City of
Mount Gambier

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7 December 2018

MAYOR
COUNCILLORS
CITY OF MOUNT GAMBIER

NOTICE is given that the Operational Standing Committee will meet in the following Meeting Room on the day, date and time as follows:

Operational Standing Committee
(Conference Room - Level 1):

Tuesday, 11 December 2018 at 5:30 p.m.

An agenda for the meeting is enclosed.

Mark McSHANE
CHIEF EXECUTIVE OFFICER

AGENDA INDEX

AGENDA OF ORDINARY OPERATIONAL STANDING COMMITTEE MEETING

Meeting to be held in the Conference Room, Civic Centre, 10 Watson Terrace, Mount Gambier on Tuesday, 11 December 2018 at 5:30 p.m.

PRESENT Mayor Lynette Martin OAM

Cr Christian Greco
Cr Kate Amoroso
Cr Paul Jenner
Cr Steven Perryman

COUNCIL OFFICERS	Chief Executive Officer	-	Mr M McShane
	General Manager Community Wellbeing	-	Ms B Cernovskis
	General Manager Council Business Services	-	Mrs P Lee
	General Manager City Infrastructure	-	Mr N Serle
	Manager Executive Administration	-	Mr M McCarthy
	Executive Administration Officer	-	Ms A Lavia

WE ACKNOWLEDGE THE BOANDIK PEOPLES AS THE TRADITIONAL CUSTODIANS OF THE LAND WHERE WE MEET TODAY. WE RESPECT THEIR SPIRITUAL RELATIONSHIP WITH THE LAND AND RECOGNISE THE DEEP FEELINGS OF ATTACHMENT OUR INDIGENOUS PEOPLES HAVE WITH THIS LAND.

APPOINTMENT OF ACTING PRESIDING MEMBER:

Mayor Martin be appointed as Acting Presiding Member of the Operational Standing Committee for the commencement of the meeting.

Moved: Seconded:

1. APOLOGY(IES)

Apology(ies) received from Cr

That the apology from Cr be received.

Moved: Seconded:

2. CONFIRMATION OF OPERATIONAL STANDING COMMITTEE MINUTES

Meeting held on 9 October 2018

That the minutes of the Operational Standing Committee meeting held on 9 October 2018 as attached be confirmed.

Moved: Seconded:

3. QUESTIONS

3.1. With Notice

Nil submitted.

3.2. Without Notice

4. DEPUTATIONS

Nil

5. OPERATIONAL STANDING COMMITTEE REPORTS

Operational Standing Committee Reports commence on the following page.

5.1. Operational Standing Committee Presiding Member - Report No. AR18/49396

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49396
RM8 REFERENCE	AF17/225
AUTHOR	Michael McCarthy
SUMMARY	This report is presented to enable the recommendation of a Presiding Member for the Operational Standing Committee.
COMMUNITY PLAN REFERENCE	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/49396 titled '*Operational Standing Committee Presiding Member*' as presented to the Operational Standing Committee on 11 December 2018 be noted. (b) The term of office for the position of Operational Standing Committee Presiding Member be ____ year(s). (c) That Cr be the Presiding Member of the Operational Standing Committee on and from 11 December 2018 subject to endorsement by Council.

Moved: Seconded:

Background

Council adopted at its meeting held on 22 November 2018 a decision making structure that included the Operational Standing Committee (a Committee established under s41 of the Local Government Act 1999).

Amongst the first items of business for Council's s41 Committees is the making of a recommendation to Council on a Presiding Member of the Committees.

In accordance with the provisions of s41(4) of the Local Government Act 1999 Council appoints (or makes provision for the appointment of) a Presiding Member of a s41 Committee.

Discussion

The selection of a Presiding Member is from amongst its own membership.

The following process is summarised from Council's *C410 Conduct of Meetings Policy*:

- *A nominee need not be present, but must accept nomination prior to consideration.*
- *Nominees should display the qualities sought to fill the position including relevant skills and experience.*
- *Where more than one nomination is received a secret ballot shall be conducted forthwith without debate. Resolutions will be passed to endorse the voting process and appoint the Chief Executive Officer (or any other Senior Officer present at the meeting) as Returning Officer to declare the result and draw lots (if/as necessary).*
- *The Mayor may vote but a Member not in their seat at the meeting does not vote.*
- *The candidate with the highest number of votes (or where two or more candidates receive the equal highest number of votes the first name drawn in the lot) shall be declared as being nominated/appointed to the vacant position.*
- *A division cannot be called on the question of appointing a person to fill a vacant position.*
- *A motion to endorse the filling of the vacant position may be accepted (but is not required) however any failure or variation of the motion shall be of no effect on the result of the secret ballot.*

Should the Committee have only one nomination for Presiding Member then that Member may be the nominee that the Committee recommends to Council for appointment as Presiding Member.

Conclusion

The Committee may now accept nominations and endorse and conduct a ballot process – if necessary, to determine a Presiding Member recommendation.

Recommended resolutions for endorsement of a voting process and sample process/minutes are provided as an attachment should the Committee require to follow this process.

Attachments

Attachment 1 (AR18/47731): Recommended resolutions for endorsement of secret ballot

Michael McCARTHY
MANAGER EXECUTIVE ADMINISTRATION

Pamela LEE
GENERAL MANAGER COUNCIL BUSINESS SERVICES

26 November 2018
MMcC

5.2. Operational Standing Committee Ordinary Meeting Day and Time - Report No. AR18/49394

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49394
RM8 REFERENCE	AF17/225
AUTHOR	Michael McCarthy
SUMMARY	This report is presented to enable the Operational Standing Committee to confirm the day and time of its ordinary meetings.
COMMUNITY PLAN REFERENCE	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report No. AR18/49394 titled '*Operational Standing Committee Ordinary Meeting Day/Time*' as presented to the Strategic Standing Committee on 11 December 2018 be noted.

(b) That the Operational Strategic Standing Committee hold ordinary meetings on the Tuesday in the week preceding each monthly Council meeting commencing at 5:30pm in the Civic Centre, 10 Watson Terrace, Mount Gambier.

(c) That ordinary meetings in accordance with resolution (b) commence in February 2019.

Moved: Seconded:

Background

Council adopted at its meeting held on 22 November 2018 a decision making structure that included the Operational Standing Committee (a Committee established under s41 of the Local Government Act 1999).

Amongst the first items of business for Council's s41 Committees is the appointment of a day, time and place ordinary meetings of the Committee are to be held.

In accordance with the provisions of s87(1) of the Local Government Act 1999 the appointment of ordinary meeting times for Committee is by Council, or subject to a decision of Council, by the Committee.

The Council resolution of 22 November 2018 included that Committees note the lead time for Council reports and agenda preparation in considering meeting days and times.

Discussion

The decision making structure adopted by Council includes all s41 Committees (excepting Sub-Committees) reporting directly to Council.

For efficient administration to enable consideration and making of decisions by Council it is necessary for Committee meeting days and time of Committees to align appropriately with the ordinary meeting schedule of Council and other Committees.

Special Meetings may be called as and when required to consider matters of business that cannot be deferred until the next scheduled ordinary Committee meeting.

Conclusion

This report recommends that the Operational Standing Committee hold ordinary meetings on the Tuesday in the week preceding each monthly Council meeting commencing at 5:30pm.

It is further recommended that ordinary Committee meetings commence from February 2019 due to insufficient lead time for agenda preparation and conduct of Committee meetings between the 18 December 2018 and 15 January 2019 Council meetings as a result of Christmas and New Year.

The (Acting) Presiding Member may consider it beneficial to invoke a short-term suspension of proceedings, with the approval of at least two-thirds of the Members present, to enable Members to discuss appropriate day, time and place for meetings of the Operational Standing Committee.

Attachments

Nil

Michael McCARTHY
MANAGER EXECUTIVE ADMINISTRATION

Pamela LEE
GENERAL MANAGER COUNCIL BUSINESS SERVICES

26 November 2018
MMcC

5.3. Operational Standing Committee Review of Terms of Reference - Report No. AR18/49395

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49395
RM8 REFERENCE	AF17/225
AUTHOR	Michael McCarthy
SUMMARY	This Report is presented to enable the Operational Standing Committee to review its Terms of Reference.
COMMUNITY PLAN REFERENCE	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report No. AR18/49395 titled '*Operational Standing Committee – Review of Terms of Reference*' as presented to the Operational Standing Committee on 11 December 2018 be noted.

(b) That the Operational Standing Committee Terms of Reference be adopted as attached to Operational Standing Committee Report No. AR18/49395.

OR

(b) That the Operational Standing Committee Terms of Reference be adopted as attached to Operational Standing Committee Report No. AR18/49395 with the following alterations:

- Insert alteration
- Insert alteration

OR

(b) That the Operational Standing Committee Terms of Reference be re-presented to the next ordinary/special meeting of the Operational Standing Committee for consideration with the following alterations:

- Insert alteration
- Insert alteration

Moved: Seconded:

Background

Council adopted at its meeting held on 22 November 2018 a decision making structure that included the Operational Standing Committee (a Committee established under s41 of the Local Government Act 1999).

Amongst the first items of business for Council's Committees is the review of Committee Terms of Reference.

In considering any changes to the Operational Standing Committee Terms of Reference, the Committee should consider the extent to which any Committee terms should remain consistent for the benefit of administration and the Members of Council's decision making structure.

Discussion

The decision making structure adopted by Council includes all s41 Committees (excepting Sub-Committees) reporting directly to Council.

In considering any changes to the Operational Standing Committee Terms of Reference, the Committee should consider its scope and objectives and the extent to which the Terms of Reference of Committees within Council's decision making structure should remain consistent for the benefit of Members and to maintain administrative consistency.

Conclusion

This report recommends that the Operational Standing Committee review its Terms of Reference with a view to recommending their adoption as presented with the report, with any specified alterations, or after they have been re-presented to a subsequent meeting of the Committee with specified alterations.

The (Acting) Presiding Member may consider it beneficial to invoke a short-term suspension of proceedings, with the approval of at least two-thirds of the Members present, to enable Members to review; and if necessary, note any proposed alterations to the Operational Standing Committee Terms of Reference.

Attachments

Attachment 1 (AR18/51027): Operational Standing Committee - DRAFT Terms of Reference

Michael McCARTHY
MANAGER EXECUTIVE ADMINISTRATION

Pamela LEE
GENERAL MANAGER COUNCIL BUSINESS SERVICES

26 November 2018

5.4. Works in Progress - City Infrastructure - Report No. AR18/44529

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/44529
RM8 REFERENCE	AF17/505
AUTHOR	Daryl Morgan
SUMMARY	Update of works that are currently being undertaken and/or completed by the City Infrastructure Department.
COMMUNITY PLAN REFERENCE	Goal 2: Our Location

REPORT RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/44529 titled '*Works in Progress - City Infrastructure*' as presented to the Operational Standing Committee on 11 December 2018

Moved: Seconded:

Background

Works in progress and works completed are reported on a monthly basis to Council as part of the governance process to ensure planned and budgeted infrastructure works are completed in a timely manner.

Discussion

The following projects have field work currently in progress:

Commenced Tasks	% Completed
• Hart Street Concrete footpath	90%
• Wireless Rd West (Acacia St to Matthew Flinders Way) Road Rec	40%
• Rail Trail shared path construction (Jub Hwy East to Pick Ave)	95%
• Crouch St South (Griffths St to Gwendoline St) Road Reconstruction	20%
• Footpath resurfacing program	50%

Completed Tasks
- Swallow Drive Concrete Footpath
- Sturt St (Bay Rd to Compton St) Road reconstruction
- Helen Street Road reconstruction
- Reuse Market 3 Eucalypt Dr fit-out works
- Hotmix intersections (various locations)
- Resurfacing of path to Centenary Tower

Notes:
The extension of the Rail Trail east of Pick Ave has extended the trail by an additional 1.2kms and connects the trail to the existing path along Jubilee Hwy East (Via the easement that runs between the Show Grounds and the Timber Mill). Works will now commence on the western extension from Jubilee Hwy to Wandilo Rd.

The resurfacing of the centenary Tower path has created an all-weather (non slip) asphalt path of approximate length of 500m over the existing worn out bitumen path.

Conclusion

It is recommended that this report be received and noted for information by Council.

Attachments

Attachment 1 (AR18/49884): Project photos

Daryl MORGAN
MANAGER ENGINEERING DESIGN & CONTRACTS

Nick SERLE
GENERAL MANAGER CITY INFRASTRUCTURE

26 November 2018

5.5. Caroline Landfill leachate disposal - Vetiver grass trial - Report No. AR18/44529

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49403
RM8 REFERENCE	AF11/505
AUTHOR	Daryl Morgan
SUMMARY	This report is intended to update Members on the recent EPA approval granted to Council to undertake a research trial for the onsite disposal of leachate at Caroline landfill via irrigation onto Vetiver grass
COMMUNITY PLAN REFERENCE	Goal 2: Our Location

REPORT RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/49403 titled *'Caroline Landfill leachate disposal – Vetiver grass trial*' as presented to the Operational Standing Committee on 11 December 2018 be noted. (b) Council Officers continue to regularly report to Council on the progress and outcomes of the trial.

Moved: Seconded:

Background

The management of engineered landfills requires waste water (referred to as Leachate) to be managed in accordance with Councils EPA licence for operation of landfill facilities. Leachate is generated as a result of either rainfall coming into contact with buried waste or via the process of the waste breaking down, which then results in generation of contaminated water (leachate).

Leachate is current stored onsite at the landfill in composite clay / poly lined ponds and evaporates off over the summer months.

However, in 2016 Council was forced to implement emergency management measures to either store or dispose of excess leachate from landfill and council resolved in that year to undertake measures necessary to action this so as to avoid environmental harm. This was a result of a number of above average rainfall years (where rainfall exceeded evaporation) which resulted in excessive volumes of leachate not being able to be stored in the onsite ponds.

These measures involved the temporary storage of leachate in onsite bladders, building up the height of the dam walls and also transporting offsite and disposing to sewer.

Whilst these options were successful at the time and managed to mitigate against any risks associated from leachate pollution, these practices are not sustainable in the longer term and will place a financial burden on Council if continued.

Council has spent approximately $160,000 in previous years to manage leachate through these alternative measures and this could be potentially required in the future if rainfall continues to exceed evaporation.

Discussion

Extensive research into alternative leachate disposal methods has been undertaken by the Manager Engineering Design and Contracts and in February 2018 a proposal was submitted to the Environmental Protection Agency (EPA) for a trial site to be established on one of the capped cells at Caroline landfill.

The trial involves planting out an area with a specialised grass (Vetiver grass) that has an affinity for leachate. If successful, this trial may provide a long term solution to the management and disposal of leachate onsite and once established will have minimal ongoing costs. (Approximately $40,000 per annum for pump running costs and testing and monitoring). The 18/19 budget has an allocation of funds to undertake the trial and cover the operational and monitoring costs with the setup and planting costs being previously funded from the 17/18 budget.

Council has just been advised that the EPA has approved the trial for a 2 year period and if this trial is successful then council may have a reliable and environmentally sound onsite treatment and disposal solution that has minimal ongoing costs. In addition, this method of leachate treatment and disposal has not been used in South Australia before so Council is potentially at the forefront of ground breaking technology for onsite treatment and disposal of leachate and this technology also has the potential to benefit many other Councils longer term.

Attached are the reports that were prepared and submitted to the EPA to gain approval which provides some more background on the vetiver grass and the trial.

This type of system is not currently supported under the South Australian EPA - landfill guidelines but EPA are very interested in the trial outcomes and subsequently have granted a 2 year trial approval. This trial has the potential to change the leachate management practices in SA if successful.

Conclusion

The trial period will be from 26th November 2018 to 26th November 2020 with various reporting periods to EPA / Council throughout the trial.

Attachments

Attachment 1 (AR18/49402): Proposal to EPA
Attachment 2 (AR18/49400): Environmental Management Plan for irrigation trial
Attachment 3 (AR18/49399): Letter of approval from EPA

Daryl MORGAN
MANAGER ENGINEERING DESIGN AND CONTRACTS

Nick SERLE
GENERAL MANAGER CITY INFRASTRUCTURE

26 November 2018
DM

5.6. Sport and Recreation Major Capital Works Program 2018/2019 - Report No. AR18/50206

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/50206
RM8 REFERENCE	AF17/225
AUTHOR	Barbara Cernovskis
SUMMARY	To seek Council endorsement for the distribution of funds for the 2018/19 Sport and Recreation Major Capital Works Program 2018/19
COMMUNITY PLAN REFERENCE	Goal 1: Our People
	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report No. AR18/50206 titled '*Sport and Recreation Major Capital Works Program 2018/19*' as presented to the Operational Standing Committee on 11 December 2018 be noted.

(b) That $70,000 be endorsed for distribution for the 2018/2019 Sport and Recreation Major Capital Works Program as follows:

Applicant	Priority (Score)	Requested	Approved
South Gambier Netball Club Association	1	$30,000	$27,000
Blue Lake Sports Club Incorporated	2	$20,625	$17,000
South Gambier Football Club	3	$50,000	$15,500
Mount Gambier and Districts Baseball League	4	$10,980	$10,500
		$111,605	$70,000

(c) All applicants be notified accordingly, advising that the provision and acquittal of these grant funds will always be subject to:

- all necessary land holder and development approvals being obtained; and
- all works being completed in accordance with all relevant legislative and compliance standards.

Moved: Seconded:

Background

Council resolved to provide an allocation in the annual budget for ongoing support for a Sport and Recreation Major Capital Works Program and to publically call for applications. The 2018/19 Budget provides an amount of $70,000 for this Program.

The Sport and Recreation Major Capital Works Program was publicly advertised during October and November 2018 and at close of business 30 November 2018 the following applications were received:

Applications Received – Overview

1. South Gambier Netball Club Association
   Project Title: Resurfacing of netball courts, installation of court shelters
   Total Project Cost: $ 54,196
   Contribution Requested: $ 30,000 (55% of project)

2. Mount Gambier and District Baseball League Inc
   Project Title: Upgrade of Batting Cages
   Total Project Cost: $ 11,320
   Contribution Requested: $ 10,980 (97% of project)

3. South Gambier Football Club Incorporated
   Project Title: Modernise Change Rooms
   Total Project Cost: $ 450,000
   Contribution Requested: $ 50,000 (11% of project)

4. Blue Lake Sports Club Incorporated
   Project Title: Fencing, seating, lighting and security upgrade
   Total Project Cost: $ 29,015
   Contribution Requested: $ 20,625 (71% of project)

Discussion

The criteria developed for the Program Guidelines includes the following (in brief);

- as a general rule, a minimum total project cost of $10,000
- preference to high incidence of self help
- preference to matching funds or significant in-kind contribution by the applicant (minimum 25% of total project costs)
- priority for capital renewal or upgrade of existing assets rather than enhancement/additions or new assets
- for projects aimed at increasing community usage of sport and recreation facilities
- not for operating costs, the purchase of land or repayment of loans
- not for projects already commenced or completed
- not for projects submitted by individuals
- projects completed and claims for payment to be submitted by 14 June 2019 to enable the release of funds before the end of financial year.

A copy of the guidelines (Attachment 1) and application form (Attachment 2) developed for the 2017/2018 Program are provided for further information.

Section 1: Membership Details

		Junior		Senior		Total		**Grand Total**
		M	F	M	F	M	F	
1	South Gambier Netball Club Association	0	54	0	38	0	92	**92**
2	Mount Gambier and District Baseball League	174	0	180	0	354	0	**354**
3	South Gambier Football Club	187	62	150	50	337	112	**449**
4	Blue Lake Sports Club Incorporated	80	18	40	15	120	33	**153**

Section 2: The Project ✓

	Community Benefit	High	Average	Low
1	South Gambier Netball Club Association	✓		
2	Mount Gambier and District Baseball League	✓		
3	South Gambier Football Club	✓		
4	Blue Lake Sports Club Incorporated		✓	

Location

1	South Gambier Netball Club Association	Blue Lake Sports Park (Council owned)
2	Mount Gambier and District Baseball League	Blue Lake Sports Park (Council owned)
3	South Gambier Football Club	Blue Lake Sports Park (Council owned)
4	Blue Lake Sports Club Incorporated	Malseed Park (Council owned)

Section 3: Project Funding

	Funding Breakdown	Cash $	In Kind $	Voluntary $	Grant Funding $	Grant Requested $	**Total**
1	South Gambier Netball Club Association	16,211	0	7,985	0	30,000	**$54,196**
2	Mount Gambier and District Baseball League	0	0	340	0	10,980	**$11,320**
3	South Gambier Football Club	347,400	40,000	7,600	5,000	50,000	**$450,000**
4	Blue Lake Sports Club Incorporated	5,000	1,310	2,080	0	20,625	**$29,015**

	Funding Breakdown	Cash	In Kind	Voluntary	Grant Funding	**Total**
1	South Gambier Netball Club Association	30%	-	15%	-	**45%**
2	Mount Gambier and District Baseball League	-	-	3%	-	**3%**
3	South Gambier Football Club	77%	9%	2%	1%	**89%**
4	Blue Lake Sports Club Incorporated	17%	5%	7%	-	**29%**

		Star Club Rating	Financial Statements	Current Bank Statements	Quotations Received	Financial Capacity (to proceed with reduced funding)
1	South Gambier Netball Club Association	5	✓	✓	-	Yes (with restrictions)
2	Mount Gambier and District Baseball League	3	-	✓	-	Yes
3	South Gambier Football Club	4	✓	✓	-	Yes
4	Blue Lake Sports Club Incorporated	5	✓	✓	✓	Yes

Section 4: Selection Rationale

The following application assessment rationale has been developed (based on the program guidelines) which in turn has influenced the recommended grant allocations.

ASSESSMENT RATIONALE LEGEND								
Rating Legend	High 3	Renew of Existing 3	50% + 3	Yes 1	Provided 1	Provided 1	None Previously 3	Rating 5 4
	Average 2	Enhance/Add to Existing 2	26-50% 2	No 0	Not Provided 0	Not Provided 0	Moderate previously 2	Rating 4 3
	Low 1	New 1	25% 1				Significant previously 1	Rating 3 2
								Rating 2 1

ASSESSMENT									
	Community Benefit	Infrastructure Assessment	Contribution of Club/ Other Contributions		Guidelines Compliance				**Score**
Application		Infrastructure Priority	% Club Contribution	Other Contributions	Financial/Bank Statements	Quotations Provided	Previous / Level of Grants	Star Club Rating	
South Gambier Netball Club Association	3	3	2	0	1	0	3	4	**16**
Mount Gambier and District Baseball League	3	3	1	0	1	0	3	2	**13**
South Gambier Football Club	3	2	3	1	1	0	1	3	**14**
Blue Lake Sports Club Incorporated	2	3	2	0	1	1	2	4	**15**

Conclusion

A copy of the funding applications have been attached (Attachment 3) to this report for Elected Members information along with a list of previous recipients of the funding (Attachment 4). ***Given the number of applications received it is recommended that each of the projects be supported.***

Attachments

Attachment 1 (AR18/38982): Sport and Recreation Major Capital Works Program 2018/2019 - Guidelines
Attachment 2 (AR18/38985): Sport and Recreation Major Capital Works Program 2018/2019 - Application Form
Attachment 3 (AR18/50677): Sport and Recreation Major Capital Works Program Applications 2018/19
Attachment 4 (AR18/38995): Sport and Recreation Major Capital Works Program - Projects Previously Funded - 2010 - 2017

Barbara Cernovskis
GENERAL MANAGER COMMUNITY WELLBEING

Mark McShane
CHIEF EXECUTIVE OFFICER

30 November 2018
DL

5.7. Heritage Advisor role in Development Applications - Report No. AR18/41818

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/41818
RM8 REFERENCE	AR17/505
AUTHOR	Simon Wiseman
SUMMARY	A report detailing the requirements for referral to the Heritage Advisor in Development Applications.
COMMUNITY PLAN REFERENCE	Goal 1: Our People
	Goal 2: Our Location
	Goal 3: Our Diverse Economy
	Goal 4: Our Climate, Natural Resources, Arts, Culture and Heritage

REPORT RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/41818 titled '*Heritage Advisor role in Development Applications*' as presented to the Operational Standing Committee on 11 December 2018 be noted.

Moved: Seconded:

Background

The Operational Standing Committee meeting held on the 9th October 2018 requested the following information;

"(a) A report be presented to the Operational Standing Committee detailing the requirements for referral to the Heritage Adviser in Development Applications."

Discussion

The Heritage Advisor provides a service to Council, Council employees and the community by providing conservation and architectural advice for development on heritage listed places and within Historic (Conservation) Policy Areas.

Development on a heritage place is regulated by the following legislation:

- The Heritage Places Act 1993;
- The Development Act 1993 and Regulations; and
- The Development Plan.

The Development Act identifies that:

- Any development which may materially affect a State Heritage Place must be referred to the State Government for advice and comment.

The Heritage Advisor is engaged by the State Government to provide advice on State Heritage listed properties and/or State Heritage Areas.

In addition to providing advice on development associated with State Heritage Places, the Limestone Coast Local Government Association has negotiated on behalf of the seven Member Councils to be able to access the expertise provided by the heritage advisor for Local Heritage Places and Historic Conservation Areas. This is a service provided throughout the Limestone Coast. The Heritage Advisor formally and informally assists with interpreting and managing the heritage requirements and guidelines within the Development Plan's. This advice is provided for:

- Local Heritage Places;
- Historic (Conservation) Policy Areas;
- Contributory Places.

There is no specific Council Policy that informs Council officers when to refer development applications to Council's Heritage Advisor. However, it is the practice of Council to seek advice from the heritage adviser in relation to applications that are listed in Council's Development Plan, as being a local Heritage Place or within a Historic (Conservation) Policy Area.

Applicants are advised of this process when lodging a Development Application with Council.

As shown in Table 1 below, Council's Heritage Advisor's expertise is used to give two types of advice, formal and informal.

TABLE 1		Heritage advisor role - scale of influence		
Types of Heritage values listed within the City of Mount Gambier	**Specific Legislation**	**Formal Advice**	**Informal advice**	**Planning Authority**
State Heritage Places and Policy Areas	Development Act and Development Regulations.	YES	YES	Minister (Heritage Advisor) and Council
Local Heritage Places	Development Regulations and Council's Development Plan	NO	YES	Council
Contributory Places	Council's Development Plan	NO	YES	Council
Historic Conservation Areas	Council's Development Plan	NO	YES	Council

Conclusion

Council provides access to the expertise of the Heritage Advisor to the community to assist in the conservation of heritage places. The expertise provided by the Heritage Advisor is used in both a formal and informal way depending on the legislative requirements and the nature of the heritage listing of a place.

Attachments

Nil

Simon WISEMAN
SENIOR PLANNER

Barbara CERNOVSKIS
GENERAL MANAGER COMMUNITY WELLBEING

19 November 2018
SBW

5.8. 2018/2019 Local Heritage Restoration Fund - Report No. AR18/49881

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49881
RM8 REFERENCE	AR18/49881, PR18/9911
AUTHOR	Simon Wiseman
SUMMARY	An outline and summary of the applications received as part of the 2018/2019 Heritage Restoration Fund.
COMMUNITY PLAN REFERENCE	Goal 4: Our Climate, Natural Resources, Arts, Culture and Heritage
	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report titled '2018/2019 Heritage Restoration Fund' as presented be noted.

(b) That the Heritage Restoration Fund Grants for 2018/2019 be endorsed as follows:

APPLICANT	RECOMMENDED VALUE OF GRANT
Adrian & Tracy Koop	$1,500
Darren & Tanya Coxon	$1,500
Ryan & Kirsty Turner	$2,000
Mount Gambier Club Inc.	$2,000
Kiri Fleming	$2,000
Georgina Jones	$700
Jo & David Glover	$500
Darren & Yvette Sims	$2,500
Kathryn Zvirgzdins	$800
John & Wendy Pocock	$500
John William Ancell & Raspati Suciati Louis	$2,000
George Haskas	$800
Fiona Smith	$500
Margaret Kaethner	$2,000
Joe & Sue Clements	$700
TOTAL	$20,000

Moved: Seconded:

Background

Since October 1999, the City of Mount Gambier's Development Plan has contained heritage policies including a register of State and Local Heritage Places, Local Heritage Conservation Areas and a schedule of Contributory Places.

As part of Council's commitment to the conservation and management of the City's heritage assets, a Heritage Restoration Fund has been established by Council. Each year owners of a Local Heritage property can apply to Council for a grant to be used for the following conservation work:

- Painting and repairs of woodwork and windows
- Repair of replacement of heritage fences
- Re-roofing and new gutters
- Stonework restoration and salt damp repairs
- Verandah repairs or reconstruction

The value of the grant is dependent on the number of applications received and the budget allocation by Council. The 2018-19 budget for the fund is a total of $20,000. Generally the maximum amount of any grant available is $2,000, although this amount can vary. The grant will be issued to successful applicants after the specified work is completed. All works are required to be completed within six months of approval of the grant.

In certain circumstances where works may be urgent, retrospective approval may be granted. These circumstances require discussion with Council staff to ensure appropriate evidence is provided for reimbursement.

Discussion

After notification to Local Heritage property owners of the grant, Council received a total of 15 applications. All the applications vary, in both conservation works proposed and in value. A summary table of applicants and their proposed works and estimated cost of the project has been attached for the Members further information.

As there is quite a number of applicants some may not be successful in gaining a Council Grant.

All of the applications seeking a grant from the Local Heritage Fund were considered by Members of Council's Heritage Sub Committee at a meeting held on Tuesday 27th November, 2018. The recommended value of grant for this year of Local Heritage Fund grants is contained within the recommendation of this report.

For the Committee's general information and comparison purposes, the following is a run-down of the 2017/18 successful applicants:

Sylvia Corker	$795
Darren & Tanya Coxon	$2,000
Ryan & Kirsty Turner	$2,000
Andrew Buchulka	$2,000
Catherine Rymill	$1,000

Julie & Rob Forgan	$2,000
Fiona Smith	$500
Graeme Garrod & Anita Penna	$1500
Key 2 Sale Pty Ltd	$700
Garry & Tracey Schloithe	$2,000
Stephen Dunn	$300
George Haskas	$2,000
Daryl & Julie Sexton	$2,000

Attachment 1 provides a summary and more details of the work the grant is being used towards.

Conclusion

The succession Applicants and the Value of the Grants as determined by the Members of the Heritage Committee and as outlined within the recommendation of this report be endorsed and supported by Council.

Attachments

Attachment 1 (PR18/9911): Local Heritage Restoration Fund 2018/2019 - Summary Table of Applications

Simon WISEMAN
SENIOR PLANNER

Barbara CERNOVSKIS
GENERAL MANAGER COMMUNITY WELLBEING

29 November 2018
SBW

5.9. Quarter One Budget Review for the financial year ending 30 June 2019 - Report No. AR18/48619

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/48619
RM8 REFERENCE	AF18/227
AUTHOR	Kahli Rolton and Jeroen Zwijnenburg
SUMMARY	This report provides the Quarter One Budget Review for the period ending 30 September 2018 within the financial year ending 30 June 2019 for consideration by the Committee.
COMMUNITY PLAN REFERENCE	Goal 1: Our People
	Goal 2: Our Location
	Goal 3: Our Diverse Economy
	Goal 4: Our Climate, Natural Resources, Arts, Culture and Heritage

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report No. AR18/48619 titled '*Quarter One Budget Review for Financial Year Ending 30 June 2019*' as presented to the Operational Standing Committee on 11 December 2018 be noted.

(b) That the Quarter One Budget Review (BR1) be adopted for the financial year 1 July 2018 to 30 June 2019 as detailed in Attachment 1 of the report titled 'Quarter One Budget Review for the Financial Year Ending 30 June 2019' which reflects a $328,000 forecast operating surplus representing no net change from the Original Budget forecast operating surplus.

Moved: Seconded:

Background

In accordance with the Local Government (Financial Management) Regulations 2011, Regulation 9 requires Council to prepare and consider the following reports relating to the review of budgets:

9.1(a) At least twice, between 30 September and 31 May (both dates inclusive) in the relevant financial year (where at least 1 report must be considered before the consideration of the report under sub regulation (1)(b), and at least 1 report must be considered after consideration of the report under sub regulation (1)(b)) - a report showing a revised forecast of its operating and capital investment activities for the relevant financial year compared with the estimates for those activities set out in the budget presented in a manner consistent with the note in the Model Financial Statements entitled Uniform Presentation of Finances;

9.1(b) Between 30 November and 15 March (both dates inclusive) in the relevant financial year - a report showing a revised forecast of each item shown in its budgeted financial statements for the relevant financial year compared with estimates set out in the budget presented in a manner consistent with the Model Financial Statements.

9.2 A council must also include in a report under sub regulation (1)(b) revised forecasts for the relevant financial year of the council's operating surplus ratio, net financial liabilities ratio and asset sustainability ratio compared with estimates set out in the budget presented in a manner consistent with the note in the Model Financial Statements entitled Financial Indicators.

Council has scheduled to undertake and present the budget reviews as follows:

Budget Review	Inclusive Dates	Council Meeting in
Quarter One (BR1)	1 July to 30 September	November (December due to elections)
Quarter Two (BR2)	1 October to 31 December	February
Quarter Three (BR3)	1 January to 31 March	May

Section 123 7(a)(b) of the Local Government Act 1999 (the 'Act) states that each budget of council must:

7(a) Be considered in conjunction with the council's annual business plan (and must be consistent with that plan, as adopted); and

7(b) Be adopted by the council after the council has adopted its annual business plan.

Table 1: Financial matters resolved by Council since adoption of the original 2018/2019 Budget and indication of inclusion of the financial implications in a Budget Reviews for this financial year.

Council Meeting Item	Description	Resolution	Note
13.12	New Year's Eve Event	(b) That the Operational Standing Committee notes the application for Events funding from Mount Gambier Community Events for $10,000 cash and $5,000 in kind to assist running the New Year's Eve event in 2018. (c) That Council provide $5,000 in cash and $3,000 in-kind on the condition that other funding support is forthcoming.	Relocated from within Existing Budget
17.02	Architectural Design Stage One – Mount Gambier Sport and Recreation Centre	(b) That Council accept the tender of Design Inc Adelaide for the completion of Intermediate Design Stage One for $40,000 and Detailed Design Stage 2 (subject to securing future funding) for the Mount Gambier Regional Sport and Recreation Centre (as identified in Tender AF18/244) for funding applications.	Included in Original Budget

13.14	Joint Boundary Roads Advisory Group – 5 year Work Plan	(b) That Council adopt the five year works program and proceed, with the concurrence of the District Council of Grant, with the following projects in 2018/2019 to be funded out of carry over funds and budgeted 2018/2019 boundary roads contributions of $30,000 from each of District Council of Grant and City of Mount Gambier; - Tollner Road (reseal) $18,000 - Hawkins Road (reseal) $10,000 - McCormick Road (reseal) $39,000 - Pinehall Avenue (reseal) $11,000 - Kennedy Avenue/Bishop Road staggered T junction (surveying, land acquisition, fencing) $50,000	WIP Original Original Original WIP
13.19	CBD Footpath Sweeping Options	(b) Extend footpath sweeping to Commercial Street from Ferrers Street to Krummel St twice per week and the footpath sweeping program be monitored subject to review in 6 months.	Reallocated from with Existing Budget
13.20	2018 Fringe Festival	(b) That Council write to the relevant State Government Minister seeking a $20,000 funding commitment as a matter of urgency to support the Mount Gambier Fringe Festival in 2019. (c) The Council contribute an additional $15,000 to the 2019 Mount Gambier Fringe Festival subject to the State Government confirming a financial commitment of $20,000	BR2
14.02	Mount Gambier Regional Sport and Recreation Centre	(e) To meet the requirements of a comprehensive elector survey seeking feedback from the Mount Gambier community an estimated budget of $65,000 is required and the CEO is authorised to expend up to this amount with adjustments in the 2018/2019 budget being made from the operating surplus at Budget Review Number 3.	BR3
13.15	Capital Work in Progress Budget Carry Overs from 2017/2018	(b) That the capital works in progress budget carry overs from 2017/2018 of $1,108,500 be adopted and reflected in the 2018/2019 budget.	WIP

Discussion

Comparison to the adopted Annual Business Plan and Budget 2018/2019

	BR1 2018/2019 $	Original 2018/2019 $
Revenues - City Growth	1,434,000	1,434,000
Revenues - City Infrastructure	4,115,000	4,115,000
Revenues - Community Wellbeing	436,000	436,000
Revenues - Council Business Services	24,590,000	24,590,000
Revenues - Total	30,575,000	30,575,000
Expenses - City Growth	4,327,000	4,238,000
Expenses - City Infrastructure	14,474,000	14,524,000
Expenses - Community Wellbeing	4,852,000	4,852,000
Expenses - Council Business Services	4,788,000	4,847,000
Expenses - Office of CEO	1,806,000	1,786,000
Expenses - Total	30,247,000	30,247,000

Council - Total	328,000	328,000

The original adopted 2018/2019 Annual Business Plan and Budget included:

- An operating surplus of $328,000
- Net capital expenditure (Capex) $8,159,000

Subsequently, $1,108,500 capex carried forward from 2017/2018 financial year.
The 2018/2019 Quarter One Budget Review has resulted in no net changes to the budget position of the forecast operating surplus or net capex.

Commentary on Quarter One Budget Review for 2018/2019

The Quarter One Budget Review reflects a $328,000 forecast operating surplus. This represents no change from the Original Budget forecast operating surplus.

There were no material changes as at Quarter One Budget Review.

Conclusion

The Quarter One Budget Review forecasts an operating surplus for the financial year of $328,000 and this is consistent with the original budget adopted by Council on 3 July 2018.

This budget review allows for the delivery of the 2018/2019 Annual Business Plan adopted by Council on 3 July 2018.

Attachments

Attachment 1 (AR18/50299): *City of Mount Gambier Proforma Comprehensive Financial Statements as at 30 September 2018*

Kahli ROLTON
MANAGEMENT ACCOUNTANT

Jeroen Zwijnenburg
MANAGER FINANCE AND CUSTOMER SERVICE

Pamela LEE
GENERAL MANAGER COUNCIL BUSINESS SERVICES

28 November 2018
KR/JZ

5.10. Great Victorian Bike Ride 2019 - Report No. AR18/49986

COMMITTEE	Operational Standing Committee
MEETING DATE:	11 December 2018
REPORT NO.	AR18/49986
RM8 REFERENCE	AF17/225
AUTHOR	Dr Judy Nagy
SUMMARY	To seek sponsorship of the Great Victorian Bike Ride event which incorporates the City of Mount Gambier in 2019.
COMMUNITY PLAN REFERENCE	Goal 1: Our People
	Goal 2: Our Location
	Goal 3: Our Diverse Economy

REPORT RECOMMENDATION

(a) That Operational Standing Committee Report No. AR18/49986 titled '*Great Victorian Bike Ride 2019*' as presented to the Operational Standing Committee on 11 December 2018 be noted.

(b) That Council approve the allocation of $12,000 cash sponsorship and up to the value of $5,000 in kind for the 2019 Great Victorian Bike Ride, conditional upon the proponents obtaining all necessary funds and approvals from the relevant authority.

(c) Funding to be allocated to account number 6350.0038.70 in the 2019/20 budget.

Moved: Seconded:

Background

The Great Victorian Bike ride was held in November 2013, incorporating Mount Gambier as a starting point for the course. Participants camped at Hastings Cunningham Reserve with local sporting groups and service clubs who have sheds on the grounds given the opportunity to cater for the event. The event organisers Cycling Network estimate that participants spend over $30 per day on average. With approximately 5,000 participants at the 2013 event that equates to an injection of approximately $150,000 into the community without factoring in money spent by support staff and others in attendance.

The City of Mount Gambier also received significant exposure from the 2013 event through integrated marketing campaigns and exposure to the organizer's members and followers. Details of potential exposure from the Bicycle Network as at December 2019 is as follows:

Bicycle Network membership (paid)	55,000
Bicycle Network newsletter database	155,000
Bicycle Network Facebook following	28,000
Bicycle Network Twitter following	12,300
Bicycle Network Instagram following	4,600

The City of Mount Gambier provided support to the 2013 event by way of a $5,000 cash donation and a large amount of in kind support, such as the supply of bins, rubbish removal, road closures and provision of additional catering at the camping site.

Discussion

Council has received a request from the event organisers Bicycle Network to again help support the inclusion of Mount Gambier for the Great Victorian Bike Ride in 2019. The event will be held from Friday 22 November to Sunday 1 December. Riders will descend into Mount Gambier on Sunday 24 November from Millicent, departing for Port Fairy on Monday 25 November.

The Bicycle Network are seeking support from the City of Mount Gambier by way of:

- $12,000 cash sponsorship.
- In kind support such as waiver of site fees at the nominated camp site and power access, supply of bins, removal of rubbish, community engagement support and advice, and support and advice on local roads and logistics.

Local community groups will again be offered extensive opportunities to fund raise on the camp site selected by Bicycle Network, with Council negotiating an appropriate site for their consideration.

There will again be significant media exposure through an integrated marketing campaign, which will provide Council with the opportunity to have their logo included in promotional material and packs, an article in the Great Vic Rider eNews, provision of City of Mount Gambier hard copy promotional collateral to riders, a section for Council content in the ride guide and the opportunity to present a video highlighting all that Mount Gambier has to offer, which will be shared on Bicycle Network's social media.

Conclusion

Given the significant exposure from the event held in 2013 and the benefits delivered to the community by hosting a leg of the Great Victorian Bike Ride, it is recommended that Council approve the allocation of $12,000 sponsorship funding and up to $5,000 in kind support.

Attachments

Attachment 1 (AR18/50676): 2019 Great Victorian Bike Ride Proposal
Attachment 2 (AR18/50675): Event Sponsorship Application Great Victorian Bike Ride

Dr Judy Nagy
GENERAL MANAGER CITY GROWTH

Mark McShane
CHIEF EXECUTIVE OFFICER

29 November 2018
DL

6. MOTION(S) - With Notice

Nil submitted.

7. MOTION(S) - Without Notice

Meeting closed at p.m.

AR18/50124

8. REPORT ATTACHMENTS

Recommended resolutions for endorsement of secret ballot

RESOLUTIONS FOR SECRET BALLOT *(These do not need to be reproduced in Council Agenda)*

(b) Council determines that the method of choosing a Presiding Member for the XYZ Committee be by a secret ballot.

(c) the successful candidate will be the candidate with the highest number of votes.

(d) where two of more candidates have an equal number of votes one of those candidates will be determined as successful from a drawing of lots by the Returning Officer.

(e) the Chief Executive Officer (or other Senior Officer present at the meeting) be appointed Returning Officer for the ballot.

(f) upon the completion of the ballot, the Returning Officer be authorised to declare the successful candidate for the position of XYZ Committee Presiding Member.

(g) upon the declaration of the Returning Officer the candidate will be recommended to Council for the position of XYZ Presiding Member for the term of office determined by Council.

PROCESS / SAMPLE MINUTES FOR SECRET BALLOT

Nominations called for the position of XYZ Committee Presiding Member:

The following nominations were received:

(i) Cr _____ nominated to be XYZ Committee Presiding Member.

(ii) Cr _____ nominated to be XYZ Committee Presiding Member.

If more than one nomination received:

The Returning Officer conducted the secret ballot.

Then –

There being only one candidate the Returning Officer declared Cr _____ to be the successful candidate to be recommended to Council for the position of XYZ Committee Presiding Member.

OR

The Returning Officer declared the successful candidate with the highest number of votes as Cr _____ to be the successful candidate to be recommended to Council for the position of XYZ Committee Presiding Member.

OR

Cr _____ and Cr _____ each having an equal highest number of votes, the Returning Officer drew a lot and declared the successful candidate being the first name drawn as Cr _____ to be the successful candidate to be recommended to Council for the position of XYZ Committee Presiding Member.

OPTIONAL RESOLUTION TO ENDORSE RESULT

move a motion to endorse the result of the ballot that Cr _____ selected as the successful candidate to be recommended to Council for the position of XYZ Committee Presiding Member.

City of Mount Gambier

Operational Standing Committee

TERMS OF REFERENCE

A Committee of Council

established pursuant to the provisions of

Section 41
of the Local Government Act 1999

Terms of Reference for the conduct of the business of the Council Committee were approved and adopted by the City of Mount Gambier at its meeting held on ##th Month, 2018.

Operational Standing Committee

The Operational Standing Committee has been established with a broad Operational ‘business’ focus on the following matters:

- Tenders
- Projects
- Legal Matters
- Road Closures
- Events
- Traffic Management
- Financial Management
- Quarterly Budget Reviews
- Leasing/Licensing
- Infrastructure
- Community Liaison
- Allocation & Delivery of Grants
- Regulatory Function
- Compliance

Operational Standing Committee

CONTENTS

1. NAME

The name of the Council Committee shall be the Operational Standing Committee (in these Terms of Reference referred to as "the Committee").

2. DEFINITIONS

2.1 For the purpose of these Terms of Reference, unless inconsistent with the subject matter or context: -

2.1.1 "Act" means the Local Government Act 1999 and includes all Regulations and Schedules.

2.1.2 "Committee" means the Committee of Council established pursuant to clause 3.

2.1.3 "Committee Member" means the persons appointed by the Council to the Committee pursuant to clause 5.

2.1.4 "Commencement Date" means the date on which the Committee is established and becomes operative pursuant to clause 3.

2.1.5 "Council" means the City of Mount Gambier that established the Committee and to which the Committee reports.

2.1.6 "Prescribed Committee" means a Prescribed Committee as defined in the Remuneration Tribunal Determination 6 of 2018 (or any replacement determination)

2.1.7 "Presiding Member of the Committee of Council" means the person appointed to that position pursuant to clause 5.

2.1.8 "Observers" means those persons attending any meeting of the Committee of Council, but not having a vote on any matter to be determined by the Committee and not having been appointed as Committee Members.

2.1.9 "Sub-Committee" means a sub-committee established in accordance with the Act.

2.2 Any words, phrases or terms used in these Terms of Reference that are defined in the Act shall have the same meaning as are given in the Act.

2.3 A reference in these Terms of Reference to a "singular" includes a reference to the "plural" and a reference to a "plural" includes a reference to the "singular".

2.4 These Terms of Reference shall be interpreted in line with the provisions of the Act.

2.5 Notices

All communication to be given to the Committee shall be addressed to: -

City of Mount Gambier Operational Standing Committee
PO Box 56
MOUNT GAMBIER SA 5290
Email: city@mountgambier.sa.gov.au

3. ESTABLISHMENT

3.1 The Operational Standing Committee is established under Section 41 of the Local Government Act 1999.

3.2 The Committee will be established and become operative from the time a resolution of the Council is passed.

3.3 The Committee is established by the Council with:

3.3.1 a Operational 'forward planning' focus on the following matters:

- Tenders
- Projects
- Legal Matters
- Road Closures
- Events
- Traffic Management
- Financial Management
- Quarterly Budget Reviews
- Leasing/Licensing
- Infrastructure
- Community Liaison
- Allocation & Delivery of Grants
- Regulatory Function
- Compliance

3.4 The Committee shall be a Prescribed Committee that is enduring to perform, assist and provide advice to Council on matters described in these Terms of Reference.

4. OBJECTIVES

The Committee is created with the express objective of providing considered advice to Council within the scope of its purpose and reasons for establishment

5. MEMBERSHIP

5.1 Membership of the Committee will comprise Elected Members as determined by resolution of Council in accordance with Council policy guiding appointment to committees.

