| | |
|---|---|
| **IN THE MATTER** | of the Resource Management Act 1991 |
| **AND** | |
| **IN THE MATTER OF** | a review of resource consent conditions under 128 of the Resource Management Act 1991 by the Manawatu-Wanganui Regional Council |
| **AND** | |
| **IN THE MATTER OF** | an application for change of consent conditions under section 127 of the Resource Management Act 1991 |
| **BY** | **HOROWHENUA DISTRICT COUNCIL**<br><br>**Consent Holder** |

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**STATEMENT OF EVIDENCE OF PHILLIP SVERRE LANDMARK (DESIGN/OPERATIONS) ON BEHALF OF THE CONSENT HOLDER**

2 September 2016

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**TABLE OF CONTENTS**

**EXECUTIVE SUMMARY**

1. My name is **Phillip Sverre Landmark.**

2. I am a Senior Civil Engineer employed by MWH New Zealand Ltd, now a part of Stantec.

3. My evidence is given in relation to the review of resource consent conditions initiated by Horizons Regional Council ("**Horizons**") and the application for change of consent conditions by Horowhenua District Council ("**HDC**") in relation to the Levin Landfill located at 665 Hokio Beach Road (the "**Landfill**").

4. My evidence provides an overview of the history of the Landfill, as well as the old unlined landfill, which is now closed. The new landfill was constructed with a multi-layer liner and leachate collection system to prevent to prevent leachate from entering the surrounding environment, and a pumped leachate disposal system has since been developed and implemented at the Landfill.

5. The Landfill is run by EnviroWaste Services Ltd acting as subcontractors to Midwest Disposals Ltd and is managed in accordance with the Landfill Management Plan ("**LMP**"), as required by condition 14 of Discharge Permit 6009. There are numerous operational requirements explained in detail in my evidence, with one important requirement being the acceptance of certain types of waste to the Landfill.

6. The Landfill is designed and consented to accept general domestic and commercial waste, and may also accept some other types of waste where it meets acceptance criteria established by the LMP. Special waste and hazardous permits may also be issued by HDC where necessary for disposal of waste that is not general domestic or commercial waste, but which still meets the acceptance criteria permitted under the LMP. Additionally, some types of waste are considered unsuitable or are completely prohibited from being disposed of at the Landfill due to the threat they pose to people or the environment. Procedures are in place to detect and deter illegal disposal of wastes, or to remove illegal waste identified after disposal.

7. My evidence also describes the history of the Tatana Drain. My understand is that the drain was required by a 1998 Horizons decision following a hearing on the Landfill consents, and I consider the drain was either deepened or was already in existence in its present state at the time of that decision. Therefore I consider that it must have been agreed and intended between Horizons, HDC, and the landowner that this drain would serve the purpose of the condition as it was, or alternatively that the drain should be deepened to serve that purpose.

**[QUALIFICATIONS AND EXPERIENCE**

8. I have the following qualifications and experience relevant to the evidence I shall give:

   (a) B.Sc.Engineering (Civil);

(b) Chartered Professional Engineer in the fields of Civil and Environmental Engineering (Registration No. 236629);

(c) International Professional Engineer (Registration No. 236629);

(d) I have twenty-five years of engineering consulting experience, of which twenty-one years has been spent focussing on the design, development and operation of solid waste management infrastructure, including landfills; and

(e) I am a member of the Waste Management Institute of New Zealand (WasteMINZ) – corporate member through MWH New Zealand Ltd.

9. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

**BACKGROUND AND ROLE**

10. In preparing my evidence I have:

(a) drawn on information derived from numerous site visits to the Landfill carried out over the past nineteen years (I have been to site well over 50 times in that period);

(b) reviewed information obtained from various reports concerning aspects of the Landfill with which I have been involved over the same time period, including the Landfill Management Plan, waste compaction density assessments, modelling of waste disposal options, report on water quality in the Tatana Drain, and Levin Landfill Annual Report 2015/2016,

(c) read the 1998 decision on the resource consent application;

(d) reviewed the decisions and reports prepared for the previous resource consent review;

(e) read the Notice of Review dated 30 October 2015;

(f) read HDC's response to the Notice of Review dated November 2015;

(g) read the application to change or cancel conditions of consent under section 127 of the RMA; and

(h) read the s42A reports prepared by Horizons officers.

