BURNIE
CITY COUNCIL

ASSESSMENT OF ALTERNATE LEACHATE MANAGEMENT OPTIONS

BURNIE WASTE MANAGEMENT CENTRE

MAY 2015

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1. INTRODUCTION

The Burnie Waste Management Centre (BWMC) Stage 1 Landfill currently produces an average of around 500kL of leachate per day which is disposed to TasWater's sewer system. (Note: the agreed charge rate with TasWater is based on the long-term average of 489kL/day). Studies indicate the leachate predominantly comprises > 80% groundwater (Syrinx Environmental Pty Ltd 2014).

The volume of leachate discharge, particularly during periods of high rainfall, is of concern to Council due to escalating trade waste discharge costs, poor environmental outcomes and lost opportunity in terms of the capacity of TasWater's sewerage infrastructure and the constraint it places on future development in the city. This is outlined in the discussion below.

In response to these concerns, Council instigated studies to assess options for addressing the long-term management of Stage 1 leachate, and stormwater on site. This project is part of a larger Stormwater Infrastructure Development Project (SIDP), described in Section 3.1 below. The first step in this process was a study undertaken by Syrinx Environmental (Syrinx) on behalf of Council, which developed and evaluated a range of leachate treatment options *"Leachate Treatment Options Development & Evaluation - July 2014"* **(Appendix 1 of DPEMP)**.

The Syrinx study concluded that the most cost effective and beneficial treatment solution is to develop a wetland on top of the Stage 1 Landfill at the BWMC. This system would be designed to ensure a treatment standard suitable for treated leachate discharge to the tributary of Cooee Creek which runs through the site. The Syrinx July 2014 report formed part of a draft Notice of Intent (NOI) submission to the EPA in July 2014, which was followed by a video conference presentation to seek preliminary feedback from EPA officers.

Since the initial draft NOI and taking into account concerns/requirements raised by the EPA, Burnie City Council undertook a series of additional studies to characterise and address potential risks. These included:

1. Additional flora and fauna surveys to assist in assessing potential risks to significant fauna (Nest (July 2014) *Report for Burnie City Council Landfill Leachate Treatment Project - Natural Values Assessment Unnamed Tributary of Cooee Creek).* This report indicated there were significant fauna listed under the EPBC Act. **(Appendix 2 of DPEMP)**

2. Preparation of a referral under the EPBC Act to ensure there were no regulatory barriers to the proposed treatment system due to the potential presence of nationally listed fauna/flora (Burnie City Council (November 2014) *Construction of a leachate treatment wetland and treated discharge, Burnie, Tas. Referral reference 2014/7386).* This referral found no significant impacts were likely to significant fauna and the Department of Environment determined it was not a controlled action **(Appendix 3 of DPEMP)**.

3. Assessment of alternative options to the proposed treatment wetland and to the location of the wetland system. This reflected an EPA request to consider all possible options (this report). This alternative options report is supported by an addendum to the Syrinx Options Study (July 2014 report) - *Addendum to Stage 1 Landfill Leachate Treatment Study - Design Changes & Alternative Wetland Option Assessment* by Syrinx, provided as an appendix to this report **(Appendix 4 of DPEMP)**.

4. Preparation of a Hydrogeotechnical Risk Assessment undertaken by Tasman Geotechnics Pty Ltd to investigate and report on the potential risks of the preferred treatment option and alternate wetlands locations **(Appendix 6 of DPEMP)**. The scope brief for the Hydrogeotechnical Risk Assessment was reviewed by the EPA on 18 February 2015. This study reflected particular concerns raised by the EPA regarding landfill stability and the potential of a wetland to increase risks.

5. Design refinement to improve cost certainty and land take requirements. This is covered in **(Appendix 4 of DPEMP)**.

It remains Council's strongly preferred option, supported by the preliminary outcomes of the Hydrogeotechnical Risk Assessment report, to treat leachate via a wetland system on top of Stage 1 Landfill.

2. OBJECTIVE

The objective of this options assessment report is to investigate and evaluate the potential risks raised by EPA and examine alternate management options, including alternate wetlands locations on or adjacent the site, to confirm or otherwise the suitability of the preferred leachate treatment option.

3. PROJECT DRIVERS

3.1. STORMWATER INFRASTRUCTURE DEVELOPMENT PROJECT

Removal of Stage 1 Landfill leachate from TasWater's sewerage system is a key component of Council's SIDP. This is a three (3) year, $4.3M federally funded project to remove 1.9ML of stormwater infiltration (during a 50mm rainfall event) to the sewer network.

The key drivers of the SIDP are:

- Stormwater infiltration to the TasWater sewerage network affects the performance of the waste water treatment plant and causes pump station and plant overflows.

- Stormwater infiltration utilises system capacity that could otherwise be used for a range of development.

- The $140M Lion cheese manufacturing plant expansion project is forecast to contribute up to 1.5ML per day to the sewage network. There is an urgent impetus to address stormwater infiltration to ensure adequate sewerage infrastructure capacity is available to manage trade waste from the proposed expansion.

- A supplementary driver is that during dry weather flow, leachate removal will free up capacity in the sewerage network to further increase future development opportunity.

The SIDP targets several residential areas and the BWMC Stage 1 Landfill leachate. Removal of approximately 1.3ML of infiltration from residential areas (based on 344 homes at 75m^2 of roof area/house) will be complete by 30 June 2015. Removal of up to 0.60ML (average daily flow over the past five (5) years) of Stage 1 Landfill leachate is an outstanding component of the SIDP and is required to meet the objectives and targets of that SIDP program.

Treatment and removal of Stage 1 Landfill leachate from TasWater's sewerage system is therefore a critical remaining component of the SIDP and a key economic driver for this project.