5.2 The Council reserves the right from time to time to remove any Member of the Committee and appoint another Committee Member in their stead.

5.3 All Operational Standing Committee Members hold office at the pleasure of the Council.

5.4 The Mayor has Ex-Officio membership on this Committee.

5.5 The Committee will determine the Committee Member to be appointed to the position of Presiding Member of the Committee, which appointment will be reviewed by the Committee every 12 months.

6 CASUAL VACANCIES AND REPLACEMENT MEMBERS

6.1 If a Committee Member is absent from 3 or more consecutive meetings of the Committee without an apology accepted by the Committee then that Committee Member's position shall be considered vacant.

6.2 The Council will determine the filling of any vacancy in the Committee Membership in accordance with clause 5.

7 NO PROXY

7.1 The appointment of a person as proxy for any Operational Standing Committee Member on the Committee is not permissible.

8 RESIGNATION OF COMMITTEE MEMBER

8.1 Any Committee Member may resign from the Committee, but such resignation shall not be effective until the Presiding Member and Council has received written notice to that effect.

9 QUORUM

9.1 At all Meetings of the Committee a quorum must be present.

9.2 A quorum will be determined by dividing by 2 the number of Operational Standing Committee Members formally appointed to the Committee ignoring any fraction and adding 1.

10 ATTENDANCE AT MEETINGS BY TELEPHONE OR OTHER ELECTRONIC MEANS

A Committee Member (including, subject to the operation of clause 11.2, the Presiding Member) may be considered as being present at a Committee Meeting despite not being physically present at the meeting, subject to the following conditions:

10.1 Written approval to participate in the meeting by telephone or other electronic means has been sought and obtained from the Committees Presiding Member and confirmed to the Chief Executive Officer not less than 24 hours prior to the meetings scheduled commencement time, and;

10.2 The Chief Executive Officer having confirmed prior to the scheduled commencement time of that meeting that the necessary technologies are available to accommodate the Committee Members participation in the meeting and compliance with the Act, and;

10.3 A Committee Member participating by such means being for the specified meeting only and not for 2 or more consecutive meetings of the Committee, and;

10.4 All Committee Members being able to hear each other Committee Member whilst a Committee Member is participating by telephone or other electronic means, and;

10.5 The Committee Member that is participating by telephone or other electronic means expressing their vote on each and every question in a manner that can be identified by all other persons present at the meeting (whether all other persons at the meeting are physically present or present by telephone or other electronic means), and;

10.6 The Presiding Member (or Acting Presiding Member) being authorised to disconnect the Committee Member in the event that the technology causes any disruption or inconvenience to the Committee meeting, and;

10.7 Should the telephone or other electronic connection fail, any attempt(s) to re-connect are made at the discretion of the Presiding Member, and;

Whilst participating in a Committee Meeting in accordance with this clause a Committee Member shall be considered as being present at the meeting for all purposes.

11 MEETINGS OF THE COMMITTEE

11.1 The Committee shall meet in accordance with its ordinary meeting schedule or otherwise in accordance with this clause.

11.2 The Presiding Member, when physically present, shall preside at all meetings of the Committee and at any other time the Committee shall appoint an Acting Presiding Member who shall preside at that meeting.

11.3 No business shall be transacted at any meeting of the Committee unless a quorum of Operational Standing Committee Members is present.

11.4 Each Operational Standing Committee Member of the Committee including the Presiding Member present at any meeting of the Committee must vote on any matter requiring determination and all decisions shall be decided on a simple majority of votes cast.

11.5 Each Operational Standing Committee Member of the Committee including the Presiding Member present at any meeting of the Committee shall have one deliberate vote only.

12 PROCEDURES AT MEETINGS

12.1 The procedure to be observed in relation to the conduct of meetings of the Committee is in accordance with the Act and the Local Government (Procedures at Meetings) Regulations 2013.

12.2 In accordance with s89 of the Act, insofar as a procedure is not prescribed by regulation, it shall be as determined by the Council, and insofar as a procedure is not determined by the Council, it shall be as determined by the Committee itself.

13 LIABILITY OF THE COMMITTEE

13.1 A liability incurred by the Committee rests against Council.

13.2 No liability attaches to a Operational Standing Committee Member of the Committee for an honest act or omission by that Operational Standing Committee Member of the Committee in the performance or discharge, or purported performance or discharge, of the Member's or the Committee's functions or duties.

14 DELEGATION

14.1 The Committee has no delegation to act with all recommendations of the Committee (and of any Sub-Committees established by the Committee) to be considered by full Council for final decision and resolution.

15 SUB-COMMITTEES

15.1 The Committee may establish a subcommittee to assist it in a matter.

15.2 When establishing a subcommittee the Committee must set out the Terms of Reference for the subcommittee.

15.3 The Committee may appoint to a Sub-Committee Council Members who are not members of the Committee, Council Officers and members of the public with skills or expertise in a field relevant to the matters which the Sub-committee is established to assist with.

15.4 A Sub-Committee established in accordance with this clause will report to the Committee and will have the same meeting notice, minute keeping and procedural obligations as the Committee as defined in the Act.

15.5 If a Sub-Committee Member is absent from 2 or more consecutive meetings of the Sub-Committee without an apology accepted by the Committee and Council then that Sub-Committee Members position shall be considered vacant.

15.6 If a Sub-Committee established under this Clause 15 fails to achieve quorum on 3 consecutive occasions then the Sub-Committee will be considered to be in recess and the Chief Executive Officer is to present a report to the Operational Standing Committee for consideration.

16 MINUTES OF THE COMMITTEE

16.2 Administration

16.1.1 The CEO or his appointee must cause minutes to be kept of the proceedings of the Committee.

16.1.2 Minutes of the Committee shall be available to all Operational Standing Committee Members of the Committee, Council and the public.

16.1.3 The Minutes of the proceedings of a meeting are to comply with the requirements of the Act

16.1.4 Minutes of the Committee Meeting shall be submitted for confirmation at the next meeting of the Committee and if confirmed, shall be signed by the Presiding Member or other person presiding at the subsequent meeting.

16.1.5 Minutes of the Committee Meeting and any recommendations (including the minutes and recommendations of any Sub-Committee established by the Committee) shall be submitted to Council and shall be of no effect until endorsed as a resolution of Council.

17 AMENDMENTS TO THESE TERMS OF REFERENCE

17.1 It will be lawful for the Council by resolution of the Council to revoke, vary or add to any of the provisions of these Terms of Reference at its own discretion within the parameters of the Local Government Act and other relevant legislation.

17.2 Not withstanding 17.1 hereof before the Council resolves to revoke, vary or add to any of the provisions of these Terms of Reference the opinion of the Committee shall be obtained.

18 INTERPRETATION OF THESE TERMS OF REFERENCE

18.1 Should there be any dispute as to the definition and/or interpretation of these Terms of Reference, or any part thereof or any irregularities whatsoever, then the Council shall determine the dispute and the decision of the Council shall be final and binding.

19 WINDING UP

19.1 The Council may cease the operation of the Committee and the Committee may make such recommendation to the Council on the completion of its function.

6th December, 2018
Ref: AF11/1718

Figure 1: Centenery Tower Walking Path

Figure 2: Rail Trail looking West to Pick Ave

Figure 3: Rail Trail looking north to Jubilee Hwy

Environment Protection Authority
GPO Box 2607 Adelaide SA 5001
211 Victoria Square Adelaide SA 5000
T (08) 8204 2004
Country areas 1800 623 445

PROPOSED VARIATION OF ENVIRONMENTAL AUTHORISATION BY CONSENT

CITY OF MOUNT GAMBIER
PO BOX 56
MOUNT GAMBIER SA 5290

RE: Proposed amendments to conditions of Environmental Authorisation – EPA 2504

To Authorisation Holder,

The Environment Protection Authority (EPA) has reviewed your Licence and proposes to vary your Licence during the term of authorisation, as set out in Attachment A to this Notice.

The reason(s) for the proposed variation is/are:

Irrigation of landfill leachate onto vetiver grass trial plot on top of partially capped landfill cell under controlled conditions

You may, as a suitably authorised representative of CITY OF MOUNT GAMBIER, indicate your response to the proposed variation to your Licence on or before 10 Dec 2018 by:

- ticking the appropriate selection on the following page, or
- you may contact the EPA as follows to discuss the proposed variation –*Carl Smith - Email: carl.smith@epa.sa.gov.au*

Naomi Grey

Delegate

ENVIRONMENT PROTECTION AUTHORITY

Date: 26 Nov 2018

PROPOSED VARIATION OF ENVIRONMENTAL AUTHORISATION 2504 BY CONSENT

☐ I consent to all proposed variations

☐ I do not consent to any of the proposed variations

☐ I consent to all the proposed variations other than those set out below

If you do not consent to the proposed variation/s, you may provide details and/or reasons in the box below:

Name: ……

Signed: ……

Position Title: ……

Date: ……

ATTACHMENT A

Environmental Authorisation - EPA 2504 ("your Licence")

The EPA proposes to add the following conditions of your Authorisation:

VETIVER IRRIGATION TRIAL (U - 949)

The Licensee must implement and comply with the approved Vetiver Irrigation Trial Plan entitled "Caroline Landfill - Leachate Irrigation of Vetiver Trial" or any revised Plan approved in writing by the EPA.

AECOM Imagine it. Delivered.

City of Mount Gambier
15-Nov-2018

Caroline Landfill - Leachate Irrigation of Vetiver Trial

Environmental Management and Sampling Plan

Caroline Landfill - Leachate Irrigation of Vetiver Trial

Environmental Management and Sampling Plan

Client: City of Mount Gambier

ABN: 17330264425

Prepared by

AECOM Australia Pty Ltd
Level 28, 91 King William Street, Adelaide SA 5000, Australia
T +61 8 7223 5400 F +61 8 7223 5499 www.aecom.com
ABN 20 093 846 925

In association with

City of Mount Gambier

15-Nov-2018

Job No.: 60452384 (42658044)

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document	Caroline Landfill - Leachate Irrigation of Vetiver Trial
Ref	60452384 (42658044)
Date	15-Nov-2018
Prepared by	Heather Wincer / Cip Wingrove
Reviewed by	Andrew Piggin

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	24 Oct 2018	Draft for EPA review	Andrew Piggin Associate Director	
B	15 Nov 2018	Final	Andrew Piggin Associate Director	

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1.0 Introduction

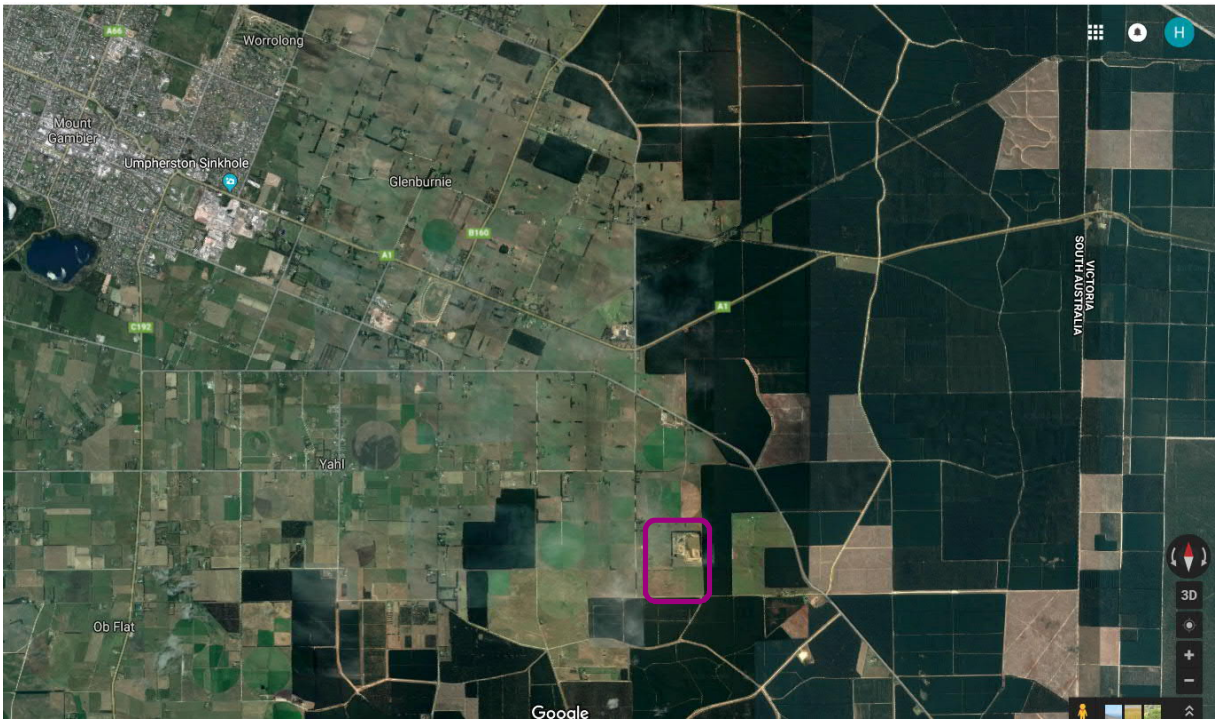
AECOM Australia Pty Ltd (AECOM), in consultation with the City of Mount Gambier (CoMG), CoMG contractors/suppliers and the South Australia Environment Protection Authority (EPA) have prepared this Environmental Management and Sampling Plan (EMP) for the proposed Leachate Irrigation of Vetiver Trial (the Vetiver Trial) at the Caroline Landfill site. The Vetiver Trial is proposed to occur over a 2 year period, subject to ongoing monitoring observations and results.

The landfill is a fully engineered landfill owned and operated by the City of Mount Gambier and has been and continues to be developed in accordance with landfill guidelines. The EPA has issued an EPA License for the site that along with the site LEMP and the WQEPP sets the operational guidelines for the site.

This EMP is focussed solely on the Vetiver Trial and further details of overall site management can be found in the latest version of the Caroline Landfill Environmental Management Plan[1] (LEMP).

1.1 General

Caroline Landfill is located approximately 12km south east of the City of Mount Gambier (CoMG) and 6.5km west of the South Australian/Victorian border.



The landfill is closed to public access and receives waste from CoMG as well as surrounding Council areas.

Leachate management at Caroline landfill has been an ongoing concern for the City of Mount Gambier for some time and will continue to cause issues if not managed in an environmentally sustainable manner. As the landfill continues to grow, there will be more pressure placed on Council to find alternative treatment and disposal solutions that are both sustainable in the long term and financially affordable.

[1] AECOM, Landfill Environment Management Plan - Caroline Landfill, Mount Gambier *(*ref 42657539-R004-A dated 21 June 2013)

As Caroline landfill is the sole engineered landfill in the south east, the City of Mount Gambier needs to ensure that the landfill remains available for refuse disposal for the City but also for its neighbouring councils.

Due to the amount of rainfall experienced in the South East of the state, the landfill is continually combatting surplus leachate volumes. CoMG have undertaken a series of methods to manage leachate, such as building an additional evaporation pond and utilising evaporation sprinklers/misters.

In recent years, CoMG has had to resort to transporting leachate offsite and disposing to sewer. This practice cannot be sustained long term due to the high costs involved and CoMG is now investigating alternative leachate management solutions. One of those solutions could be the irrigation of leachate onto a planted grassed area on top of capped cells, with the selected grass species (vetiver grass) being tolerant to landfill leachate.

1.2 Use of Vetiver for Leachate Management

The City of Mount Gambier has proposed the Vetiver grass trial to sustainably manage their leachate, as an alternative to discharging to sewer and other less suitable leachate management measures.

Vetiver grass (native to India) has been used across Australia and overseas to successfully manage excess leachate volumes. Leachate is used to irrigate the Vetiver that is planted into the final capping layer of landfill cells. The Vetiver can grow up to 5ft high requiring a significant amount of liquid for growth and evapotranspiration. Additional leachate losses can occur with the direct evaporation of liquid from the leaves and ground surface at the time of irrigation.

Vetiver is also resistant to heavy metals and highly efficient at removing heavy metals and nutrients from contaminated soils, storing biomass within the plants itself for later disposal. Documented research has proven the success of soil remediation through phytoextraction whereby the uptake of heavy metals from the surrounding soil occurs and the metals are stored in the plant biomass.

Vetiver is highly tolerant of leachate and therefore planting of Vetiver is a sustainable method to manage leachate volumes where evaporation is failing to meet the requirements.

1.3 Vetiver Trial Scope & Objectives

The purpose of the vetiver grass leachate disposal trial is to continue CoMGs commitment to find more sustainable practices in leachate management. More specifically, this trial is aimed at achieving the following objectives;

a. Development of an onsite leachate management system that could be employed longer term.

b. Reduce current onsite leachate volumes in an environmentally sensitive and sustainable way.

c. Avoid costs of carting and disposing leachate offsite.

d. Reduce council's environmental footprint associated with offsite disposal of leachate.

e. Reduce the financial burden for leachate management and disposal.

f. Employ an alternative use for capped landfill cells.

It is envisaged that the vetiver trial will be conducted over a 2 year period (e.g. November 2018 to October 2020 depending on date of approval) in order to assess the effect on leachate balances over several summer/winter seasons. The trial may be terminated earlier depending on the progressive observations and findings.

This EMP is applicable to the trial period only. If the trial is successful, management requirements will be discussed further within the updated review of the Caroline Landfill Environmental Management Plan (LEMP) or other separate documentation.

The objectives of this Vetiver Trial EMP are to provide:

a. Background to the Vetiver trial;

b. Details of proposed environmental management during the trial period;

c. Sampling requirements; and,

d. Clear and concise documented processes for conducting and evaluating the trial.

2.0 Site Conditions

A brief summary of key site conditions is provided below for background and context. Further site condition and management details can be referenced in the site LEMP.

2.1 Site Setting

Surrounding land use includes forestry, grazing land, piggery, municipal livestock yards with irrigation of wastewater on adjoining land (located approximately 3 km north of the landfill) and low density country living mixed with general farm living.

The site geology, based on drilling and installation of groundwater bores and review of published information, consists of:

- Siliceous Dune Sheet approximately 2 to 4m in thickness consisting of orange sandy clays overlain by sand and topsoil.
- Bridgewater Formation consisting of 3 units; the 3 to 9m thick upper unit of calcarenite overlying the 5 to 9m thick middle consisting of a sequence of calcareous clays and sands which overlies the 1 to 3m thick basal unit consisting of reworked limestone which transitions to the underlying Gambier Limestone.
- Gambier Limestone – the top of the unit occurs at depths of approximately 16 to 19m.

The site hydrogeology is summarised as the localised perched Bridgewater Formation Aquifer, the Bridgewater Formation Aquitard underlain by the Gambier Limestone Aquifer.

2.2 Climatic Conditions

The data presented in Table 1 has been sourced from the Bureau of Meteorology: Climate Statistics. This data has been averaged across the last 80 years of data collection.

Table 1 Climatic Conditions

Season	Temperature (Max/Min)	Monthly Rainfall (mm)	Daily Evaporation (mm)	Monthly Evaporation (mm)	Wind Speed (9am-km/hr)	Wind Speed (3pm-km/hr)
Summer (Jan-Mar)	24.6/13.5	29.6	5.7	159	16.8	22.9
Autumn (May-Jun)	16.5/8.4	54.5	1.8	18	12.8	17.6
Winter (Jul-Sep)	14.4/7.7	89.7	1.9	57	15.9	20.8
Spring (Oct-Dec)	20.5/11.6	48.3	4.6	138	19.0	23.1

2.3 Landfill Layout

The landfill consists of two closed and partially capped landfill cells 1 and 2 and two active / uncapped sub cells 3A and 3B, with a new sub cell 3C proposed for construction in 2018/2019. The site location and general site plan and landfill cell layout are shown in the attached Figure 1 in Appendix A.

2.4 Landfill Cap Properties

The final landfill cap comprises of four layers which are from the surface down:

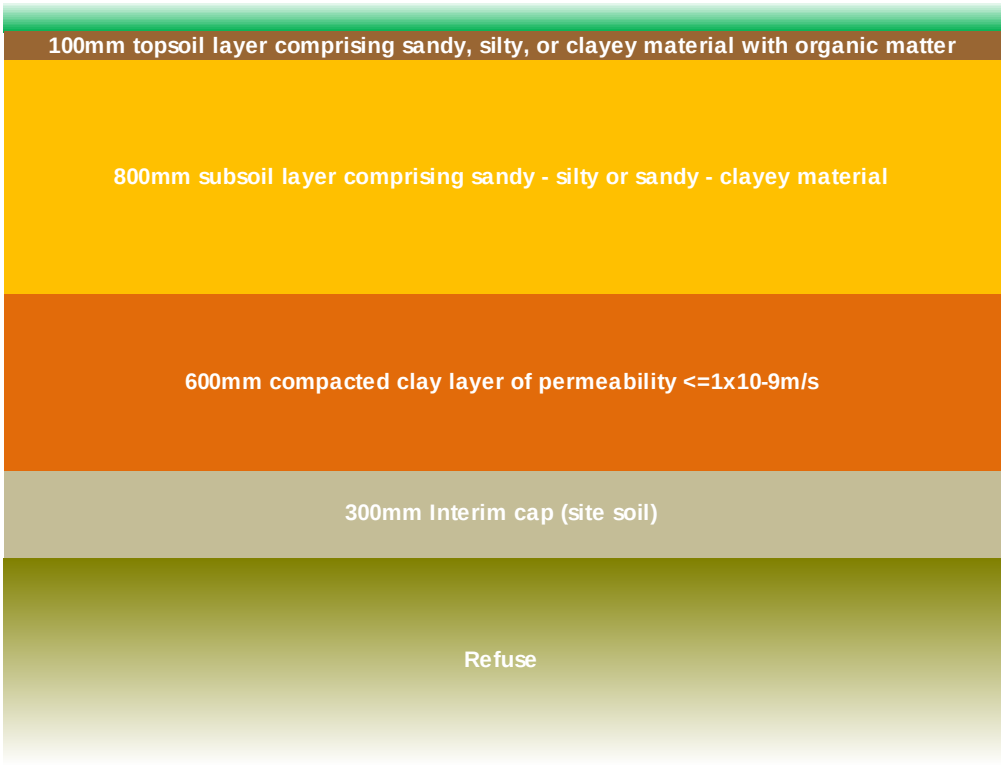
- **Topsoil Layer** – an upper layer designed to promote and sustain the development of vegetation. Established vegetation serves to reduce infiltration through catching of precipitation and evaporation and moisture uptake and evapotranspiration.

- **Subsoil Layer** – to support vegetation and provide enhanced soil moisture storage and evapotranspiration
- **Clay Barrier Layer** – an underlying compacted clay layer to act as a barrier to infiltration of surface waters and emission of landfill gas.
- **Interim Cover** – a layer of cover placed directly on the waste and daily cover once a cell is filled to provide an interim cover prior to placement of the final capping.

The top of the clay barrier layer and the final landfill surface are graded to divert subsurface water flow and surface water flow respectively, thereby further reducing the potential for infiltration into the landfill waste body.

The diagram below shows the landfill capping materials and nominal thicknesses:

Figure 1 Typical Final Landfill Capping Profile



2.5 Stormwater Management

The objective of the site stormwater management is to limit potential impacts to the surrounding environment from stormwater runoff and reduce the potential for generating leachate.

The existing stormwater system at Caroline Landfill includes the following:

- an earthen bund and swale drain constructed around the landfill perimeter to divert stormwater runoff away from the cell;
- stormwater drains and bunds surrounding each cell to divert stormwater from the active cell;
- an earthen bund constructed between sub cells to divert stormwater from the active subcell.

It should be noted that no surface water courses run through the landfill site or are located in the adjacent properties.

As part of the Vetiver trial, additional stormwater/leachate management practices will be incorporated into the works and these are described further in Section 4.0 below.

2.6 Leachate Management

Leachate is any liquid that, in the course of passing through matter, extracts soluble or suspended solids, or any other component of the material through which it has passed. Leachate is a widely used term in the environmental sciences where it has the specific meaning of a liquid that has dissolved or entrained potentially environmentally harmful substances that may then enter the environment. It is most commonly used in the context of land-filling of putrescible or industrial waste.

The objectives of leachate management at the site include:

- Limit the amount of leachate generated;
- Collection and removal of leachate from the active and closed landfill cells; and
- Limit the potential for leachate to impact upon the surrounding environment, including stormwater, soil and groundwater.

The management of leachate at Caroline Landfill is facilitated through the installation of a compacted landfill liner and leachate collection system at the base of the landfill, which is sloped towards leachate collection sumps. The leachate is pumped via air driven pumps to a series of leachate storage and evaporation ponds (Leachate ponds 1,2 and 3 in series – refer to attached Figure 1) which have been constructed with a clay / HDPE liner system. The total storage capacity within the current leachate ponds is approximately 7.4ML.

Placement of interim and final landfill capping, as well as the diversion of clean stormwater from entering the active landfill cells further serves to reduce infiltration and leachate generation.

As part of the Vetiver trial, additional leachate management practices will be incorporated into the works and these are described further in Section 4.0 below.

3.0 Roles and Responsibilities

The organisational chart (Plate 1) summarises the management and implementation of the trial with further details of the key contacts, roles and responsibilities provided in Table 2.

Plate 1 Vetiver Trial Organisation Chart

The roles and responsibilities for key organisations involved in the Vetiver Trial are summarised below:

Table 2 Roles and Responsibilities

Organisation (key contacts)	Contact Details	Responsibility
City of Mount Gambier (Daryl Morgan)	0418 810 523 DMorgan@mountgambier.sa.gov.au	• Overall management and coordination of the Vetiver Trial • Collation and management of trial data • EPA liaison and reporting • Reporting to Council
AECOM (Andrew Piggin/ Cip Wingrove)	0417 834 996 / 0408 080 311 andrew.piggin@aecom.com / cip.wingrove@aecom.com	• Principal consultant • Independent of Council • Environmental sampling and advice • Interpretation and reporting
SA EPA (Carl Smith)	0427 800 170 carl.smith@sa.gov.au	• EPA License Officer – Caroline Landfill • Government Environmental Regulator • Review of monitoring and reports
SA EPA (Ashley Natt)	0439 475 147 ashley.natt@sa.gov.au	• Vetiver trail – EPA Advisor • Review of Vetiver trail monitoring and reports
Integrated Irrigation (Tim Powell)	0459 231 028 tim@integratedirrigation.com.au	• Irrigation monitoring • Modifying irrigation rates as required • Irrigation system maintenance & repair • Interpretation of results and reporting
Rick Jordan & Associates (Rick Jordan)	0427 447 753 rick@advantageag.net.au	• Horticultural sampling and advice • Assessment of soil quality & plant health • Interpretation of results and reporting

4.0 Proposed Vetiver Trial Methodology

4.1 Site Layout and Irrigation Trial Area

The Vetiver trial site has been specifically selected and modified in order to minimise the potential for impact to the environment, to efficiently utilise the final capped landfill surface and to conduct a trial at a suitable scale.

The trial will be conducted in two trial plots in Cell 2 of the Caroline Landfill as shown in the attached Figures 1 and 2 in Appendix A. Each trial plot is 50m x 50m in size with plants at 0.5m spacing in rows at 1m centres (5000 plants per plot) This trial is proposing a maximum of 2 plots (total area of 5000m2).

A surface run-off bund was installed north of the trial area to redirect surface run-off to the west, with excess run-off being collected by the existing leachate collection system (refer to the attached Figure 2).

4.2 Irrigation Methodology

The trial plots will be irrigated by an above ground irrigation system that is designed to irrigate the area with a uniform measured irrigation rate that can be easily adjusted to change the rate of irrigation as required. Irrigation is initially proposed to occur in summer months (approx. November to March, depending on actual weather conditions) when soil moisture content is at an acceptable level (as progressively assessed through the trial) and on days when rainfall is not forecast.

Leachate will be pumped from leachate ponds 1 and 2 (with additional leachate provided from leachate pond 3 as required) using a 3LFS/200 (5.5kW 3 phase) pump via nominal 75mm dia HDPE pipework or a suitable alternate pumping system. The system will be controlled using an automated Evo 40 evolution control system, which will control 11 separate irrigation zones over the 0.5 Ha trial area. The controller will initially be pre-programmed to irrigate 3 days per week for 30 minutes per zone/day (for a total of 5.5 hrs of irrigation per day) with approximately 40,000 litres of irrigation per day. The application rate and volume of leachate irrigation will be measured via a flow meter and will be compared with controller run times at known standard flow rates. The flow rates will be collected and displayed in the site specific database (refer to Section 5.1.2). Indicative irrigation rates and the corresponding daily volumes of leachate irrigated are summarised in Table 3 below.

Table 3 Daily Leachate Irrigation Rates and Volumes

Irrigation Rate over Trial Area (mm/day)	Leachate Volumes (L/day)
2	10,000
4	20,000
6	30,000
8 (initial irrigation rate)	40,000
10	50,000
12	60,000
14	70,000
16	80,000

Note: At the start of the trail the maximum proposed irrigation rate is not known and will be assessed based on ongoing monitoring.

Robust and reliable impact sprinklers will be installed initially on 1.5m risers so the throw of the spray will not be impeded by grass growth. The risers will be designed to be adjusted to a greater height if required without having any impact on the irrigation rate or the vetiver grass can be cut as required. The design of the sprinkler system is set out so that only the trial plot is irrigated, and that trial area receives a uniform application rate. Quarter, half and full spray nozzles are changed to suit the output and ensure the uniform application rate (refer to the attached Figure 3).

It is noted that due to the effects of wind (speed and direction) there will need to be some allowance for overspray beyond the trial plots (but within the bunded containment area surrounding the trial plots) so as to ensure that the edge of the trial plots remain irrigated.

The proposed initial irrigation rate of approximately 8mm/day was proposed by Integrated Irrigation based on:

- their irrigation experience;
- review of the site;
- consideration of possible losses (vetiver condition, vetiver uptake, evaporation, etc.);.and,
- irrigation for approximately 5.5 hours per day over the trial area for 3 days per week.

The trial (at the proposed initial irrigation rates) will not be commenced until the trial is approved by the EPA and Integrated Irrigation has reviewed the soil moisture content data and assessed the site conditions to be suitable for irrigation.

The irrigation rates will be set at this initial lower rate of 8 mm/day and progressively increased once onsite monitoring confirms that the trial area has additional capacity to evaporate/uptake more moisture. Once the trial operation is established, there have been some irrigation rate changes and there is a reasonable baseline of irrigation data and vetiver uptake/evapotranspiration response (minimum 4 weeks but to be assessed by Integrated Irrigation) the trial area will be *'stressed'* by applying significant irrigation quantities. The intention of stressing the systemis to assess what application rates will drive infiltration to the clay barrier and/or create excessive runoff. This will be done in order to assess the capacity of the overall system and thereby optimise the amount of leachate that can be irrigated and managed. This will be done at several stages under varying vetiver and site conditions.

Soil moisture will be measured using onsite moisture probes and remote telemetry, with output sent to a database which can be accessed online (see Section 5.1.2 below). Moisture levels in the soil profile will be continuously monitored throughout the trial using the *AddVantage Irrigation Control Program*. If the data suggests there will be an over saturation of the soil profile with the combined watering of irrigation and rainfall; irrigation will be delayed or irrigation rates reduced. Conversely, if the site observations, weather and soil moisture conditions indicate that additional leachate could be applied then the irrigation rate may be increased. Relevant trigger levels for modifying irrigation will be progressively developed during the trial based on ongoing review of the data.

If there is a fault in the irrigation system, the repair works will be carried out by either CoMG staff or the contractor who installed the system.

The landfill leachate trial weekly checks flow chart, showing onsite and offsite duties, for assessing and modifying irrigation rates is attached as Appendix B.

4.3 Trial Area Leachate Management

The vetiver trial area is essentially a closed loop leachate management system with:

- Leachate pumped from the lined leachate evaporation ponds to the trial area where it is irrigated;
- Leachate loss through evaporation of irrigated leachate from plant and ground surfaces;
- Infiltration of moisture into the capping layer with leachate losses via plant uptake and evapotranspiration;
- Infiltration of moisture into the capping layer past the vetiver root uptake zone and to the clay barrier (the trial will aim to optimise irrigation to avoid saturated conditions at the landfill cap clay barrier)
- Possible, subsurface migration of leachate along the sloping compacted clay barrier in the landfill cap, distributing the moisture for subsequent uptake and/or infiltration. (It is noted that one of the objectives of the trial is to identify a sustainable balance of soil moisture content profile vs leachate irrigation and there are significant controls in place to assess and manage this).

- Trial area surface runoff to the west, including excessive leachate irrigation (if any), runs over the completed portion of the final landfill capping to the interim cover along the western toe of Cell 2 and is captured by cell 2 leachate cut off drain. Runoff to the north/northwest of the trial plots is redirected by a trial area bund to the west to cell 2 leachate cut off drain. The cell 2 cut-off drain flow is redirected to the leachate collection blanket underlying cell 2. It is worth noting that small amounts of runoff are progressively distributed and infiltrated into the cap, before reaching the leachate cut-off drain, and are subject to the same processes as noted above.
- Any runoff/leachate captured in the cell 2 leachate collection blanket is drained to the cell 1/ 2 sump where it is pumped back into the leachate evaporation pond system.

4.4 Vetiver Management

Vetiver plants have been and will be sourced from the Vetiver nursery in Ashby Heights, NSW. When Vetiver is harvested, a portion will be retained for sampling (refer to Section 5.2.1) and the remainder will be disposed of to landfill.

Vetiver use or disposal, other than to the landfill, will not proceed without the review and approval of the EPA.

Chemical testing undertaken will be used to assess possible future uses or disposal options, which would require the review and written approval of the EPA prior to implementation. Possible future harvested vetiver uses may include:

- Use as mulch on the closed trial area;
- Other suitable options as identified during or after the trial.

5.0 Monitoring & Sampling Methodology

Monitoring and sampling will be undertaken in order to identify issues (if any) and to measure the success of the trial.

Monitoring and sampling will be completed in 3 phases:

- Pre-Trial
- During the Trial
- Post-Trial

The monitoring and sampling results will be analysed and regularly reported as detailed within Section 8.0.

5.1 Monitoring

Close monitoring of the weather, leachate irrigation, soil profile and vetiver conditions will be conducted during the trial.

Monitoring results including rainfall, irrigation flow rates, soil temperature and soil moisture content through the capping profile will be automatically uploaded to an online database and graphically presented. This database will be accessible at any time to Integrated Irrigation, CoMG, AECOM, Rick Jordan & Associates and the EPA, to allow for regular review as required.

The monitoring parameters, frequency, equipment/approach, review and information provided to the SA EPA are summarised below.

5.1.1 Weather Conditions

Weather conditions will be measured through the combined use of the irrigation system rain gauge, CoMG landfill site based weather station data (located between leachate pond 1 and leachate pond 2) and, if required, the Bureau of Meteorology (BOM) weather station data.

The weather conditions to be monitored during the trial are summarised in Table 4 below:

Table 4 Weather Monitoring

Parameter	Monitoring Frequency	Monitoring Equipment/Approach	Project Team Review Frequency	Info provided to EPA
Rainfall	Continuously	Rainfall gauge linked with the soil moisture probes (remotely uploaded) and CoMG site weather station	Weekly or as required	Summarised Monthly or as agreed (continuous access to database)
Temperature	Continuously	Site Weather Station – CoMG site weather station	Monthly or as required	Monthly or as required
Wind speed and direction	Continuously	Site Weather Station – CoMG weather station	Quarterly or as required	Quarterly or as required

5.1.2 Leachate Irrigation

Leachate irrigation will be monitored as summarised below:

Table 5 Irrigation Monitoring

Parameter	Monitoring Frequency	Monitoring Equipment/Approach	Project Team Review Frequency	Info provided to EPA
Leachate Quality refer to Sec 5.2.2	Pre-Trial, during the Trial and Post-Trial (part of bi-annual site monitoring)	As outlined in the LEMP and GW monitoring plans	After each monitoring round	Final Trial report
Flow Rate	Continuously	Flow meter	Weekly	Monthly
	Monthly	Crude cross check via pond volumes and pump run time	Monthly	
Volume used	Continuously	Daily application rate and time will be known and set Cross check calculation-from flow meter rate and run hours	Monthly	
	Monthly	Leachate pond levels measurement and volume estimates	Monthly	
Excess Surface Runoff	Weekly when irrigating	Site Observations	Weekly when irrigating	

5.1.3 Soil Profile

Soil profile monitoring includes assessment of the physical, chemical and soil moisture properties of the soil primarily in the topsoil and subsoil layers for vegetation establishment but also extending part way into the compacted clay barrier in the final landfill cap.

The soil profile monitoring and recording system has been designed and installed by Integrated Irrigation. Soil moisture probes have been installed at 4 locations with 2 probes for each monitoring probe controller (refer to the attached Figure 2) with a rain gauge on one controller (see Plate 2).

Plate 2 Solar powered data logger/controller with rain gauge

Each probe has 12 sensors measuring soil moisture content at approximately 100mm intervals from approximately 0.1m to 1.2m below the surface. The probes were installed on April 2018 and soil moisture monitoring results have been collected since 27 May 2018 as a baseline for the trial.

The soil profile will be monitored as summarised below:

Table 6 Soil Profile Monitoring

Parameter	Monitoring Frequency	Monitoring Equipment/ Approach	Project Team Review Frequency	Info provided to EPA
Soil quality and chemistry– Environmental & Horticultural refer to Section 5.2.3	Pre-Trial & Post-Trial	Hand auger and sample uphill, downhill and in trial area	After each monitoring round	Final Trial report
	During the trial – as required depending on site observations (~ six monthly)	Hand auger and sample as required	After each monitoring round	
Soil moisture content	Hourly but can be modified	4 probes with sensors at 0.1m intervals	Weekly	Continuous –EPA given access to database Also summarised in monthly report
Temperature	Hourly but can be modified	4 probes with sensors at 0.1m intervals	Weekly	Continuous –EPA given access to database Also summarised in monthly report
Soil structure	At end of trial and/or when harvesting Vetiver	Testpits and observations	Review of draft report	Final Trial report

The relevant trigger levels for optimising irrigation rates will be progressively developed based on ongoing review of the data including rainfall, soil moisture at various depths in the profile, run off and vetiver health.

5.1.4 Vetiver

Vetiver monitoring includes assessing the overall health, height, changes in plant chemistry due to absorption/uptake of leachate and the plant rooting depth and distribution. The monitoring plan is summarised below:

Table 7 Vetiver Monitoring Requirements

Parameter	Monitoring Frequency	Monitoring Equipment/Approach	Project Team Review Frequency	Info provided to EPA
Plant Tissue Analysis Refer to Sec 5.2.4	Pre-trial and post-trial (as part of ongoing site monitoring)	Hand sampling of plant matter	After each monitoring round	Final Trial report
	During the trial – as required depending on site observations (~ six to twelve monthly)	Hand sampling of plant matter as required		
Height	Monthly	Tape measure plants at same 4 locations (see R1A, R1B, R2A and R2B on Figure 2)	Monthly	Monthly or as agreed
Plant Health	As required (initially Quarterly)	Observations by Agronomist	Quarterly	Quarterly or as agreed
Harvest yield	Time of harvest	Estimation of volume by observation and truck loads	At time of harvest	Final Trial report
Vetiver root length and distribution	Time of harvest	Testpits and observations	Review of draft report	Final Trial report

5.2 Sampling

As part of the EPA licence requirements and as outlined in the Caroline LEMP, the CoMG conducts a bi-annual environmental monitoring of leachate, groundwater and landfill gas. Sampling is typically conducted in October/November and March/April each year, with an annual monitoring report compiled from the two rounds. Sampling is to be carried out by a qualified consultant in accordance with accepted environmental sampling practices (as outlined in the Caroline LEMP and annual Caroline monitoring reports).

Sampling will be separated into four medias:

- Leachate;
- Soil;
- Vetiver plant tissue; and,
- Groundwater (PFAS analysis only)

There will be 3 phases of sampling, these are discussed in the tables below:

- **Pre- Trial** – leachate, soil, vetiver plant tissue, groundwater (PFAS)
- **During the Trial** – leachate as part of bi-annual landfill environmental monitoring program. Soil and plant sampling will be assessed for possible inclusion during the trial based on site observations of vetiver health and growth. Groundwater sampling for PFAS during the trial is not proposed at this stage, but may be included based on initial results and duration of the trial.
- **Post-Trial** - leachate, soil, vetiver plant tissue, groundwater (PFAS)

Bi-annual monitoring was conducted the week of 8 to 11 October 2018 and served as the pre-trial test program for leachate, soil, plant tissue and groundwater.

5.2.1 Proposed Analysis

As part of the sampling program, the following analytes are proposed by media type:

Table 8 Analytes by Media

Analyte	Leachate	Soil *	Vetiver *	Groundwater
Environmental				
Major Constituents - pH, calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), chloride (Cl), sulphate (SO4), total dissolved solids (TDS) or electrical conductivity	X	X		O
Major Constituents - suspended solids	X			
Major Constituents - carbonate (CO3), bicarbonate (HCO3)				O
Nutrients - nitrate (NO3), nitrite (NO2), ammonia (NH3), Total Kjeldahl Nitrogen (TKN), and total phosphorus.	X	X		O
Organics Speciated phenolic compounds	X	X		O
Organics - volatile organic compounds (VOCs)	X	X		
Organics - total organic carbon (TOC)	X			O
Filtered Metals – dissolved (filtered) iron (Fe), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), and zinc (Zn).	X			O
Total Metals – Standard suite of cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), total lead (Pb), zinc (Zn).	X	X	X	O
Total Metals – Further standard suite of arsenic (As), boron (B), mercury (Hg), total nickel (Ni), selenium (Se. Additional metals: total aluminium (Al), barium (Ba), hexavalent Chromium (Cr6+), manganese (Mn), silver (Ag), tin (Sn)	X	X	X	
Chemical Characteristics and Other Substances –cyanide as CN, formaldehyde as HCHO, herbicides, pesticides, TPH	X	X		O
Chemical Characteristics and Other Substances – BOD, suspended solids, grease and oil	X			
PFAS – 28 Analytes	X	X	X	X
Horticultural *				
Phosphorus (Colwell), Phosphorous (Olsen), Potassium (Colwell), Sulphur (KCl 40), Organic Carbon (Walkley Black), Nitrate Nitrogen, Ammonium Nitrogen, Electrical Conductivity, pH (Water), pH (CaCl) Boron, Trace elements (DTPA - Copper, Zinc, Manganese, Iron), Exchangeable Cations - Calcium, Magnesium, Sodium, Potassium, Aluminium Chloride Heavy metals – Cadmium, Molybdenum, Selenium, Lead, Chromium, Arsenic		X		
Standard Test Nitrogen, phosphorus, potassium, sulphur, copper, zinc, manganese, calcium, magnesium, sodium, iron, boron, nitrate and chloride. Heavy metals – Cadmium, Molybdenum, Selenium, Lead, Chromium, Arsenic			X	

Note:

***** *-Not included in the Caroline landfill bi-annual environmental sampling and reporting program*

X *– Analysed and reported under the Vetiver trial program*

O *– Sampled and analysed under the bi-annual environmental program and <u>not</u> proposed for reporting under the Vetiver trial program (though will be reported in the annual monitoring report and can be referenced as required)*

This analyte list may be revised and updated following review of initial and ongoing data.

5.2.2 Leachate Sampling

As leachate is produced, its chemical composition and concentrations vary with the types of waste disposed of within the landfill, changes in leachate generation over time and the addition of rainwater in the leachate evaporation ponds. The leachate will be sampled and analysed in order to assess which chemicals are present within the irrigated leachate which will identify chemicals which may accumulate in the trial area soil and vetiver. Leachate sampling has been conducted at the Caroline landfill site as part of the environmental monitoring program and therefore there is established baseline of leachate composition. Some analytes proposed have not been detected but remain in this trial program as a precaution.

The leachate that will be used for the vetiver irrigation trial will be pumped from leachate evaporation ponds 1, 2 and 3 at the Caroline Landfill site (see Figure 1 attached).

The leachate sampling program will include:

- Pre-trial (October 2018) and post-trial sampling and analysis for the analytes as noted in Section 5.2.1 above.
- Obtaining field parameters at the time of sampling
- Leachate samples will be obtained from the cell 1/2 leachate sump, cell 3 sump and one sample from each of the three leachate ponds 1, 2 and 3 (5 samples in total)

At the request of the EPA, initial pre-trial sampling of leachate for per-and poly-fluoroalkyl substances (PFAS) was conducted. Samples from each of the 3 leachate ponds and 1 leachate sump sample were obtained on 3 August 2018 with the subsequent raw laboratory reports (with no assessment or quality control review) provided to the EPA as part of the discussions in developing this EMP. The leachate will also be re-analysed for PFAS as part of the October 2018 pre-trial sampling program.

5.2.3 Soil Sampling

The purpose of the soil sampling program is to assess:

- the baseline soil chemistry for key parameters;
- the change in soil chemistry due to the application and build-up of chemicals in the leachate;
- the effect of infiltration /water movement through the soil profile;
- the potential effect of runoff and irrigation spray drift; and,
- nutrient addition and removal.

The 6 soil sampling locations (SS01 to SS06) are shown on the attached Figure 2 and the sampling areas, sampling depths, purposes of sampling at each sampling depth and which samples will be submitted for environmental or horticultural analysis are summarised in Table 9 below.

Table 9 Soil Sampling Locations and Depths

Soil Sampling Area	Sampling Depth (~ meters below surface)	Purpose	Environmental	Horticultural
Upgradient/Uphill outside Trial Area (SSO1)	Surface Soil (~0 -0.1m)	Background / Upgradient of Trial	X	
	Subsoil Water Use /Storage (~0.4-0.5m)		X	
	Above Clay Barrier (~0.8-0.9m)		X	
Trial Area (SSO2, SS03, SS04)	Surface Soil (~0 -0.1m)	Changes in surficial soil chemistry during the trial	X	X
	Subsoil Water Use /Storage (~0.4-0.5m)	Changes in soil chemistry in the zone of expected water utilisation by the Vetiver	X	X
	Above Clay Barrier (~0.8-0.9m)	Changes in soil chemistry in the subsoil just above the barrier / zone of reduced infiltration	X	X
Downgradient/ downhill outside trail area (SS05, SS06)	Surface Soil (~0 -0.1m)	Changes in surficial soil chemistry potentially due to runoff / spray drift	X	
	Above Clay Barrier (~0.8-0.9m)	Changes in soil chemistry in the subsoil just above the barrier / zone of reduced infiltration potentially due to surface or subsurface runoff/drainage	X	

5.2.4 Vetiver Plant Tissue Sampling

The purpose of the plant sampling is to assess:

- the baseline plant tissue chemistry for key parameters;
- the change in plant tissue chemistry due to the application and surficial build-up and uptake of chemicals in the leachate; and,
- horticultural properties including nutrient addition and removal.

Table 10 Plant Sampling Locations

Plant Sampling Area	Purpose	Environmental	Horticultural
On site but away from trial area and watered with site bore water.	Background	X	X
Trial Area (Adjacent to SSO2, SS03, SS04)	Changes in plant chemistry due to uptake of heavy metals and PFAS. Potential for reuse or alternate disposal	X	
	Assess nutrient removal per hectare		X

5.2.5 Groundwater Sampling

Groundwater sampling and analysis, for the purposes of this leachate irrigation trial, will be limited to the addition and reporting of PFAS, primarily as a baseline indication of the presence (if any) of PFAS compounds.

