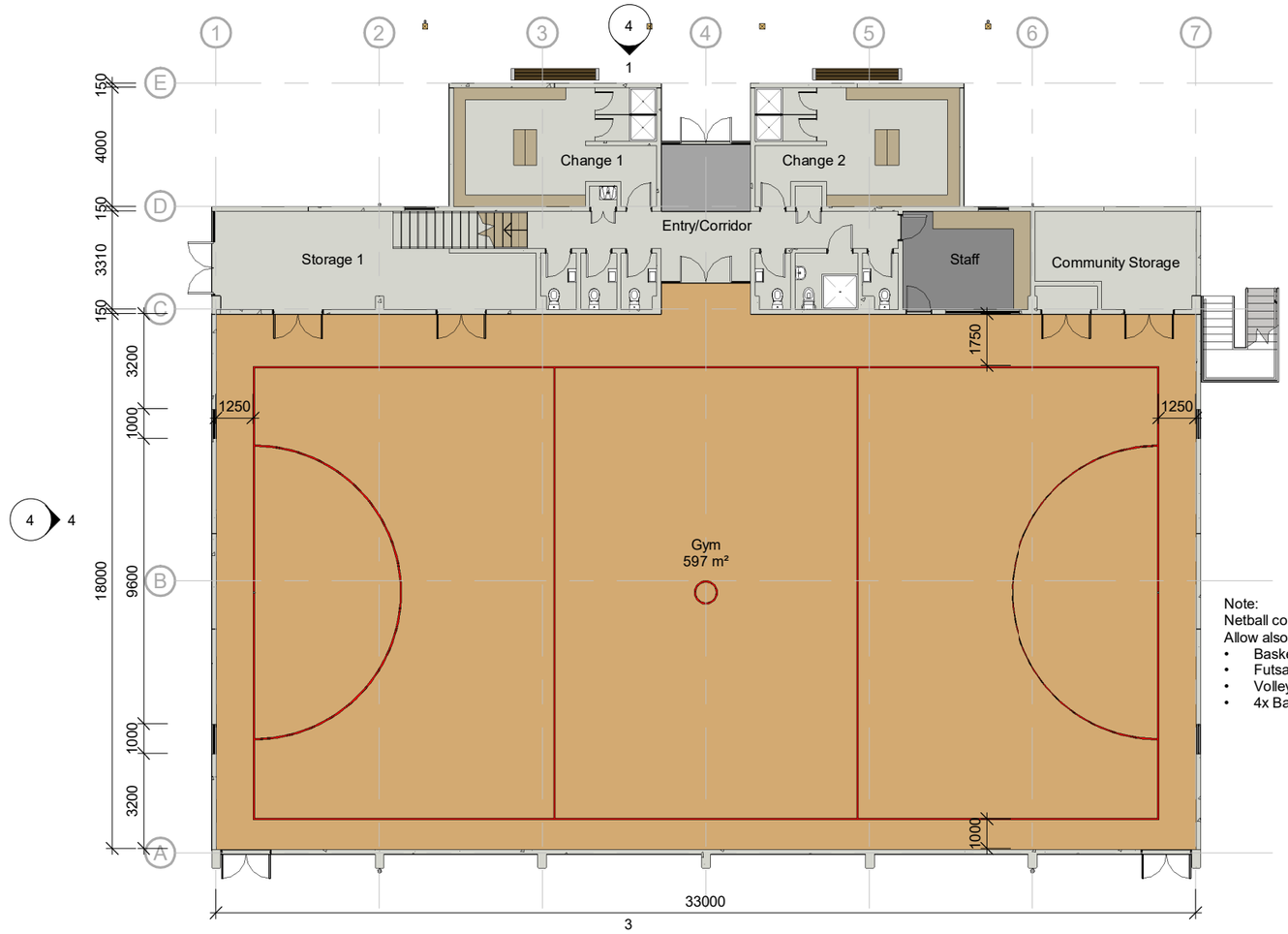
Overall Floor Plan

DATE. NOVEMBER 2020

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN

PROJECT No. M675



Note:
Netball court shown.
Allow also markings for:
- Basketball
- Futsal
- Volleyball
- 4x Badminton

1/4 **Overall Floor Plan**

SCALE @ A3 - 1 : 200 | SCALE @ A1 - DOUBLE SCALE

NORTH

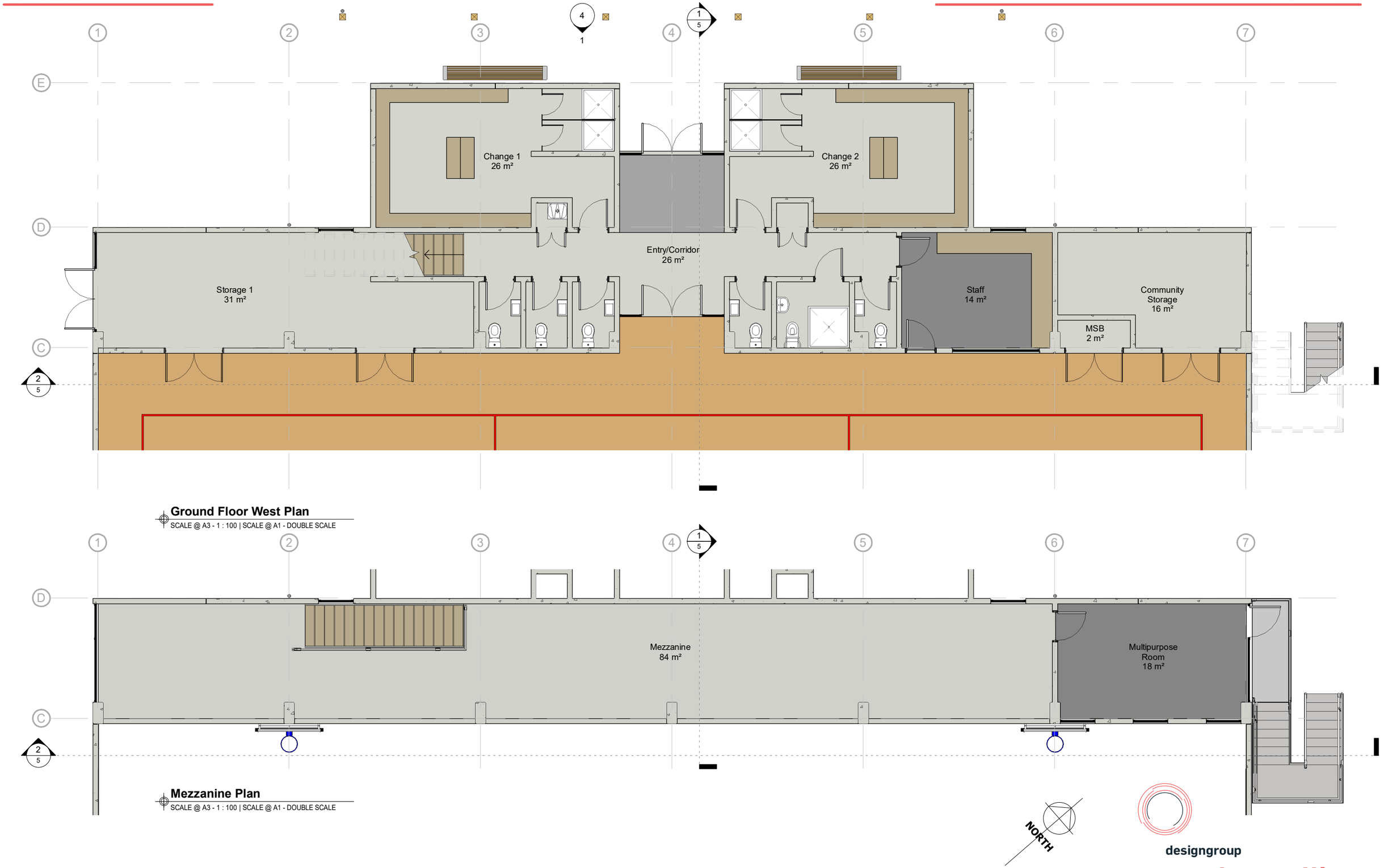
designgroup
stapleton elliott

Ground Floor West & Mezzanine Plans

DATE. NOVEMBER 2020

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN

3
PROJECT No. M675



Ground Floor West Plan
SCALE @ A3 - 1 : 100 | SCALE @ A1 - DOUBLE SCALE

Mezzanine Plan
SCALE @ A3 - 1 : 100 | SCALE @ A1 - DOUBLE SCALE

designgroup
stapleton elliott

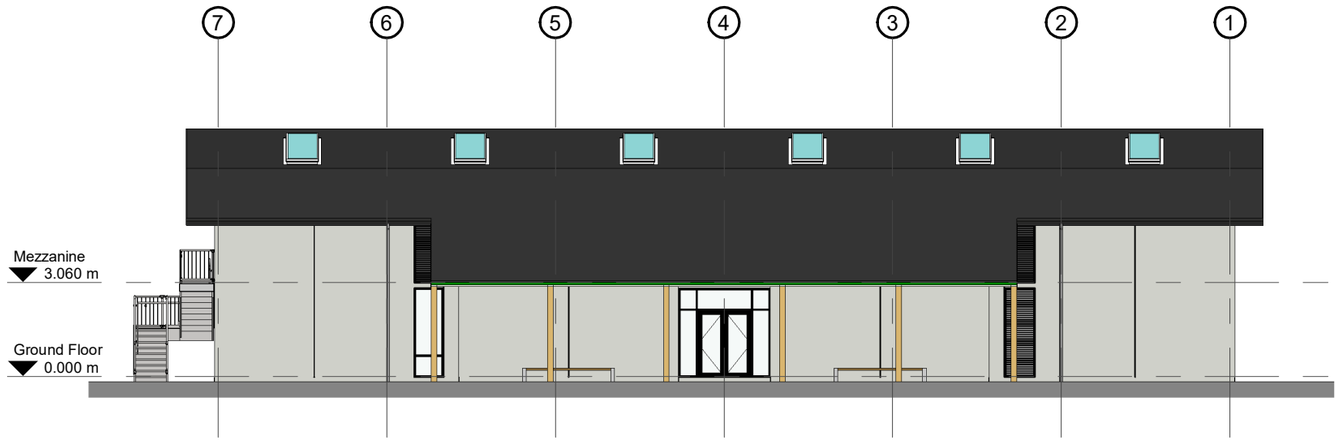
Elevations

DATE. NOVEMBER 2020

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN

4

PROJECT No. M675



1/2 **North-West Elevation**
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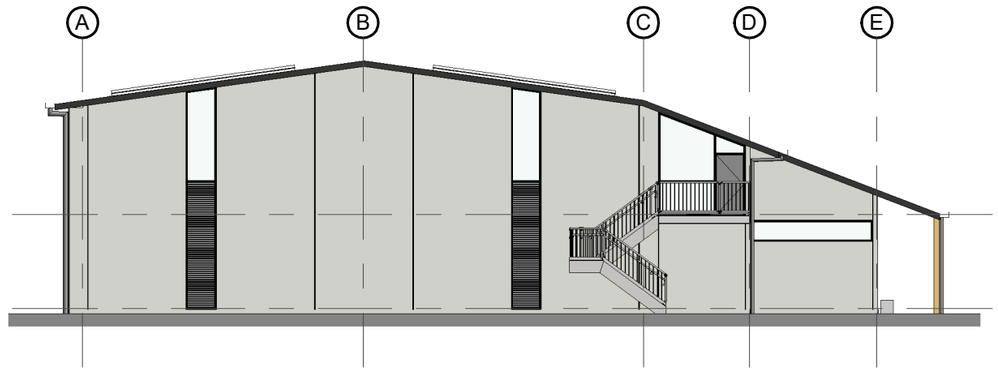

