WHINNEY HILL LANDFILL SITE

Leachate Management Plan

For EP/BL9500IJ-V007 & EPR/AP3096LZ-V011

Prepared for: **SUEZ Recycling and Recovery UK**

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1.0 Introduction

SUEZ Recycling and recovery UK Ltd (SUEZ) have commissioned SLR Consulting Ltd (SLR) to produce a Leachate Management Plan (LMP) for their Whinney Hill Landfill site. The Site is located at National Grid Reference (NGR) SP 757 304, approximately 1km north east of Accrington, Lancashire.

To the north the site is bound by the M65 motorway and to the south by the Whinney Hill Road. To the east the site is bound by a quarry and an industrial estate and to the west by the William Street Works (light industrial units) and a residential area (Altham) alongside the Whalley Road (A680).

The landfill occupies an area of approximately 39.1Ha in a void created by the formal quarrying of sandstones and mudstones. The site has been developed in two distinct phases. The oldest part of the site is known as Phase 1 and comprises three cells, 1, 2 and 3, occupying an area of approximately 13Ha, regulated under permit EPR AP3096LZ-V011. Phase 1 was developed as essentially a naturally contained site with no engineered basal lining system (although the most recent cell, number 3, does benefit from external side wall lining and a basal leachate collection layer. Phase 1 of the site has been largely capped and restored.

Phase 2 of the site began waste filling in 1999 and is divided into eleven sub-cells; 4/1[1]; 4/2; 5/1; 5/2; 6/1; 6/2; 7/1; 7/2; 7/3; 8/1 and 8/2 and is regulated under permit EP BL9500IJ-V007. These Phase 2 cells occupy approximately 26Ha and have all been engineered to construction quality assured (CQA) standards of containment benefiting from basal engineered low permeability lining and leachate drainage features. Permanent capping of the northern, eastern perimeters of phase 2 has been completed and capping of much of the body of the Phase 2 site is planned for between 2020 to 2025. Active waste placement is currently taking place in the cell 6 area of site with Cell 6/1 being filled in 2020 and Cell 6/2 being the final, western most cell to be constructed at a future date.

1.1 Purpose

This management plan has been prepared to set out the site's Leachate Management Plan supported by an updated Hydrogeological Risk Assessment for the site, both of which are integral to the leachate disposal strategy for the landfill that includes the imminent development of an on-site Leachate Treatment Plant (LTP) designed to serve the needs of the landfill for the foreseeable future.

This document should be read in conjunction with an updated and contemporary Hydrogeological Risk Assessment being prepared for the site by SLR Consulting in October 2020 along with an updated trade effluent discharge consent for the site issued by United Utilities (UU) in December 2018 (see Appendix 01).

Complying with the terms of the new UU consent has resulted in the need to design and plan for the operation of a new on site LTP that is currently planned to be constructed in 2021 and fully commissioned during 2022. It has been recognised by SUEZ that in designing and constructing a new LTP, future management of the site will be based on an integrated strategy of:

- control of leachate production;
- on-going leachate extraction;
- leachate treatment up to the capacity of the site's LTP; and
- short-term leachate storage within the base of the waste mass where leachate production rates exceed leachate treatment and disposal capacity at the site.

It is also recognised that future leachate production rates at the site will evolve in response to:

[1] The Cells 4/1 and 4/2 are technically one cell with two monitoring points and one abstraction point serving both.

- current and proposed capping programmes;
- effective segregation and management of incident surface water run off;
- the timing of the remaining development of Phase 6; and
- the rate / intensity of rainfall at the site both during the remaining operational period of the site and then through the extended period of aftercare management.

Reference is also made within this management plan to the on-going maintenance of leachate infrastructure at Whinney Hill Landfill Site.

1.2 Leachate Management Philosophy

As one of the leading waste management companies in the UK, SUEZ is dedicated to ensuring that leachate is managed, collected and disposed of safely and effectively at all of its landfill sites.

This is achieved through the implementation of leachate management systems, which are designed to minimise the production of leachate and to collect, extract and treat leachate that is generated at a site. These measures aim to prevent pollution to the environment, harm to human health or detriment to the local community.

All leachate management infrastructure and leachate management practices are designed to comply with all relevant Health and Safety legislation.

SUEZ is committed to supporting the development of new landfill leachate management technologies and will continue to operate in accordance with relevant regulations and codes while looking to develop within the current and emerging regulatory environments the most sustainable approaches for effective and risk based solutions to the extended requirements of leachate management across its portfolio of sites within the UK.

1.3 Report Context

This Management Plan has been prepared for SUEZ based on all data and historical records retained by SUEZ to the date of issue of this plan. It is recognised that where this document is used to support a permit variation, additional data and potentially records will be obtained by SUEZ prior to determination and issue of the variation which may evolve further the conceptual model and required outcomes for future management of the site.

At Whinney Hill, it is recognised that the earlier areas of the site were developed prior to the contemporary permitting regime with Phases 1 - 3 being developed by other parties as set out in this Management Plan and supporting HRA. As such, retrospective application of contemporary standards for leachate management, monitoring and control may not be appropriate across the site, noting that landfilling of waste has been on-going at the site with effective management of leachate since issue of the site's first Waste Disposal Licence in May 1993.

2.0 Mechanisms for Leachate Production and Associated Risk Assessment

This section provides a summary of the core elements of leachate production at the Whinney Hill Landfill Site based on the extended management and monitoring data retained at the site over the period from 2018 to August 2020.

2.1 Leachate Storage Strategy and Linkage to Hydrogeological Risk Assessment

Phase 2 of the Whinney Hill Landfill has been subject to detailed hydrogeological risk assessments (HRAs) to 2020. Past HRAs have justified suitable leachate compliance limits at the site at 3m above base of well for all cells so that leachate from the site will not produce an unacceptable discharge in terms of the Environmental Permitting Regulations 2016.

With the site located above the regional groundwater table, the primary means of leachate production at the site through its residual aftercare period will be through:

- Water ingress through the site's low permeability capping layer and overlying restoration soils across the waste mass; and
- Residual degradation of the organic matter within the site, releasing low volumes of leachate through both the degradation of waste and the physical consolidation of the waste mass structure.

Both of the above inputs are controlled by the physical nature and properties of the capping system and the waste mass composition.

The site's 2021 HRA reports detail the key site setting information and fundamental concepts in the storage and long-term release of leachate into the underlying water environment. With Phase 1 of the site having ceased accepting putrescible waste in approximately 1999 and having been subsequently capped and restored, leachate production rates within Phase 1 now are reflective of "aftercare" steady state rates[2] allowing for the seasonality of leachate production between drier and wetter months in the year. Based on 2021 HRA prepared for the site the previously agreed compliance limits of 3m above base of site will remain in force in this part of the site with the heads revised to be expressed as an elevation in mAOD.

Table 2-1: Phase 1 Current and Future Leachate Compliance Levels

Phase 1 Cells	Base Level (assumed) mAOD	Compliance Level mAOD	Future Compliance Level
1	145 – 150	148.00	Remains unchanged at 148mAOD
2	155 – 158	160.00	Remains unchanged at 160mAOD
3	143	146.00	Remains unchanged at 146mAOD

Phase 2 of the site consists of a mixture of areas that have had waste deposited from as early as 1999 (cell 4) and may have subsequently been permanently capped. However, much of the site has been subject to temporary capping and subsequent over tipping with waste, recently (in the few years prior to and including early 2019) waste was being tipped in an area to the northeast of the site centred over the southern boundary of cell 8/1

[2] Noting that Phase 1 was re-opened to take waste from the PPC bund excavation works in approximately 2004/2006.

and the northern intersection of Cells 5/1 and 5/2. In the latter half of 2019 and throughout 2020 tipping has now moved to be centred on Cell 6/1 to be followed by tipping in Cell 6/2 with capping of much of the main body of Phase 2, to be followed by re-tipping over Cells 4, 5, 7/1-3, 8/1 and 8/2. As such Phase 2 leachate production rates are reflective of "active" variable rate production, responding in a 'flashy' manner to rainfall events with an underlying seasonality of leachate production between drier and wetter months in the year.
Accordingly, SUEZ has proposed the following strategy to manage future volumes of leachate arising at the site as follows:

- extraction of leachate for discharge to sewer – either via the current short-term disposal route without treatment to foul sewer or with full biological treatment following construction of the site's proposed LTP;
- improved segregation and management of surface water runoff from areas of temporary and permanent capping over the site; and
- short-term storage of leachate (where required) within the base of the waste mass during and following periods of extended wet weather

Normal Operating Conditions

Under normal operating circumstances storage of leachate in the base of the Phase 2 will be largely unchanged from the Action Limits currently set out in the most recent HRA, that is leachate levels will be managed to permit the storage of 2m of leachate in the base of the site; and

Wet Weather Management

In recognising the risks associated with the recent production rates of leachate at the site to 2020, notwithstanding the extended capping works at the site being completed in 2020, there are likely to be periods of time before the end of operational filling at the site and during the move of the site into aftercare management when the rate of leachate production may exceed the rate at which leachate can be extracted and treated at the site's proposed LTP. During such periods, SUEZ propose to store excess leachate in a controlled manner for a short-term period of time until the rate of leachate treatment exceeds the rate of leachate production and any backlog of leachate storage can be addressed.

Having due regard to the risks of short-term leachate storage within a site engineered with a composite basal liner and composite side-slopes, the proposed sequence for additional storage of leachate in the site would be via increasing leachate heads in the base of the site in the following order:

- Cell 5 (5/1 and 5/2); then
- Cell 8 (8/1 and 8/2); then
- Cell 4 (4/1 and 4/2); and finally
- Cell 7/3.

With this storage strategy and sequential phasing reflecting the acceptable level of risk posed to the external groundwater environment as detailed in the site's 2020 HRA with revision of the site's compliance limits as detailed in Table 2-2. The revised compliance levels reflect a move to a single "leachate elevation as mAOD" across cells, reflecting the differing basal elevations for the sumps / bases across the site as detailed in Drawing 01 and Drawing 02.

It is noted that leachate heads of less than 3m are retained in the operational cell, Cell 6/1 until such time that the future and final cell (Cell 6B) is constructed – at which point a revised long-term leachate elevation within Cells 6/1 and 6/2 would be adopted following the removal of the risk of short-term overtopping of leachate heads in Cell 6/1 into the remaining area of undeveloped site (future cell 6/2).

Table 2-2: Phase 2 Current and Future Leachate Compliance Levels

Phase 2 Cells	Compliance Well ID	Base Level mAOD	Compliance Level mAOD	Future Compliance Level mAOD
4/1	LM4/3R*	138.25	142.00	142.00
4/2	LM4/4R	138.13	147.00	147.00
5/1	LM5/1	144.81	147.00	147.50
	LM5/2	143.64	147.00	147.50
5/2	LM5/3	141.26	145.00	145.00
	LM5/4	141.26	145.00	145.00
6/1	LMP6A*	140.60	143.60	143.60
	LM6/1*	141.88	144.88	144.88
7/1	LM7/1	137.10	140.05	141.00
	LM7/2	137.30	140.34	141.00
7/2	LM7/3	137.80	140.76	141.00
	LM7/4	137.90	140.87	141.00
7/3	LM7/5	138.3	141.34	143.00
	LM7/6	138.70	141.85	143.00
8/1	LM8/1	135.40	138.40	143.00
	LM8/2	135.90	138.87	143.00
8/2	LM8/3	134.00	137.02	137.00
	LM8/4	134.50	137.47	137.00

Note: * to be revised to 145 mAOD after Construction of Cell 6/2

The 2021 HRA report will only propose compliance limits that it concludes, with on-going management of leachate to maintain leachate heads in accordance with the proposed revised limits at the site, will enable Phase 2 of the site to continue to present a level of risk to the external groundwater and surface water environment that continues to comply with the requirements of Schedule 10 and 22 (Groundwater Activities) of the Environmental Permitting Regulations 2016.

Appendix 11 provides additional information relating to the proposals to revise the leachate compliance levels at the site in relation to stability and landfill gas risks.

Technical elements relevant to ongoing management of leachate set out in the 2021 HRA will be expanded within this LMP to provide further information on the management techniques and approaches taken by SUEZ in 2020 to ensure on-going protection of the receiving water environment.

It should also be stressed that under normal operating conditions SUEZ will continue to maintain leachate levels at low levels in the site (between 0.8 and 2.0m above base).

2.1.1 Hydraulic Units within the Site

One consequence of amending the leachate compliance levels as proposed in the 2021 HRA and detailed above in Table 2-2 is that in Phase 2 of the site, at the maximum permitted levels, leachate will be able to cross some of the intercell bunds, creating larger discreet hydraulic units within the site. Once Cell 6/2 is built it will be possible (once there is a depth of greater than circa. 10m of waste across the whole of Cell 6) to have the western end of the site rebalanced to become one hydraulic phase). A summary of the current and potential future hydraulic phasing of the site is presented below in Table 2-3.

Table 2-3: Future Hydraulic Units within Phase 2 of Whinney Hill Landfill

Current Phase 2 Cells	Hydraulic Unit	Leachate Sumps	Leachate Level Compliance Points		Leachate Quality Sampling Points	
			ID	Number	ID	Number
4/1	A	LMP4.1, LMP6B	LM4/3R, LM4/4R, LM6/2	3	LMP4.1, LMP6B	2 (as Cell 6 is operational)
4/2						
6/1						
5/1	B*	LMP5A, LMP5B	LM5/1, LM5/2, LM5/3, LM5/4	4	LMP5B	1
5/2						
7/1	C	LMP7A, LMP7B, LMP7C, LMP8A	LM7/1, LM7/2, LM7/3, LM7/4, LM7/5, LM7/6, LM8/1, LM8/2	8	LMP7B, LMP8A	2 (due to layout of sub cells)
7/2						
7/3						
8/1						
8/2	D	LMP8B	LM8/3, LM8/4	2	LMP8B	1

Note: * in the event of loss of a monitoring well, provided 2 monitoring wells remain functional in the hydraulic unit then the lost / failed monitoring well would not be replaced.

2.2 Current and Future Rates of Leachate Production

The Whinney Hill Landfill area was designed to established water balance principles in order to minimise the production of leachate during infilling. However, whilst Phase 1, now filled and restored, long term leachate management requirements reflect the long-term ingress of water through the capping systems requiring the control / management by leachate infrastructure within the waste mass. Phase 2 of the site is still receiving waste and so has not yet achieved this post-tipping stable state of leachate generation.

As noted above in Section 2.1, Phase 2 of the landfill is subject to relatively 'flashy' leachate generation, this being due to the geometry of the landfill cell development making efficient removal of surface waters from temporary capped batters and slopes problematic, and the location of the site on the western edge of the Pennines in a relatively high rainfall location.

Over the past three years active landfilling has taken place in the northeastern area of the site, with extensive internal temporary capped waste batters both internal to the site perimeter and also around the site perimeter. Surface water that sheds from these temporary batters has been collected via a series of temporary drains, sumps and ditch systems with the aim of removing un-contaminated surface water to surface water discharge systems. However, due to the difficulties of installing and operating such systems at an active site and to prevent lightly contaminated 'grey waters' generated at the site from running off to controlled waters, the site has been subject to significant ingress of waters from these temporary surface water management systems. It is understood that these matters have been largely addressed by SUEZ in the extended capping works at the site in 2020 and will continue to be addressed in the future where appropriate, accepting that some further surface water ingress is likely as the tipping progresses back across to area 7 and 8 of Phase 2, supplemented by extended monitoring of the site's leachate extraction systems prior to commissioning of the LTP to confirm the improved exclusion / return of surface water management from the site.

During 2020 waste tipping has moved to the western end of the landfill, into Cell 6 of Phase 2. Progressive capping of the waste across the eastern end of the site has taken place and, as part of these works, a number of the surface water control issues noted above are being resolved so that surface waters no longer directly enter the waste mass. As noted above, similar surface water control issues may arise as tipping progresses from east to west across the site over the period from 2020 to 2025.

In light of the proposed development of an on-site LTP to serve the needs of the landfill and to enable the continued discharge of leachate (in future, treated leachate effluent) to the public sewer, a detailed understanding of the historic, current and future generation of leachate from the site is required.

Using detailed leachate flow monitoring from individual wells, total discharge to sewer and various water/leachate balance calculations, employing data supplied by SUEZ for the period January 2018 to July 2020, it has been possible to produce a detailed calibrated water/leachate balance for the site, which is presented in Appendix 02.

This work indicates the following:

- In 2019 the theoretical new leachate generation rate was 283m^3/day through the year;
- If somewhere between a third and half of the water that should have been shed by surface water control systems was in fact returned to the waste, daily leachate generation through the year would increase to 403m^3/day to 464m^3/day respectively, an increase of around 120m^3/day to 181m^3/day respectively due to surface water ingress to the site;
- At the end of 2020, if all projected capping work is completed successfully, but still allowing for some additional generation due to surface water still being experienced from leachate well 08/01B, new leachate generation through the year could fall to 262m^3/day;
- Thereafter, as tipping progresses back east to west over the site and then eventually is completed by filling of Cell 6/2 by the end of 2025, leachate generation rates may again rise towards 300m^3/day (a maximum of 270m^3/day being predicted for 2023); and
- Once waste tipping ceases at the site, and the site is capped, the rate of leachate generation could fall to as low as 61m^3/day but, given the historic performance of the site in terms of additional generation from surface water, a more conservative estimate for post closure generation has been made at ~100m^3/day allowing for the long-term drain down and drying out of the waste mass during the first decade of aftercare.

Further summary information on the rates of leachate production at Whinney Hill Landfill relating to flow metering is presented in Appendix 03. Flow metering from individual pumped locations, each fitted with a well-head flow meter, have been assessed for the period 31/12/2017 to 31/07/2020. This has included the identification of reliable periods of flow meter operation, assumptions of performance during periods when

reliable flow monitoring is missing with reference to previous performance (or to performance from similar wells on the site) and collecting similar wells into groups with similar performance.

This work indicates the following:

- In 2019 the average leachate production rate was 438m^3/day and the maximum rate was estimated to be 1,391m^3/day, including all additional leachate generation from 'grey water' and surface water ingress; and
- In the first eight months of 2020 the average rate of leachate production had fallen to 381m^3/day and the maximum estimated rate had also decreased to 541m^3/day, including on-going generation from 'grey water' and surface water ingress;

MCERTS certified flow metering to sewer and leachate tankering figures (from weighbridge records) have also been assessed for the period 06/05/2019 to 06/08/2020, a summary of this date is also presented in Appendix 03. This work indicates the following:

- From May to December 2019, the average leachate volume removed from the site was 344m^3/day (with the maximum rate closer to around 1,000m^3/day); and
- From January to August 2020, the average leachate volume removed from the site was 350m^3/day (with the maximum rate being closer to 900m^3/day).

Finally, when the average flow rate from field pumping estimates and metered disposal from site are compared over the longest possible time period for which data exists for both methods of flow monitoring (06/05/2019 – 23/08/2020), the average daily flow is 381m^3/day from well head flow metering and 346m^3/day total disposal from site.

As a result of this work, the following conclusions can be drawn:

- Water balance models have a reasonable agreement with well head and final discharge flow monitoring both in terms of historic and current conditions at the Whinney Hill site, therefore the volumes predicted by the water balance calculations for likely future leachate generation are likely to be reliable;
- Capping works that have taken place are having an effect at reducing leachate generation at the site, particularly removing the peaks of the 'flashy' leachate generation periods; and
- During 2020 leachate production rates will be likely to decline to rates in the region of the high 200's m^3/day to the low 300's m^3/day and are likely to remain at this rate whilst active waste placement continues at the site, depending on the success of the capping works on excluding as much surface water as possible from the site and the rate of rainfall (noting that average rainfall for Accrington was calculated at 1,221mm/yr but that the maximum was as high as 1,530mm/yr and that further increases in annual rainfall can be expected as a result of predicted climate change).

Further confirmation that sufficient leachate is being removed form the landfill to prevent an excess building up within the waste mass is derived from a review of leachate heads reported from the site over the period 07/01/2018 – 25/05/2020. This data is summarised below and is presented graphically in Appendix 04.