All of the site monitoring wells will be sampled and analysed for PFAS (at the same time as the bi-annual monitoring program) including the following wells:

- MGS1 and MGD1
- MGS2 and MGD2
- MGS3 and MGD3
- MGS4 and MGD4
- MGS5 and MGD5
- MGS6 and MGD6
- MGS7 and MGD7
- MGS10 and MGD10
- MGS11
- MGS12
- MGS13
- MGS14
- MGS15

Historical and current groundwater monitoring results can still be considered and referenced from the annual monitoring reports, as required.

6.0 Risks and Control Measures

The proposed irrigation of vetiver for leachate management is not without risk, hence the need for this trial period with clear management, monitoring and sampling approaches. Possible risks have been identified in the following categories:

- Trial Location
- Irrigation Approach
- Growth and Health of Vetiver
- Potential for Contamination
- Erosion

Possible risks have been summarised with an assumed qualitative risk rating (low, medium, high) along with proposed control measures for each risk item and the estimated resulting qualitative residual risk. This summary is included in Appendix C.

7.0 Health & Safety

Due to the heavy metals, minerals and nutrients present in leachate, it can be harmful if exposed to humans without the appropriate safety controls. The hierarchy of control, shown in plate 3 is to be adhered to during the trial. Processes are to be assessed for risks to safety by conducting a Safe Work Method Statement (SWMS) prior to carrying out the tasks required.

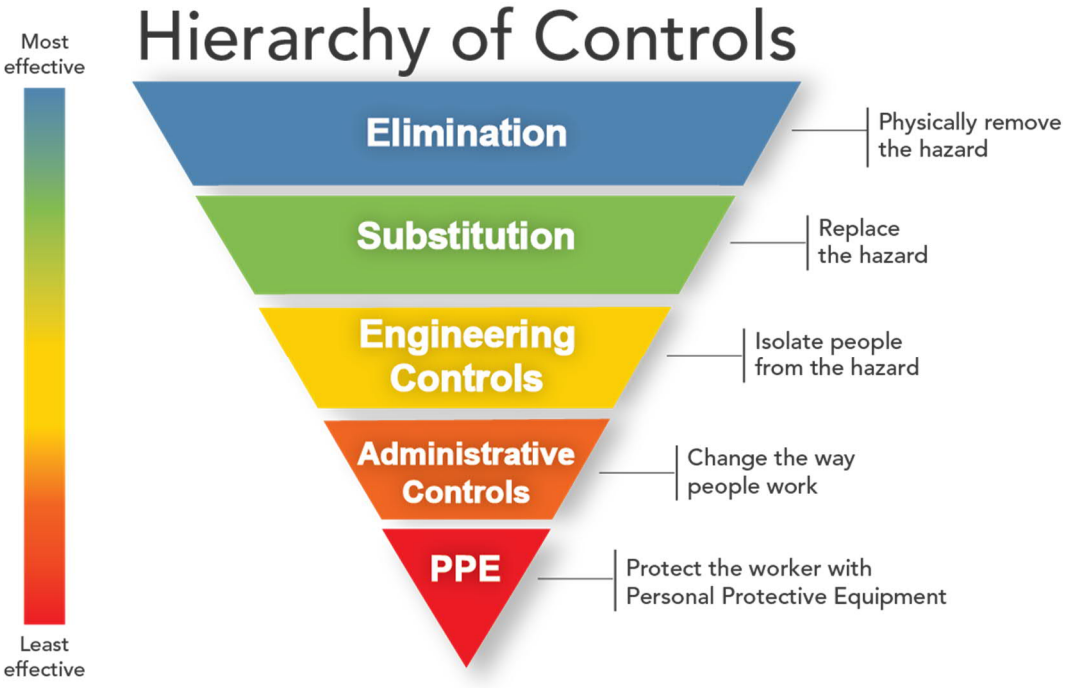


Plate 3 Hierarchy of Control

The site is currently closed to the public with access limited to approved commercial delivery of waste and Council employees. The irrigation area is to be clearly identified and Council employees will be advised of the trial program and requirements, including Health and Safety.

Leachate will be sprayed by an adjustable sprinkler system with automated timers and remote turn off valves to eliminate the need for human contact with the leachate during the irrigation process.

Access to the trial area (e.g. for sampling or measuring) will only occur when irrigation is not in progress and it is considered safe to enter the area. Soil moisture testing is to be completed by automated soil meters, allowing data to be remotely collected for analysis.

Sampling is to be carried by a suitably qualified environmental technician/consultant that has experience in working within a similar environment.

CoMG will prepare a separate trial specific Health and Safety plan, which will be a live document which can be updated in the field as required. Council workers and others working in the vicinity of the leachate trial area, will be inducted into the Health and Safety Plan.

As a minimum, the following PPE is to be worn if sampling or maintenance needs to occur in the trial area:

- Industry appropriate rated gloves
- Safety glasses
- Long sleeve pants
- Long sleeve high vis shirt

8.0 Review, Communications and Reporting

8.1 EMP Review

This EMP is required for the relatively short duration of the Vetiver Trial and therefore the EMP review will be less formal and imbedded in ongoing monitoring and reporting. Significant changes to the EMP will be noted to the EPA in the monthly (or as required) email reporting or other EPA communications and will be circulated to the applicable trial project team members.

If upon completion of the Vetiver Trial it is considered that the leachate irrigation of vetiver will be adopted as long term site practice, then the Vetiver EMP will be reviewed and updated for inclusion in the site LEMP or as a standalone document.

8.2 EPA Communications and Reporting

8.2.1 Pre-Trial

Communications and reporting to the EPA in the Pre-Trial period will include:

- Submission of preliminary lab reports for PFAS testing of leachate (completed).
- Submission of the draft version of this EMP for review and discussion.
- Meeting with EPA (if required) to discuss the draft EMP and agreed revisions.
- Submission of the final version of this EMP for EPA approval prior to commencing the trial.
- CoMG will provide access details to the EPA for the soil moisture content monitoring database, so they may check the latest results at any time.

8.2.2 During the Trial

Communications and reporting to the EPA during the Trial period will include:

- Provision of monthly (or as agreed with the EPA) email update reports summarising the status and findings since the previous update report. Further details of the monthly email update reports are summarised below.
- Ongoing and continuous access to the soil moisture content monitoring database. so that they may check the latest results at any time.
- Conducting a site visit and discussions of the Vetiver trial, if required, during the course of the trial.
- EPA representatives will be invited to conduct a site visit at the time of vetiver harvest and test pit assessment of the soil profile and vetiver root distribution.

The email update reports will include a summary of the following:

- Weather condition ranges – rainfall, temperature, wind speed & direction, evaporation
- Irrigation system run times
- Irrigation system maintenance and repair (if any)
- Leachate Irrigation flow rates
- Estimated leachate irrigation volumes
- Leachate pond levels
- General discussion and interpretation around the changes in the soil profile (e.g. moisture content, uptake, infiltration, etc.) with reference to the soil moisture content monitoring database.
- Vetiver height and health observations
- Proposed changes to the Vetiver trial approach (if any) based on observations and data.
- Selected site photos

8.2.3 Post-Trial

It is envisaged that the vetiver trial will be conducted over a 2 year period (e.g. November 2018 to October 2020, subject to timing of EPA written approval) in order to assess the effect on leachate balances over several summer/winter seasons. The trial may be terminated earlier depending on the progressive observations and findings.

It is noted that the 'Post-Trial' period is when CoMG considers that there is enough information to prepare a report and conclusions about the findings from the trial and/or when the Vetiver is completely harvested and not proposed to be replanted in the near future. The CoMG may continue to gather data in the post-trial period, depending on the circumstances.

Communications and reporting to the EPA after the Trial period will include:

- Advise EPA when the irrigation system is shut down and estimated timing for system restart and/or replanting of Vetiver.
- Provision of the draft Vetiver Trial Assessment report for review
- Meeting with EPA (if required) to discuss the draft Vetiver Trial Assessment report and agreed revisions

The Vetiver Trial Assessment final report will include:

- Background information regarding the Vetiver Trial objectives and approach
- Summary of weather condition ranges – rainfall, temperature, wind speed & direction, evaporation
- Summary of irrigation system (run times, flow rates, volumes, pond levels, etc.)
- Irrigation system maintenance and repair (if any)
- Interpretation of the changes in the soil profile (e.g. moisture content, uptake, infiltration, etc.)
- Summary of changes in Vetiver during the trial (height/health observations, growth rates, horticultural/ environmental chemistry assessment including metals and PFAS, yield, root distribution, etc.)
- Discussion and conclusions (e.g. success or failure, scaling potential, etc.)
- Lessons Learned
- Recommendations

9.0 Contingency

In the event that the Vetiver Trial is not successful, the CoMG will consider a number of other leachate management contingency actions including, but not limited to (and in no particular order):

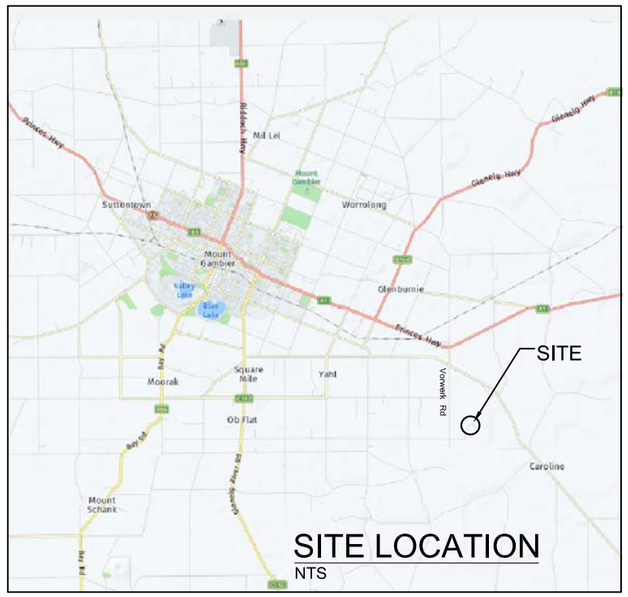
- Extension of the Vetiver Trial if results indicate that significant modification of the trial approach may result in more successful outcomes.
- Consideration of other plant species for leachate irrigation.
- Further consideration of other enhanced evaporation options
- Review of the latest leachate/water balance data, including current landfill cell and capping configurations (and potentially updated water balance modelling and calibration with site conditions) in order to estimate the quantity of leachate to be managed under various conditions.
- Review of leachate generation reduction options (e.g. further cell size optimisation, runoff assessment, etc.).
- Installation of additional leachate storage (e.g. tanks, covered ponds, etc.) that can allow for evaporation of excess leachate in the summer months.
- Installation of seasonal leachate pond covers / roofing which would allow for shedding rainfall in the winter and could be removed to enhance evaporation in the summer months.
- Leachate treatment and/or offsite disposal.
- Other as identified during the trial or after further contingency review.

The CoMG is not currently committing to any further leachate management options until the Vetiver Trial findings have been finalised.

Appendix A

Figures

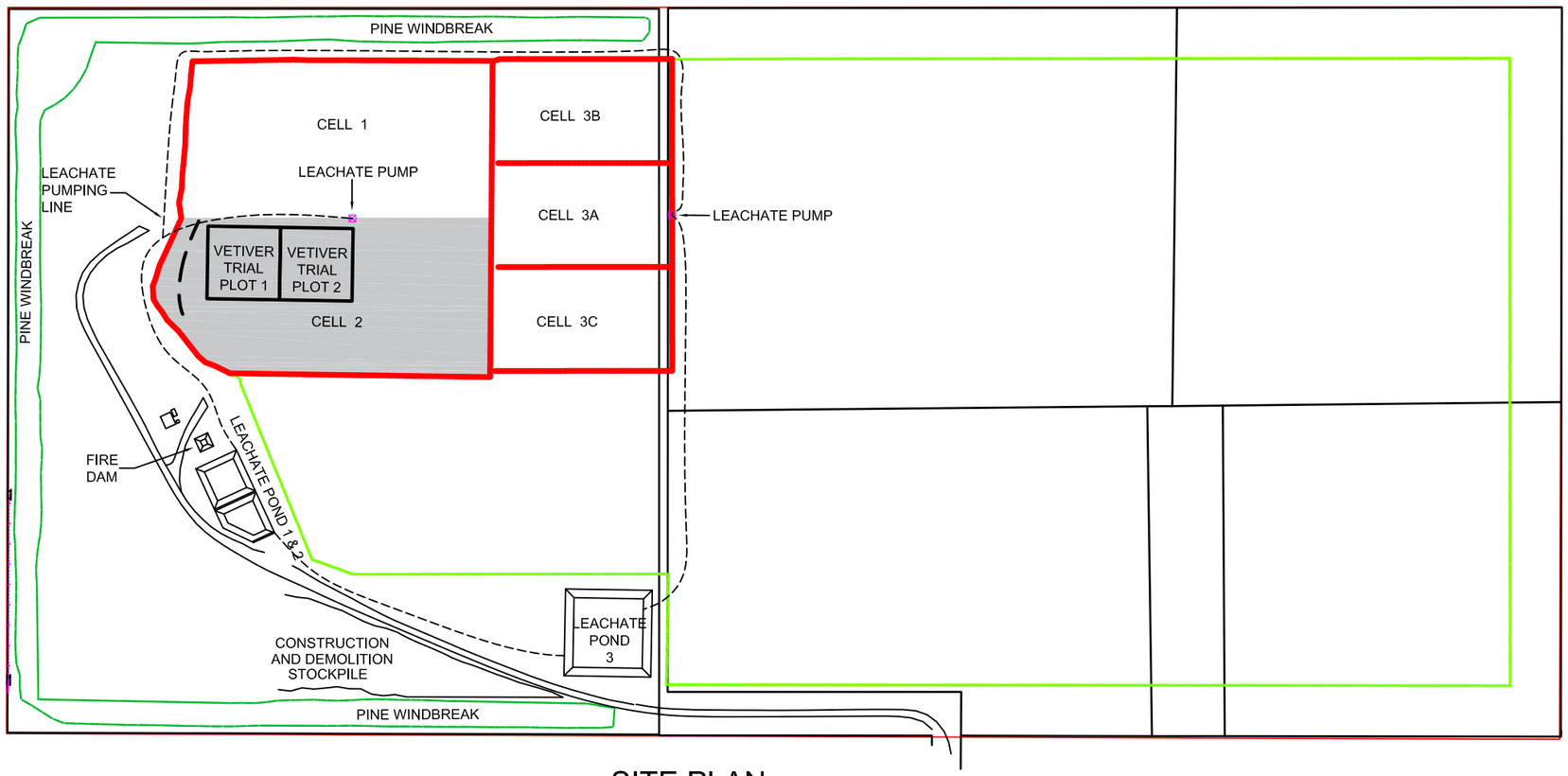
LEACHATE IRRIGATION OF VETIVER TRIAL



Drawing No.	DRAWING TITLE
1 of 3	SITE LAYOUT AND GENERAL NOTES
2 of 3	CELL 2 TRIAL PLOTS
3 of 3	VETIVER GRASS LAYOUT PLAN

GENERAL NOTES

1. THE DESIGN DRAWINGS ARE TO BE READ AS A SET AND IN CONJUNCTION WITH VETIVER TRIAL EMP PROVIDED.



SITE PLAN
SCALE 1:4

City of Mount Gambier
BLUE LAKE CITY

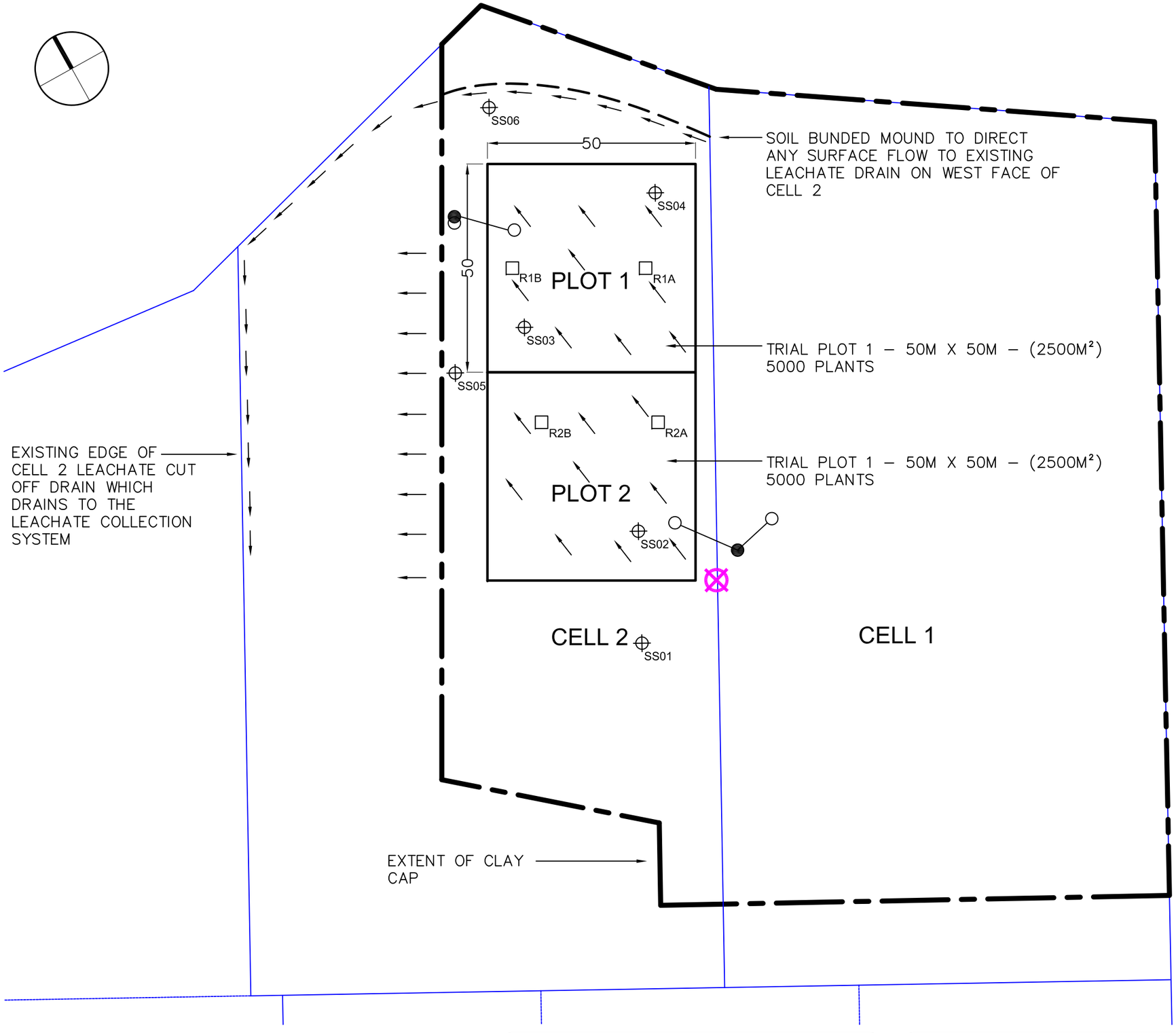
Approved by	
Co-ordinates	
Height Datum	
Level book	
Drawn by SG FEB 2018	CAD ref
Designed by	Survey ref

CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

VETIVER GRASS TRIAL

Scale	Sheet No
as shown	1 0F 3
Plan No	
FIGURE 1	



LEGEND

- CELL BOUNDARY
- EXISTING CAPPING (CELL 1)
- CAPPING EXTENT
- SOIL BUND
- EXISTING CELL 1 AND 2 LEACHATE PUMP
- SS01 APPROXIMATE SOIL SAMPLING LOCATION
- SOIL MOISTURE MONITORING CONTROLLER
- SOIL MOISTURE MONITORING PROBE
- VETIVER GRASS SAMPLE TRIAL

NOTES

1. VETIVER GRASS TO BE PLANTED IN ROWS AT 1M SPACING WITH GRASSES PLANTED AT 0.5m CENTRES.

2. STORMWATER BUND 0.3m HIGH AND 0.5M WIDE TO BE GRADED TO DIRECT WATER TO THE WEST SIDE OF THE CELL AND LEACHATE COLLECTION SYSTEM.

City of Mount Gambier
BLUE LAKE CITY

Approved by	
Co–ordinates	
Height Datum	
Level book	
Drawn by SG FEB 2018	CAD ref
Designed by	Survey ref

CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

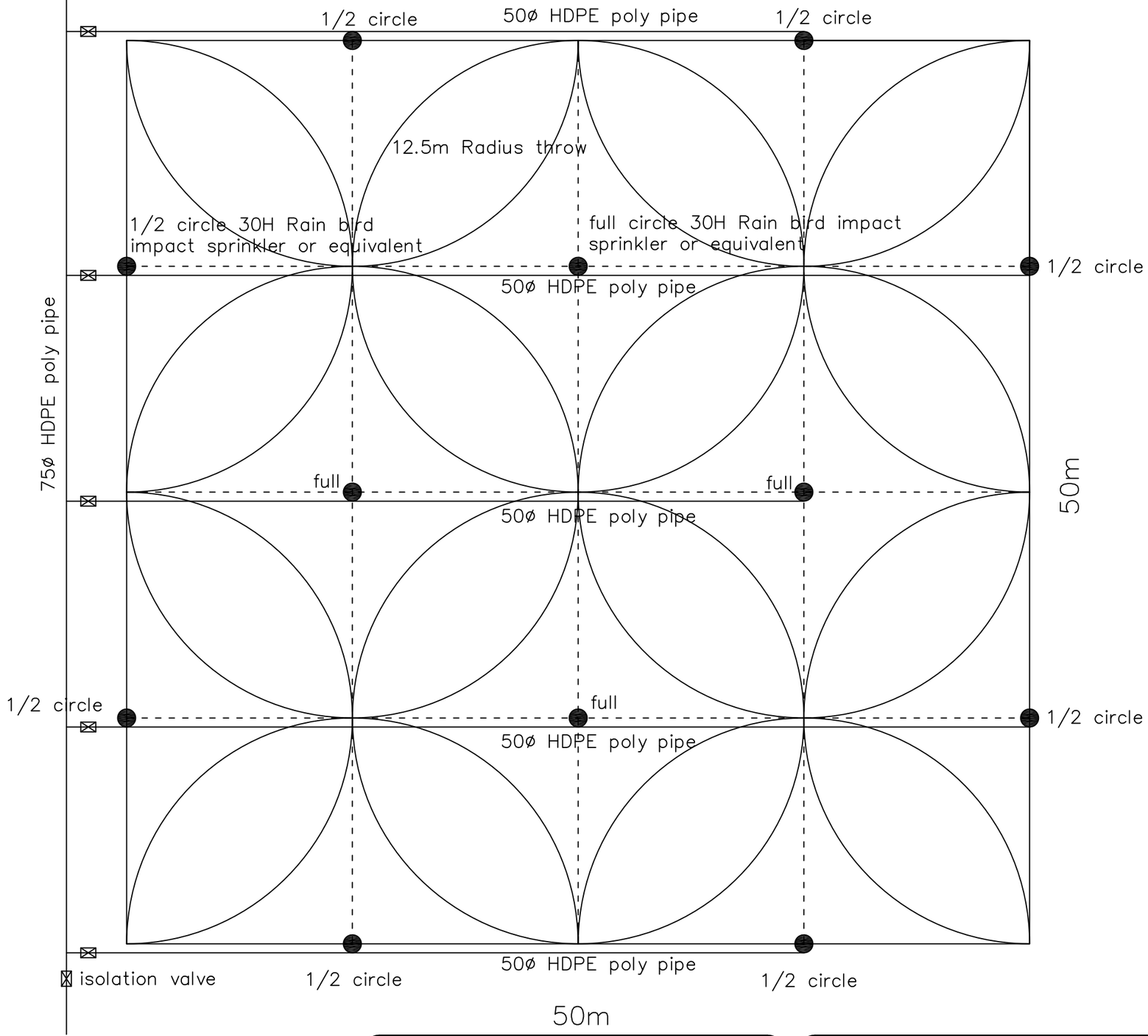
VETIVER TRIAL PLOT LOCATION

Scale	Sheet No
1:1000	2 OF 3

Plan No

FIGURE 2

grass planted in rows at 1.0m centres. Plant spacing at 0.5m centres.



NOTES

1. SPRAY IRRIGATION SYSTEM DESIGNED TO DELIVER 10mm/HOUR TO IRRIGATION AREA VIA OVERHEAD SPRAYS.

City of Mount Gambier
BLUE LAKE CITY

Approved by	
Co-ordinates	
Height Datum	
Level book	
Drawn by SG FEB 2018	CAD ref
Designed by	Survey ref

CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

VETIVER TRIAL IRRIGATION LAYOUT

Scale	Sheet No
1:250	3 OF 3

Plan No

FIGURE 3

Appendix B

Weekly Checks Flow Chart

CAROLINE LANDFILL VETIVER TRIAL WEEKLY CHECKS FLOW CHART

ONSITE DUTIES

Check irrigation system weekly.

If the system is in good condition.

If there is a broken sprinkler or leak in the system.

Stop all irrigation until repaired. Use contractor if required.

Once repaired.

Visually check bunds weekly.

If the bund is in good condition.

If there are abnormalities or faults in the bund.

Stop all irrigation until repaired. Determine cause.

Once cause has been identified/resolved and bund has been repaired.

Irrigate as per normal.

Onsite duties will be carried out by the responsible officer: Integrated Irrigation representative.

If the responsible officer is unavailable, the responsibility of the onsite duties will transfer to the CoMG Landfill Operator or CoMG Engineer.

If the Landfill Operator is also unavailable, the responsibility will escalate to the CoMG Manager Engineering Design & Contracts.

OFFSITE DUITES

Check Soil Moisture Data using AddVantage Irrigation Control Program.

If the moisture level has reached/exceeded the trigger value.

Go on site and stop irrigation schedule.

When the soil moisture returns to below the trigger value.

If the moisture level is below the trigger value.

Check weather forecast.

If there is a forecasted rain event that will cause soil moisture to exceed the trigger value.

Go on site and stop irrigation schedule.

When the soil moisture returns to below the trigger value after the storm event.

If there is NOT a forecasted rain event that will cause soil moisture to exceed the trigger value.

Offsite duties will be carried out by the responsible officer: Integrated Irrigation representative

If the responsible officer is unavailable, the responsibility of the onsite duties will transfer to the CoMG Engineer or Technical Officer.

If the Technical officer is also unavailable, the responsibility will escalate to the CoMG Manager Engineering Design & Contracts.

Appendix C

Risks and Control Measures

Appendix C Risks and Control Measures

The proposed vetiver irrigation method is not without risks, hence the need for a vetiver trial period. Key risks have been identified along with their corresponding control measures.

Risk Element	Risk	Qualitative Risk Rating	Control measure	Qualitative Residual Risk
Location				
	Trial plot located outside of capped landfill cell	High	Locate trial plot by geographic survey to ensure it is located in confines of cell 2 engineered cap.	Low
	Vetiver grass spreads to other areas of landfill site and becomes uncontrollable	Medium	Vetiver grass is a non – invasive plant. It produces neither stolons nor rhizomes and has to be established vegetatively by root subdivisions or slips. Vetiver can be killed easily by spraying with glyphosate or uprooting and drying out.	Low
Irrigation				
	Irrigation rates may be higher or lower than required	Medium	Monitor trial plots via flowmeter / moisture probes and site observations and adjust irrigation rate to suit climatic conditions	Low
	Lack of irrigation	Medium	Ensure irrigation system is setup and is functional before planting grass. Have backup watering system available, i.e. water cart or onsite irrigation bore.	Low
	Trail grass required more moisture than leachate storage	Medium	Use onsite bore system or council water cart.	Low
Growth of Vetiver				
	Weather conditions including frost	Medium	Ensure planting time period avoids frost periods and the grass has time to establish before onset of frosty weather. No irrigation is planned for the winter months.	Low
	Mount Gambier climate may not be suitable for vetiver grass growth	Medium	Research indicates that vetiver grass has a great tolerance to extreme climatic variations such as prolonged drought, flood, submergence and temperature levels ranging from -20oC to 55oC (ref Truong et al 2004, report extract from Vetiver phytoremediation technology for rehabilitating Shiraz landfill, Iran)	Low
	Competition from other grasses/weeds	Medium	Manage other grasses and weeds through regular weeding programs by the application of herbicides, mowing or hand weeding (if required). Note, once the vetiver grass is established and growing, other grasses such as kikuya will only grow if they can tolerate the leachate. It may be proven that leachate is the only control measure for weed / grass management that is required.	Low
	Grass grows higher than expected and dirupts overhead sprinkler system	Low to Mediu	Design sprinkler system to be vertically adjustable to raise sprinklers above grass height, if required. Cutting grass height to below sprinklers.	Low
	Dormancy of grass plot through winter months leading to no photosynthesis and moisture uptake	High	Trial plot not to be irrigated during winter (dormant) periods. Monitor grass growth to determine periods of dormancy.	Medium
Potential for Contamination				
	Runoff of leachate from irrigated area	High	Reduce irrigation and ensure application rates of leachate are monitored daily. Monitoring to include flow meters, moisture probes and physical inspections of trial site. Only irrigate when Landfill operator is present onsite. Install soil bund on northern face of cell 2 to direct surface runoff to leachate drain on west side of cell 2 which will capture excess leachate and return it to leachate collection system and leachate ponds.	Low
	Grass contains high levels of heavy metals and will be evident in biomass of cut grass	High	Dispose of cut grass to landfill cell Investigate alternative offsite disposal options (if necessary)	Low
	Leachate not suitable for irrigation onto Vetiver grass	High	Leachate chemical analysis from Caroline Landfill has been compared to the leachate used in the Stott's Creek Landfill disposal system, with all Caroline landfill leachate values well below the target values reported in the Stott's Creek system. Stott's Creek landfill leachate disposal system has not caused any adverse concerns for vetiver grass growth due to toxicity of leachate so there is no reason why the leachate at Caroline landfill should cause any issues. As part of this trial, Vetiver health will be monitored.	Low
	Buildup of contaminants in the capping profile due to long term irrigation of leachate	High	Vetiver grass is highly efficient at removing heavy metals and nutrients from contaminated soil and storing within the plant biomass for later use or disposal. Documented research has proven the success of soil remediation through phytoextraction whereby the uptake of heavy metals from the surrounding soil occurs and the metals are stored in the plant biomass. Vetiver is very effective at this due to its high tolerance to landfill leachate. In addition, research has also shown that vetiver can reduce soluble Phosphorous by up to 97% after 3 weeks and soluble Nitrogen by up to 74% after 5 weeks. As part of the trial, soil material from with the trial cap will be chemically tested for heavy metals and other concentrates (as part of the groundwater monitoring program for the landfill) in order to assess no significant buildup of material within the soil capping layers that is likely to cause environmental harm. Testing of the biomass will also occur to determine the vetiver grasses ability to store various metals, etc. within the plant biomass. For the trial the biomass shall be removed from the cap and safely disposed of within the active landfill cell. Likewise, should the soil within the clay cap become contaminated to the point of increased risk of environmental harm occurring, then this material shall be removed from the cap and used within the active landfill cell as daily / intermediate cover.	Low to Medium
Erosion				
	Erosion of cap due to long term irrigation combined with effects of rain events	High	Soil moisture probes installed within the trial plot will establish baseline moisture levels and combined with visual inspections, allow for the determination of the optimum irrigation rates of leachate in order to prevent erosion occurring. Soil moisture will be used to control application of leachate (in periods where rainfall is likely to increase moisture levels which could lead to erosion). No irrigation to occur on days where rainfall is forecast or where soil moisture levels have increased to levels that may lead to erosion. Vetiver grass has long been proven to be effective in trapping silts and sediments from being washed off un-vegetated embankments and this is one of the main applications of the grass species. Given that vetiver grass is predominantly used to stabilize soil and prevent erosion, this material will greatly assist in preventing erosion of the landfill cap irrespective of whether leachate is being irrigated or not. The application of leachate via a controlled irrigation system is unlikely to cause erosion on its own, unlike rainfall events that can be unpredictable and highly intense which can cause soil erosion. The use of vetiver grass will help to stabilize the soil cap and minimize the potential for erosion to occur and combined with monitoring of soil moisture for the duration of the trial, is likely to reduce the risk of erosion of the cap.	Low to Medium
	Slope stability issues from furrow planting and root intrusions into capping profile	High	Vetiver grass is used extensively worldwide to stabilize embankments and prevent soil erosion. This occurs due to the high tensile strength in the plants roots which act to bind the soil particles together. Whilst the vetiver roots are fast growing and can grow up to 3 metres in depth when in search of moisture, by maintaining soil moisture within the upper layers of the cap profile (ie the layers above the clay) then it is not expected that the roots will go down into the densely compacted clay layers searching for moisture. Monitoring of root growth will be undertaken as part of the trial by regularly removing a number of vetiver slips to measure the root growth. Should extensive root growth start to compromise the clay cap, then grasses will be either sprayed with glyphosate to kill them off or physically removed from the cap and safely disposed. A geotechnical assessment of the trial area has been conducted by AECOM and is reported seperately.	Low

Landfill Leachate Treatment and Disposal Trial Using Vetiver Grass on Capped Cell - Caroline Landfill Cell – City of Mount Gambier

Introduction

Leachate management at Caroline landfill has been an ongoing concern for the City of Mount Gambier for some time and will continue to cause issues if not managed in an environmentally sustainable manner. As the landfill continues to grow there will be more pressure placed on Council to find alternative treatment and disposal solutions that are both sustainable in the long term and financially affordable.

As Caroline landfill is the only engineered landfill in the south east, the City of Mount Gambier needs to ensure that the landfill remains available for refuse disposal for the City but also for its neighbor councils.

In recent years, Council has had to resort to transporting leachate offsite and disposing to sewer. This practice cannot be sustained long term due to the high costs involved and Council is now investigating alternative leachate management solutions. One of those solutions could be the irrigation of leachate onto a planted grassed area on top of capped cells, with the selected grass species (vetiver grass) being tolerant to landfill leachate.

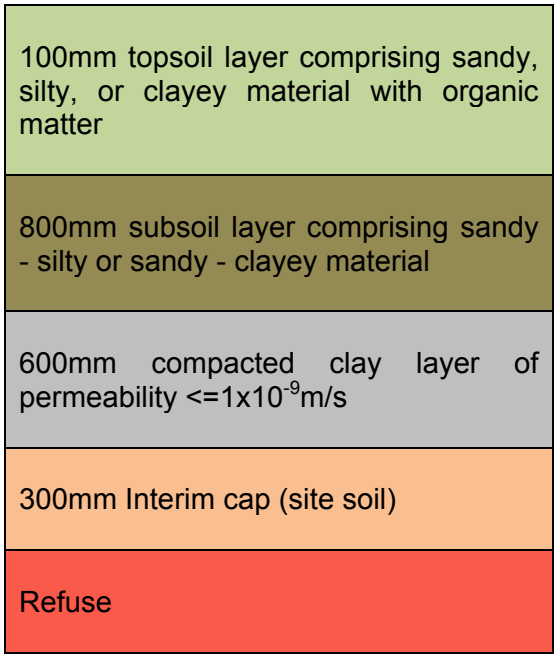
Background

Caroline Landfill is located approximately 12km south east of the City of Mount Gambier and receives waste from the City as well as surrounding Council areas. The landfill is a fully engineered landfill owned and operated by the City of Mount Gambier and being developed in accordance with landfill guidelines and managed in accordance with an approved Landfill Environmental Management Plan (LEMP).

On average, approximately 20,000 tonnes per annum are received at the landfill site, with the landfill receiving the first load of refuse in May 1997.

Cell 2, the site for the proposed vetiver grass trial has recently been capped with a clay / subsoil engineered cap and received the last load of waste in November 2014. After landfilling was ceased in cell 2 in late 2014, an interim soil cap was placed on the cell with the subsequent engineered final clay / soil cap being placed in summer 2017 - 2018.

The engineered clay / soil cap consists of the following soil profile.



Leachate is managed onsite by collection and storage in evaporation ponds constructed with a clay / HDPE liner system. Evaporation is the primary method of leachate volume reduction but in past years due to above average rainfall, Council has had to transport and dispose of surplus leachate offsite to sewer. This practice is unsustainable for Council in the long term due to the significant costs involved but also because the process of transporting creates a larger environmental footprint than compared to other onsite disposal methods (such as the proposed vetiver grass trial).

The total storage capacity within the current leachate ponds is approximately 7.4ML with the cost to dispose of leachate to sewer @ $35,000/ML

Accordingly, Council is now investigating other leachate reduction methods which have also included enhanced evaporation through spray misting and evaporation panels. Whilst these systems have a positive impact on leachate reduction, they are however not significant enough to provide a full reduction to the extent that Council would not be faced with future risk of storage ponds overtopping and having to resort to leachate transport and disposal to sewer.

Mount Gambier climate:

- annual daily temperature is 18.8^{o}C
- mean annual rainfall 711.5mm, decile 9 rainfall 856mm
- mean annual pan evaporation 1341mm
- 9am mean wind speed 15.9km/h, 3pm mean wind speed 20.9km/h

Whilst Mount Gambier's climate has a yearly evaporation greater than average rainfall, because of the combined area of active tipping faces and pond surface areas, leachate ponds can contain some residual leachate at the end of summer in some years.

Council is now investigating alternative leachate reduction methods that are cost effective and environmentally sustainable and is now exploring in more detail, the possibility of a trial utilising vetiver grass as an irrigated surface on top of part of cell 2.

This document outlines in more detail the proposed vetiver grass trial and will be used to gain EPA approval for the trial.

Proposal

- Location – Caroline landfill cell 2 (refer to attached locality plan)

- Size – trial plots to be 50m x 50m (2500m2) with plants at 0.5m spacing in rows at 1.0m centres (5000 plants per plot). This trial is proposing a maximum of 2 plots (total area of 5000m2)

- Timing (commencement, trial period) – March 2018 to March 2021. Once EPA approval is obtained, commencement on establishment of the trial plots will occur immediately. Depending on the timing, initially only one plot may be established prior to winter 2018, with the second plot established in early spring when weather conditions are not likely to impact on the vetiver grass slips. However, Council is hopeful of being able to establish the 2 plots immediately this side of winter if all necessary approvals can be obtained.

Technical parameters

- Vetiver slips (Vetiveria zizanioides) are proposed to be purchased from *The Vetiver Nursery* (Ashby Heights, NSW) which is a nursery that specialises in growing vetiver grass for commercial applications. Upon transportation to Mount Gambier, the slips will be immediately transported to site for planting, with slips being watered with onsite bore water (if necessary) whilst awaiting planting (so that they do not dry out).

- Irrigation system. The trial plots will be irrigated by an above ground irrigation system that is designed to irrigate the area with a uniform measured irrigation rate that can be easily adjusted to change the rate of irrigation if required.

  Robust and reliable impact sprinklers will be installed initially on 1.5m risers so the throw of the spray will not be impeded by grass growth. The risers will be designed to be adjusted to a greater height if required without having any impact on the irrigation rate.

The location of sprinklers shall be set out so that only the trial plot is irrigated with minimal irrigation designed to occur outside the plot area. However, it is noted that due to the effects of wind (speed and direction) there will need to be some allowance for overspray so as to ensure that the edge of the trial plot(s) remain irrigated.

The application rate of leachate irrigation will be measured via a flow meter and recorded as part of the monitoring and reporting for the trial period. Initially application rates will be set at a lower level and progressively increased once onsite monitoring confirms that the trial has additional capacity to absorb more moisture.

Irrigation will only occur in summer months when soil moisture is low and on days when rainfall is not forecast. Rate of irrigation will typically be established after a trial period to determine what is the most effective rate (i.e. delivering enough moisture without saturating the soil profile or causing surface runoff).

Whilst the soil moisture holding capacity of the soil can be typically measured based on soil analysis, insitu conditions may produce different values due to field compaction density and field moisture etc. Therefore, it has been suggested to initially increase the frequency of monitoring at the commencement of the trial in order to guard against soil saturation occurring and until such time as the soil / grass moisture saturation point is determined.

Soil moisture will be measured using onsite moisture probes and irrigation rates measured via a flow meter.

- Irrigation rates. As an example, an initial irrigation rate of approximately 10mm/day will be used with adjustments made accordingly. Therefore, over a trial plot area of 2500m2 and watering over 5 days per 7 days, this will deliver 125KL of leachate per plot/week. Assuming that irrigation can occur over the period November to March, this will allow for a possible irrigation of approximately 1ML/month or 4ML/ 4 month summer period. This equates to approximately 54% of total leachate storage for Caroline Landfill.

  In past years, Council has experienced a maximum residual leachate storage volume of around 45%, so this trial has the potential to cater for all residual leachate. However, it should be noted that 10mm/day may not be achievable and actual values could be significantly higher or lower and also the irrigation period may be longer or shorter. Therefore, considering the variability of the factors in this trial, a reasonable irrigation range should be suggested based on a percentage plus or minus (say +/- 30%). It is therefore suggested that a typical summer period could dispose of between 2.8 – 5.2ML of leachate through this trial system.

- Monitoring of the trial will occur by installing moisture sensors throughout the plot area and also down gradient of the plot site in order to monitor soil

moisture levels. It is proposed to install sensors in 2 separate locations per plot, plus one down gradient and outside each plot area. Moisture sensors will be set at various depths to enable measurement and comparison of soil moisture through the soil profile. Digital soil moisture sensors are very effective at logging moisture data that can be periodically downloaded with a plug in data logger or even read in real time through wireless technology.

Weather conditions (wind speed and direction, temperature, precipitation) will be monitored using the existing weather station located at Caroline Landfill.

- Recording of measurements. All measurements and readings from site data will be recorded either electronically or manually (i.e. plant growth) and entered into a spreadsheet for better reporting purposes (i.e. graphical representation of various trends over time).

- Items regularly recorded will include irrigation volumes and rates, grass growth rates, soil moisture, harvest yields and analysis.

- Reporting of site measurements for various trends will be reported in a 3 monthly report submitted to the EPA for information, but with other data being available on an as needs basis. These reports will be prepared in-house by Council staff.

- Post-trial (expectations, learnings, modifications, continuation of trial). Whilst ongoing monitoring and reporting will occur during the trial period, on completion of the trial, a final report will be prepared with the findings of the trial and a recommended course of action for either continuing on with the leachate treatment and disposal system or altering or abandoning for another system

- Expansion of additional plot area. It is not proposed to expand the trial plot area beyond the 5000m2, until there is sufficient evidence that the trial is successful and that the EPA approves any expansion or continuance of the disposal system.

Objectives of trial

The purpose of the vetiver grass leachate disposal trial is to continue Council's commitment to find more sustainable practices in leachate management. More specifically, this trail is aimed at achieving the following objectives;

- Onsite leachate management & disposal system that could be employed longer term
- Reduce current onsite leachate volumes in an environmentally sensitive way
- Avoid costs of carting and disposing leachate offsite
- Reduce council's environmental footprint associated with offsite disposal of leachate
- Reduce the financial burden for leachate management and disposal

- Employ an alternative use for capped landfill cells

Risks and risk control measures

As with any trial, there are numerous risks that Council needs to be aware of. The following table is a list of the identified risks with the vetiver grass trial and a suggested control measure to reduce the consequence of any identified risk to an acceptable and manageable level.

Risk	Control Measure
Grass doesn't grow – frost, lack of water, competition from other grasses / weeds	Ensure planting time period avoids frost periods and the grass has time to establish before onset of frosty weather. Manage other grasses and weeds through regular weeding programs by the application of herbicides, mowing or hand weeding (if required). Note, once the vetiver grass is established and growing, other grasses such as kikuya will only grow if they can tolerate the leachate. It may be proven that leachate is the only control measure for weed / grass management that is required. Ensure irrigation system is setup and is functional before planting grass. Have backup watering system available, i.e. water cart or onsite irrigation bore.
Runoff of leachate from irrigated area	Reduce irrigation and ensure application rates of leachate are monitored daily. Monitoring to include meters, moisture probes and physical inspections of trial site. Only irrigate when Landfill operator is present onsite Install soil bund on northern face of cell 2 to direct surface runoff to leachate drain on west side of cell 2 which will capture excess leachate and return it to leachate ponds.
Trial grass requires more moisture than is available from leachate storage	Use onsite bore system or council water cart. Note. Given that vetiver grass is highly drought tolerant, it is not expected that lack of moisture will be a high risk for this trial.
Grass grows higher than expected and disrupts overhead irrigation system	Design sprinkler system to be vertically adjustable to raise sprinklers above grass height Maintain grass height to below sprinklers
Grass contains high levels of heavy metals and will be evident in biomass of cut	Dispose of cut grass to landfill cell Investigate alternative offsite disposal options (if necessary)

grass	
Dormancy of grass plot through winter months leading to no photosynthesis and moisture uptake	Trial plot not to be irrigated during winter (dormant) periods. Monitor grass growth to determine periods of dormancy.
Irrigation rates may be higher or lower than required	Monitor trial plots via flowmeter / moisture probes and adjust irrigation rate to suit climatic conditions
Trial plot located outside of capped landfill cell	Locate trial plot by geographic survey to ensure it is located in confines of cell 2 engineered cap.
Leachate not suitable for irrigation onto Vetiver grass	Leachate chemical analysis from Caroline Landfill has been compared to the leachate used in the Stott's Creek Landfill disposal system, with all Caroline landfill leachate values well below the target values reported in the Stott's Creek system. Stott's Creek landfill leachate disposal system has not caused any adverse concerns for vetiver grass growth due to toxicity of leachate so there is no reason why the leachate at Caroline landfill should cause any issues
Mount Gambier climate may not be suitable for vetiver grass growth	Research indicates that vetiver grass has a great tolerance to extreme climatic variations such as prolonged drought, flood, submergence and temperature levels ranging from -20^{o}C to 55^{o}C (ref Truong et al 2004, report extract from *Vetiver phytoremediation technology for rehabilitating Shiraz landfill, Iran)*
Vetiver grass spreads to other areas of landfill site and becomes uncontrollable	Vetiver grass is a non – invasive plant. It produces neither stolons nor rhizomes and has to be established vegetatively by root subdivisions or slips. Vetiver can be killed easily by spraying with glyphosate or uprooting and drying out.