3.2. TRADE WASTE COST

The current cost to discharge Stage 1 Landfill leachate to the TasWater sewer network is currently $198,000 per annum under an agreed flow rate of 489.6 kL/day. This cost is projected to escalate to $201,417 in the 2015/16 financial year to account for indexation and a future measured flow rate of approximately 500 kl /day (Stage 1 and 2 leachate disposal).

Council is committed to reduce the trade waste costs by adopting a treatment system for discharge to the creek. The intent of the Stage 1 treatment system is to expand/modify it in time to accept and treat Stage 2 flows as well, once the system has been established and performance verified.

3.3. ENVIRONMENT

The current leachate management system poses an ongoing risk of leachate overflows to the tributary of Cooee Creek during significant storm events. On site treatment will enable enhancement of storages, pump capacity and contingency systems.

The waterway through the site is vulnerable to sediments entering the creek during significant storm events. On site treatment will also provide an opportunity to modify erosion and sedimentation controls via detention and vegetation filters.

4. LEACHATE TREATMENT OPTIONS

The Syrinx Environmental PL report *"Leachate Treatment Options Development & Evaluation - July 2014"* **(Appendix 1 of DPEMP)** concluded the most efficient and cost effective treatment option is to construct a Wetland Treatment System on top of the Stage 1 Landfill which offers the following benefits compared to alternative treatment:

- A passive system of a sustainable nature.
- Low energy use.
- Low chemical requirements.
- Able to deal with changes in flow and leachate quality.
- Enhancement of the site environmental and cultural values.

One of the key concerns raised by the EPA regarding the wetland options was the potential risks associated with locating the wetland on top of the Stage 1 Landfill. These risks include:

- Wetland Leakage - potential to saturate the landfill cell and resultant impact on the containment bund.
- Wetland Mass - potential for landfill cap settlement and risk to overall stability as a result of the added mass on the cell.
- Water Table Rise/Flood - potential for the inflowing groundwater to rise within the waste cell and or flood from an extreme event.

Furthermore, the EPA requested that consideration be given to risk mitigation alternatives to leachate treatment or alternate locations on the site for the wetlands treatment.

5. ALTERNATE LEACHATE MANAGEMENT OPTIONS

The leachate management options to be evaluated in this report are:

- **Preferred Option** - Locate a Wetlands Treatment System on top of Stage 1 Landfill.
- **Option 1** - Do nothing and continue to discharge to TasWater Sewerage System under a Trade Waste Agreement (TWA) with TasWater.
- **Option 2A** - Remove Waste from Stage 1 Landfill and develop and dispose to new waste cell on site (Stage 2B/C).
- **Option 2B** - Remove waste from Stage 1 Landfill, transport and dispose to an alternate landfill (Port Latta or Dulverton).
- **Option 3C** - Wetland Treatment System located north of the Stage 1 Landfill within the site boundary. Note: **(Appendix 4 of DPEMP)** assesses variable locations for the wetland treatment option of which Option 3C was found to the most feasible of the alternatives. Hence, only this sub-option has been evaluated in this main report.

Evaluation Criteria

The evaluation criteria used to access each option includes: Environmental Benefit/Impact, Risk, Economic Impact, and Community Impact/Sustainability. The criterion has been chosen as the key factors to compare the leachate management options identified.

5.1. PREFERRED OPTION - WETLAND TREATMENT SYSTEM LOCATED ON STAGE 1 LANDFILL

The preferred option identified in Syrinx's July 2014 report **(Appendix 1 of DPEMP)**, is to construct a wetland treatment system to treat leachate from Stage 1 Landfill to allow for indirect discharge vi infiltration on-site and high flow discharge to the unnamed Cooee Creek.

This option involves locating the treatment wetland on top of the Stage 1 Landfill where there is a large relatively flat land area available, meaning the full treatment system can be constructed within the site boundaries with adequate buffer zones. The system involves pumping leachate to the head of the wetland and gravity flow returns the treated effluent to an infiltration wetland and overflows directly to the creek. For this option, the required pumping distance is 365m and the pumping head is 24m.

This option has been investigated and a concept design developed in the July 2014 report **(Appendix 1 of DPEMP)**.

Since the July 2014 report a design and cost review has been undertaken. The updated information is contained in the Syrinx addendum May 2015, **Appendix 4 of DPEMP**.

5.1.1. EVALUATION

C1 – Environmental Benefit

Constructing a treatment wetland and diverting the leachate from discharging to the sewer will have an overall positive environmental impact. Some of the key benefits include:

- A reduction in discharge of, what is, effectively stormwater to sewer.
- Improved efficiencies at the Burnie Waste Water Treatment Plant (BWWTP) due to removal of the dilute waste stream and additional capacity for taking other waste streams.
- Improved ecosystem health of the unnamed Cooee Creek tributary as a result of increased flows, which mainly will occur in the winter/spring period.
- Ability to buffer flows and quality variations through the extended detention and biologically driven removal processes.
- Ability for flexible, modular construction that can be added to handle Stage 2 flows in time with little additional work and cost.
- Ability to manage changing leachate chemistry as the landfill matures and as Stage 2 leachate is added.
- Compared with mechanical systems, low energy cost, low maintenance complexity and no chemical requirements. This is imperative; given it is no longer an operational landfill site. Environmental enhancement - enhancement of biodiversity through the use of locally native species within the treatment area, extension of a ‘wet forest’ within the infiltration area, and restoration of biodiversity values within the unnamed Cooee Creek tributary.
- Enhancement of landscape amenity - improvement to the amenity of the site via a wetland landscaped feature and integration with the surrounding environment. This is particularly important given the expanding residential areas in the vicinity of the landfill site.
- Easily accessible wetlands for education, training, scientific and cultural values.