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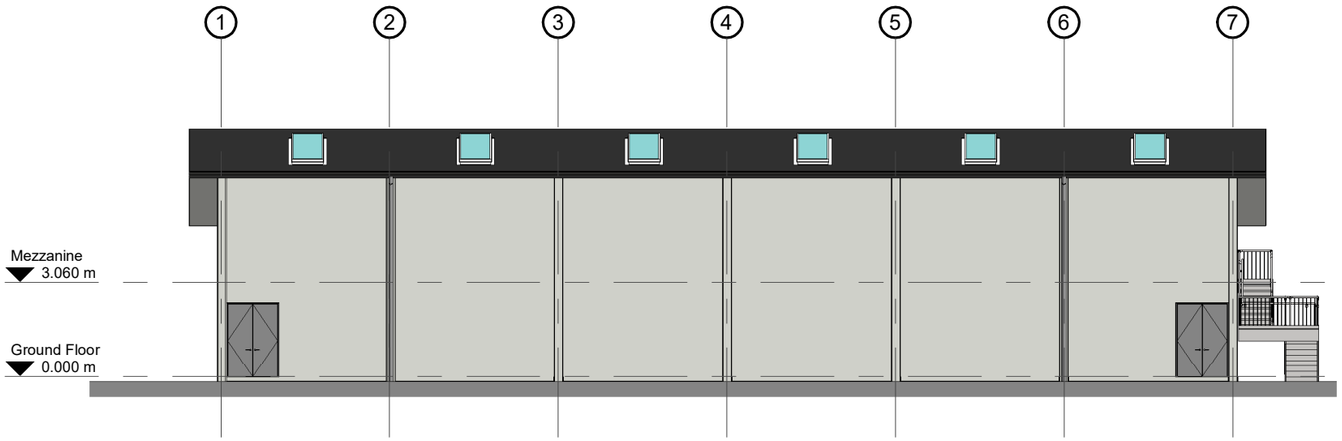

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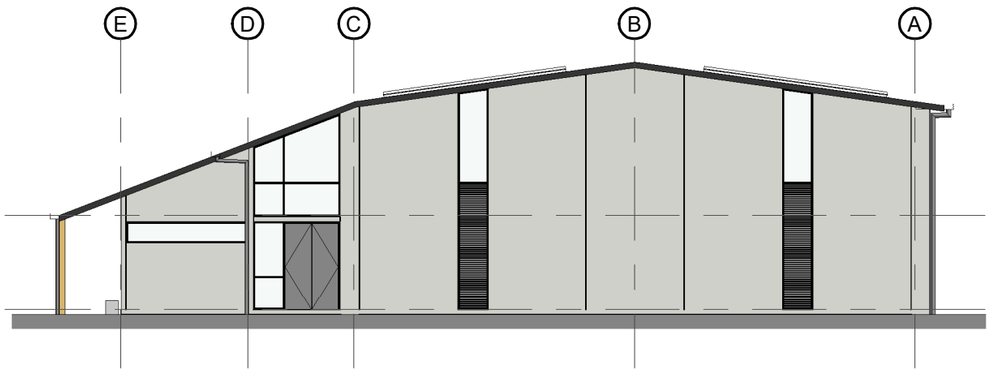

4/2 **South-West Elevation**
SCALE @ A3 - 1 : 200 | SCALE @ A1 - DOUBLE SCALE

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stapleton elliott

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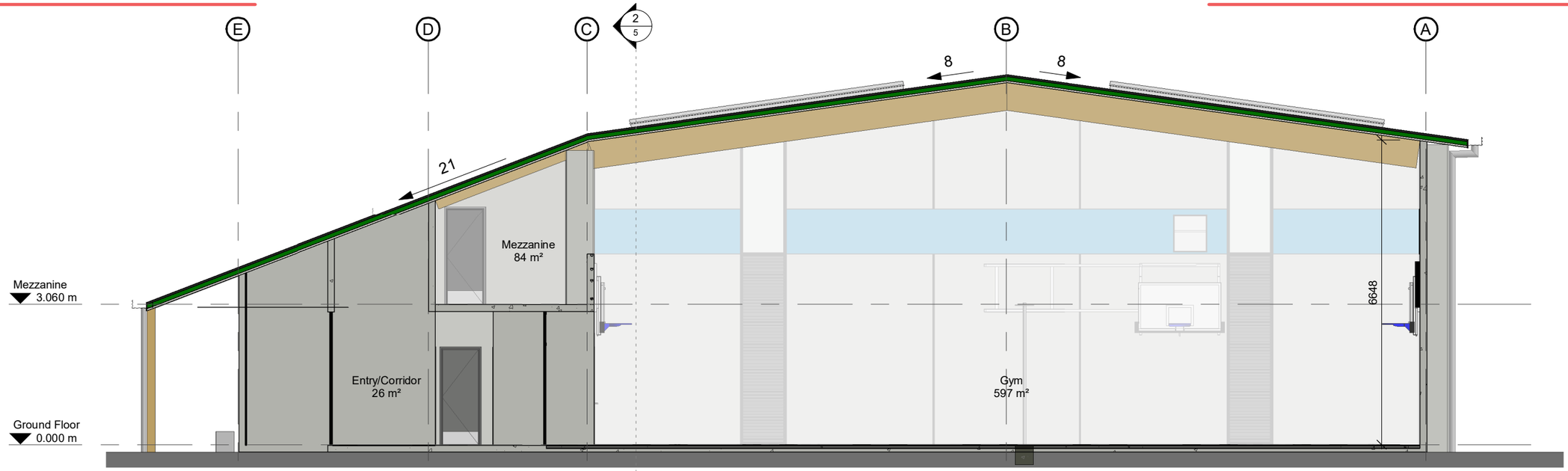
Sections

DATE. NOVEMBER 2020

MOE
KURANUI COLLEGE GYMNASIUM
6 WAKELIN ST, GREYTOWN

5

PROJECT No. M675



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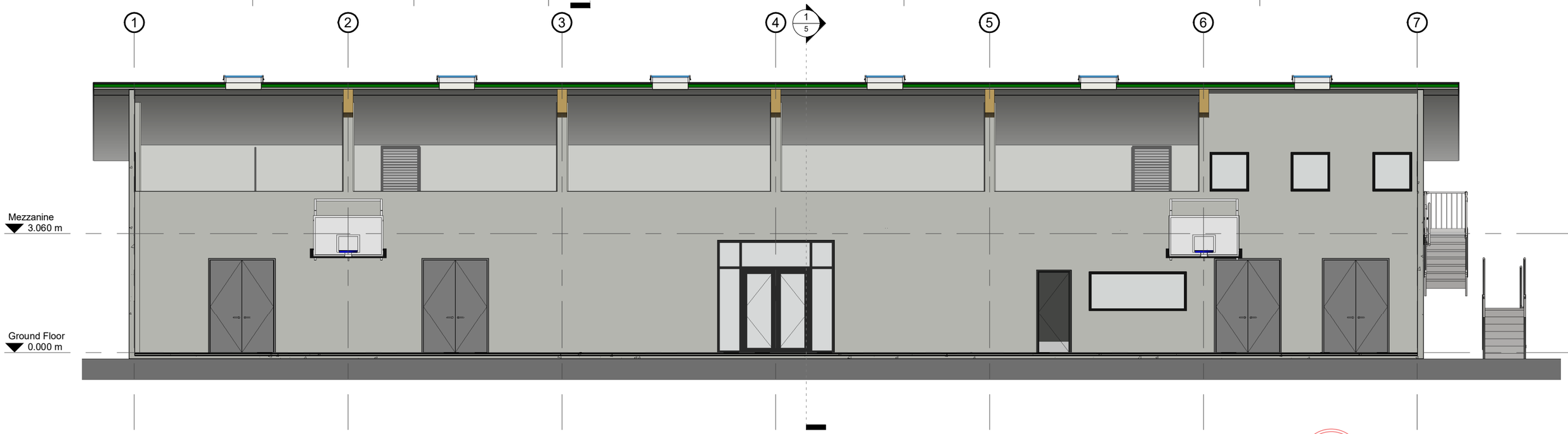

2/3 **Section 2**
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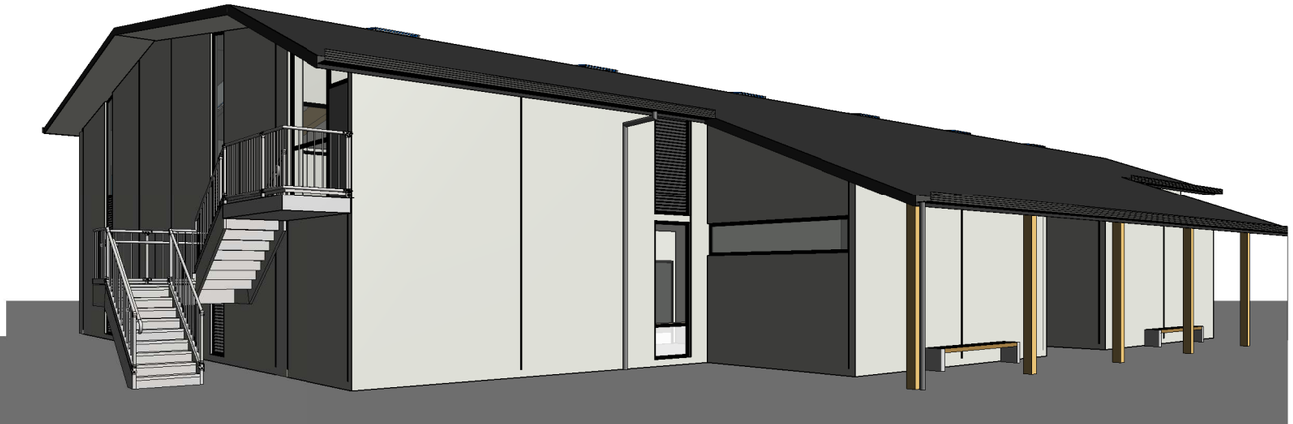
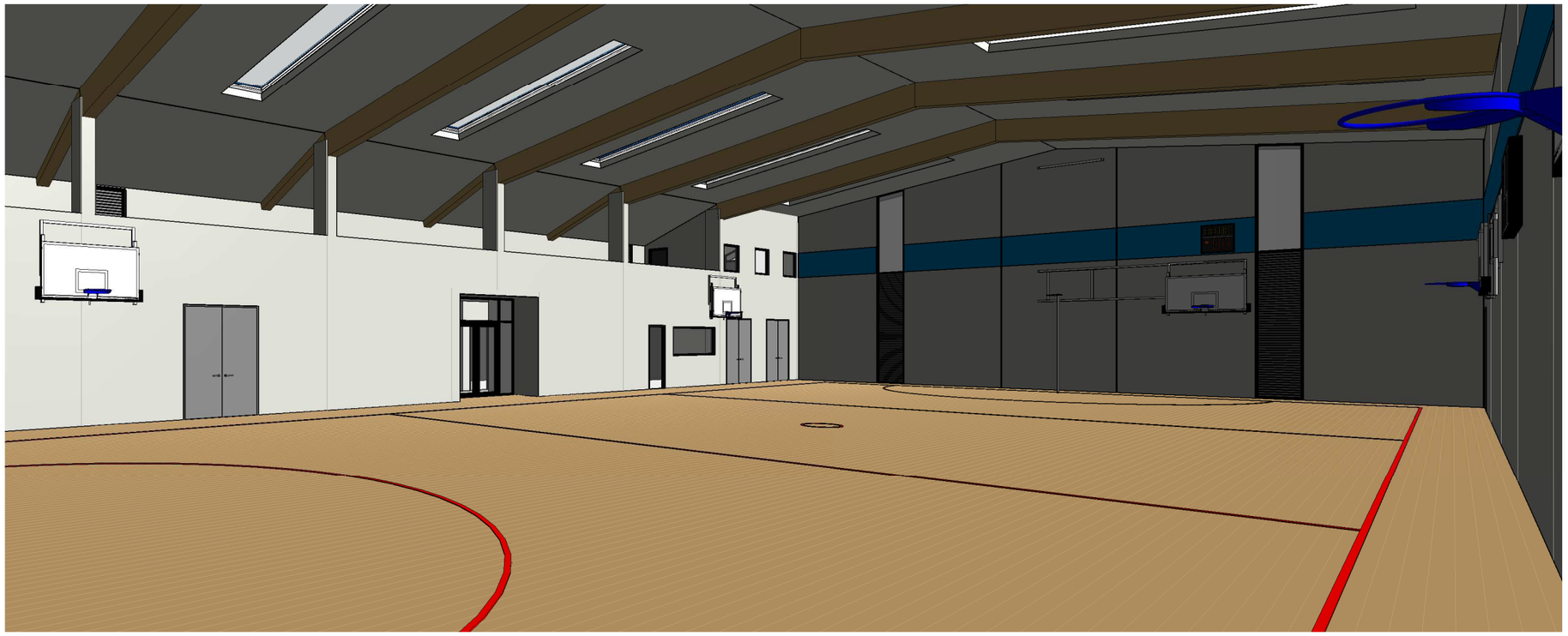
stapleton elliott

