ARUP

Subject	Addendum – Silent Valley Landfill Leachate Lagoon - Review of Requirements and Feasibility Study
Date	15 December 2017
Job No/Ref	244847

1 Introduction

This addendum is an update to aspects included within Sections 5, 6 and 7 of the original report titled 'Silent Valley Landfill Leachate Lagoon – Review of Requirements and Feasibility' issued to Blaenau Gwent Borough Council (BGCBC) on 16th November 2016.

The decommissioned landfill site at Silent Valley currently releases a leachate – ultimately discharging into DCWW's system. Discharging leachate into DCWW's system has a cost implication; a cost which the client desires to minimise.

Ongoing issues have been identified with the on-site leachate management infrastructure. The existing infrastructure incorporates a diesel-powered pump to transfer a proportion of the leachate to a lagoon which ultimately connects to DCWW's system. A number of options to improve the leachate management infrastructure were presented in the previous report. These options are re-evaluated as far as possible within this addendum using updated leachate flow data.

2 Basis of the update

Leachate is formed when water, in the course of passing through landfill waste, becomes contaminated through extracting soluble or suspended solids. By reducing the amount of water entering a landfill the volume of leachate should reduce.

Phase 1 of the landfill capping was completed in September 2015. The implementation of a capping layer should reduce water ingress into the landfill, which should therefore reduce the volume of leachate. Minimal treatment is undertaken on site and the leachate is discharged into DCWW's system. The volume of flow entering DCWW's system is recorded and charged, the incurred DCWW costs are proportional to the volume of leachate entering their system.

The main report documents leachate flow data up to April 2015. Supplementary leachate flow data has been provided up to October 2017. This additional flow data should show what effect the capping has had in reducing the leachate volume.

The options discussed in the main report are to be qualitatively assessed within this addendum based on the updated leachate flow data.

3 Trends and data

Daily leachate volume and rainfall data ranging from 1st April 2013 to 31st October 2017 for the site have been received. Figure 1 presents the leachate volume and rainfall depths between these dates.