C2 – Risk

The key risks for this option include:

- Treatment wetland not functioning - possible leachate spills into the creek.
- Hydrogeotechnical risks - landfill cap settlement due to wetland mass, stability of landfill containment bund, wetland leakage, and extreme flood/rain events.

The draft Hydrogeotechnical Risk Assessment (under separate cover) indicates that the abovementioned risks remain low to very low provided a wetland is located at least 10m from the landfill containment bund and is designed with sufficient freeboard to cope with anticipated rainfall events. Hence, both of these risk categories are manageable and considered Low to Very Low.

C3 – Economic Impact

The capital cost, to develop a treatment wetland on Stage 1 Landfill is estimated to be approximately $2M including design, approvals, construction, testing and commissioning and a 20% contingency provision. This capital cost includes costs associated with refurbishment of the MH1 pump station required for separation of stormwater, and removal of sediment which currently report to sewer or the creek directly. Once commissioned, the treatment wetland will require ongoing monitoring and maintenance.

Initial post-establishment, monitoring and maintenance costs, including power consumption over the first two (2) years are expected to be $75,966 in Year 1 with wetland performance commissioning, and $43,580 in Year 2. This includes additional monitoring, staff training and specialist input from the Wetlands designer. Routine annual operational and maintenance costs from Year 3 onwards are estimated to be $30,841.

The total Net Present Value (NPV) cost for this option over a 20 year period is $2,571,055. (Refer to calculations in **Appendix 1, this report**).

C4 – Community Impact/Sustainability

A treatment wetland is a long-term sustainable solution with flexibility for future upgrade. Wetlands have educational, scientific, training and cultural values and constructing a treatment wetland on Stage 1 Landfill would provide an easily accessible space for passive recreational and interpretive activities.

The treatment wetland would provide an opportunity for a broad section of the community to become involved in developing an understanding of the waste water treatment process and includes the potential to establish interpretation features at the site. A community planting day could be organised to assist in building community ownership of the project.

Removing the leachate waste stream from the sewer system improves operation and reduces overflow and spill risk within TasWater's sewerage reticulation and treatment infrastructure.

Removal of Stage 1 Landfill leachate from the sewerage system is a critical remaining component of Council's Stormwater Infrastructure Development Project; a three (3) year, $4.3M federally funded program.

The overall success of the project hinges on removing the Stage 1 Landfill leachate from the sewerage. Such an outcome will free up capacity for future economic development.

5.2. OPTION 1 – BASE CASE – CONTINUE WITH TRADE WASTE AGREEMENT

The leachate generated from the Stage 1 Landfill cell is currently pumped and disposed to TasWater's sewerage system.

Council has a TWA with TasWater for the disposal of leachate from the site. Until the end of June 2015, the disposal cost is a volumetric charge only based on an agreed average flow rate, however after such time, the disposal cost will include:

- a volumetric charge calculated by measuring the volume of trade waste, plus
- a mass load charge calculated using relevant acceptance criteria, monitoring and sampling results.

5.2.1. EVALUATION

C1 – Environmental Impact

There is no apparent environmental benefit in continuing to discharge leachate to TasWater's sewer system under a TWA. The BWWTP, which currently accepts and treats the leachate from Stage 1 Landfill approaches or exceeds capacity and has treatment constraints during significant rainfall events.

Removal of leachate inflow to the TasWater network will lower the risk of sewer spills and overflows to the environment during periods of high rainfall.

C2 – Risk

The key risks for this option include:

- Escalating TWA costs - TasWater have indicated costs are likely to increase over time.
- Existing sewer gravity main has capacity constraints which pose relatively high risks of sewer overflows.
- Pump failure (overflow pump from existing rising main to Leachate Pond) when gravity pipe capacity exceeded.

C3 – Economic Impact

The current annual cost for the disposal of leachate, under a TWA with TasWater, is $198,000. This is a volumetric charge calculated on an agreed average daily discharge rate of 489.6kl/day. Under the agreement, after 30 June 2015, Council will be charged an increased rate which is a combination of a measured volumetric rate at $1.0707/kl and a mass load charge. (This rate is to be indexed annually by 2.6%).

The measured volumetric rate is dependent on seasonal conditions and will increase during periods of wet weather. For example, for the 2013/14 financial year period, an average daily discharge of 665kL/day was recorded (combined Stage 1 and 2 leachate). This was a result of extended rainfall during August and September.

Trade waste charges for Stage 1 leachate for the 2015/16 financial year are expected to escalate to approximately $201,417.

In addition to this waste disposal charge, is the ongoing maintenance and replacement of infrastructure, including the pipe network and pumps. For the purpose of equal comparison with other options, it is assumed that removal of stormwater from the leachate chamber (MH1), and sediment control from this chamber is required as a minimum expenditure to avoid further environmental issues, sewer capacity constraints and sediment accumulation in the network. The total NPV cost for this option over a 20 year period is $4,353,669. (Refer to calculations in **Appendix 1**).

The cost estimate for this option is based on the following criteria and assumptions:

- Disposal charges under the TWA with TasWater are to be indexed annually by 2.6%.
- Volumetric charge is to be $1.0707/kl (for the 2014/15 financial year).
- Mass load charge - as the leachate flow is considered to be around 90% groundwater, the concentration of contaminants is very low. At this stage, the value of the Mass Load charge is uncertain as leachate characteristic monitoring has not occurred as yet.
- Daily discharge rate of 489kL/day has been agreed with TasWater to 30 June 2015.
- Annual Council maintenance and monitoring costs are estimated at $30,000.
- Energy costs associated with pumping are estimated at $10,500 annually.
- MH1 refurbishment works estimated at $104,890 including:
  - Sealing of stormwater inlet/outlet and decommissioning of the existing stormwater pipe from MH1 to the creek outlet.
  - Supply and install Inlet sediment chamber (Humegard HG 35A) upgradient of MH1.
  - Supply and install C1050 C2 RCP stormwater pipe 70m line from MH2 to the existing creek discharge point.