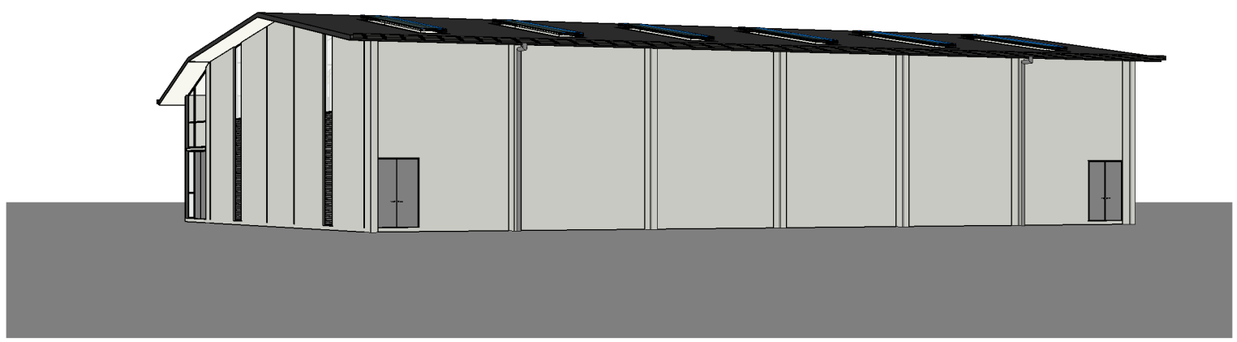
West 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE



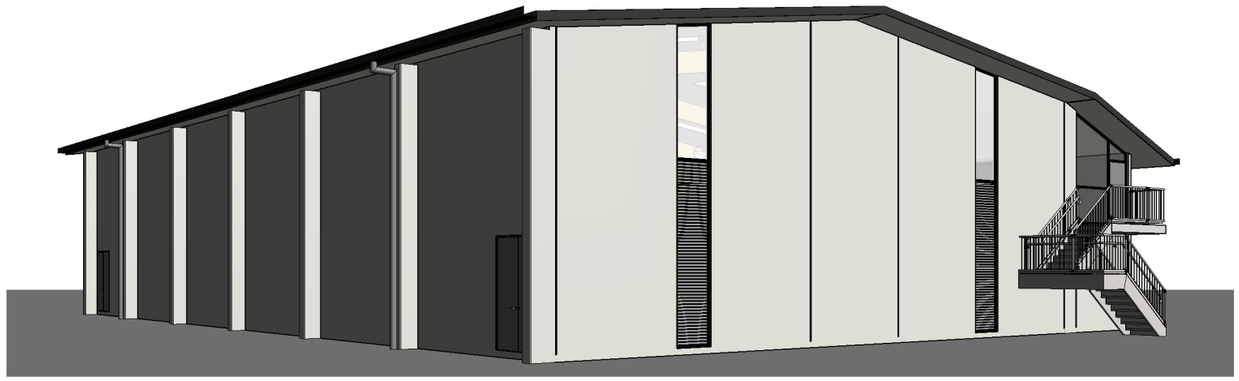
North 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE



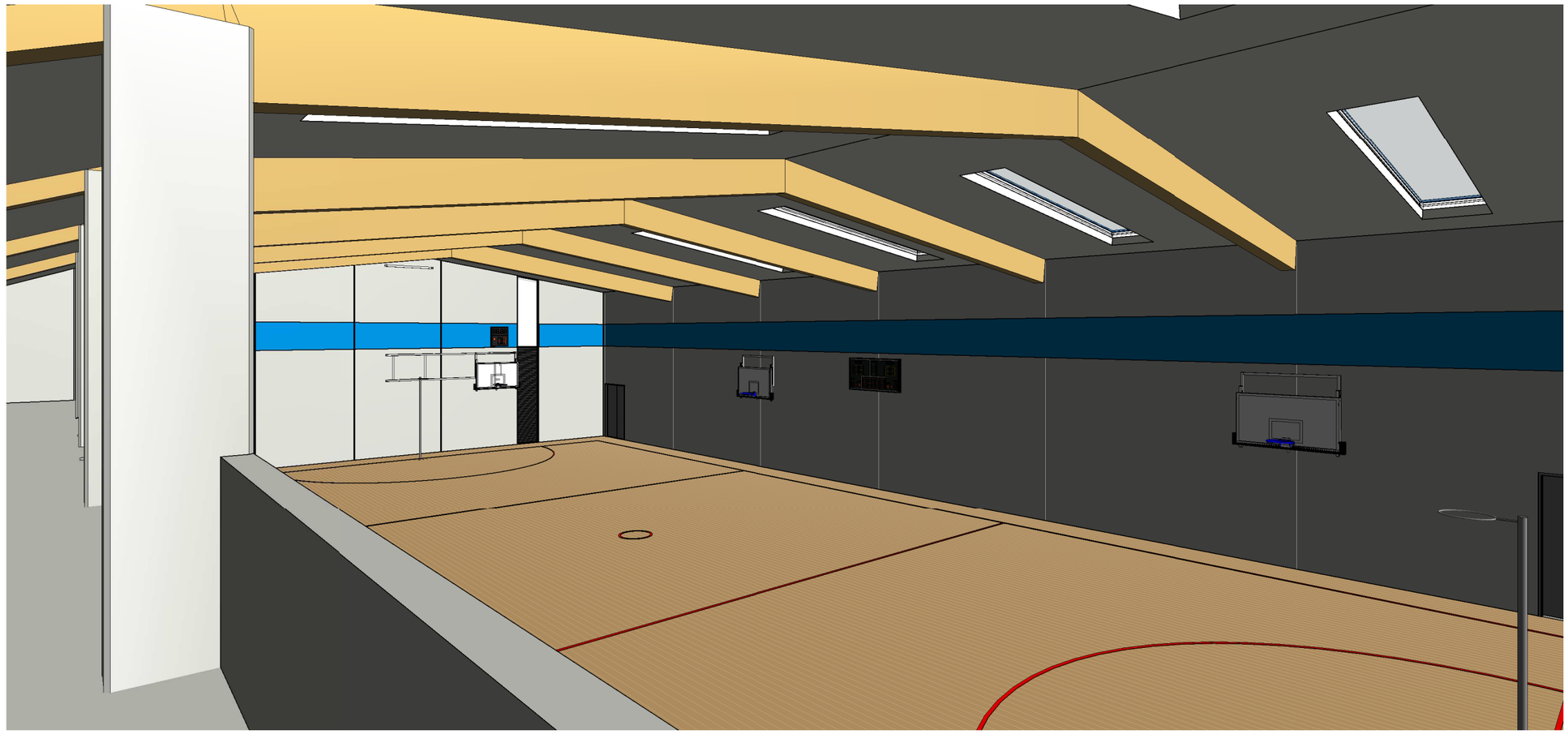
Gym Interior 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE



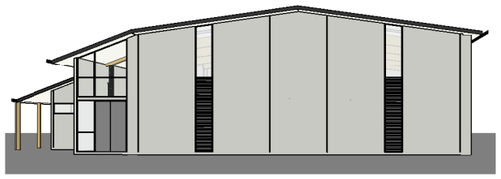
South - East 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE



North-East 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE

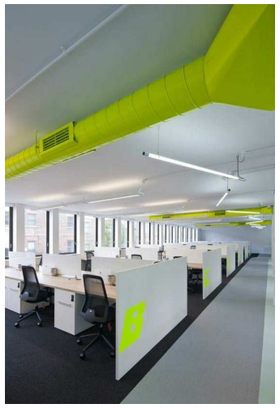


Mezzanine 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE

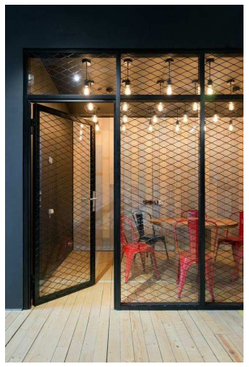
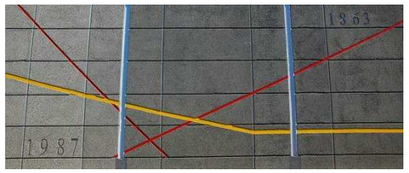


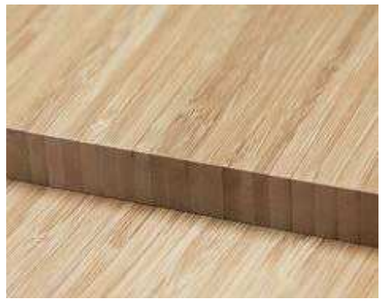
South-West 3D View
SCALE @ A3 - | SCALE @ A1 - DOUBLE SCALE



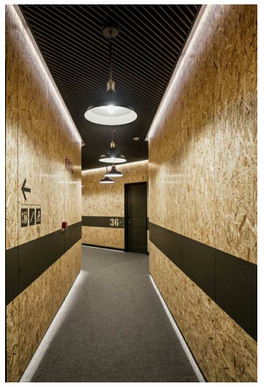




RESPECT MANAAKITANGA
INTEGRITY MANA TANGATA
EMPATHY AROHA
CREATIVITY AUAHATANGA
DETERMINATION TE HIRINGA





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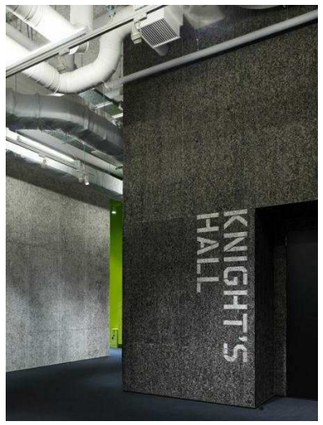
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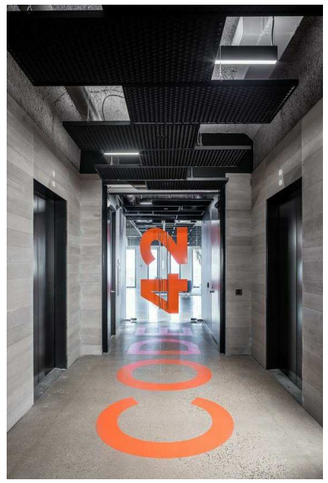
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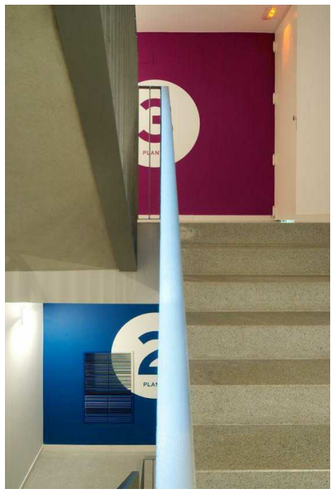
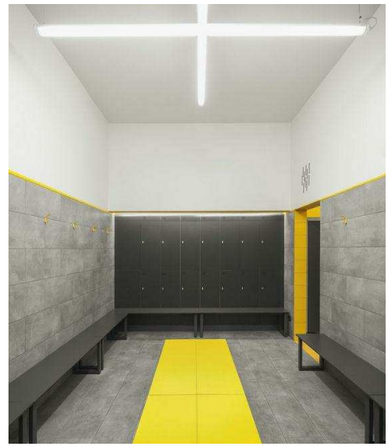
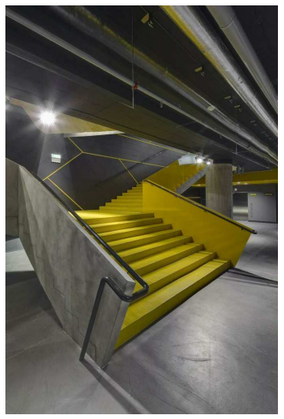
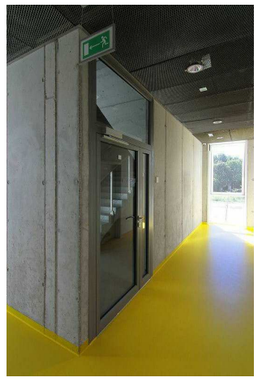
4
3 FILM & TV GRAFISK DESIGN EKSPONERINGSDESIGN
2 ADMIN ANSATTE MØTEROM
1 KANTINE MEDIATEK RESEPSJON
0 ATELIER VERKSTED AUDITORIUM










115 - 117
515 - 517

Appendix 2 – Draft MOU

Agreement between Kuranui College and South Wairarapa District Council Regarding Community Access to Kuranui College Gymnasium

Underlying Principles:
The SWDC will provide Kuranui College with a $1M contribution towards the cost of building a new gymnasium. The SWDC will promote responsible community use of the facility and will have no further funding obligations unless mutually agreed.