11. I have been involved with various aspects of the Landfill from 1997 through to the present day. During this period I have provided professional consulting services to HDC on a range of matters, including the following:

(a) re-designing the shape of the old landfill so as to shed stormwater to the centre of the Landfill site property;

(b) preparing an Assessment of Environmental Effects for the application for a resource consent to discharge stormwater to ground;

(c) detailed design of all stages of the new, lined landfill (Stages 1A, 2, 3A, 3B and 3C);

(d) procuring construction contracts for all stages of the new, lined landfill; contract administration, construction monitoring and acting as Engineer to the Contract;

(e) providing technical advice to HDC on operational matters including the 2009 – 2010 resource consent review;

(f) assessing the compaction density of the Landfill for annual reports, and carrying out annual financial liability assessments for various years;

(g) carrying out financial modelling of waste disposal options and solid waste activity cashflows, including the future use of the Landfill;

(h) reviewing the quarterly and annual environmental monitoring reports for a number of years;

(i) leading a project that prepared a tender for a landfill gas flare and evaluating tender submissions; and

(j) carrying out financial modelling of options to either install a landfill gas flare, or not, taking account of capital development costs and the costs of Emissions Trading Scheme charges.

**SCOPE OF EVIDENCE**

12. My evidence addresses the following matters:

(a) overview of the Landfill design and all key component parts,

(b) day to day operations at the Landfill;

(c) Tatana drain;

(d) comment on the s42A report of Mr. Standen.

**OVERVIEW OF THE LANDFILL DESIGN**

13. The Landfill consists of the old, unlined landfill which was closed in 2004, and the new, lined landfill where disposal operations commenced in May 2004.

**The Old, Unlined Landfill**

*Site History*

14. The 2010 resource consent review decision provides a brief history of the Landfill site. I understand it was established in the 1950's in an inter-dune depression. When this became filled to capacity (around 1975) a new landfill was established in an adjoining depression. Both landfills were unlined, as was the practice in those days, and it was only in the early 1990's, with the introduction of the Resource Management Act 1991, that more rigorous environmental controls began to be implemented in New Zealand.

15. The old, unlined landfill consisted of at least two areas which are shown approximately on an aerial photograph (refer to **Figure 1** in **Appendix 1**) based on a drawing which was referred to as "Figure 2" in the May 2002 resource consent order, and which is reproduced below. I am not aware of the exact boundaries of the old landfill since much of it was closed and covered with vegetation when I first was involved at the site in August 1997. I am also not aware of any survey that clearly defines the boundaries of the old landfill, especially that area designated as "Area 2" in **Figure 1**.

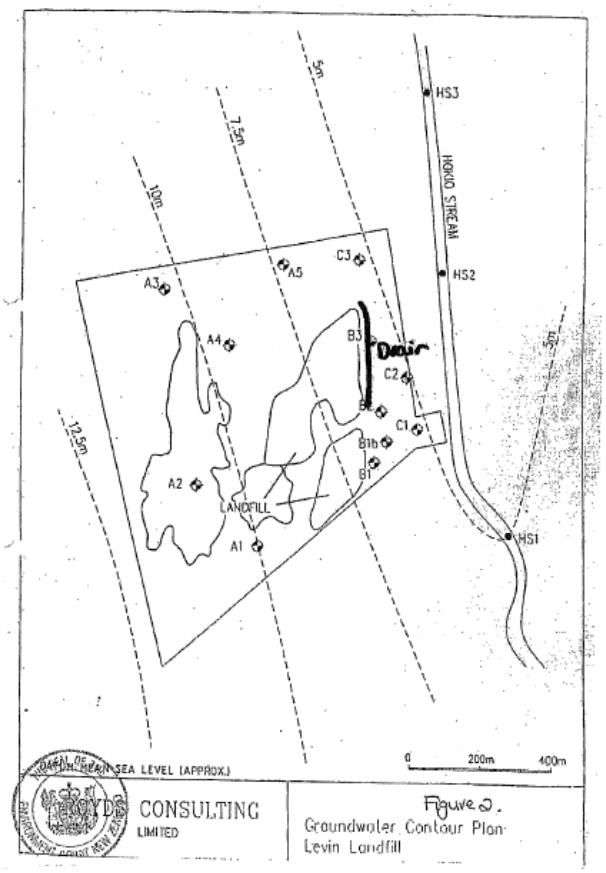



Figure 2 from 2002 resource consent order.

16. Other facilities that existed on site at that time are shown in **Figure 1** and included: an access road sealed up to the office and workshop; a weighbridge and kiosk (unused

after 11 August 2004); a concrete greenwaste drop-off pad; the borrow pit area; and a hazardous goods container.

17. Offal pits used to be located in Area 2 up until at least 2000, based on aerial photographs. I think, but cannot be certain, that they had been relocated to Area 1 by about 2001.