Trial period, measurements and reporting

In order to measure the success of the trial it is important to report on the final outcomes but also to be able to gauge the success (or otherwise) of the trial as it progresses over time. An ongoing monitoring and measuring program will be used to provide data for future discussion and consideration with the following parameters setting the basis for data capture and reporting:

- Measure & record daily irrigation rates to trial plot – via flow meter
- Measure & record moisture in soil profile (at various depths) in trial plot
- Measure and record moisture in soil profile (at various depths) down gradient of trial plot
- Measure and record growth rate of vetiver grass above ground
- Measure and record rainfall values at site (via onsite weather station)

- Lab assessment of biomass to determine heavy metals etc. (harvest yields and analysis)

Cost of proposed trial

• Supply of 10,000 Vetiver grass slips		$39,000
• Preparation and planting of grasses		$4,500
• Supply and Installation of irrigation system		$26,000
• Supply and installation of moisture monitoring system		$8,500/yr
	Total	$78,000

Attachments

- Plan of plot layout
- Chemical analysis of landfill leachate – Caroline
- Stott's Creek landfill extract report & additional information

Additional Information for EPA

Risk assessment for issues surrounding long term irrigation of cap with leachate

Risk	Control Measures
Erosion of cap due to long term irrigation combined with effects of rain events	Soil moisture probes installed within the trial plot will establish baseline moisture levels and combined with visual inspections, allow for the determination of the optimum irrigation rates of leachate in order to prevent erosion occurring. Soil moisture will be used to control application of leachate (in periods where rainfall is likely to increase moisture levels which could lead to erosion). No irrigation to occur on days where rainfall is forecast or where soil moisture levels have increased to levels that may lead to erosion. Vetiver grass has long been proven to be effective in trapping silts and sediments from being washed off un-vegetated embankments and this is one of the main applications of the grass species. Given that vetiver grass is predominantly used to stabilize soil and prevent erosion, this material will greatly assist in preventing erosion of the landfill cap irrespective of whether leachate is being irrigated or not. The application of leachate via a controlled irrigation system is unlikely to cause erosion on its own, unlike rainfall events that can be unpredictable and highly intense which can cause soil erosion. The use of vetiver grass will help to stabilize the soil cap and minimize the potential for erosion to occur and combined with monitoring of soil moisture for the duration of the trial, is likely to reduce the risk of erosion of the cap.
Slope stability issues from furrow planting and root intrusions into capping profile	Vetiver grass is used extensively worldwide to stabilize embankments and prevent soil erosion. This occurs due to the high tensile strength in the plants roots which act to bind the soil particles together. Whilst the vetiver roots are fast growing and can grow up to

	3 metres in depth when in search of moisture, by maintaining soil moisture within the upper layers of the cap profile (ie the layers above the clay) then it is not expected that the roots will go down into the densely compacted clay layers searching for moisture. Monitoring of root growth will be undertaken as part of the trial by regularly removing a number of vetiver slips to measure the root growth. Should extensive root growth start to compromise the clay cap, then grasses will be either sprayed with glyphosate to kill them off or physically removed from the cap and safely disposed.
Buildup of contaminants in the capping profile due to long term irrigation of leachate	Vetiver grass is highly efficient at removing heavy metals and nutrients from contaminated soil and storing within the plant biomass for later use or disposal. Documented research has proven the success of soil remediation through phytoextraction whereby the uptake of heavy metals from the surrounding soil occurs and the metals are stored in the plant biomass. Vetiver is very effective at this due to its high tolerance to landfill leachate. In addition, research has also shown that vetiver can reduce soluble Phosphorous by up to 97% after 3 weeks and soluble Nitrogen by up to 74% after 5 weeks. As part of the trial, soil material from with the trial cap will be chemically tested for heavy metals and other concentrates (as part of the groundwater monitoring program for the landfill) in order to ensure no significant buildup of material within the soil capping layers that is likely to cause environmental harm. Testing of the biomass will also occur to determine the vetiver grasses ability to store various metals and nutrients within the plant biomass. Should levels within the biomass exceed safe levels and be considered to be classed as hazardous, then the biomass shall be removed from the cap and safely disposed of within the active landfill cell. Likewise, should the soil within the clay cap become contaminated to the point of increased risk of environmental harm occurring, then this material shall be removed from the cap and used within the active landfill cell as daily / intermediate cover.

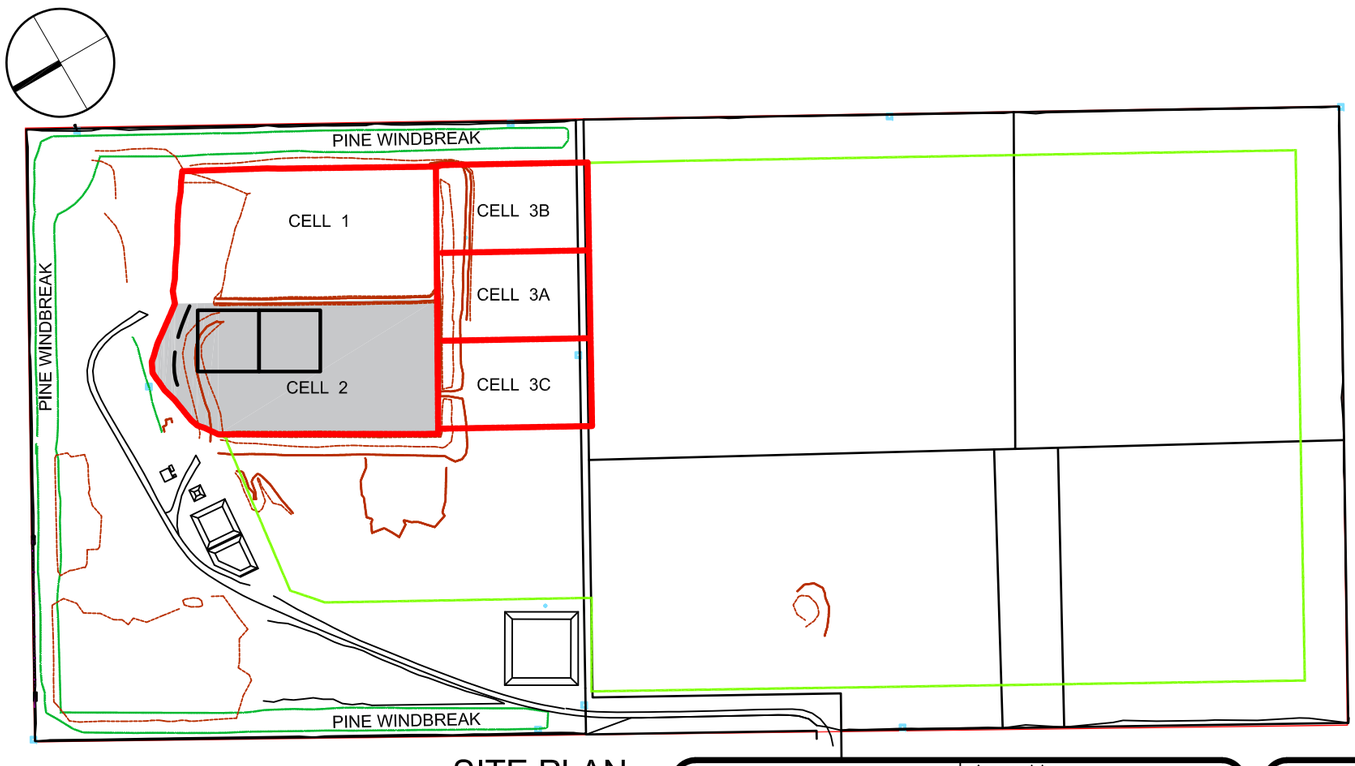
SITE LOCATION
NTS

VETIVER GRASS LEACHATE DISPOSAL SYSTEM

Drawing No.	DRAWING TITLE
1 of 3	SITE LAYOUT AND GENERAL NOTES
2 of 3	CELL 2 TRIAL PLOTS
3 of 3	VETIVER GRASS LAYOUT PLAN

GENERAL NOTES

1. THE DESIGN DRAWINGS ARE TO BE READ AS A SET AND IN CONJUNCTION WITH CONSTRUCTION QUALITY PLAN AND SPECIFICATIONS PROVIDED.



SITE PLAN
SCALE 1:5

City of Mount Gambier
BLUE LAKE CITY

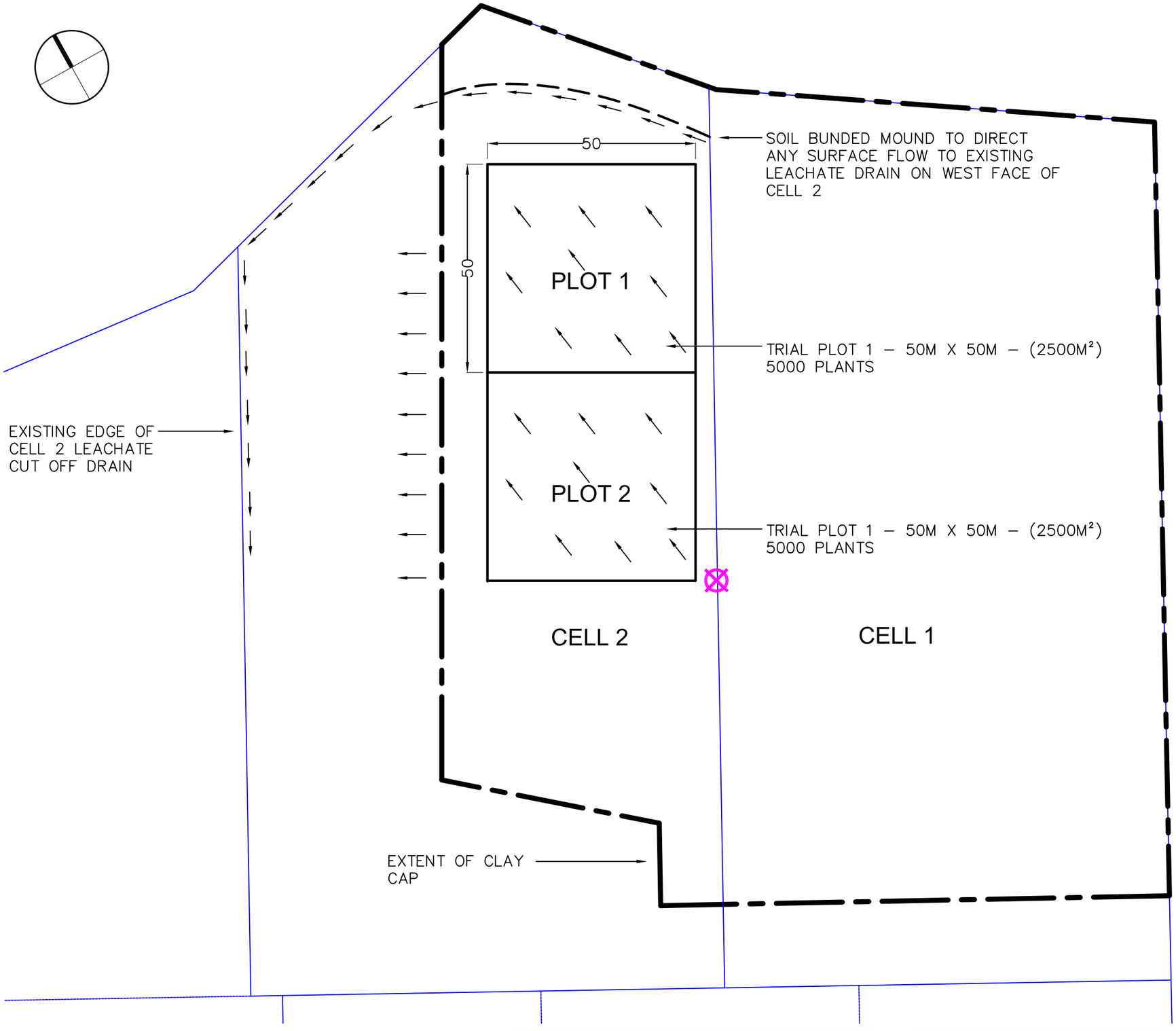
Drawn by SG FEB 2018	Approved by
Designed by	Co-ordinates
	Height Datum
	Level book
	CAD ref
	Survey ref

CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

VETIVER GRASS TRIAL

Scale	Sheet No
as shown	1 0F 3
Plan No	



LEGEND

- CELL BOUNDARY
- EXISTING CAPPING (CELL 1)
- CAPPING EXTENT
- SOIL BUND
- EXISTING CELL 1 AND 2 LEACHATE PUMP

NOTES

1. VETIVER GRASS TO BE PLANTED IN ROWS AT 1M SPACING WITH GRASSES PLANTED AT 0.5m CENTRES.

2. STORMWATER BUND 0.3m HIGH AND 0.5M WIDE TO BE GRADED TO DIRECT WATER TO THE WEST SIDE OF THE CELL.

3. SPRAY IRRIGATION SYSTEM DESIGNED TO DELIVER 10mm/HOUR TO IRRIGATION AREA VIA OVERHEAD SPRAYS.

City of Mount Gambier
BLUE LAKE CITY

Drawn by	SG FEB 2018
Designed by	
Approved by	
Co–ordinates	
Height Datum	
Level book	
CAD ref	
Survey ref	

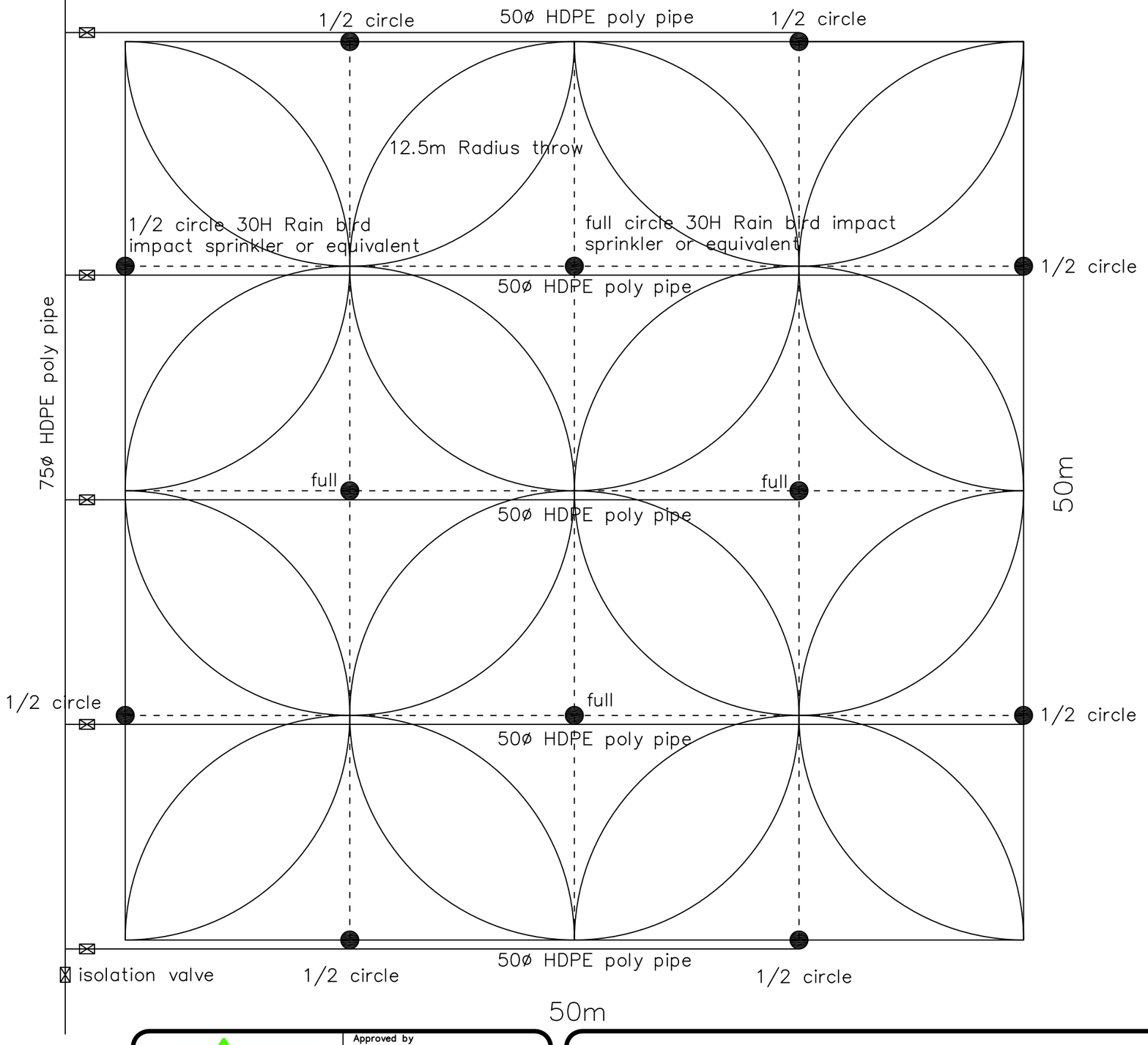
CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

PLOT LOCATION

Scale	Sheet No
1:1000	2 OF 3
Plan No	

grass planted in rows at 1.0m centres. Plant spacing at 0.5m centres.



City of Mount Gambier BLUE LAKE CITY	Approved by
	Co-ordinates
	Height Datum
	Level book
Drawn by SG FEB 2018	CAD ref
Designed by	Survey ref

CITY OF MOUNT GAMBIER

CAROLINE LANDFILL

GRASS TRIAL LAYOUT PLAN

Scale	Sheet No
1:250	3 0F 3
Plan No	

Pond 1 → Pond 2 → Pond 3

Analytical Results

Average.

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	—
			Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit	EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EA005: pH								
pH Value	---	0.01	pH Unit	8.47	9.23	9.07	7.85	8.92 ---
EA015: Total Dissolved Solids								
Total Dissolved Solids @ 180°C	---	10	mg/L	6460	1300	1640	8870	---
EA025: Suspended Solids								
Suspended Solids (SS)	---	5	mg/L	98	314	92	54	---
EA037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	---
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	108	84	87	<1	---
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	3070	302	404	4850	---
Total Alkalinity as CaCO3	---	1	mg/L	3180	386	491	4850	---
EA045: Solids (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	191	18	13	580	---
EA065: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1630	516	670	1810	---
EG020F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	38	18	11	59	---
Magnesium	7439-95-4	1	mg/L	89	35	43	91	---
Sodium	7440-23-5	1	mg/L	1330	306	425	1480	---
Potassium	7440-09-7	1	mg/L	624	127	168	681	---
EG020T: Dissolved Metals by ICP-MS								
Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	<0.0001	0.0002	---
Chromium	7440-47-3	0.001	mg/L	0.026	<0.001	<0.001	0.030	---
Copper	7440-50-8	0.001	mg/L	0.002	0.002	<0.001	0.008	---
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	---
Zinc	7440-66-6	0.005	mg/L	0.047	<0.005	0.006	0.260	---
Iron	7439-89-6	0.05	mg/L	0.90	0.19	<0.05	0.91	---
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.21	0.71	0.04	0.09	---
Barium	7440-39-3	0.001	mg/L	0.046	0.038	0.005	0.086	---
Cadmium	7440-43-9	0.0001	mg/L	0.0003	<0.0001	<0.0001	0.0004	---
Chromium	7440-47-3	0.001	mg/L	0.027	0.002	<0.001	0.037	---
Copper	7440-50-8	0.001	mg/L	0.006	0.005	0.002	0.015	---
Lead	7439-92-1	0.001	mg/L	0.002	0.002	<0.001	<0.001	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Unit	Client sample ID: LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
				Client sampling date / time: 01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
				EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EG020T: Total Metals by ICP-MS - Continued								
Manganese	7439-96-5	0.001	mg/L	0.083	0.144	0.023	0.162	---
Nickel	7440-02-0	0.001	mg/L	0.149	0.011	0.015	0.204	---
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	---
Tin	7440-31-5	0.001	mg/L	0.003	<0.001	<0.001	0.006	---
Zinc	7440-66-6	0.005	mg/L	0.100	0.088	0.008	0.392	---
Boron	7440-42-8	0.05	mg/L	1.64	0.35	0.33	1.82	---
Iron	7439-89-6	0.05	mg/L	2.10	2.27	0.21	1.46	---
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	---
EG050T: Total Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	---
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	0.007	---
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	286	1.46	1.46	743	---
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	---	0.01	mg/L	0.30	<0.01	<0.01	16.1	---
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	1.70	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	---	0.01	mg/L	0.30	<0.01	<0.01	17.8	---
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	---	0.1	mg/L	844	45.4	20.0	1710	---
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	---	0.01	mg/L	3.55	3.02	0.68	1.09	2.42
EN055: Ionic Balance								
Total Anions	---	0.01	meq/L	113	22.6	29.0	160	---
Total Cations	---	0.01	meq/L	---	20.3	26.9	---	---
Total Cations	---	0.01	meq/L	114	---	---	160	---
Ionic Balance	---	0.01	%	---	5.37	3.79	---	---
Ionic Balance	---	0.01	%	2.98	---	---	4.88	---
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	---	1	mg/L	302	140	92	274	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
			Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit	EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EP010: Formaldehyde								
Formaldehyde	50-00-0	0.1	mg/L	0.3	0.2	0.1	0.2	---
EP020: Oil and Grease (O&G)								
Oil & Grease	---	5	mg/L	<5	<5	<5	<5	---
EP030: Biochemical Oxygen Demand (BOD)								
Biochemical Oxygen Demand	---	2	mg/L	21	22	29	41	---
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
beta-BHC	319-85-7	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
gamma-BHC	58-89-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
delta-BHC	319-86-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Heptachlor	76-44-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Aldrin	309-00-2	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Heptachlor epoxide	1024-57-3	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
trans-Chlordane	5103-74-2	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
alpha-Endosulfan	959-98-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
cis-Chlordane	5103-71-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Dieldrin	60-57-1	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
4,4`-DDE	72-55-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Endrin	72-20-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
beta-Endosulfan	33213-65-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
4,4`-DDD	72-54-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Endrin aldehyde	7421-93-4	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Endosulfan sulfate	1031-07-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
4,4`-DDT	50-29-3	2.0	µg/L	<2.0	<4.0	<2.0	<2.0	---
Endrin ketone	53494-70-5	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Methoxychlor	72-43-5	2.0	µg/L	<2.0	<4.0	<2.0	<2.0	---
^ Total Chlordane (sum)	---	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
^ Sum of DDD + DDE + DDT	---	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Demeton-S-methyl	919-86-8	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
			Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit	EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EP068B: Organophosphorus Pesticides (OP) - Continued								
Monocrotophos	6923-22-4	2.0	µg/L	<2.0	<4.0	<2.0	<2.0	---
Dimethoate	60-51-5	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Diazinon	333-41-5	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Parathion-methyl	298-00-0	2.0	µg/L	<2.0	<4.0	<2.0	<2.0	---
Malathion	121-75-5	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Fenthion	55-38-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Parathion	56-38-2	2.0	µg/L	<2.0	<4.0	<2.0	<2.0	---
Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Fenamiphos	22224-92-6	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Prothiofos	34643-46-4	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Ethion	563-12-2	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Carbophenothion	786-19-6	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
EP068C: Triazines								
Atrazine	1912-24-9	0.5	µg/L	<0.5	<1.0	1.6	<0.5	---
Simazine	122-34-9	0.5	µg/L	<0.5	<1.0	<0.5	<0.5	---
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	---
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	---
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	---
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	---
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5	---
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	---
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5	---
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5	---
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5	---
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5	---
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5	---
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5	---
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
				Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit		EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EP074A: Monocyclic Aromatic Hydrocarbons - Continued									
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	<5	<5	---
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	<50	<50	---
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	<50	<50	---
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	<50	<50	---
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	<50	<50	---
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	<5	<5	---
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	<5	<5	---
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	<5	<5	---
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	<5	<5	---
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	<5	<5	---
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	<5	---
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	<50	---
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	<50	---
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	<50	---
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	<50	---
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	<50	---
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	<50	---
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	<5	---
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	<5	---
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	<5	---
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	<5	---
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	<5	---
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	<5	---
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	<5	---
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	<5	---
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	<5	---
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	<5	---
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	<5	---
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	<5	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
			Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit	EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EP074E: Halogenated Aliphatic Compounds - Continued								
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5	<5	---
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5	<5	---
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5	<5	---
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5	<5	---
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5	<5	---
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5	<5	---
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5	<5	---
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5	<5	---
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5	<5	---
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	<5	<5	---
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5	<5	---
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5	<5	---
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	---
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	---
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5	<5	---
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5	<5	---
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5	<5	---
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5	<5	---
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	---
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5	<5	---
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	---
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	---
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	---
EP074H: Naphthalene								
Naphthalene	91-20-3	7	µg/L	<7	<7	<7	<7	---
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	<2.0	<2.0	<2.0	---
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	LP1_1/5/13	LP2_1/5/13	LP3_1/5/13	SUMP_1/5/13	---
			Client sampling date / time	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	01-MAY-2013 14:00	---
Compound	CAS Number	LOR	Unit	EM1304572-001	EM1304572-002	EM1304572-003	EM1304572-004	---
EP075(SIM)A: Phenolic Compounds - Continued								
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
4-Chloro-3-Methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	---
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	<2.0	<2.0	---
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	---	20	µg/L	<20	<20	<20	30	---
C10 - C14 Fraction	---	50	µg/L	640	<50	<50	800	---
C15 - C28 Fraction	---	100	µg/L	1840	580	210	2600	---
C29 - C36 Fraction	---	50	µg/L	180	400	60	170	---
^ C10 - C36 Fraction (sum)	---	50	µg/L	2660	980	270	3570	---
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	---	20	µg/L	<20	<20	<20	<20	---
>C10 - C16 Fraction	---	100	µg/L	950	210	<100	1230	---
>C16 - C34 Fraction	---	100	µg/L	1660	740	240	2270	---
>C34 - C40 Fraction	---	100	µg/L	<100	170	<100	<100	---
^ >C10 - C40 Fraction (sum)	---	100	µg/L	2610	1120	240	3500	---
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	68.0	62.0	87.0	69.0	---
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	73.0	88.0	90.0	109	---
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	123	113	110	124	---
Toluene-D8	2037-26-5	0.1	%	111	104	102	126	---
4-Bromofluorobenzene	460-00-4	0.1	%	94.3	86.9	85.6	103	---
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	35.4	17.7	20.5	12.0	---
2-Chlorophenol-D4	93951-73-6	0.1	%	60.0	32.3	27.9	38.8	---
2.4.6-Tribromophenol	118-79-6	0.1	%	114	63.5	99.7	93.9	---
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	83.8	57.8	86.5	92.6	---

Table 1 Long term average levels of pollutants in Stotts Creek Leachate

Test	Units	Levels (ranges)	Carolnic maximum levels
pH	-	7.2 – 9.3	~~8.42~~ 9.23
Conductivity	µScm^{-1}	199 – 11,150	
Alkalinity (Total)		256 – 1 262	
Redox Potential	Mv	-86 – +144	
Dissolved Oxygen	mg/L	0.2 – 30	
Nitrate	mg/L	<0.01 – 10.5	0.30
Nitrite	mg/L	1.4 – 5.9	0.30
Ammonia	mg/L	0.01 – 410	286
Total N	mg/L	31.8 – 48.1	
* Total Phosphorus	mg/L	0.04 – 3.5	~~2.42~~ 3.55
Chloride	mg/L	215 – 1700	1630
Fluoride	mg/L	0.2 – 1.1	
Sodium	mg/L	153 – 2680	1330
Calcium	mg/L	<1 – 658	38
Potassium	mg/L	78 – 1650	624
Magnesium	mg/L	20 – 96	89
Sulphate	mg/L	3.8 – 134	191
BOD	mg/L	<2 – 640	29
Total Suspended Solids	mg/L	6 – 3243	314
Total Organic Carbon	mg/L	43 – 1440	302
Aluminum	mg/L	<0.1 – 1.0	0.71
Arsenic	mg/L	<0.01 – 0.12	
Boron	mg/L	0.5 – 2.1	1.64
Cadmium	mg/L	<0.01 – 0.03	0.0003
Copper	mg/L	<0.01 – 0.06	0.006
Chromium	mg/L	0.01 – 0.34	0.026
Iron	mg/L	0.09 – 7.0	0.19
Lead	mg/L	<0.01 – 0.03	0.002
Manganese	mg/L	0.01 – 1.74	0.144
Mercury	mg/L	<0.0001 – 0.001	<0.0001
Zinc	mg/L	<0.1 – 0.4	0.10

Table 2 ANZECC guideline levels as compared with average levels of pollutants in leachate

Test	Units	Levels (ranges)	ANZECC
pH	-	7.2 - 9.3	4 – 9
Conductivity	µScm^{-1}	199 – 11,150	750
Total N	mg/L	31.8 – 48.1	0.35
Total Phosphorus	mg/L	0.04 – 3.5	0.025
Chloride	mg/L	215 – 1700	700
Fluoride	mg/L	0.2 – 1.1	4
Sodium	mg/L	153 – 2680	460
Sulphate	mg/L	3.8 - 134	1 000
BOD	mg/L	<2 – 640	20
Aluminum	mg/L	<0.1 – 1.0	20
Arsenic	mg/L	<0.01 – 0.12	2
Cadmium	mg/L	<0.01 – 0.03	0.5
Copper	mg/L	<0.01 – 0.06	5
Chromium	mg/L	0.01 – 0.34	1
Iron	mg/L	0.09 – 7.0	10
Lead	mg/L	<0.01 – 0.03	2
Manganese	mg/L	0.01 – 1.74	10
Mercury	mg/L	<0.0001 – 0.001	0.002
Zinc	mg/L	<0.1 – 0.4	5
Total Suspended Solids	mg/L	6 – 3 243	30

* limit exceeded stotts creek values

Landfill Leachate Disposal with Irrigated Vetiver Grass

Ian Percy[1], and Paul Truong[2]

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[2]*Veticon Consulting, Brisbane, Queensland, Australia*

Abstract: Stotts Creek Landfill is a major waste depot of the Tweed Shire receiving wastes from both Tweed Heads and Murwillumbah townships and neighboring local government areas. Disposal of leachate is a major concern of the Shire as the landfill site is close to agricultural areas. An effective and low cost leachate disposal system is needed, particularly during summer high rainfall season.

As vetiver grass has a very high water use and nutrient uptake rates, and it is tolerant to elevated levels of heavy metals and other adverse conditions, it is best suited for effluent and leachate disposal.

Leachate quality at Stotts Creek Landfill is low in heavy metals but relatively high in salts and nutrients. Currently leachate and runoff from the landfill site are stored in ponds at the foot of the mound. During dry periods the leachate is irrigated onto the top of the completed waste mound where it evaporates or transpires into the atmosphere. During heavy rainfall the leachate overflows into a system of wetlands and then to a local creek.

Following capping and topsoiling, vetiver has been planted on the surface of the completed waste mound and irrigated with leachate from collecting ponds. So far an area of 3.5 ha has been planted with vetiver and the land area will be extended to about 6 ha in total late in 2003.

Results to date has been excellent, as soon as an area was planted it was irrigated with leachate by overhead spray irrigation and almost 100% establishment was achieved.

Key words: Vetiver, leachate disposal, irrigation, nutrient, phytoremediation

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1 INTRODUCTION

The Tweed Shire is situated on the most northern shire of New South Wales and covers an area of 1300 km^2, with a total population of about 75,000 people, which scattered over most of the shire. There are several large to medium size towns in the shire, including Tweed Heads and Murwillumbah, the capital of the shire. The main business activities of the shire are tourism and agriculture production, tourism is a rapidly expanding industry.

2 THE PROJECT

2.1 Stotts Creek landfill Site

Stotts Creek landfill site is one of the major landfills currently being operated by the Waste Management Section of the Tweed Council. This site receives wastes from the towns of Tweed Heads and Murwillumbah, and also from the adjacent Byron Shire and City of Gold Coast in Queensland.

This site was started 20 years ago, where both dry and wet wastes were dumped together, compacted with heavy machinery and covered with a thin layer of clay to control odor and vermin. Therefore over the years the mound has gradually built up to the present size of about 35 m high and 300 m long, with many layers of waste and clay.

2.2 Current Treatment System

Currently both leachate and surface water are separated where possible to reduce the volume of leachate. The surface water is discharged to local streams via an artificial wetland, which was constructed to help improve the water quality leaving the site. The leachate is stored in a dam in the lower portion of the site and is irrigated onto completed and partially completed sections of the landfill to provide for evaporation and transpiration into the atmosphere. The amount of leachate able to be disposed of by this method is limited, particularly during high rainfall periods. During periods of heavy rainfall, excess leachate has to be transported off site to Council's effluent treatment plan. Although this practice is very inefficient and costly, it has to be done for Council to comply with Environment Protection Authority License Conditions. Therefore effective disposal of leachate is a major concern to Council (Photo 1).

Photo 1 Leachate pond and excess leachate is taken away during high rainfall period

2.3 Anticipated Future Need

The tourist industry and population growth in the Shire is expected to grow substantially in the near future; hence an expanded landfill facility is required to service the Shire. The Council is therefore looking for a cost effective and more efficient leachate treatment method than the existing irrigation / transport system to cope with this future need. After looking at various options, Vetiver System is considered to be a more appropriate solution to the Shire requirement.

2.4 Leachate Quality

The levels of pollutants in leachate varied greatly due to rainfall and seasonal changes. In general, monitoring over a five year period form 1998 to the end of 2002 indicates that the leachate is high in pH, Chloride and Sulphate salts, mainly sodium chloride; high in nutrients particularly N and relatively low in heavy metals (Table1). However some of these exceed the guideline levels set up by ANZECC (Table 2).

2.5 License Limit

The License Conditions permits the discharge of leachate offsite after a rainfall event of 430 mm over 5 days. Leachate is not permitted to be discharged during lesser rainfall events.

3 VETIVER SYSTEM FOR LEACHATE CONTROL

Application of the Vetiver System (VS) for wastewater treatment is a new and innovative phytoremedial technology developed in Queensland by the Department of Natural Resources and Mines,

Table 1 Long term average levels of pollutants in Stotts Creek Leachate

Test	Units	Levels (ranges)
pH	-	7.2 – 9.3
Conductivity	μScm^{-1}	199 – 11,150
Alkalinity		256 – 1 262
Redox Potential	Mv	-86 – +144
Dissolved Oxygen	mg/L	0.2 – 30
Nitrate	mg/L	<0.01 – 10.5
Nitrite	mg/L	1.4 – 5.9
Ammonia	mg/L	0.01 – 410
Total N	mg/L	31.8 – 48.1
Total Phosphorus	mg/L	0.04 – 3.5
Chloride	mg/L	215 – 1700
Fluoride	mg/L	0.2 – 1.1
Sodium	mg/L	153 – 2680
Calcium	mg/L	<1 – 658
Potassium	mg/L	78 – 1650
Magnesium	mg/L	20 – 96
Sulphate	mg/L	3.8 – 134
BOD	mg/L	<2 – 640
Total Suspended Solids	mg/L	6 – 3243
Total Organic Carbon	mg/L	43 – 1440
Aluminum	mg/L	<0.1 – 1.0
Arsenic	mg/L	<0.01 – 0.12
Boron	mg/L	0.5 – 2.1
Cadmium	mg/L	<0.01 – 0.03
Copper	mg/L	<0.01 – 0.06
Chromium	mg/L	0.01 – 0.34
Iron	mg/L	0.09 – 7.0
Lead	mg/L	<0.01 – 0.03
Manganese	mg/L	0.01 – 1.74
Mercury	mg/L	<0.0001 – 0.001
Zinc	mg/L	<0.1 – 0.4

Table 2 ANZECC guideline levels as compared with average levels of pollutants in leachate

Test	Units	Levels (ranges)	ANZECC
pH	-	7.2 - 9.3	4 – 9
Conductivity	μScm^{-1}	199 – 11,150	750
Total N	mg/L	31.8 – 48.1	0.35
Total Phosphorus	mg/L	0.04 – 3.5	0.025
Chloride	mg/L	215 – 1700	700
Fluoride	mg/L	0.2 – 1.1	4
Sodium	mg/L	153 – 2680	460
Sulphate	mg/L	3.8 - 134	1 000
BOD	mg/L	<2 – 640	20
Aluminum	mg/L	<0.1 – 1.0	20
Arsenic	mg/L	<0.01 – 0.12	2
Cadmium	mg/L	<0.01 – 0.03	0.5
Copper	mg/L	<0.01 – 0.06	5
Chromium	mg/L	0.01 – 0.34	1
Iron	mg/L	0.09 – 7.0	10
Lead	mg/L	<0.01 – 0.03	2
Manganese	mg/L	0.01 – 1.74	10
Mercury	mg/L	<0.0001 – 0.001	0.002
Zinc	mg/L	<0.1 – 0.4	5
Total Suspended Solids	mg/L	6 – 3 243	30

3.1 Vetiver Grass

VS is based on the use of vetiver grass (*Vetiveria zizanioides* (L.) Nash) for various applications, ranging from erosion and sediment control to phytoremediation. Research conducted by NRM showed that Monto vetiver grass has a fast and very high capacity for absorption of nutrients, particularly nitrogen and phosphorus in wastewater. In addition it has a very high water use rate and tolerant to elevated levels of salts, heavy metals and agrochemicals in the effluent or leachate (Tables 3 and 4). As a result of these findings, presently VS has been used successfully for these purposes in Australia, China, Thailand and Vietnam (Anon., 1997; Truong and Hart, 2001; Truong, 2000; Truong and Baker, 1998; Xia *et al.*, 2000; Zheng *et al.*, 1997).

3.2 Australian Research Results

A demonstration site was set up in Brisbane to treat effluent discharged from a septic system. Vetiver grass was selected after the failure of other plants including a variety of fast growing tropical grasses and trees, and crops such as sugar cane and banana to absorb the effluent discharge from the septic tank on a public park. After five-month growth, vetiver was more than 2 m tall and a stand of about 100 vetiver plants in an area less than 50 m^2 have completely dried up the effluent discharge (Photo 2).

Groundwater monitoring (collected at 2m depth) showed that after passing through 5 rows of vetiver the levels of total N reduced by 99% (from 93 to 0.7 mg/L), total P by 85% (from 1.3 to 0.2 mg/L), and faecal coliforms by 95% (from 500 to 23 organisms/100 ml). These levels are well below the following thresholds set out in ARMCANZ and ANZECC (1997).

- Total Nitrogen <10 mg/L
- Total Phosphorus <1 mg/L
- *E. coli* <100 organisms/100ml

Photo 2 ***Left,*** **new vetiver planting to treat sewage effluent from a septic tank,** ***Right,*** **8 months later, vetiver completely absorbed all the effluent discharge**

3.3 High Water Use Rate

Research conducted to determine water use capacity of vetiver grass showed under wetland conditions, vetiver had the highest water use rate as compared with other wetland plants such as *Iris pseudacorus, Typha spp.*, *Schoenoplectus validus*, and *Phragmites australis*. At the average consumption rate of 600 ml/day/pot over a period of 60 days, vetiver used 7.5 times more water than Typha (Cull *et al.*, 2000).

The water use rate of vetiver is also strongly correlated to its dry matter yield. From this correlation it was estimated that for 1 kg of dry shoot biomass, vetiver would use 6.86 L/day. Under favourable growing conditions, a mature sward of vetiver is expected to yield 41 t/ha/3 months, so a hectare of

Table 3 Threshold levels of heavy metals to vetiver growth as compared with other species

Heavy Metals	Threshold levels in soil (mg kg^{-1}) [a]		Threshold levels in plant (mg kg^{-1})	
	Vetiver	Other plants	Vetiver	Other plants
Arsenic	100-250	2.0	21-72	1-10
Cadmium	20-60	1.5	45-48	5-20
Copper	50-100	Not available	13-15	15
Chromium	200-600	Not available	5-18	0.02-0.20
Lead	>1 500	Not available	>78	Not available
Mercury	>6	Not available	>0.12	Not available
Nickel	100	7-10	347	10-30
Selenium	>74	2-14	>11	Not available
Zinc	>750	Not available	880	Not available

[a] Available elements

Table 4 Salt tolerance level of vetiver grass as compared with some crop and pasture species grown in Australia (Truong *et al*., 2002)

Plant Species	Soil EC_{se} (dSm^{-1})	
	Saline Threshold	50%Yield Reduction
Bermuda Grass (*Cynodon dactylon)*	6.9	14.7
Rhodes Grass (C.V. Pioneer) (*Chloris guyana*)	7.0	22.5
Tall Wheat Grass (*Thynopyron elongatum*)	7.5	19.4
Cotton (*Gossypium hirsutum*)	7.7	17.3
Barley (*Hordeum vulgare*)	8.0	18.0
Vetiver (*Vetiveria zizanioides*)	8.0	20.0

3.4 VS for Landfill Leachate Control

Vetiver grass was first recognised early in the 1990s for having a “super absorbent” characteristics suitable for the treatment of wastewater and leachate generated from landfill in Queensland (Truong and Stone, 1996). Although this technology was used to treat landfill leachate in the past, recently it has been used in a large scale in China and Australia.

3.4.1 Landfill leachate treatment overseas

In Guangdong Province, China, the Datianshan landfill was built in 1985; it has a surface area over 23 ha and currently takes 2500 t of waste a day from Guangzhou City. This landfill is built at a nearby valley, where two earthen walls built across the valley floor with semi-weathered rocks and clay but they are not properly designed and well built as normal dam walls. The city garbage was then dumped and compressed into the space between the two walls. When the garbage reached few meters high, the surface was covered with earth then with heavy plastic sheets to cover the whole surface. When the space was completely filled with wastes the two walls were raised to take more garbage. The walls are now 75 m high and 100 m long, which had very high pressure caused by both large amount of garbage and heavy machinery working on the surface layer. As a result, large quantity of leachate seeped through the wall causing slippage and erosion in rainy season. Previous attempts to stabilise the wall with both native and imported vegetation have failed because of the toxic nature of the leachate.

Vetiver was planted in November 2000 to stabilise the dam wall and to reduce seeping leachate. Despite the extremely poor soil (crushed weathered rock, highly compacted and extremely poor in nutrients) vetiver established and not only succeeded in stabilizing the dam wall, it has also dried up leachate seepage. Vetiver also grew well on the edge of highly toxic leachate pools; both native and introduced plants were killed (Photo 3) (Xia *pers. com*.). In Thailand vetiver was also used successfully to treat landfill leachate seepage.

Photo 3 ***Left,*** **Vetiver planted for leachate seepage control and dam wall stabilisation**
Right, **Vetiver grew well in toxic leachate pool while other plants died**


3.4.2 Landfill leachate treatment in Australia

VS has also been used successfully to treat leachate from landfill seepage in Cleveland (Photo 4) and Port Douglas in Queensland; Armidale City (Photo 5) and Lithgow City in New South Wales.

Photo 4 ***Left,*** **Toxic leachate seepage at the foot of an old landfill at Cleveland**
Right, **One year after planting, Vetiver grew well and dry up the seepage**


Photo 5 ***Left,*** **Toxic leachate seepage at the foot of an working landfill at Armidale**
Right, **One and half year after planting, Vetiver grew well and dry up the seepage**


4 TREATMENT PROCESS

The treatment process involves:

- Some evaporation loss by a high pressure and fine irrigation system and
- Mainly on the extensive land area planted with vetiver grass.

Due to its high water use rate, high absorption of nutrients and high level of tolerance to salinity, alkalinity and pollutants including heavy metals, vetiver is expected dispose of all leachate produced at this site. Based on the water use date presented above, at the peak of its growth stage**,** 6ha of vetiver planting would use up to 1.68 ml/day, without any surface runoff or deep drainage.

5 IMPLEMENTATION

5.1 The Site

When the designed height was reached, the mound top surface was first capped with a thick layer of impervious clay and then topped up with topsoil and organic mulch. The planting area consists of a short northern slope (100 m) of about 15% gradient and a longer (300 m) southern slope of 10% gradient, both slopes drain to a flat area near the middle where excess rain water will be collected and drain off the mound to the storage ponds (Fig.1 and Photo 6). Because of this gradient vetiver was planted on contour lines to spread irrigated and rain water evenly down slope.

Fig. 1 Cross section (left) and longitudinal section (right) of the Stotts Creek landfill mound

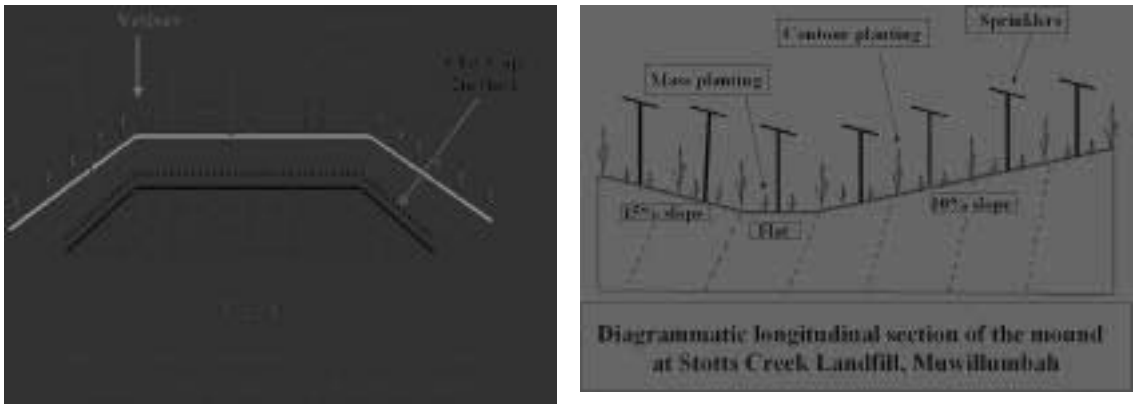

Photo 6 Side view (left) and top view (right) of the landfill mound, which has been mulched

5.2 Ground Preparation

The whole area was first surveyed and contour lines marked out before planting. Due to the thick layer of mulch, a small backhoe was used to mix up the mulch and topsoil for planting (Photo 7).

Photo 7 Contour lines marked before planting (left) and after planting (right) on the mound

5.3 Planting

The total land area on the top of the mound is about 6 ha, but so far only 3.5 ha has been planted, as the will be planted when the site is ready. Vetiver was planted in two patterns:

- Thick contour hedges (10 plants/m) to spread runoff and irrigation water, the contour lines were planted at 0.5 m Vertical Interval. Vetiver tube stock was used for the contour lines planting.
- Random pattern in the areas between the hedges planted with bare root slips (Photo 8).

The overall planting density is at 5 plants per square metre. Due to the variation in nutrient levels of the leachate, Di-Ammoniun Phosphate was used at the rate of 500 kg/ha at planting.

Photo 8 Random planting between contour lines

5.4 Irrigation System

An overhead spray irrigation system was installed and used immediately after planting each day. This system has a capacity of delivering 1300 L/min (Photo 9).

5.5 Weeds Control and Maintenance

Under the nutrient rich and irrigated conditions, weed control is needed on this site. After planting, pre-emergent herbicide Atrazine was used to control weed. To ensure best growth occasional fertiliser application may be required in the future.

6 RESULTS SO FAR

6.1 Establishment and Growth

Excellent establishment was obtained on the contour lines with potted vetiver (100%) and very good rate (90%) were also achieved with bare root slips (Photo 10).

Photo10 Excellent establishment and growth three months after planting

6.2 Unexpected Problem

An unexpected problem occurred after planting. As a large population of Ibis lives at this landfill site, the birds often rest on the top of the mound. In some newly planted sections, up to 30% of bare toot slip planting were lost when the birds pulled up the slips form the ground. The birds also damaged some

older plants when they sat on them. As no solution has been found for this problem, replanting was done using potted plants.

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A Brief Introduction to the First Author

Ian Percy has been employed in Local Government in New South Wales, Australia for almost 25 years in the fields of Environmental Health, Building Control and Waste Management, the last 16 years at Tweed Shire and the last 7 years in Waste Management. His major responsibilities include the supervision of the waste collection and disposal contractor and the improvement of the environmental performance of Council's Landfill Operations.