Kuranui College will invite representatives from SWDC to be party to meetings to discuss concept designs for the gymnasium and to observe during the construction phase of the facility.
Both parties agree that all communications will be mutually agreed before release.

Kuranui College will guarantee community access under the following terms:

Management and Review:
A Gymnasium Management Group consisting of the Kuranui College Principal, EO, Booking Manager, an SWDC representative and a representative from Greytown Sport and Leisure Society will meet at least annually to review arrangements and as required to manage any issues that may arise.

Reporting:
The College will provide SWDC with an annual gymnasium usage report identifying the profile type of groups using the facility and the hours of community use.

Insurance:
The building itself will be owned by the Crown.
Kuranui College is a member of the Ministry of Education's Risk Management Scheme which provides the college with comprehensive contents and liability insurance.

Maintenance:
Ongoing maintenance will be the responsibility of Kuranui College. Major maintenance will be met under the College's 10 Year Property Plan.

Cleaning:
Cleaning of the facility will be the responsibility of Kuranui College. Users must leave the facility in a reasonably clean and tidy condition. Failure to do so may result in the user being invoiced for any additional cleaning required or having their use of the facility terminated.

Security:
The gymnasium will be fitted with security lighting and fitted with security cameras both inside and outside the building.
Entry will be by individualised swipe cards for each user group.
After hours, the gymnasium will be alarmed and monitored under the College's existing alarm system.

Health and Safety:
Kuranui College accepts responsibility for Health and Safety and PCBU requirements. These include maintaining Hazard Registers, Evacuation Procedures and providing access to a reporting system for any incidents / accidents or near misses occurring on site.

Community Access:
At a minimum, community access to the gymnasium will be between the hours of 5pm – 10pm during termtime. Outside these times, bookings will be by mutual arrangement to encourage maximum community use of the facility while allowing the College to carry out any cleaning and maintenance programmes required.
The Kuranui College Booking Manager will take responsibility for ensuring fair and equitable access for all user groups and has the right to refuse or cancel the booking.
All users must comply with Kuranui College policies including Health and Safety, alcohol on school property and maintain the college's Smokefree and Vape free status at all times.

Booking Administration:
The College website will feature the gymnasium booking timetable. A link will exist to allow community groups to email the college with their booking requests or phone to make enquiries.
Kuranui College's booking manager will arrange the booking which will be confirmed on completion of a signed Casual Use Agreement which outlines the obligations of both parties. At this point individualised access swipe tags will be released.
Users will be invoiced on a monthly basis by the College's accounts department.

Hireage Rates:
Hireage rates will be set and reviewed by the College on an annual basis. The Gymnasium Management Group will be consulted on any increase in rates.
The hireage rate will differ between not-for-profit and commercial/sole trader sectors.
The not-for profit hireage charge will be nominal and set to offset the increased cost to the College of water, electricity, waste removal, cleaning, maintenance and administration.
(As an indication, the current rate for hire of school facilities for the not-for-profit sector is $15 per hour.)

Equipment and Storage:
The hireage cost provides users with the use of the facility and fittings only.
Users must provide their own equipment.
Storage of community owned equipment will be at the discretion of the College in order to ensure equitable access by all community groups. There will be no charge for storage. However the college will take no responsibility for damage or loss of community owned equipment.

Damage / Vandalism:
Supervision of the facility will be the responsibility of the hirer at all times. Hirers must report any damage to the College promptly. Repairs will be the responsibility of the College. However any acts of deliberate vandalism may result in the user being invoiced for the cost of repair or having their use of the facility terminated.

Complaints:
Complaints should initially be made to the Bookings Manager, escalated to the EO, Principal then if necessary, the Management Group.

Appendix:
Kuranui College Casual Use Agreement

Harry Wilson Date:
SWDC CEO

Simon Fuller Date:
Kuranui College Principal

Appendix 3 – Casual Use Agreement

[insert date]

[Insert address to licensee]

Dear [insert name]

Casual Use Agreement - Licence to Occupy school premises

1 The School Board of Trustees (*the Board*) is the controlling authority Kuranui College (*the School*) and has agreed to enter into this licence agreement to allow [***name of licensee***] (*you/your*) to use [***the school hall or playing fields or part of the school premises-delete or amend as appropriate***] (*the Premises*) for the purpose of [***insert the purpose***] (*Permitted Use*) on the terms and conditions set out in this letter (*Licence*). The Secretary of Education (*the Secretary*) has authorised the Board to enter into this Licence pursuant to a Gazette Notice published under Section 163 of the Education and Training Act 2020.

2 The Board grants you a non-exclusive licence to occupy the Premises commencing on [***commencement time and date***] and expiring on [***expiry time and date***], on the terms and conditions set out in this Licence.

3 At the end of the term or earlier termination of this Licence, you will remove all of your property (including any property of your invitees if any) from the Premises, and leave the Premises in a clean, safe and tidy condition to the complete satisfaction of the Board.

4 You will pay to the Board:

a. a licence fee of $[***note: can be a nominal fee***] **NA** to be paid immediately upon the execution of this Licence [and weekly/fortnightly/monthly thereafter if the arrangement is ongoing]; and

b. a bond of $[***note: optional***] **NA** which will be refunded after your property (and that of your invitees if any) has been removed from the Premises, and the Premises left in a satisfactory condition in terms of clause 3; and

c. all costs and expenses arising from your use and occupation of the Premises including (without limitation) the following costs expenses:

i. [***list the relevant items and costs / expenses here – hire cost (CURRENTLY $15 per hour***]

5 You acknowledge that the Premises form part of the School which is controlled and managed by the Board as part of its statutory responsibilities, including under the Education and Training Act 2020, which prevail over the terms of this Licence.

6 You are not responsible for insuring the Premises for catastrophic loss. However, the Secretary reserves the right to seek compensation, including any costs for recovery, for any loss or damage caused by your or your invitee's or agent's, use and occupation of the Premises. You acknowledge that the Secretary and the Board shall have no liability for damage or loss to School buildings or facilities or the Premises. You are responsible for insuring your own contents.

7 You must, at your own cost, promptly repair any damage caused to the Premises by you or any your invitees. If you fail to do so, the Board may, in addition to its other rights, repair any damage and recover the costs from you.

8 You will comply with and observe the Board's health and safety policy and procedures, the Health and Safety at Work Act 2015 and any relevant Regulations or Codes of practice under that Act and any Ministry of Education requirements in the use and occupation of the Premises. You will provide to the Board, if demanded, a health and safety policy and management plan for the Premises having regard to your intended use and occupation of the Premises. The Board may make recommendations to such plan or any revised plan from time to time which you must comply with.

9 You will use the Premises only for the Permitted Use.

10 You will not bring or store within the Premises (nor allow to be brought upon or stored within the Premises) any goods or things of any offensive, noxious, illegal or dangerous nature which could cause damage to School buildings or other facilities, or affect the health and safety of any person on the Premises.

11 You will not allow any act or thing to be done which may be or grow to be a nuisance or annoyance to the Board or any other person and generally and you will use the Premises in a clean, quiet and orderly manner free from nuisance, disturbance or annoyance to any person.

12 Due to its overriding statutory obligations, the Board may terminate this Licence at any time by giving you minimum **2 days' notice in writing**. The Board may terminate this Licence at any time without notice if you are in breach of any covenant or agreement on your part expressed or implied in this Licence. You are not entitled to any compensation for any such early termination of this Licence.

13 You may not place or display any signage or advertising on the Premises (except with the written permission of the Board) or make any alterations to the Premises or construct any buildings, structures or other improvements on the Premises.

14 You must comply with all relevant legislation, regulations and bylaws affecting the Premises and your use of the Premises, and must not cause or allow any act on the Premises that would cause nuisance or annoyance to any neighbouring property, or any contamination of the Premises. You must, at your own cost, obtain and comply with any resource consents, permits and other planning approvals required for the Permitted Use of the Premises.

15 The Board makes no warranty or representation that the Premises are fit for any particular use, and you acknowledge that you have entered into this Licence completely in reliance upon your own skill and judgment. You agree to occupy and use the Premises at your own risk and release the Board from any claim for any loss or damage you may suffer or incur.

16 You indemnify the Board against any loss, claim, damage, expense, fine, penalty, liability or proceeding suffered or incurred at any time by the Board (or the School or the Secretary) as a direct or indirect result of any breach of your obligations, undertakings or warranties contained or implied in this Licence, or as a direct or indirect result of your activities on the Premises.

17 You must meet all costs and expenses (including legal costs on a solicitor/client basis) which the Board may incur in enforcing its rights under this Licence.

18 This Licence is personal to you, and you may not assign, transfer, sub-licence or otherwise share your rights under this licence or in the Premises to or with any other person.

19 This Licence is the entire agreement (and replaces all earlier negotiations, representations, warranties, understandings and agreements) between you and the Board regarding your use of the Premises. Any amendments to this Licence must be recorded in writing and signed by both you and the Board.

20 Please confirm your acceptance of these terms and conditions by signing the enclosed copy of this letter and returning it to us.

Yours sincerely

_____

[(Signed by an authorised signatory
for and on behalf of the Board)]

The terms of the Licence granted by this letter are agreed and accepted

_____

[***insert name of licensee***]

AGENDA ITEM C2

UPGRADE OF THE WATER TREATMENT PLANT AT SOLDIERS MEMORIAL PARK RESERVE, GREYTOWN

Purpose of Report

To advise members of the upgrade of the water treatment plant at Soldiers Memorial Park, Greytown to secure the Greytown water supply.

Recommendations

Officers recommend that the Committee:

1. *Receive the Upgrade of the Water Treatment Plant at Soldiers Memorial Park Reserve, Greytown report.*
2. *Note the requirement for Council to approve the work and grant an easement to enable the upgrade of the water treatment plant to go ahead.*

1. Executive Summary

Wellington Water Limited (WWL) and their consultants GHD have identified a programme of work to upgrade the Memorial Park Water Treatment Plant in the Soldiers Memorial Park Reserve, Greytown. This work helps secure the quality and consistency of the Greytown water supply into the future.

WWL is required under the Soldiers Memorial Park Reserve Management Plan 2008 to seek the Council's approval for the proposed work. Wellington Water also requests Council grant an easement under section 48 of the Reserves Act 1977 to convey water through the existing water treatment and supply facilities (which will be upgraded) as well as a new associated facility to be installed onsite. The application for the proposed work has been publicly notified and no comments were received. Officers will report to the Council meeting on 2 June 2021 to seek these approvals.

2. Background

The Memorial Park Water Treatment Plant (WTP) is owned by South Wairarapa District Council (SWDC) and operated by WWL. Pumping and treatment facilities are located within Soldiers Memorial Park Reserve in Greytown. The WTP is a key source of drinking water for the residents of Greytown.

During periods of increased water demand, when the Memorial Park WTP cannot keep up with demand (typically during summer), flow is supplemented by the Waiohine WTP, which is the primary producer of drinking water for the residents of Featherston. However, due to current production and storage limitations at the Waiohine WTP, the Memorial Park WTP has been running continually for the last year. SWDC is in the process of upgrading its Memorial Park WTP to address the following risks:

- Water wastage – the existing pump is not designed to meet the low night-time flows of the water network and consequently must over-pump, resulting in significant water wastage.
- Equipment failure – the existing pump, Variable Speed Drive (VSD) and instrumentation are aging and are at the end of their useful life. It is imperative that this equipment is replaced proactively, as current water storage in the Featherston/Greytown network is insufficient to respond to pump failure and which would result in emergency water shortages.
- Groundwater supply contamination – a catchment assessment for the groundwater supply at Memorial Park determined that 4 log protozoal removal is required due to risk of protozoa (such as Cryptosporidium and Giardia) entering the groundwater supply.
- Chemical storage – the chemicals currently used for water treatment are stored in a room adjacent to the changing facilities of the swimming pool. Previous leakages from the chemical room have leached through the shared wall with the changing facilities and have deposited onto the floor. Although the issue has since been resolved, chemical storage onsite continues to be a public and environmental safety risk.