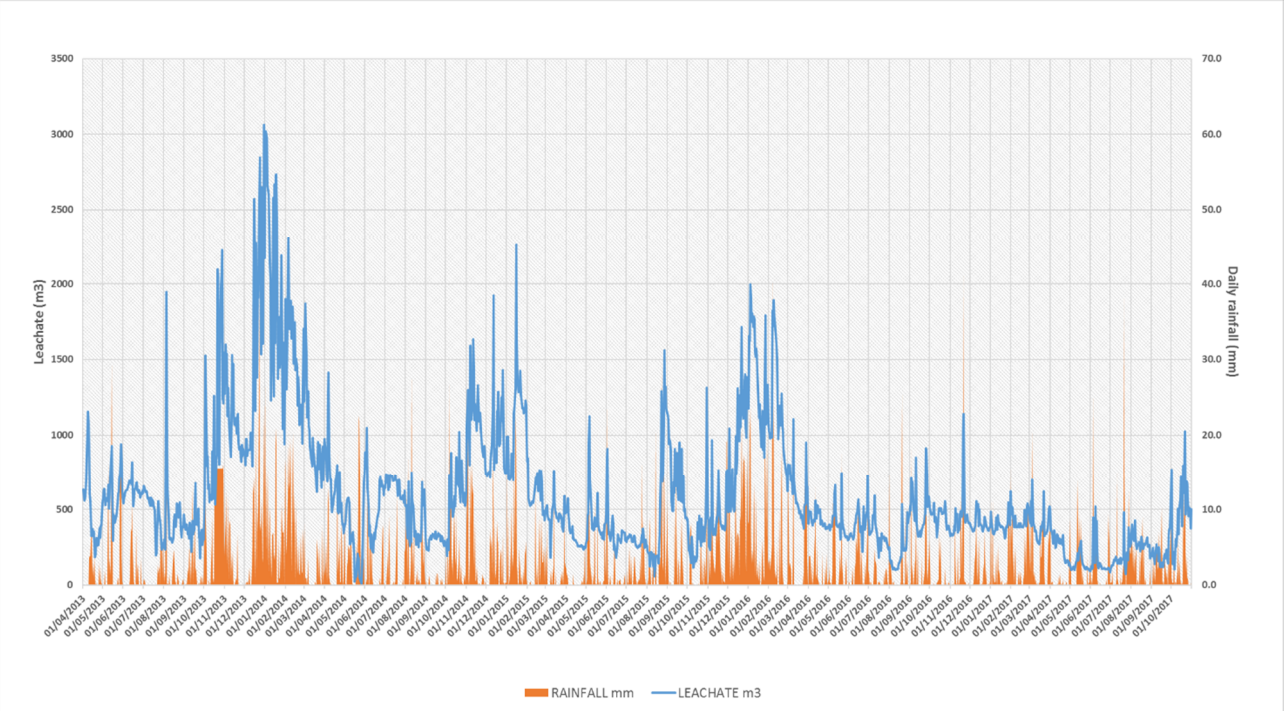

Figure 1 – Graphical presentation of the leachate flow and rainfall between 1/4/13 and 31/10/17

A general reduction in leachate flow can be observed over time, the flow peaks since September 2015 have also been lower than previously recorded. However, without further analysis it is possible that the reduction is not fully attributable to the capping – the correlation could be due to climatic conditions. Similar flow events need to be assessed to make any quantifiable comparison to assess if the capping had any effect.

Records show the wettest months between November and January with each peak leachate volume event occurring within these dates (excluding 2017) as shown in Table 1.

Table 1 – Yearly Peak leachate flow events

Year	Peak Leachate Flow (m^3/d)	Date	Number of days with significant rainfall	Rainfall event depth (mm)
2013	3062	30/12/2013	13	158.5
2014	3021	02/01/2014	16	196.3
2015	2261	15/01/2015	10	89.8
2016	1997	04/01/2016	17	217.4
2017*	1025	21/10/2017	3	38.1

* Incomplete records

The peak flow events cannot be examined in isolation as rainfall from previous days could have an impact on the leachate volume. The rainfall events leading to the peaks in 2014 and 2016 are similar in terms of cumulative depth over a similar number of days. The data shows an approximate 33% reduction between the 2014 (pre- capping) and 2016 (post capping) peak events.

The wettest months are November to January each year. Table 2 shows the leachate volumes for this period along with the cumulative rainfall. Flow records for 2017 is incomplete as the data

terminates in October. As the record omits the wettest months of the year; 2017 has been removed from further analysis included in this addendum.

Table 2 – Leachate flow and rainfall analysis over the wettest months of the year

Period		No. of days	Total leachate (m^3)	Average Leachate flow (m^3/d)	Total rainfall mm	Peak Leachate Flow (m^3/d)
1	1/11/13 to 31/1/14	92	144063	1566	516	3062
2	1/11/14 to 31/1/15	92	97296	1058	380	2261
3	1/11/15 to 31/1/16	92	86186	937	644	1997
4	1/11/16 to 31/1/17	92	38773	421	229	1142
				Difference		
		Comparison of 1 and 3		-40%	+25%	-35%
		Comparison of 2 and 4		-60%	-40%	-49%

It is important to compare on a like-for-like basis. In terms of rainfall depths over November to January, as shown in Table 2; the comparable rainfall depths are identified to be between period 1 and 3 and between period 2 and 4.

3.1 Comparison of 1 and 3

The rainfall over the period increased by 25% whist the total leachate reduced by 40% and the peak event reduced by 35%.

By analysing the two periods it could be stated that the capping has had an effect on the leachate amount, the amount has reduced whilst the total rainfall has increased.