Removal of nutrient and heavy metal loads from sewage effluent using vetiver grass, *Chrysopogon zizanioides* (L.) Roberty

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ABSTRACT

Urban cities in many developing nations face the challenge of relieving the pressure exerted on overloaded sewage treatment works. Apart from limited financial capacity, complementary treatment methods like phyto-extraction of pollutants from the effluent have not been fully exploited, particularly in southern Africa. A study was conducted in Harare, Zimbabwe, to assess the potential of vetiver grass, *Chrysopogon zizanioides*, in removing N, P, Zn, Mn and Ni loads in sewage effluent from primary clarification, under hydroponic conditions. Vetiver grass was grown from tillers on floating trays suspended in effluent, and the total concentrations of selected parameters were monitored in both effluent and vetiver grass at 0, 7, 14 and 21 days of retention in effluent. Higher pollutant reduction (62–100%) in effluent, with respect to all parameters, under vetiver grass compared to no vetiver treatment (9–27%), was recorded by Day 21. Effluent pH remained stable at 7.44–7.64. Smaller changes were found for N (9.8 from 27.5 mg·ℓ$^{-1}$) and P (2.0 from 5.3 mg·ℓ$^{-1}$) than for the heavy metals. Vetiver grass dry biomass accumulated at 3.8–4.7 g·tiller^{-1}·week^{-1}, while heavy metal extraction (up to 6.2 mg Zn, 3.3 mg Mn and 0.06 mg Ni tiller^{-1}) by root uptake increased with time at an exponential rate (R^2, 0.73–0.83). The study established that, while root uptake was a significant feature of the clean-up process, the corresponding high reduction of heavy metals in effluent suggests multiple removal mechanisms, including bio-sorption by microorganisms producing an immobilised microbial biomass on the container wall. A deliberate lowering of effluent pH may increase root uptake thereby possibly reducing the clean-up time and improving effluent quality. There is potential for application of this technology in cities struggling with the cost of conventional sewage treatment.

Keywords: bio-accumulation, bio-sorption, heavy metals, hydroponic, nitrogen, phosphorus

INTRODUCTION

The primary objective of wastewater treatment is to allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment (Pescod, 1992). Apart from safe disposal, treatment of wastewater reduces the cost of water purification, especially in cases where the catchment basins receiving treated effluent are also the main sources of domestic water. This is largely the case of Lake Chivero in Harare, Lake Mutirikwi in Masvingo, and many other catchments within which the major cities of Zimbabwe are located. Many studies have reported considerable damage to the natural environment and potential health risks that were attributed to inadequate treatment and poor disposal of sewage in Zimbabwe (Nyamangara and Mzezewa, 1999; Madyiwa et al., 2002; Mapanda et al., 2005; 2007; Ndebele and Mzime, 2012). On the same note, the attempts to relieve pressure on the overloaded sewage treatment works have been hindered by lack of financial capacity, more than lack of technical capacity (Thebe and Mangore, 2012). However, it is apparent that limited research on cheaper complementary sewage treatment methods could also have diminished the hope of finding sustainable solutions to the wastewater treatment problem.

Most conventional sewage treatment methods incorporate mechanical and chemical processes that are labour-intensive, require large amounts of energy resources, and are costly (Prasad, 2011). The restructuring of existing sewage and water plants and their pumping stations, which came into effect in June 2013, is projected to cost about ZAR1 440 million (ZAR10 ≈ USD1 as at June 2013) for Harare alone (CMEC, 2013). However, there are a number of sewage treatment methods that can perform a complementary function for a centralised sewage treatment system. Gutterer et al. (2009) described some decentralised wastewater treatment systems designed by planners and engineers in developing countries to reduce system overloading and overall generation of wastewater. One of the key components of these systems is the use of plants to remove nutrient loads from wastewater that has gone through the initial sedimentation process.

The extraction of nutrients from sewage using a free-floating plant, water hyacinth, *Eichhornia crassipes*, may have been one of the earliest attempts to decentralise wastewater treatment in Zimbabwe. It, however, became problematic when the noxious weed colonised large areas of waterways, mainly because *E. crassipes* had no natural enemies in Zimbabwe, and caused anoxic conditions upon its decomposition (Mahamadi, 2011). Many studies worldwide have given a non-invasive plant, vetiver grass, *Chrysopogon zizanioides* (L.) Roberty, as an answer to low-cost complementary technology in sewage treatment systems (Boonsong and Chansiri, 2008; Gerrard, 2008; Roongtanakiat, 2009; Gupta et al., 2012; Paz-Alberto and Sigua, 2013). In their support, researchers argue that vetiver grass has a high absorption rate for nutrients and heavy metals in wastewater, and a high adaptive capacity under different climatic and growth media conditions. However, the plant is not free-floating, like most waterweeds. Truong and Baker (1998) reported on a water purification study in China, which showed that vetiver grass can reduce soluble P by up to 99% after 3 weeks,

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and soluble N by up to 74% after 5 weeks, and had potential to remove up to 102 t N and 54 t P per hectare of vetiver per year. Such properties could make this plant suitable as a cheaper and more effective complementary treatment option for sewage effluent in Harare.

The objective of the current study was to assess the potential of vetiver grass in removing nutrient and heavy metal loads from wastewater composed of both domestic and industrial sewage effluent in Harare, Zimbabwe. Many researchers have used vetiver grass for the removal of water contaminants but the responses differed with climatic conditions as well as the concentration of the contaminants (Gupta et al., 2012). It was therefore hypothesised that vetiver grass grown on floating platforms in sewage effluent without soil media can accumulate significant biomass while effecting significant extraction of nutrients and heavy metals through its root system under the local conditions in Harare.

MATERIALS AND METHODS

Study sites, floating platform installation and treatments

The study was conducted between February and May 2013 in a glasshouse at the University of Zimbabwe in Harare, using untreated sewage effluent from the Firle Sewage Treatment Works (FST-Works) and propagated vetiver grass cuttings from Environment Africa in Harare. A glasshouse was used to avoid effluent dilution by incoming rainfall but allowed free movement of ambient air to reduce the differences in temperature and humidity between the inside and outside. The FST-Works extends from 30° 55.97' E to 30° 56.33' E, and lies between 17° 55.78' S and 17° 56.20' S in south-west Harare. It processes more than 180 000 $m^3 \cdot day^{-1}$ of mixed domestic-and-industrial sewage, while its design capacity is about 144 000 $m^3 \cdot day^{-1}$ (Nhapi, 2009). Thus the system has been overloaded. Currently, the treatment works uses the conventional biological trickling filtration system and the activated sludge biological nutrient removal system for sewage treatment.

Hydroponic stations were constructed from floating rafts and plastic containers using a procedure adapted from Truong and Hart (2001), Boonsong and Chansiri (2008), and Gerrard (2008). A total of 16 floating raft trays were designed from kaylite material, each measuring 0.5 m in diameter and having 6 cells. The rafts were overlaid on 16 plastic containers, each with a capacity of 9 ℓ and a height of 0.2 m. The experiment was a 2 (with and without vetiver grass) x 4 (effluent retention time: 0, 7, 14 and 21 days) factorial, laid out in a completely randomised design with 4 replicates.

Untreated effluent from FST-Works was collected into a 200-ℓ plastic drum. The effluent was collected soon after the primary sedimentation and before biological nutrient removal. The effluent was added into the 16 containers to a volume of 9 ℓ each. Before adding the effluent, a total of 64 vetiver grass tillers were collected from a nursery and their roots were dipped in distilled water for 21 days in the glasshouse. This was meant to make the plants adapt from being xerophytes to hydrophytes, as recommended by Maffei (2002) and Truong (2007). After 21 days, the aerial part of each tiller was cut at 4 cm from the crown area, taking care not to damage the roots. In all treatments that had vetiver grass the plants were fixed in positions by their crowns on the floating raft trays, with one tiller per cell. The trays were then overlaid on the containers to float, with the roots submerged in effluent and sticking out from the tray bottom. This set up was maintained for up to 21 days.

Sampling and sample preparation

Two replicate samples of untreated effluent, each measuring 0.5 ℓ, were collected for initial characterisation from the 200-ℓ drum with bulk effluent from FST-Works. The samples were collected after mixing using a plastic plunger. Effluent from containers under the floating platforms with and without vetiver grass was also sampled at 0, 7, 14 and 21 days of retention. To facilitate sample collection, the float trays were temporarily removed at each sampling occasion and 0.2 ℓ of effluent was extracted after thorough mixing of the effluent using a plastic plunger. The effluent samples were immediately taken to the laboratory for analysis.

Vetiver grass was sampled just before fixing on the floating trays, and at 7, 14 and 21 days of retention on the floating trays. At each sampling 2 plants from each tray were randomly selected and pulled out as whole plants including their roots. The samples were first air-dried in an open shed for 7 days to remove much of the water in the tissues, then oven-dried at 70°C for 24 h (Campbell and Plank, 1998) and weighed. After oven drying the samples were ground and passed through a 2-mm mesh sieve before their analysis in the laboratory.

Analysis of samples

Effluent from FST-Works was analysed for pH, total dissolved solids, electrical conductivity and total concentrations of N, P, Zn, Ni and Mn, immediately after collection, and for the same nutrients and heavy metals at 0, 7, 14 and 21 days of effluent retention using the methods of water analysis described by Sauter and Stoub (1990) and APHA (1999). All the glassware and crucibles used in the analysis of samples were acid-washed prior to analyses. Effluent pH was measured using a pH meter (model: Mettler Toledo EL-20) calibrated using buffer pH 4 and 7. Electrical conductivity was measured using the conductivity meter (model: WTW Inolab Cond Level 1) calibrated using 0.1 M KCl, after the sample was filtered into a beaker. Total dissolved solids were measured gravimetrically by evaporating 0.1 ℓ of filtered effluent in a previously weighed beaker at 100°C to a constant weight. The difference between the initial and final beaker weight represented the total dissolved solids.

Total N in effluent was measured using the Kjeldhal method in which the sample was digested using concentrated H_2SO_4 followed by steam distillation after alkalination with NaOH in the presence of Devarda's alloy. The amount of N in the sample was determined colorimetrically using the UV-Vis Spectrophotometer after nesslerisation. Total P was determined colorimetrically after the effluent sample was digested using concentrated H_2SO_4. Total Zn, Ni and Mn were determined using the atomic absorption sprectrophotometric method (AAS model: Varian AA50), after dissolving suspended metals by digestion using aqua regia (mixture of concentrated HCl and HNO_3 at a ratio of 3:1) with external heating, obtaining a supernatant solution after centrifuging. The detection limits for Zn, Ni and Mn were 0.002, 0.02 and 0.005 $mg \cdot \ell^{-1}$, respectively.

Vetiver grass was analysed for dry biomass, and total concentrations of Zn, Ni and Mn at 7, 14 and 21 days of effluent retention. At each respective retention time, dry mass of the vetiver grass was weighed using analytical balance before being ground and passed through a 2-mm sieve. The total concentration of Zn, Ni and Mn in vetiver grass were determined using the atomic absorption sprectrophotometric method after ashing each ground plant sample in a crucible in a muffle furnace (Model: Wildbarfield M1354) at 450°C for 24 h. The ash was digested using aqua regia and a supernatant solution was obtained by centrifuging before reading on an AAS.

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Data analysis

Sample analysis data were subjected to homogeneity of variance and normality tests using the Levene's and Kolmogorov-Smirnov's tests, respectively, at the 5% level. One-way multivariate analysis of variance was carried out on data from plant analysis to establish any significant treatment effects (P <0.05). However, effluent data did not meet all assumptions of normality and homogeneity of variance, even after transformation; hence the Kruskal-Wallis one-way analysis of variance was used, while a pair-wise separation of significantly different treatment means was done using the Mann-Witney test. Bivariate correlation analysis (two-tailed) was performed using the Spearman's Rank Correlation Coefficient (rs). Genstat 14 Edition (Lawes Agricultural Trust, UK) and SPSS 16.0 (SPSS Inc., USA) statistical packages were used in data analysis.

RESULTS

Characteristics of sewage effluent

The selected properties of untreated effluent from FST-Works were in the red (high hazard) category in terms of total N, P, Zn, Mn, Ni and total dissolved solids, according to the Effluent and Solid Waste Disposal Regulations in Zimbabwe (Table 1). The heavy metals deviated from the prescribed limits more than a 100-fold, followed by P and total dissolved solids (>10-fold), and, lastly, N which was more than twice the permissible limit.

Removal of pollutants from effluent

The resultant characteristics of effluent at different retention periods with and without vetiver grass are presented in Table 2. All parameters responded to both vetiver and time of retention with the exception of pH. No Zn and Mn could be detected in the effluent by Day 14 of retention under vetiver grass, while the treatment without vetiver had only lost 9 and 11% of initial Zn and Mn, respectively, in the same period of retention. By Day 21 of retention total Ni in effluent was significantly reduced (P <0.05), by 77%, under vetiver treatment, although the remaining concentration was still above the permissible limit. Total P in the effluent under vetiver treatment had decreased (P <0.05) by 62% at Day 21 of retention, compared with a 22% decrease under no vetiver grass for the same period.

Vetiver grass was able to reduce the amount of total N and total dissolved solids in effluent to levels that were acceptable for disposal at Day 21 of retention. This translated to a 64 and

TABLE 1
Selected properties of untreated sewage effluent from Firle Sewage Treatment Works in Harare compared to permissible limits according to the national regulations* (n = 2).

Parameter	Mean total concentration ± std. dev.	Permissible limit
pH	7.6 ± 0.1	6.0–9.0
Electrical conductivity (dS·m^{-1})	6.6 ± 4.5	10
Total dissolved solids (g·ℓ$^{-1}$)	7.0 ± 0.0	0.5
Total nitrogen (mg·ℓ$^{-1}$)	27.5 ± 0.2	10
Total P (mg·ℓ$^{-1}$)	5.3 ± 0.3	0.5
Zinc (mg·ℓ$^{-1}$)	63.7 ± 0.2	0.5
Nickel (mg·ℓ$^{-1}$)	51.4 ± 0.1	0.3
Manganese (mg·ℓ$^{-1}$)	31.0 ± 0.3	0.1

**Environmental Management (Effluent and Solid Waste Disposal) Regulations (2007)*

TABLE 2
Mean effluent pH, electrical conductivity (EC), total dissolved solids (TDS) and total concentrations of selected nutrients and heavy metals under different treatments (n = 4).

Treatment	pH	EC	TDS	N	P	Zn	Ni	Mn
		dS·m^{-1}	mg·ℓ$^{-1}$					
– Vetiver, 00 day	7.62	6.6^{f}	7 025^{e}	27.5^{g}	5.3^{d}	63.7^{d}	51.4^{e}	31.5^{e}
07 day	7.59	6.5^{f}	6 695^{e}	25.6^{f}	4.6^{c}	59.3^{c}	47.6^{d}	28.6^{d}
14 day	7.60	6.2^{e}	5 603^{d}	24.3^{e}	4.1^{b}	58.1^{c}	46.1^{c}	27.8^{d}
21 day	7.61	6.0^{d}	5 138^{c}	23.2^{d}	4.1^{b}	58.2^{c}	43.4^{b}	26.0^{c}
+ Vetiver, 00 day	7.62	6.6^{f}	7 025^{e}	27.5^{g}	5.3^{d}	63.7^{d}	51.4^{e}	31.5^{e}
07 day	7.64	5.1^{c}	1 745^{b}	21.8^{c}	4.0^{b}	21.3^{b}	14.8^{a}	16.3^{b}
14 day	7.53	4.7^{b}	473^{a}	16.8^{b}	2.8^{a}	n/d^{a}	13.0^{a}	n/d^{a}
21 day	7.44	3.9^{a}	367^{a}	9.8^{a}	2.0^{a}	n/d^{a}	12.0^{a}	n/d^{a}
Significance	n/s	*	*	*	*	*	*	*
CV%	1.1	1.7	11.4	6.1	11.8	2.4	6.6	8.8
SED	0.06	0.1	348	0.9	0.3	0.7	1.6	1.3
Permissible limit	6–9	10	500	10	0.5	0.5	0.3	0.1

** Significant at 0.05 probability level; n/d = not detected; n/s = not significant; different letters within a column denote significant differences. Detection limits (mg·ℓ$^{-1}$): Zn = 0.002, Ni = 0.02 and Mn = 0.005*

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95% reduction in total N and total dissolved solids, respectively, at 21 days of retention. However, at this time the treatment without vetiver had only 16 and 27% reduction in the levels of these respective parameters.

Results showed significant negative correlation (P <0.01) between retention time and the amounts of N, P, Zn, Mn and electrical conductivity (rs range: –0 .93 to –0.97), total dissolved solids (rs, –0.77), Ni (rs, –0.69) and pH (rs, –0.61) in the effluent under vetiver treatments. In the treatments with no vetiver the correlation was also significant for all parameters (P <0.01, rs range: –0 .78 to –0.97), except for pH (P >0.05). The regression analysis revealed distinct relationships between the period of retention under vetiver treatment and the levels of the measured parameters in effluent (Table 3). The relationships were linear for electrical conductivity, N and P, and curvilinear (polynomial, second order) with quadratic terms for total dissolved solids, Zn, Ni and Mn.

Vetiver grass biomass production and heavy metal uptake

Survival rate of all vetiver grass tillers on the effluent was 100%. The average dry mass of vetiver grass tillers increased (P <0.05) from 8.9 g at the start of the experiment to 26.5 g at Day 21 of effluent retention under vetiver grass (Fig. 1a). A lag phase in biomass accumulation was observed between Day 7 and Day 14, where the mean biomass reached 18.3 and 18.9 g, respectively. Before this phase the biomass had accumulated at an average rate of 4.7 g·tiller^{-1}·week^{-1}, and after this phase the biomass accumulation rate was about 3.8 g·tiller^{-1}·week^{-1}. The

TABLE 3
Relationships between the amount of a measured parameter (*Y*) in effluent and the retention time (*X*, in days) for the treatments under vetiver grass

Parameter	Relationship	r^2 value	*Y* data range and units
EC	$Y = 6.3 - 0.12[X]$	0.94	3.8–6.6 dS·m^{-1}
TDS	$Y = 0.027[X]^2 - 0.86[X] + 6.9$	0.95	0.1–7.2 g·ℓ$^{-1}$
N	$Y = 27.6 - 0.85[X]$	0.96	7.0–27.7 mg·ℓ$^{-1}$
P	$Y = 5.3 - 0.17[X]$	0.91	1.4–5.6 mg·ℓ$^{-1}$
Zn	$Y = 0.22[X]^2 - 7.57[X] + 63.7$	0.99	0–63.9 mg·ℓ$^{-1}$
Ni	$Y = 0.182[X]^2 - 5.53[X] + 49.6$	0.92	8.0–51.5 mg·ℓ$^{-1}$
Mn	$Y = 0.078[X]^2 - 3.22[X] + 32.4$	0.95	0–31.9 mg·ℓ$^{-1}$

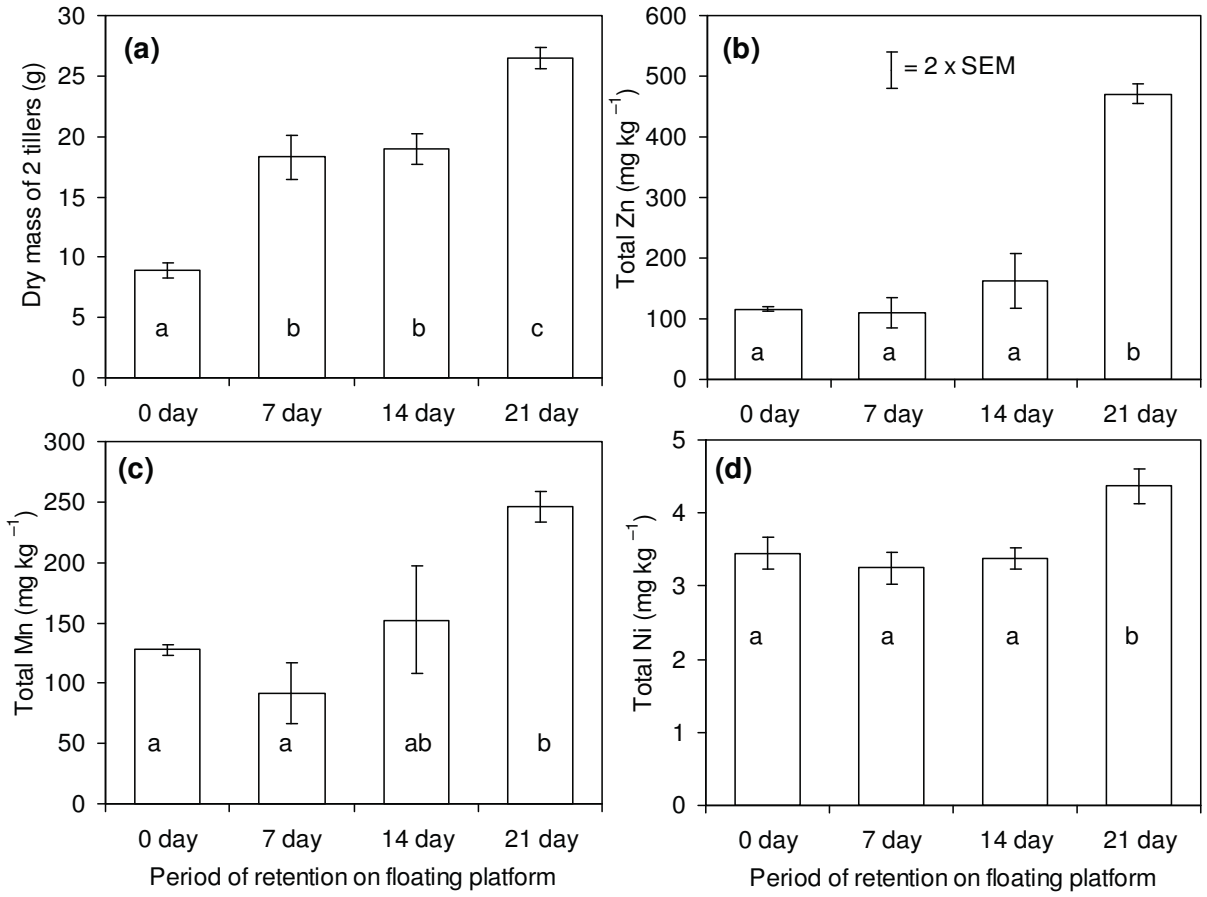

Figure 1

(a) Vetiver grass tiller weight; (b) total concentration of Zn; (c) total concentration of Mn; and (d) total concentration of Ni; under 4 periods of retention on floating platforms above sewage effluent from Firle Sewage Treatment Works. Different letters inside the bars denote significant differences between times at the 0.05 probability level (n = 4).

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amounts of Zn, Mn and Ni that accumulated per unit weight of vetiver grass biomass at different effluent retention periods are shown in Figs 1b,c,d. Zinc concentration (means range: 116–471 mg·kg^{-1}) showed a significant increase from the initial value only at Day 21 of effluent retention. This trend was also observed with Mn (128–246 mg·kg^{-1}) and Ni (3.5–4.4 mg·kg^{-1}). Nickel had the lowest concentration in vetiver grass, despite the fact that its concentration in effluent was higher than that of Mn (Tables 1 and 2).

In terms of total heavy metal extraction per tiller of vetiver grass (i.e. accumulated biomass multiplied by heavy metal concentration in the biomass), results showed an exponential increase in the bioaccumulation of heavy metals by vetiver grass with time (Fig. 2). The highest extraction was that of Zn (means: 0.5, 1.0, 1.5 and 6.2 mg·tiller^{-1} at Days 0, 7, 14 and 21, respectively) (Fig. 2a), followed by Mn (means: 0.6, 0.8, 1.4 and 3.3 mg·tiller^{-1} at the same respective days) (Fig. 2a) and lastly Ni (means: 0.02, 0.03, 0.03 and 0.06 mg·tiller^{-1} also at the same respective days) (Fig. 2b). These averages amounted to net heavy metal removals of 16.4 mg Zn, 9.9 mg Mn and 0.21 mg Ni from the 9 ℓ of effluent through summed harvests of Days 7, 14 and 21, against the initial concentrations of 63.7, 31.5 and 51.4 mg·ℓ$^{-1}$ for Zn, Mn and Ni in the effluent (Table 2).

DISCUSSION

The significant biomass accumulation over time supported the hypothesis that vetiver grass can be effective on sewage effluent in a floatation system under the local conditions in Harare, tolerating relatively high pollutant levels. However, it was not convincing to attribute the larger fraction of the purification process to plant uptake within the studied 21 days of effluent retention under vetiver grass, as many researchers have demonstrated (e.g. Chomchalow, 2003; Gupta et al., 2012; Aksorn and Chitsomboon, 2013). This was mainly because the reduction in heavy metal amounts in the effluent was considerably higher than the corresponding plant uptake of the heavy metals, especially for Ni. Thus, there could have been other mechanisms responsible for effluent cleaning, which were favoured more in the presence of vetiver grass. One such mechanism could be bio-sorption in which the microorganisms and colloidal sludge particles exhibit metal-binding capacities related to metabolic or physico-chemical processes (Ahalya et al., 2003). This mechanism may also explain why the effluent under no vetiver grass showed some natural self-purification over time, although at a considerably lower rate than the effluent under vetiver grass.

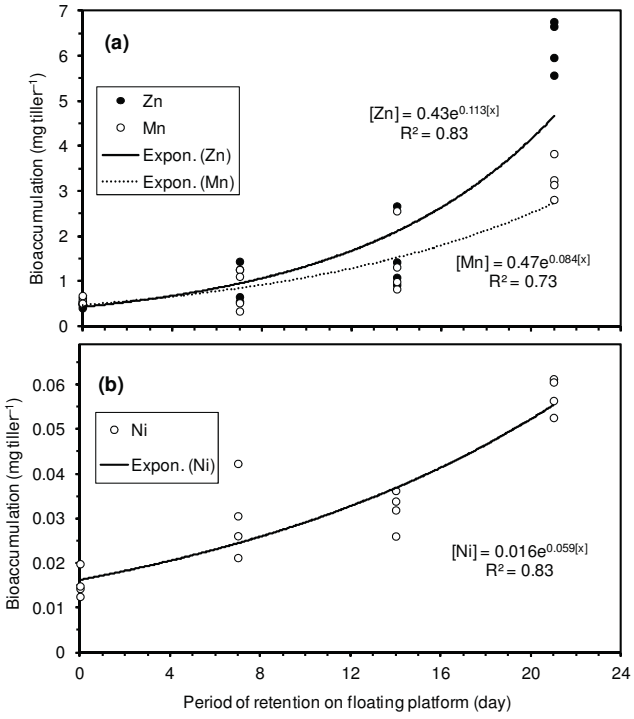

Figure 2

Total extraction of (a) Zn, Mn, and (b) Ni per tiller of vetiver grass on 9 ℓ of sewage effluent and its relationships with the period of retention on the floating platform.

The lack of a simple linear relationship between the reduction in heavy metal concentration in effluent and the retention time suggests multiple heavy metal removal mechanisms. According to Prasad (2011), experimental evidence showing nonlinear kinetics of disappearance of metals from solutions suggests that several different mechanisms, of differing speeds, operate simultaneously. The researcher added that the fastest mechanism is surface absorption by roots, followed by bio-sorption in which microbial, fungal or other biomass, living or dead, is used to take away large quantities of heavy metals. Microorganisms exhibit a strong ability to accumulate (bio-accumulate) metal and metalloids from substrates containing extremely low concentrations of these elements (Bolan et al., 2010). Over time a film of microorganisms develops on the support surfaces, which Ahalya et al. (2003) referred to as 'adsorption on inert supports'. In this study the support surface could imply the inside walls of effluent containers. Das et al. (2008) referred to it as an 'immobilised microbial biomass' that can be reused in extracting more pollutants in a bioreactor setup. In their study on phytoextraction of Cu, Zn, and Pb enhanced by chelators with vetiver grass, Chen et al. (2012) also attributed some discrepancies in their data to metal adherence to the experimental tank. This mechanism could be largely responsible for heavy metal reduction in the effluent. The roots of vetiver grass could have supported microbial life through provision of a habitat in the rhizosphere.

The roots of grasses can produce exudates that can increase the bio-availability of heavy metals, e.g., phytosiderophores that are biosynthesised from nicotinamide (Jabeen et al., 2009), or exudates that precipitate heavy metals from solution (Prasad, 2011). There was no clear evidence of exudation by vetiver grass roots as the effluent pH was maintained at a stable level above neutral. Phytosidephores are a family of acid-producing chelators produced by roots to solubilise the external insoluble metal nutrients, especially iron (Shojima et al., 1990). Prasad (2011) referred to plant removal of heavy metals from solutions through exudates as the slowest mechanism in comparison with surface absorption and bio-sorption. Under acidic conditions the solubility of most heavy metals is increased, while alkaline conditions generally result in precipitation of heavy metals. A low uptake of heavy metals would therefore be expected from the studied effluent considering that its pH was above neutral. In some batch experiments by Kumar et al. (2013) it was noted that higher pH (4–8) has no effect on Cr (VI) removal from effluents by vetiver grass, but that at pH 3.5, Cr (VI) removal increased to 55%, and at pH 2.5 metal bio-sorption was maximum around 97%. Thus, it would be necessary to make the local effluent slightly acidic in order to improve the availability of heavy metals for uptake by vetiver grass.

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The results showed an exponential increase in heavy metal extraction by the grass as time progressed, which is encouraging as it reflected the contribution of increased root biomass that could be achieved by increasing the retention time. Zinc had the highest uptake rates and this was consistent with a study by Aksorn and Chitsomboon (2013) that established that all vetiver ecotypes display a high capability for Zn uptake in both shoots and roots after 7 days of retention. The Aksorn and Chitsomboon (2013) study reported Zn uptake by vetiver grass (*Vetiveria zizanioides* and *V. nemoralis*) in the range of 8 714 to 23 285 $mg{\cdot}kg^{-1}$, from an aqueous solution containing 500 $mg\ kg^{-1}$ of Zn, and concluded that vetiver grass is a good hyperaccumulator only for Zn. However, in many studies the level of uptake depended on the amount of Zn in the media and the retention time; e.g., Chen et al. (2012) found an average Zn uptake of 229 $mg{\cdot}kg^{-1}$ at Day 7 of retention time, from a solution containing only 5 $mg{\cdot}kg^{-1}$ Zn.

There have been relatively few studies on the uptake of Mn and Ni by vetiver grass, as the choice of most researchers has largely been on Zn, Cd and Pb. In a study by Roongtanakiat et al. (2007), Mn was recorded in higher concentrations (125 $mg{\cdot}kg^{-1}$ in shoot, 188 $mg{\cdot}kg^{-1}$ in root) than Zn (26 $mg\ kg^{-1}$ in shoot, 140 $mg{\cdot}kg^{-1}$ in root), despite the higher concentrations of Zn (13.8–126.4 $mg{\cdot}\ell^{-1}$) than Mn (0.2–8.3 $mg{\cdot}\ell^{-1}$) in the wastewater. According to Truong (1999), the distribution of heavy metals in vetiver grass can be divided into 3 groups: (i) very little of the As, Cd, Cr and Hg absorbed was translocated to the shoots (1–5%); (ii) a moderate proportion of Cu, Pb, Ni and Se was translocated to shoots (16–33%); and (iii) Zn was almost evenly distributed between shoot and root (40%). In the current study, it was, however, difficult to explain why the uptake of Ni was more than 10 times lower than that of Mn and Zn, despite the exponential accumulation with retention time.

The information contained in the study can be implemented in other parts of the world. The City of Johannesburg used floating wetlands to deal with sewage in Bruma Lake, a small artificial lake located northeast of the Johannesburg CBD (Reid, 2014). The efficacy of these wetlands was, however, never tested. There is therefore also a need for proven cost-effective technologies outside of Harare.

CONCLUSION

This study confirmed that bioremediation of sewage effluent using vetiver grass under hydroponic conditions is a feasible complementary treatment method that can reduce the amounts of total dissolved solids, N, Zn and Mn within 21 days to levels that are acceptable for direct discharge into streams according to the wastewater discharge standards in Zimbabwe. In addition to plant uptake via the roots, other heavy metal removal mechanisms, particularly bio-sorption by microorganisms forming an immobilised microbial biomass on supporting surfaces, would be required to account for the effluent clean-up within 21 days of effluent retention under vetiver grass. There was no evidence to support heavy metal precipitation through root exudates as a mechanism of heavy metal removal since vetiver grass treatment maintained a stable effluent pH within a very narrow range above neutral. In future, a deliberate lowering of effluent pH might increase root uptake thereby lowering the effluent residence time under vetiver grass. A longer study covering the changes in redox states and speciation of nutrients and heavy metals in wastewater under vetiver grass treatment is recommended to improve understanding of the absolute contribution of bio-sorption to wastewater treatment.

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Vetiver Phytoremediation for Heavy Metal Decontamination

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ABSTRACT

Heavy metal contamination commonly results from human activities which has become a serious environmental problem today. Phytoremediation, a cost effective green technology, appears promising for cleaning up environment. Vetiver, a "Miracle Grass" for soil and water conservation, has great potential to apply this technology because of its characteristic tolerance to heavy metals. Successful vetiver phytoremediation, however, depends on various factors such as vetiver behavior, chemical and physical properties of growth media as well as agronomic practice, all of which must be carefully investigated and properly considered for site specific conditions. This paper describes the application, research experience and future prospects of utilizing vetiver phytoremediation as an appropriate natural tool in promoting sustainable environment.

Keywords: *miracle grass, soil and water conservation, agronomic practice, sustainable environment, wastewater treatment, hyperaccumulator, Chrysopogon nemoralis, Chrysopogon zizanioides*

1. INTRODUCTION

Phytoremediation is a technology of using plant to clean up pollutants in the environment. Besides being an economical, energy efficient and environmental friendly method, phytoremediation can be applied to large areas and is useful for solving a wide variety of contaminants (metal, radionuclide and organic substances) and growth media (soil, sludge, sediment and water). Phytoremediation can be specified into many applications including: phytoextraction, in which plants decontaminate soil through uptake of heavy metals into aerial part and then can be

harvested and removed from the site; Phytostabilization, in which plants are used to minimize heavy metal mobility in contaminated soil; and Phytovolatilization, in which plants extract volatile metals from soil and volatilize them from foliage (Cunningham *et al.,* 1995).

Vegetation is important for all phytoremediation applications. It is necessary to use plants that tolerate high levels of toxic pollutants. Vetiver grass is widely known for its effectiveness in erosion and sediment control. After it was found that vetiver can tolerate extreme climatic variations and soil conditions, including heavy metals (Truong and Baker, 1998; Truong, 1999; Roongtanakiat and Chairoj, 2001a; Roongtanakiat and Chairoj, 2001b), the concept of using vetiver for phytoremediation occurred. Many researches reported the potential of utilizing vetiver to decontaminate heavy metals from soil (Truong and Baker, 1998; Roongtanakiat and Chairoj, 2001a; Roongtanakiat and Chairoj, 2001b), garbage leachate (Xia *et al*., 2000; Roongtanakiat *et al*., 2003), wastewater (Kong *et al.,* 2003; Roongtankiat *et al.,* 2007) and mine tailings (Truong, 1999; Yang *et al*., 2003; Roongtanakiat *et al*., 2007). Application of vetiver for phytoremediation, however, depends upon various factors such as physical and chemical properties of growth media as well as agronomic practice. They should be carefully investigated and properly considered in applying for site specific conditions to achieve the desired goal.

2. VETIVER ECOTYPE AND GROWTH PERFORMANCE

There are two species of vetiver in Thailand, namely *Chrysopogon nemoralis* (Balansa) Holttum and *Chrysopogon zizanioides* (L.) Roberty. Both species have distinct ecological characteristics which make them adapt to different habitats. They are commonly found in all regions of Thailand and there are many ecotypes. Thai vetiver ecotypes have been named after the provinces where they were first found, for example, Ratchaburi, Surat Thani, Roi Et, Loei, Kamphaeng Phet. The Department of Land Development has performed a comparative study of 28 vetiver ecotypes, 11 ecotypes of *Chrysopogon nemoralis* and 17 ecotypes of *Chrysopogon zizanioides*. As the result, 10 ecotypes have proven suitable to grow in various soil types and regions (Tables 1 and 2) (ORDPB, 2000).

For remediation purposes, a high heavy metal uptake by plant is needed. Therefore, vertiver ecotype used for this technology has to develope well in contaminated sites, and give high biomass. The experiment conducted to evaluate the Mn, Cu, Cd and Pb uptake potential of three vetiver ecotypes grown in five different levels of artificially contaminated soils, showed that three vetiver ecotypes could grow

Table 1. Suitability of vetiver ecotypes in various soil types

Soil type	*Chrysopogon nemoralis*	*Chrysopogon zizanioides*
Sandy soil	Nakhon Sawan, Kamphaeng Phet 1, Roi Et, Ratchaburi	Kamphaeng Phet 2, Songkhla 3
Clay loam soil	Loei, Nakhon Sawan, Ratchaburi, Kamphaeng Phet 1, Prachuap Khiri Khan	Surat Thani, Songkhla 3
Leterite soil	Prachuap Khiri Khan, Loei	Kamphaeng Phet 2, Songkhla 3, Surat Thani, Sri Lanka

Table 2. Suitability of vetiver ecotypes in different regions

Region	*Chrysopogon nemoralis*	*Chrysopogon zizanioides*
North	Nakhon Sawan, Kamphaeng Phet 1	Sri Lanka
Northeast	Roi Et	Songkhla 3
Central and East Region	Ratchaburi, Kamphaeng Phet 1, Prachuap Khiri Khan	Kamphaeng Phet 2, Songkhla 3, Surat Thani
South		Songkhla 3, Surat Thani

well in soil with all tested levels of heavy metal contamination (Fig. 1). Height of Surat Thani ecotype was significant greater than those of Ratchaburi and Kamphaeng Phet ecotypes. However, Ratchaburi ecotype gave the highest shoot dry weight but there was no significant difference among vetiver ecotypes regarding shoot dry weight. (Roongtanakiat and Chairoj, 2001a). In 2006, an experiment was conducted at Padaeng Industry Public Company Limited in Tak province in order to compare development of two *Chrysopogon nemoralis* ecotypes, Nakhon Sawan and Prachuap Khiri Khan, and two *Chrysopogon zizanioides* ecotypes, Kamphaeng Phet 2 and Surat Thani, grown in zinc mining area (Fig. 2). It was found that both *Chrysopogon zizanioides* ecotypes gave better growth performance than that of *Chrysopogon nemoralis,* while Kamphaeng Phet 2 gave the highest plant height and shoot dry weight.

Similar results were obtained from the experiment of wastewater treatment conducted by Roongtanakiat *et al*. (2007). Three vetiver ecotypes were hydroponically cultured in four samples of industrial wastewater taken from a dairy factory, a battery manufacturing plant, an electric lamp plant and an ink manufacturing facility. The results showed that Kamphaeng Phet 2 and Sri Lanka ecotypes had significantly higher average plant height and total dry weight than Surat Thani ecotype (Fig. 3 and 4).

3. PRIMARY NUTRIENT CONTENT IN VETIVER

Primary nutrients are needed in large quantities for plant growth. LDD (1994) reported that concentrations of N, P and K in vetiver shoot were 2.5, 0.17 and 1.5%, respectively. Our previous studies indicated that vetiver grown in iron ore tailings, had concentrations of 5.31-5.42, 0.45-0.50 and 1.27-1.46%, respectively for N, P and K in shoot. However, the vetiver grown in zinc mine soil, which has lower fertility than iron ore tailings, had lower concentrations of primary nutrients in shoot of 2.12-2.55, 0.44-0.50, and 1.26-1.40%, respectively. Primary nutrient concentrations in shoot and root of three vetiver ecotypes hydroponically cultured in four sources of industrial wastewater which have different contents of nutrients and heavy metals are shown in Table 3 and 4. The data obviously showed that wastewater sources affected the nutrient content in vetiver plant more than the tested ecotypes.

Table 3. Primary nutrient concentrations in shoot and root of vetiver grown in industrial wastewaters from milk factory (W1), battery manufacturing plant (W2), electric lamp plant (W3) and ink manufacturing facility (W4).

Wastewater Source	Nitrogen[1/] (%)		Phosphorus[1/] (%)		Potassium[1/] (%)	
	Shoot	Root	Shoot	Root	Shoot	Root
W1	0.47 b	0.52 b	0.18 b	0.15 b	1.26 a	0.77 a
W2	0.33 c	0.44 c	0.14 c	0.70 d	1.24 a	0.76 a
W3	0.40 bc	0.46 bc	0.46 a	0.22 a	1.15 a	0.66 b
W4	0.49 a	1.60 a	0.14 c	0.09 c	1.20 a	0.39 c

[1/] Figures in the same column with a common letter are not significantly different at 0.05 probability by DMRT.

Table 4. Primary nutrient concentrations in shoot and root of Kamphaeng Phet 2 (K), Sri Lanka (L) and Surat Thani (S) vetiver ecotypes grown in industrial wastewaters.

Vetiver Ecotype	Nitrogen[1/] (%)		Phosphorus[1/] (%)		Potassium[1/] (%)	
	Shoot	Root	Shoot	Root	Shoot	Root
K	0.58 a	0.60 b	0.21 b	0.13 a	1.17 a	0.62 a
L	0.49 b	0.59 b	0.25 a	0.14 a	1.19 a	0.69 a
S	0.57 a	0.66 a	0.23 ab	0.14 a	1.27 a	0.62 a

[1/] Figures in the same column with a common letter are not significantly different at 0.05 probability by DMRT.

Fig. 1 Surat Thani vetiver ecotype grown in soil contaminated with five levels of heavy metals.

Fig. 2 Vetiver grew well on zinc mine area at Padaeng Industry Public Company Limited, Tak province, Thailand.

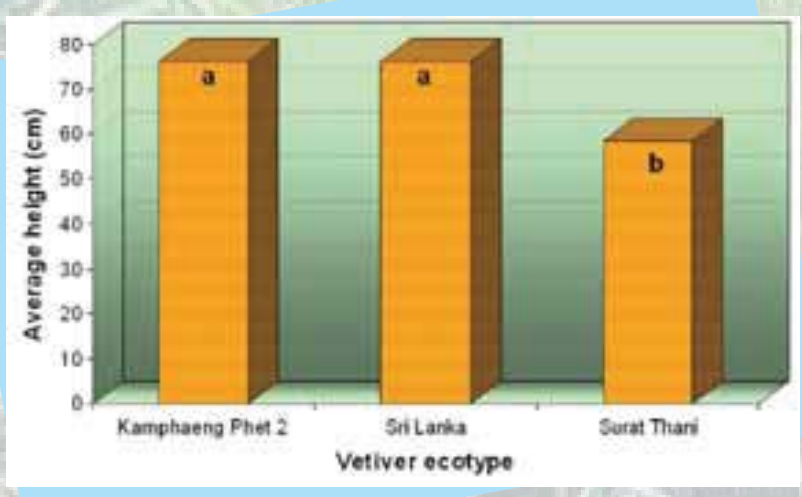

Fig. 3 Average height of Kamphaeng Phet 2, Sri Lanka and Sura Thani vetiver ecotypes grown in industrial wastewaters. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT.*

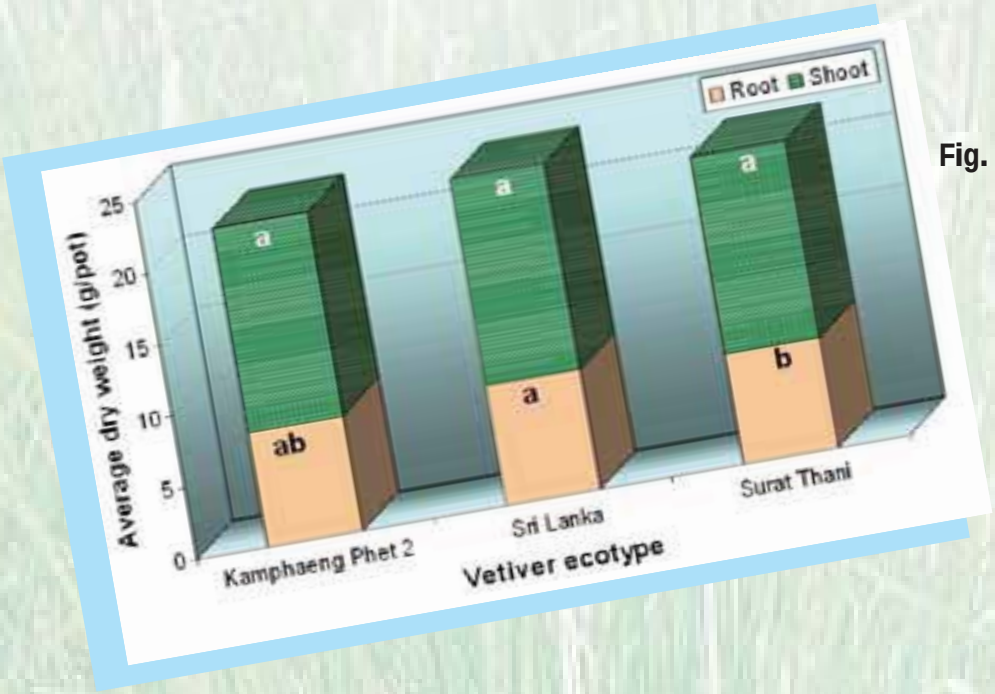

Fig. 4 Average shoot and root dry weight of Kamphaeng Phet 2, Sri Lanka and Sura Thani vetiver ecotypes grown in industrial wastewaters. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT*.

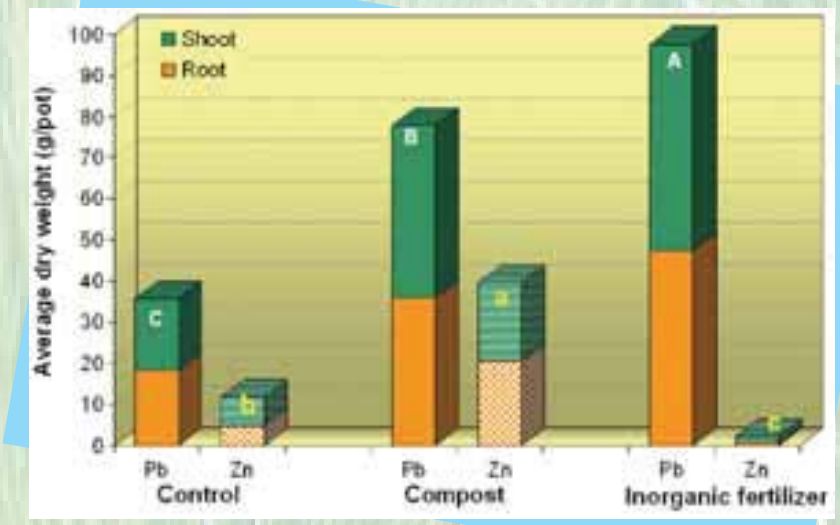

Fig. 5 Shoot and root dry weight of vetiver grown in lead and zinc mine soils treated with compost and inorganic fertilizers. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT*.