3. Discussion

3.1 Proposed works

WWL engaged GHD to complete the civil engineering design and project manage the proposed work. GHD propose sequencing the WTP upgrades in three stages, summarised in the table below. WWL advise that the remainder of the work is urgent and has been provisionally scheduled to commence in June 2021.

Stage	Description	Outcome
1	Installation of containerised UV unit connection to the existing bore pump and chemical systems using temporary pipework. This work was completed in December 2019	Temporary solution to quickly provide 3 log protozoal removal until a long-term solution could be designed and installed.
2	Installation of: •A new submersible bore pump and VSD to replace the existing bore pump. • A new UV transmittance meter. • A new raw water turbidity meter. • Minor aboveground pipework changes to facilitate new pump	Proactively replace equipment that is at high risk of failure, which can be used as part of the permanent solution.

Stage	Description	Outcome
3	Construction of: • New containerised building unit • New chemical dosing systems • New cartridge filter • Relocated UV unit • Installing permanent pipework to connect bore pump, container, and reticulation • Water discharge pipe and overflow structure to a nearby water race	The new cartridge filter will provide an additional 2 log protozoal removal credits (5 log total); satisfying treatment recommendations from Wellington Water's catchment assessment.

3.2 Approval for work

The proposed works are in Soldiers Memorial Park, which is classified under section 17 of the Reserves Act 1977 as a Recreation Reserve. The part of the Soldiers Memorial Park containing the native bush (referred to as O'Connor's Bush) is classified Historic Reserve under Section 18 of the Reserves Act 1977.

The Management Plan has been developed in accordance with the Reserves Act 1977 and was adopted by Council on 29 August 2007. Clause 41 of the Management Plan requires an application to be made to Council for the construction of public utilities on the reserve. Such applications must be publicly notified for comment. In addition, clause 43 states that any new pumping facilities or modifications to the existing pump house structure requires Council approval after public consultation.

WWL's application for the proposed work is included in Appendix 1. The application details the proposed work, an assessment of effects, consideration of alternative sites and options, compliance with statutory requirements and pre-application consultation carried out with iwi and relevant stakeholders.

Due to the urgency of the work, the application has been notified in accordance with statutory requirements on Council's website (see here) and in the Wairarapa Times Age (see Appendix 2). No comments have been received.

3.3 Granting of an easement

In order to secure ongoing rights to use the land, section 48 of the Reserves Act 1977 enables the Council, as administering body for the reserve, to grant WWL an easement over land in the reserve for the provision of water systems. The extent of the proposed easement is included in Appendix 3. A survey will be undertaken and an easement instrument registered against the property following Council approval.

Section 48(2) of the Reserves Act provides for public notification of applications for an easement and these requirements are more extensive than the notification requirements under the Management Plan, discussed in paragraph 3.1 above. However, section 48 requires prior public notification of an application for an easement unless the following applies:

a. The reserve is vested in an administering body and is not likely to be materially altered or permanently damaged.

b. The rights of the public in respect of the reserve are not likely to be permanently affected.

Officers consider that these circumstances apply and the applicant is not required to undertake the more extensive notification requirements for the easement under the Reserves Act. Information on the easement has, however, been included in the application under the Management Plan.

4. Consultation

The consultation requirements under the Management Plan and Reserves Act have been met, as detailed above. Pre-application consultation has been undertaken and is detailed in paragraph 6 of the application.

5. Legal Implications

The legal requirements relating to the application and notification of the proposed works and granting of an easement under the Reserves Act and Management Plan are detailed above. The application for the proposed works meets all other requirements of the Management Plan and Reserves Act, as detailed in the application itself.

6. Financial Considerations

The proposed works have been budgeted in the Annual Plan 2020/21 and proposed Long Term Plan 2021-31. Additional capex costs relating to the application to Council and easement will be included under WWL budgets.

7. Conclusion

The purpose of this report is to inform the Committee of the application to Council for proposed works the Soldiers Memorial Park Management Plan and for an easement under section 48(1)(e) of the Reserves Act 1977 to allow the upgrade of the Greytown Water Supply. Officers will report to the Council meeting on 2 June 2021 to seek approvals.

8. Appendices

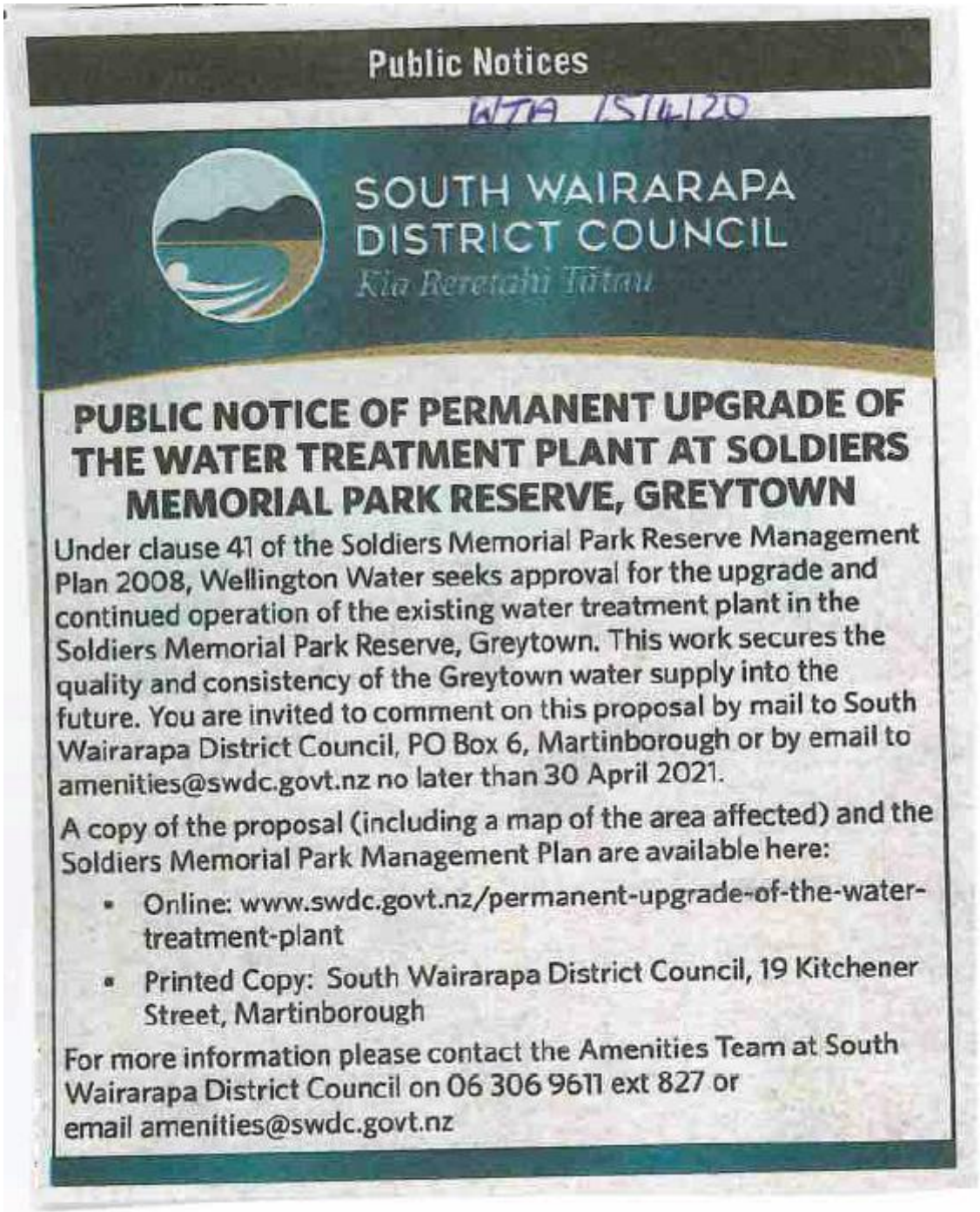
Appendix 1 – Application for proposed works

Appendix 2 – Public Notification

Appendix 3 – Easement location

Contact Officer: Bryce Neems, Amenities and Solid Waste Manager
Reviewed By: Euan Stitt, Group Manager Partnership and Operations

Appendix 2 – Public Notification



Public Notices

WTA 15/4/20

SOUTH WAIRARAPA DISTRICT COUNCIL

Kia Reretahi Tātau

PUBLIC NOTICE OF PERMANENT UPGRADE OF THE WATER TREATMENT PLANT AT SOLDIERS MEMORIAL PARK RESERVE, GREYTOWN

Under clause 41 of the Soldiers Memorial Park Reserve Management Plan 2008, Wellington Water seeks approval for the upgrade and continued operation of the existing water treatment plant in the Soldiers Memorial Park Reserve, Greytown. This work secures the quality and consistency of the Greytown water supply into the future. You are invited to comment on this proposal by mail to South Wairarapa District Council, PO Box 6, Martinborough or by email to amenities@swdc.govt.nz no later than 30 April 2021.

A copy of the proposal (including a map of the area affected) and the Soldiers Memorial Park Management Plan are available here:

- Online: www.swdc.govt.nz/permanent-upgrade-of-the-water-treatment-plant
- Printed Copy: South Wairarapa District Council, 19 Kitchener Street, Martinborough

For more information please contact the Amenities Team at South Wairarapa District Council on 06 306 9611 ext 827 or email amenities@swdc.govt.nz

Appendix 3 - Proposed easement extent (indicated by black line)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REFER DRAWING FOR DETAILS
SERVICES LEGEND
ELECTRONIC COPYRIGHT STATEMENT
IMPORTANT SERVICES NOTE
NOTES

AGENDA ITEM C3

PARTNERSHIPS AND OPERATIONS REPORT

Purpose of Report

To update councillors on activity and progress within the Partnerships and Operations group.

Recommendations

Officers recommend that the Committee:

1. Receive the Partnerships and Operations Report.

1. Group Manager Commentary

As we near the end of the FY, programmes are being completed and across the group there has been excellent progress made in parallel with the LTP development work and continued operational delivery. The project dashboard at Appendix 1 to this report outlines the key updates to each project.

2. Water

2.1 Wellington Water Q3 Performance

Wellington Water's operational performance for Q3 is provided at Appendix 2.

2.2 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.

Continued monitoring of the night flows identified possibly leaks in the Featherston area and a further leak survey was carried out in March 2021. The public leaks identified in this survey have been repaired and where private leaks were identified, we have contacted the property owners and informed them of the responsibility to

have the leaks repaired. Rechecks are being carried out on these private leaks, however, night flows in Featherston have now returned to normal levels.

WWL continue to monitor the night flows across the SWDC area and will undertake further leak surveys as required.

2.3 Water Capex programme delivery and issue resolution

Wellington Water have appointed a Programme Lead, Adam Mattsen, to focus on the effective delivery of the SWDC capital works programme. This is a multi-faceted and pivotal role that will provide a single point of contact into WWL for project delivery and the resolution of more technical issues faced by Council and ratepayers. This is seen as a key appointment to enable an improved interface between SWDC and WWL.

The cost of this role is already included within the Management Fee paid by Council.

3. Land Transport

3.1 Roading Maintenance - Ruamahanga Roads

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

- 274.2 km of roads were inspected and identified faults recorded in RAMM for future scheduling with 194.4 being sealed and 79.8 being unsealed.
- 10 bridges were inspected and found to be in an acceptable condition.
- 64 rural culverts were inspected, RAMM data updated including condition rating.
- 103.6 km of unsealed roads were graded.
- 124 signs were inspected, and condition and data updated.
- Reflective raised pavement markers have been installed along Bidwills Cutting Rd.
- 32.1 km of mechanical street sweeping was completed.
- Pre-seal repairs for the 2021-2022 sealing season have continued and draft programmed identified and will be confirmed as final as soon as budgets approved.
- Maintenance works continued on the footpaths within the three main towns.
- 54 metres of unsealed culverts were replaced.
- Works have commenced on Donalds Creek gravel extraction under the GWRC consent.
- 500 tonne of rock protection delivered to Cape Palliser Rd for coastal protection.
- Rock reclamation along Cape Palliser Road was completed by retrieving displaced rock from below the waterline and placing back in the revetements:

- Sealed pavement rehabilitation sites for 2021/2022 on Western Lake Road have identified allowing investigation and design to commence and estimates calculated.
- Noxious Plant control has taken place on various Roads.