18. Area 2 was remediated by the application of sand cover (as was required by the original resource consent conditions), and has subsequently been planted with trees. I understand that Area 2 was also used after 2001 for the disposal of waste materials such as large tree trunks which could not easily be placed within the landfill.

19. When I first got involved with the Landfill in 1997, Area 1 of the old landfill was still being landfilled. At that time the top surface of the Landfill was shaped in such a manner that much of the stormwater falling on the top surface was shed to the north and towards the property of Mr. Ivan Jones, who has since passed away. That property is now owned by the Tatana family.

20. One of my first roles was to re-design the shape of the Landfill to shed most of the stormwater to an inter-dune depression marked as “SW1” on the attached **Site Plan** (refer to **Appendix 2**). The re-shaping of the north-western end of Area 1 was carried out progressively between 1997 and 1998, with landfilling continuing over the rest of Area 1 until 2004.

21. Waste disposal operations ceased in Area 1 in May 2004 following the commissioning of Stage 1A of the new, lined landfill. Area 1 was remediated in 2004 and 2005 by capping it with sand and planting it with grass, as required by the consent conditions in place at the time. Pine trees were subsequently planted over the north-western part of the Landfill surface. The south-eastern half of Area 1 was capped with a weathered quarry overburden which comprised of some silts and clays.

22. The capping of Area 1 was raised as an issue in the 2009 – 2010 review. Test pit investigations had shown the old landfill had not been capped to the full depth and the consent conditions were amended to require the pine trees to be removed, and the full extent of capping (700mm depth) to be provided with the balance of materials being made up with clayey materials. This was completed in 2010 / 2011. **Photograph 1** (attached in **Appendix 3**) shows this construction in progress.

**The New Lined Landfill**

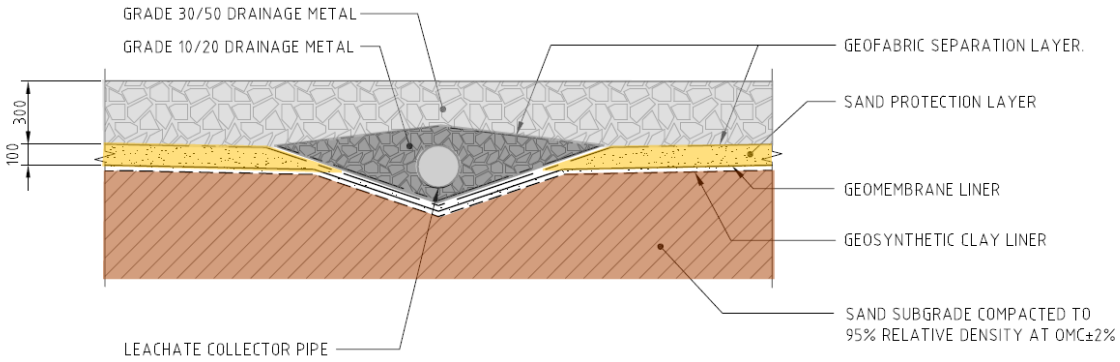
*Landfill Stages*

23. The new, lined landfill presently encompasses the area shown in **Figure 2** (see attached in **Appendix 1**). It currently consists of Stages 1A, 2, 3A and 3B. Stage 3C is due to be constructed later this year.

*Landfill Liner System*

24. The liner system at the Landfill has two separate configurations, one for the flat base of the Landfill, and one for the lateral side slopes. **Figure 3** below shows the basal liner system.

**Figure 3**: Diagrammatic section of the basal liner system at Levin Landfill



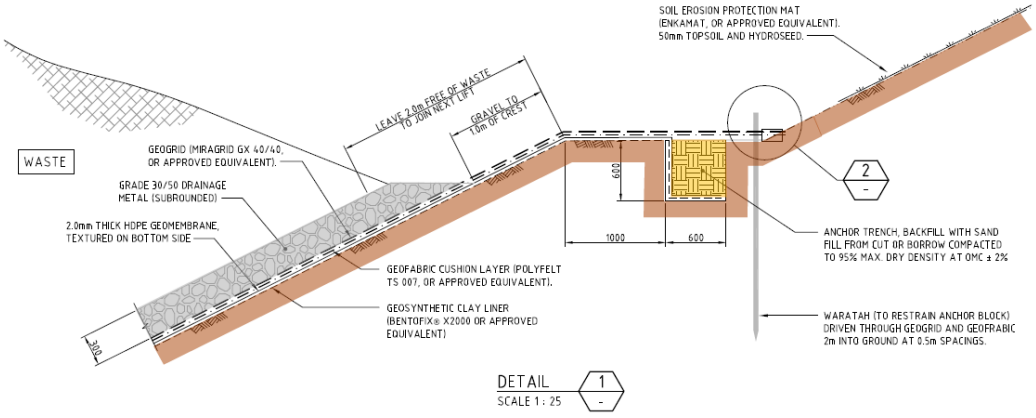

25. It consists of the following layers which have different functions, as detailed in **Table 1** below. Layers are described from top to bottom.