Table 2-4: Average Leachate Head per Cell January 2018 to May 2020

Cell	Minimum Head (m)	Average Head (m)	Maximum Head (m)
Phase 1 Cell 1 Average	0.24	0.59	1.29
Phase 1 Cell 2 Average	0.30	0.61	1.07
Phase 1 Cell 3 Average	0.16	0.63	1.31

Cell	Minimum Head (m)	Average Head (m)	Maximum Head (m)
Phase 2 Cell 4 Average	0.13	0.81	1.62
Phase 2 Cell 5 Average	0.18	0.61	1.04
Phase 2 Cell 6 Average	0.27	1.96	2.75
Phase 2 Cell 7 Average	0.21	0.57	1.03
Phase 2 Cell 8 Average	0.28	0.63	0.98

This data indicates that leachate levels at the site are routinely kept below the compliance level of a 3m head above base and the graphs presented in Appendix 04 indicate that there is now a general increasing trend in leachate heads across the site. It is therefore concluded that leachate removal from site is approximately equivalent to leachate production over the period assessed.

Rainfall and surface water ingress to the site will have affected the volume of leachate produced and this increase in water input will have reduced the instantaneous concentration of pollutants in the leachate. However, with reference to the limits expressed in the UU Trade Effluent Consent for the site (see Appendix 01) what is critical is the load of ammonia present in the leachate. It is also the loading of ammonia that is critical in the sizing of any LTP to be designed to serve the site. The load of contaminant in the leachate produced by the site is largely unaffected by the volume, therefore data for historic daily ammonia load discharged from the site is relevant in assessing the leachate treatment and disposal capacity required and this information is presented in Appendix 05. In summary this indicates that:

- To date in 2020 average ammonia load discharge is 291kg/day with a maximum load of 667kg/day having been reported; and
- Over the period 06/05/2019 to 01/09/2020 the average load of ammonia discharged in 310kg/day with a maximum of 924kg/day having been reported.

It should however be noted that production of ammonia does not peak until recently placed wastes have had time to undergo the earlier aerobic stages of degradation. It is likely that leachates being produced in Phase 2 Cell 6 of the site have not yet reached the point where significant methanogenic decay has begun, therefore it can be anticipated that daily ammonia loads averaging around 300 – 350kg/day may be expected as wastes mature in Cell 6, with the potential for maximum daily loads to again exceed 900kg/day as short term ‘spikes’ whilst waste placement continues at the site.

3.0 Leachate Management Systems and Infrastructure

This section provides a summary of the core elements of leachate management infrastructure at the Whinney Hill Landfill based on the information retained at the site to August 2020.

3.1 Leachate Management System

As infilling of the landfill progressed, the leachate management system was developed to facilitate the collection, extraction, treatment and disposal of leachate to ensure that there has been no unacceptable impact on the surrounding environment. This has been achieved through the construction of an engineered lining system around the Phase 2 waste mass, which physically impedes leachate formation and migration, and the installation of a leachate collection and extraction system above the base of both the Phase 1 and Phase 2 sites as detailed below.

The current layout of the leachate extraction wells and monitoring wells within the site is presented as Drawing 01 and the schedule of in waste leachate infrastructure presented as Appendix 06.

3.2 Leachate Infrastructure

Key leachate infrastructure in place Whinney Hill Landfill includes:

- For Phase 1:
  - Cell 1 monitoring wells: LW08/03, LW08/04 and LW08/05;
  - Cell 1 pumped wells[3]: LW08/03 (P), LW08/04 (P) and LW08/05 (P);
  - Cell 2 monitoring wells: L3/1; L3/2; L3/3; L3/4;
  - Cell 2 pumped wells[3]: PC8 (E) and PC2 (P);
  - Cell 3 monitoring wells: LW08/01B; LW08/02;
  - Cell 3 pumped wells[3]: LW08/01B (E); LW08/02 (P) and PC3 (E);
  - Pumped gas wells[3]: 8 gas wells (8 x P)
- For Phase 2:
  - Cell 4 monitoring wells: LM4/3R; LM4/4R; LMP4;
  - Cell 4 pumped wells[3]: LM4/3R (P); LM4/4R (P); LMP4 (E);
  - Cell 5 monitoring wells: LMP5A; LMP5B; LM5/1; LM5/2; LM5/3; LM5/4;
  - Cell 5 pumped wells[3]: LMP5A (2 x E); LMP5B (2 x E);
  - Cell 6 monitoring wells: LM6/1; LM6/2;
  - Cell 6 pumped wells[3]: LMP6A (E);
  - Cell 7 monitoring wells: LMP7A; LMP7B; LMP7C; LM7/1; LM7/2; LM7/3; LM7/4; LM7/5; LM7/6;
  - Cell 7 pumped wells[3]: LMP7A (E); LMP7B (E) and LMP7C (E);
  - Cell 8 monitoring wells: LMP8A; LMP8B; LM8/1; LM8/2; LM8/3; LM8/4;
  - Cell 8 pumped wells[3]: LMP8A (E); LMP8B (E) and LMP8C (2 x E).

[3] P = pneumatic pump; E = electric submersible pump

In Phase 1 all wells are essentially retro-drilled with the exception of PC3 and PC3 in Cell 3, this is because Cells 1 and 2 were not designed to accommodate active leachate abstraction but were instead designed to operate as naturally contained / dilute and disperse cells. Cell 3 did have a basal drainage system installed, however PC3 has subsequently failed and been replaced by the nearby retro-drill LW08/01B. The pump installed into PC3 is still functioning and pumping leachate, although it cannot be retrieved for repair and the well cannot be dipped for leachate level.

In Phase 2 of the site all wells extend to the base of the cell with the exception of LM5/3 in Cell 5 (which is blocked at a depth of 13m from surface) and LM4/3R and LM4/4R, both located in Cell 4 and both of which are retro-drilled replacement wells.

Wells LM7/5 and LM7/6 in Cell 7 are side slope risers.

Wells fitted with leachate pumps have pumps set to within 0.3m of the well base, with the exception of wells with two pumps installed where the second pump is installed at a slightly higher elevation that the first pump above base.

A network of 63mm and 90mm lateral HDPE lines connecting each well head to the site's leachate storage lagoon, from where it is transferred to a tank known as the 'doughnut tank'. Whilst in the leachate lagoon and tank leachate is aerated to provide mixing and methane stripping. As leachate is pumped into the doughnut tank, it fills and is allowed to weir over to a chamber set within the tank, from here leachate gravity feeds to the 'V-notch weir' chamber for MCERTs certified flow metering prior to gravity discharge to the public sewer.

The leachate lagoon is an irregular triangle shaped HDPE lined lagoon that holds approximately 1,700m^3 of leachate.

The tank holds 100m^3 of leachate and is partially buried below ground.

3.2.1 Basal Liner and Drainage Blanket

Phase 1 Cells 1 and 2 were engineered as naturally contained / dilute and disperse cells. Cell 1 has no engineered basal lining or leachate collection system; Cell 2 has been anecdotally reported as having a basal drainage system that directs leachate to PC2. Phase 1 Cell 3, whilst also technically designed to rely on natural containment was installed with side wall engineering and a basal drainage blanket that also reportedly incorporated lateral drainage pipework reflecting the change in regulatory standards after the development of Cells 1 and 2.

Phase 2 of the site (cells 4 to 8) has been designed, constructed and operated as a fully contained landfill.

Each cell has been constructed with a composite basal lining system consisting of a welded HDPE low permeability membrane overlying a layer of re-engineered clay. The PPC bund forms the southern sidewalls of cells 4 and 5 and is only partially constructed with a fully lined composite system. The lower section linked to the cell bases has a fully lined system and the mid and upper section relies solely on the vertical mineral liner for containment. Cells have been constructed with sub-cells to restrict leachate generation as follows:

- Cell 4 – divided into sub-cells 4/1 and 4/2 (Considered one cell from a leachate perspective as leachate from both cells is directed to one single extraction chamber at the northwest corner of cell 4/1 and monitored by 2 wells LM4/3R and LM 4/4R);
- Cell 5 – divided into sub-cells 5/1 and 5/2;
- Cell 6 – divided into sub-cells 6/1 and 6/2;
- Cell 7 – divided into sub-cells 7/1, 7/2 and 7/3; and
- Cell 8 – divided into sub-cells 8/1 and 8/2.

Each cell is separated from those adjacent to it by intercell bunds and all external sidewalls have also been installed with low permeability lining systems. The interface between Phase 1 and Phase 2 has been provided with a separation bund with a low permeability vertical mineral liner constructed at the core.

A leachate drainage system has been installed across the base of each cell in Phase 2. Basal drainage comprises a variable thickness layer of granular drainage stone incorporating collection pipework that lead to extraction chambers where liquid is removed.

3.2.2 Leachate Extraction and Monitoring Wells

Leachate extraction wells at the site comprise an established network of 'constructed' and 'retro drilled' leachate wells.

Within the Phase 1 area, there three types of leachate well across the phase:

- Wells used for extraction and compliance assessment (5 in total);
- Wells used for leachate "extraction only" purposes (9 in total, 1 leachate and 8 gas wells); and
- Wells used for compliance assessment only (6 in total).

Within the Phase 2 area, there are three types of leachate well across the phase:

- Wells used for extraction and compliance assessment (8 in total).
- Wells used for leachate "extraction only" purposes (2 in total); and
- Wells used for compliance assessment only (16 in total).

Leachate removal from the network of wells has continued to be highly effective, with the site yielding on average around 345m^3/day over the past 18 months (see Section 2.2). This means that, with 27 pumps installed at the site, each pump yields around 12.8m^3/day. However, of the 27 pumps, 13 are pneumatic (see Section 3.2) and a pneumatic pump is unlikely to yield much more than 1m^3/day from a deep waste landfill. Therefore, it is more likely that each of the 13 pneumatic pumps is yielding 1m^3/day and each of the electrical pumps is yielding on average 23.7m^3/day. These assumed pump rates are within the technical capabilities of pneumatic and electrical pump systems typically employed at landfill sites in the UK.

In addition, observations on the volumes of leachate yielded by each extraction well across the site, leachate heads at individual well locations total volumes of leachate discharged for disposal and theoretical calculations on new leachate generation (with suitable allowances made for additional surface water ingress) have confirmed that the pumps installed at the site are more than capable of removing the required volume of leachate to maintain leachate levels across the base of the landfill in compliance with the currently approved 3m head. There is also considerable over-capacity in the pumping system as demonstrated by the ability of the site to remove volumes of around 1,000m^3/day of leachate when required.

Leachate levels from both pumped and un-pumped wells also indicates that levels are consistent across the base of the landfill and so it is concluded that no additional further drilling of extraction or monitoring wells is required at the site and that the field pumping system is adequate to remove the required volumes of leachate.

3.2.3 Leachate Pumps

In conjunction with the leachate collection system (basal drainage layer, leachate extraction and monitoring wells), a network of leachate pumps is installed across the site to provide a reliable, low maintenance method of removing leachate from the waste mass.

Leachate is extracted by dedicated borehole pumps across the landfill site. The primary pump installed at the site is an electrical submersible positive displacement pump (currently typically 'ZDS 5-17' model is most commonly in place), these are controlled by level sensors installed within the well alongside the pump to activate the pump when leachate is present and to turn the pump off when a low level shut-off level is achieved (low level shut-off ensures that the pump motor remains submerged in leachate at all times so that pump motors do no overheat). Each pump is also supplied with electrical power via a network of power distribution cables and local control panels. The electrical pumps are supplemented by a number of self-controlling pneumatic pump

unit that only activates when leachate is available in the well / sump. Each of these pneumatic pumps is supplied by compressed air from an air compressor and dryer unit.

SUEZ will continue to ensure that the height of the pump in each extraction well is set to ensure leachate levels are controlled to reflect the action and compliance limits set in the site's licence and 2020 HRA (pending agreement with the EA).

While the rate of leachate production will continue to fluctuate through the seasons, albeit that the magnitude of fluctuation is likely to decrease as capping proceeds and resolves many of the surface water ingress issues previously experienced at the site, the capacity of the extraction system across the site is capable of extracting significantly more leachate than the site is predicted to generate by a considerable margin. Once waste placement ceases and the whole site is capped and in established aftercare, the peak rate of leachate production of the site has been estimated as being less than approximately 100m^3/day. Accordingly, SUEZ is confident that there is sufficient extraction capacity through the network of pumps to remove all leachate arising at the site through the remaining operational period and into extended aftercare.

3.2.4 Leachate Lines

Leachate extracted by the pumps is pumped to the site's leachate storage lagoon before transfer to the storage tank prior to discharge from site to sewer, as detailed in Section 6.1 through a main and spur system of pipework. The main system is formed using 63 - 120mm diameter MDPE pipework or similar. Spur connections have been constructed using 32 - 63mm diameter MDPE pipework or similar. A compressed air supply pipeline network also exists to each of the pneumatically pumped wells, again consisting of MDPE pipework mains and spurs to well heads. Appropriate isolation valves, and non-return valves are installed to protect against leachate backflow to the landfill through a malfunctioning pump or connection. Sampling taps are present to allow collection of samples.

Wherever possible, all permanent leachate lines and air supply lines have been buried on final restoration of the site to a minimum of 500mm below ground level and surveyed to provide an electronic record of their position on site. This is to protect against damage by site operations and to give protection against winter weather conditions.

3.2.5 Leachate Recirculation Systems

Whinney Hill Landfill site has not been designed with temporary or permanent sub-cap leachate recirculation systems.

Recirculation of leachate back into the capped waste mass is not currently part of the management techniques / strategy at the site but could be introduced in the future via the installation of dedicated pin wells (or other approved management techniques) into the upper layers of the waste mass.

The potential change of risk arising from the introduction of leachate recirculation will be detailed and justified in any subsequent HRA review for EA approval before any future proposal for re-circulation of leachate is included in the site's leachate management strategy.

3.2.6 Leachate Storage Systems

Leachate and 'grey water' generated at the site is currently pumped to a large, HDPE lined storage lagoon in the sites north western corner. This lagoon can hold up to 1,700m^3 of leachate and also provide aeration and mixing prior to pumped transfer of leachate to a smaller, 100m^3 coated steel panel tank set in the waste at the north western end of the Phase 1 landfill. Leachate is also aerated in this tank prior to final discharge to the public sewer via a v-notch flow metering chamber.

Leachate can also be removed from the storage lagoon to road tanker via a dedicated tanker loading point.

The asset maintenance and management plan detailed in Section 4.0 applies to all leachate infrastructure within the Whinney Hill Landfill. Further extension of this management plan will occur following the installation and commissioning of the proposed Leachate Treatment Plant (detailed in Section 6.2) to provide a single point of reference to all leachate infrastructure across the site.

3.2.7 In Waste Leachate Storage

An assessment, contained within Appendix 07, provides a calculation of the potential free leachate storage volumes held below the current compliance limits of 3m head above base and the complaints limits that will be justified in the soon to be submitted 2021 HRA review as detailed in Table 2-1 and Table 2-2.

The following methodology has been employed to calculate the potential free leachate storage volume below current and proposed compliance levels across the site:

1. Calculate the current compliance level and proposed compliance level per cell in mAOD;
2. Plot the current and proposed leachate layers per cell in a 3D CAD model of the site basal, sidewall and cap topography;
3. Using the 'Geotech Module' embedded within 'Civil 3D'[4], compliance level information is collated and interpreted to produce coherent 3D volumes of the site bound by surfaces defined from the site base, assumed top of drainage stone, current compliance level and proposed compliance level;
4. Lateral extents of layers are terminated by;
    i. physical features such as the sites side walls or intercell bunds (where layers intersect such features);
    ii. theoretical vertical barriers along the centre line of inter-cell bund crests;
5. Each identified volume (A = drainage blanket, B = between top of drainage blanket and current compliance level and C = from top of current compliance level to proposed compliance level) is then provided with a volume calculated by the 'Civil 3D'[4] software;
6. The average depth below current landfill surface is calculated for each identified volume by determining the depth below ground level for the upper surface of each of the current and proposed compliance levels (average of 3 point depths per cell for each level);
7. Calculate the free leachate volume held in each leachate layer by multiplying the total waste volume for each layer by its theoretical waste porosity, this being determined by referencing the average depth from surface (from step 6. above) to the relevant theoretical waste porosity at various depth as detailed in Appendix 07 notes that a minimum waste porosity of 2% will be assigned; and
8. For the basal leachate blanket volume assume that a porosity of 10% is maintained.

The output of this modelling is summarised below;

[4] Autodesk® Civil 3D® 2019.

Table 3-1: Summary of In-Waste Leachate Storage Volumes in m^3 of Free Leachate

16	A Leachate Volume in Drainage Blanket	B Additional Leachate Volume that can be held below current compliance level	C Additional Leachate Volume that can be held below proposed compliance level
Phase 1 Cell 1	No drainage blanket	161	No change to compliance
Phase 1 Cell 2	No drainage blanket	161	No change to compliance
Phase 1 Cell 3	863	668	No change to compliance
Phase 2 Cell 4	1,195	5,003	657
Phase 2 Cell 5	787	1,572	144
Phase 2 Cell 6	318	3,865	No change to compliance
Phase 2 Cell 7	464	1,049	424
Phase 2 Cell 8	401	881	1,000
Site Total	4,028	13,360	2,225

These calculations indicate that currently the site is able to store at total volume of 17,388m^3 of leachate in its base, below current compliance levels.

As justified by the 2021 HRA, this volume will increase by a further 2,225m^3 to a total of 19,613m^3 below the proposed compliance levels.

This additional leachate storage volume that is potentially available in the waste mass can be used to temporarily buffer any periodic excessive leachate generation volumes once, particularly, the on-site LTP is constructed.

4.0 Maintenance Programme

4.1 Asset Maintenance

With the site still in its operational phase, the leachate extraction, storage and discharge systems will continue to be inspected on a regular basis by the site staff in accordance with the agreed schedules set by the Site Manager, currently a minimum of weekly inspections are undertaken.

Maintenance schedules for the leachate systems at the site have been developed and are now being included within the national asset management programme supported by the Mainsaver Application across SUEZ' UK portfolio of waste management facilities.

Repairs or replacements are undertaken as necessary to maintain compliance with permitted leachate levels.

The inspections and any actions taken will be recorded on the Site Log held at the Whinney Hill Landfill Offices.

Any notification by any telemetry alarm systems are be dealt with by site staff within agreed reaction/response timescales set by the Site Manager.

A schedule of the key maintenance events is detailed in Appendix 10 with a key focus being not only the day to day operation of the site's leachate extraction systems but also the preventative maintenance of the site's leachate wells.

During planned maintenance events on leachate extraction wells, SUEZ will endeavour – where appropriate – to obtain key data for assessment of the long term performance of the site such as: dip to base of well data, rest leachate level data and confirmation of the elevation of the pump depth within the well.

Any faults identified during the regular inspections of the leachate collection system will be investigated and repair or replacement of parts undertaken within designated timescales set by SUEZ as per their IMS and COMPAS management systems procedures. Where repair cannot be carried out within the designated time for an element of the system that is critical for the prevention of pollution at the site associated with leachate, a remediation timescale for the element/component will be submitted to the Environment Agency.

5.0 Monitoring Programme

Leachate levels, quality and pumping information is collected as the site to both comply with the requirements of the sites Permits and also to inform management decisions in relation to leachate control at the site.

In continuing with the established monitoring of the site's leachate systems at Whinney Hill Landfill, SUEZ will continue to undertake the following qualitative and quantitative monitoring as follows:

5.1 Qualitative Monitoring

In planning ahead for short-term leachate management issues, the site's management team under the direction of the Operations Manager will undertake the following tasks;

1. Review of meteorological forecasts to identify possible periods of future heavy rainfall at the site;
2. Complete and document a check of the levels in the leachate storage tank at the site's environmental compound (including remote view of tank levels); and
3. Complete and document a check on the condition of key element of the surface water run-off systems at the site.

5.2 Quantitative Monitoring

Quantitative monitoring of leachate levels, volumes and quality stored at or removed from the site will continue in accordance with:

- the schedules for testing set in the site's Environmental Permit; and
- internal schedules for monitoring retained by SUEZ to ensure good operation of the process of leachate management at the site.

The schedule for monitoring of the site's leachate systems is included at Appendix 08.

Hard copy records of site inspection logs, desilting and maintenance logs are retained by the site's management team at the Landfill site offices along with the daily rainfall data from the site's meteorological station.

The minimum requirements for periodic spot level and quality monitoring at the site will be supplemented – where appropriate – by SUEZ to retain volumes of leachate extracted at the site and the rate of response of pumping systems to seasonal climatic conditions.

Each leachate compliance limit at the site will have an associated, lower action limit. The purpose of the action limit is to provide the site management team with early warning of the need for action, in order to prevent exceedance of the control limit.