- Infrastructure replacement costs, including pumps, telemetry and associated components are estimated at over $143,550 over a 20 year operational period.

Council has no control over the majority of future costs associated with this option as a result of trade waste charges.

C4 – Community Impact/Sustainability

Council desires to reduce the cost impact, improve environmental outcomes and assist to remove the TasWater infrastructure constraint on future development.

Although the existing arrangement for leachate disposal is functional, it does not meet Council's objective and is not a sustainable solution. TasWater advised Council in January 2012 that while the base case continues, it contributes to a constraint on further and future development of the City of Burnie.

There are no apparent community benefits to discharge large volumes of leachate to the sewer system, it is a continuing cost burden to Council finances and represents a significant lost opportunity cost in terms of future development constraint.

5.3. OPTION 2 – REMOVE WASTE FROM STAGE 1 LANDFILL

If waste is removed from the Stage 1 Landfill (mining the waste), then in theory, leachate generation in that zone would cease, the groundwater flow would be un-contaminated and it could discharge to the creek.

The filling of Stage 1 Landfill commenced in 1987 and ceased in 2004. The volume of landfill waste in Stage 1 equates to approximately 360,000 tonnes (513,000m^3) of waste material based on an average fill rate of 20,000 tonnes per annum over the 18 year period.

Possible options for Stage 1 waste disposal include to develop a new waste cell on site (Option 2A) or transport the waste off site (Stage 2B).

A) OPTION 2A – DEVELOP AND DISPOSE TO STAGE 2B/C ON SITE

A potential waste disposal option is to develop a new waste cell within the existing BWMC site. The only available location on the site is likely to be within the previously approved area (DPEMP, 2004) of the Stage 2B/C in the south and south east corner of the site adjacent to the recently rehabilitated Stage 2A Landfill. Stage 2B & C zones lie over the existing watercourse which runs through the site.

The development of Stage 2B & C has been considered previously and discussed in the Hyder (2009) report *"Economic Assessment of Waste Disposal Options"*. The Hyder report highlighted significant environmental risks associated with developing a landfill over the watercourse, with a surrounding high water table. The outcome of this investigation was to cease landfill operations and transition to a waste transfer facility; hence Stage 2B & C was not progressed.

The transfer facility was chosen to be the preferred option based on assessment of key criteria including; environmental risk, sustainability, legislation compliance, ease of use, resource recovery potential and financial viability.

Since the commissioning of the transfer facility in November 2012, approximately 70 tonnes per month of re-use materials are recovered from the waste stream inside the transfer shed that would otherwise have been disposed to landfill and the overall volumes of waste to landfill has reduced.

5.3.1. EVALUATION

C1 – Environmental Impact

When assessing the environmental impacts for this option, there are three (3) key elements:

- the environmental impacts associated with the development of Stage 2B & C Landfill,
- leachate generation and discharge from additional landfill, and
- the environmental impacts associated with the excavation of waste material from Stage 1 Landfill.

A key factor in the decision to transition from a landfill operation to a waste transfer facility was the environmental risks associated with developing Stage 2B & C over a watercourse. A geotechnical risk assessment was undertaken which identified a strong potential for a developed waste cell to impact on the groundwater and surface water systems.

The environmental impacts associated with the excavation of waste material from the Stage 1 Landfill cell are considered significant. Concerns include the strong odour impacting nearby residential areas, potential for windblown litter, disease, and contaminated run-off management.

There are no apparent environmental benefits in developing a new landfill cell on this site to reduce leachate flows. It is likely that this option will result in some level of degradation of the site ecosystem until the Stage 1 Landfill site is fully rehabilitated.

C2 – Risk

The key risks for this option include:

- Approvals process - uncertainty in obtaining approvals to proceed with waste removal from Stage 1.
- Potential for groundwater/leachate mixing once Stage 2B & C is developed and filled with waste.
- Environmental risks associated with the excavation of waste; including odour, landfill gas management, disease, and water run-off management.
- Construction risks and worker health and safety are considered significant.

- Effectiveness and cost of the rehabilitation of Stage 1 Landfill footprint

C3 – Economic Impact

The Hyder report provided cost estimates for the development of waste cells Stages 2B & C.

Cell development costs, together with the costs to remove the waste body from Stage 1 to Stage 2B & C and rehabilitate the footprint of the former landfill site is estimated to cost in the order of $16,300,960. (Refer to estimate in **Appendix 2, this report**).

Project costs for this option would impose a significant economic burden on Council.

The annual operational costs after the completion of waste removal and rehabilitation are considered to be minor and have not been included in this assessment.

C4 – Community Impact/Sustainability

Removing Stage 1 leachate from mixing with groundwater could enable reinstatement of the original flows to the creek. However, there are many risks identified above which may affect the success of this option.

There are no community benefits in this option.

B) OPTION 2B – TRANSPORT AND DISPOSE WASTE TO ALTERNATIVE LANDFILL SITE

Another potential waste disposal location is at an alternative operational landfill site within close proximity to Burnie. There are two (2) sites in North-West Tasmania which may be able to accept the volumes of waste; however Council has not had any discussion with those landfill operators at this stage.

The potential sites are Port Latta Landfill and Dulverton Landfill which are both approximately 80km from the BWMC site.