**Table 1**: Description of the basal liner system at Levin Landfill

| Layer | Thickness | Function |
|---|---|---|
| Gravel drainage layer | 300mm | Leachate drainage and liner protection |
| Geofabric | ± 2mm | Separate gravel from sand underneath |
| Sand protection layer | 100mm | Protect the geomembrane from mechanical damage |
| HDPE geomembrane | 2mm | Primary leachate barrier |
| Geosynthetic clay liner | ± 6mm | Secondary leachate barrier |
| Compacted sand subgrade | Varies | Foundation for landfill liner |

26. The configuration of the side slope liner system is shown in **Figure 4** below. It needs to be different to the basal liner because a sand protection layer will stay on the side slopes and will be eroded by stormwater and wind. The configuration shown varies from that prescribed in the current consent conditions, as has been agreed with Horizons. It is proposed to amend the consent conditions to reflect this change.

**Figure 4**: Diagrammatic section of the side slope liner system at Levin Landfill




27. **Table 2** below describes the different layers and their functions from the top down.

**Table 2**: Description of the side slope liner system at Levin Landfill

| Layer | Thickness | Function |
|---|---|---|
| Sub-rounded gravel drainage layer | 300mm | Leachate drainage and liner protection |
| Geogrid | 2mm | Support the leachate drainage layer |
| Geofabric | ± 6mm | Protect the geomembrane from mechanical damage |
| HDPE geomembrane | 2mm | Primary leachate barrier |
| Geosynthetic clay liner | ± 6mm | Secondary leachate barrier |
| Compacted sand subgrade | Varies | Foundation for landfill liner |

28. **Photographs 2** and **3** in **Appendix 3** show the completed side slope liner constructed in Stage 1A with waste already having been placed on the base.

29. **Photographs 4** and **5** in **Appendix 3** show the construction of the liner in Stage 3A which was done in a different benched manner.

*Landfill Liner Materials*

30. The barrier portion of the liner systems - those layers which prevent leachate from entering the surrounding environment - consists of the geosynthetic clay liner (GCL) overlain by a high density polyethylene (HDPE) plastic.

31. The GCL is about 6mm thick and consists of bentonite powder enclosed between two layers of geotextile material. On contact with the underlying soil the bentonite hydrates and swells, creating an impermeable barrier.

32. On top of the GCL is placed the HDPE liner which is textured underneath to grip onto the GCL, but smooth on top, to allow material to slip off it and so reduce the amount of

tension (stress) going into the liner system. The HDPE liner is 2mm thick which is more than that required in the consent condition (1.5mm).

*Quality of Liner Materials*

33. The quality of materials used in the landfill liner system and the manner in which it is constructed are extremely important to ensure that the liner system performs as intended. Mechanical damage during construction is the main way in which holes can occur in the liner.

34. Good quality GCL and HDPE materials are used on site by specifying that they meet industry standards such as GRI-GM13 specification for geomembranes and specific products for the GCL.

*Construction of Liners*

35. The manner in which the liner system is constructed is specified in construction contract documents. All liner materials are installed by specialist sub-contractors who have proven experience. **Photographs 6** and **7** in **Appendix 3** show liners being installed in Stage 1A.

36. The specifications require the contractor to provide extensive quality assurance documentation for both the manufacture and installation of the liner system.

37. GCL sheets are overlapped by 400mm with additional bentonite paste being added to the seam overlap – refer to **Photograph 8** in **Appendix 3**

38. HDPE sheets are joined together using a hot-wedge welder (see **Photograph 9** in **Appendix 3**). This joins the sheets in a double seam allowing the seam to be sealed at both ends, then pressure tested to confirm there are no leaks.

39. All HDPE panels are marked (see **Photograph 10** in **Appendix 3**) and a record made of which roll of geomembrane is used in which parts of the Landfill.

40. Placing sand protection and gravel drainage layers on top of the liner system is done with care to avoid damaging the liner. **Photographs 11** and **12** in **Appendix 3** show this operation being done in Stage 1A with vehicles working from a depth of sand or gravel to ensure that wheel and track loads are not concentrated on the liner.