The current permitted compliance limit for leachate storage in the base of the waste mass is set at 3.0m supported by an action level of 2.5m.

As to be set out in the 2020 HRA, it is proposed to revise the compliance limits across the base of the site to be to elevations as detailed in Table 2-1 and Table 2-2 supported by an action level of set at 0.5m below the agreed compliance level in each of the leachate wells used for compliance assessment.

Internal assessment limits are set by SUEZ to provide information on unexpected changes in in waste leachate quality from sample data obtained at the site.

Contingency actions associated with the exceedance of a leachate action and compliance limits are presented in Appendix 09.

5.3 Monitoring Techniques and Quality Assurance

Manual leachate level and quality measurements are obtained by SUEZ in accordance with the company's monitoring procedures "S01: Procedure to Sample Raw Waters and Leachate" and "L01 Procedure to Measure Groundwater and Leachate levels", which draw on established company and industry best practice for the monitoring of landfill sites. Details of whether the well is a pumped well or non-pumped well will be recorded by SUEZ in the monitoring data set.

Having due regard to the siltation risk of leachate wells / infrastructure at the site, a dip to base of each leachate well will be obtained on every monitoring visit for leachate level compliance assessment made by SUEZ.

Where possible, all leachate samples from wells will be obtained as a pumped sample as opposed to spot bailed sample.

Compliance analysis is obtained via spot samples sent to an accredited third-party laboratory with results automatically returned, imported, stored and assessed against permit compliance limits.

5.4 Site Compliance

Through the continued active extraction of leachate and its disposal by discharge to sewer and occasional off-site tankering, leachate levels within the site have remained compliant during the period of data reviewed in this report of January 2018 to May 2020. This has been achieved through the extraction and disposal of approximately 345m^3/day of leachate with this rate increasing to a peak removal rate of 1,139m^3 in October 2019 following a very wet period for the UK (when 10 year average rainfall amounts were exceeded by between 30% – 60% during August, September and October).

As detailed above, the proposed Action and Compliance levels to be adopted at the site for leachate level management are:

Table 5-1: Compliance and Action Levels

Cell	Well	Current Compliance (mAOD)	Current Action (mAOD)	Proposed Compliance (mAOD)	Proposed Action (mAOD)
Phase 1 Cell 1	08/03	148.00	147.50	148.00	147.50
	08/04	148.00	147.50	148.00	147.50
	08/05	148.00	147.50	148.00	147.50
Phase 1 Cell 2	L3/1	148.00	147.50	148.00	147.50
	L3/2	148.00	147.50	148.00	147.50
	L3/3	148.00	147.50	148.00	147.50
	L3/4	148.00	147.50	148.00	147.50
Phase 1 Cell 3	LW08/01B	146.00	145.50	146.00	145.50
	LW08/02	146.00	145.50	146.00	145.50
Phase 2 Cell 4/1	LM4/3R	142.00	141.50	142.00	141.50
Phase 2 Cell 4/2	LM4/4R	147.00	146.50	147.00	146.50
Phase 2 Cell 5/1	LM5/1	147.00	146.50	147.50	147.00
	LM5/2	147.00	146.50	147.50	147.00

Cell	Well	Current Compliance (mAOD)	Current Action (mAOD)	Proposed Compliance (mAOD)	Proposed Action (mAOD)
Phase 2 Cell 5/2	LM5/3	145.00	144.50	145.00	144.50
	LM5/4	145.00	144.50	145.00	144.50
Phase 2 Cell 6/1*	LMP6A	143.60	143.10	143.60	143.10
	LM6/1	144.88	144.38	144.88	144.38
Phase 2 Cell 7/1	LM7/1	140.05	139.55	141.00	140.50
	LM7/2	140.34	139.84	141.00	140.50
Phase 2 Cell 7/2	LM7/3	140.76	140.26	141.00	140.50
	LM7/4	140.87	140.37	141.00	140.50
Phase 2 Cell 7/3	LM7/5	141.34	140.84	143.00	142.50
	LM7/6	141.85	141.35	143.00	142.50
Phase 2 Cell 8/1	LM8/1	138.40	137.90	143.00	142.50
	LM8/2	138.87	138.37	143.00	142.50
Phase 2 Cell 8/2	LM8/3	137.02	136.52	137.00	136.50
	LM8/4	137.47	136.97	137.00	136.50

*: Leachate compliance elevation to be revised on construction of Cell 6/2.

All leachate levels will be obtained without turning off pumps, but SUEZ will undertake an annual 'rested' (pumps off for 24 hours prior to monitoring) monitoring level recorded in the original leachate wells installed into the site's basal drainage blankets.

5.5 Internal and External Reporting

SUEZ continues to capture all key data required for site compliance within the company's Monitor Pro database, with data forwarded on to the Environment Agency at quarterly intervals.

The Monitor Pro database continues to be the single point of reference for assessing compliance with respect to leachate level calculation and then reporting within SUEZ.

A Quarterly Report is produced by SUEZ for the Operations Management Team detailing the following:

- Leachate levels in the base of the site (as an elevation, mAOD) against the agreed compliance limits;
- The volume of leachate removed in comparison to the site's conceptual model for leachate production;
- Pumping well performance; and
- Any other points of technical performance of the leachate systems.

Time series graphs of level and quality data were included with the reports to enable the identification of longer-term trends (positively / negatively) if occurring.

5.6 Update of Key Survey Data

In recognising the need for accurate data sets for assessing leachate level compliance, SUEZ will continue to obtain topographic survey updates for key leachate wells used for compliance assessment at annual intervals until 5 years into the site's legal aftercare period from the point of Definitive Closure. After this time the

frequency of update of the topographic survey will be reassessed against the rate of long-term settlement of the waste mass.

In the event of changes to leachate well levels (as a result of extension or lowering of a leachate well), SUEZ will measure and record the change in the height of well at the time of the works, and update the cover level stored in Monitor Pro.

5.7 Groundwater Monitoring and Surface Water Monitoring

As a further check on the efficiency of the leachate management system and any environmental impact, perimeter groundwater and surface water monitoring will be undertaken as set out in the site's Monitoring Management Plan.

6.0 Leachate Treatment and Disposal

Leachate is removed from the Whinney Hill Landfill site mainly via a consented discharge to the public sewer, this being occasionally supplemented by tankering in recent years to attempt to remain below the daily ammonia loading incorporated into the recently amended conditions of the discharge consent.

As a result of the amendments to the discharge consent, SUEZ intend to install an on-site leachate treatment plant (LTP) to treat leachate to a sufficiently high standard to allow it to be discharged to the public sewer without the need for routine tankering.

6.1 Current Management Techniques

Leachate will be continued to be removed from the site via discharge to public sewer after methane stripping by aeration and, when required by United Utilities, by tankering to a third-party licensed treatment facility.

The volumes and quality of leachate removed from the site are recorded by SUEZ.

6.2 Future Management Techniques

During 2019 SUEZ undertook a tendering exercise for the supply of an on-site LTP. The LTP will be constructed within a landscaped screening bund that will be constructed in a field owned by SUEZ, across the Whinney Hill Road opposite the current site entrance.

Once the proposed LTP design has been finalised, SUEZ will prepare and submit a separate permit variation to incorporate the LTP in the sites permit.

The proposed treatment process will be biological oxidation of ammonia, BOD and COD using the well understood activated sludge treatment process. The plant will operate as a sequencing batch reactor and will employ aerobic treatment (principally to convert ammoniacal nitrogen to nitrate and to convert BOD and COD to CO_2 and water) and anaerobic treatment (principally to convert nitrate to nitrogen and also to help with the removal of BOD and COD) as part of the process. The plant will consist of a raw leachate balancing tank, two SBR treatment tanks and an effluent balance tank all housed within a fully engineered bund complying with current BAT standards. The plant will include the following basic elements:

- transfer of leachate from the existing site leachate storage tank, via a pipeline installed for the purpose, to the leachate treatment plant inlet with suitable pumps, pipework and automated valve arrangement for filling of the raw leachate tank, complete with flow metering and SCADA controls;
- access roadways from the Whinney Hill Road existing access, suitable for tankering of raw leachate from the plant if required and provision of process chemicals and maintenance equipment to the plant;
- raw leachate balancing storage tank with facility to deliver and remove leachate by road tanker and via pumped systems, complete with flow monitoring system integrated to process control and monitoring systems;
- treatment of the leachate by activated sludge SBR process to a standard suitable for discharge to the public sewer complete with suitable discharge flow monitoring and control integrated to process control and monitoring systems;
- installation of control and monitoring equipment to the LTP;
- treated leachate balancing tank with outlets to a pumped discharge to sewer, to road tankering connection point complete with suitable discharge flow monitoring and control integrated to process control and monitoring systems;

- sludge storage tank with outlet to road tankering connection point complete with suitable discharge flow monitoring and control integrated to process control and monitoring systems
- final effluent pumped discharge system and pipeline to the public sewer discharge connection point, complete with suitable sampling, flow metering and control integrated to process control and monitoring systems;
- systems for removal of sludge from the SBR tanks to the sludge storage tank complete with suitable sampling, flow metering and control integrated to process control and monitoring systems;
- storage and dosing of chemicals complete with suitable control integrated to process control and monitoring systems;
- on-site laboratory and toilet facility;
- protection of controlled waters through secondary containment of leachate treatment area;
- suitable surface water drainage system to prevent build up and run-on of surface water to the LTP compound, drained to the nominated surface water discharge connection point;
- suitable and required security and health and safety arrangements, including CCTV;
- electrical power distribution within the LTP from an HV connection in the Gas Utilisation Plant compound to include a 'plug-and-play' connection point for a suitable temporary diesel-powered generator;
- electrical power distribution from a transformer at the southwest corner of Phase 1 of the landfill to power the raw leachate feed pumps and two existing cell pumps at the EDB cage in the northwest corner of Phase 1;
- mains water supply;
- telephony systems;
- instrumentation, control and automation; and
- external lighting.

The LTP will be designed to treat up to 300m^3/day of leachate derived from the Whinney Hill Landfill and will be capable of treating ammonia loads of 750kg/day, both of these design parameters being sufficient to deal with the average anticipated yield from the landfill site.

As a result of the works to construct the LTP, field systems will also be altered so that the current storage lagoon can be removed to make way for engineering works associated with the construction of the final landfill Cell (6B0. Field pumping system will instead pump direct to the existing 1200m^3 storage tank at the northwest end of Phase 1, which will be retained. From this tank leachate will be pumped in a controlled manner to the LTP for storage in the LTP raw leachate balance tank prior to treatment. As such the control systems installed will prevent field pumps from filling the site leachate tank in the event that the LTP is at capacity, this preventing overtopping of the storage tank and the LTP tanks. Details of the proposed new layout of the leachate management systems after the LTP has been completed are presented in Drawing 02.

It is anticipated that the maintenance and monitoring sections of this Management Plan will be updated by SUEZ following the commissioning of the Leachate Treatment Plant to ensure SUEZ has one single document to manage and maintain all elements of the leachate infrastructure across Whinney Hill Landfill site.

APPENDIX 01

Trade Effluent Consent

Document:Direction
WwTW:HYNDBURN
DPID:716T4-4-62

WATER INDUSTRY ACT 1991

NOTICE OF DIRECTION CONCERNING THE DISCHARGE OF TRADE EFFLUENT

To **Suez Recycling and Recovery Lancashire Limited**

of **Sita UK Limited**
Sita House
Grenfell Road
Maidenhead, Berkshire
SL6 1ES

United Utilities Water Limited (hereinafter called "the Company") hereby give you Notice as **owner** of the trade premises situate at **Whinney Hill Road, Altham, Accrington, Lancashire, BB5 5EN** that the Company in exercise of the powers conferred upon them by Section 124 of the above Act DIRECT that as from **1 March 2019** all conditions attaching the CONSENT dated the **4 July 1995** to the discharge of trade effluent into the public sewer from the said trade premises as requested by a Trade Effluent Notice **16 March 1995** dated the shall be varied and the following conditions be substituted, namely:

Nature of discharge

1a) Subject to the provisions of conditions 6,7,8 and 9 below the nature or composition of the trade effluent to be discharged under this Notice of Direction shall be solely as specified in the said application form and shall consist solely of waste water derived from **landfill leachate.**

1b) The trader shall give to the Company prior written notice of any change in the process or the process materials or any other circumstances likely to alter the constituents of the trade effluent as set out in condition 1(a). In such circumstances, no substance of which the Company has not had previous notice, may be discharged unless and until the Company has agreed to accept the substance at a limit imposed by the Company which shall then be deemed to be incorporated in this Notice of Direction by agreement and shall not prejudice the right of the Company to serve a Direction earlier than two years from the date of such incorporation.

The Trader shall also give not less than seven days written notice to the Company of any change in the name of the occupier or owner.

Sewer affected

2. The sewer into which the trade effluent may be discharged and the point of discharge is the foul sewer situate at **private sewer on Whinney Hill Road leading to public sewer on Church Lane.**

Connections

3. No connections shall be made to the said sewer without the prior approval of the Company and all such connections shall be constructed and maintained to the satisfaction of the Company at the expense of the Trader.

Maximum volume of discharge

4. The maximum amount of the trade effluent discharged in any one day of twenty four hours shall not exceed **1,500** m^3 without prior written consent of the Company.

United Utilities Water Limited
Registered in England & Wales No. 2366678
Registered Office: Haweswater House,
Lingley Mere Business Park, Lingley Green Avenue,
Great Sankey, Warrington, WA5 3LP

Maximum rate of discharge

5. The highest rate at which the trade effluent may be discharged shall not exceed **18** litre/sec.

Matters to be eliminated prior to discharge to sewers

6. The following matters shall be eliminated from the trade effluent before it is discharged into the sewers of the Company:

a) petroleum spirit;

b) calcium carbide;

c) carbon disulphide;

d) except as provided in paragraph 7 hereof, the prescribed substances listed in Schedule 1 to The Trade Effluents (Prescribed Processes and Substances) Regulations 1989, as amended from time to time, insofar as they are in concentration greater than the background concentration (as defined in the said Regulations);

e) where the trade effluent derives from a prescribed process mentioned in Schedule 2 to the said Regulations, and except as provided in paragraph 7 hereof, asbestos (as defined in the said Regulations) and chloroform in concentration greater than the background concentration (as defined in the said Regulations);

f) organo-halogen compounds including pesticide residues and degreasing agents;

g) any substances which either alone or in combination with each other or with any other matter lawfully present in the said sewers would be likely to;

i) cause a nuisance or produce flammable, harmful or toxic vapours either in the sewers or at the sewage works of the Company;

ii) injure the sewers or interfere with the free flow of their contents or affect prejudicially the treatment and disposal of their contents or have injurious effects on the sewage treatment works to which it is conveyed or upon any treatment plant there;

iii) be dangerous to or cause injury to any person working in the sewers or at the sewage treatment works;

iv) affect prejudicially any watercourse, estuary or coastal water into which the treated effluent will eventually be discharged.

Matters to be limited prior to discharge to

7. The trade effluent shall not contain

a) Ammonia and its compounds as N load in excess of **375** kg/d in any one period of 24 hours, such load being determined by multiplying the Ammonia concentration of the supernatant liquor of a composite sample of the trade effluent taken during that 24 hour period and the volume of the trade effluent discharge during that 24 hour period.

b) Ammonia and its compounds as N in excess of **250** mg/l

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c) Cyanides and cyanogen compounds which produce hydrogen cyanide on acidification in excess of **1** mg/l

d) Methane in solution in excess of **0.14** mg/l

e) Separable grease and oil in excess of **50**mg/l

f) Settled chemical oxygen demand in excess of **10,000** mg/l

g) Sulphates as SO_4 in excess of **1,000** mg/l

h) Sulphides, hydrosulphides, polysulphides and substances producing hydrogen sulphide on acidification in excess of **1** mg/l

i) Toxic metals in excess of **10,000** ug/l either individually or in total ie Antimony, Beryllium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Tin, Vanadium, Zinc;

j) Total Phosphorus as P in excess of **50** mg/l

Temperature

8. No trade effluent shall be discharged which has a temperature higher than 43.3°C (110°F).

pH value

9. No trade effluent shall be discharged having a pH of less than **6** or greater than **10**

Inspection Chamber

10. a) An inspection chamber or manhole shall be provided and maintained by the Trader in a suitable position in connection with each pipe through which the trade effluent is discharged and shall be so constructed and maintained as to enable a person readily to obtain at any time samples of the trade effluent so discharged, to the approval of the Company.

b) There shall be provided, operated and maintained in working order by the Trader a meter in such a position and of such specification as shall be approved by UUWLtd such as will measure and provide a continuous record of the quantity and rate of discharge of any trade effluent being discharged from the premises into the said sewer and following the written request of UUWLtd to have the accuracy of the meter independently tested by an agreed body, and such apparatus or other facilities in such position and of such specification as shall be approved by UUWLtd as will: (i) provide for a continuous flow proportional sample as will enable the nature and composition or constituents as set out in these conditions of any trade effluent being discharged from the premises into the said sewer to be ascertained; (ii) provide for a continuous record of the pH of the trade effluent discharged from the premises into the said sewer. Suitable apparatus for measuring and automatically recording the quantity and rate of trade effluent discharged shall be provided and maintained in working order by the Trader in connection with every such pipe unless otherwise exempted in writing by the Company and such apparatus or other facilities in such position and of such specification as shall be approved by UUWLtd as will provide for a continuous flow proportional sample as will enable the nature and composition of constituents as set out in these conditions of any trade effluent being discharged from the premises into the said sewer to be ascertained.

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c) If the measuring and recording apparatus as aforesaid ceases to function satisfactorily, then the Company shall have the right to make estimates of the volume and composition of the trade effluent until such time as the said apparatus is again operating to the satisfaction of the Company.

d) Records shall be kept by the Trader of the volume, rate of discharge, nature and composition of the trade effluent discharged to the sewer, together with any records required to be kept by the Trader under the provisions of any Notice of Determination issued by the Secretary of State under Sections 120 and 132 of the Water Industry Act 1991. Such records shall be kept available for inspection at all reasonable times by an authorised officer of the Company and copies shall be sent to the Company on demand.

e) The foregoing provision of this condition shall be deemed to be complied with if other methods of sampling the trade effluent, determining its nature and composition, and measuring and recording the discharge are agreed and confirmed in writing by the Company.

Dated: **21 December 2018**

Issuing Office
Wastewater Services
Lingley Mere Business Park
Lingley Green Avenue
Great Sankey
Warrington
WA5 3LP

Signed

Wastewater Asset Manager
for and on behalf of United Utilities Water Limited

1. Your attention is drawn to the following provisions of Section 126 (1) of the Water Industry Act 1991 relating to Appeals to the Director General of Water Services. The owner or occupier of any trade premises may within two months of the giving to him under Subsection (5) of the Notice of a Direction under that Section, or with the written permission of the Director at any later time, appeal to the Director against the Direction.

2. The Notice of Direction must state the date, being a date not less than two months after the giving of the Notice on which the Direction is to take effect. If an appeal is brought under Section 126 (1) before that date the Direction shall not take effect until the appeal is withdrawn or finally disposed of. Provided that so far as a Direction which is the subject of an appeal relates to the making of Charges payable by the occupier of the trade premises, it may take effect on any date after the giving of the Notice.

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On appeal under Section 126 (3) and (4) the Director General of Water Services shall have power to annul the Direction given by the Sewerage Undertaker and to substitute for it any other Direction, whether more or less favourable to the appellant and any Direction given by the Director of Water Services may include provision as to the charges to be made for any period between the giving of the Notice by the Sewerage Undertaker and the determination of the appeal.