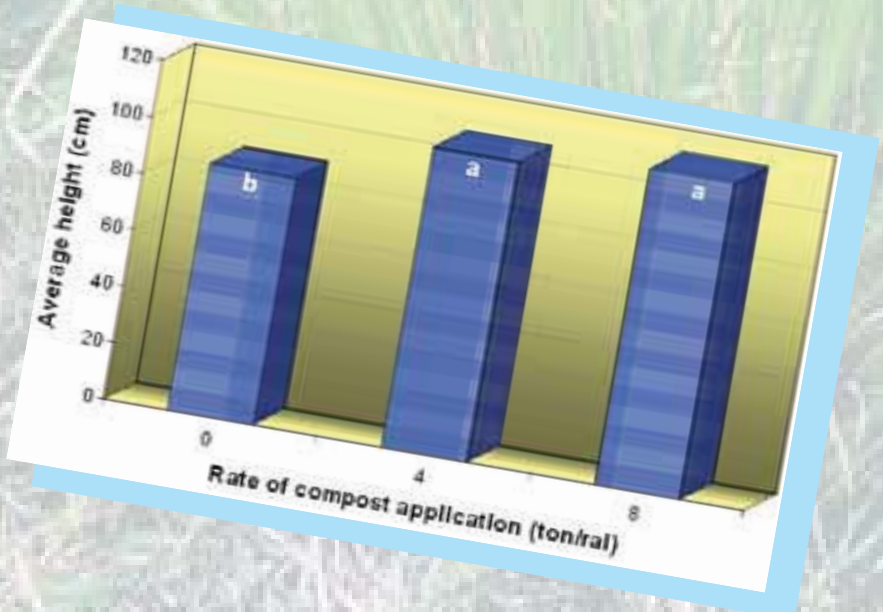

Fig. 6 Average height of vetiver grown in zinc mine area applied with compost at rate of 0, 4 and 8 ton/rai. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT.*

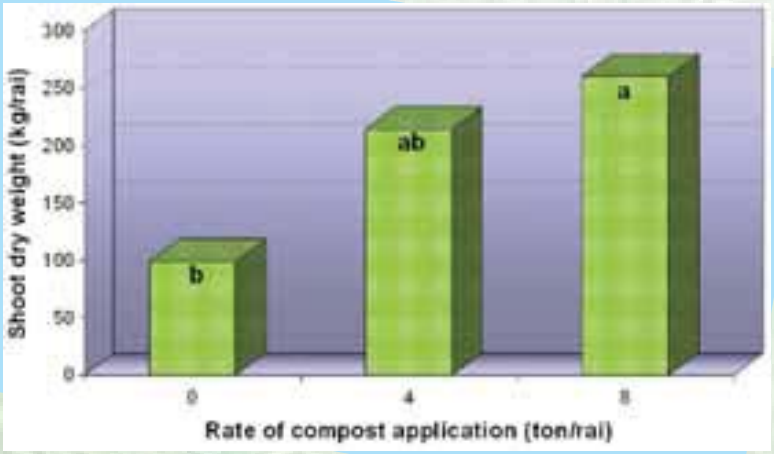

Fig. 7 Average shoot dry weight of vetiver grown in zine mine area applied with compost at rate of 0, 4 and 8 ton/rai. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT.*

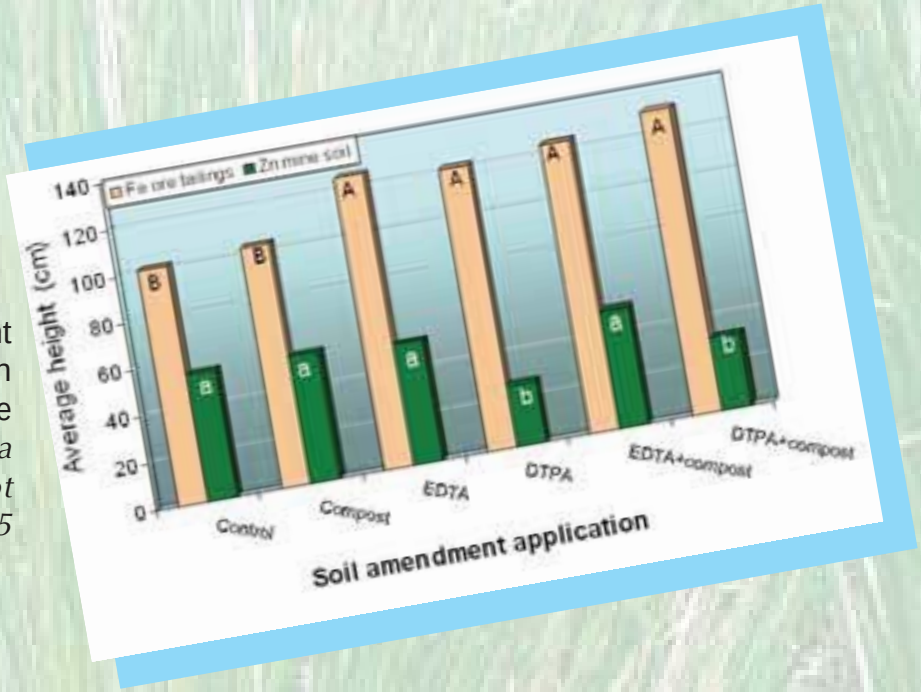

Fig. 8 Influence of soil amendment on height of vetiver grown on iron tailings and zinc mine soil. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT.*

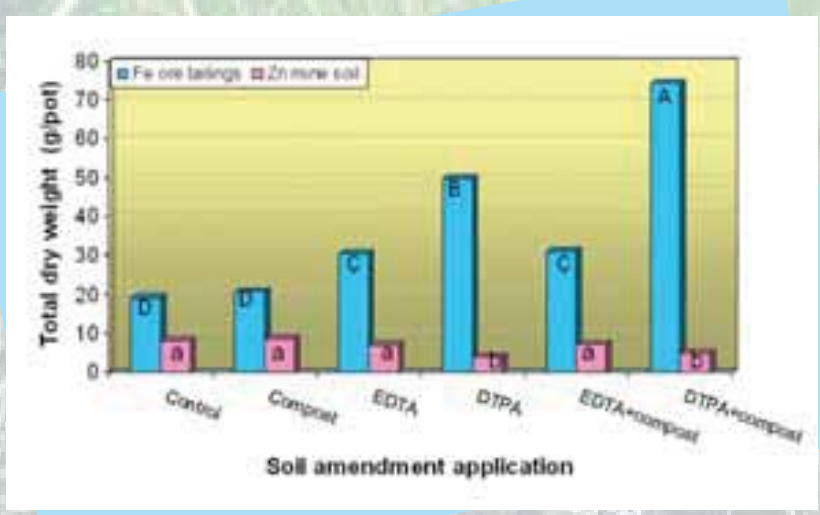

Fig. 9 Influence of soil amendment on biomass of vetiver grown on iron tailings and zinc mine soil. *Bars associated with a common letter are not significantly different at 0.05 probability by DMRT.*

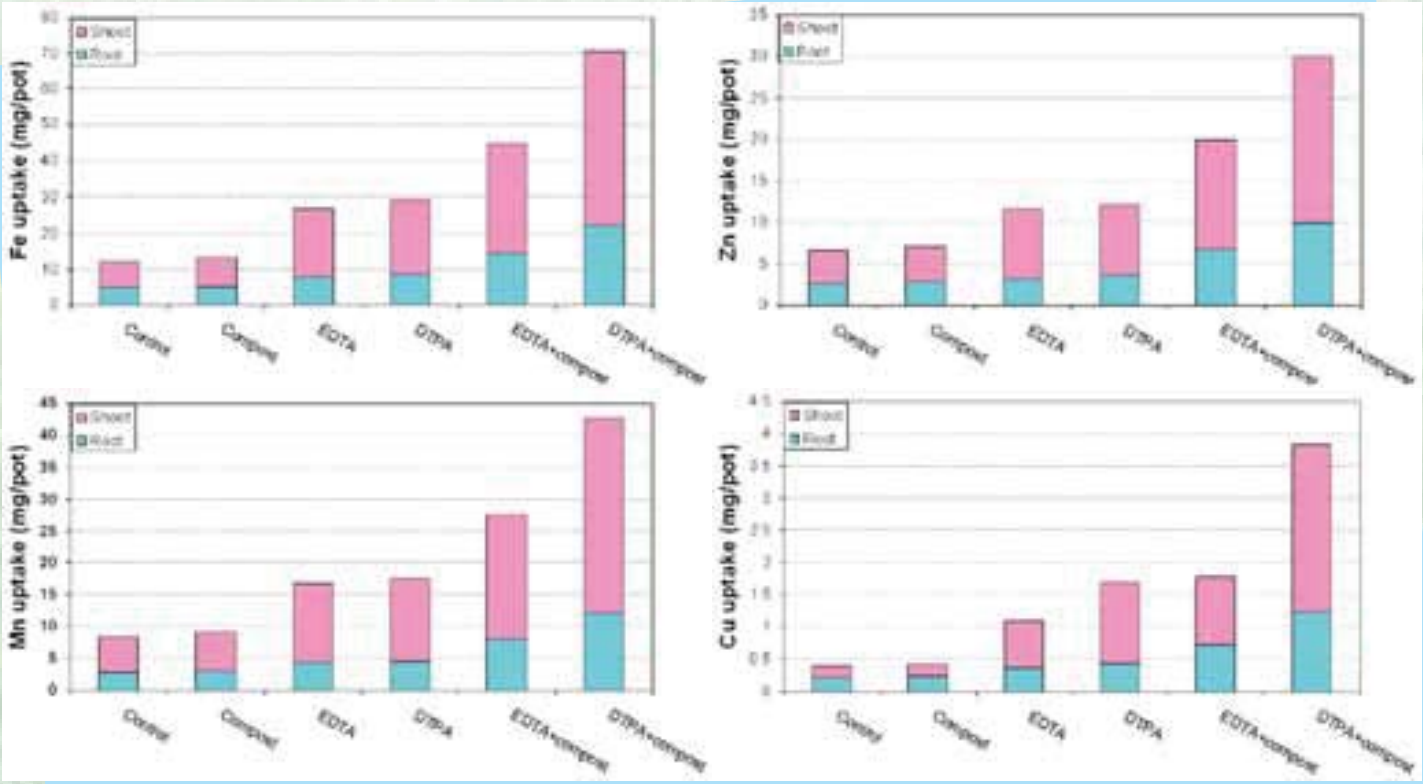

Fig. 10 Uptake of Fe, Zn, Mn and Cu in shoot and root of vetiver grown in iron ore tailings.

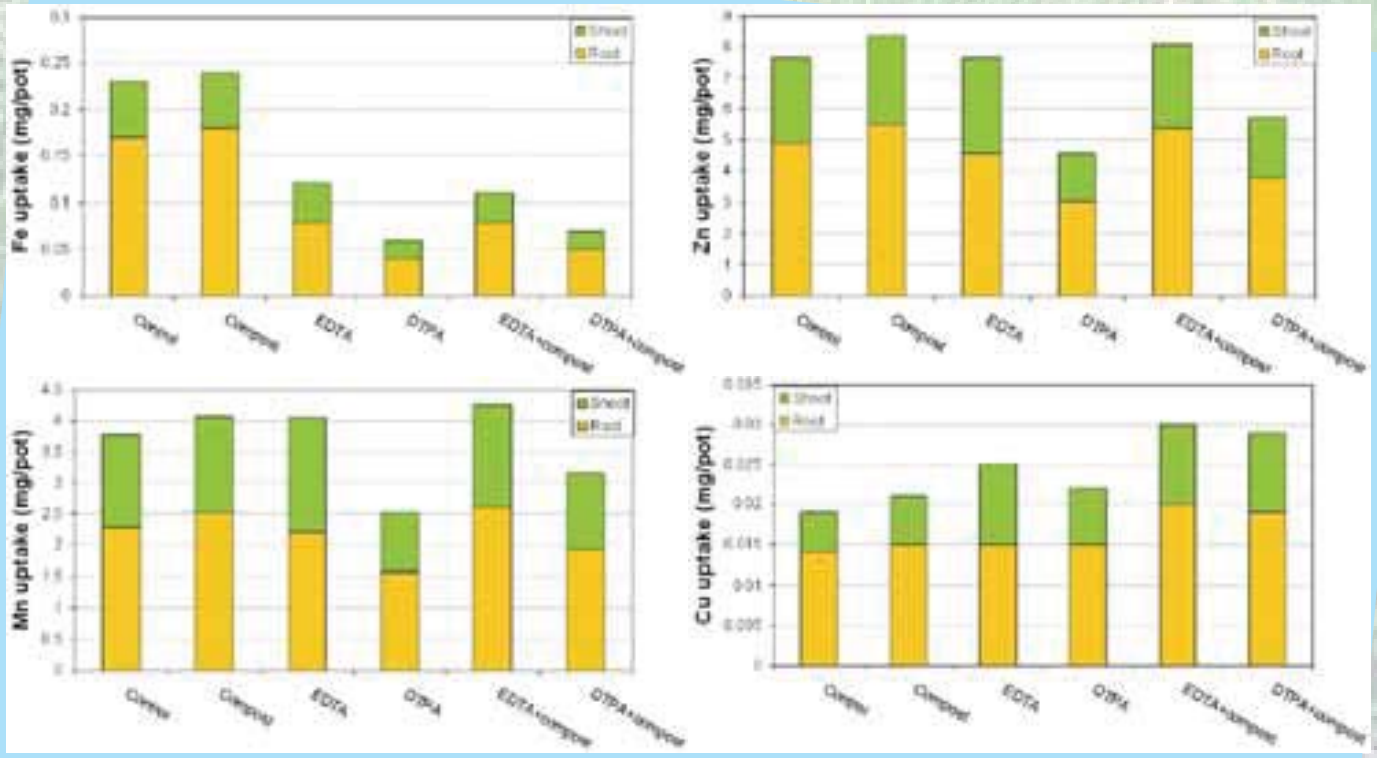

Fig. 11 Uptake of Fe, Zn, Mn and Cu in shoot and root of vetiver grown on zinc mine soil.

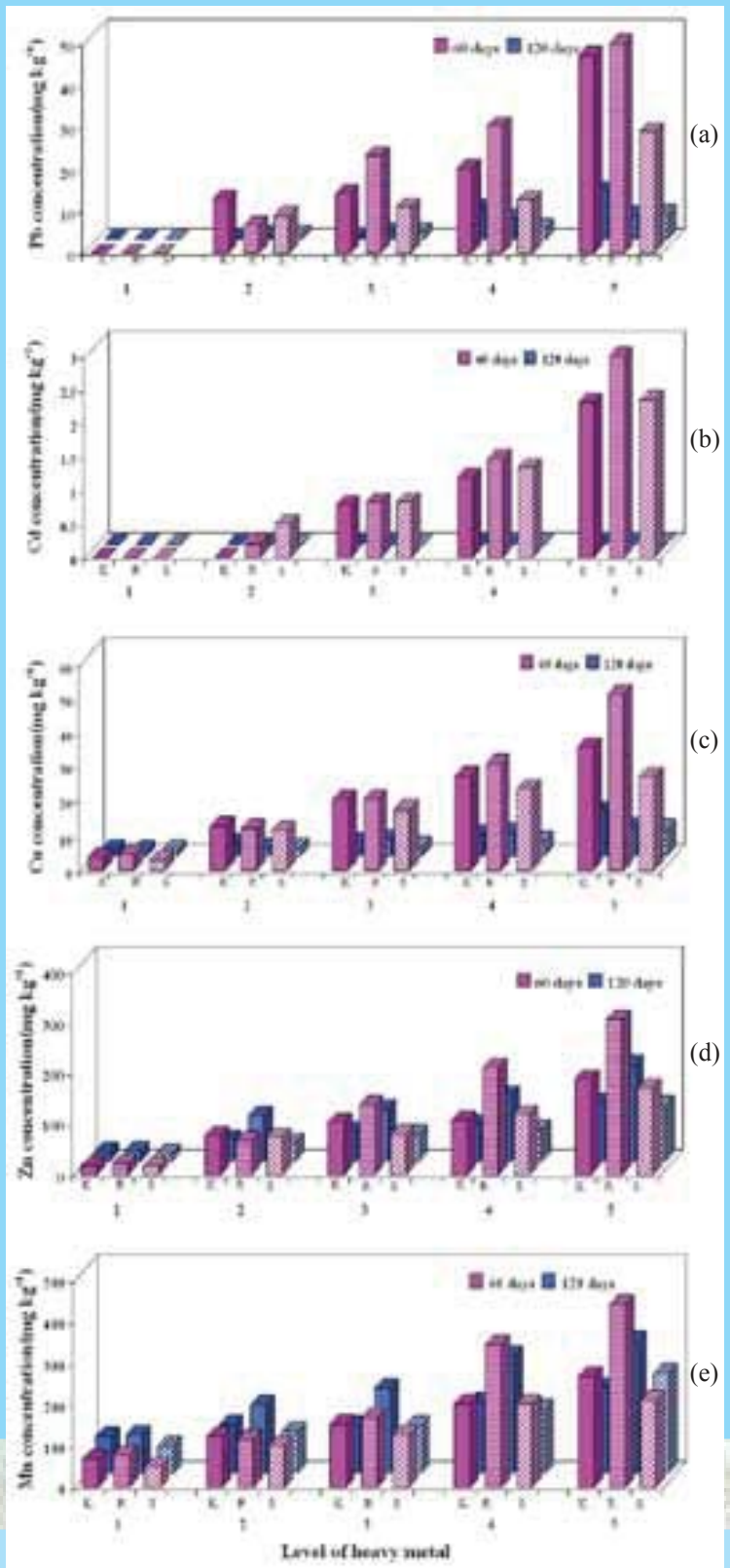

Fig. 12 Concentration of Mn (a), Zn (b), Cu (c), Pb (d) and Cd (e) in shoot of three vetiver ecotypes (Kamphaeng Phet, K; Ratchaburi, R; Surat Thani, S) planted in soils contaminated with different levels of heavy metals at 60 and 120 day harvest.

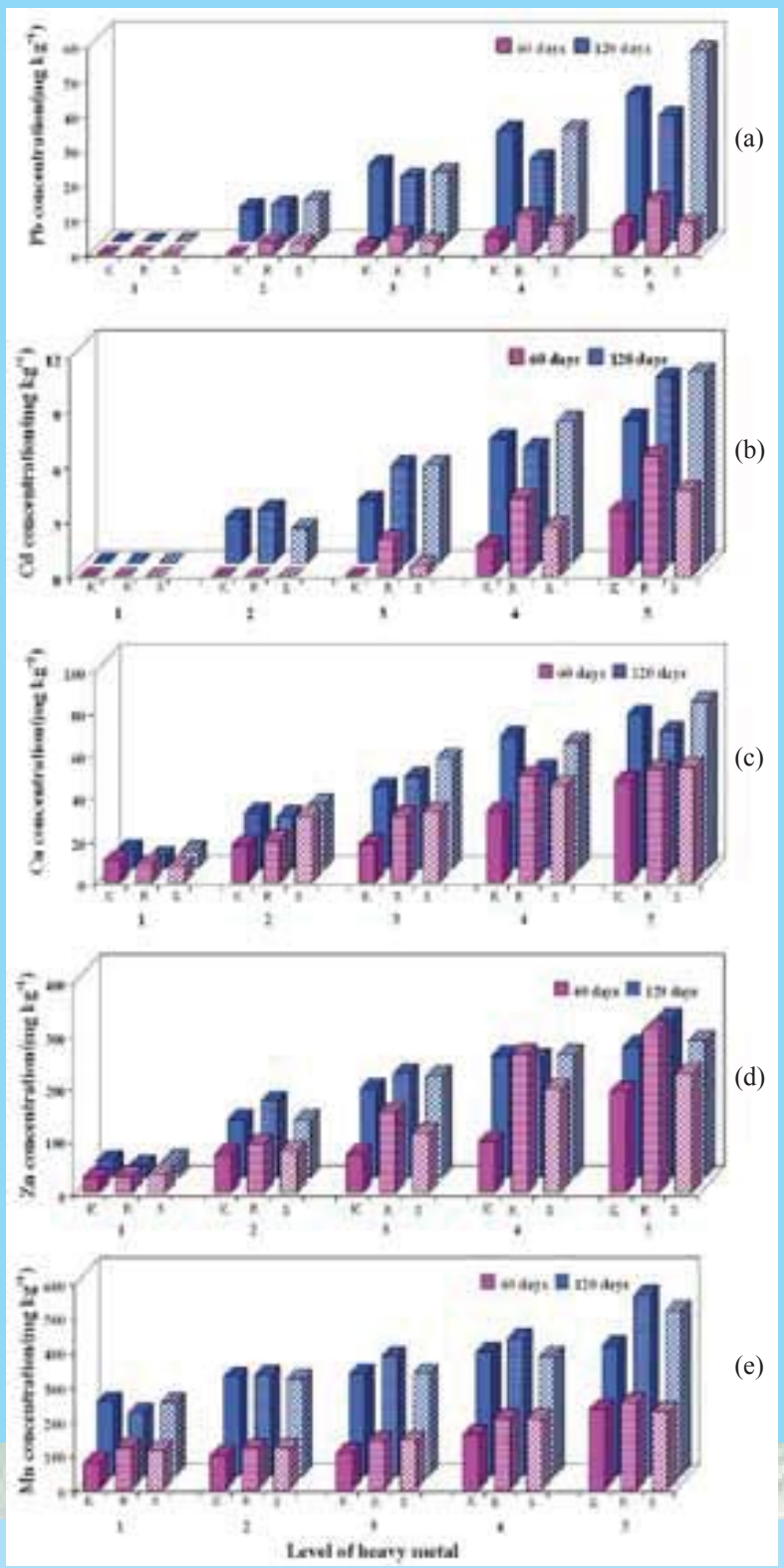

Fig. 13 Concentration of Mn (a), Zn (b), Cu (c), Pb (d) and Cd (e) in root of three vetiver ecotypes (Kamphaeng Phet, K; Ratchaburi, R; Surat Thani, S) planted in soils contaminated with different levels of heavy metals at 60 and 120 day harvest.

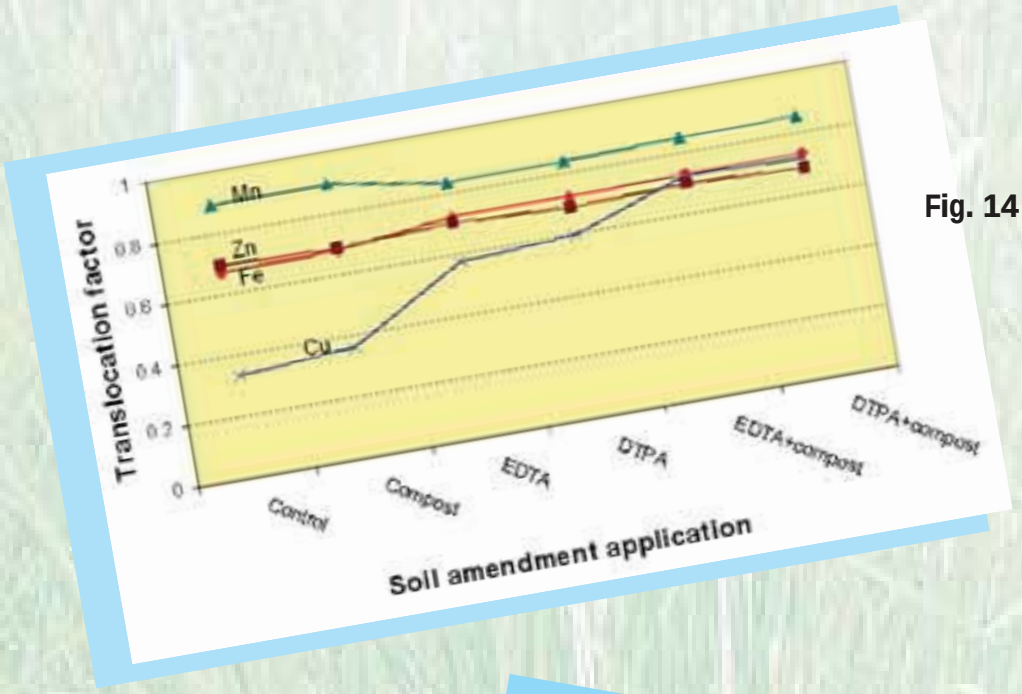

Fig. 14 Translocation factor of Mn, Zn, Cu and Fe for vetiver grown in iron ore tailings amended with chelating agent and compost.

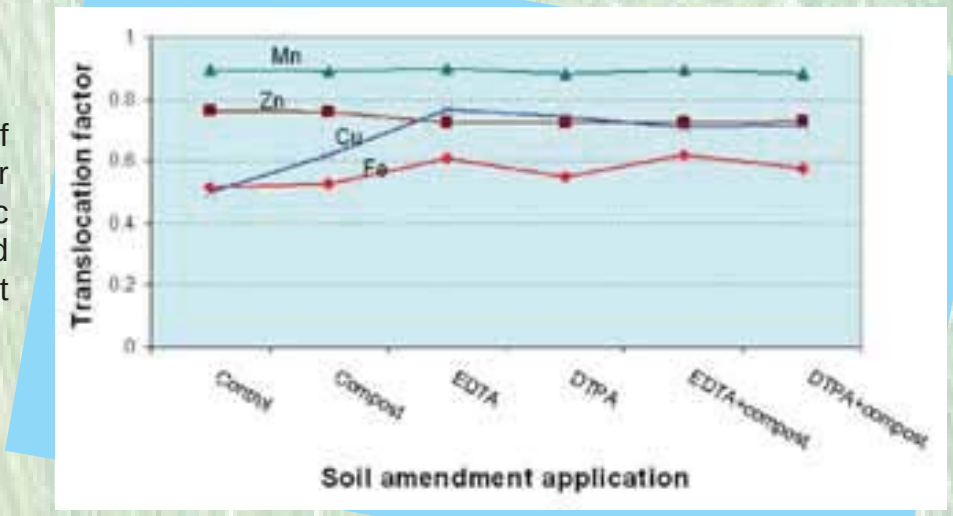

Fig. 15 Translocation factor of Mn, Zn, Cu and Fe for vetiver grown in zinc mine soil amended with chelating agent and compost.

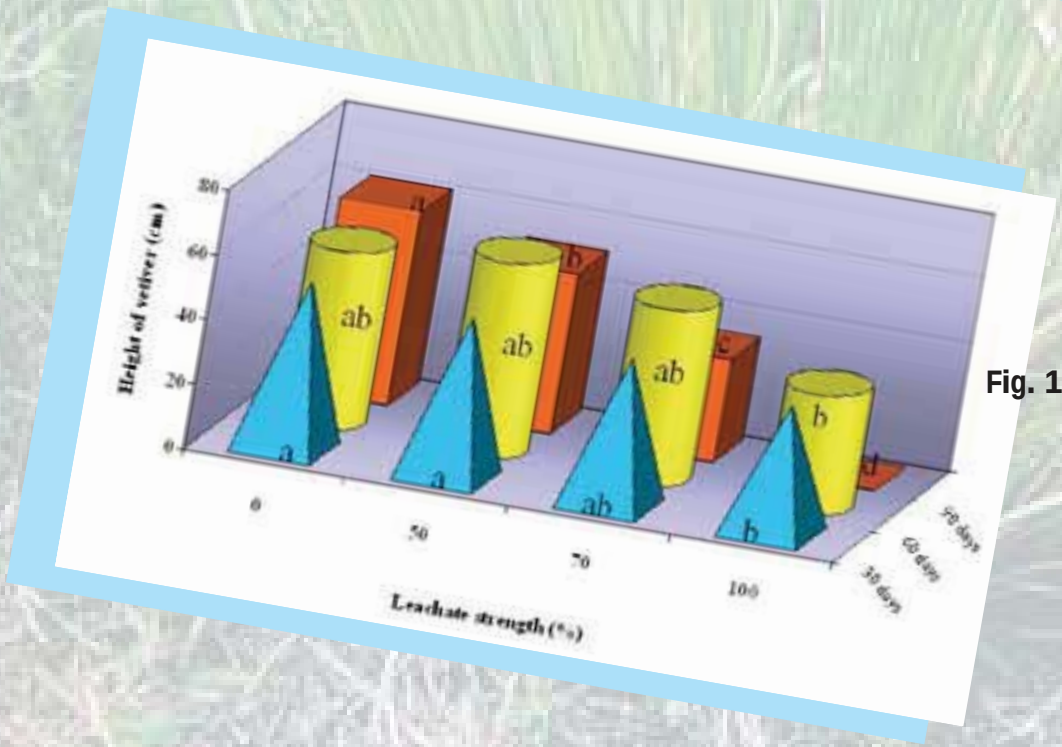

Fig. 16 Average height of vetiver plants treated with 0, 50, 70 and 100 % leachate strength at 30, 60 and 90 days after planting.

Fig. 17 Effect of landfill leachate (a) on growth of veitver planted at landfill site, Kamphaeng Saen, Nahon Phathom province. Vetiver height of the two top rows were higher than those in the three lower rows which received greater leachate strength (b).

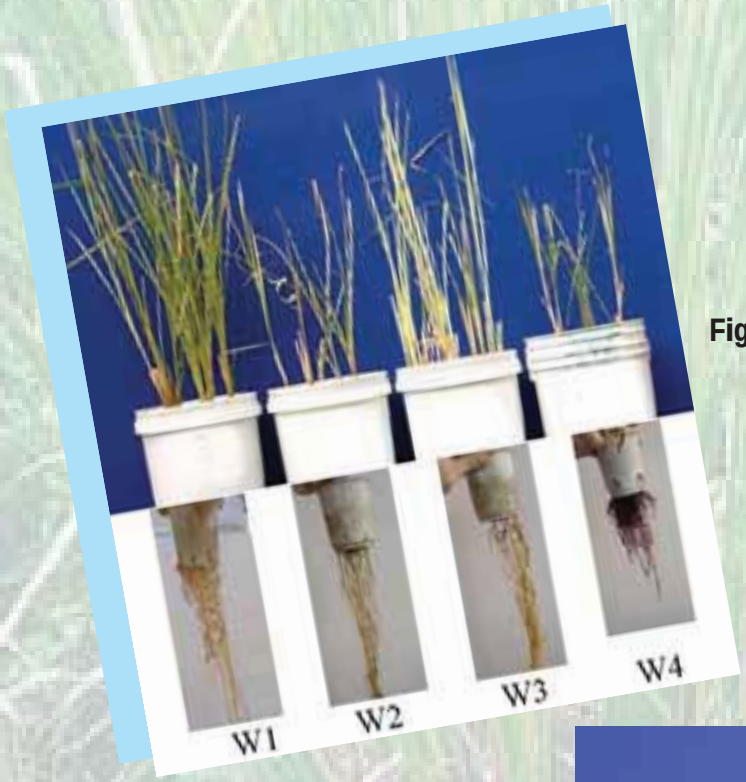

Fig. 18 Growth of vetiver grown in industrial wastewaters from milk factory (W1), battery manufacturing plant (W2), electric lamp plant (W3) and ink manufacturing facility (W4).

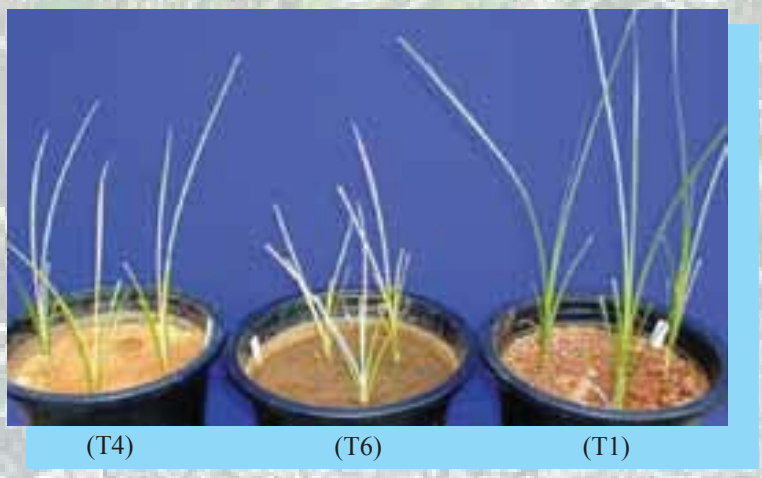

Fig. 19 Chlorosis caused by heavy metal toxicity in vetiver grown in zinc mine soil (T1), amended with DTPA (T4), and amended with combination of compost and DTPA (T6).

4. FERTILIZER AND SOIL AMENDMENTS

Nutrient availability is an important factor governing the success of phytoremediation and can be regulated through the addition of fertilizers (Hutchinson *et al.,* 2001). The influence of organic and inorganic fertilizers on growth of vetiver grown in lead and zinc mine soils had been compared in pot experiment. It demonstrated that in lead mine soil, both organic (compost) and inorganic fertilizer applications could significantly improve vetiver biomass while inorganic fertilizer gave better result than that of compost (Fig. 5). Contrary result occurred to the vetiver grown in zinc mine soil; the compost elevated vetiver biomass while the inorganic fertilizer decreased vetiver growth which gave biomass significantly different to those in control and compost treatments. However, the study of Rotkittikhun *et al.,* 2007 showed that organic fertilizer (pig manure) could improve the biomass of vetiver grown in lead mine soil while inorganic fertilizer application did not effectively improve vetiver growth. For vetiver cultivation on deteriorated land with low fertility, the Land Development Department recommended to fill the bottom of the plant holes with manure or compost. Once the tillers start to sprout, the 15-15-15 inorganic fertilizer should be added to accelerate growth at the rate of 25 kg/rai (0.4 acre), along the contour (ORDPB, 2000).

Besides increasing organic matter and nutrient content in soil, application of organic amendments, e.g., compost to mine tailings, is known to increase water holding capacity, cation exchange capacity and to improve the structure of mine tailings by forming stable aggregates (Ye *et al*., 2000; Stevenson and Cole, 1999; Krzaklewski and Pietrzykowski, 2002). These amendments also mitigate the toxicity of heavy metals and plant failure to grow in their absence (Brown *et al*., 2003). Nevertheless, the rate of application should be considered to achieve beneficial results. A field experiment performed at Padaeng Industry Public Company Limited revealed that application of compost could significantly increase growth and shoot dry weight of vetiver, however, there was no significant difference between 4 ton/rai and 8 ton/rai applications (Fig. 6 and 7). Hence, the application 4 ton/rai of compost was suggested for vetiver plantation in this area, as recommended by LDD (1998).

Since plant uptake requires metals in an environmentally mobile form, the negative charges of various soil particles tend to attract and bind heavy metals which are cations and prevent them from becoming soluble and diffuse to root surface. This causes the lower metal bioavailability in soil, which is the major limiting factor for phytoremediation. Using chelating agents such as ethylenediaminetetraacetic acid (EDTA), diethylenetriaminepentaacetic acid (DTPA), nitrilotriacetic acid (NTA) and cyclohexanediaminetetraacetic acid (CDTA) have been developed to overcome these problems (Huang and Cunningham 1996; Robinson *et al*., 1999; Cooper *et*

al., 1999). However, the effects of chelating agents on growth performance and heavy metal uptake can differ among chelating agents, heavy metals and soils. A study by Roongtanakiat *et al.* (2009) showed that amended iron ore tailings with compost and chelating agents (EDTA and DTPA), especially the combination of DTPA and compost, could improve vetiver growth (Fig. 8 and 9) and heavy metal (Fe, Zn, Mn and Cu) uptakes (Fig. 10). However, contrary results were obtained in the zinc mine soil with the same treatments. The combination of DTPA and compost application actually reduced growth of vetiver in both height and biomass (Fig. 8 and 9). The EDTA could enhance concentration and uptakes of Zn, Mn and Cu but not Fe while DTPA increased the mentioned heavy metal concentrations but not uptakes (Fig. 11). These studies also revealed that sole compost application to iron ore tailings and zinc mine soil did not affect to heavy metal uptakes by vetiver.

5. TRANSLOCATION OF HEAVY METAL IN VETIVER

Plants absorb contaminants through root systems and store them in the root biomass and/or transport them to the stem and/or leaves. They may continue to absorb contaminants until they are harvested and disposed of safely. For phytoextraction purpose, this process is repeated several times to reduce contamination to acceptable levels. Therefore, apart from taking up large amounts of contaminants, plants should be able to transport the contaminants to the shoots, which then enable their removal. Truong (1999) reported that the distribution of heavy metals in vetiver plant can be divided into three groups: (i) Very little of the arsenic, cadmium, chromium and mercury absorbed, were translocated to the shoots (1-5%); (ii) A moderate proportion of copper, lead, nickel and selenium were translocated (16-33%); (iii) Zinc was almost evenly distributed between shoot and root (40%). However, numerous investigators (Yang *et al.*, 2003, Roongtanakiat *et al.*, 2007 and Singh *et al.*, 2007) concluded that vetiver root accumulated higher heavy metal concentrations than shoot. When vetiver plants were more mature, they could not concentrate higher heavy metal in the shoot. On the contrary the shoot heavy metal concentrations decreased, possibly due to dilution effect of increasing biomass, whilst the root heavy metal concentrations increased (Roongtanakiat and Chairoj, 2001b). These results were illustrated in Fig. 12 and 13 which compared heavy metal concentrations in shoot and root of three vetiver ecotypes planted in different levels of contaminated soils at 60 and 120 day harvest.

The ratio of metal concentrations in shoot to root is defined as translocation factor (TF) which refers to the ability of plant to translocate metals from the root to the shoot. The heavy metal translocation ability of vetiver grown in industrial wastewaters varied depending on the characteristic of growth media and metal

types as shown in Table 5. The ability of vetiver to translocate heavy metal was quite low when hydroponically cultured in wastewaters with average TFs of 0.07-0.67. However, vetiver grown on iron tailings and zinc mine soils could translocate higher quantities of heavy metal from root to shoot with TFs of 0.55-0.86 and 0.50-0.89, respectively.

Soil amendments applied to iron ore tailings and zinc mine soil affected the ability of some heavy metal translocations by vetiver (Fig. 14 and 15). It was obviously shown that chelating agents (EDTA and DTPA), especially in combination with compost, could elevate Cu translocation in both mine soils. Application of soil amendments increased Fe translocation slightly in iron ore tailings while Mn

Table 5. Concentration of heavy metal in shoot and root parts and translocation factor of vetiver grown in industrial wastewater from milk factory (W1), battery manufacturing plant (W2), electric lamp plant (W3) and ink manufacturing facility (W4).

Heavy metal	Wastewater source	Concentration of heavy metal (mg kg^{-1}) in		Translocation factor
		Shoot	Root	
Mn	W1	48.12	121.55	0.40
	W2	64.76	88.65	0.73
	W3	58.24	68.73	0.85
	W4	330.26	473.21	0.70
	Average	**125.35**	**188.04**	**0.67**
Fe	W1	62.31	1430.07	0.04
	W2	83.13	791.18	0.11
	W3	64.02	977.36	0.07
	W4	165.75	3688.30	0.05
	Average	**93.80**	**1721.73**	**0.07**
Cu	W1	2.45	4.30	0.57
	W2	4.07	17.95	0.23
	W3	4.23	5.88	0.72
	W4	8.46	87.54	0.10
	Average	**4.80**	**28.92**	**0.41**
Zn	W1	14.27	82.31	0.17
	W2	25.28	192.76	0.13
	W3	18.97	134.76	0.14
	W4	46.58	148.90	0.31
	Average	**26.28**	**139.68**	**0.19**
Pb	W1	0.69	4.50	0.15
	W2	3.76	109.57	0.03
	W3	2.02	5.51	0.36
	W4	2.25	4.88	0.46
	Average	**2.18**	**31.12**	**0.07**

translocation was slightly decreased. The compost and chelating agents did not affect the Zn translocation of vetiver grown in both mine soils. Even soil amendments could enhance some metal translocations; the TFs for studied heavy metals were all less than one.

Plants used for phytoextraction purpose should have the ability to concentrate metals in their tissue, especially in the aerial part. This type of plants is called hyperaccumulator. Baker and Brooks (1989) have defined metal hyperaccumulator as plants that can take up and concentrate in excess of 0.1% a given element (pollutant involved) in their tissues i.e. more than 1000 mg g^{-1} of Cu, Cd, Cr, Pb, Ni, Co or 1% (>10000 mg g^{-1}) of Zn or Mn in the dry matter. These ratios are 10-500 times higher than those in ordinary plants. Some researches identified a plant as hyperaccumulator using the translocation factor. This factor is more than one for hyperaccumulator and less than one for ordinary plant (Raskin and Ensley, 2000; Yanqun *et al*., 2005). Therefore, many authors concluded that vetiver is a non-hyperaccumulator plant (Truong, 1999; Greenfield, 2002; Roongtanakiat, 2006).

6. DEGREE OF HEAVY METAL CONTAMINATION

Phytoremediation process depends on the tolerance of the plant to the contaminant. Truong (1999) demonstrated that vetiver is highly tolerant to many heavy metals. For vetiver growth, the shoot threshold level of As, Cd, Cu, Cr and Zn are 21-72, 45-48, 13-15, 5-18 and > 880 mg kg^{-1}, respectively. Vetiver grown in iron ore tailings could accumulate high concentrations of Cu in shoot (47 mg kg^{-1}) and in root (66 mg kg^{-1}) which was higher than the threshold level (Roongtanakiat *et al*., 2008). Even so, an extremely high degree of heavy metal concentration, in the growth media, could influence the plant and play an important role in vetiver growth, as can be noted from the following experiments.

- An experiment treated with landfill leachate indicated that the growth of vetiver was reduced as the landfill leachate strength increased (Fig. 16). The vetiver treated with 100% leachate could not survive at 80-85 days after planting. At the landfill site in Kamphaeng Saen, Nahon Phathom province, vetiver grew well during the first 1-2 months after planting. They showed a good resistance to the poor environment of the garbage landfill. The average plant heights of the two top rows were higher than those in the three lower rows which received greater leachate strength. The toxicity of leachate was more serious at the fourth month, especially in the lower rows, in which some vetiver plants gradually wilted and finally died as shown in Fig. 17.

- Industrial wastewater treatment by vetiver experiment, vetiver grown in W1 (wastewater from milk factory) had the best growth due to less content of heavy

metals, while the worst growth was found in W4 (ink manufacturing facility) in which was not only contaminated with Mn, Fe but also contained Cu as high as 118.92 mg kg^{-1} above the industrial effluent standard (≤ 20 mg kg^{-1}). They appeared unhealthy with stunted plant, few tillers and whitish-yellow old leaves. Roots were stunted, cracked and brown (Fig. 18). This was probably caused by Cu toxicity as its principal effect is on root growth (Osotsapa, 2003; Sheldon and Menzies, 2005).

- In zinc mine soil with extremely high concentration of multi-heavy metals, vetiver appeared with severe chlorosis with light yellowish to white in color on young leave (Fig. 19). It may be the symptom of Zn toxicity due to the concentration of Zn in soil which was as high as 5,039 mg kg^{-1} which is very much higher than the toxic concentration level (900 mg kg^{-1}) in soil (Alloway, 1995).

7. HEAVY METAL UPTAKE

Two factors involving the heavy metal uptake, are the concentration of heavy metal in plant and plant biomass. Suitable vetiver ecotype and agricultural practice for a specific heavy metal are needed to obtain high heavy metal concentration in plant and biomass as previously described. For non-hyperaccumulator like vetiver, improving biomass and propagation are necessary for high efficiency of phytoremediation. Application of organic fertilizer can increase vetiver yield (Fig. 5-7) and may reduce toxicity of heavy metal through the adsorption of the toxic compounds to the organic matter. If chelating agents are needed for enhanced bioavailability of heavy metals, establishment of vetiver growth is required before application. Once the vetiver is fully grown, the aerial growth should be harvested periodically to remove the heavy metals from contaminated site and accelerate new growth for more uptakes.

8. CONCLUSION

Phytoremediation is an interesting alternative to current environmental cleanup methods that are energy intensive and expensive. However, it required hyperaccumulator plants such as alpine pennycress (*Thlaspi caerulescens*), Indian mustard (*Brassica juncea*), Chinese brake (*Pteris vittata* L.) as they concentrate high pollutants. However, some characteristics of these plants, for example, slow growth, low biomass and shallow root system, can limit phytoremediation efficiency. With vetiver phytoremediation, the long and dense root system of vetiver, can absorb heavy metals from the deep soil layers, then transfer to aerial part for harvest and thus reduce the metals concentration in soil. At the same time, vetiver roots can prevent leaching and runoff of heavy metals to nearby areas and ground water by immobilizing and stabilizing heavy metals. Moreover, on land affected by degradation and contamination, this plant can be an excellent pioneer plant to

conserve water and improve soil quality. When hydroponic culture is applied for wastewater treatment, vetiver shoots and roots can be harvested easily to remove the pollutants. To clean up soil, the aerial part can be harvested occasionally without replanting. An important advantage of harvested vetiver is that it is not considered hazardous waste, unlike hyperaccumulator residual. It can be used safely for bio-energy production, compost or even as material for handicrafts.

This versatile technology is applicable to sites with low to moderate contamination. For extremely polluted sites, it is more suitable to use in conjunction with other remediation method. However, as previously mentioned, factors affecting vetiver growth and metal uptake must be considered before introducing vetiver. Further studies should be site based and focused on optimizing agronomic management practice. Genetic engineering and mutation breeding to modify vetiver characteristics can also be beneficial to increase utilization of vetiver technology for environmental sustainability.

9. ACKNOWLEDGEMENTS

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Stevenson, F.L.; and Cole, M.A.. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulfur, Micronutrients. John Wiley & Sons, Inc., New York, USA.

Truong, P. 1999. Vetiver grass technology for mine rehabilitation. PRVN Technical Bulletin No. 1999/2. Office of the Royal Development Projects Board, Bangkok, Thailand.

Truong, P. and Baker, D. 1998. Vetiver grass for stabilization of acid sulfate soil, pp.196-198. *In* Proc. 2nd Nat. Conf. Acid Sulfate Soils. Coffs Harbour, Australia.

Xia, H.; Liu, S.; and Ao, H. 2000. Study on purification and uptake of garbage leachate by vetiver grass, pp. 394-406. *In* Proc. ICV-2. Cha-am, Phetchaburi, Thailand. 18-22 January 2000.

Yang, B.; Shu, W.S.; Ye, Z.H.; Lan, C.Y.; and Wong, M.H. 2003. Growth and metal accumulation in vetiver and two *Sesbania* species on lead/zinc mine tailings. Chemosphere 52: 1593-1600.

Yanqun, Z.; Yuan, L.; Jianjun, C.; Haiyan, C.; Li, Q.; and Schvartz, C. 2005. Hyperaccumulation of Pb, Zn, and Cd in herbaceous grown on lead-zinc mining area in Yunnan, China. Environ. Int. 31: 755-762.

Ye, Z.H.; Wong, J.W.C.; and Wong, M.H. 2000. Vegetation response to lime and manure compost amendments on acid lead/zinc mine tailings: A greenhouse study. Restoration Ecology 8: 289-295.

City of Mount Gambier

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 GUIDELINES

The aim of the City of Mount Gambier Sport and Recreation Major Capital Works Program is to foster and assist in the development and/or capital renewal of Sport and Recreation infrastructure, within the City.

For the 2018/2019 year, Council will again make available significant funds for allocation to eligible Sport and Recreation groups and organisations.

Applications for funding under the Sport and Recreation Major Capital Works Program, as a general rule, should be for projects with a minimum total project cost of $10,000. An allocation of $70,000 has been made in Councils 2018/2019 budget for distribution in this annual program.

As a general rule, preference will be given to applications which can demonstrate a high incidence of self help as evidenced by matching funds or significant in kind contributions by the organisation, towards the project evidenced by bank statements or written commitment from funding partner/s.

The applicant's contributions for this purpose may include cash from the organisation's own resources, grants or funds from sponsors or other sources or in kind support in the form of labour or services. If the applicant's contribution includes a grant from another source, the applicant must provide evidence that the grant has been awarded or confirmed with an application under this program.