5.3.2. EVALUATION

C1 – Environmental Impact

Similar to Option 2A, the environmental impacts associated with excavation of waste material from Stage 1 Landfill cell are considered significant. Refer to Section 5.4.1.

The transportation of approximately 360,000 tonnes of waste to an alternate landfill site would require a significant trucking resource and depending on truck configuration, this volume could equate to up to 12,000 truckloads and 24,000 truck movements (return loads).

Environmental impacts include:

- Significant increase in $C0_2$ emissions from trucking movements transporting waste.
- Impact on road condition resulting in higher maintenance requirements.

C2 – Risk

The key risks for this option include:

- Approvals process - high risk in obtaining approvals to proceed with waste removal.
- Alternate landfill sites may not have the capacity or the approval status to accept the waste.
- It is probable new waste cells would need to be developed at either site to accept the waste provided approval was gained.
- Environmental risks associated with the excavation of waste; including odour, landfill gas management, disease and water run-off management.
- Construction risks and worker health and safety are considered significant.
- Effectiveness of the rehabilitation of Stage 1 Landfill footprint.

C3 – Economic Impact

The estimated rate for disposal (gate fee) at the alternative landfill sites is in the order of $85/tonne.

The gate fee disposal cost, together with the costs to remove the waste from Stage 1 and transport to Port Latta or Dulverton is estimated to cost in the order of $40,720,000. (Refer to estimate in **Appendix 3, this report**).

This option would impose a significant economic burden on Council.

The annual operational costs for maintenance after the completion of waste removal and rehabilitation are considered to be only minor and have not been included in this assessment.

C4 – Community Impact/Sustainability

This option has the potential to be a sustainable outcome in the long-term if it enables repurposing of the site for higher land value activities or for revegetation. However, there are significant risks and environmental impacts.

The trucking movements required to transport the waste would result in increased pressure on the road network and infrastructure. This increased traffic and the increased maintenance requirement would be a burden to the community.

The consumption of significant landfill space, at an alternate location, that could otherwise be used for future landfill need is likely to be a strategically importance issue for regional waste management.

There appears to be no community benefit from this option.

5.4. OPTION 3 – WETLAND TREATMENT SYSTEM – ALTERNATIVE LOCATION TO STAGE 1

Potential alternative locations for constructing the proposed leachate treatment wetland on Stage 1 Landfill have been investigated by Syrinx (refer to options assessment in **(Appendix 4 of DPEMP)**. There are three (3) identified alternative locations and are as follows:

- Option 3A - wetlands located south of Stage 1 adjacent the creek system.
- Option 3B - wetlands located down gradient of pump station (on Bartlett's property).
- Option 3C - wetlands located north of Stage 1 Landfill, within existing Council boundary, pumped.

The above options were assessed against five (5) criteria:

- Available area and compliance with discharge criteria.
- Availability and timely acquisition of land (including rezoning).
- Clearance of established vegetation buffers.
- Proximity to residential areas.
- Avoidance of 1:1000 year flood plain.
- Cost.

The *Syrinx Alternate Sites for Wetland - Option 3 Study, May 2015* **(Appendix 4 of DPEMP)**, concludes Option 3C is the most favourable alternate site option to compare with the preferred location for a wetlands development.

Option 3C would be fully contained within the site and no additional purchase of land would be required. Similar to locating the treatment system on the Stage 1 Landfill, this option involves pumping leachate to the head of the wetland and gravity flow of the treated effluent to the infiltration wetland and the creek. The required pumping distance is 350m and the pumping head is 32m.

The terrain available for this option is very steep and would require significant earthworks, estimated to cost approximately $1.5M more than the preferred location.

5.4.1. EVALUATION

C1 – Environmental Impact

Similar to the preferred option, constructing a treatment wetland in any location has positive environmental impact and benefits of this alternative are the same as for the preferred option, given in Section 5.2.1. However, Option 3C includes significant excavation and relocation of soils compared to the preferred location. Further, this option involves the clearance of the vegetation buffer to the east of the Stage 1 Landfill boundary.

C2 – Risk

The key risks for this option include:

- Limited operation and maintenance access to the wetlands components.
- Significant excavation and relocation of soils to prepare level platforms for the wetland cells.
- Very limited buffer space between wetland cells and the property boundary with no space for vegetation screen planting.

C3 – Economic Impact

The capital cost, to develop Option 3C a treatment wetland north of the Stage 1 Landfill is estimated by Syrinx to be approximately $3,497,394. The earthworks component compared to the preferred location is approximately $1.5M higher.

This total cost includes design, approvals, construction, testing and commissioning.

The total cost for Option 3C over a 20 year period is $4,052,553 (refer to calculations in **Appendix 1, this report**).

C4 – Community Impact/Sustainability

A treatment wetland is a long-term sustainable solution with operational flexibility.

Whilst this Option 3C would potentially offer similar educational, scientific and cultural value opportunities for the community, access will be constrained due to the tight footprint available and the multi-level wetland feature/cell layout that would be required, compared to the preferred location.