3.2 Comparison of 2 and 4

The rainfall over the period decreased by 40% between the two years and the total amount of leachate reduced 60% and the peak event reduced by 49%.

This reduction is consistent with what is observed between period 1 and 3. The average and peak flows are lower post capping. The leachate volume reductions are greater when compared to section 3.1 which could be due to less rainfall entering the landfill.

3.3 Analysis of data

There is direct correlation between the total precipitation and the leachate flow as shown in Figure 1. The leachate is shown to have reduced since Phase 1 of the landfill capping was completed in September 2015.

Due to limited records it is currently difficult to accurately quantify the flow reduction due to the capping and relate the leachate volume based on rainfall events. Further monitoring data is required

4 Discussion

4.1 Climate Change

As previously discussed the flow monitoring data indicate that the leachate flow has reduced in recent years. It appears that Phase 1 capping has been responsible for contributing to this reduction. However, it should be noted that due to climate change it is expected that future storm events are to be more intense and more frequent. Recent government guidance recommends that an additional allowance should be made to existing flow rates to allow infrastructure to accommodate future extreme rainfall events.

The UK government publish recommended climate change values as shown in 'Flood risk assessments: climate change allowances[1]'.

The site is located within the Severn basin. An extract of the guidance stating the recommended allowances are displayed in Figure 2.

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Severn	Upper end	25%	40%	70%
	Higher central	15%	25%	35%
	Central	10%	20%	25%

Figure 2 – Table extract for the climate change allowance within the Severn basin

It is understood that the site will generate leachate for at least the next 60 years therefore assessments should take climate change into account.

As an example, climate change has been applied to the post-capping volumes presented in Table 2. When climate change is applied to the recorded post capping leachate flow the volumes may well be similar to the pre-capping levels as shown in Table 3 and 4.

[1] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1

Table 3 – Climate change applied to average leachate flows.

		Range			
		1	2	3	4
		1/11/13 to 31/1/14	1/11/14 to 31/1/15	1/11/15 to 31/1/16	1/11/16 to 31/1/17
	Total rainfall (mm)	516	380	644	229
	Average Leachate flow (m^3/d)	1566	1058	937	421
Climate Change allowance (%)	Central (25%)	-	-	1171	527
	Higher Central (35%)	-	-	1265	569
	Upper end (70%)	-	-	1593	716

Table 4 – Climate change applied to peak leachate flows.

		Range			
		1	2	3	4
		1/11/13 to 31/1/14	1/11/14 to 31/1/15	1/11/15 to 31/1/16	1/11/16 to 31/1/17
	Total rainfall (mm)	516	380	644	229
	Peak Leachate Flow (m^3/d)	3062	2261	1997	1142
Climate Change allowance (%)	Central (25%)	-	-	2496	1428
	Higher Central (35%)	-	-	2696	1542
	Upper end (70%)	-	-	3395	1941

4.2 Monitoring

In addition to the existing monitoring effort; supplementary monitoring should be undertaken on site as highlighted in Section 7.0 of the Feasibility Report. Incoming flow rates into the sump and lagoon will be required to effectively design any upgrades to the leachate management infrastructure.

It is recommended that the chemical composition of the various flow sources into the sump and lagoon should be investigated to assess their contamination level. The various sources may not all be contaminated by the landfill. Alternative methods of disposal could be explored such as river discharge or groundwater infiltration. Alternative disposal options would reduce the flow into DCWW's system providing yearly cost savings.

5 Options analysis

A qualitative analysis has been undertaken for each option considered in Section 6 of the previous report taking into account that the post-capping leachate flow has reduced. However, due to climate change the flow may return to the pre-capping levels over the long term.

The options considered in Section 6 of the main report were:

Option 1: Do nothing

Option 2: Permanent pumping station

Option 3: Gravity-fed lagoon

Option A: Leachate treatment

Option B: Discharge into River Ebbw

5.1 Do nothing

5.1.1 Capital expenditure

No change in cost as this option assumes that the existing infrastructure is to be retained.