The Applicants 'Self Help' contribution, as defined, must equate to a minimum contribution of at least 25% of the total project costs.

The following guidelines are provided to assist in the preparation of applications.

What Types of Projects are eligible for Program Funding?

The types of projects which would be considered appropriate for Sport and Recreation Major Capital Works Program funding include:

- Capital renewal of existing asset infrastructure e.g. replace lighting, pitches, upgrade courts, capital repair of buildings, grounds etc.
- Capital upgrades to enhance existing asset infrastructure e.g. building extensions, rebuild structures, upgrade lighting, additional new facilities etc.
- New capital assets - to build/develop assets not previously provided e.g. new clubrooms, toilets, lighting, change rooms etc.
- Projects which are aimed at increasing the community usage of specific sport or recreation facilities.

In respect of projects involving buildings or infrastructure, preference will be given to applications which aim to renovate, overhaul or repair existing buildings or facilities, rather than the construction of new or additional facilities.

What is not eligible for Program Funding?

Grants will not be awarded to fund:

- Routine or ongoing operating costs (staff wages, rent, electricity, water, insurance etc), the purchase of land or the repayment of financial loans.

- Projects which have already been commenced or completed prior to grants being awarded.
- Projects submitted by individuals.

Who can apply for Grant Funding?

In recognition of Council's support of the Office of Recreation and Sport Starclub Program to be eligible grant applicants must:

- Be an existing Starclub Member - minimum 4* with commitment to achieving 5* rating as pre-condition for release of funds, or
- Be a new Starclub Member - registered prior to closing date for applications with commitment to achieving 2* rating as a pre-condition for release of funds.
- Any Sport or Recreation organisation, which is based in the City of Mount Gambier area and who's activities are predominantly conducted within the City of Mount Gambier.
- Applicants **must** have a current Australian Business Number (**ABN**) issued by the Australian Taxation Office (ATO). Applications will not be considered unless the applicant has an ABN at the time of submitting the grant application.

Any individual or organisation can apply for an ABN very easily on-line via the Australian Business Register at http://www.abr.gov.au/

An organisation may only submit one application per annum.

Primary and Secondary schools are generally excluded from applying, unless they can demonstrate that their project is predominantly for the benefit of the wider community.

Assessment:

Council grant funding is subject to landowner/council consent including any engineering/building requests.

Council may seek additional information and support from Local or Regional Association or equivalent when and if required for assessment of application.

Payment Conditions of Grants:

Grant funds will be paid to successful applicants following receipt by Council of evidence clearly demonstrating that the project has been completed that include:

- Written Quotes – x 2 for works >$5,000, x3 for works >$20,000
- Invoices for completed works
- Development approvals / landowner consent
- Evidence of completed works (ie. Photos, Certificate/Statement of Completion, Electrical or Plumbing Certificates)
- Warranty Certificates/documentation
- As-Constructed plans including specifications and service locations
- Financial summary of completed project
- Payment will not be made for a completed project which is not the project detailed in the grant application.

- If the grant recipient is registered for GST, a tax invoice must accompany the Claim for payment.

Acquittal documentation must be submitted by 14th June 2019 to enable the release of funds before the end of the financial year.

Funds that are not acquitted by 30 June 2019 will be forfeited unless an extension has been sought and granted in writing by 31 May 2019. The applicant must demonstrate that the project is substantively complete at the time of submitting an extension request.

Claims for payment of a Grant which are received by Council after 30 June 2019 will not be considered under any circumstances.

Applications must be received by the Chief Executive Officer, City of Mount Gambier by 5.00 p.m. on the advertised closing date for the program.

Mark McSHANE
CHIEF EXECUTIVE OFFICER
City of Mount Gambier
Civic Centre
10 Watson Terrace
(P O Box 56)
MOUNT GAMBIER SA 5290
Email: city@mountgambier.sa.gov.au

City of Mount Gambier

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 APPLICATION

SECTION 1 - INFORMATION ABOUT YOUR ORGANISATION

1.	**Name of Organisation**	
2.	**ABN** (Mandatory)	
3.	**Registered for GST ?**	Yes ☐ No ☐
4.	**Address of Organisation**	Street Address : Suburb/Town : Postcode :
5.	**Postal Address** (If different to Street Address)	Address : Suburb/Town : Postcode :
6.	**Contact Person**	Title : Mr ☐ Mrs ☐ Miss ☐ Ms ☐ Dr ☐ First Name : Surname : Position : Phone : Mobile : Email :
7.	**Is your Club/Association registered for the StarClub Development Program**	Yes ☐ No ☐
8.	**Is your Club/Association registered as a Good Sports Club?**	Yes ☐ No ☐ If yes, which Level: Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 0 ☐ (accreditation Level for clubs without a Liquor Licence)

9. **About Your Membership**
(Indicate numbers under each heading)

	Junior	Senior	Total
Male			
Female			
Total			

SECTION 2 - INFORMATION ABOUT YOUR PROJECT

(Please attach extra pages if insufficient space is provided)

1. Title of your Project

2. Describe what you are planning to do

3. Describe why you are doing it

4. Will the wider community benefit from your project, and how will they benefit?

5. Where will the project be conducted? (If the project involves construction)

If the construction is to occur on land owned by City of Mount Gambier, you MUST obtain approval from Council PRIOR to submitting this application, or your application will not be considered.

Address:

SECTION 3 - PROJECT COSTS, FUNDING SOURCES AND GRANT SOUGHT

PROJECT COSTS

A. Project Cash Expenses

Item (List all items and expenses you will have to pay for with cash)	Amount (Inc GST)
	$
	$
	$
	$
	$
	$
	$

Sub Total (A) **$**

B. Project In Kind Contributions

Item (List all items which are to be provided IN KIND toward your Project)	Estimated Value
	$
	$
	$
	$
	$
	$
	$

Sub Total (B) **$**

C. Project Voluntary Labour Contributions

Item (Provide an estimate of any voluntary labour directly involved in your Project)			Estimated Value
Skilled (Trade) Voluntary Labour	(hours)	X $45/hour =	$
Unskilled Voluntary Labour	(hours)	X $20/hour =	$

Sub Total (C) $

D. Total Project Cost (A + B + C) $

PROJECT FUNDING

	Amount
E. Your Organisation's Cash Contribution	$
F. Grant/s from other sources (Attach evidence that other grants have been awarded)	$
G. Value of In Kind Contributions (Sub Total **B** from previous page)	$
H. Value of Voluntary Labour (Sub Total **C** from previous page)	$

I. Value of Grant Requested from Council	$

J. Total Project Funding (E + F + G + H + I)	$

[The Total Costs at (D) must equal the Total Funding at (J)]
[Please ensure that the total of (e), (f), (g) and (h) equate to at least 25% of (j)].

Applications which are not accompanied by the following documents will not be considered.

The following documents for your organisation must be attached to this application :

1. Most recent annual financial statements (do not have to have been audited).
2. All bank statements for the last 3 months up to the current date.
3. Starclub Membership of minimum 4* (with commitment to achieving 5* rating), or
4. Starclub Membership registered prior to closing date for applications with evidence of commitment to achieving 2* rating

REDUCED GRANT VALUE

1. Will your Organisation be able to proceed with the Project if Council awards a Grant of a lower value than that requested in (I) above ?

Yes ☐ **No** ☐

2. If your Project can still proceed with a lower value Grant, how will you meet the funding shortfall for the Project ?

Signature :	
Name :	
Position :	
Date :	

Applications may be lodged at the Council Office, Civic Centre, 10 Watson Terrace, posted to P O Box 56, Mount Gambier SA 5290 or emailed to city@mountgambier.sa.gov.au but must be received by Council by **5.00 p.m. on Friday, 30 November, 2018**.

City of Mount Gambier

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 APPLICATION

SECTION 1 - INFORMATION ABOUT YOUR ORGANISATION

1.	**Name of Organisation**	South Gambier Netball Club Association
2.	**ABN** (Mandatory)	90 748 040 883
3.	**Registered for GST ?**	No
4.	**Address of Organisation**	Street Address: Commercial Street West Suburb/Town: Mt Gambier Postcode: 5290
5.	**Postal Address** (If different to Street Address)	Address: P.O. Box 8666 Suburb/Town : Mt Gambier East Postcode : 5291
6.	**Contact Person**	Title : Mrs First Name : Michaela Surname : Bell Position : Committee Member Phone : Mobile : 0423399407 Email : joirjac@gmail.com
7.	**Is your Club/Association registered for the StarClub Development Program**	Yes
8.	**Is your Club/Association registered as a Good Sports Club?**	No If yes, which Level: Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 0 ☐ (accreditation Level for clubs without a Liquor Licence)

9. **About Your Membership**

(Indicate numbers under each heading)

	Junior	Senior	Total
Male			
Female	54	38	92
Total			92

SECTION 2 - INFORMATION ABOUT YOUR PROJECT

(Please attach extra pages if insufficient space is provided)

1. Title of your Project

Resurfacing of two existing Netball Courts and upgrade and installation of Netball Court Shelters at the South Gambier Netball Club

2. Describe what you are planning to do

The South Gambier Netball Club (SGNC) has experienced significant growth in recent years and currently have over 90 active members competing in the Western Border Netball Association.

The SGNC plans to do the following:

1. Resurface the two existing netball courts to obtain adequate court dimensions, install kerb and channel drainage, court resealing and line marking to meet the required standards set by Netball Australia. The current SGNC court surfaces are an old asphalt surface which is over 30 years old.

2. Upgrade Court 1 Shelter: Extend the Court 1 Shelter to enable 2 teams, along with officials, coaches, and playing equipment to remain dry and safe, away from the harsh elements of a Mount Gambier Winters.

3. Install Court 2 Shelter: Install two Court Shelters to enable each team, along with officials, coaches, and playing equipment to have their own separate shelter enabling them to remain dry and safe, away from the harsh elements of a Mount Gambier Winters. Currently our younger Juniors play on this Court and are often having to sit exposed to the elements of wind and rain.

3. Describe why you are doing it

The South Gambier Netball Club (SGNC) is a thriving community sporting club that currently has 6 Junior Teams & 4 Senior Teams in the Western Border Netball Association, spanning South Australia and Victoria and has been an important part of the community for over 30 years. However, as the SGNC has continued to grow and succeed the facilities have unfortunately deteriorate over the years with the club receiving an increasing number of complaints from netball players, umpires, officials, parents and spectators due to the poor playing surfaces and lack of safe and secure shelters made available.

Resurfacing of existing Netball Courts

The current court surfaces are deteriorating, slippery in wet conditions and unforgiving to fall on and failing to meet netball court standards. The asphalt surface is quite tired and worn with cracks and dents that can cause injuries and accidents and represents a safety issue for not only players but umpires and spectators as well. Poor court drainage results in excess water on the courts with games regularly stopped as the courts become inundated with water making it unsafe for games to continue. If the SGNC can provide a smooth, even and safe playing surface and insure the court run off is now compliant, we will be able to increase access to the courts and allow other community groups and sporting organisations to access the courts. Improved court surfaces will assist us in attracting new users to the club and utilise our facilities, improve the professionalism of the game along with the standard of the games and skill level of players.

Shelters

Currently the SGNC is the only Western Border Netball Club with inadequate Shelters, with just one small shelter available. This shelter can only be used by one court and then needs to be shared by players, coaches, officials, parents and spectators. The provision of shelters along the sidelines of the two netball courts is needed as netball is a wet weather sport and play often continues when it is raining and windy. Shelter from the weather needs to be provided for game officials, scorers, coaches, first aid trainers, spectators and interchange and injured players. Provisions to keep game day equipment dry is also required. Items such as the player's bags, team game day equipment, score sheets, first aid equipment, game day checklists and paperwork are required courtside during the game.

Currently the teams that are required to play on Court 2 have no shelter provided to them at all, with Coaches, Officials etc and young children being forced to sit in the rain and wind to watch their game. With no Shelter available people also become reluctant to become involved in the sport, especially if the weather is wet and windy. It can become difficult to find volunteers on a Saturday who are prepared to sit in the rain for an hour, such as the responsible person or timer.

Teams on Court 1, fair no better with the home team being provide a small amount of shelter that is limited to only a

couple of people with little remaining room for equipment and players bags. Visiting teams are required to sit on a bench exposed to the weather. There are some quite large trees that run parallel to the Court and on windy days falling branches and leaves make this area a hazard, as teams & officials can be potentially injured by falling branches.

Presently the SGNC shelter facilities are not adhering to the recommendations of Netball Australia.

4. Will the wider community benefit from your project, and how will they benefit?

As a result of the facilities upgrade, the SGNC will be able to provide a better quality, safer and more accessible sporting facility for the over 500 players that compete in the Western Border Netball Association and the greater Limestone Coast community. Improving our facilitates through the resurfacing of our Courts and upgrading of our Clubs shelters will benefit the community by;

- Bringing us in line with Netball Australia's National Facilities Policy which has been adopted by Netball SA & the Western Border Netball Association enabling us to host elite athletes at the club which is a real boost for the club, and extremely important for its viability.
- Increasing the number of players who will and can now play sport utilising our new facilities, leading to healthier, more active community.
- Increasing the number of games that can be played on the courts and the number of people who can access and utilise the courts, in both Summer & Winter due to improved facilities.
- Maintaining a consistent standard of facilities across the Western Border Netball Association enabling us to attract regional/state and national events to the City of Mount Gambier.
- Increasing usage of the Courts by schools and community organisations due to improved and safer facilities.
- Providing a more professional environment and facilities potential new users can be attracted.
- The South Gambier Football Club, men's & women's league will also be able to access the facilities for exercising, particularly when the oval surface is unavailable due to wet weather.

Facilities play a vital role in the vibrancy of community sport. Proving access to high quality facilities that meet the needs and demands of netball is a critical component of growing and sustaining participation as well as supporting the sustainability of associations, leagues and clubs.

5. Where will the project be conducted? (If the project involves construction)

If the construction is to occur on land owned by City of Mount Gambier, you MUST obtain approval from Council PRIOR to submitting this application, or your application will not be considered.

Address: Blue Lake Sports Park, Commercial Street West, Mount Gambier SA

SECTION 3 - PROJECT COSTS, FUNDING SOURCES AND GRANT SOUGHT

PROJECT COSTS

A. Project Cash Expenses

Item (List all items and expenses you will have to pay for with cash)	Amount (Inc GST)
Mobile required plant site	$596.00
Retaining wall construction	$2,354
Profile edges to 155m2	$950.00
Application of 30mm of AC7 asphalt to a total area of 1,523m2	$27,782
20m x 2 m Shed (Court 1)	$6,633
2 x 6m x 2 m Shed (Court 2)	$4,000
Supply material to set out and mark lines to 2 netball courts	$3,300

Sub Total (A) **$46 211**

B. Project In Kind Contributions

Item (List all items which are to be provided IN KIND toward your Project)	Estimated Value
We have had to include In Kind contribution in the Project Cash Expenses as the quotes received where from businesses that are supporters of SGNC so have therefor offered discounts in their quotes.	$
	$
	$
	$
	$
	$
	$

Sub Total (B) **$**

C. Project Voluntary Labour Contributions

Item (Provide an estimate of any voluntary labour directly involved in your Project)			Estimated Value
Skilled (Trade) Voluntary Labour	(hours)	133X $45/hour =	$5985
Unskilled Voluntary Labour	(hours)	100X $20/hour =	$2000

Sub Total (C) **$7,985**

D. Total Project Cost (A + B + C)

$ 54 196

PROJECT FUNDING

	Amount
E. Your Organisation's Cash Contribution	$16 211
F. Grant/s from other sources (Attach evidence that other grants have been awarded)	$
G. Value of In Kind Contributions (Sub Total B from previous page)	$
H. Value of Voluntary Labour (Sub Total C from previous page)	$7 985

I. Value of Grant Requested from Council	$30 000

J. Total Project Funding (E + F + G + H + I)	$54 196

[The Total Costs at (D) must equal the Total Funding at (J)]
[Please ensure that the total of (e), (f), (g) and (h) equate to at least 25% of (j)].

Applications which are not accompanied by the following documents will not be considered.

The following documents for your organisation must be attached to this application :

1. Most recent annual financial statements (do not have to have been audited).
2. All bank statements for the last 3 months up to the current date.
3. Starclub Membership of minimum 4* (with commitment to achieving 5* rating), or
4. Starclub Membership registered prior to closing date for applications with evidence of commitment to achieving 2* rating

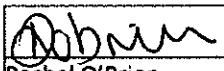
REDUCED GRANT VALUE

1. Will your Organisation be able to proceed with the Project if Council awards a Grant of a lower value than that requested in (I) above ?

   Yes, with restrictions

2. If your Project can still proceed with a lower value Grant, how will you meet the funding shortfall for the Project?

Potentially our Project can proceed if we receive a lesser amount, however we would have to review proceeding with both the Courts resurfacing and the Shelter upgrade and potentially select one. This project can be broken down into stages and any funding received will go towards the upgrading of our facilities

Signature :	
Name :	Rachel O'Brien
Position :	SGNC Vice President
Date :	Thursday 15th November

Applications may be lodged at the Council Office, Civic Centre, 10 Watson Terrace, posted to P O Box 56, Mount Gambier SA 5290 or emailed to city@mountgambier.sa.gov.au but must be received by Council by **5.00 p.m. on Friday, 16 November, 2018.**

City of Mount Gambier

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 APPLICATION

SECTION 1 - INFORMATION ABOUT YOUR ORGANISATION

1. **Name of Organisation** — Mount Gambier And District Baseball League Inc.
2. **ABN** (Mandatory) — 27 657 057 895
3. **Registered for GST ?** — Yes ☐ No ☑
4. **Address of Organisation**
   Street Address : Blue Lake Sports Park
   Suburb/Town : Mt Gambier Postcode : 5290
5. **Postal Address**
   (If different to Street Address)
   Address :
   Suburb/Town : Postcode :
6. **Contact Person**
   Title : Mr ☑ Mrs ☐ Miss ☐ Ms ☐ Dr ☐
   First Name : TREN
   Surname : GREEN
   Position : PRESIDENT
   Phone :
   Mobile : 0428838663
   Email : greendog.5@hotmail.com
7. **Is your Club/Association registered for the StarClub Development Program** — Yes ☑ No ☐
8. **Is your Club/Association registered as a Good Sports Club?** — Yes ☑ No ☐
   If yes, which Level: Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 0 ☐ (accreditation Level for clubs without a Liquor Licence)
9. **About Your Membership**
   (Indicate numbers under each heading)

	Junior	Senior	Total
Male	174	180	
Female			
Total			354

SECTION 2 - INFORMATION ABOUT YOUR PROJECT

(Please attach extra pages if insufficient space is provided)

1. Title of your Project

UPGRADE OF BATTING CAGES

2. Describe what you are planning to do

REPLACE INTERNAL BATTING CAGE NETS
INSTALL SYNTHETIC GRASS TO COVER CONCRETE SLAB

3. Describe why you are doing it

THE CURRENT NETS HAVE MULTIPLE HOLES AND TEARS WHICH ALLOWS THE BASEBALL TO SHOOT THROUGH TO THE OTHER SIDE WHICH COULD HIT AND INJUR THE PEOPLE ON THE OTHER SIDE. WE only HAVE SMALL PIECES OF SYNTHETIC GRASS WHICH ALLOWS PEOPLE TO SLIP ON THE CONCRETE WHEN WET OR DAMP.

4. Will the wider community benefit from your project, and how will they benefit?

ALL MEMBERS OF THE BASEBALL LEAGUE AND SOFTBALL LEAGUE WILL BENEFIT FROM BEING ABLE TO USE THESE BATTING CAGES IN A SAFE MANNER. ALSO WE ARE HOPING TO HOST MORE ARL GAMES IN THE FUTURE & PROVIDE A PROFESSIONAL FACILITY FOR THE GAMES IN DECEMBER.

5. Where will the project be conducted? (If the project involves construction)

If the construction is to occur on land owned by City of Mount Gambier, you MUST obtain approval from Council PRIOR to submitting this application, or your application will not be considered.

Address: BLUE LAKE SPORTS PARK IN THE PRE-EXISTING BATTING CAGES NEXT TO THE CLUBROOMS

SECTION 3 - PROJECT COSTS, FUNDING SOURCES AND GRANT SOUGHT

PROJECT COSTS

A. Project Cash Expenses

Item (List all items and expenses you will have to pay for with cash)	Amount (Inc GST)
Synthetic Grass & TAPE	$ 4,726
Custom made netting For inside	$
The batting Cages	$ 6054
	$
Epoxy GLUE	$ 200
	$
	$

Sub Total (A) $ 10,980

B. Project In Kind Contributions

Item (List all items which are to be provided IN KIND toward your Project)	Estimated Value
Stripping out the old nets 1hr	$
Stripping out the old Synth grass 3hrs,	$
Steam clean the concrete slab 5hrs	$
Glue down the new Synth grass 5hrs	$
Hang The new nets 3hrs	$
	$
	$

Sub Total (B) $

C. Project Voluntary Labour Contributions

Item (Provide an estimate of any voluntary labour directly involved in your Project)			Estimated Value
Skilled (Trade) Voluntary Labour	(hours)	X $45/hour =	$
Unskilled Voluntary Labour	17 (hours)	X $20/hour =	$ 340

Sub Total (C) $ 340

D. Total Project Cost (A + B + C) $ 11,320

PROJECT FUNDING

	Amount
E. Your Organisation's Cash Contribution	$
F. Grant/s from other sources (Attach evidence that other grants have been awarded)	$
G. Value of In Kind Contributions (Sub Total B from previous page)	$
H. Value of Voluntary Labour (Sub Total C from previous page)	$ 340
I. Value of Grant Requested from Council	$ 10980
J. Total Project Funding (E + F + G + H + I)	$ 11320

[The Total Costs at (D) must equal the Total Funding at (J)]
[Please ensure that the total of (e), (f), (g) and (h) equate to at least 25% of (j)].

Applications which are not accompanied by the following documents will not be considered.

The following documents for your organisation must be attached to this application :

1. Most recent annual financial statements (do not have to have been audited).
2. All bank statements for the last 3 months up to the current date.
3. Starclub Membership of minimum 4* (with commitment to achieving 5* rating), or
4. Starclub Membership registered prior to closing date for applications with evidence of commitment to achieving 2* rating

REDUCED GRANT VALUE

1. Will your Organisation be able to proceed with the Project if Council awards a Grant of a lower value than that requested in (I) above ? **Yes** ☑ **No** ☐

2. If your Project can still proceed with a lower value Grant, how will you meet the funding shortfall for the Project ?

Pay the shortfall out of the MGDBL Account

Signature :	
Name :	BEN GREEN
Position :	PRESIDENT
Date :	6.11.18

Applications may be lodged at the Council Office, Civic Centre, 10 Watson Terrace, posted to P O Box 56, Mount Gambier SA 5290 or emailed to city@mountgambier.sa.gov.au but must be received by Council by 5.00 p.m. on Friday, 16 November, 2018.

City of
Mount Gambier

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 APPLICATION

SECTION 1 - INFORMATION ABOUT YOUR ORGANISATION

1. Name of Organisation

South Gambier Football Club Inc

2. ABN (Mandatory)

83 850 824 916

3. Registered for GST ?

Yes ☒ No ☐

4. Address of Organisation

Street Address : 200 Jubilee Hwy East

Suburb/Town : Mt Gambier Postcode : 5290

5. Postal Address

(If different to Street Address)

Address : PO Box 362

Suburb/Town : Mt Gambier Postcode : 5290

6. Contact Person

Title : Mr ☒ Mrs ☐ Miss ☐ Ms ☐ Dr ☐

First Name : Wayne

Surname : Glynn

Position : President

Phone : 08 87250952

Mobile : 0407 928 753

Email : wayneglynn@bigpond.com

7. Is your Club/Association registered for the StarClub Development Program

Yes ☒ No ☐

8. Is your Club/Association registered as a Good Sports Club?

Yes ☒ No ☐

If yes, which Level: Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 0 ☐ (accreditation Level for clubs without a Liquor Licence)

9. About Your Membership

(Indicate numbers under each heading)

	Junior	Senior	Total
Male	187	150	337
Female	62	50	112
Total			449

SECTION 2 - INFORMATION ABOUT YOUR PROJECT

(Please attach extra pages if insufficient space is provided)

1. Title of your Project

MODERNISE CHANGE ROOMS

2. Describe what you are planning to do

ENLARGE + MODERNISE HOME + AWAY CHANGE ROOMS
ENLARGE + MODERNISE UMPIRE CHANGE ROOMS
MAKE ALL CHANGE ROOMS SUITABLE FOR MALE / FEMALE / CHILDREN.
INCLUDE GYM + DISABLED TOILET UNDER MAIN ROOF
RESURFACE NETBALL COURTS + CRICKET PITCH.

3. Describe why you are doing it

CLUB ROOM IS 45 YEARS OLD + DESPERATELY NEEDS TO BE MODERNISED TO MEET AFL STANDARD. WE WANT TO MAKE THE CLUB SUITABLE + ATTRACTIVE TO ALL - MEN, WOMEN, CHILDREN, NON-TRADITIONAL PARTICIPANTS, FAMILIES

4. Will the wider community benefit from your project, and how will they benefit?

THE CLUB IS ALREADY USED BY MANY SPORTS IN THE COMMUNITY (FOOTBALL, CRICKET, NETBALL, TENNIS, SOFTBALL, EQUESTRIAN, DOG OBEDIENCE, RUGBY ETC). BY MAKING THESE CHANGES MORE PEOPLE CAN BE INVOLVED SAFELY AND SECURELY.

5. Where will the project be conducted? (If the project involves construction)

If the construction is to occur on land owned by City of Mount Gambier, you MUST obtain approval from Council PRIOR to submitting this application, or your application will not be considered.

Address: 200 JUBILEE HWY EAST, MT GAMBIER
BLUE LAKE SPORTS PARK.

SECTION 3 - PROJECT COSTS, FUNDING SOURCES AND GRANT SOUGHT

PROJECT COSTS

A. Project Cash Expenses

Item (List all items and expenses you will have to pay for with cash)	Amount (Inc GST)
DESIGN & SUPERVISION	$ 20 000
DEMOLITION & EARTHWORKS	$ 30000
ELECTRICAL	$ 30000
PLUMBING & ROOFING	$ 50000
CARPENTRY & JOINERY	$ 60000
CONCRETE & OTHER	$ 162,000
RESURFACE NETBALL COURTS, CRICKET PITCH	$ 50,400

Sub Total (A) $ 402 400

B. Project In Kind Contributions

Item (List all items which are to be provided IN KIND toward your Project)	Estimated Value
DESIGN & SUPERVISION	$ 10000
TILING	$ 5000
PAINTING	$ 15000
PLASTER / CLADDING / INSULATION	$ 10000
	$
	$
	$

Sub Total (B) $ 40 000

C. Project Voluntary Labour Contributions

Item (Provide an estimate of any voluntary labour directly involved in your Project)			Estimated Value
Skilled (Trade) Voluntary Labour	80 (hours)	X $45/hour =	$ 3600
Unskilled Voluntary Labour	200 (hours)	X $20/hour =	$ 4000

Sub Total (C) $ 76 00

D. Total Project Cost (A + B + C) $ 450,000

PROJECT FUNDING

		Amount
E.	**Your Organisation's Cash Contribution**	$ 34740o
F.	**Grant/s from other sources** (Attach evidence that other grants have been awarded)	$ 5000 SANFL
G.	**Value of In Kind Contributions** (Sub Total B from previous page)	$ 40000
H.	**Value of Voluntary Labour** (Sub Total C from previous page)	$ 7600
I.	**Value of Grant Requested from Council**	$ 50000
J.	**Total Project Funding** (E + F + G + H + I)	$ 450000

[The Total Costs at (D) must equal the Total Funding at (J)]
[Please ensure that the total of (e), (f), (g) and (h) equate to at least 25% of (j)].

Applications which are not accompanied by the following documents will not be considered.

The following documents for your organisation must be attached to this application :

1. Most recent annual financial statements (do not have to have been audited).
2. All bank statements for the last 3 months up to the current date.
3. Starclub Membership of minimum 4* (with commitment to achieving 5* rating), or
4. Starclub Membership registered prior to closing date for applications with evidence of commitment to achieving 2* rating

REDUCED GRANT VALUE

1. Will your Organisation be able to proceed with the Project if Council awards a Grant of a lower value than that requested in (I) above ? Yes ☒ No ☐

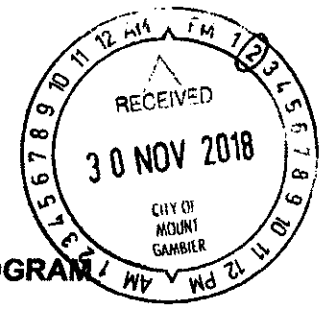
2. If your Project can still proceed with a lower value Grant, how will you meet the funding shortfall for the Project ?

WE WILL SELF-FUND AS MUCH OF THE PROJECT AS WE CAN. WE HAVE APPLIED FOR A $225,000 GRANT FROM ORSR GRISSEWOODS FOOTBALL, CRICKET & NETBALL FACILITY PROGRAM.

Signature :	
Name :	WAYNE GLYNN
Position :	PRESIDENT
Date :	13.11.18

Applications may be lodged at the Council Office, Civic Centre, 10 Watson Terrace, posted to P O Box 56, Mount Gambier SA 5290 or emailed to city@mountgambier.sa.gov.au but must be received by Council by 5.00 p.m. on Friday, 16 November, 2018.

City of
Mount Gambier



SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

2018/2019 APPLICATION

SECTION 1 - INFORMATION ABOUT YOUR ORGANISATION

1. **Name of Organisation** — BLUE LAKE SPORTS CLUB INCORPORATED

2. **ABN** (Mandatory) — 28 736 209 156

3. **Registered for GST ?** — Yes ☐ No ☒

4. **Address of Organisation**
   Street Address : 50 WHITE AVENUE
   Suburb/Town : MT GAMBIER Postcode : 5290

5. **Postal Address**
   (If different to Street Address)
   Address : PO BOX 324
   Suburb/Town : MT GAMBIER Postcode : 5290

6. **Contact Person**
   Title : Mr ☒ Mrs ☐ Miss ☐ Ms ☐ Dr ☐
   First Name : JEREMY
   Surname : BUTLER
   Position : VICE PRESIDENT
   Phone :
   Mobile : 0415 868 571
   Email : BLUELAKESOCCERCLUB@OUTLOOK.COM

7. **Is your Club/Association registered for the StarClub Development Program** — Yes ☒ No ☐

8. **Is your Club/Association registered as a Good Sports Club?** — Yes ☒ No ☐
   If yes, which Level: Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 0 ☒ (accreditation Level for clubs without a Liquor Licence)

9. **About Your Membership**
   (Indicate numbers under each heading)

	Junior	Senior	Total
Male	80	40	120
Female	18	15	33
Total			153

SECTION 2 - INFORMATION ABOUT YOUR PROJECT

(Please attach extra pages if insufficient space is provided)

1. Title of your Project

FENCING, SEATING, LIGHTING & SECURITY UPGRADE

2. Describe what you are planning to do

SECURE GROUNDS TO PROTECT FROM UNAUTHORISED USE (EG. 'HOONS')
ENSURE PLAYING FIELD MEETS FULL REGULATIONS (FENCING)
UPGRADE SPECTATOR SEATING
UPGRADE LIGHTING FOR SAFER TRAINING / GAMES
GENERAL GROUNDS BEAUTIFICATION

3. Describe why you are doing it

WE HAVE HAD SEVERAL INCIDENTS WITH 'HOONS' ON GRASSED AREAS
AS FIELD & SURROUNDS ARE NOT PROPERLY SECURE
INCREASED LIGHING OUTPUT FOR SAFER TRAINING / GAME PLAY
ENHANCE VISUAL APPEARANCE OF OVERALL FACILITY

4. Will the wider community benefit from your project, and how will they benefit?

ATTRACT ADDITIONAL COMMUNITY INVOLVEMENT (WE ALREADY HAVE A
LARGE REFUGEE / MIGRANT CONTINGENT & HOST ALL ABILITIES SOCCER)
AND THIS UPGRADE WILL SUPPORT ADDITIONAL PLAYERS

5. Where will the project be conducted? (If the project involves construction)
If the construction is to occur on land owned by City of Mount Gambier, you MUST obtain approval from Council PRIOR to submitting this application, or your application will not be considered.

Address: NOT APPLICABLE - LIGHTING TO BE PLACED ON EXISTING
POLES & GATES ADDED TO EXISTING FENCING

SECTION 3 - PROJECT COSTS, FUNDING SOURCES AND GRANT SOUGHT

PROJECT COSTS

A. Project Cash Expenses

Item (List all items and expenses you will have to pay for with cash)	Amount (Inc GST)
PLAYING FIELD FENCE - 14 GATES	$ 2141
GATES - EASTERN, WESTERN & CRICKET ENTRANCES	$ 2327
POST + RAIL FENCE 45m	$ 2539
LABOUR - FENCING	$ 1500
LIGHTS - 2 x LED PER POLE	$ 10,824
LABOUR + PLANT HIRE FOR LIGHTING	$ 2,673
SEATING	$ 1,354
TURF	950
Sub Total (A)	$ 25,625
SHRUBS	1317

B. Project In Kind Contributions

Item (List all items which are to be provided IN KIND toward your Project)	Estimated Value
DINGO HIRE	$ 1,000
SEATING / SECURITY BOLLARDS	$ 310
	$
	$
	$
	$
	$
Sub Total (B)	$ 1,310

C. Project Voluntary Labour Contributions

Item (Provide an estimate of any voluntary labour directly involved in your Project)			Estimated Value
Skilled (Trade) Voluntary Labour	32 (hours)	X $45/hour =	$ 1,440
Unskilled Voluntary Labour	32 (hours)	X $20/hour =	$ 640
Sub Total (C)			$ 2,080

D. Total Project Cost (A + B + C) $ 29,015

PROJECT FUNDING

	Amount
E. Your Organisation's Cash Contribution	$ 5,000
F. Grant/s from other sources (Attach evidence that other grants have been awarded)	$
G. Value of In Kind Contributions (Sub Total **B** from previous page)	$ 1,310
H. Value of Voluntary Labour (Sub Total **C** from previous page)	$ 2,080
I. Value of Grant Requested from Council	$ 20,625
J. Total Project Funding (E + F + G + H + I)	$ 29,015

[The Total Costs at (D) must equal the Total Funding at (J)]
[Please ensure that the total of (e), (f), (g) and (h) equate to at least 25% of (j)].

Applications which are not accompanied by the following documents will not be considered.

The following documents for your organisation must be attached to this application :

1. Most recent annual financial statements (do not have to have been audited).
2. All bank statements for the last 3 months up to the current date.
3. Starclub Membership of minimum 4* (with commitment to achieving 5* rating), or
4. Starclub Membership registered prior to closing date for applications with evidence of commitment to achieving 2* rating

REDUCED GRANT VALUE

1. Will your Organisation be able to proceed with the Project if Council awards a Grant of a lower value than that requested in (I) above ? **Yes** ☑ **No** ☐

2. If your Project can still proceed with a lower value Grant, how will you meet the funding shortfall for the Project ?

REDUCE LIGHTING UPGRADE TO 1 LED PER POLE (REDUCES COST BY OVER $6,000)
NOT UNDERTAKE HEDGING
ALTERATIVE REPLACEMENT OF SOUTH WEST FENCE

Signature :	
Name :	JEREMY BUTLER
Position :	VICE PRESIDENT
Date :	30/11/2018

Applications may be lodged at the Council Office, Civic Centre, 10 Watson Terrace, posted to P O Box 56, Mount Gambier SA 5290 or emailed to city@mountgambier.sa.gov.au but must be received by Council by **5.00 p.m. on Friday, 16 November, 2018.**

SPORT AND RECREATION MAJOR CAPITAL WORKS PROGRAM

PROJECTS PREVIOUSLY FUNDED

Year	Organisation	Project Description	Allocation $	Total Annual Allocation $
2010	MG Little Athletics	Purchase of timing gate	10,000	45,000
	Basketball Mount Gambier	Canteen/viewing area upgrade (stage 1)	20,000	
	Suttontown Tennis	Court fencing upgrade	15,000	
2011	Apollo Soccer	Fencing	12,242	100,000
	MG Softball League	Fencing	25,000	
	Basketball Mount Gambier	Clubroom upgrade (stage 2)	31,046	
	West Gambier Cricket	Turf wicket development	22,312	
	MG Tennis Club	Kitchen upgrade	9,400	
2012	LSE Hockey Association	Upgrade/replace playing surface	40,000	100,000
	MG Croquet	Upgrade kitchen & watering system	10,000	
	MG Netball Association	Netball shelters	20,000	
	Basketball Mount Gambier	Clubroom upgrade (stage 3)	30,000	
2013	West Gambier Football Club	Clubroom air-conditioning	11,000	100,000
	MG Greyhound	Well construction	11,000	
	MG Softball League	Clubroom upgrade	18,000	
	MG Tennis Club	Safety fencing / sun shelters	10,000	
	North Gambier Football/Netball	Vansittart Park Infrastructure Upgrades (Special Allocation)	50,000	
2014	West Gambier Football Club	Purchase/Install Rainwater Tanks	10,000	70,000
	East Gambier Sportsmen's Club	Re-roof Clubrooms	20,000	
	North Gambier Football Club	Upgrade Canteen/BBQ Shed	8,000	
	Mount Gambier Little Athletics	Upgrade Athletic Track	24,000	
	Blue Lake BMX Club	Re-roof Clubrooms	8,000	
2015	Apollo Soccer Club	Water Reduction Program	15,000	65,000
	MG Harness Racing Club	Lighting Upgrade	20,000	
	MG Cricket Association	Sight Screens & Covers Upgrade	30,000	
2016	West Gambier Football Club	Upgrade Flood Lighting and Tower	40,000	70,000
	South Gambier Football Club	Renovation Public Toilet Block	9,000	
	MG District Baseball League	Lighting Upgrade	14,000	
	Blue Lake Soccer Club	Storage Shed (Extension)	7,000	
2017	South Gambier Football Club	Home Change Room Renovations	15,000	56,450
	Mil-Lel Cricket Club	Upgrade Frew Park Nets	6,360	
	MG Harness Racing Club	Lighting and PA system upgrade	20,000	
	Basketball Mount Gambier	Upgrade Entrance	15,090	

2018 HERITAGE RESTORATION FUND - SUMMARY OF APPLICATIONS

APPLICATION NO.	APPLICANT	PROPERTY	DESCRIPTION OF WORK	ESTIMATED COST	RECOMMENDED VALUE OF GRANT	DATE APPLICANT RECEIVED FUNDING
	Adrian Robert & Tracy Pearl Koop	93 Penola Road	Repairs and re-roofing of back section of the house. Leaking roof has damaged inside ceilings and needs full replacement.	$7700	$1500	
	*George Haskas	16 Eglington Terrace	Repair south bay window frame bottom sashes as they are rotted and glass is cracked. Replace broken glass above front door Replace glass east top window	$1,679.50 Quote 1 $425.50 Quote 2 $427.90	$800	
	Mount Gambier Club Inc	7 Penola Road	Restoration of wood work and gutters. Install rain head and down pipes. Remove ability of moisture of inner walls. Restore roof parapet wall on east side of roof.	$13,399.03 Quotes to the value of $9,157.50	$2000	
	Kiri Fleming	35 Jubilee Highway West	External painting after repainting store work. Restore iron fretwork and repaint. Repair sash windows x4. Reinstate front entry gate and driveway gate.	$12,635.87	$2000	
	Georgina Jones	12 Canavan Road	Repair of eaves/woodwork and rotten guttering.	$4,000 (Quotes range from $1,148.25 - $2,815)	$700	
	Jo & David Glover	33 O'Halloran Terrace	Propose to install wooden boards over existing concrete to return to original state.	$4,500	$500	
	Darren & Yvette Sims	82 Penola Road	Current return verandah and cast iron posts are in danger of collapsing. The wall has bowed 100mm and the verandah slab has dropped 50mm.	Quote 1 $13,057 Quote 2 $13,530	$2500	
	Kathryn Zvirgzdins	7 Jardine Street	Painting front verandah, pressure clean verandah, sand down fascias, gap fill, repair pillars, replace pillars, ceiling panels and beams painted.	Quote 1 $2,293 Quote 2 $2,250	$800	
	*Ryan & Kirsty Turner	58 Bay Road	Supply and install emu wire fence, gutters to be replaced and improve drainage away from stone walls. Repair and paint timber	$35,000+	$2000	

***** These Applicants received funding as part of the 2016 Local Heritage Restoration Fund

2018 HERITAGE RESTORATION FUND - SUMMARY OF APPLICATIONS

			windows and stonework at front of house. Reinstate stone chimneys in style appropriate to era of the house.	Quote $9,600 – fence		
	*Darren & Tanya Coxon	55 Bay Road	Replace existing verandah with new bull nose as per Richard Wood's advice. Repair finial x2 (Remove, repair and install) as per Richard Woods advice.	$5,000	$1500	
	John & Wendy Pocock	45 Crouch Street North	Replacement of rotted/broken cords in 8 sash-windows $132/set	$1,056	$500	
	John William Ancell & Raspati Suciati Louis	36 Elizabeth Street	Replace shed roof and gutters	$11,150.49	$2000	
	Fiona Smith	17 O'Halloran Terrace	Remove cracked pointing to front of home and patch with matching coloured mortar e.g. Dolomite, to match in with dolomite stone. Also painting to limestone where required.	$950	$500	
	Margaret Kaethner	93 Crouch Street South	Repairing of stone and woodwork. Repair of salt damp. Removing and replacing the original wiring in the front half of the house.	Quote for painting etc. - $10,365 Quote for rewiring - $2,076.67	$2000	
	Joe & Sue Clements	24 Fairlie Street	Paint of fascias, barge board, verandah posts and front of carport in existing colours.	Quote 1 $3,621.98 Quote 2 $1,850	$700	

***** These Applicants received funding as part of the 2016 Local Heritage Restoration Fund

City of Mount Gambier

PROFORMA STATEMENT OF COMPREHENSIVE INCOME
Budget FY2019 and BR1 FY2019

	FY Budget 2019	FY BR1 2019	2018
	$'000	$'000	$'000
INCOME			
Rates	**21,486**	**21,486**	20,597
Statutory charges	**462**	**512**	447
User charges	**4,855**	**4,855**	4,484
Grants, subsidies and contributions	**3,321**	**3,321**	3,906
Investment income	**48**	**48**	62
Reimbursements	**85**	**85**	83
Other income	**269**	**269**	522
Total Income	**30,525**	**30,575**	**30,102**
EXPENSES			
Employee costs	**11,575**	**11,596**	11,034
Materials, contracts & other expenses	**11,433**	**11,462**	10,023
Depreciation, amortisation & impairment	**7,032**	**7,032**	7,004
Finance costs	**157**	**157**	236
Total Expenses	**30,197**	**30,247**	**28,296**
OPERATING SURPLUS / (DEFICIT)	**328**	**328**	1,805
Asset disposal & fair value adjustments	**399**	**399**	(243)
Amounts received specifically for new or upgraded assets	**-**	**-**	445
Physical resources received free of charge	**-**	**-**	463
NET SURPLUS / (DEFICIT) transferred to Equity Statement	**727**	**727**	**2,470**
Other Comprehensive Income			
Amounts which will not be reclassified subsequently to operating result			
Changes in revaluation surplus - infrastructure, property, plant & equipment			22,325
Impairment (expense) / recoupments offset to asset revaluation reserve			(1,217)
Total Other Comprehensive Income	**-**	**-**	**21,108**
TOTAL COMPREHENSIVE INCOME	**727**	**727**	**23,578**

City of Mount Gambier

PROFORMA STATEMENT OF FINANCIAL POSITION
Budget FY2019 and BR1 FY2019

	FY Budget 2019	FY BR1 2019	2018
ASSETS	**$'000**	**$'000**	**$'000**
Current assets			
Cash and cash equivalents	**5,314**	**5,314**	4,587
Trade & other receivables	**1,524**	**1,524**	1,524
Other financial assets	**-**	**-**	-
Inventories	**304**	**304**	304
	7,142	**7,142**	**6,415**
Non-current Assets held for Sale	**-**	**-**	-
Total current assets	**7,142**	**7,142**	**6,415**
Non-current assets			
Financial assets	**-**	**-**	-
Equity accounted investments in Council businesses	**-**	**-**	-
Investment property	**-**	**-**	-
Infrastructure, property, plant & equipment	**246,964**	**246,964**	246,964
Other non-current assets	**-**	**-**	-
Total non-current assets	**246,964**	**246,964**	**246,964**
Total assets	**254,106**	**254,106**	**253,379**
LIABILITIES			
Current liabilities			
Trade & other payables	**2,429**	**2,429**	2,429
Borrowings	**218**	**218**	218
Provisions	**2,332**	**2,332**	2,332
Other current liabilities	**-**	**-**	
	4,979	**4,979**	**4,979**
Liabilities relating to Non-current Assets held for Sale	**-**	**-**	-
Total current liabilities	**4,979**	**4,979**	**4,979**
Non-current liabilities			
Trade & Other Payables	**-**	**-**	-
Borrowings	**2,572**	**2,572**	2,572
Provisions	**3,593**	**3,593**	3,593
Liability - Equity accounted Council businesses	**-**	**-**	-
Other Non-current Liabilities	**-**	**-**	
Total non-current Liabilities	**6,165**	**6,165**	**6,165**
Total liabilities	**11,144**	**11,144**	**11,144**
NET ASSETS	**242,962**	**242,962**	**242,235**
EQUITY			
Accumulated surplus	**65,495**	**65,496**	64,768
Asset revaluation reserves	**176,619**	**176,619**	176,619
Available for sale Financial Assets	**-**	**-**	-
Other reserves	**848**	**848**	848
Total Council Equity	**242,962**	**242,962**	**242,235**
Minority Interest	**-**	**-**	-
TOTAL EQUITY	**242,962**	**242,962**	**242,235**

City of Mount Gambier

PROFORMA STATEMENT OF CHANGES IN EQUITY
Budget FY2019 and BR1 FY2019

	Accumulated surplus	Asset revaluation reserve	Other reserves	Total equity
2019	$'000	$'000	$'000	$'000
Balance at end of previous reporting period	**64,768**	**176,619**	**848**	**242,235**
Restated opening balance	**64,768**	**176,619**	**848**	**242,235**
Net surplus / (deficit) for the year	**727**			**727**
Other Comprehensive Income				
Transfers between reserves	**-**		**-**	**-**
Balance at end of period	**65,496**	**176,619**	**848**	**242,962**
2018	$'000	$'000	$'000	$'000
Balance at end of previous reporting period	**61,333**	**155,509**	**3,030**	**219,872**
Net surplus / (deficit) for the year	1,253			**1,253**
Other Comprehensive Income				
Gain on revaluation of infrastructure, property, plant & equipment		22,325		**22,325**
Impairment (expense) / recoupments offset to asset revaluation res		(1,217)		**(1,217)**
Other equity adjustments	(0)	2	0	**2**
Transfers between reserves	2,183		(2,183)	**-**
Balance at end of period	**64,768**	**176,619**	**848**	**242,235**
2017	$'000	$'000	$'000	$'000
Balance at end of previous reporting period	**54,680**	**168,966**	**4,382**	**228,028**
Net surplus / (deficit) for the year	5,301			**5,301**
Other Comprehensive Income				
Gain on revaluation of infrastructure, property, plant & equipment		(13,457)		**(13,457)**
Transfers between reserves	1,352		(1,352)	**-**
Balance at end of period	**61,333**	**155,509**	**3,030**	**219,872**

City of Mount Gambier

PROFORMA STATEMENT OF CASH FLOWS
Budget FY2019 and BR1 FY2019

	FY Budget 2019	FY BR1 2019	2018
CASH FLOWS FROM OPERATING ACTIVITIES	**$'000**	**$'000**	**$'000**
Receipts			
Rates - general & other	**20,370**	**20,370**	19,522
Fees & other charges	**462**	**512**	447
User charges	**4,855**	**4,855**	4,322
Investment receipts	**-**	**-**	62
Grants utilised for operating purposes	**3,321**	**3,321**	3,906
Reimbursements	**85**	**85**	83
Other revenues	**269**	**269**	597
Payments			
Employee costs	**(11,575)**	**(11,596)**	(11,715)
Materials, contracts & other expenses	**(10,317)**	**(11,479)**	19,115
Finance payments	**(157)**	**(157)**	(172)
Net cash provided by (or used in) Operating Activities	**7,312**	**6,180**	**36,167**
CASH FLOWS FROM INVESTING ACTIVITIES			
Receipts			
Amounts specifically for new or upgraded assets	**-**	**-**	445
Sale of replaced assets	**399**	**352**	146
Sale of surplus assets	**-**	**-**	71
Repayments of loans by community groups	**-**	**-**	35
Payments			
Expenditure on renewal/replacement of assets	**(4,374)**	**(4,678)**	(3,919)
Expenditure on new/upgraded assets	**(2,610)**	**(1,126)**	(31,179)
Net cash provided by (or used in) Investing Activities	**(6,585)**	**(5,453)**	**(34,402)**
CASH FLOWS FROM FINANCING ACTIVITIES			
Payments			
Repayments of borrowings	**-**	**-**	(206)
Net cash provided by (or used in) Financing Activities	**-**	**-**	**(206)**
Net increase / (decrease) in cash held	**727**	**727**	**1,559**
Cash & cash equivalents at beginning of period	**4,587**	**4,587**	3,028
Cash & cash equivalents at end of period	**5,314**	**5,314**	**4,587**

BICYCLE NETWORK®

GREAT VIC BIKE RIDE

2019 Partnership Proposal

Prepared by the Bicycle Network Events Team

22nd November - 1st December 2019

Overview

The most iconic, supported bicycle holiday in the Southern Hemisphere

Event: Great Victorian Bike Ride

Dates: Friday 22nd November - Sunday 1st December

Location: Limestone Coast to the Great Ocean Road

Anticipated Audience Numbers: 4500 - 5000 Riders

Ticket Types: First 4 days, Last 4 days, 9 day

The Great Victorian Bike Ride is a fully supported cycle touring holiday. 2019 will be the event's 36th year and we're going to make it the most epic yet!