*Integrity Testing of Liners*

41. A new liner integrity testing method was undertaken for Stage 3A. **Photograph 13** in **Appendix 3** shows the test being undertaken. I understand that this was the first time it had been done in New Zealand on a landfill liner. The system uses an electric dipole to establish whether or not electric current will earth to ground through holes in the liner, even as small as pin pricks. No holes were detected which confirmed the integrity of the liner system after it had been covered with the sand protection and gravel drainage layers.

*Commencing with Waste Disposal Operations*

42. Once landfilling commences in a new layer, selected waste is used to build up a “fluff layer” about 2 m thick at the base of the Landfill. The selected wastes avoid pieces of timber and metal and any other bulky wastes. **Photograph 14** in **Appendix 3** shows the start of filling operations in Stage 1A.

*Brief History of the Lined Landfill Development*

43. Stage 1A was constructed in 2004 (see **Figure 2** in **Appendix 1**), together with a leachate collection manhole, a rising main leading to the leachate pond (see **Photograph 15** in **Appendix 3**), and a pumped system which irrigated leachate to the top of forested sand dunes located to the east of the lined Landfill.

44. Between 2004 and 2006 HDC designed several in-house alterations to the leachate collection manhole and provided a leachate sump adjacent to the leachate pond.

45. In approximately 2006 alterations were made to the leachate distribution network to allow leachate to be re-circulated back into the body of waste within Stage 1A, and there were also several surface irrigators provided which allowed leachate to be sprayed onto the top of that stage. The re-circulation lines were designed to allow them to be converted to landfill gas collector lines at a later stage.

46. Stage 2 was constructed in 2007 (see **Photographs 16** and **17** in **Appendix 3**) with leachate from the stage being drained by gravity to the collection manhole.

47. Further leachate re-injection lines were constructed by EnviroWaste in Stage 2.

48. In 2009 a rising main was constructed to pipe the leachate from the leachate pond to connect to the pipe line that runs from the Levin Wastewater Treatment Plant (WWTP) to The Pot. The initial design was for the connection to be made at Hokio Sands Road, but prior to commissioning I understand that the HDC decided to extend the pipeline to connect to the Levin sewerage infrastructure so allowing the leachate to be directed to the WWTP.

49. Since 2009 no leachate has been irrigated to the sand dunes to the east of the new, lined Landfill.

50. A landfill gas flare was leased from EnviroWaste in 2012 for trial purposes. The intention was to test the capability of the landfill gas collection network in order to determine if flaring of the gas would be financially beneficial with respect to charges levied through the Emissions Trading Scheme. The flare was used between 2012 and early 2015. During the trial it was realised that the flare is not correctly sized for the current gas collection infrastructure, and a new one is needed. The trial gas flare was therefore discontinued from service. The use of the flare is discussed in Dr Boddy's evidence.

51. Stage 3A was constructed in 2013 with the leachate drainage system also connecting into the leachate collection manhole.

52. Stage 3B followed in late 2014 and Stage 3C will be completed this year.

53. In July 2016 the HDC commenced with the construction of a biofilter which will treat the landfill gas extracted from the leachate collection manhole. It will be commissioned later this year. The use of the biofilter is discussed in Dr Boddy's evidence.

## DAY TO DAY OPERATIONS AT THE LANDFILL

### Waste Contractor

54. HDC contracts out the Landfill operations to Midwest Disposals Ltd who, in turn, sub-contract the day to day running of the Landfill to EnviroWaste Services Ltd. The contract commenced in 2004 and, following various changes to the contract, it expires in 2021.

### Waste Contract

55. In terms of the contract agreement MWDL's responsibilities cover: receiving waste; providing weighbridge records; landfill operations; stormwater management; leachate management; erecting litter control fences; maintaining access roads; providing security and reporting. Development of the Landfill is the responsibility of HDC.

### Summary of Daily Operations

56. EnviroWaste open the Landfill at 7.30am and operate it through to about 4.30pm on week days, with an earlier closure time of around 2.00pm on Saturdays. It is closed on Sundays. The entrance gates are locked when the Landfill is not operating.

57. Typically a brief site inspection is carried out first thing in the morning.

58. All waste is weighed at transfer stations and then sent to the Landfill for disposal. The landfill operator directs the placement of waste, compacts it and covers it at the end of the day predominantly using sand cover excavated from the site borrow pit.

59. Sand cover is augmented with other cleanfill that may be delivered to site, as well as shredded greenwaste which is stored on site and composted in windrows.

60. Between 20 and 25 trucks go to the Landfill each day with some dropping off greenwaste and glass outside the Landfill tipping face.

61. Other daily duties of the landfill operator include: collecting wind-blown litter, controlling pests such as seagulls, cats and vermin; maintaining haul roads, checking waste loads for materials that are prohibited or unsuitable for disposal; and monitoring the leachate pond.