6. ECONOMIC SUMMARY

The table below is a summary of the costs associated with the options presented in this evaluation:

	Preferred Option	Option 1	Option 2A	Option 2B	Option 3C
Option Description	Wetland on Stage 1	Do Nothing TWA	Remove Waste to Site	Remove Waste to Alternate Landfill	Wetland North of Stage 1
Upfront Capital Costs	$2,045,464	$104,890	$16,300,960	$40,720,000	$3,497,394
Annual Operational Costs (Year 1)	$75,966	$246,831	Minor Operational/ Maintenance Costs Only	Minor Operational/ Maintenance Costs Only	$49,898
Financial Viability NPV (20 years)	**$2,571,055**	**$4,353,669**	**$16,300,960** (initial capital cost)	**$40,720,000** (initial capital cost)	**$4,052,553**

7. EVALUATION SUMMARY

The evaluation criterion scoring system for the outcomes is:

+	Substantially Meets Criterion
±	Option may meet criterion, but requires more effort/investment
-	Does not meet criterion, requires substantial effort/investment with higher risk

The following table summarises the outcome of this Options Assessment Study:

CRITERIA			OPTION				
			PREFERRED OPTION	1	2A	2B	3C
			Wetland Treatment on Stage 1 Landfill	Status Quo Continue with Trade Waste Agreement	Remove waste from Stage 1 Landfill, develop and dispose to Stage 2B/C on site	Remove waste from Stage 1 Landfill, transport and dispose to alternative landfill site	Treatment Wetland located north of Stage 1 Landfill, within the site boundary
C1	ENVIRONMENTAL IMPACTS		+	-	-	-	+
C2	PROJECT RISKS		+	±	-	-	±
C3	COST	Project Development Costs	+	+	-	-	-
		Operational Costs	±	-	+	+	±
		Long Term Financial Viability	+	±	±	-	+
C4	COMMUNITY IMPACT / SUSTAINABILITY		+	-	-	-	±

8. RESULTS AND CONCLUSION

The scoring in the table above shows that the Preferred Option, that is to locate a wetland treatment system on top of the Stage 1 Landfill, provides the least cost and risk outcome for Council and improved environmental and sustainability outcomes for the community.

Option 2A and Option 2B are not considered environmentally or financially viable. The costs to remove the waste body and dispose it to an alternate location are extreme. There are also high risks associated with both of these options in terms of environmental impacts during the construction and rehabilitation phase.

Option 1 - Do Nothing and continue with a Trade Waste Agreement will cost $1.6M more, over a 20 year period compared to the preferred option and has poor environmental and community outcomes. This assumes that TasWater does not require major capital contributions to expand their treatment facility in order to deal with these dilute flows (a common scenario in other states), nor will increase charges beyond that assumed currently.

Furthermore, the objectives of Council's Stormwater Infrastructure Development Project would not be met without a solution that removes leachate from the TasWater sewerage system.

On site leachate treatment using a constructed wetland system is identified in this assessment, to be the preferred leachate management solution. For a treatment wetland, the two (2) possible locations assessed include:

- Treatment wetland on top of Stage 1 Landfill.
- Treatment wetland to the north of Stage 1 Landfill.

Locating the wetland to the north of the Stage 1 Landfill requires significant earthworks due to the steep terrain. That location would involve a greater pumping head compared with locating the wetland on top of Stage 1 Landfill.

In contrast, the area on top of the Stage 1 Landfill requires only minor earthworks as the terrain is ideally suited to a wetland. Also, this location has a lower pumping head and enables recirculation between system components with minor grade changes.

Based on this evaluation, a wetland system constructed on top of the Stage 1 Landfill scored highest against the assessment criteria and remains Council's preferred option for the management of the Stage 1 Landfill leachate.

The Tasman Geotechnics report (**ATTACHMENT D**) evaluates the potential hydrogeotechnical risks and concludes that the hazards associated with locating and operating a wetland on top of the Stage 1 Landfill presents a Low to Very Low risk provided the following aspects are incorporated into the design and operation of the wetland as follows:

- Regular maintenance checks on pump and equipment are undertaken to minimise blockages and overtopping.
- Wetland is designed for sufficient freeboard to cope with anticipated rainfall events.
- Wetland is located at least 10m from the crest of the landfill containment bund.

Incorporating a geosynthetic or HDPE liner in the floor of the wetland is not essential; however it would reduce the risk profile associated with seepage into the landfill to Very Low.

9. APPENDICES

1. Economic Evaluation - Preferred Option, Option 1 and Option 3C
2. Cost Estimate - Option 2A
3. Cost Estimate - Option 2B

ECONOMIC EVALUATION –

PREFERRED OPTION, OPTION 1 AND OPTION 3C

Economic Evaluation
Preferred Option, Option 1 & Option 3C

Preferred Option - Treatment Wetland Constructed on Stage 1 Landfill

	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Capex																						
Treatment Wetland - design, approvals, construction, testing and equipment commissioning		$ 2,045,464																				
Operational																						
Performance Commissioning			$ 39,208																			
Maintenance			$ 9,754	$ 18,760	$ 11,760	$ 12,042	$ 12,331	$ 12,627	$ 12,930	$ 13,241	$ 13,558	$ 13,884	$ 14,217	$ 14,558	$ 14,908	$ 15,265	$ 15,632	$ 16,007	$ 16,391	$ 16,784	$ 17,187	$ 17,600
Water quality monitoring			$ 17,504	$ 15,092	$ 9,120	$ 9,339	$ 9,563	$ 9,793	$ 10,028	$ 10,268	$ 10,515	$ 10,767	$ 11,025	$ 11,290	$ 11,561	$ 11,838	$ 12,123	$ 12,414	$ 12,711	$ 13,016	$ 13,329	$ 13,649
Pumping costs/electricity			$ 9,500	$ 9,728	$ 9,961	$ 10,201	$ 10,445	$ 10,696	$ 10,953	$ 11,216	$ 11,485	$ 11,760	$ 12,043	$ 12,332	$ 12,628	$ 12,931	$ 13,241	$ 13,559	$ 13,884	$ 14,217	$ 14,559	$ 14,908
TOTAL																						
Real time - $		$ 2,045,464	$ 75,966	$ 43,580	$ 30,841	$ 31,582	$ 32,340	$ 33,116	$ 33,911	$ 34,724	$ 35,558	$ 36,411	$ 37,285	$ 38,180	$ 39,096	$ 40,035	$ 40,995	$ 41,979	$ 42,987	$ 44,018	$ 45,075	$ 46,157
PV - Cost		$ 2,045,464	$ 72,716	$ 39,930	$ 27,050	$ 26,514	$ 25,988	$ 25,473	$ 24,969	$ 24,474	$ 23,989	$ 23,514	$ 23,048	$ 22,591	$ 22,143	$ 21,705	$ 21,275	$ 20,853	$ 20,440	$ 20,035	$ 19,638	$ 19,249
NPV		**$ 2,571,055**																				