The Great Victorian Bike Ride provides bike riders with an affordable, supported cycling and camping holiday visiting iconic rural destinations. The event is challenging and fun with a friendly community environment. It's a week in another world.

For 2019

Riders will be able to choose
First 4 days, last 4 days or the full 9 days

We are seeking to begin the ride in Robe, travel through the Limestone Coast to the Great Ocean Road before heading east through the Otways concluding in Torquay
Robe - Torquay

Riders will challenge themselves on distances between
50km - 107km per day

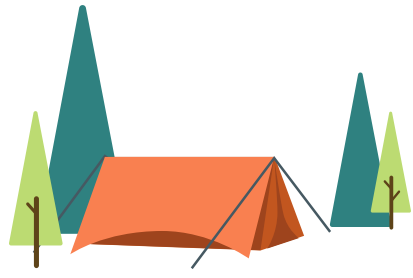
The ride

Destination

Great Ocean Road- Our Most Popular Destination

We know our riders love heading to the Great Ocean Road, in fact each time we have visited the region we achieve the largest rider numbers. By starting from South Australia and including the iconic town of Robe and the stunning Limestone Coast we predict 2019 to continue this trend.

A Great Ocean Road ride will on average bring an extra 39.5% of riders to the ride.



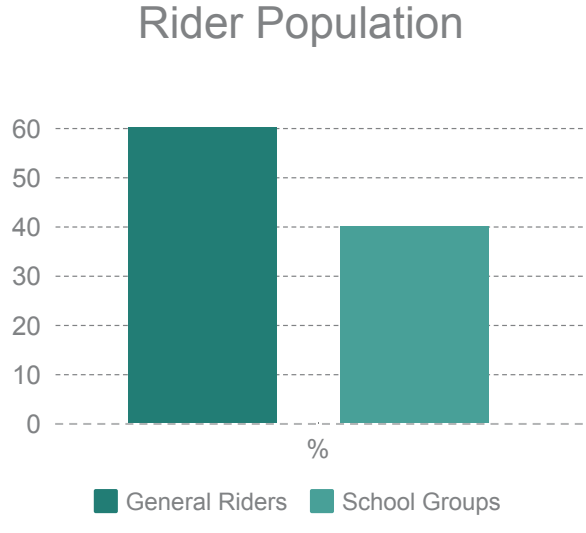
The Riders

Who are the riders?

The majority of our riders are male
60% male / 40% female

Out of our non school riders
85% are aged between 40-70

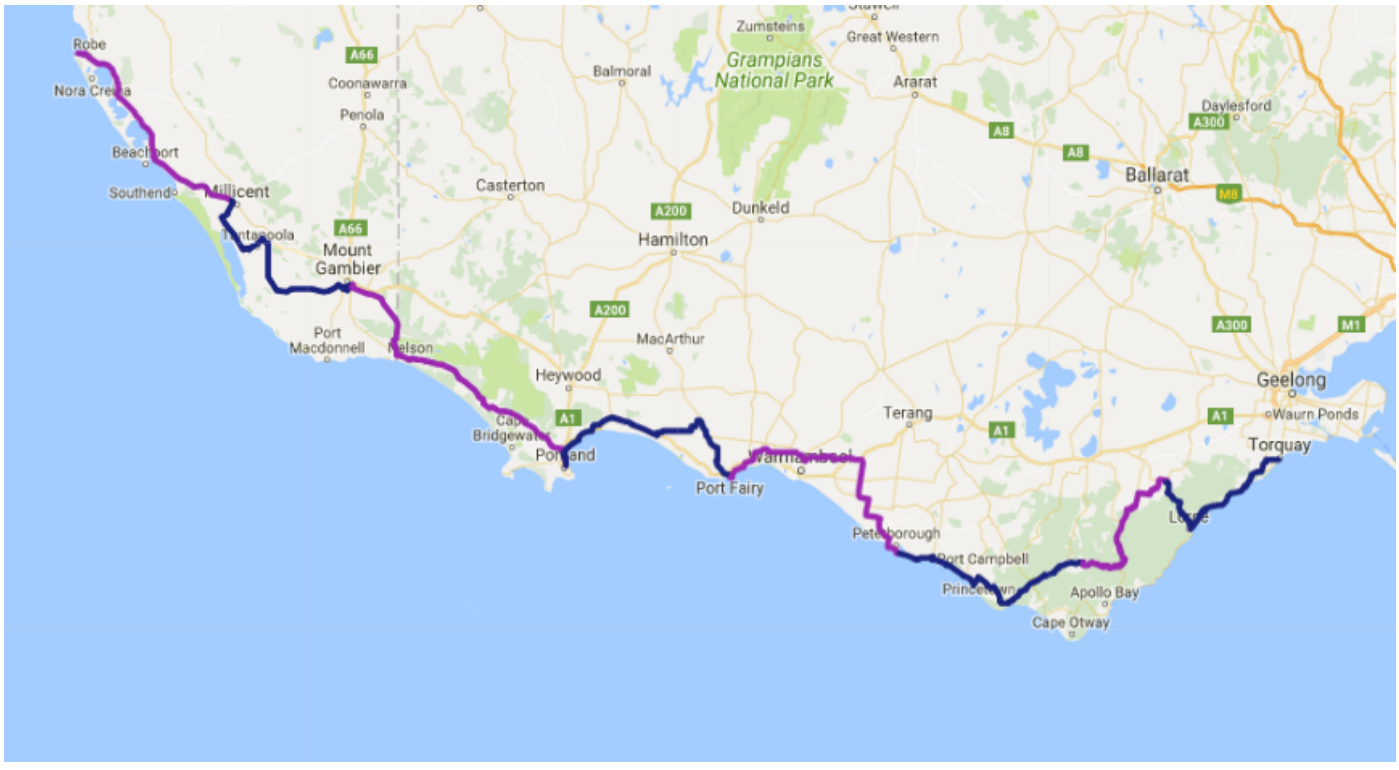
Most of our riders are local with
80% of riders from Victoria

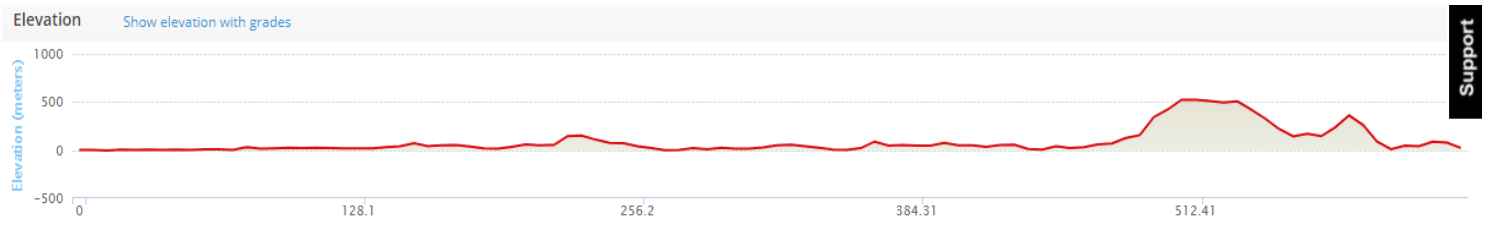


The event has three distinct target markets:

- School groups, who we anticipate will make up approximately 40% of event attendees.
- 50-70 year olds, residing in Victoria, with an interest in camping, travelling and cycling.
- 40-50 year olds, interested in the festival feel of the event and ticking this must do ride off their bucket list.

Route Proposal





Route Proposal

For the 2019 event Bicycle Network are proposing a challenging yet spectacular route taking in South Australia's Stunning Limestone Coast and making it's way through to the iconic Great Ocean Road and the Otways. Starting the ride in Robe we will trek to Millicent via the coast, the next day take us to a Great Vic favourite, Mt Gambier. Riders will then make the journey back to Victoria arriving in Portland which will be the longest day of riding on the event. Port Fairy is our next destination and our rest day, here we will farewell the first 4 day ticket holders and welcome the second group of riders.

From Port Fairy we will continue heading east heading to the small town of Peterborough. Notorious Lavers Hill will follow Peterborough. Riders will tackle this challenging climb before finishing in Beech Forest. Continuing through the magical Otway's riders will make it to Deans Marsh for their last night in their tents. The final day of riding will conclude in the beautiful surf coast town of Torquay.

Route Proposal - In Detail

Challenging, yet achievable

Our proposal will see riders on the 9 day route with a 651km journey. The longest distance ridden in a single day is 107km and the average day is 81km

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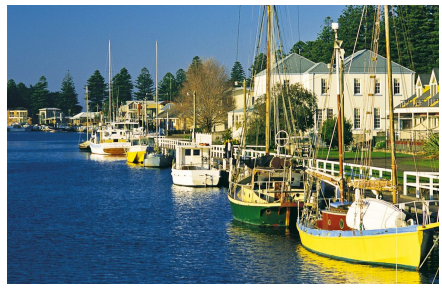
1. Start Site - Robe
Fri 22nd Nov - 9 day & first 4 day ride option start

2. Robe - Millicent (79km)
Sat 23 November

3. Millicent - Mt Gambier (77km)
Sun 24 November

4. Mt Gambier - Portland (107km)
Mon 25 November



5. Portland - Port Fairy (85km)
Tue 26 November

Route Proposal - In Detail

6. Port Fairy Rest Day
Wednesday 27 November
First 4 day ride finish / Second 4 day ride start

7. Port Fairy - Peterborough (95km)
Thu 28 November

8. Peterborough - Beech Forrest (81km)
Fri 29 November

9. Beech Forest - Deans Marsh (62km)
Sat 30 November

10. Deans Marsh - Torquay (66km)
Sun 1 Dec

Campsites

We'd love to make your home our home!

The Great Vic is a community on the move! Operationally, we are fully self-sufficient but we do require a site equaivalent in size to 3-4 footballs ovals to set-up on. We'll use this site to accommodate the Riders camping areas, catering operations, toilets and showers, etc. While 3 or 4 actual ovals would be perfect, we know that's hard to come by in regional areas, so we're experienced in making any combination of public space (reserves, show grounds, golf clubs, etc.) and private land work.

If power and water aren't available on-site, that's ok too – we bring it all with us!

"3 to 4 football ovals is a good guideline"

The Benefits of Having Us

Economic impact

In 2017, > 60% of riders spent over $20/day, and 37% spent over $40/day

That's an injection of approximately $140,000 per day into the local community

Increased off peak trading for local traders

Repeat Visitation

66% of respondents said they were likely to return one of the towns visited within 12 months.

43% said they would bring an additional person, 53% said they would bring more than one.

This equates to an extra 7,400 possible visits!

Destination Marketing

The Great Vic towns get exposure to markets in Victoria and beyond through integrated marketing campaigns that incorporate both above the line and below the line platforms.

Each town has a video produced showcasing what the destination has to offer which is shared on social media platforms.

Community Fundraising Opportunities

Bicycle Network offer extensive opportunities for local community groups to fund raise at both campsite and rest stops.

Community Benefits

There's a huge host of benefits for the region when the Great Vic comes to town!

Rider Communications

- Logo acknowledgement on our ride guide, brochure, website, poster and other printed collateral
- Dedicated section for the hosting community on the website
- A section for council content within ride guide
- An article in the Great Vic rider Enews to registered riders
- 3mx3m tourism information stand at each campsite
- Opportunity to present at the rider briefing the night preceeding our visit to your town.
- A digital copy of a short professional promotional video showcasing each host town
- Opportunity to provide hard copy promotional collateral in our rider pack

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Event Marketing

Marketing for the Great Victorian Bike Ride is primarily via direct marketing to our database of over 300,000 names.

This includes communicating to our target markets through our website, posters, flyers, sales emails and inbound/outbound calling. An individual campaign with focus on the towns and region visited will be created by our marketing team.

In the Loop

Fortnightly newsletter sent to our members and friends with information from all over the bike riding world

Audience - 130,000 recipients

Open rate - 37%

Click through rate - 29%

Sales EDMs

Weekly segmented emails sent to our 'cyclist' and 'rider' demographics about upcoming events

Audience - 150,000 recipients

Open rate - 27%

Click through rate - 9%

Facebook - 20,000+ likes

Twitter - 2,000+ followers

Instagram - 3,500+ followers

Website - 340,000 unique visitors p/month

Collateral Examples:

Media Exposure

In 2018, the Great Vic Bike Ride attracted over 300 media hits with over 14 million views in print media alone! This was combined with successful distribution across radio, print, TV and online. The value of all editorial in Print Media Alone was estimated at $758,000.

Don't miss

SEE VICTORIA ON TWO WHEELS

Hundreds of cyclists will take part in the 34th RACV Great Victorian Bike Ride from November 25 to December 3. The 539km ride will take riders from Wilson's Promontory through the spectacular scenery of Gippsland's countryside and coast to the foothills of the Great Dividing Range. Nine-, five- and three-day rides available. Visit greatvic.com.au.

TRAVEL

Doing Something Different

If you are on the look out for your next scenic adventure, *Gail Robbins* has road tested the perfect bike ride festival for you to get peddling on.

Photo credit: Bicycle Network

Photo credit: Bicycle Network

Photo credit: Bicycle Network

Day Two, the riding began and the magnificent Grampians National Park greeted us with a cool 4 degrees, a few long hills, plenty of gorgeous gum trees and views of dramatic escarpments

WIN News Gippsland
14 November at 18:36

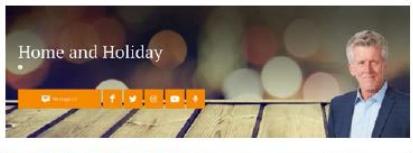
Morwell's Sacred Heart Primary is gearing up for the Great Victorian Bike Ride later this month. Kids of all ages are ready to saddle up, as the famous ride takes on a Gippsland flavour... Pedalling into action from the Prom.

WINNEWS

3.2k Views

Like Comment Share

2UE TALKING lifestyle



3AW693 NEWS TALK

Council Investment

We're excited to offer you the opportunity to join the 2019 Great Vic as a Host Council.

With an investment of $12,000 per overnight stay, plus some in-kind support, you can expect to see a direct economic injection to into local businesses and community groups, high repeat visitation and a unique destination marketing opportunity.

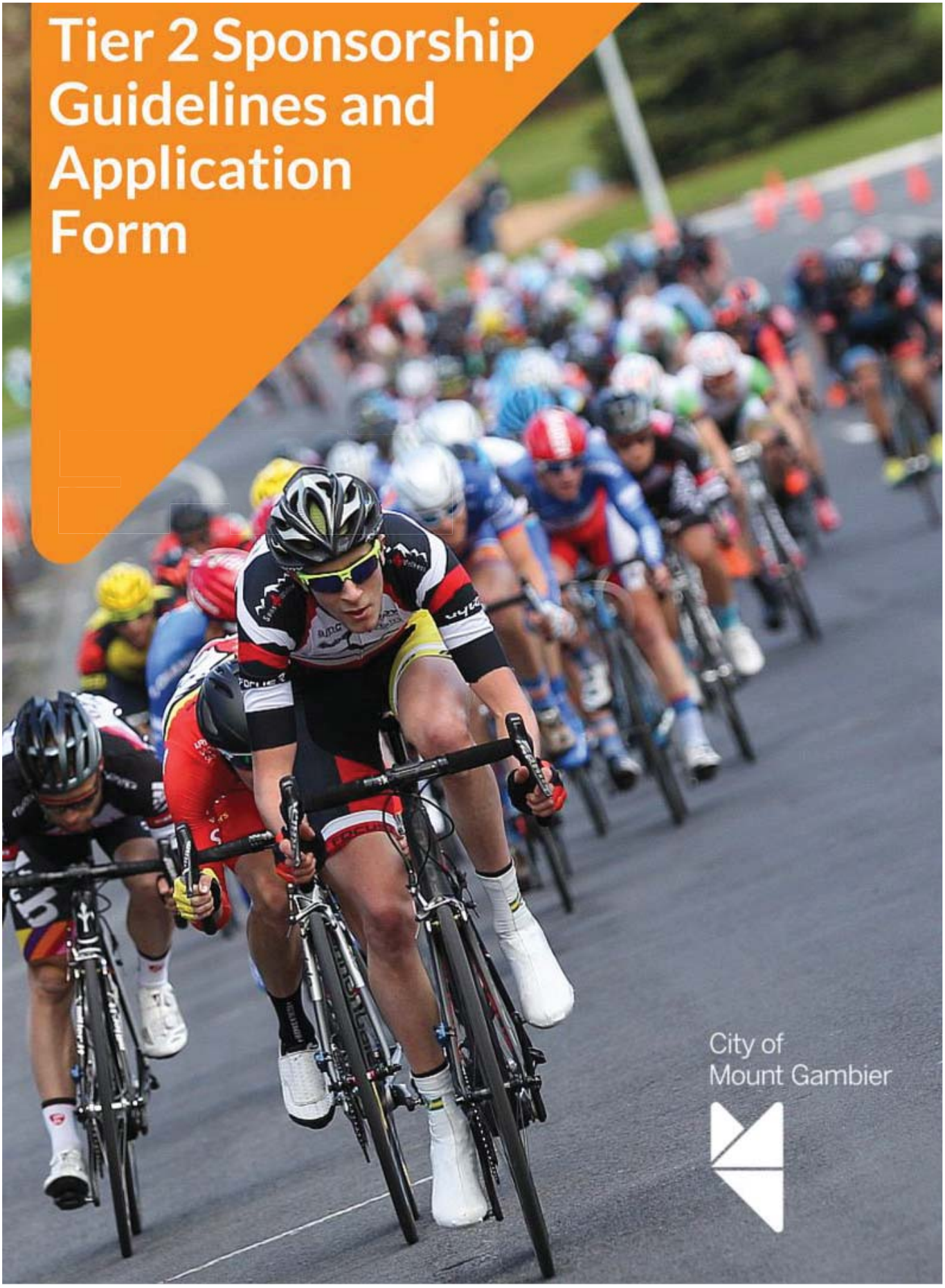
The cash investment can be split across both the 18/19 and 19/20 Financial Year, if required, and from an in-kind perspective we justask for support with:

- Waiver of site fees related to nominated campsites (rec reserves etc.) and rest stops
- Waiver of fees in relation to power at nominated sites
- Supply of 140 wheely bins for the campsite (Bicycle Network responsible is responsible for removing refuse)
- Support and advice for local roads
- Community engagement support and advice

We'd love to chat more:
Kahlia Dix
Event Manager
Bicycle Network
P:(03) 8376 8845
M: 0427 300 823
E:kahliad@bicyclenetwork.com.au

BICYCLE NETWORK®

Tier 2 Sponsorship Guidelines and Application Form



City of Mount Gambier

Sponsorship Program Overview

Tier 1 Sponsorship - Up to $2000

Funding provided to events held within the City of Mount Gambier that meets the aims of Council's Sponsorship Program and supports the Community Plan.

Tier 2 Sponsorship - Over $2000

Funding provided to major/significant events held within the City of Mount Gambier that meet the aims of Council's Sponsorship Program and supports the Community Plan. The event must also attract substantial economic benefit and visitation to the City of Mount Gambier and include strategic and targeted marketing.

Which category should I apply for?

All applicants should apply under the Tier 1 Sponsorship, unless it can be proved that the proposed event will:

- attract substantial visitation to the City
- deliver substantial and measurable economic benefit to the City
- incorporate strategic and targeted marketing practices in its planning and implementation
- The event being held is that of State, National or International significance.

NOTE unsuccessful Tier 2 sponsorship applications are automatically considered under Tier 1 Sponsorship.

Aims of the Sponsorship Program

The aims of the City of Mount Gambier's Event Sponsorship Program are to support the four pillars of the Community Plan in helping to:

- Support the development of vibrant, creative and innovative events that enhance the economic, social and cultural life of the City of Mount Gambier
- Increase tourist visitation and deliver measurable economic benefits to the City
- Facilitate community involvement in events and activities
- Attract new and diverse events to the City of Mount Gambier
- Support events that build and reinforce the unique and positive attributes of the City of Mount Gambier.

Assessment

If funding requested exceeds $5,000 the application is referred to a committee/ council for consideration. A decision regarding the level of assistance will be considered at the next available Council meeting. A decision will be reached within approximately **two months** of the application being proposed at the Council meeting. Notification of the decision will be made in writing.

Applicant Eligibility Criteria

Before submitting your application, please check that you meet the following eligibility criteria – all boxes must be ticked or your application will not be progressed.

- ☒ The organisation is an incorporated body or, if not incorporated, is being auspiced by an incorporated body
- ☒ The proposed event is covered by a current Public Liability Insurance Policy to the minimum value of $10,000,000.
- ☒ Provide either an Australian Business Number (ABN) or complete the Australian Taxation Office "Statement by a Supplier" form
- ☒ Addresses the criteria outlined in the Event Sponsorship Guidelines and Application Form
- ☐ Any sporting organisation must be a registered STARCLUB – for more information visit https://www.recsport.sa.gov.au/starclub/index.php or contact your local STARCLUB Field Officer.

Your proposal is INELIGIBLE for funding if:

- ☐ Your proposal is for funding towards the operating costs associated with running an organisation (e.g. salaries, equipment)
- ☐ Your proposal is for retrospective funding or funding of budget deficits
- ☐ Your proposed event is not open to the general public
- ☐ Your organisation has not fulfilled previous sponsorship obligations, including provision of post event evaluation/report and financial acquittal
- ☐ Your organisation is not an incorporated body, or your proposal is not auspiced by an incorporated body

If you ticked any of the six boxes above your proposal is ineligible for funding.

Assessment Criteria

All applicants must address the following criteria in their application:

- Ability to increase tourist visitation to the City of Mount Gambier including intra and interstate visitors
- Demonstrate the ability to deliver significant and measurable economic benefit to the City of Mount Gambier.
- Ability to facilitate community involvement in the event/activities.
- Ability for the event to add to the diversity of the City's event calendar.
- Marketing plan and promotional strategies.
- Demonstrated capacity of the event organisers to successfully manage the event.
- Risk management and event accessibility planning
- Event sustainability planning and strategies
- Involvement of and consultation with local businesses, artists and community groups.
- Acknowledgement of the City of Mount Gambier's sponsorship in all event publicity and promotions (please provide a proof for approval prior to printing).

Evaluation

Post-event you will be required to complete an Event Evaluation form & provide a copy of your final budget, along with any additional information that will help support your evaluation. A form outlining evaluation requirements will be issued upon confirmation of the City of Mount Gambier sponsorship.

Additional Council Support

In addition to cash sponsorship, you may wish to apply for additional support from the City of Mount Gambier. Please refer to the attached fee schedule for estimated value of additional support. Your event may also be eligible for:

- Free publication in the 'What's On' Column published weekly in The Border Watch
- Free listing of your event on the City of Mount Gambier online events calendar found at www.mountgambier.sa.gov.au/whatson
- Display of posters, flyers &/or programs at The Lady Nelson Visitor & Discovery Centre.
- Use of City of Mount Gambier's promotional bali banners, corflute &/or canvas signs pull- up display banners (all subject to availability).
- Visitor information packs

Submission of Applications

Please return completed form via email city@muntgambier.sa.gov.au or contact (08) 8723 1025 or (08) 8723 3901

City of Mount Gambier

Office Use Only	
CM	
Forwarded	
Approved	
PO #	
G/L Code	
1st Instalment	
2nd Instalment	
EE	

Event Sponsorship Program

Application for Tier 2 Sponsorship (over $2000)

Title of Event: Great Victorian Bike Ride
Name of Organisation/s: Bicycle Network
Postal Address: Level 4 246 Bourke Street Melbourne 3000

Details of Key Personnel for the event:

Name	Role/Responsibility	Contact Phone	Email Address
N/A	President		
N/A	Secretary		
Kahlia Dix	PR/Events Coordinator	(03) 8376 8845	kahliad@bicyclenetwork.com.au

Is your organisation registered for GST?	✓ YES				NO						
Please provide your organisation's Australian Business Number (ABN)	4	1	0	2	6	8	3	5	9	0	3

Event Dates: 22/11/2019 - 1/12/2019 (Mount Gambier 24th and 25th November 2019)		
Event Venue: TBC		
Is this is a new event or continuation of existing? Yes (The event is in it's 36th year)		
Are you considering applying for use of a council venue? i.e City Hall, Cave Garden etc	✓ YES	NO
If yes, please specify which venue you are considering: TBC		
Have you submitted your Special Events Permit for use of council land or Hire Permit for The Main Corner?	YES	✓ NO

**Please note – If you are in the process of negotiating access to a Council venue, you will need to complete the hire permit before we can consider this application for sponsorship (please include copy of permit/application with your sponsorship application)

Anticipated Event Attendance			
Number of *local residents* you anticipate your event will attract:		0	
Number of *visitors* you anticipate your event will attract:		5000	
Please provide a percentage breakdown of the anticipated attendees: 5000			
Local Residents	% Include in SA total	Surrounding Areas	% Included in SA total
Interstate	% 4,750	Other SA	% 200
Overseas	% 50		
Provide an indication of the percentage of non-local participants and spectators expected to stay in paid accommodation within the region			% 10

Estimated total budget for event: (please attach itemised budget including funding from other sources)	**$** TBC

Please detail below any cash &/or additional support you are seeking from Council

Cash Amount Requested	**$** 12,000
Describe how your funding will be expended:	
Funding is used to market the event. As the towns are one of the biggest selling point for this ride we market in both Victoria and beyond through integrated marketing campaigns that incorporate both above the line and below the line platforms. Another fun thing we do for each town is produce a video showcasing the destination available for council use.	
Other Council Support Amount Requested (Refer to Fee Schedule for an estimated cost)	**$** TBC
Please detail any other assistance you are requesting (eg. supply of rubbish bins, hire of bollards, bunting, witches hats, tiered seating, road closures, road signage etc)	
In addition to the $12,000, we ask for council to waiver site fees for the nominated campsite and and rest areas. Waiver fees for power and water (if available at the site), provide 140 wheelie bins for the event, assist in local engagement with the community and also provide advice on local roads.	

When assessing your application, a cost will be applied to the support/assistance sought. Local Government account for all costs for the organisation whether they be direct or in-direct. Please note that any additional requests for support not included in this application will incur a cost as determined by the Event Support Fee Schedule.

Event Description & Program Outline Please attach detailed program if available. Please include activities, entertainment, catering and other relevant information
The Great Victorian Bike Ride is a camping and cycling holiday. Going into its 36th year in 2019 the event takes on a new spectacular destination each year. In 2019 approximately 5,000 will embark of what we are calling the Greatest Great Vic from the Limestone Coast to the Great Ocean Road. More information on next years event can be found here: https://www.bicyclenetwork.com.au/rides-and-events/great-victorian-bike-ride/great-vic-2019/

Event History
Please provide a brief history of the event, including number of times the event has been held in the past, including number of participants, spectators and key event outcomes

The event is going into into it's 36th year in 2019 and is still going strong. The first Great Vic was a trip from Wodonga to Melbourne and from there it has traveled to many destinations around Victoria, this year tackling Bright to Benalla. In 2019 we are going further out of Victoria and into South Australia starting in Robe on the Limestone Coast and traveling to the Great Ocean Road finishing in Torquay. The Great Ocean Road has proven to be our most popular destination to visit for the ride, having the highest ticket sales in comparison to other areas (the highest being 8,000).

Event Objectives
Please list the aims and objectives of the proposed event

- To put an event on for riders to spend a week in another world and visit spectacular locations and to travel the road less traveled
-

Event Sustainability
What strategies do you have in place to ensure the event is sustainable?

The event is going into it's 36th year and has no sign of slowing down. The event is a school camp and consistently has over 1,200 students attend each year. We have a high percentage of returning riders and also attract new riders each yeare.

Economic Impact
Provide detailed examples of the economic impacts that are likely to result from the event. Include estimations ie. Increase in tourism/retail/hospitality/business trade, new economic opportunities, tourism growth etc.

For the local community there is a huge contribution to the community. In 2017 we surveyed our riders and 60% spent over $20 a day and 37% spent over $40 a day. That works out to be a contribution of approximately $140,000 per community per day. This is through avenues such as spending money at local businesses, fundraising for community groups, local accommodation providers etc. In this survey 66% also said they would return to a destination within the next 12 months and 96% of them said they would bring one or more people with them. This means the opportunity for economic impact after the event will be fantastic for the local community.

Sponsorship Acknowledgement
Outline how you intend to recognise the support provided by City of Mount Gambier
When using the City of Mount Gambier Logo please provide a proof for approval prior to printing.

Local Council will get logo acknowledgment on collateral and online, dedicated section for their community on the website, council content in the ride guide, an article in the Great Vic Enews, a digital copy of the video showcasing their town, opportunity to have hard copy promotional collateral in the rider pack, opportunity to present at the rider briefings and a marquee on site for the event.

Community Involvement & Consultation
How will your event involve local businesses, artists and community groups? eg. markets, entertainment, food, security etc.

At campsite and rest areas we encourage and love having local community groups fund raise at the sites (sausage sizzle, icy poles etc.). By doing this it adds to the community atmosphere that the event embraces. In the past we have had street parties, local businesses open later etc. that have been welcomed by our riders.

Marketing Plan and Advertising Schedule
Please provide a detailed schedule of marketing and advertising activities to be undertaken. Please specify what media outlets you are using. When using the City of Mount Gambier Logo please provide a proof for approval prior to finalising media.

Date	Media	Activity	Cost (estimate)
eg. 4-15 Dec	Radio – 5SE	On Air spots x 3	$
eg 6-15 Dec	Newspaper – Border Watch	Display ads x 5	$
TBC			

Accessibility
How will you address accessibility for people with disabilities?

The Great Victorian Bike Ride is an event for everyone. We provide disability related facilities (toilets, access points etc.) and work with individuals to ensure they are provided with a great environment on the event.

Environmental Impact
Briefly outline how you intend to manage the environmental impact of your event. This may include elements from your Traffic Management Plan, Occupational Health & Safety Plan, Waste Management Plan and Risk Assessment. Factors to consider will include waste management, noise levels, pollution/rubbish, impact on community infrastructure etc. Also identify any environmental benefits arising from the event.

All details will be provided in event plan due in 2019.

Event Evaluation

How will you know if you have achieved the aims and the objectives of the event? eg. Customer surveys, local business surveys, community surveys, participant surveys, attendance data-registrations etc.

Our biggest measure for evaluating include registration data (rider numbers, ticket types, add ons etc.) and also we survey all our riders and volunteers at the end of the event. This provides us with details on how much money they spent, favourite destinations etc. If council would like to do any local surveys, Bicycle Network would be happy to assist.

City of Mount Gambier Community Plan

Please identity the area/s in which your event supports the City of Mount Gambier Community Plan?

☑ **Our People**	☑ **Our Location**	☑ **Our Diverse Economy**	☑ **Our Climate, Natural Resources, Arts, Culture & Heritage**
A safe inclusive City where access to quality services & facilities supports a socially connected, vibrant & healthy community	A perfectly centered place where people aspire to live, work, visit & invest	A diversified, innovative & resilient economy that generates jobs & services	A culturally-inspired City that strives to minimise its ecological footprint

To download a copy of the Community Plan, please visit: www.mountgambier.sa.gov.au/CommunityPlan-TheFuturesPaper2016-2020.pdf

Please explain how your event supports these pillars

As previously stated, one of our main sellers for this event are the destinations we travel to. This means it is a great opportunity to showcase the region whether that be out on the road by riding past iconic locations or at campsite where riders want to go into town and explore and visit what Mt Gambier has to offer. The Great Vic also has the opportunity to have a real positive economic contribution to the even. That could look like a punter buying a sausage from the local football club, a group of riders dining at a local restaurant or even a group joining in on a tour of the town, the possibilities are endless. Having the town back the Great Vic and having the people get involved in fundraising, providing activities and really showcasing the great community of Mount Gambier will result in the Great Vic having support all four pillars of the Mount Gambier Community Plan.

Risk Management Planning

Please attach details of Risk Management Planning to be undertaken for the event, including pre-event liaison with emergency services and any emergency services to be present at your event. Your event planning should include a Risk Management Plan, Occupational Health & Safety considerations, and Emergency Response Plan. If you anticipate your event will attract large numbers, you should also consider completing a SAPOL Safety Assessment for Crowded Places – this only takes a few minutes and can be accessed online at www.police.sa.gov.au/online-services/mass-gatherings.

Please ensure you make contact with the following organisations to inform them about your event;

- SAPOL
- St John First Aid - requests completed online at www.stjohnsa.com.au/EventsQuoteRequest.aspx
- Security
- Mount Gambier Hospital if necessary.
- SA Ambulance Service regarding access to your event if required
- Metropolitan Fire Service

If you need information in regard to establishing a Risk Management Plan, please contact the Community Events Division.

Digital Photos

Council requires digital photos to help promote your event. On completion of event please submit post photos to help with promotion the following year.

Event Evaluation

If you are successful with your application Council will require a completed Event Evaluation form & reconciled budget post-event providing declarations that the funding has been spent only for the purposes for which you applied.

I acknowledge that the above information provided in this application is true and correct. I have read the "Events Sponsorship Guidelines" and understand that should this application be approved by the City of Mount Gambier I will be required to enter into a Sponsorship Agreement with the City in order to receive the funds.

In order for your application to be considered please attach a clear event budget including breakdown of income and expenditure

Signature: Kahlia Dix Digitally signed by Kahlia Dix Date: 2018.12.03 16:46:47 +11'00' Date: 03/12/2018

Name: Kahlia Dix

Before submitting your application, please ensure you have attached the following;

☐ Full Event Budget showing all income & expenditure
☐ Proof of Public Liability Insurance
☐ List of all funding partners for event
☐ Copy of Hire permit/Special Event Permit – if applicable
☐ Your Business Plan and/or Marketing Plan
☐ Copy of your organisation's most recent audited annual financial statement
☐ Completed Risk Assessment for your event

Please return completed form via email city@mountgambier.sa.gov.au or contact 8723 3901 or 8723 1025

Event Support Fee Schedule

Local Government account for all costs for the organisation whether they be direct or in-direct, as a result a cost will be applied to any support sought from Council.

Labour	Monday – Friday	$100 per hour per person
	Saturday, Sunday & Public Holidays	$150 - $180 per hour per person
	Call-out Fee	$ as determined
Plant Hire	Light Vehicle - each additional hour	$26 per hour $10 per hour
	Heavy Vehicle	$36 per hour
	Other Machinery (inc Street Sweeper)	$60 per hour
Waste	Removal – Labour & Truck	$170 per hour
	Bin Hire	$2 per bin/event
Equipment Hire	Loading/Delivery/Collection	Refer labour/plant hire charge
	Witches Hats/Bollards/Bunting	$1 per unit
	Seating	$20 per unit
	Stage	$20 per unit
	Inflatable Screen	$50 per event
	Crowd Control Fencing	$5 per unit
Advertisements	Road Closures – The Border Watch	$100 per ad

Unless otherwise indicated, all charges are independent and will be aggregated (ie Equipment Hire requiring delivery/collection by Council will also incur hourly rates for labour (driver/operator) and plant hire.

All fees are inclusive of GST.

MINUTES OF ORDINARY OPERATIONAL STANDING COMMITTEE MEETING

Meeting held in the Conference Room, Civic Centre, 10 Watson Terrace, Mount Gambier on Tuesday, 9 October 2018 at 7:30 a.m.

PRESENT

Cr Mark Lovett (Presiding Member)
Cr Christian Greco
Cr Ian Von Stanke
Cr Steven Perryman
Cr Des Mutton

COUNCIL OFFICERS

General Manager Community Wellbeing	-	Ms B Cernovskis
General Manager Council Business Services	-	Mrs P Lee
General Manager City Infrastructure	-	Mr N Serle
Administration Officer	-	Mrs F McGregor

WE ACKNOWLEDGE THE BOANDIK PEOPLES AS THE TRADITIONAL CUSTODIANS OF THE LAND WHERE WE MEET TODAY. WE RESPECT THEIR SPIRITUAL RELATIONSHIP WITH THE LAND AND RECOGNISE THE DEEP FEELINGS OF ATTACHMENT OUR INDIGENOUS PEOPLES HAVE WITH THIS LAND.

1. APOLOGY

Apology received from Mayor Lee

That the apology from Mayor Lee be received.

Moved: Cr Greco Seconded: Cr Perryman Carried

2. CONFIRMATION OF OPERATIONAL STANDING COMMITTEE MINUTES

Meeting held on 11 September 2018

That the minutes of the Operational Standing Committee meeting held on 11 September 2018 as previously circulated be confirmed as an accurate record of the proceedings of that meeting.

Moved: Cr Mutton Seconded: Cr Von Stanke Carried

3. QUESTIONS

3.1. With Notice

Nil submitted.

3.2. Without Notice

Nil submitted.

4. DEPUTATIONS

Nil

5. COMMITTEE REPORTS, MINUTES AND RECOMMENDATIONS

5.1. Heritage Adviser Report - August 2018 - Report No. AR18/38770

COMMITTEE RECOMMENDATION
(a) That Heritage Sub-Committee Report No. AR18/38770 titled *'Heritage Adviser Report - August 2018'* as presented to the Operational Standing Committee on 9 October 2018 be noted.

Moved: Cr Lovett Seconded: Cr Greco Carried

5.2. Lake Terrace Cemetery 150 Year Anniversary Celebration - Report No. AR18/37578

COMMITTEE RECOMMENDATION
(a) That Heritage Sub-Committee Report No. AR18/37578 titled '*Lake Terrace Cemetery 150 Year Anniversary Celebration*' as presented to the Operational Standing Committee on 9 October 2018 be noted.

Moved: Cr Lovett Seconded: Cr Von Stanke Carried

5.3. Rook Walk 100 Year Celebration Update - September 2018 - Report No. AR18/38072

COMMITTEE RECOMMENDATION
(a) That Heritage Sub-Committee Report No. AR18/38072 titled '*Rook Walk 100 Year Celebration Update September 2018*' as presented to the Operational Standing Committee on 9 October 2018 be noted.

Moved: Cr Lovett Seconded: Cr Von Stanke Carried

5.4. Minutes of Audit Committee – 26 September 2018

That the minutes of the Audit Committee meeting held 26 September 2018 as previously circulated be noted.

Moved: Cr Von Stanke Seconded: Cr Greco Carried

5.5. Capital Work in Progress Budget Carry Overs from 2017/2018 - Report No. AR18/37381

(a) That Audit Committee Report No. AR18/37381 titled '*Capital Work in Progress Budget Carry Overs from 2017/2018*' as presented to the Audit Committee on 26 September 2018 be noted.

Moved: Cr Lovett Seconded: Cr Mutton Carried

5.6. Control Track Continuous Improvement as at September 2018 - Report No. AR18/38581

(a) That Audit Committee Report No. AR18/38581 titled '*Control Track Continuous Improvement September 2018*' as presented to the Audit Committee on 26 September 2018 be noted.

Moved: Cr Lovett Seconded: Cr Von Stanke Carried

5.7. Annual Financial Statements for 2017/2018 - Report No. AR18/38407

The Audit Committee acknowledges:

- Comments by Council's Audit Partner Tim Muhlhausler from Galpin's regarding the annual financial statements including:
  - Good standard of underlying financial data and financial statements
  - Quality of work on the assets including the asset revaluation internal process, calculations and assumptions is of a high and impressive standard
  - Comprehensive and quality the flow of asset revaluation data to Authority and to the financial standards
  - Audit clearance with unqualified financial statements for the financial year ended 30 June 2018.
- The caliber of expertise, effort and time by staff in preparing the EOFY and annual financial statements and working with Council's Auditors and Audit Committee members to provide / resolve / clarify queries regarding the annual financial statements leading up to and at the Audit Committee meeting.

(a) That Audit Committee Report No. AR17/38407 titled '*Annual Financial Statements for 2017/2018*' as presented to the Audit Committee on 26 September 2018 be noted.

(b) That in accordance with Section 126 of the Local Government Act 1999, the Audit Committee advises that it has reviewed the draft annual financial statements of Council for the financial year 2017/2018 and is satisfied 'they present fairly the state of affairs of Council'.

(c) That the Audit Committee recommends to Council for the financial year ended 30 June 2018 that:

i. Council adopts the annual financial statements and as presented at the meeting held 26 September 2018 as final.

ii. The Chief Executive Officer and the Mayor of the City of Mount Gambier be authorised to certify the financial statements.

(d) That the Presiding Member of the Audit Committee and the Chief Executive Officer of the City of Mount Gambier be authorised to sign Council's *Certification of Auditor Independence Statement* that will accompany the financial statements for the financial year ended 30 June 2018.

(e) That the Auditor's representative, Mr Tim Muhlhausler's verbal report providing an overview of the audit report as presented to the Audit Committee Meeting on 26 September 2018 be noted.

Moved: Cr Lovett Seconded: Cr Perryman Carried

5.8. Treasury Management - Annual Review - Report No. AR18/38413

(a) That Audit Committee Report No. AR18/38413 titled '*Treasury Management – Annual Review*' as presented to the Audit Committee on 26 September 2018 be noted.

Moved: Cr Lovett Seconded: Cr Greco Carried

5.9. Resignation of Ms Vanessa McDonald from the Audit Committee - Report No. AR18/37443

(a) That Audit Committee Report No. AR18/3443 titled '*Resignation of Ms Vanessa McDonald from Audit Committee*' as presented to the Audit Committee on 26 September 2018 be noted.

(b) That Ms McDonald resignation be noted.

(c) That a letter of appreciation be sent to Ms McDonald for her service to the Audit Committee.

Moved: Cr Lovett Seconded: Cr Perryman Carried

5.10. Recruitment of an Independent Member of the Audit Committee - Report No. AR18/37454

(a) That Audit Committee Report No. AR18/37454 titled '*Recruitment of an Independent Member of the Audit Committee*' as presented to the Audit Committee on 26 September 2018 be noted.

(b) That the Audit Committee recommend to Council a recruitment process be undertaken by the Chief Executive Office for a new independent member of the Audit Committee for Council's consideration.

Moved: Cr Lovett Seconded: Cr Perryman Carried

6. OPERATIONAL STANDING COMMITTEE REPORTS

6.1. Works in Progress - City Infrastructure - Report No. AR18/40177

COMMITTEE RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/40177 titled '*Works in Progress - City Infrastructure*' as presented to the Operational Standing Committee on 9 October 2018 be noted.

Moved: Cr Lovett Seconded: Cr Mutton Carried

6.2. Implementation of Agenda / Minute System - Report No. AR18/40177

COMMITTEE RECOMMENDATION
(a) That Operational Standing Committee Report No. AR18/39908 titled '*Implementation of Agenda / Minute System*' as presented to the Operational Standing Committee on 9 October 2018 be noted.

Moved: Cr Lovett Seconded: Cr Von Stanke Carried

6.3. 29 Ferrers Street Tree Retainment - Report No. AR18/39868

COMMITTEE RECOMMENDATION
(a) That Operational Standing Committee Report No. AF17/421 titled '*29 Ferrers Street Tree Retainment*' as presented to the Operational Standing Committee on 9 August 2018 be noted. (b) That Council approves to remove a car parking space adjacent to 29 Ferrers Street and establish a no standing zone to be able to retain the tree adjacent to this property as per the attached parking resolution. (c) The Traffic Impact Statement attached to the Report be endorsed by Council; (d) The City of Mount Gambier, pursuant to Ministerial delegation resolves the following: Prohibited Area NO PARKING 1.2.073 FERRERS STREET (Eastern Side) From 72.19 metres south of the intersection with Heriot Street to 82.0 metres south of the said intersection. To apply at all times. To be effective on the installation of appropriate linemarking.

Moved: Cr Lovett Seconded: Cr Von Stanke Carried

7. MOTION(S) - With Notice

Nil Submitted

8. MOTION(S) - Without Notice

8.1. GOVERNANCE – Committees – Statutory Committee – Council Assessment Panel CAP 2018 Ref. AF17/507

(a) a report be presented to the Operational Standing Committee detailing the requirements for referral to the Heritage Adviser in Development Applications.

Moved: Cr Von Stanke Seconded: Cr Mutton Carried

8.2. INFORMATION MANAGEMENT – Project Management – Agenda Management System and Implementation Ref. AF18/141

(a) coinciding with the InfoCouncil project that Standing Committee and Council Agendas be prepared in such a way that all reports and correspondence pertaining to the items are included as attachments to said Agendas.

(b) an opt in system be made available to Councillors to collect a hard copy of the full Agenda.

Moved: Cr Perryman Seconded: Cr Greco Carried

Meeting closed at 8.03 a.m.

CONFIRMED THIS DAY OF 2018.

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PRESIDING MEMBER

AR18/41431