3.2 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.
- Rock protection has been delivered to Western Lake Road for the upstream protection of the Wairongamai Bridge, in a cost sharing project with GWRC.
- Heavy vehicle Over Weight Permits, Traffic management Plans and Corridor Access requests have been actioned and approved.
- Environmental Management Plan has been submitted to GWRC as per consent requirements. Iwi and Archaeologist engagement will occur prior to works starting on ECOREEF.

- WSP consultants have been engaged to provide concept plans for possible intersection improvements for Bidwills Cutting/ Moiki Road intersection and Bidwills Cutting Road Glenmorven Roads/Faibians Road intersections.
- Ongoing work with PowerCo and Mercury on the periodic outages of Greytown streetlights.

4. Amenities: Senior Housing

Recent activity includes:

- Two tenants have vacated their flats and moved into fulltime care. Both flats require refurbishment to bring up to standard before re letting.
- One unit in Cecily Martin complex has new toilet installed and raised as previous was too low for tenant and not functioning well.
- Pest Spraying to be carried out around all the flats at Cecily Martin after reports of white tail spiders seen.
- All flat inspections have been carried out. Some Tenants struggling with upkeep were given cleaning company business cards as an option.
- Age Concern Information Packages delivered to each Tenant which was mostly appreciated.

4.1 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.

Outdoor maintenance takes place on a fortnightly basis by council contractor.

4.2 SWDC Playgrounds

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

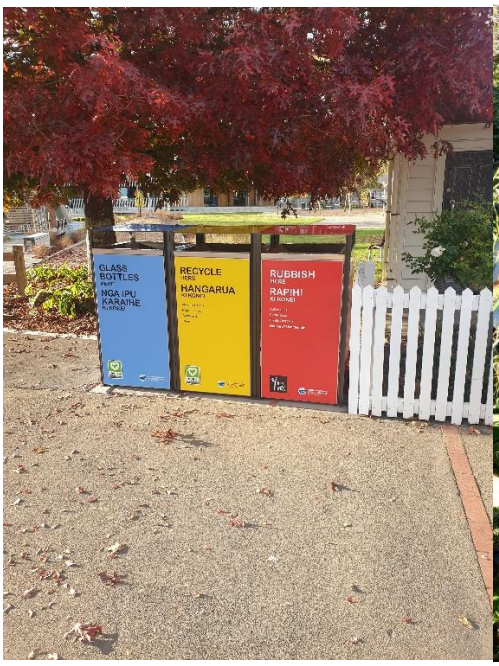
- New fence and park bench has arrived but installed delayed due to school holidays in the Martinborough Playground.
- Featherston playground general refresh is completed with painting and new bark
- Still awaiting parts for replacement of netting for Greytown equipment, ordering replacement see-saw and spinning wheel due to age. Equipment ordered can take 3 months to arrive.

4.3 Parks and Reserves

Activity has been ongoing in maintaining our parks and reserves:

- SWDC completed Section 17a review for the efficient delivery of Parks and Reserves services. A summary of the review is provided at Appendix 3 of this report for information. Conclusion of the review is for an enhanced outsource arrangement, which will be procured in time for the current contract expiry in September.

- Tree management plan for all SWDC parks and reserves under way
- Recycling bins being installed in three towns, Martinborough below, Featherston next to public toilets and still working with GHT on site in Greytown
- Ohauira Reserve in Featherston had a large amount of Asbestos dumped down a bank which cost a considerable sum of money and time to remove.



4.4 Cemeteries:

Cemetery Activity and Burials have been busy.

Purchases of burial plots/niches 01/03/21 to 30/04/21

	Greytown	Featherston	Martinborough
Niche			1
In-ground ashes Beam			
Burial plot	5		2
Services area			
Total	**5**		**3**

Ashes interments/burials 01/03/2021 to 30/04/2021

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

Two new concrete beams are to be installed in Martinborough Cemetery. This will open up new plots for purchasing and/or internments in Martinborough.

A member of the public rang to compliment us on the outstanding presentation of Greytown Cemetery. We are working toward all three cemeteries being maintained to this high standard. Development of the remaining land at Greytown cemetery is being planned with the GCB.

Anzac Day 2021

Anzac Day Commemorations went well in all towns – After Covid lockdown last year the feeling of togetherness this year was more intense.

4.5 Swimming Pools:

All Pool closed on 14th March 2021 for the winter season. Maintenance to be carried out between now and re-opening includes, retiling the outer areas of pools, repainting toddler's pools, replacing chairs in offices, repairs and general maintenance. All water filters to be replaced. Finding tradesman is difficult.

4.6 Other Projects:

- SWDC Building team successfully moved into 64 Main Street, Greytown
- SWDC has recently taken over Mr Bicknell's house in Papawai and we are currently cleaning up the grounds.

5. Innovating Streets

SWDC have been working with contractor Boffa Miskell analysing community feedback and working on the design for the 'Innovating Streets' installation. This design will be the first iteration of a process which aims to enliven and provide engaging community spaces. This temporary installation on the north-western side of the square will give a physical talking point and offer just one option for how the space could be used.

Moving forward with a temporary installation will allow us to engage the community in a more meaningful way by giving people the opportunity to imagine new ways of using the area, how people can utilise public spaces, invoke greater engagement and to collect informed feedback.

The installation will provide important passive safety measures and a traffic calming effect temporarily transforming the area into a destination zone rather than a car thoroughfare. As a result of this trial, SWDC hopes to make the area a more user friendly community space while slowing traffic and addressing safety concerns in an innovative way.

SWDC is working with Ventana Collective to engage local school children to submit road artwork ideas click here to view. The top three designs will then be chosen not only for their artistic merit, but their appropriateness for the space as per feedback received, as well as fit within the legal limitations for road art.

The three ideas will be circulated giving the community the opportunity to vote on the road artwork to be implemented – please note this will not be an exact replication, rather used as inspiration for the artist engaged. Again, the road art will be painted with temporary road paint, and not a permanent fixture.

The timeline for this project is as follows:

Background – The temporary design installation has been finalised after feedback from the public and is provided at Appendix 4. Speed data has been collected around the square and logistical organisation has started – such as organising builders, materials, and artists. There may be some roading work in Texas street, if the speed data show average speeds over 30 km per hour.

Early May – Local artist collective is organising local school children to submit artworks

Mid May – The community votes on the top design.

Early June – Installation & Artwork begins.

Mid June – Installation opening.

Saturday events continue in weeks following.

There will be official avenues for feedback throughout this process, stressing it is part of the consultation process on a temporary structure.

6. Waste Management

6.1 Glass Recycling

Action 89, transferred to the Assets and Services Committee from Council, requested officers relook at options for glass recycling, including within the regional waste and recycling management contract.

SWDC's rubbish and recycling contract is joint with Masterton and Carterton District Councils. To reduce risk for the three Wairarapa Councils the contract is based on a fixed price, where the contractor bore the risk for any revenue variation from changes in the recycling market prices. Any substantive change to the contract, nature or volume of material available for the contractor to generate revenue from will therefore require significant contractual change, exposing Council to significant financial costs, and legal and reputational risk.

Masterton, in their LTP, has indicated that it will be looking to review these services as part of its Waste Management and Minimisation Plan (WMMP) review. This review will look at different options, including an alternative local process of glass, prior to the renewal of the waste contract in 3 years time. It will also enable the increased MfE funding, made available through the upcoming waste levee increases, to be incorporated into any identified options.

By working with the other councils in this way, at an agreed review point in the contract and accessing alternative funding sources, SWDC can explore the opportunity for local glass processing in a manner that substantially reduces the risks and costs to Council.

6.2 MRF Upgrade Recycling

One of the major projects Earthcare has been working on at the MRF is to assist in meeting the new requirements created by the China Sword Policy, Revised Basel Convention and NZ Government export requirements for plastic.
This investment of 2 million dollars is to improve the sorting capability to meet the new standards and has doubled the size of the plant.

We now have access to the most sophisticated MRF in New Zealand that matches best practice in Europe countries for sorting and classifying recycled kerbside material.

7. Appendices

Appendix 1 – SWDC Operations Project dashboard

Appendix 2 - Wellington Water Q3 performance report

Appendix 3 – Summary of s17a review on Parks and Reserves

Appendix 4 – Innovating Streets, Martinborough – Concept Design

Contact Officer: Euan Stitt, GM Partnerships and Operations
Reviewed by: Harry Wilson, CEO

Appendix 1 – SWDC Operations Project Dashboard

SWDC Assets and Services Committee		**Programme**	Amenities	
Meeting	12-May-21	**Period**	Apr-21	

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Overall programme progressing to plan, including works that were not resourced at start of year (PGF etc.)
Current Projects						
Featherston War Memorial	**$250k**	**Apr-21**				
Repair earthquake damage and structural deficiencies						PROJECT COMPLETE - to time (for ANZAC Day) and budget
Anzac Hall upgrades	**$100k**					
Toilets, roof and wall repairs						PROJECT COMPLETE
Featherston Community Centre	**$110k**	**tbc**				
Roof and wall repairs, asbestos removal, painting, car park and kitchen/toilet repairs						PROJECT COMPLETE
Hau Ariki marae - PGF support	**$371k**	**tbc**				
Various upgrades - sprinkler systems, water storage, kitchen/toilet upgrades.						Works underway and progressing well - ongoing consultation with contractors and marae.
Tauherenikau Bridge	**$1.36m**	**tbc**				
Construct cycle/walkway over Tauherenikau river						Contract with MBIE agreed. Finalising agreements with Trails Trust and Kiwirail.
Kuranui College Gym	**$1m**	**tbc**				
Manage delivery of gym in college and provide for community access.						Agreeing MOU and use agreements with College and MoE (separate paper) before funding released.
SWDC Tree asset management	**tbc**					
Develop a long term District wide programme for tree management						Awaiting business case to be presented for LTP. May break into zones and capture the most public used Parks and Reserves as a trial this year to determine the state of our trees to attach to the Parks management plan. Relates to H & S and age of trees.
Stella Bull Park Lighting	**$12k**	**Nov-20**				
Install lighting for safety/security of users						Lights have arrived 2/12/2020 and will be installed prior to Christmas.
Peace Garden, Featherston	**$120k**	**tbc**				
Construct accessible ramp and web-enabled information display with additional seating and planting						Heritage NZ have received partial private funding to progress, meeting w/c 14th Dec on site to consider delivery v revised budget (half of that required for current design).
Featherston Stadium	**$20k**	**tbc**				

Upgrade to kitchen, seating and ablutions						PGF declined, will carry out repairs as funding becomes available
Ngawi Community Hall	**$30k**	**Dec-20**				
Upgrade septic system						Designer engaged, Resource consent applied to GW, Resource consent stopped awaiting on further investigation of land
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 will be placedon hold at Christmas
Pain Farm upgrades	**$100k**	**Sep-20**				
Upgrades to Main House and cottage to meet standards			↑			Standard maintenace with some trees and driveway to cottage
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						Gate built and will be installed pre Christmasmas
Considine Park, Martinborough	**$8k**	**Nov-20**				
Install additional lime path						Likely Lions involvement - to be discussed at next 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**	Roading
Meeting	12-May-21	**Period**	Apr-21

	Finance	Delivery	H&S	Stakeholders	Risk profile	Commentary
Overall Programme Status (RAG)						Programme on track overall. Some resource constraints remain but works progressing 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						Rrogramme completed
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						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.						Completed works this period - Seal widening on Western Lake Road and Johnson Street, raised pavement markers on Bidwills Cutting Rd installed. Planned works - Lake Ferry box culvert extension programmed for May; Guard rail for Ponatahi Rd bridge ordered; Intersection designs for Bidwills Cutting Rd at Moiki and Glenmorven Rd
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, 500 tonne of rock delvered, Final documentation (Environmental Management Plan) for ECOREEF signed off by GWRC
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. Positive feedback from NZTA. Funding increase 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 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**	Water
Meeting	12/05/2021	**Period**	Apr-20