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APPENDIX 02

Water Balance Calculations

Inputs to Leachate Balance Models						
Infiltration rates	**mm/yr**	**1/3 of shed water returns**	**1/2 of shed water returns**		**Parameter**	**Explanation**
Rainfall	1,221				Rainfall	2012 – 2015 average annual rainfall for Accrington
Open Waste	977				Open waste infiltration	80% of rainfall (assume 20% lost to evaporation)
Phase 1-3 capped	63				Aged cap infiltration	Based on LandSim 1m clay cap with 1m restoration, fully saturated
Old or temp Cap	63	305	457	where	New cap infiltration	Conservative assumption based on SLR experience of new caps in similar high rainfall regions
New Cap	50	309	464		Shed water returns	Estimate of rate of water that returns to site from capped site that would otherwise run-off if surface water control systems functioned 100% correctly
					Draw Down Allowance	Allow for double the equivalent post closure infiltration rate as a contingency in recognition of the need to dry out and draw down leachate built up due to historic surface water inflow issues

Model 1: 2019 (All landfill surface water controls work, PC8 continues to receive grey water)				
Cell	**Area (m^2)**	**Infiltration Rate (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
PC8			12,775	35
1-3	130,500	63	5,475	15
4/1	40,000	63	2,520	7
4/2	28,000	63	1,764	5
5/1	10,313	977.04	10,076	28
	17,188	63	1,083	3
5/2	6,500	977.04	6,351	17
	19,500	63	1,229	3
6	37,000	977.04	36,150	99
	37,000	0	0	0
7/1	3,140	63	198	1
	4,187	977.04	4,091	11
	8,373	63	528	1
7/2	4,000	63	252	1
	6,000	50	300	1
7/3	7,467	63	470	1
	3,733	50	187	1
8/1	1,975	63	124	0
	13,825	977.04	13,508	37
8/2	6,150	63	387	1
	6,150	977.04	6,009	16
Total	391,000		103,475	**283**

Model 2: 2019 (Surface water controls don't work, 1/3 of shed water returns, plus 23m³/day to Phase 1 Cell 3 (01/08B & PC8 continues to receive grey water)				
Cell	**Area (m^2)**	**Infiltration Rate (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
PC8			12,775	35
1-3	130,500	63	13,870	38
4/1	40,000	305	12,187	33
4/2	28,000	305	8,531	23
5/1	10,313	977.04	10,076	28
	17,188	305	5,237	14
5/2	6,500	977.04	6,351	17
	19,500	305	5,941	16
6	37,000	977.04	36,150	99
	37,000	0	0	0
7/1	3,140	305	957	3
	4,187	977.04	4,091	11
	8,373	305	2,551	7
7/2	4,000	305	1,219	3
	6,000	309	1,854	5
7/3	7,467	305	2,275	6
	3,733	309	1,154	3
8/1	1,975	305	602	2
	13,825	977.04	13,508	37
8/2	6,150	305	1,874	5
	6,150	977.04	6,009	16
Total	391,000		147,210	**403**

Model 3: 2019 (Surface water controls don't work, 1/2 of shed water returns, plus 23m³/day to Phase 1 Cell 3 01/08B & PC8 continues to receive grey water)				
Cell	**Area (m^2)**	**Infiltration Rate (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
PC8			12,775	35
1-3	130,500	63	13,870	38
4/1	40,000	457	18,281	50
4/2	28,000	457	12,797	35
5/1	10,313	977.04	10,076	28
	17,188	457	7,855	22
5/2	6,500	977.04	6,351	17
	19,500	457	8,912	24
6	37,000	977.04	36,150	99
	37,000	0	0	0
7/1	3,140	457	1,435	4
	4,187	977.04	4,091	11
	8,373	457	3,827	10
7/2	4,000	457	1,828	5
	6,000	464	2,781	8
7/3	7,467	457	3,412	9
	3,733	464	1,730	5
8/1	1,975	457	903	2
	13,825	977.04	13,508	37
8/2	6,150	457	2,811	8
	6,150	977.04	6,009	16
Total	391,000		169,400	**464**

Model 4: Assumed end 2020 (All surface water controls work, plus 23m³/day to Phase 1 Cell 3 from 01/08)				
Cell	**Area (m^2)**	**Infiltration Rate (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
PC8				0
1-3	130,500	63	13,870	38
4/1	40,000	50	2,000	5
4/2	28,000	50	1,400	4
5/1	10,313	50	516	1
	17,188	50	859	2
5/2	6,500	50	325	1
	19,500	50	975	3
6	37,000	977.04	36,150	99
	37,000	977.04	36,150	99
7/1	3,140	63	198	1
	4,187	50	209	1
	8,373	50	419	1
7/2	4,000	63	252	1
	6,000	50	300	1
7/3	7,467	63	470	1
	3,733	50	187	1
8/1	1,975	63	124	0
	13,825	50	691	2
8/2	6,150	63	387	1
	6,150	50	308	1
Total	391,000		95,791	**262**

Model 5: 2021 (SW controls work except for 08/1B, so add 23m3/day to Phase 1)						
Cell	**Capped Area (m^2)**	**Uncapped Area (m^2)**	**Capped Infiltration (mm/yr)**	**Uncapped Infiltration (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
1-3	130,500	0	63	n/a	13,870	38
4/1	33,393	6,607	50	977	8,125	22
4/2	21,393	6,607	50	977	7,525	21
5/1	27,500	0	50	977	1,375	4
5/2	26,000	0	50	977	1,300	4
6/1	37,000	37,000	63	977	38,481	105

Model 5: 2021 (SW controls work except for 08/1B, so add 23m3/day to Phase 1)						
7/1	3,140	0	63	977	198	1
	12,560	0	50	977	628	2
7/2	3,393	6,607	63	977	6,669	18
7/3	4,593	6,607	63	977	6,745	18
8/1	1,975	0	63	977	124	0
	13,825	0	50	977	691	2
8/2	6,150	0	63	977	387	1
	6,150	0	50	977	308	1
Total	327,573	63,428			86,426	**237**

Model 6: 2023 (SW controls work except for 08/1B, so add 23m3/day to Phase 1)						
Cell	**Capped Area (m^2)**	**Uncapped Area (m^2)**	**Capped Infiltration (mm/yr)**	**Uncapped Infiltration (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
1-3	130,500	0	63	977	13,870	38
4/1	40,000	0	50	977	2,000	5
4/2	12,010	15,990	50	977	16,223	44
5/1	11,510	15,990	50	977	16,198	44
5/2	10,010	15,990	50	977	16,123	44
6/1	74,000	0	63	977	4,662	13
7/1	3,140	0	63	977	198	1
	12,560	0	50	977	628	2
7/2	3,393	0	63	977	214	1
	6,607	0	50	977	330	1
7/3	4,593	0	63	977	289	1
	6,607	0	50	977	330	1
8/1	0	15,800	63	977	15,437	42
8/2	0	12,300	63	977	12,018	33
Total	314,931	76,069			98,521	**270**

Model 7: 2024 (SW controls work except for 08/1B, so add 23m3/day to Phase 1) Assumes 6/2 gets developed at total catchment of 72,000m^2						
Cell	**Capped Area (m^2)**	**Uncapped Area (m^2)**	**Capped Infiltration (mm/yr)**	**Uncapped Infiltration (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
1-3	130,500	0	63	977	13,870	38

Model 7: 2024 (SW controls work except for 08/1B, so add 23m3/day to Phase 1) Assumes 6/2 gets developed at total catchment of 72,000m²						
4/1	40,000	0	50	977	2,000	5
4/2	28,000	0	50	977	1,400	4
5/1	27,500	0	50	977	1,375	4
5/2	26,000	0	50	977	1,300	4
6/1	74,000	0	63	977	4,662	13
6/2	0	72,000	50	977	70,347	193
7/1	3,140	0	63	977	198	1
	12,560	0	50	977	628	2
7/2	3,393	0	63	977	214	1
	6,607	0	50	977	330	1
7/3	4,593	0	63	977	289	1
	6,607	0	50	977	330	1
8/1	15,800	0	50	977	790	2
8/2	12,300	0	50	977	615	2
Total	391,000	72,000			98,349	**269**

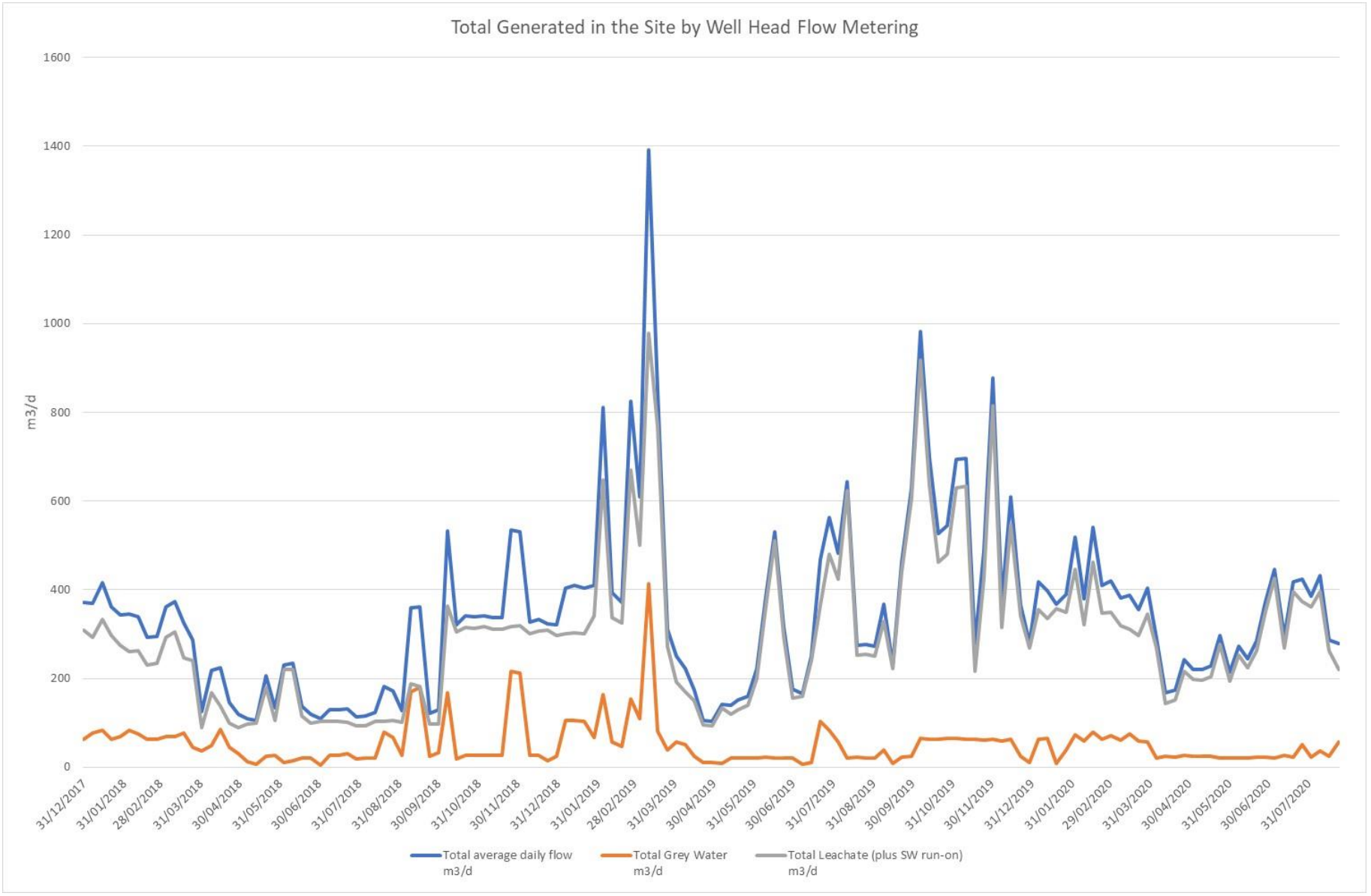
Model 8: Post 2024, half 6/2 capped (SW controls work except for 08/1B, so add 23m3/day to Phase 1) Assumes 6/2 gets developed at total catchment of 72,000m²						
Cell	**Capped Area (m²)**	**Uncapped Area (m²)**	**Capped Infiltration (mm/yr)**	**Uncapped Infiltration (mm/yr)**	**Annual New Generation (m³/yr)**	**Daily Equivalent (m³/d)**
1-3	130,500	0	63	977	13,870	38
4/1	40,000	0	50	977	2,000	5
4/2	28,000	0	50	977	1,400	4
5/1	27,500	0	50	977	1,375	4
5/2	26,000	0	50	977	1,300	4
6/1	74,000	0	63	977	4,662	13
6/2	36,000	36,000	50	977	36,973	101
7/1	3,140	0	63	977	198	1
	12,560	0	50	977	628	2
7/2	3,393	0	63	977	214	1
	6,607	0	50	977	330	1
7/3	4,593	0	63	977	289	1
	6,607	0	50	977	330	1

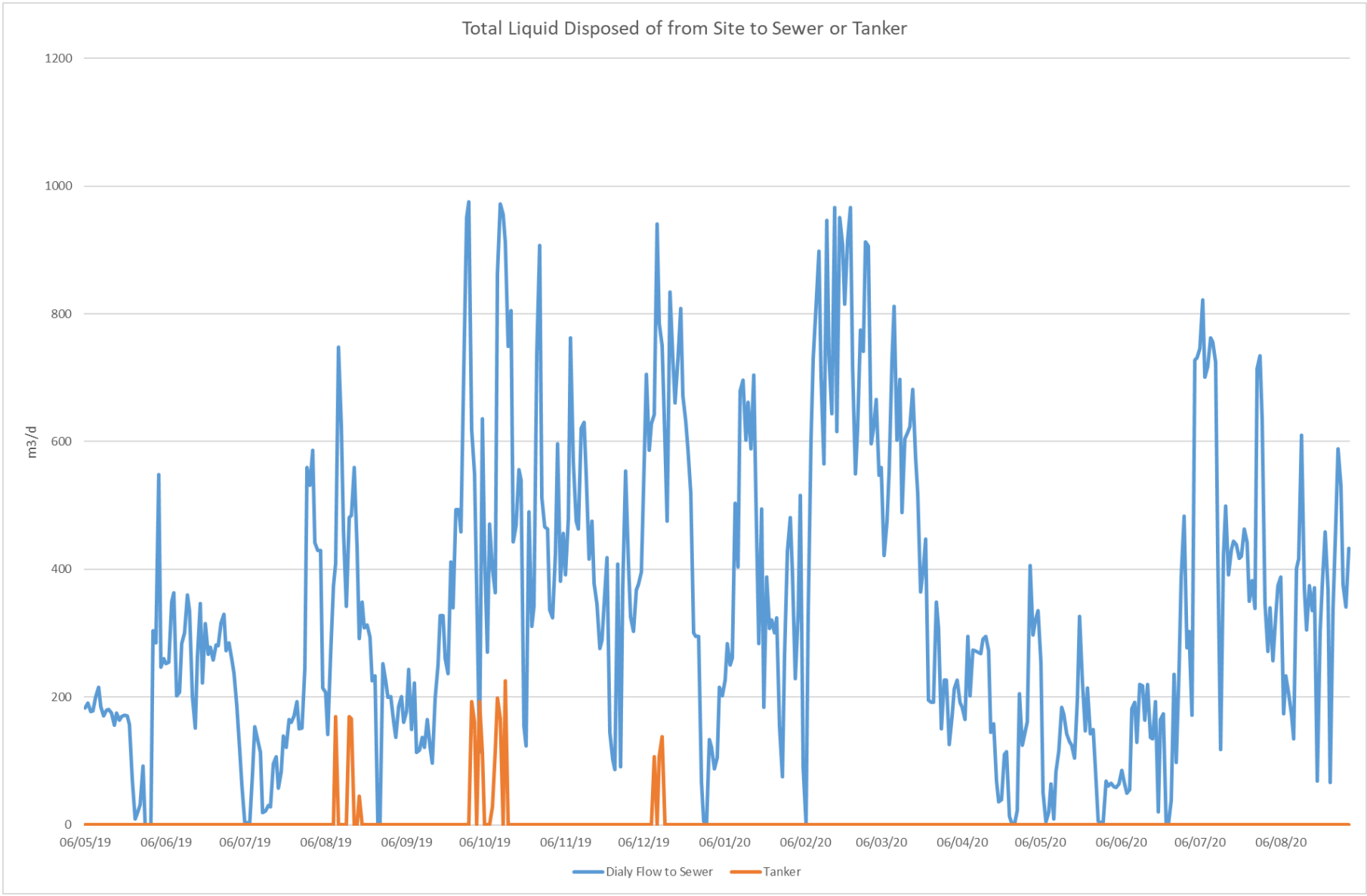
Model 8: Post 2024, half 6/2 capped (SW controls work except for 08/1B, so add 23m3/day to Phase 1) Assumes 6/2 gets developed at total catchment of 72,000m^2						
8/1	15,800	0	50	977	790	2
8/2	12,300	0	50	977	615	2
Total	427,000	36,000			64,975	**178**

Model 9: Assumed at Closure (All site capped, allowance for additional ingress of surface water in recognition of site history)				
Cell	**Area (m^2)**	**Infiltration Rate (mm/yr)**	**Annual New Generation (m^3/yr)**	**Daily Equivalent (m^3/d)**
SW Allowance			18,615	51
1-3	130,500	63	5,475	15
4/1	40,000	50	2,000	5
4/2	28,000	50	1,400	4
5/1	27,500	50	1,375	4
5/2	26,000	50	1,300	4
6/1	74,000	50	3,700	10
6/2	72,000	50	3,600	10
7/1	3,140	63	198	1
	12,560	50	628	2
7/2	3,393	63	214	1
	6,607	50	330	1
7/3	4,593	63	289	1
	6,607	50	330	1
8/1	15,800	50	790	2
8/2	12,300	50	615	2
Total	463,000		40,860	**112**