### Waste Quantities

62. **Table 3** below sets out the waste quantities received on site over the past nine years.

| | 07-08 | 08-09 | 09-10 | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 | 15-16 |
|---|---|---|---|---|---|---|---|---|---|
| Waste Tonnage | 18,589 | 17,877 | 29,155 | 31,340 | 33,040 | 32,784 | 38,141 | 35,834 | 36,981 |

63. Approximately 40% of the waste is derived from within the district, with the balance coming from the Kapiti Coast.

64. The waste is generally described as "municipal solid waste". As such the class of landfill is "Class 1" in terms of the new classification introduced in the *Land Disposal Guidelines* published by WasteMINZ in April 2016.

**Landfill Management Plan**

*Requirements for a Landfill Management Plan*

65. Condition 14 of Discharge Permit 6009 sets out the requirements for the Landfill Management Plan. Two such plans are required, one for the active, lined landfill (termed the "*The Landfill Management Plan*" - LMP) and another for the closed unlined landfill (termed the "*Closed Landfill Aftercare Management Plan*" - CLAMP).

*LMP Version*

66. The latest version of the LMP[1] is dated November 2010 and it was revised following the review of consents which was completed in May 2010.

*Reasons for Updating the LMP*

67. Section 1.2 of the LMP describes it as a "…*flexible document to be adjusted as required for changes to the resource consent*…" Updates are also needed to reflect developments and changes on site. The following lists changes which are currently due:

    (a) new landfill development (eg. additional stages – Stage 3A, 3B etc.);

    (b) new design features (eg. new side slope liner configuration for Stages 3A, 3B and 3C);

    (c) new infrastructure on site (eg. access road to the top of Stage 2, biofilter, and proposed new landfill gas flare);

    (d) changes to persons named within the LMP for specific roles;

    (e) changes to legislation which may affect site operations (eg. the LMP includes the contractor's Health and Safety Plan – this is likely to be amended following introduction of the Health and Safety at Work Act 2015); and

    (f) changes to guidelines (eg. the new *Land Disposal Guidelines* have replaced the *CAE Landfill Guidelines 2000*).

[1] *Levin Landfill Management Plan*; prepared by MWH for HDC; November 2010.

*Structure of the LMP*

68. The LMP has the following major sections:

    (a) Design and Construction Manual: includes Archaeological Protocol; Design Requirements; Landfill Staging; Aftercare;

    (b) Site Management: includes Ownership; Roles and Responsibilities; Access; Operating Hours;

    (c) Landfill Operations: includes Site Preparation; Stormwater and Leachate Control; Waste Acceptance; Tipping; Compaction; Cover Material; Control of Nuisances; Site Records; Closure and Reinstatement;

    (d) Environmental Monitoring: includes Field Procedures; Quality Control; Landfill Gas Monitoring Procedures; Bore Development; Surface Water Sampling; Annual Reporting;

    (e) Health and Safety; and

    (f) Emergency Response Procedures.

**Design and Construction Manual**

*Landfill Staging*

69. The new lined Landfill was originally designed to consist of five stages with the approximate location of each stage being shown in **Figure 2** (refer to **Appendix 1**).

70. The estimated airspace volume (landfill capacity) of each stage is given in **Table 4** below extracted from Table 2-1 of the LMP. The volumes have been based on concept designs and so are approximate.

**Table 4**: Approximate capacity in cubic metres ($m^3$) for new, lined Levin Landfill

| | Stages 1A and 1B | Stage 2 | Stages 3A, 3B and 3C | Stage 4 | Stage 5 | Total |
|---|---|---|---|---|---|---|
| Waste Volume ($m^3$) | 234,000 | 128,000 | 226,000 | 250,000 | 190,000 | 1,028,000 |

71. MWH has surveyed the Landfill every year for the past 9 years to assess the compaction of the waste. From these records, the waste density has steadily increased from 0.61t/$m^3$ in 2007/2008 to 1.01t/$m^3$ in 2015/2016. The density achieved is considered to be high and exceeds the consent requirements for compacting the waste to a density between 0.6 and 0.8 t/$m^3$.

72. Based on the latest waste density information every tonne of waste placed in the Landfill will occupy approximately 1 $m^3$ of airspace volume. This includes the sand cover placed on top of it, but excludes the final clay capping to be placed on top of the

completed landfill stages. So, if annual waste quantities are about 30,000 tonnes, then about 30,000m$^3$ of landfill airspace will be used in that year.