	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. Some project delays due to consultation requirements and H&S incident. Multiple projects in train and progressing well.
Major Projects						
Manganese Reduction Plant - Martinborough	**$2.5m**	**Nov 19 - Nov 20**				
Construct and commission a manganese reduction plant						PROJECT COMPLETE - MRP is successfully running and allowing use of additional bores in Martinborough.
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. Further work is being undertaken on the shortlisted options before further public consultation is undertaken. This has also been delayed by LTP consultation limiting the opportunity to do so.
Upgrade/Renewal Projects						
Papawai Road WW Upgrade	**$2.8m**	**May 2021 onwards**				
Capacity issue - upgrade pipe						Project commenced May 21. Budget and works will run through to 21/22 FY.
Pinot Grove WW upgrade	**$300k**	**Mar 21 - Jul21**				
Capacity issue - upgrade pipe		↓				Construction activities are underway. LTI incident during late March resulted in construction being on hold whilst investigation undertaken. Change in construction methodology agreed with expected construction completion moving to mid-June. Other network issues identified and requiring additional investigation.
Waiohine Water Treatment Plant (WTP)	**$900k**	**Dec-20**				
a) 4th bore/pump and commissioning						PROJECT COMPLETE - Work complete, awaiting as-builts
b) Treated water storage (chlorine)		↓				Construction work for the piping scope planned for May. Commissioning work to be done this FY. Treated water storage procurement phase underway.
c) pH dosing system upgrade		↓				Temp dosing system has been installed, the Permanent dosing system is planned to be constructed mid June and commissioning early next FY
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		↓				Pump Installation will complete this FY. Pump installation contract signed. Work planned to commence in May for pump replacement.
Memorial Park WTP upgrades stage 3	**$1.5m**	**Apr-21**				
Chemical dosing, UV and filter upgrades		↓				Design and Construct contract awarded to Brian Perry Civils and Filtec. Containerized unit design is in progress. Unit fabrication planned to be delivered on site this FY. Onsite construction work will commence this FY may continue to complete in August in the next FY due to the delay in obtaining approvals under the reserve management plan and Operational resource constraints.
Lake Ferry WWTP driplines	**$326k**	**May-21**				**D**
Renewal driplines at WWTP		↑				Construction started on Monday 3rd May, and is scheduled for completion on 25 May
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 has been installed. 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		↓				The water races survey had a 40% return rate with stakeholders taking the opportunity to share detailed information about how they value and use thier water race. Next steps include Water Race Committee discussion of the results and project planning for bylaw renewal and consenting processes. https://www.swdc.govt.nz/water-races
Longwood Water Race Consent	**n/a**	**Dec-20**				
Gain consent for continued use of water race						Final 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**	Other
Meeting	12-May-21	**Period**	Apr-21

	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						
Waihinga Lessons Learned	**$15k**	**tbc**				
Business Improvement - Undertake a review of the Waihinga Centre project to improve future SWDC project delivery		↑		↑		Contract and timeline agreed
Greenspace review	**$40k**					
Undertake a review of the availability and use of Council greenspace provision in Greytown						Resolution from AP deliberations. Further data collection underway, including use, size and accessibility.
Walking and Cycling Strategy	**tbc**	**tbc**				
Develop a District-wide Walking and Cycling strategy						Linked to 5TTN project and other stakeholders. SWDC plans to be developed at town level. Project commenced with initial scoping underway.
Innovating Streets - Martinborough	**$200k**	**Apr-21**				
Develop and test repurposing of car parks near square						Boffa Miskell engaged as PM and lead. Initial scoping and multiple engagement sessions complete. Design shared in Ops Report, installation through May.
Road Stopping Policy	**$15k**	**Jan-21**				
Develop a Road Stopping Policy						Draft policy being finalised. Completing user guide to enable easier use.

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

Appendix 2 - Wellington Water Q3 performance report

Council SWDC

2020/21 Council Performance Dashboard as at Q3

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	Q2	Q3	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	88.89 %					A
			GTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	66.67 %					
			MTB: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	33.33 %					B
			Pirinoa: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 4 bacterial compliance criteria)	Yes	0 %					C
			FTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	88.89 %					D
			GTN: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	0 %					E
			MTB: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	33.33 %					F
			Pirinoa: Compliance with Drinking Water Standards for NZ 2005 (revised 2008) (Part 5 protozoal compliance criteria)	Yes	0 %					G
	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	32.12					
			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 %	20 %					
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	4.16					
		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	632.44					H
	Water ..	To minimise water loss from the network	Percentage of real water loss from networked reticulation system	<30 %	43.33 %					I
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	220 mins					S
			Attendance time: from notification to arrival on site < 1 hour	>75 %	23.53 %					T
			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	64 hrs					U
			Resolution time: from notification to resolution of fault < 4 hours	>80 %	23.53 %					V
			Proportion of urgent wastewater service requests responded to within 6 hours of notification	>95 %	49.95 %					W
		Reliability of the network	Number of blockages per 1000 connections	<10	11.31					R
		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	1.62					
			No. of complaints per 1000 connections received about sewage system faults	<15	2.08					
			No. of complaints per 1000 connections received about sewage system blockages	<15	11.31					
			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 %					
		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	229 mins					K
			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 %	50 %					L
			Median response times for: resolution of urgent callouts	<8	25 hrs					M
			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 %	78.58 %					N
			Median response times for: attendance for non-urgent callouts	<48	76 hrs					O
			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 %	38.47 %					P
			Median response times for: resolution of non-urgent callouts	<8	7 days					
			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 %	44.22 %					Q

Council SWDC

2020/21 Council Performance Dashboard as at Q3

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	Subsequent to planned plant shut downs (as a result of plant upgrades and Manganese Reduction Plant commissioning), data loss occurred as a result of a fault found in the programming of the control and communication hardware. We have implemented initial fixes and additional investigation is underway.
C	Water Safety Plan development underway to enable compliance to be met.
D	The water quality data systems improvement work by the team over a number of months has resulted in this measure being compliant.
E	UV is in place however filtration at the Water Treatment Plant is required to achieve compliance for this measure. Addition of filtration will be achieved upon completion of the Memorial Park Bore WTP upgrade.
F	Subsequent to planned plant shut downs (as a result of plant upgrades and Manganese Reduction Plant commissioning), data loss occurred as a result of a fault found in the programming of the control and communication hardware. We have implemented initial fixes and additional investigation is underway.
G	Water Safety Plan development underway to enable compliance to be met.
H	General increase in water demand as expected for summer. Due to an ageing network, the number of leaks and total leakage across the network remains relatively high. Additional Service Crews have targeted proactive leak repairs to help manage summer demand.
I	Based on night flows, high summer demand, including irrigation overnight, has been recorded. Despite leakage detection surveys the reduction appears minimal. The monthly minimum night flow is usually observed after a rainfall event, which are infrequent over summer.
K	The attendance time in Q3 was 96 minutes, a decrease from 642 minutes in Q2.
L	The percentage of attendance in time in Q3 was 50%, an increase from 40% in Q2.
M	The resolution time in Q3 was 5 hours, a decrease from 25 hours in Q2.
N	The percentage of attendance in time in Q3 was 79%, an increase from 60% in Q2.
O	The resolution time in Q3 was 76 hours, an increase from 72 hours in Q2.
P	The percentage of attendance in time in Q3 was 38%, a decrease from 47% in Q2.
Q	The percentage of attendance in time in Q3 was 44%, a decrease from 53% in Q2.
R	We continue to observe blockages caused by fat and sanitary product blockages, deteriorating pipes and tree root intrusions across the region. Active replacement of vulnerable pipes through the Preventative Maintenance Program and a prompt response to the reported incidents remain our primary methods to manage blockages.
S	The overall demand for reactive repairs across the region continued to increase over the summer quarter. In the South Wairarapa, we observed a particularly large spike in the customer service requests, which increased by 30% compared to the previous quarter. Leaking pipes and tobies remain the most prevalent issues across the city, accounting for almost two-thirds of the Water Supply jobs. Drainage blockages and overflows accounted for almost half of the Wastewater Network jobs. Stormwater and drainage jobs comprised 26 % of the total work, which was comparable to the region's average. The Water Supply jobs comprised 75% of the total work. In the Wastewater and Stormwater Networks, the drainage blockages and overflows repairs accounted for about half of the ..
T	The percentage of attendance in time in Q3 was 24%, an increase from 0% in Q2.
U	The resolution time in Q3 was 23 hours, a decrease from 171 hours in Q2.
V	The percentage of attendance in time in Q3 was 24%, an improvement from 0% in Q2.
W	The percentage of attendance in time in Q3 was 48%, a decrease from 50% in Q2.

Appendix 3 – Summary of s17a review on Parks and Reserves

Service Delivery Options Assessment

Activity:	Amenities	**Potential benefits of the option:**						
Client:	South Wairarapa District Council	5	High level of benefit					
Review date:	Mar-21	3	Medium level of benefit					
Version	Final	1	Low level of benefit					

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		In-house	Status Quo	Enhanced Status Quo	Shared Services	Other options			
Service delivery options		**Option 1:** **By own council and in-house**	**Option 2:** **By own council and out-sourced**	**Option 2a:** **Enhanced Status Quo** **Amend work packages and contracts and new procurement**	**Option 3:** **By shared service agreement with another council(s)**	**Option 4:** **By CCO/CCTO owned by Council**	**Option 5:** **By joint CCO/CCTO owned by Council and another local authority**	**Option 6:** **By partnership between Council and other parties e.g. private and community**	**Option 7:** **By a party other than Council**
Description of option:		SWDC provides strategy and policy direction, asset management and operational services. Levels of service based on historical patterns of delivery, with changes in response to ad-hoc community demand or changes in patterns of use. An internal team or works group would perform physical works for council and possibly grow over time to contract a small amount of work to the private sector. Can be agile and responsive to customer needs. This team or group would use council finance and health and safety systems and other processes. Customer facing work would increase. The business group would rely on organic growth. Cultural differences between this group and the remainder of council would need to be managed.	SWDC provides strategy, policy direction and asset management. Delivery of operational services (operations and maintenance) is outsourced to two large external contractors and several smaller local organisations. Continue to contract most services to the private sector in existing bundles. SWDC retain specialist functions only if there is no commercial or competitive market for those services.	SWDC provides strategy, policy direction and asset management. Delivery of operational services (operations and maintenance) continues to be outsourced but scope is reviewed and repackaged to increase potential efficiencies and to ensure specialist services are provided by suitable contractors. Update contracts appropriate to the scope. Focus on incentivising innovation as well as quality of work and value for money. Ensure collection of detailed asset and maintenance data. New procurement (beginning with an RFI to request feedback on which packages would be attractive on their own or bundled.)	SWDC and another council(s) provide their own strategy, policy direction and asset management functions. SWDC enters into a formal shared services arrangement with another council(s) to manage and provide operational services. This would typically have a formal governance group of some description overseeing the joint delivery of works across the two (or more) councils. Operations could be managed through an in-house group or through external contracts with the private sector.	SWDC retains the strategy and policy direction functions. SWDC establishes a CCO or CCTO to deliver asset management and operational services. SWDC is responsible for setting the CCO Statement of Intent (SOI) and monitoring CCO delivery. May include: - the transfer of some assets that are currently owned by Council but maintained by Contractors and the establishment of a board of directors and formal entity. - an expectation to return a dividend to Council, and to compete for work from Council and the wider market.	SWDC and other council(s) retain the strategy and policy direction functions. SWDC and other council(s) jointly establish a CCO or CCTO to deliver planning, asset management and operational services. SWDC and other council(s) are jointly responsible for setting the CCO Statement of Intent (SOI) and monitoring CCO delivery. Some potential for reduced operational costs. However likely to be relatively higher set up and governance costs for this option.	SWDC retains the strategy, policy direction and asset management functions. SWDC would form an alliance to deliver operational services with a private company or community group such as: - Long-term agreement e.g. 15 years - A Joint Venture (JV) or Special Purpose Vehicle (SPV) set up between the councils and the private sector. - Management of all or parts of the portfolio could transfer to a Trust, Joint Venture or other partnership arrangement e.g. iwi or a sports code or the Department of Conservation (DOC).	SWDC does not provide properties, parks and reserves maintenance services and activities – i.e. Council opts out of providing the service.
Further assessment required?		Yes	Yes	Yes	Yes	Not recommended at this time	Not recommended at this time	Not now but investigate possiblity for some operational services in the future.	Not now but investigate possiblity for some operational services in the future.
Strategic objectives:	**Weight**								
Achieves customer satisfaction through meeting adopted levels of service	30%	3	3	3	3				
Supports happy, healthy, connected communities by providing access to recreation facilities and activities	20%	5	5	5	5				
Optimises climate change resilience and sustainable environmental practices	20%	3	3	5	3				
Service delivery that is cost effective and supports Council's risk management approach	30%	3	3	5	5				
Score - Strategic Objectives		**3.4**	**3.4**	**4.4**	**4**				
Financial criteria:	**Weight**								
Direct service delivery costs	50%	5	3	3	5				
Indirect (overhead) costs	50%	1	5	5	3				
Score - Financial		**3**	**4**	**4**	**4**				
Non-financial criteria:	**Weight**								
SWRC capability and capacity to attract, retain and develop fit for purpose people and skills, management systems, processes and resources for proactive management of issues	25%	**1**	**3**	**5**	**3**				
Quality and efficient delivery of service	25%	**3**	**3**	**5**	**5**				
Acceptable and manageable level of risk	10%	**3**	**5**	**5**	**3**				
The ability to be agile and adaptable (respond quickly to changing expectations and requirements)	10%	**5**	**3**	**3**	**3**				
Clear definition of roles & decision making responsibilities	10%	**3**	**3**	**5**	**3**				
Simplicity of governance & contract management	10%	**3**	**5**	**5**	**3**				
Keeping community services local (engage local contractors, employ local staff)	10%	**5**	**3**	**3**	**5**				
Score - Non-Financial		**2.9**	**3.4**	**4.6**	**3.7**				
Total score (financial & non-financial):	**100%**	**2.95**	**3.7**	**4.3**	**3.85**				
Overall ranking:		**4**	**3**	**1**	**2**				
Financial benefit ranking:		**4**	**1**	**1**	**1**				
Non-financial benefit ranking:		**4**	**3**	**1**	**2**				
Overall assessment:		**Discounted**	**Discounted**	**Recommended**	**Future investigation recommended**	**Not recommended now**	**Not recommended now**	**Not recommended now**	**Not recommended now**