APPENDIX 03

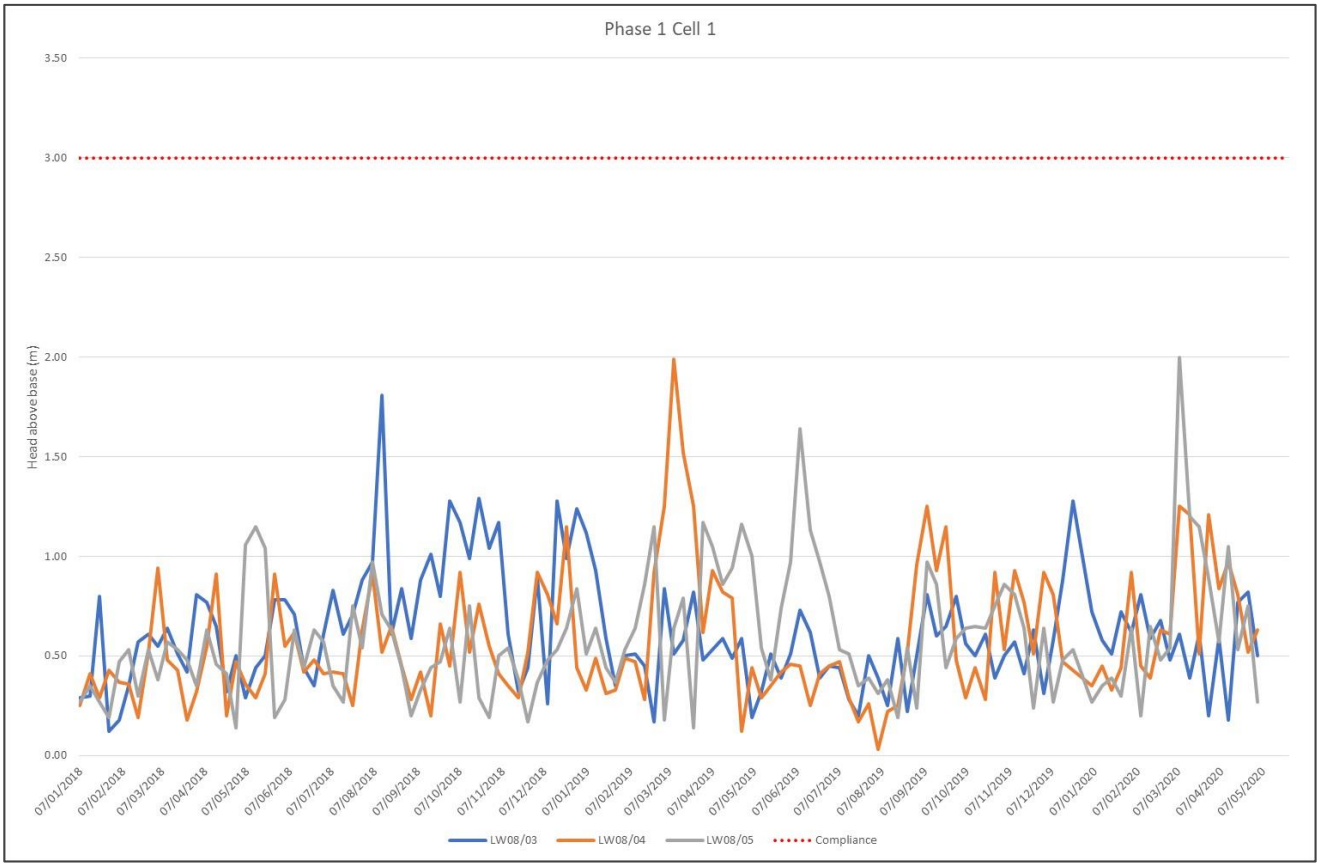
Leachate Flow Metering

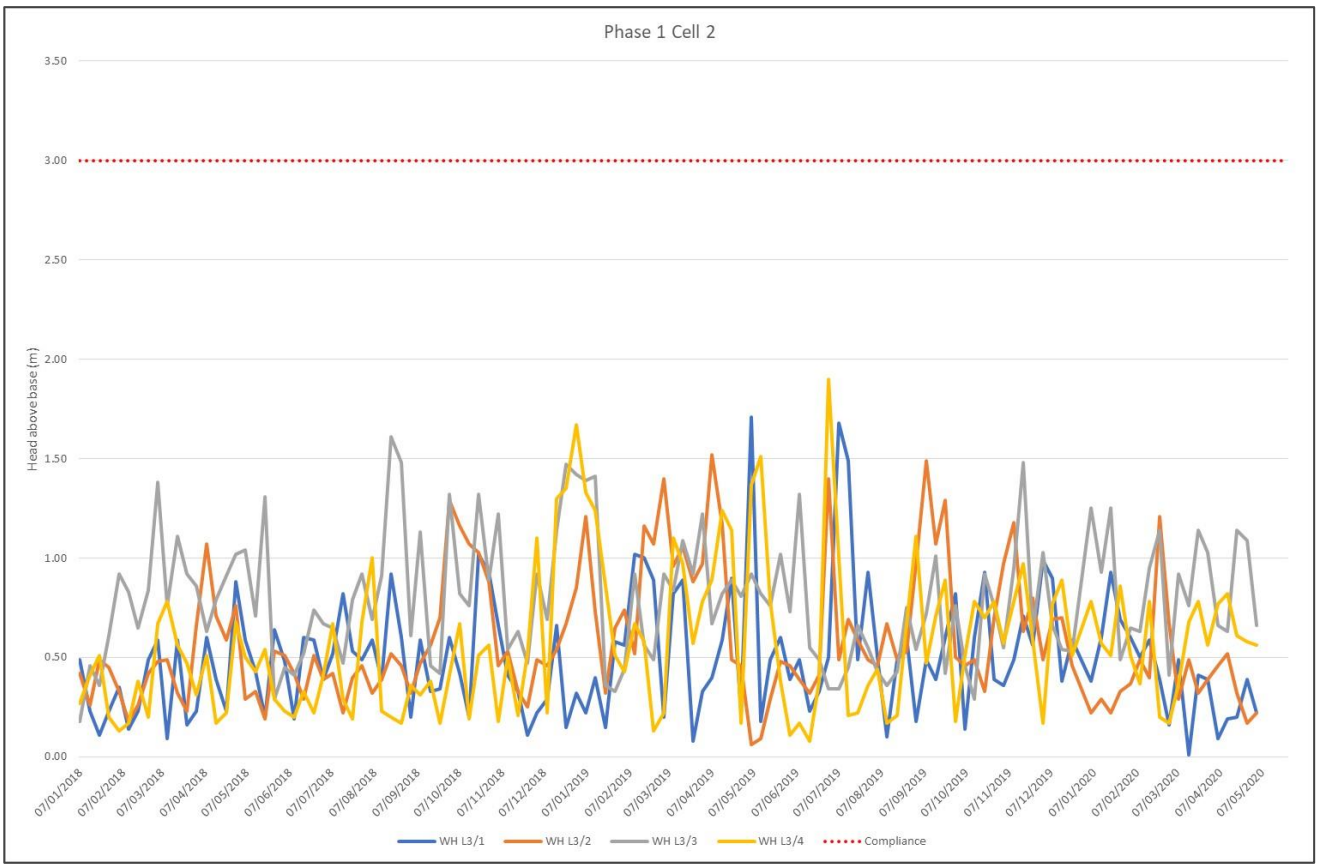

Total Generated in the Site by Well Head Flow Metering
m3/d
1600
1400
1200
1000
800
600
400
200
0
31/12/2017
31/01/2018
28/02/2018
31/03/2018
30/04/2018
31/05/2018
30/06/2018
31/07/2018
31/08/2018
30/09/2018
31/10/2018
30/11/2018
31/12/2018
31/01/2019
28/02/2019
31/03/2019
30/04/2019
31/05/2019
30/06/2019
31/07/2019
31/08/2019
30/09/2019
31/10/2019
30/11/2019
31/12/2019
31/01/2020
29/02/2020
31/03/2020
30/04/2020
31/05/2020
30/06/2020
31/07/2020
Total average daily flow m3/d
Total Grey Water m3/d
Total Leachate (plus SW run-on) m3/d


Total Liquid Disposed of from Site to Sewer or Tanker
1200
1000
800
600
400
200
0
m3/d
06/05/19
06/06/19
06/07/19
06/08/19
06/09/19
06/10/19
06/11/19
06/12/19
06/01/20
06/02/20
06/03/20
06/04/20
06/05/20
06/06/20
06/07/20
06/08/20
Dialy Flow to Sewer
Tanker

APPENDIX 04

Leachate Level Graphs


Phase 1 Cell 1
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LW08/03
LW08/04
LW08/05
Compliance


Phase 1 Cell 2
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
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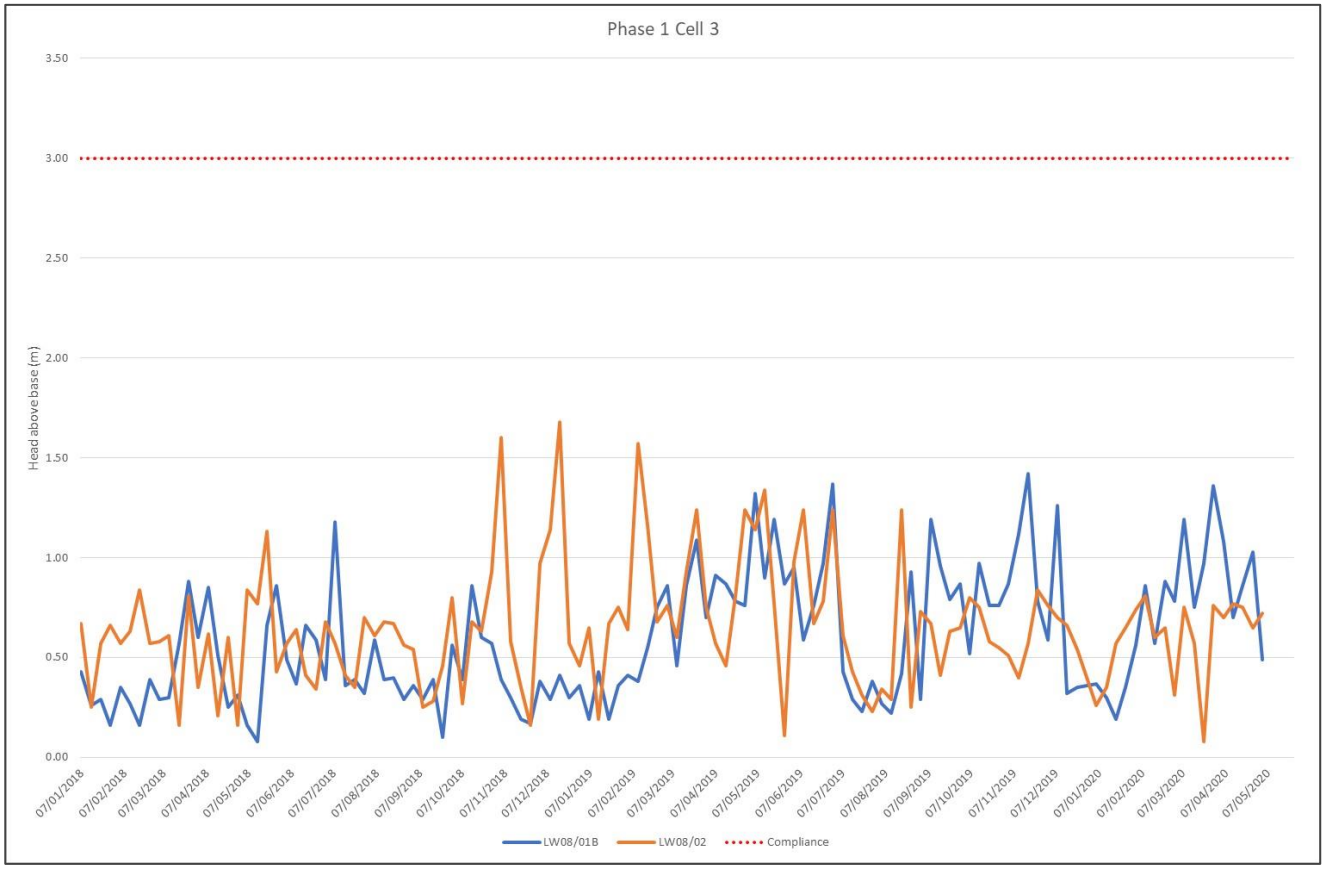
07/05/2020
WH L3/1
WH L3/2
WH L3/3
WH L3/4
Compliance


Phase 1 Cell 3
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
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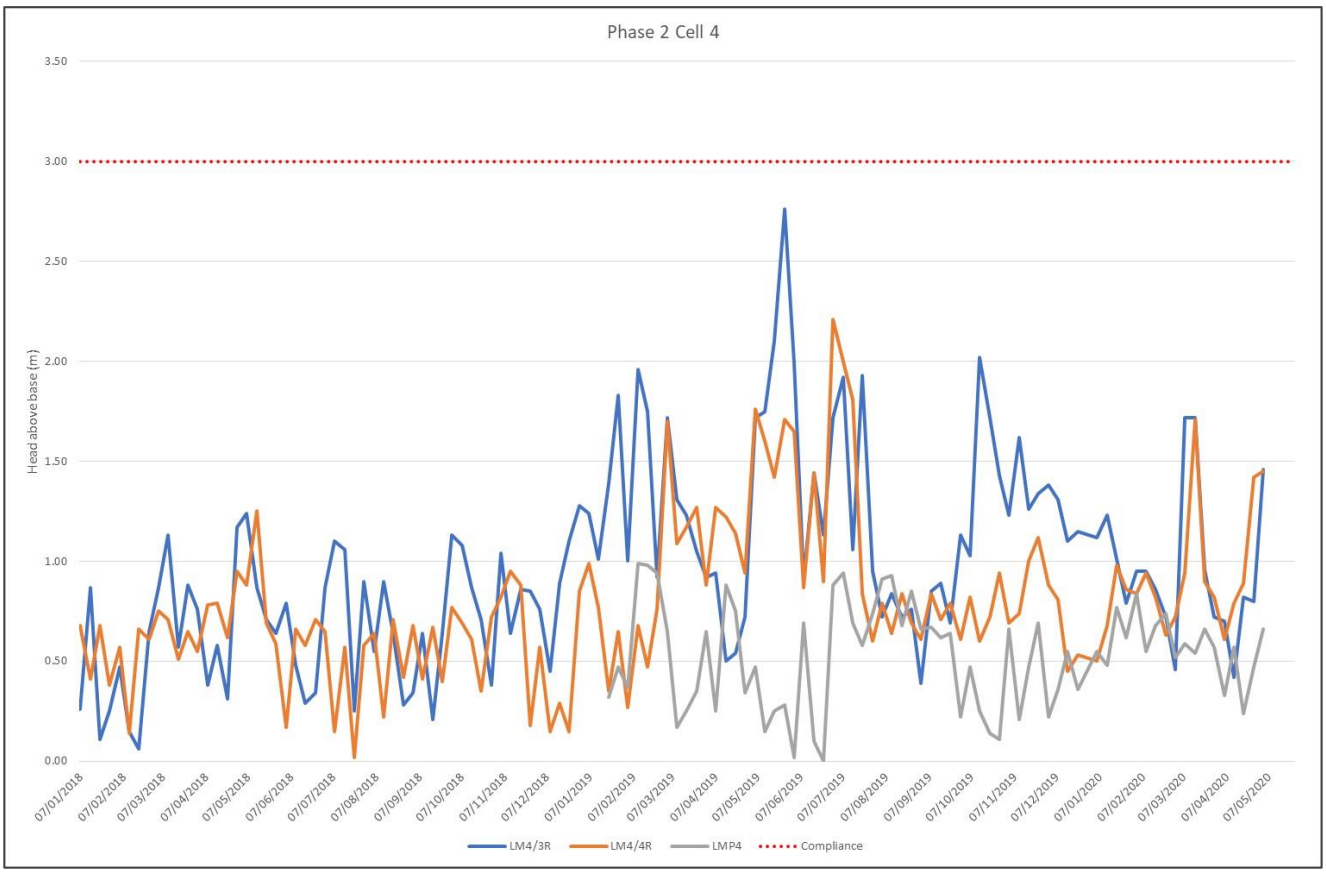
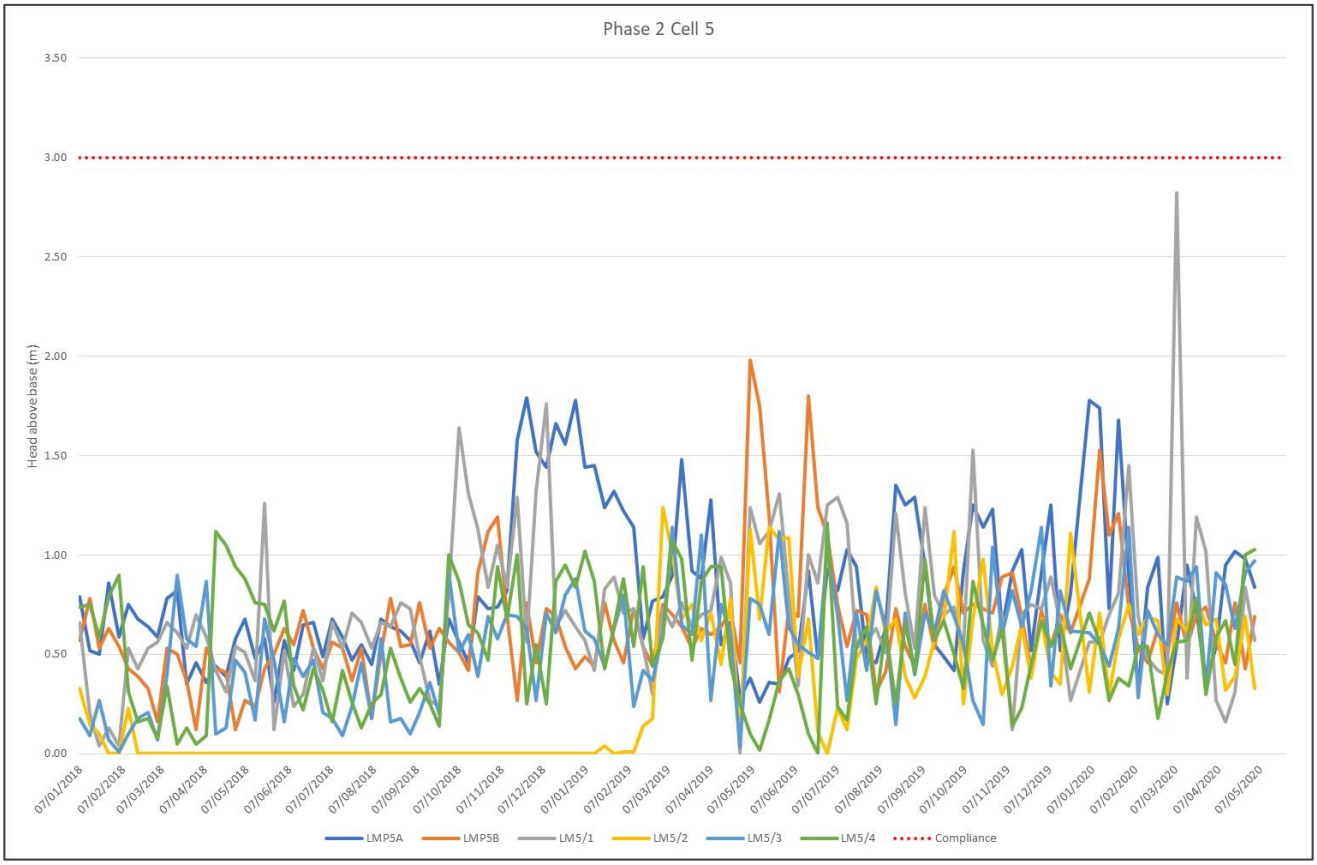
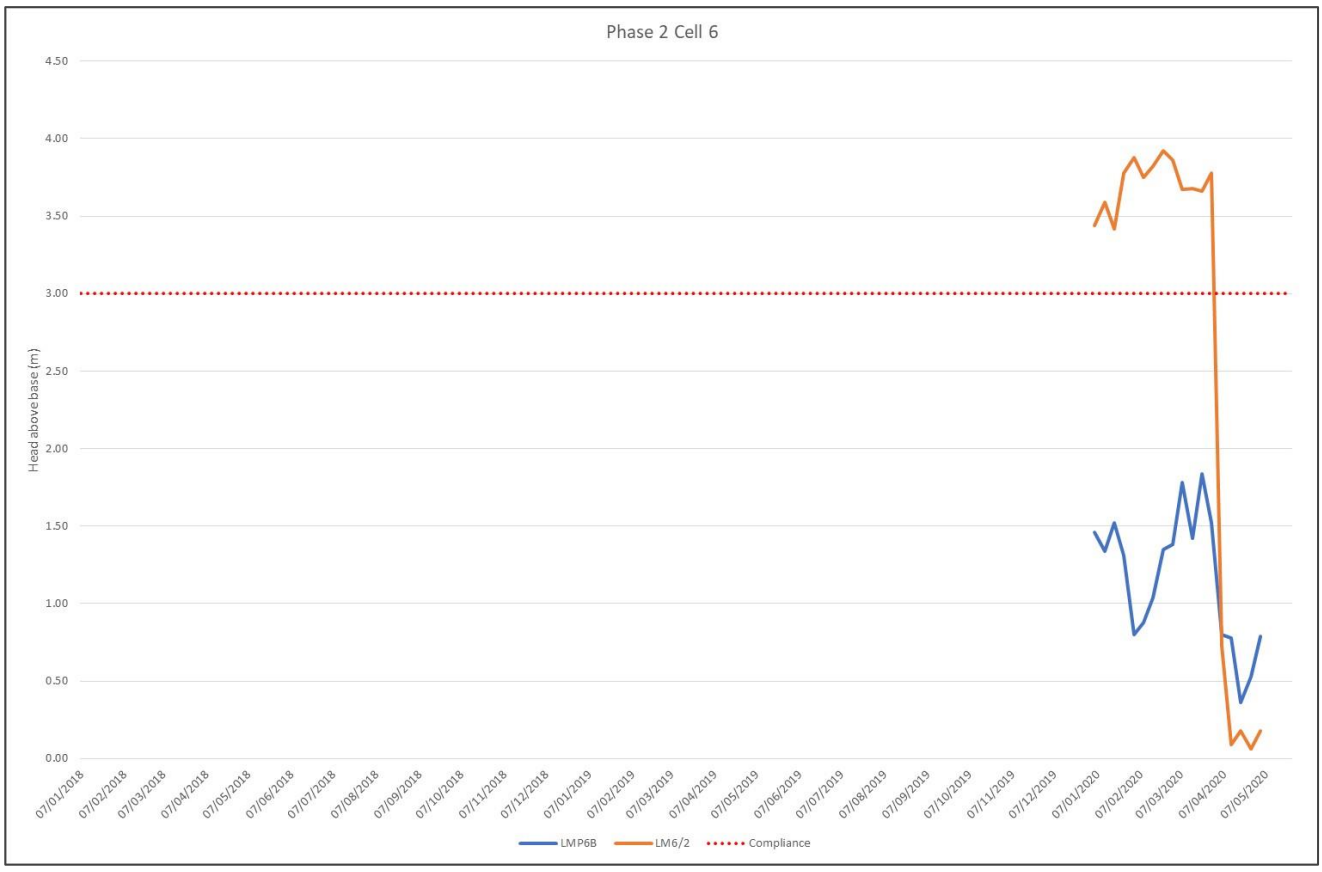
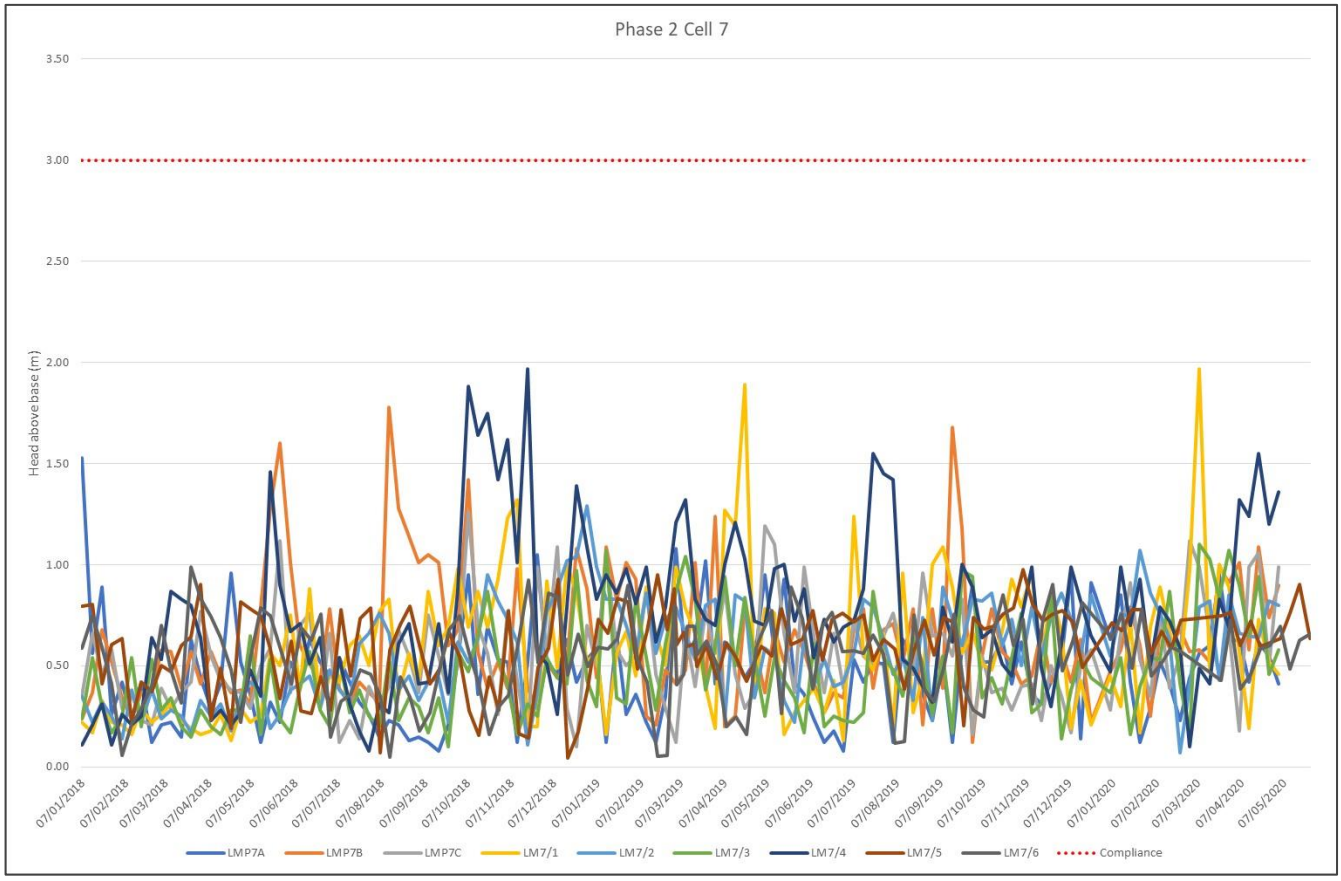
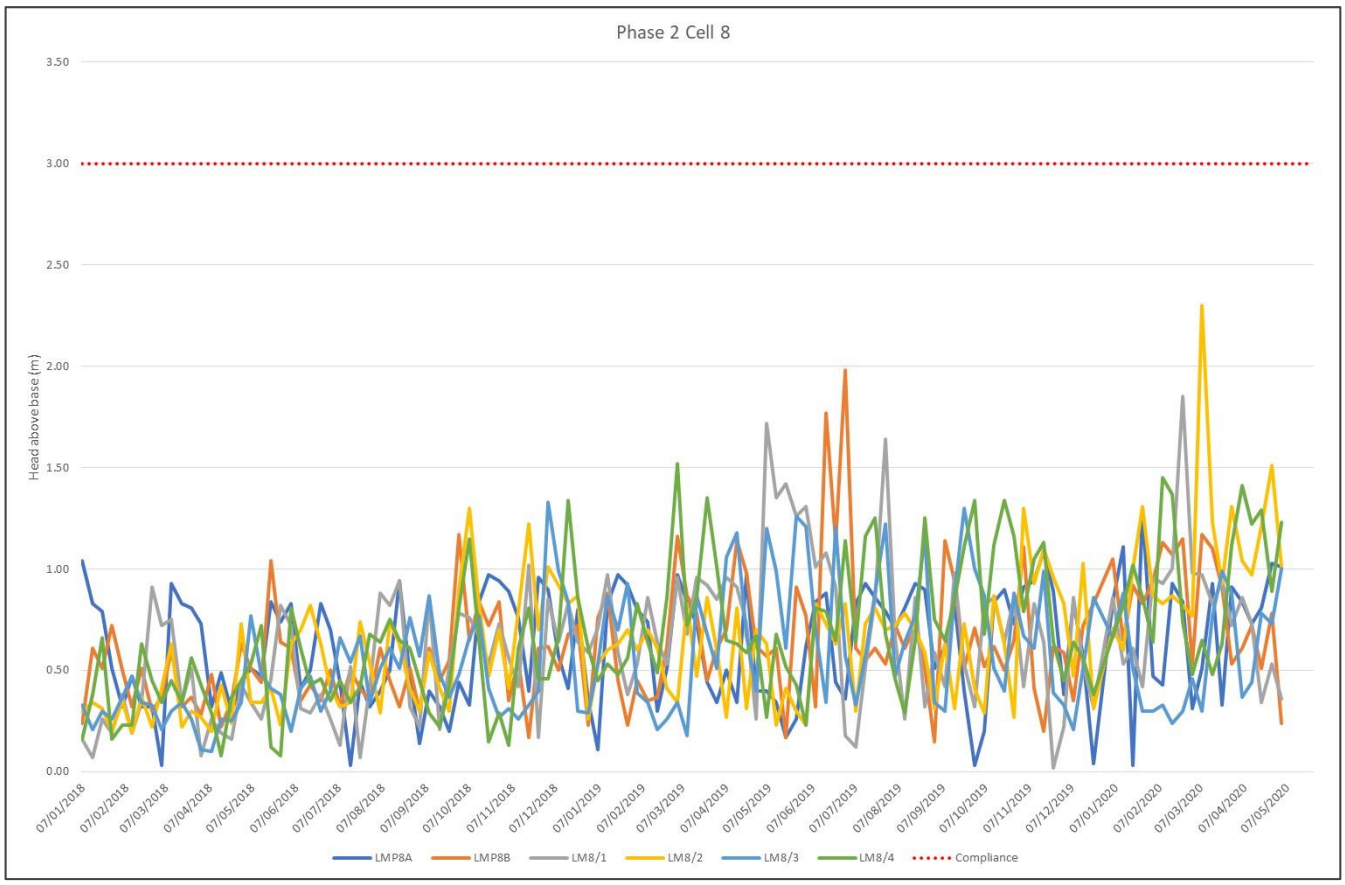
07/04/2020
07/05/2020
LW08/01B
LW08/02
Compliance