73. An estimate of the remaining life of the Landfill can be made by dividing the estimated remaining volume by an annual rate of airspace consumption. A 2014 MWH report[2] estimated that the Landfill will be filled to capacity by 2031/2032 if filled at a rate of 30,000m$^3$ per year, and by 2012/2018 if filled at 40,000m$^3$ per year.

74. However, the above estimation does not take into account decomposition of waste and its subsequent settlement. It is estimated that waste can settle up to 30% of its original depth, so as filling progresses, additional volume becomes available through settlement which means one cannot simply take the total airspace and divide it by the waste volume per year to derive an estimated remaining life. In reality, settlement of the waste pile could add several more years of life to the Landfill.

*Archaeological Protocol*

75. The Landfill is classified as an historic site in the Historic Places Trust (HPT) register and an authority is need from the HPT to strip the topsoil. The HDC was issued with authority No. 2009/212 on 8 June 2009. It expires in 2019.

76. The authority requires that monitoring be undertaken during the stripping operations and there is a set procedure (protocol) that must be followed should any archaeological features be found. The procedure is set out in the *Levin Landfill - Borrow Area Operational Plan*[3] and is summarised in the LMP.

*Aftercare*

77. Completed stages of the Landfill are required to be monitored and maintained after final capping, as required by resource consent conditions. A minimum 30-year post closure period is recommended for a municipal landfill by the Ministry for the Environment[4]. It is recommended that the aftercare period be extended for 30 years from the cessation of refuse disposal operations, unless the HDC can prove through site monitoring that a lesser period is appropriate.

78. The main tasks during the aftercare period will be monitoring and maintenance of the Landfill site, together with any measures that may be required for contingencies, should they arise.

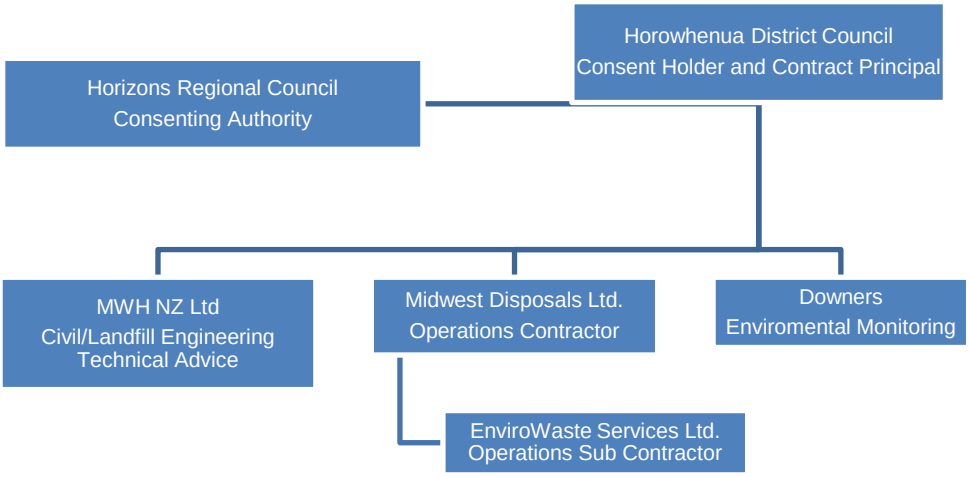
**Site Management**

*Roles and Responsibilities*

79. The Landfill contract management structure is given in **Figure 5** below.

[2] *Modelling of District Waste Disposal Options and Solid Waste Activity Cashflows*; report prepared by MWH for HDC; 10 March 2015.
[3] *Levin Landfill – Borrow Area Operational Plan*; prepared by MWH for HDC; August 2010.
[4] Section 5.5, page 46; *A Guide for the Management of Closing and Closed Landfills in New Zealand*; Ministry for the Environment; May 2001.

**Figure 5**: Levin Landfill management structure




80. The site and resource consents are owned by HDC. It has the overall responsibility for compliance of the site.

81. A landfill operator is contracted by HDC either under a specific contract or as part of a contract involving wider solid waste operations. The landfill operator is EnviroWaste Services Ltd., acting as subcontractors to Midwest Disposals Ltd. The landfill operator is responsible for:

    (a) the operation and maintenance of the Landfill, the associated infrastructure, and the Landfill site;

    (b) the management of the Landfill site; and

    (c) the monitoring of solid waste and other materials received at the site.

82. MWH New Zealand Ltd, on behalf of HDC, is responsible for:

    (a) preparing the annual report that records the results of environmental monitoring activities;

    (b) landfill survey;

    (c) ongoing advice with respect to landfill operations and maintenance; and

    (d) design of additional landfill staging, as required.