Option 1 - Continue with Trade Waste Agreement

	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Capex																						
MH1 refurbish, disconnect stormwater from MH1 and construct new line from MH7 to creek outlet, install sediment chamber		$ 104,890																				
Infrastructure Replacement - pumps, telemetry and associated components		$ -	$ 35,840				$ 50,665					$ 57,044										
Depreciation																						
(Capex/20 Years)		$ -	$ 5,245	$ 1,792	$ -	$ -	$ -	$ 2,533	$ -	$ -	$ -	$ -	$ 2,852	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operational																						
Trade Waste -Disposal Rate ($/KL)		$ 1.1271	$ 1.1564	$ 1.1865	$ 1.2173	$ 1.2490	$ 1.2814	$ 1.3148	$ 1.3489	$ 1.3840	$ 1.4200	$ 1.4569	$ 1.4948	$ 1.5337	$ 1.5735	$ 1.6145	$ 1.6564	$ 1.6995	$ 1.7437	$ 1.7890	$ 1.8355	$ 1.8833
Trade Waste Annual Monitoring Fee		$ 1,835	$ 1,879	$ 1,924	$ 1,970	$ 2,018	$ 2,066	$ 2,116	$ 2,166	$ 2,218	$ 2,272	$ 2,326	$ 2,382	$ 2,439	$ 2,498	$ 2,558	$ 2,619	$ 2,682	$ 2,746	$ 2,812	$ 2,880	$ 2,949
Trade Waste - Disposal Charges (Stage 1 only)		$ 201,417	$ 206,654	$ 212,027	$ 217,540	$ 223,196	$ 228,999	$ 234,953	$ 241,062	$ 247,329	$ 253,760	$ 260,358	$ 267,127	$ 274,072	$ 281,198	$ 288,509	$ 296,011	$ 303,707	$ 311,603	$ 319,705	$ 328,017	$ 336,546
Site maintenance including; slashing, plumbing, repairs etc.		$ 7,000	$ 7,168	$ 7,340	$ 7,516	$ 7,697	$ 7,881	$ 8,070	$ 8,264	$ 8,462	$ 8,666	$ 8,874	$ 9,087	$ 9,305	$ 9,528	$ 9,757	$ 9,991	$ 10,231	$ 10,476	$ 10,727	$ 10,985	$ 11,249
Pump maintenance & monitoring		$ 4,400	$ 4,506	$ 4,614	$ 4,724	$ 4,838	$ 4,954	$ 5,073	$ 5,195	$ 5,319	$ 5,447	$ 5,578	$ 5,712	$ 5,849	$ 5,989	$ 6,133	$ 6,280	$ 6,431	$ 6,585	$ 6,743	$ 6,905	$ 7,071
Pumping costs/electricity		$ 10,500	$ 10,752	$ 11,010	$ 11,274	$ 11,545	$ 11,822	$ 12,106	$ 12,396	$ 12,694	$ 12,998	$ 13,310	$ 13,630	$ 13,957	$ 14,292	$ 14,635	$ 14,986	$ 15,346	$ 15,714	$ 16,091	$ 16,477	$ 16,873
Water quality monitoring		$ 15,500	$ 15,872	$ 16,253	$ 16,643	$ 17,042	$ 17,451	$ 17,870	$ 18,299	$ 18,738	$ 19,188	$ 19,649	$ 20,120	$ 20,603	$ 21,098	$ 21,604	$ 22,122	$ 22,653	$ 23,197	$ 23,754	$ 24,324	$ 24,908
TOTAL																						
Real time - $		$ 240,653	$ 287,916	$ 254,961	$ 259,669	$ 266,336	$ 323,840	$ 282,722	$ 287,384	$ 294,763	$ 302,332	$ 367,140	$ 320,911	$ 326,226	$ 334,604	$ 343,196	$ 352,010	$ 361,051	$ 370,323	$ 379,834	$ 389,590	$ 399,596
PV - Cost		$ 240,653	$ 275,597	$ 233,610	$ 227,743	$ 223,596	$ 260,239	$ 217,476	$ 211,602	$ 207,750	$ 203,967	$ 237,091	$ 198,370	$ 193,028	$ 189,513	$ 186,063	$ 182,676	$ 179,350	$ 176,086	$ 172,880	$ 169,733	$ 166,644
NPV		**$ 4,353,669**																				