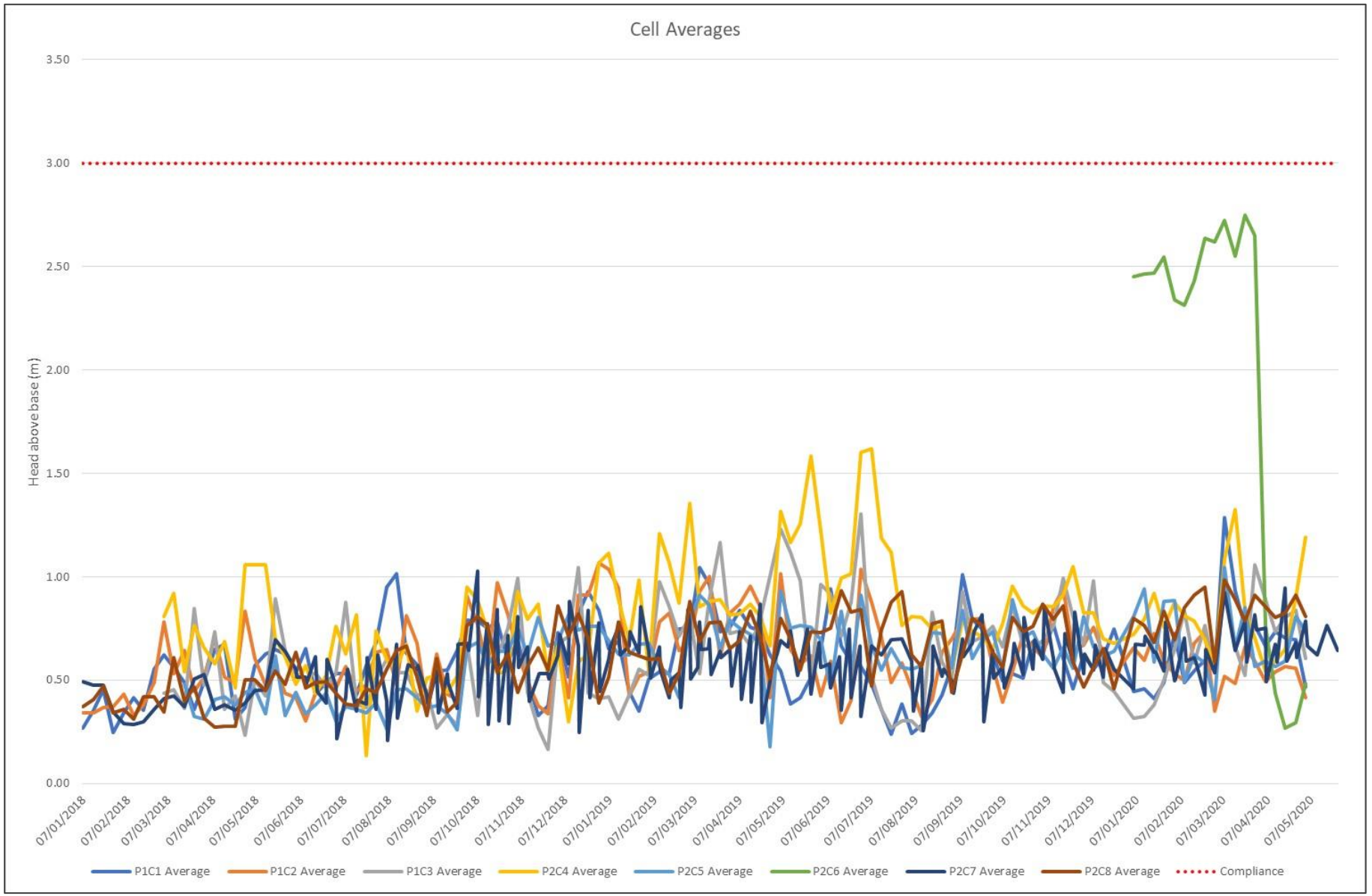

Phase 2 Cell 4
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LM4/3R
LM4/4R
LMP4
Compliance


Phase 2 Cell 5
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LMP5A
LMP5B
LM5/1
LM5/2
LM5/3
LM5/4
Compliance


Phase 2 Cell 6
Head above base (m)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LMP6B
LM6/2
Compliance

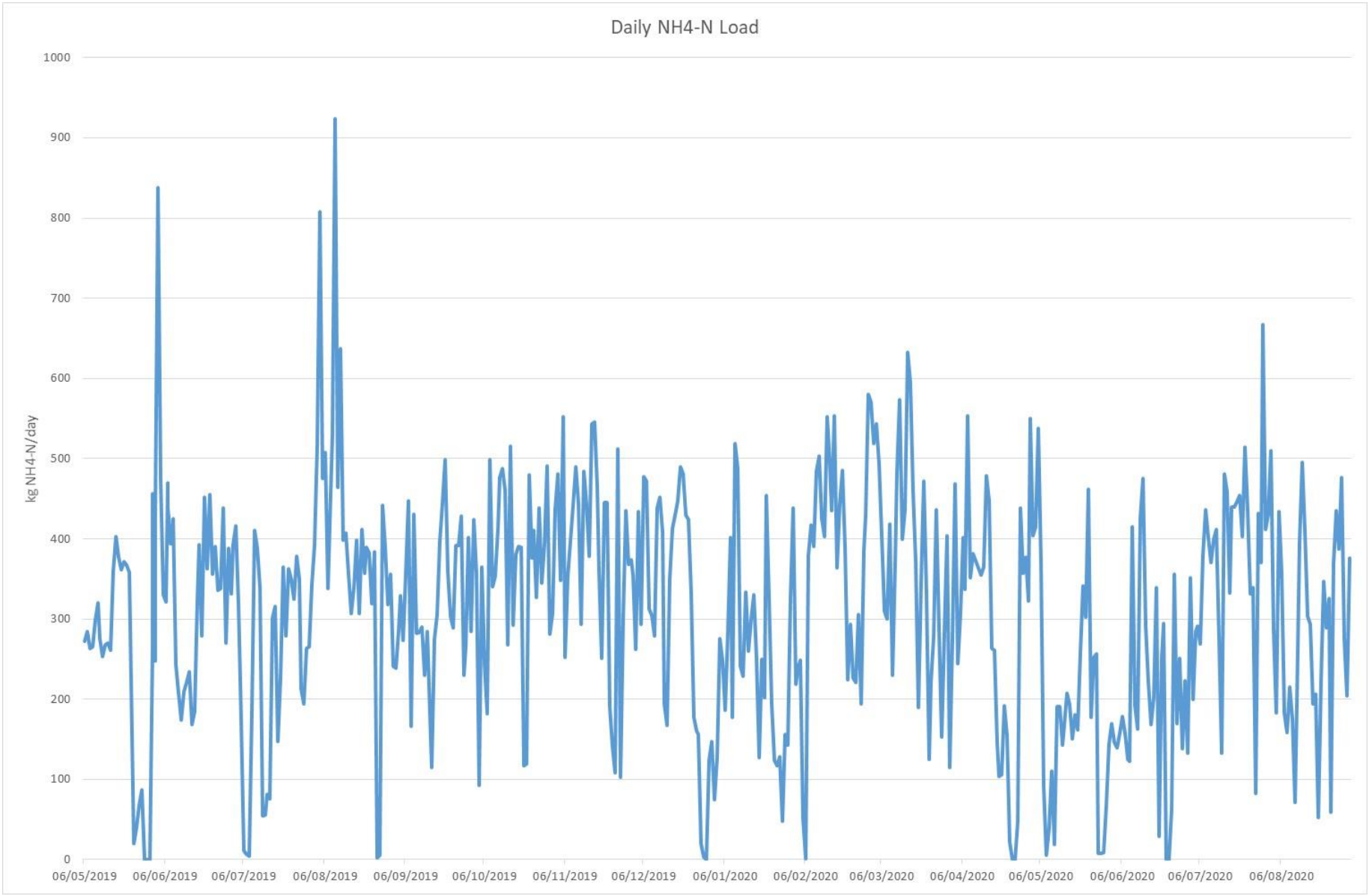

Phase 2 Cell 7
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LMP7A
LMP7B
LMP7C
LM7/1
LM7/2
LM7/3
LM7/4
LM7/5
LM7/6
Compliance


Phase 2 Cell 8
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
LMP8A
LMP8B
LM8/1
LM8/2
LM8/3
LM8/4
Compliance


Cell Averages
Head above base (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07/01/2018
07/02/2018
07/03/2018
07/04/2018
07/05/2018
07/06/2018
07/07/2018
07/08/2018
07/09/2018
07/10/2018
07/11/2018
07/12/2018
07/01/2019
07/02/2019
07/03/2019
07/04/2019
07/05/2019
07/06/2019
07/07/2019
07/08/2019
07/09/2019
07/10/2019
07/11/2019
07/12/2019
07/01/2020
07/02/2020
07/03/2020
07/04/2020
07/05/2020
P1C1 Average
P1C2 Average
P1C3 Average
P2C4 Average
P2C5 Average
P2C6 Average
P2C7 Average
P2C8 Average
Compliance

APPENDIX 05

Ammonia Load Generated by Site


Daily NH4-N Load
kg NH4-N/day
1000
900
800
700
600
500
400
300
200
100
0
06/05/2019
06/06/2019
06/07/2019
06/08/2019
06/09/2019
06/10/2019
06/11/2019
06/12/2019
06/01/2020
06/02/2020
06/03/2020
06/04/2020
06/05/2020
06/06/2020
06/07/2020
06/08/2020

APPENDIX 06

Leachate Infrastructure Log

Whinney Hill Landfill - Leachate Infrastructure Log
September 2020

Phase or Area	Well ID	Status	Material of Constuction	Diameter (mm)	Type	Pump Installed?	Pump Type	CQA Report held?	Cover Level [Aug 2020]	CQA Base of Well mAOD	Current Plumb to Base Level
Area 1	08/03	OK			Original	Yes	Electric	n/a	189.7	146.0	41.9
Area 1	08/04	OK			Original	Yes	Electric	n/a	186.9	142.0	41.5
Area 1	08/05	OK			Original	Yes	Electric	n/a	187.9	145.0	42.2
Area 1	L1/6	OK			Original	No	n/a	n/a	179.2		
Area 2	L3/1	OK			Original	No	n/a	n/a	180.3	156.2	24.1
Area 2	L3/2	OK			Original	No	n/a	n/a	173.5	155.9	17.6
Area 2	L3/3	OK			Original	No	n/a	n/a	182.5	157.0	25.5
Area 2	PC2	OK	Concrete ring		Original	Yes	Electric	n/a	166.1		
Area 3	PC8	OK	Concrete ring		Original	Yes	Electric	n/a			
Area 3	08/01B	OK			Original	No	Electric	n/a	173.5	141.0	32.4
Area 3	08/02	OK			Original	Yes	Electric	n/a	181.9	142.0	36.8
Area 3	PC3	OK	Concrete ring		Original	Yes	Electric	n/a			
Area 3	LFG wells x 8	OK	HDPE	200	Retrodrilled	Yes	8 x Pneumatic	n/a			
4	LM4/3R	Good	Steel	250	Retrodrilled	Yes	Electric	Yes - Oct_13	179.2	138.3	41.0
4	LM4/4R	Good	Steel	250	Retrodrilled	Yes	Electric	Yes - Jan_16	187.5	138.1	35.3
4	LMP4	Pumping only	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		136.7	
5/1	LMP5A	Good	Concrete with HDPE inner	1080	Original	No	2 x Electric	n/a		142.1	
5/1	LM5/1	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	193.2	144.8	45.8
5/1	LM5/2	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	178.9	143.6	35.3
5/2	LMP5B	Good	Concrete with HDPE inner	1080	Original	Yes	2 x Electric	n/a		139.7	
5/2	LMP5B_P2		Concrete with HDPE inner		Original	No	n/a	n/a			
5/2	LM5/3	Blocked	Concrete with HDPE inner	1080	Original	No	n/a	n/a	177.4	141.3	39.3
5/2	LM5/4	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	172.4	141.3	31.1
6A	LMP6A	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		140.6	
6A	LM6/1	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	147.6	141.9	11.8
7/1	LMP7A	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		135.8	
7/1	LM7/1	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	171.6	137.1	36.1
7/1	LM7/2	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	161.8	137.3	25.0
7/2	LMP7B	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		136.4	
7/2	LM7/3	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	172.3	137.8	35.1
7/2	LM7/4	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	162.8	137.9	25.5
7/3	LMP7C	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		137.7	
7/3	LM7/5	Good	Concrete with HDPE inner	1080	Original	Transducer	n/a	n/a		138.3	37.3
7/3	LM7/6	Good	Concrete with HDPE inner	1080	Original	Transducer	n/a	n/a		138.9	37.2
8/1	LMP8A	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		134.7	
8/1	LM8/1	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	162.3	135.4	26.0
8/1	LM8/2	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	161.1	135.9	23.9
8/2	LMP8B	Good	Concrete with HDPE inner	1080	Original	Yes	Electric	n/a		133.8	
8/2	LM8/3	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	158.2	134.0	23.4
8/2	LM8/4	Good	Concrete with HDPE inner	1080	Original	No	n/a	n/a	153.2	134.5	18.7