5.1.2 Operating costs

The operating cost are likely to decrease in the short term as the leachate flow has reduced. However, the operating cost are likely to increase in the long term due to factors such as climate change, DCWW effluent rates increasing, diesel prices and the need to maintain/replace the pumps.

5.2 Permanent pumping station

5.2.1 Capital expenditure

There is likely to be small change in cost for this option. The same infrastructure associated with the permanent pumping station will be required irrespective of the change in leachate flow. The size of the pump unit could be reduced which decreases initial expenditure.

5.2.2 Operating costs

The operating costs are likely to be reduced in the short term due to the reduced leachate flow.

Electricity cost are expected to rise in the future; its impact could be reduced by implementing renewable power sources (which would impact initial capital expenditure).

5.3 Gravity-fed lagoon

5.3.1 Capital expenditure

The lagoon size will need to deal with any future extreme storm events therefore there is unlikely to be significant change in capital expenditure. Further monitoring data will be required to accurately assess the lagoon size.

5.3.2 Operating costs

No change.

5.4 Leachate treatment

5.4.1 Capital expenditure

The reduction of storm water infiltrating into the landfill is likely to increase the leachate concentration. The treatment plant becomes more cost effective with concentrated leachate. Flow reduction will reduce the cost of a treatment plant however the design will need to consider climate change.

5.4.2 Operating costs

If the average leachate flows can be maintained at a lower rate the operating cost will be lower.

5.5 Discharge into River Ebbw

Further data will be required before commenting on the viability and any cost implications of this option.

6 Recommendations

The flow monitoring into DCWW's system currently being carried out should be maintained to provide further data on peak and average flows together with rainfall. It is recommended that any pump failure occurrences should also be recorded to allow assessment of any inconsistencies between rainfall events and leachate flows.

It is recommended that incoming flows into the pumping station and lagoon should be monitored as highlighted in Section 7 of the Feasibility Report. The infrastructure necessary to deal with the peak and base flow of leachate can only be accurately designed with this additional monitoring data. This data will be needed to identify the optimum method and minimise the clients ongoing costs and liability.

Any future design should consider the potential for increased flows due to climate change.

The degree of contamination of the various groundwater/leachate sources should be assessed as there may be an opportunity for alternative disposal. Alternative disposal would reduce the amount of flow that drains into DCWW's network.

7 Conclusion

This addendum is intended to provide an update to the original report based on additional flow data which includes both pre and post Phase 1 capping of the landfill.

The flow data show that a general reduction in leachate flow has been observed since September 2015, when Phase 1 capping was completed. This flow reduction signifies that provisions for any new infrastructure to deal with the leachate could be reduced – reducing cost.

Climate change will need to be considered for any future designs which may impact on any cost benefit gained from the flow reduction due to capping.

Based on current monitoring data it will be challenging to reliably design new leachate management infrastructure to convey or treat the leachate. It is recommended to continue monitoring the flow and rainfall. Additional monitoring should also be carried out for the various flow input sources to effectively inform the chosen design to manage the leachate.

8 DCWW Update

As presented in the Feasibility Report, the current volumes of leachate discharged to the DCWW foul sewer exceed the Trade Effluent Discharge Agreement (1988) between Blaenau Gwent CBC and DCWW. Subsequent the to the Feasibility Report discussions with DCWW have resulted in the issue of a new agreement with the following conditions:

Maximum Daily volume – 2000 m^3 per day

Flow Rate – 83 m^3 per hour

Total Suspended Solids – 200 mg/l

Ammonia (as N) – 100 mg/l

Total Sulphide – 1 mg/l

Dissolved Methane – 0.14 mg/l

pH – 6 to 11.

This agreement is to be reviewed after 5 years.

Review of the daily leachate flows presented in Figure 1 indicates that since the completion of the capping in September 2015 there have not been any exceedances of the new maximum daily volume.