Appendix 4 – Innovating Streets, Martinborough – Concept Design

MARTINBOROUGH SQUARE

CONCEPT

Parking and reversing isle is retained

The footpath will be widened to reduce the road width, encourage slower vehicle speeds around the corner and creates a shorter crossing distance for pedestrians. Two carparks will be removed to increase pedestrian safety

Planted half-barrels ensure visibility at the crossing is maintained while reducing road width

Planted barrels and road surface paint for traffic calming and road width reduction

Original crossing to be kept clear and increased in width to conform to the new standards making it more visible to drivers and safer for pedestrians

Bike parking and maintenance/repair station accessible from multiple sides

Raised timber structure provides a range and flexibilty of seating options. The climbing plants on the pergola overhead help reduce the perceived width of the road and provide separation between vehicles and parklet users

Increased size of pedestrian island helps reduce the road width, encourages slower vehicle speeds and creates a shorter crossing distance for pedestrians

Picnic table surrounded by planters and planted barrels

Potential for poles holding banners and climbing plants framing the crossing

Painted pattern on the road; opportunity for community input

Pedestrian zone is extended into the carriageway. Vehicle maneuverability unimpeded though the speed is reduced

Barrel top tables with local wine tours and project aspirations fixed under clear perspex

Raised timber platform surrounded by planters with a pergola overhead visually helps reduce the width of the road coming up to the intersection, slowing traffic. Users of parklet are protected by the planters. Platform is multi-functional which can serve as both a rest spot and a stage

Barrels planted with trees and flowers act as a buffer to the park edge, help reduce the carriageway width and slow the traffic

Pedestrian crossing to be raised at Texas Street to slow traffic coming into the square

ASSETS AND SERVICES COMMITTEE

12 MAY 2021

AGENDA ITEM C4

ACTION ITEMS REPORT

Purpose of Report

To present the Assets and Services Committee with updates on actions and resolutions.

Recommendations

Officers recommend that the Committee:

1. Receive the Assets and Services Action Items Report.

1. Executive Summary

Action items from recent meetings are presented to the Committee for information. The Chair may ask officers for comment and all members may ask 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. Procedural resolutions are not reported on.

2. Appendices

Appendix 1 – Action items to 12 May 2021

Contact Officer: Euan Stitt, Group Manager Partnerships and Operations

Appendix 1 – Action Items to 12 May 2021

Number	Meeting	Raised Date	Responsible Manager	Action or Task details	Open	Notes
81	A&S	20-Feb-19	Euan	COUNCIL RESOLVED (DC2019/15): 1. To receive the Wastewater Sewer Later Replacement Management Report. 2. That lateral renewal up to the boundary where necessary will be undertaken at Council's cost but only when main pipeline renewal is being undertaken (this will be regarded as an operational expense). 3. That council in the meantime will not fund depreciation of private lateral assets. 4. That clearing of obstructions and ensuring the lateral is functional will be carried out within Council land. 5. That private property owners remain responsible for lateral renewal maintenance and renewal as per the bylaw when (2 above) does not apply. 6. That the policy be altered to reflect this change and the bylaw remain unchanged. (Moved Cr Olds/Seconded Cr Craig) Carried Cr Wright voted against the motion. Cr Carter voted against the motion.	Open	Policy to come to A&S meeting on the 24th of July 29/07/19 - The section 3.1.9 of the Bylaw will be amended when the bylaw is reviewed and the resolution is put into practice now. Lateral Renewals being done in conjunction with capital works is currently in practice and able to be done under the current bylaw. 27/08/19 Bylaw and Policy reviewed. Officers feel there is no need to amend as the changes can be done under existing policy. 4/9/19: Reopened, report required to next A&S Committee to ensure inconsistencies are address 12/2/20: To be placed on a policy review schedule for 2020 (for the purpose of checking consistency)
423	A&S	19-Jun-19	Euan	ASSETS AND SERVICES RESOLVED (AS2019/12): 1. To receive the Directional Sign Policy for Accommodation, Information and Tourist Attraction Report. 2. That the Blue Signs Policy be amended and then circulated to community board chairs for feedback, and then presented to the Assets and Services Committee seeking a recommendation for Council to approve the Policy. (Moved Cornelissen/Seconded Cr Colenso) Carried	Open	16/08/19 policy is being redrafted in terms of NZTA Traffic Control Devices Manual to ensure Level of Service meets ONRC requirements for national consistency 12/2/20: To be placed on a policy review schedule for 2020
424	A&S	19-Jun-19	Euan	Make amendments to the Directional Sign Policy so that consideration is given to generic vs business specific signs, historic business specific signs, making the policy	Open	16/08/19 policy is being redrafted in terms of NZTA Traffic Control Devices Manual to ensure Level of Service meets ONRC requirements for

Number	Meeting	Raised Date	Responsible Manager	Action or Task details	Open	Notes
				relevant for all towns, consideration and appropriate use of coloured signs (blue and white vs black and yellow vs brown signs), policy exclusion situations, relevant NZTA policies, publication of the approved policy and application form, and a recommended process for managing requests		national consistency 12/2/20: To be placed on a policy review schedule for 2020
39	A&S	19-Feb-20	Euan	Provide a programme of scheduled maintenance works for the Senior Housing units to the A&S Committee	Open	12/08/20 programme being finalised. Update to work completed in P&O Officers Report.25/02/ 2021 report included in main document
114	A&S	18-Mar-20	Euan	COUNCIL RESOLVED (DC2020/27): 1. To receive the Featherston Treated Wastewater to Land and Water Resource Consent Application Report. (Moved Cr West/Seconded Cr Colenso) Carried 2. To endorse Option 2 (withdrawal of the current consent application and lodging a new consent application) as the way forward for the Featherston Treated Wastewater to land and water consent application. 3. Within three months prepare options for the Assessment of Environmental Effects and a Community Engagement Plan. (Moved Cr Fox/Seconded Cr Colenso) Carried	Open	27/5/20: work continues on the Project Plan, AEE and Comms plans. Due to significance and budget, project sits within the Major Projects team at Wellington Water. GHD have been engaged to manage the project and progress the above work. 17/06/20 - A&S committee provided with updated timeline. 12/08/20 Work continues 04/11/20 – 2017 Consent application withdrawn in letter to GWRC. Ongoing update to project provided in Officers' Report.
400	A&S	12-Aug-20	Euan	Investigate the nature of Moroa Water Race events resulting in an operational callout (e.g. urban vs rural vs stormwater), cost and location, and put together some analysis	Open	16/12/20 - Data gathered, analysis under way 12/05/21 – to be completed in parallel with WR survey.
591	A&S	4-Nov-20	Euan	Review whether additional lighting can be placed on or around the Featherston War Memorial	Actioned	16/12/20 - Existing lighting has been removed due to earthquake risk. Alternative/additional lighting being considered as part of renovations but beyond scope of PGF funding. Work continues for best solution. 01/02/2021 have met an electrician and Colin Old to look at lighting the internal memorial in Featherston. We will look at solar lighting strip connected to the new steel

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						work in the roof area with a solar panel on the side. Reason this is required as the current overhead power feed was removed as deemed dangerous for the memorial and public in an earthquake. Completion late March 2021 11/3/21: There is going to be additional lighting installed once the civil work is completed 12/05/21 – solar lighting installed within memorial.
689	A&S	16-Dec-20	Euan	ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/68): 1. To receive the Draft Roading Activity Management Plan Report. (Moved Cr Plimmer/Seconded Cr Jephson) Carried 2. To consider the Activity Management Plan and provide strategic feedback for consideration following a workshop yet to be advised. (Moved Mayor Beijen/Seconded Cr Jephson) Carried	Open	
693	A&S	16-Dec-20	Euan	Provide a progress report on leak detection and repair across the network and a new estimate of water loss through the network following repairs to date	Actioned	12/05/21 – update included in Ops report. Ongoing cycle of work being undertaken and will be reported regularly as new info is collected.
694	A&S	16-Dec-20	Euan	Provide an update on the Martinborough and Greytown wastewater plant volume capacity now and planned capacity following upgrades including narrative on whether the plants will cater to future growth projections	Actioned	12/05/21 – work ongoing
695	A&S	16-Dec-20	Euan	Schedule a workshop with the A&S Committee and Greater Wellington Regional Council to understand the Donald's Creek flooding issue and to clarify responsibilities for works and protection in waterways	Open	12/05/21 – work being undertaken now under GWRC global consent.
89	A&S	7-Apr-21	Euan	Relook at options, including the waste management contract, to determine whether there is an opportunity	Open	20/4/21: moved to A&S 12/05/21 – Update included in Ops Report

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				for local glass recycling initiatives to be implemented in the Wairarapa (i.e. reducing the carbon footprint) as opposed to the current out-of-town destination (transfer action to A&S)		
131	P&R	29-Apr-20	Euan	COUNCIL RESOLVED (DC2020/42): 1. To receive the Listing of the Carkeek Observatory as a Heritage Building Report. (Moved Cr Emms/Seconded Cr Colenso) Carried 2. To support, in principle, the listing of the Carkeek Observatory by Heritage New Zealand through Heritage New Zealand's public consultation process. 3. To delegate to the Chief Executive and Mayor the authority to make the submission to Heritage New Zealand subject to councillor comment on said submission. 4. To inform the public about the Heritage New Zealand process and Council's support for the listing. 5. To undertake further investigation, including costings, to conserve Carkeek Observatory as recommended by Heritage New Zealand. (Moved Cr Fox/Seconded Cr Vickery) Carried	Actioned	27/5/20: Items 2-4 completed. Action transferred to P&R Committee. 14/9/20: A conservation plan for Carkeek Observatory is work noted for under the LTP. 4/5/21: moved to A&S and closed. A Conservation Plan is being prepared and funds have been put aside in the LTP to address any recommendations. This will be managed as a BAU project.