APPENDIX 07

In-Waste Leachate Storage Volume Assessment

Cell	A: Free Leachate Storage Volume Held in Drainage Blankets		
	Volume of Drainage Blanket	Porosity*	Volume of Free Leachate
	(m^3)	%	(m^3)
Phase 1 Cell 1	No drainage blanket	n/a	n/a
Phase 1 Cell 2	No drainage blanket	n/a	n/a
Phase 1 Cell 3	8,625	10.0	863
Phase 2 Cell 4	11,952	10.0	1,195
Phase 2 Cell 5	7,871	10.0	787
Phase 2 Cell 6	3,177	10.0	318
Phase 2 Cell 7	4,641	10.0	464
Phase 2 Cell 8	4,012	10.0	401
Site Total	40,278		4,028

*: see below for porosity with depth

Cell	B: Free Leachate Storage Volume Held between Top of Drainage Blankets and Current Compliance Level			
	Waste Volume above top of drainage blanket and below CURRENT COMPLIANCE level	Average Depth from surface to top of CURRENT COMPLIANCE layer	Porosity*	Volume of Free Leachate
	(m^3)	(m)	%	(m^3)
Phase 1 Cell 1	8,067	38.0	2.0	161
Phase 1 Cell 2	8,067	38.0	2.0	161
Phase 1 Cell 3	33,410	39.0	2.0	668
Phase 2 Cell 4	250,164	32.5	2.0	5,003
Phase 2 Cell 5	184,816	30.0	2.0	1,572

Cell	B: Free Leachate Storage Volume Held between Top of Drainage Blankets and Current Compliance Level			
	Waste Volume above top of drainage blanket and below CURRENT COMPLIANCE level	Average Depth from surface to top of CURRENT COMPLIANCE layer	Porosity*	Volume of Free Leachate
	(m^3)	(m)	%	(m^3)
Phase 2 Cell 6	58,557	11.8	6.6	3,865
Phase 2 Cell 7	43,690	22.2	2.4	1,049
Phase 2 Cell 8	36,719	22.0	2.4	881
Site Total	623,490			13,360

*: see below for porosity with depth

Cell	C: Free Leachate Storage Volume Held between Top of Current Compliance Level and Proposed Compliance Level			
	Waste Volume above top of drainage blanket and below PROPOSED COMPLIANCE level	Average Depth from surface to top of PROPOSED COMPLIANCE layer	Porosity*	Volume of Free Leachate
	(m^3)	(m)	%	(m^3)
Phase 1 Cell 1	n/c	n/c	n/c	n/c
Phase 1 Cell 2	n/c	n/c	n/c	n/c
Phase 1 Cell 3	n/c	n/c	n/c	n/c
Phase 2 Cell 4	32,847	34.0	2.0	657
Phase 2 Cell 5	7,221	35.5	2.0	144
Phase 2 Cell 6	n/c	n/c	n/c	n/c
Phase 2 Cell 7	16,321	21.6	2.6	424

Cell	C: Free Leachate Storage Volume Held between Top of Current Compliance Level and Proposed Compliance Level			
	Waste Volume above top of drainage blanket and below PROPOSED COMPLIANCE level	Average Depth from surface to top of PROPOSED COMPLIANCE layer	Porosity*	Volume of Free Leachate
	(m^3)	(m)	%	(m^3)
Phase 2 Cell 8	33,339	20.0	4.6	1,000
Site Total	88,575			2,225

*: see below for porosity with depth

n/c: no change

THEORETICAL WASTE POROSITY.

Assessments of waste porosity are notoriously difficult to make due to the heterogeneous nature of waste and differing methods of waste emplacement resulting in various degrees of compaction at time of deposit. Furthermore, conditions within areas of a site will vary at different depths and over time. In essence however most commentators on the subject agree that porosities of somewhere between 2% and 12% exist within most domestic waste landfills. Porosities will in general decrease with depth and age of waste and with a greater proportion of waste soils and/or cover deposited in the site.

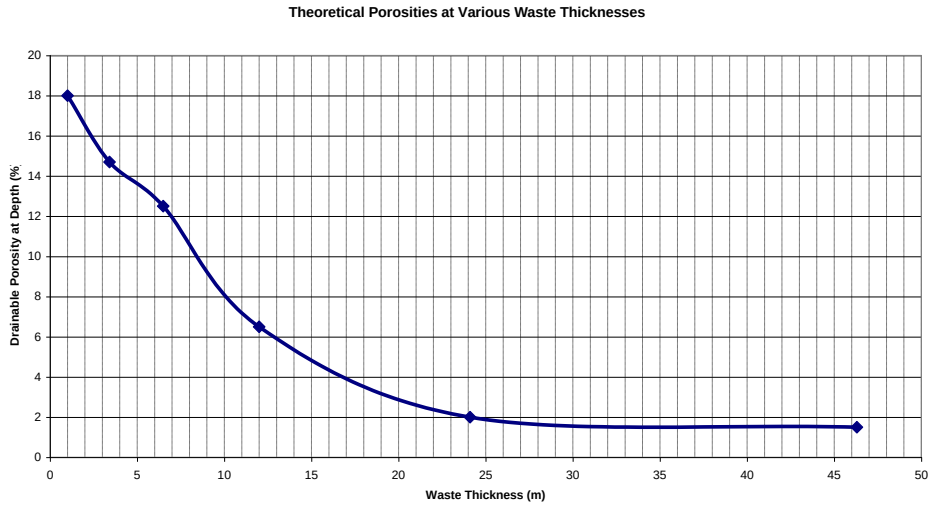
A review the findings of the Powrie & Beavan report published in 1999♣ is summarised below.

Theoretical Porosities

Relationship Between Waste Thickness and Waste Porosity and Hydraulic Conductivity, using data from Powrie & Beaven, 1999

Applied Stress	Average Vertical Stress	Dry Density	Drainable Porosity	WC_{dry} at field capacity	WC_{vol} at field capacity	Saturated hydraulic conductivity (m/s)		Assumed depth of waste
kPa	kPa	Mg/m3	%	%	%	min	max	Entec
Initial		0.32	18					1
40	34.1	0.39	14.7	101	40	1.50E-04	3.40E-05	3.4
87	64.9	0.42	12.5	99	42	8.20E-05	1.90E-05	6.5
165	120	0.49	6.5	91	45	2.80E-05	3.10E-06	12.0
322	241	0.59	2	76	45	8.90E-06	4.40E-07	24.1
600	463	0.72	1.5	62	44	2.70E-07	3.70E-08	46.3

The results of this being capable of graphing to enable a theoretical assessment of the likely porosity of the waste at depth.



♣ Powrie, w and Beaven, R P. 'Hydraulic Properties of Household Waste and Implications for Landfills'. Proceedings of the Institute of Civil Engineers; Geotechnical Engineering, October 1999, pp235-247.

Depth	Porosity
1.0	18.0
1.1	17.8
1.2	17.6
1.3	17.4
1.4	17.2
1.5	17.0
1.6	16.8
1.7	16.6
1.8	16.4
1.9	16.2
2.0	16.0
2.1	15.9
2.2	15.8
2.3	15.7
2.4	15.6
2.5	15.6
2.6	15.4
2.7	15.3
2.8	15.2
2.9	15.1
3.0	15.0
3.1	14.9
3.2	14.8
3.3	14.7
3.4	14.6
3.5	14.6
3.6	14.4
3.7	14.3
3.8	14.2
3.9	14.1
4.0	14.0
4.1	14.0
4.2	13.9
4.3	13.9
4.4	13.8
4.5	13.8
4.6	13.7
4.7	13.7
4.8	13.6
4.9	13.6
5.0	13.6
5.1	13.4
5.2	13.4
5.3	13.3
5.4	13.3
5.5	13.2
5.6	13.2
5.7	13.1
5.8	13.1
5.9	13.0
6.0	13.0
6.1	12.9
6.2	12.8
6.3	12.7
6.4	12.6

Depth	Porosity
6.5	12.6
6.6	12.4
6.7	12.3
6.8	12.2
6.9	12.1
7.0	12.0
7.1	11.9
7.2	11.8
7.3	11.7
7.4	11.6
7.5	11.6
7.6	11.4
7.7	11.3
7.8	11.2
7.9	11.1
8.0	11.0
8.1	10.8
8.2	10.6
8.3	10.4
8.4	10.2
8.5	10.0
8.6	9.8
8.7	9.6
8.8	9.4
8.9	9.2
9.0	9.0
9.1	8.9
9.2	8.8
9.3	8.7
9.4	8.6
9.5	8.6
9.6	8.4
9.7	8.3
9.8	8.2
9.9	8.1
10.0	8.0
10.1	7.9
10.2	7.8
10.3	7.7
10.4	7.6
10.5	7.6
10.6	7.4
10.7	7.3
10.8	7.2
10.9	7.1
11.0	7.0
11.1	7.0
11.2	6.9
11.3	6.9
11.4	6.8
11.5	6.8
11.6	6.7
11.7	6.7
11.8	6.6
11.9	6.6

Depth	Porosity
12.0	6.6
12.1	6.4
12.2	6.4
12.3	6.3
12.4	6.3
12.5	6.2
12.6	6.2
12.7	6.1
12.8	6.1
12.9	6.0
13.0	6.0
13.1	6.0
13.2	5.9
13.3	5.9
13.4	5.8
13.5	5.8
13.6	5.7
13.7	5.7
13.8	5.6
13.9	5.6
14.0	5.6
14.1	5.4
14.2	5.4
14.3	5.3
14.4	5.3
14.5	5.2
14.6	5.2
14.7	5.1
14.8	5.1
14.9	5.0
15.0	5.0
15.1	5.0
15.2	4.9
15.3	4.9
15.4	4.8
15.5	4.8
15.6	4.7
15.7	4.7
15.8	4.6
15.9	4.6
16.0	4.6
16.1	4.4
16.2	4.4
16.3	4.3
16.4	4.3
16.5	4.2
16.6	4.2
16.7	4.1
16.8	4.1
16.9	4.0
17.0	4.0
17.1	4.0
17.2	3.9
17.3	3.9
17.4	3.9

Depth	Porosity
17.5	3.8
17.6	3.8
17.7	3.8
17.8	3.8
17.9	3.7
18.0	3.7
18.1	3.7
18.2	3.6
18.3	3.6
18.4	3.6
18.5	3.4
18.6	3.4
18.7	3.4
18.8	3.4
18.9	3.3
19.0	3.3
19.1	3.3
19.2	3.2
19.3	3.2
19.4	3.2
19.5	3.1
19.6	3.1
19.7	3.1
19.8	3.1
19.9	3.0
20.0	3.0
20.1	3.0
20.2	3.0
20.3	2.9
20.4	2.9
20.5	2.9
20.6	2.9
20.7	2.8
20.8	2.8
20.9	2.8
21.0	2.8
21.1	2.8
21.2	2.7
21.3	2.7
21.4	2.7
21.5	2.7
21.6	2.6
21.7	2.6
21.8	2.6
21.9	2.6
22.0	2.6
22.1	2.4
22.2	2.4
22.3	2.4
22.4	2.4
22.5	2.3
22.6	2.3
22.7	2.3
22.8	2.3
22.9	2.2

Depth	Porosity
23.0	2.2
23.1	2.2
23.2	2.2
23.3	2.2
23.4	2.1
23.5	2.1
23.6	2.1
23.7	2.1
23.8	2.0

APPENDIX 08

Leachate Monitoring Schedule

Whinney Hill - Leachate Management Plan - September 2020
System Monitoring Requirements for 2021 onwards

Phase	Monitoring Point	Parameter	Frequency	Action Limit	Trigger Limit
Phase 1 (Cells 1 - 3)	WH/LW08/01b, WH/LW08/02, WH/LW08/03, WH/LW08/04, WH/LW08/05, WH/L3/1, WH/L3/2, WHL3/3 and WH/L3/4	Dip to Leachate (m), Dip to Base (m)	Quarterly	Cells 1 - 2: 147mAOD Cell 3: 145.5mAOD	Cells 1 - 2: 148mAOD Cell 3: 146mAOD
Phase 1 (Cells 1 - 3)	WH/LW08/02, WH/LW08/04, PC2 and PC8	ammN, chloride, pH, EC and COD	Quarterly	Internal action limits for ammN and COD	n/a
Phase 1 (Cells 1 - 3)	WH/LW08/02, WH/LW08/04 and PC2	Quarterly plus Annual suite	Annually	n/a	n/a
Phase 1 (Cells 1 - 3)	WH/LW08/02, WH/LW08/04 and PC2	Targetted Hazardous Substances	Every 4 Years	n/a	n/a
Phase 2 (Cells 4 - 8)	LMP6A and LM6/1	Dip to Leachate (m), Dip to Base (m)	Monthly	1.5m head	3m head
Phase 2 (Cells 4 - 8)	LM4/3R and LM4/4R	Dip to Leachate (m), Dip to Base (m)	Quarterly	140mAOD	144mAOD
Phase 2 (Cells 4 - 8)	LM5/1, LM5/2, LM5/3, LM5/4	Dip to Leachate (m), Dip to Base (m)	Quarterly	well specific at 2m head	147mAOD
Phase 2 (Cells 4 - 8)	LM7/1, LM7/2, LM7/3, LM7/4, LM7/5 and LM7/6	Dip to Leachate (m), Dip to Base (m)	Quarterly	well specific at 2m head	142mAOD
Phase 2 (Cells 4 - 8)	LM8/1, LM8/2, LM8/3 and LM8/4	Dip to Leachate (m), Dip to Base (m)	Quarterly	138mAOD	144mAOD
Phase 2 (Cells 4 - 8)	LMP4, LMP5B, LMP6A, LM7/1, LMP7/2, LMP7/3, LMP8/1 and LMP8/2	ammN, chloride, pH, EC and COD	Quarterly		
Phase 2 (Cells 4 - 8)	LMP4, LMP5B, LMP6A, LM7/1, LMP7/2, LMP7/3, LMP8/1 and LMP8/2	Quarterly plus Annual suite	Annually	n/a	n/a
Phase 2 (Cells 4 - 8)	LMP4, LMP5B, LMP6A, LM7/1, LMP7/2, LMP7/3, LMP8/1 and LMP8/2	Targetted Hazardous Substances	Every 4 Years	n/a	n/a
Phase 1 and Phase 2	Leachate Extraction Wells (with electrical pumps)	Extraction Rate (as hrs run / pump rate)	Weekly	n/a	n/a
Phase 1 and Phase 2	Leachate Discharge Point (prior to LTP Build)	pH, electrical conductivity, ammoniacal-N, chloride, COD, suspended solids, phosphate	Monthly	Internal action limits for ammN and COD	TEDC limits for discharge
Phase 1 and Phase 2	Leachate Discharge Point (prior to LTP Build)	as monthly plus: metals suite, sulphate, sulphide	6 Monthly		TEDC limits for discharge
Phase 1 and Phase 2	Leachate Discharge Point (prior to LTP Build)	as six monthly plus selected organic substances for assessment against TEDC	Annually		TEDC limits for discharge
Phase 1 and Phase 2	Leachate Discharge Point (prior to LTP Build)	Volume removed	Daily and Monthly Totals	n/a	n/a

APPENDIX 09

Contingency Action Plan

Whinney Hill Landfill: Leachate Management Plan
Contingency Action Plan

Purpose and Scope

Routine leachate monitoring of a site is a critical activity to ensure that the leachate levels on site are known and risks appropriately managed.

This Action Plan has been written to ensure that SUEZ's management and aftercare personnel have clear actions to take on recording a leachate level exceedance during routine monitoring visits/data analysis at Whinney Hill against the stated Action Levels and Compliance Limits set out in this Management Plan.

Action Plan Procedure

In the event of an exceedance of a leachate head action or compliance level proposed within the 2020 HRA and Leachate Management Plan, SUEZ will respond by implementation of the following actions as detailed in the table below.

Contingency Actions		Response Time	Following exceedance of a	
			Action Level	Compliance Limit
1	Notify Site Management, Technical Team and EIR Team.	24 hours	✓	✓
2	Review existing management systems monitoring information including leachate head changes, pumping volumes, system performance and associated works on site.	4 days	✓	✓
3	Notify Environment Agency of findings via a Schedule 5 Notification Part A Form	5 days		✓
4	Review site management and operations and implement actions to address any future exceedance of a management level.	7 days	✓	✓
5	Review the assumptions incorporated into the site water balance/leachate production rates/leachate extraction rates	7 days	✓	✓
6	Identify timescale for reduction of head(s) to maintain leachate elevations at or below Action Levels.	7 days	✓	✓
7	Update Environment Agency of findings via a Schedule 5 Notification Part B Form	14 days		✓
8	Review (as required) the existing LMP, HRA Review, action and compliance levels with regards to change in risks and timescales for management of elevated leachate heads. If risks are unacceptable set in place procedures for implementing corrective measures in consultation with the Environment Agency.	3 months		✓

APPENDIX 10

Maintenance Schedule

Whinney Hill LMP - Inspection and Preventative Maintenance Management Plan
for 2021 onwards - to be revised post installation of the LTP

Ref	Element	Sub Element	Interval	Fault (if Found)	Corrective Action
1	Pump System	System SCADA	Daily	As identified on the SCADA: pump fault / high level alarm / pump off	On day: As directed by the Site Manager supported by on site team and external contractors as required
1	Leachate Lagoon	Visual Inspection of Aerators	Daily	No aeration	On day: As directed by the Site Manager supported by on site team and external contractors as required to restart aeration system
1	Leachate Lagoon	Visual Inspection of Lagoons for Foam	Daily	Excess foam on lagoon surface	On day: As directed by the Site Manager supported by on site team and external contractors as required to review dosing rates of anti-foam against loads and flows through the lagoon
1	Leachate Lagoon	Check on status / settings for No1 Transfer Pump	Daily	No pump discharge	On day: As directed by the Site Manager supported by on site team and external contractors as required
1	Leachate Lagoon	Visual Inspection of Level	Daily	High Level in Lagoon	On day: As directed by the Site Manager supported by on site team and external contractors as required to reduce inflows into lagoon / increase outflows
1	Leachate Discharge	Check autosampler is working, clean V notch weir plate and record daily flow / quality	Daily	Autosampler off line	On day: As directed by the Site Manager supported by on site team and external contractors as required to obtain quality samples
2	Well Head	Well Head	Weekly	Damage / Loss of Gas Tightness to Well Head	On day: Affect an immediate temporary repair where possible. Agree the permanent solution/repair within 48 hours. Complete permanent repair within timescales agreed with SUEZ Management Team.
2	Well Head	Well Head Top Connections	Weekly	Loose connections / loss of gas pressure	On day: Affect an immediate temporary repair where possible. Agree the permanent solution/repair within 48 hours. Complete permanent repair within timescales agreed with SUEZ Management Team.
2	Well Head	Air Regulator / Control Panel	Weekly	Loss or leakage of air pressure	On day: Replace regulator from on-site spares
2	Well Head	Cycle Counter / Hours Run Meter	Weekly	Loss or leakage of air pressure	Within 48hrs: Replace cycle counter from on-site spares
2	Well Head	Exhaust Line/Vent	Weekly	Continuous leakage of air pressure	Within 48 hrs: Arrange for and remove pump to identify fault and / or install replacement pumping unit
2	Well Head	Well ID	Weekly	Well ID not legible	Within one month: replace Welll ID label
2	Well Head	Manual Isolation Valves	Weekly	Visual evidence of leachate leakage from valve or pipework elbows	Immediately: isolate well and identify element of leakage. Within 48hrs: replace valve unit.
2	Leachate Storage Tank	Inflow Pipelines	Weekly	Visual evidence of leachate leakage from pipework	On day: isolate leak and repair leachate line as soon as is practically possible. Where required, follow SUEZ P+P for leachate spill
2	Air Compressor and Blowers	Compressor Running	Weekly	Loss of air pressure	On day: Attempt on site restart checks / contact specialist service provider (SAS)
2	Air Compressor and Blowers	Noise Check	Weekly	Warning of mechanical failure	On day: Attempt to identify cause of noise and rectify / contact specialist service provider (SAS)
2	All Locks	All Locks	Each check	Lubricate lock or replace lock	On day: apply oil / replace lock
2	Air Compressor	Air Pressure Within Limits	Weekly	Loss of air pressure / over pressurisation of system	On day: Contact specialist service provider (SAS)
3	Well Head	Manual Isolation Valves	Monthly	Valve stuck in position	Within one week: replace valve unit
3	Leachate Well Field Pump	Pump Exchange/Service Review	Monthly	Preventative Maintenance Only	Review well field performance to identify monthly pump exchange and service programme.
3	Lateral Air Lines	Visual / Audible Leakage Check	Monthly	Visual / audible evidence of air leakage	On day: isolate leak and repair air line as soon as is practically possible
3	Lateral Leachate Lines	Visual Leakage Check	Monthly	Visual evidence of leachate leakage from pipework	On day: isolate leak and repair leachate line as soon as is practically possible. Where required, follow SUEZ P+P for leachate spill
3	Air Compressor	Oil Level Check	Monthly	Preventative Maintenance Only	On day: refill oil level as required
3	Air Compressor	Run Hours	Monthly	Preventative Maintenance Only	On day: Contact specialist service provider (SAS)
4	Air Compressor	PPM Service	Quarterly	Preventative Maintenance Only	On day: Contact specialist service provider (SAS)
5	Leachate Lagoon	Desilting Assessment	Six monthly	Preventative Maintenance Only	Structured PPM workflow on desilting of lagoon until replaced by LTP
6	Lateral Leachate Lines	Automated Isolation Valves	Annually	Failure of valve to operate	Within two weeks: Arrange for valve replacement with external contractor
6	Leachate Discharge Point	Calibration of V Notch Weir	Annually	Preventative Maintenance Only	Undertaken by external party

The interval of inspection stated above reflects the risks and associated management approach for Definitive Closure, noting the risks will evolve with time with the inspection regime being updated accordingly

APPENDIX 11

Gas Management and Stability

Impact of Leachate Level Changes on Gas Management

In looking to revise the leachate heads in the base of the site, there will be a reduction in the thickness in the unsaturated zone of the waste mass in this area of the site by between 0.1m and 4.60m from current trigger levels to future trigger levels (noting that for some cells no increase is proposed, resulting in an average change to trigger level across the site of 1.06m). This can be compared to the residual thickness of unsaturated waste above the current consented levels which range between circa. 12m and >35m, averaging at no less 20m of waste across the whole Phase 2 site. For leachate levels to be maintained at the revised "action" levels, the resulting waste mass within the engineered lining system will comprise:

- <8.9m of saturated waste at the base of the site; and
- On average, >20m of unsaturated waste from which gas will continue to be effectively captured and pumped down to the site power generation compound.