Option 3C - Treatment Wetland - Alternate Location, North of Stage 1 Landfill

	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Capex																						
Treatment Wetland - design, approvals, construction, testing and commissioning		$ 3,497,394																				
Operational																						
Performance Commissioning			$ 9,500																			
Maintenance			$ 9,754	$ 18,760	$ 11,760	$ 12,042	$ 12,331	$ 12,627	$ 12,930	$ 13,241	$ 13,558	$ 13,884	$ 14,217	$ 14,558	$ 14,908	$ 15,265	$ 15,632	$ 16,007	$ 16,391	$ 16,784	$ 17,187	$ 17,600
Water quality monitoring			$ 17,504	$ 15,092	$ 9,120	$ 9,339	$ 9,563	$ 9,793	$ 10,028	$ 10,268	$ 10,515	$ 10,767	$ 11,025	$ 11,290	$ 11,561	$ 11,838	$ 12,123	$ 12,414	$ 12,711	$ 13,016	$ 13,329	$ 13,649
Pumping costs/electricity			$ 13,140	$ 13,455	$ 13,778	$ 14,109	$ 14,448	$ 14,794	$ 15,149	$ 15,513	$ 15,885	$ 16,267	$ 16,657	$ 17,057	$ 17,466	$ 17,885	$ 18,314	$ 18,754	$ 19,204	$ 19,665	$ 20,137	$ 20,620
TOTAL																						
Real time - $		$ 3,497,394	$ 49,898	$ 47,307	$ 34,658	$ 35,490	$ 36,342	$ 37,214	$ 38,107	$ 39,022	$ 39,958	$ 40,917	$ 41,899	$ 42,905	$ 43,935	$ 44,989	$ 46,069	$ 47,174	$ 48,307	$ 49,466	$ 50,653	$ 51,869
PV - Cost		$ 3,497,394	$ 47,763	$ 43,346	$ 30,397	$ 29,795	$ 29,204	$ 28,626	$ 28,059	$ 27,503	$ 26,958	$ 26,424	$ 25,900	$ 25,387	$ 24,884	$ 24,391	$ 23,907	$ 23,434	$ 22,969	$ 22,514	$ 22,068	$ 21,631
NPV		**$ 4,052,553**																				

**Operational Costs indexed annually by 2.4% (Average Hobart CPI (December) over past 5 years)*
**Trade Waste disposal costs indexed annually by 2.6% as per infrastructure agreement with TasWater*
**Discount rate of 4.47% has been adopted for PV (average Council WAIR over the past 5 years)*

COST ESTIMATE –

OPTION 2A

COST ESTIMATE SHEET

BURNIE CITY COUNCIL

WASTE MANAGEMENT CENTRE - STAGE 1 LANDFILL WASTE REMOVAL
OPTION 2A - DEVELOP STAGE 2B/C LANDFILL AND DISPOSE ON-SITE

Date: 22/05/2015

ITEM	DESCRIPTION OF WORKS	QTY	UNIT	RATE	AMOUNT	TOTAL
1	**PRELIMINARIES**					
1.1	Site establishment, de-establishment, set out, compaction and testing, site offices, amenities Locate and protect all existing services Prepare and maintain a Project Plan to include Traffic Management Plan, WHS, risk, environmental management and construction program.				$750,000	
						$750,000
2	**DESIGN, APPROVALS, DOCUMENTATION & SUPERVISION**					
2.1	Allowance for Consultant Services, EPA approval etc.				$250,000	
						$250,000
3	**STAGE 2B/C LANDFILL**					
	Development and rehabilitation of Stage 2B & 2C Landfills at the BWMC site.					
3.1	Develop Stage 2B				$3,105,600	
3.2	Develop Stage 2C				$1,821,960	
3.3	Rehabilitate Stage 2B				$496,000	
3.4	Rehabilitate Stage 2C				$2,120,400	
						$ 7,543,960
4	**CIVIL WORKS**					
4.1	Strip landfill capping material and stockpile on-site for re-use	43,000	m3	$7.0	$301,000	
4.2	Excavation of waste material	513,000	m3	$5.0	$2,565,000	
4.3	Cart, place and compact waste material	513,000	m3	$7.0	$3,591,000	
	Stage 1 Landfill Site;					
4.4	Miscellaneous costs Inc. drainage works, access roads etc.	1	Item	$500,000	$500,000	
4.5	Environmental protection works Inc. silt fencing, leachate & litter management etc.	1	Item	$300,000	$300,000	
4.6	Revegetation of the site Inc. spreading capping material, planting vegetation etc.	1	Item	$500,000	$500,000	
						$7,757,000
	TOTAL (Exc. GST)					**$16,300,960**

COST ESTIMATE –

OPTION 2B

COST ESTIMATE SHEET

BURNIE CITY COUNCIL

WASTE MANAGEMENT CENTRE - STAGE 1 LANDFILL WASTE REMOVAL
OPTION 2B - TRANSPORT AND DISPOSAL TO ALTERNATIVE LANDFILL FACILITY

Date: 22/05/2015

ITEM	DESCRIPTION OF WORKS	QTY	UNIT	RATE	AMOUNT	TOTAL
1	**PRELIMINARIES**					
1.1	Site establishment, de-establishment, set out, compaction and testing, site offices, amenities Locate and protect all existing services Prepare and maintain a Project Plan to include Traffic Management Plan, WHS, risk, environmental management and construction program.				$1,500,000	
						$1,500,000
2	**DESIGN, APPROVALS, DOCUMENTATION & SUPERVISION**					
2.1	Allowance for Consultant Services, EPA approval etc.				$350,000	
						$ 350,000
3	**SITE WORKS**					
3.1	Strip landfill capping material and stockpile on-site for re-use	43,000	m3	$7.0	$301,000	
3.2	Excavation of waste material	513,000	m3	$5.0	$2,565,000	
3.3	Cartage to Dulverton Landfill	513,000	m3	$8.0	$4,104,000	
3.4	Disposal costs - to Landfill at Dulverton or Port Latta	360,000	tonnes	$85.0	$30,600,000	
3.5	Miscellaneous costs Inc. drainage works, access roads etc.	1	Item	$500,000	$500,000	
3.6	Environmental protection works Inc. silt fencing, leachate & litter management etc.	1	Item	$300,000	$300,000	
3.7	Revegetation of the site Inc. spreading capping material, planting vegetation etc.	1	Item	$500,000	$500,000	
						$38,870,000
	TOTAL (Exc. GST)					**$40,720,000**