Having due regard to the site's Gas Management Plan and Perimeter Gas Risk Assessments (updated in 2021), the site's HRA (updated in 2021) and the site's Leachate Management Plan (updated in 2021), SUEZ has provided a qualitative assessment of the change in leachate levels in the base of the engineered landfill and any possible change in the performance of the site's Gas Collection System as follows:

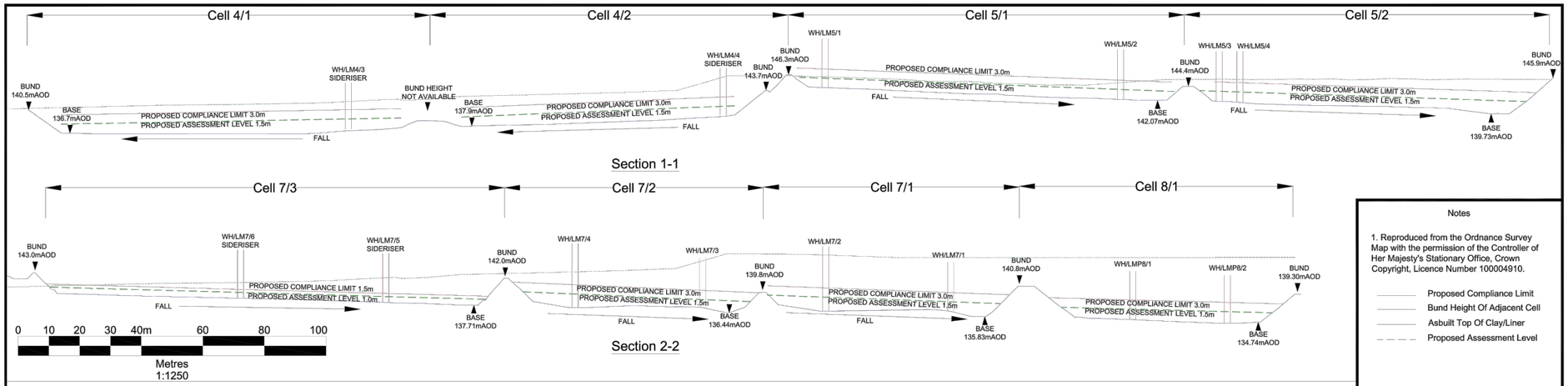
1. The maximum change in trigger elevations within the site is by +4.6m.
2. In protecting the base of the landfill and ensuring landfill gas management is focused on the higher yielding upper areas of the waste mass, the site's extensive landfill gas collection system extends down to be close to the base of the site. Having due regard to the thickness of unsaturated waste at the site, no loss in the performance of the landfill gas system would occur as the >90% of the thickness of the landfill gas wells remain above the highest future permitted level for leachate within the site, with this infrastructure drawing gas from upper 20m of waste within the engineered landfill.
3. The site has been capped wherever possible with either permanent or temporary capping – with capping providing the most effective mechanism to control any gas odour release at a site.
4. There has been no evidence of unexpected or anomalous hydrogen sulphide release, foaming of wells, odour condensate or reduced landfill gas extraction as a result of changes in leachate levels with time within the site. During occasional periods of higher leachate heads (as a result of pump failure etc), there has been no evidence of unexpected or anomalous hydrogen sulphide release, foaming of wells, odour, condensate or reduced landfill gas extraction
5. Having due regard to future waste inputs and types into the site, the site's gas production is either at its peak or has recently passed its peak production rate, and any (very small/diminimus) change in gas production that could occur from the requested change in leachate heads in the base of the site would be managed within the residual capacity of the site's gas infrastructure.

It is recognised that waste placed at the base of the site will have been subject to the highest degree of compaction and consolidation over time within the site. As such, the potential for the basal waste to yield significant quantities of landfill gas or odour are lower from this waste in response to wetting or drying the waste mass when compared to wastes higher up in the site's profile. This is consistent with the recognised understanding in the industry of waste hydraulics and properties within UK landfills.

Impact of Leachate Level Changes on Engineering Stability

An update / review of the site's Capping Stability Risk Assessment (SRA) was submitted by SUEZ in 2020. Given the high factors of safety used in this assessment it has been assessed that the proposed increase in leachate level would have not have any detrimental effect on stability in the short, medium- or long-term risk scenarios considered by SUEZ.

DRAWINGS



Notes

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- Proposed Compliance Limit
- Bund Height Of Adjacent Cell
- Asbuilt Top Of Clay/Liner
- Proposed Assessment Level

Rev	subject	date

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Site: Whinney Hill Landfill Site

Title: Sections Through Cell Basals

Scale: As Shown @ A3

Date: March 2017

Drawing Ref: Wnh-BASE-0317-01 (Sheet 1 of 2)

Drawn by: RB

Checked by: ML

NOTES

INFORMATION SHOWN BASED ON DRAWINGS SUPPLIED BY SUEZ, 'Wnh-BASE-0317-01 (sheet 1 of 2)-A3'

Revision	By	Chk'd By	Date	Comments
I0	DPB	DJ	09/2020	

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WHINNEY HILL ROAD LANDFILL
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Project
LEACHATE MANAGEMENT PLAN

Drawing Title
CELL BASE DETAILS 1

Scale

Date
SEPTEMBER 2020

Drawing Number
401.00079.10010.11.001.0

Revision
I0

FOR INFORMATION

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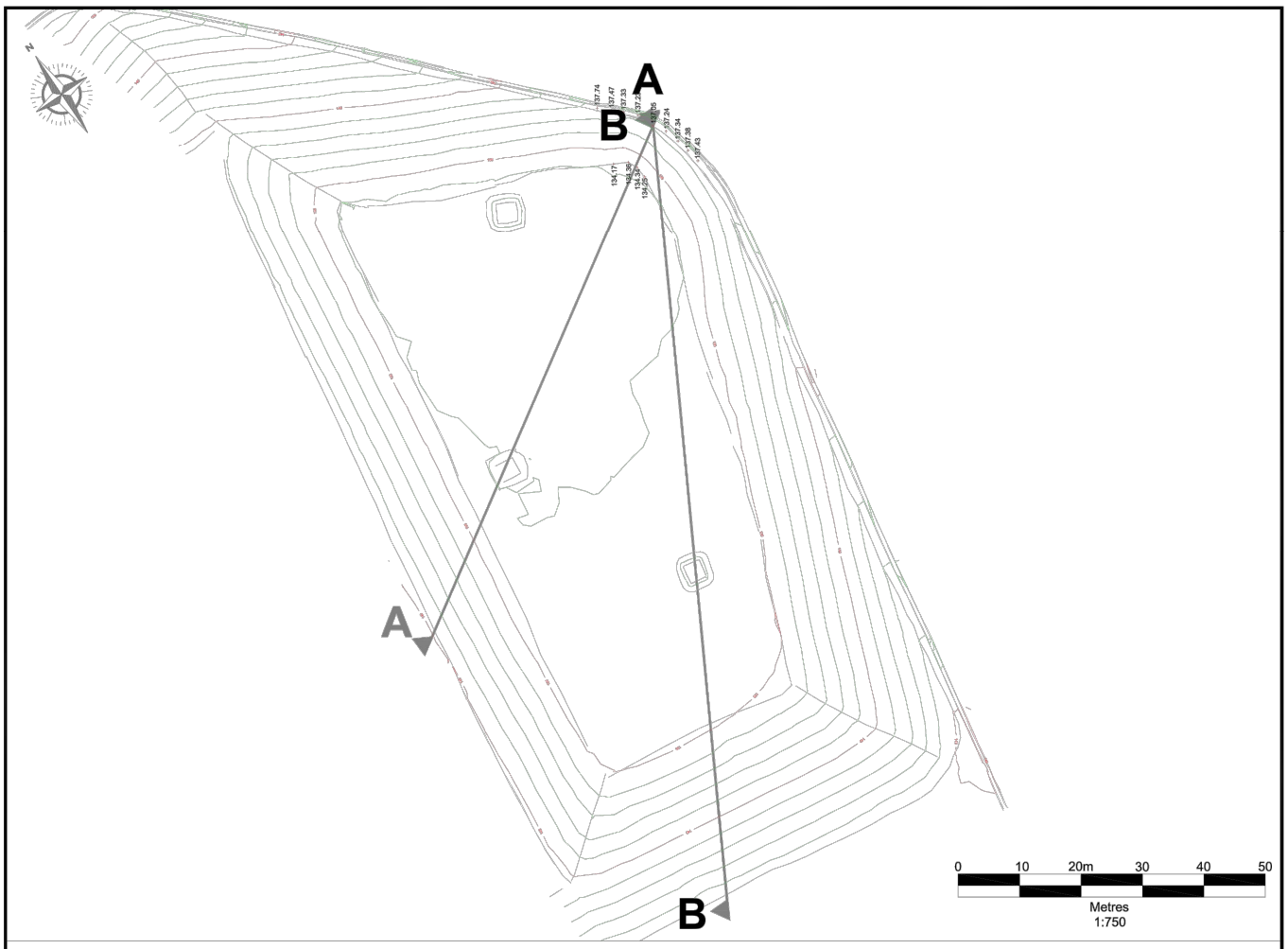
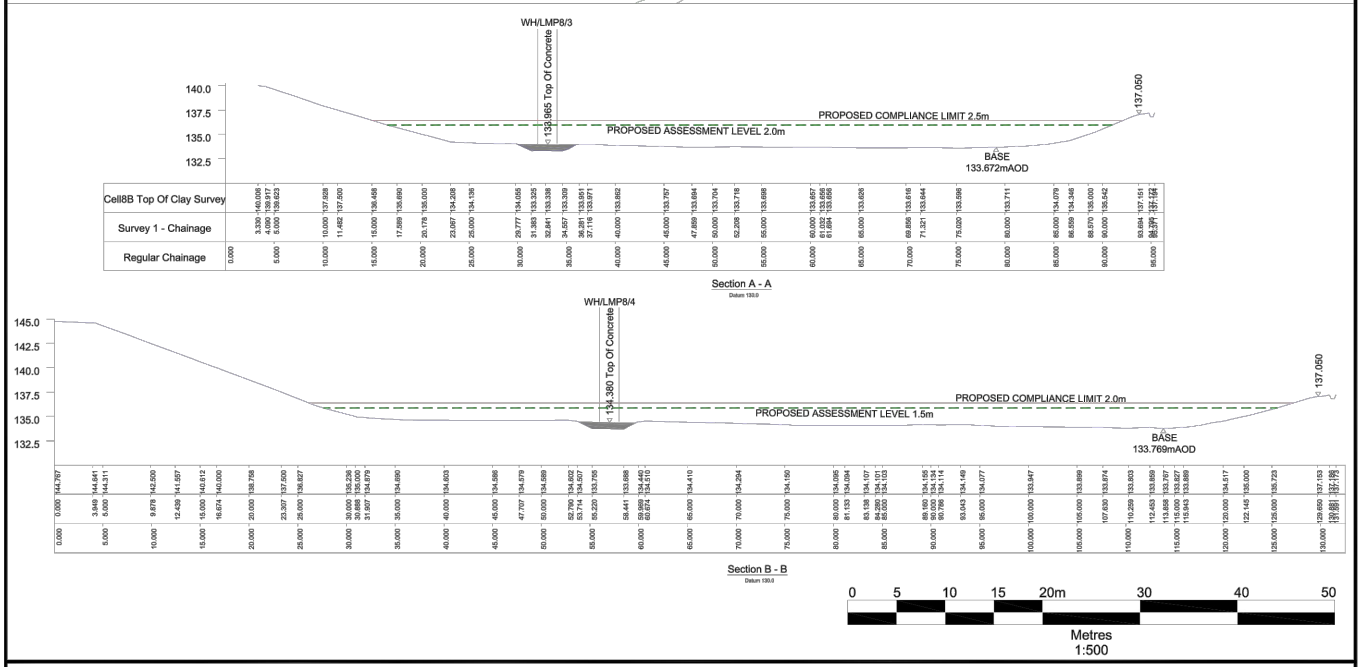
NOTES

INFORMATION SHOWN BASED ON DRAWINGS SUPPLIED BY SUEZ, 'Wnh-BASE-0317-01 (sheet 2 of 2)-A3'





Notes

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Proposed Compliance Limit
Proposed Assessment Level
Asbuilt Top Of Clay/Liner

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Title: Sections Through Cell 8b Asbuilt Base	Date: March 2017	Checked by: ML	
	Drawing Ref: Wnh-BASE-0317-01 (Sheet 2 of 2)		

Revision	By	Chk'd By	Date	Comments
I0	DPB	DJ	09/2020	

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LEACHATE MANAGEMENT PLAN

Drawing Title
CELL BASES DETAILS 2

Scale

Date
SEPTEMBER 2020

Drawing Number
401.00079.10010.11.002.0

Revision
I0

FOR INFORMATION

401.00079.10010.11.002.0.dwg

NOTES

INFORMATION SHOWN BASED ON DRAWINGS SUPPLIED BY SUEZ, 'Drawing 03'

Site	Scale	Drawn by	Rev	subject	date
Whinney Hill Landfill Site	1:3000 @ A3	RB	A	Alterations To Existing Service Routes	July 2019
Title: Existing Services Plan (Leachate, SW, BT & Domestic Water)	Date: June 2019; Drawing Ref: Wnh-SERV-0619-01A	Checked by: ML			

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I0	DPB	DJ	09/2020	

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Project
LEACHATE MANAGEMENT PLAN

Drawing Title
CURRENT LEACHATE MANAGEMENT SYSTEMS

Scale

Date
SEPTEMBER 2020

Drawing Number
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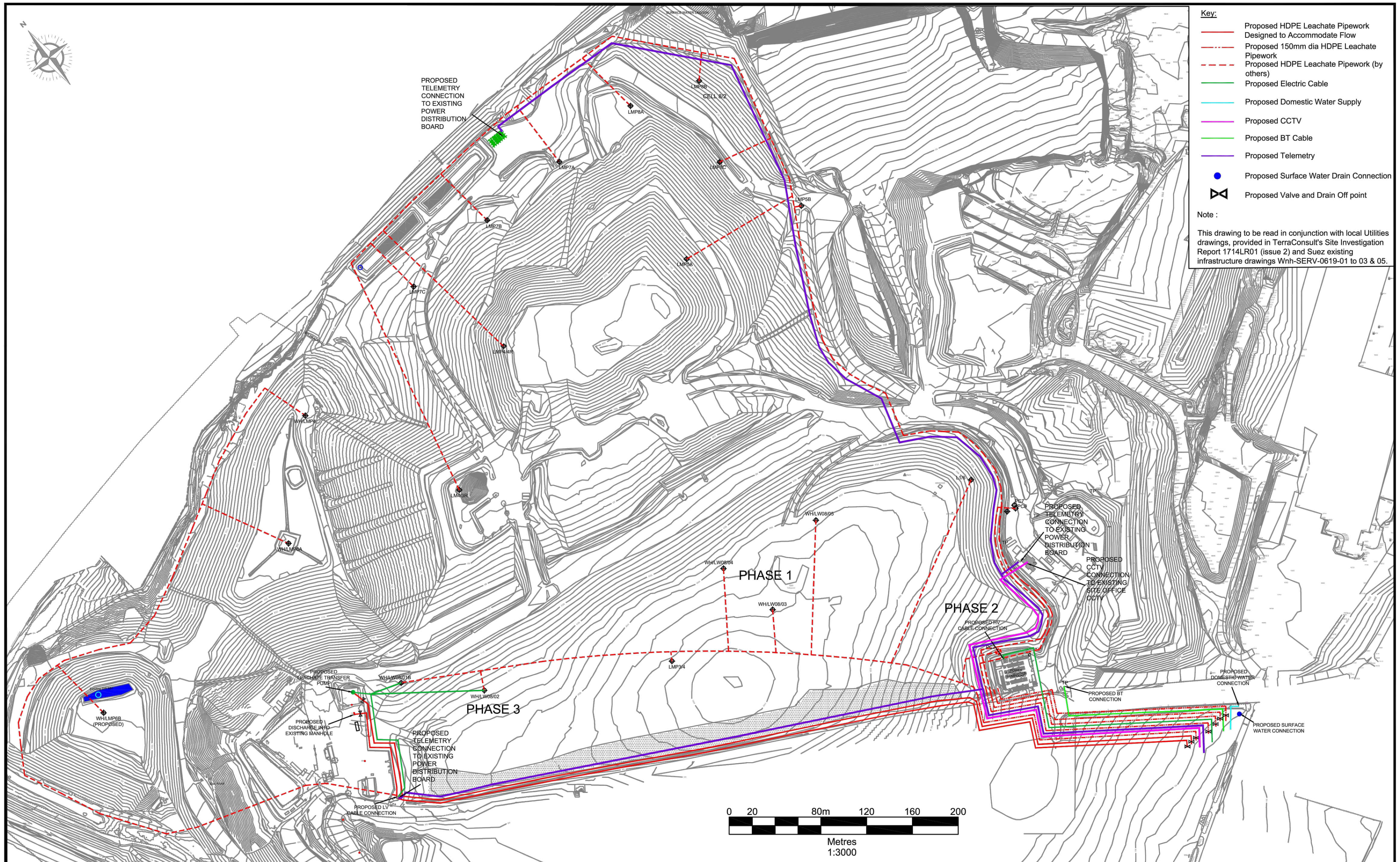
NOTES

INFORMATION SHOWN BASED ON DRAWINGS SUPPLIED BY SUEZ, 'Drawing 04'



Site	Scale	Drawn by	Rev	subject	date
Whinney Hill Landfill Site	1:3000 @ A3	RB	A	Alterations To Proposed Service Routes	July 2019
Title: Proposed Services Plan	Date: June 2019	Checked by: ML			
	Drawing Ref: Wnh-SERV-0619-04a				

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I0	DPB	DJ	09/2020	
Revision	By	Chk'd By	Date	Comments

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Drawing Title
PROPOSED LEACHATE MANAGEMENT SYSTEMS

Scale

Date
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Drawing Number
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Revision
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