83. Downers, on behalf of HDC, is responsible for carrying out the environmental monitoring activities.

*Access*

84. No public access to the Landfill is permitted. Access is restricted to vehicles transporting refuse from refuse transfer stations.

*Operating hours*

85. The site can be operated seven days per week during daylight hours 07:30 to 16:00 (Monday to Friday) and from 08:00 to 16:30 (Saturday and Sunday), but is currently operated Monday to Saturday. It is closed on Christmas Day, New Year's Day and Good Friday.

**Landfill Operations**

*Control of Stormwater*

86. The objective of stormwater management is to control stormwater run-off to minimise soil erosion, keep clean stormwater separate from leachate and to minimise infiltration of water into the Landfill.

87. Any rain falling on the operational area and which comes into contact with refuse is regarded as leachate (or "dirty stormwater") and is contained and soaked into the surface of the Landfill.

88. As each stage is filled with refuse and the level reaches the top of the liner, either at the bunds or around the sides of each stage, a shallow depression is left so that stormwater from the Landfill cannot escape out of the lined area. This depression is then filled with clay material when the stage is capped. **Photograph 18** in **Appendix 3** illustrates this for Stage 1A.

89. Stormwater is directed to several inter-dune depressions on site which are shown on the **Site Plan** in **Appendix 2**. Sampling of bores located close to these areas is undertaken for specific parameters to check whether or not the groundwater is influenced by leachate. The results indicate no contamination of the stormwater by leachate.

*Control of Leachate*

90. Leachate is collected from the base of each of the lined Landfill stages by a perforated collection pipe bedded in a 300mm thick gravel drainage layer that extends over the base of each stage. The drainage system is designed to limit the head of leachate on the liner to less than 300mm.

91. Leachate from all stages gravitates to a single collection manhole from where it is pumped to the leachate pond.

92. The leachate pump is monitored through telemetry. It is serviced regularly and the leachate collector pipes and leachate manhole jetted out periodically to prevent accumulation of bio-mass and sediments.

93. Leachate is pumped to a manhole via a pipeline which is connected to sewerage infrastructure leading to the Levin WWTP. I understand that leachate quantities are approximately 23$m^3$ per day, increasing to about 45$m^3$ per day during winter.

*Landfill Gas Control*

94. Landfill gas control is obviously related closely to odour control which has become a significant matter, especially for the neighbours closest to the Landfill. The evidence of Dr Boddy will cover odour management. I describe the existing infrastructure that helps control the migration of landfill gas off-site, and the infrastructure available for the collection of gas in the near future once the system is commissioned.

95. For the lined Landfill horizontal migration of landfill gas through the surrounding soils is eliminated by the geocomposite liner on the base and side slopes.

96. There are no measures for controlling the horizontal migration of gas on the old, unlined landfill. However, monitoring bores are tested for gas each time groundwater sampling is undertaken and results in the past five years show no methane has been detected which implies that the horizontal migration of gas from the old landfill is negligible. This is addressed further in Dr Boddy's evidence.

97. In 2012 the HDC decided to undertake a trial to determine how much landfill gas could be captured and destroyed using a landfill gas flare. I had very little involvement in this project since the HDC worked closely with EnviroWaste who had experience from other landfills and were also able to lease a spare flare to the HDC, but I understand the background to the project.

98. It was important to establish how much gas could be captured and destroyed because around that time the New Zealand Emissions Trading Scheme (NZ ETS) had been introduced under the Climate Change Response Act 2002, and it required landfill owners to surrender trading units ("carbon credits") because landfills are a source of greenhouse gases.

99. The trial ran for two years. In the meantime, with the global financial crises, the cost of trading units decreased significantly. However, the HDC opted to keep the flare operating recognising that there was an environmental benefit in doing so.

100. The flare was not sized appropriately for the Landfill. It extracted gas at a rate higher than the landfill gas collection system could deliver to it, and so it would operate intermittently.

101. The flare was switched off in January 2015 to allow a gas sampling exercise to be carried out in the first half of 2015.

102. The condition of the flare is poor and it has deteriorated to the extent that EnviroWaste has decided to scrap it, and it cannot be used in its present state.

103. There has been an ongoing issue regarding odour at the Landfill and the HDC has investigated the costs of installing a new flare. I have been involved in preparing and letting a tender on behalf of the HDC for a new flare, and this is discussed in detail in the evidence of Mr Saidy.

*Waste Acceptance*

104. Section 6 of the LMP deals with waste acceptance including procedures for dealing with hazardous waste, liquid waste (where accepted as a contingency), offal and dead animals, biosolids and sludges.

105. The Landfill is designed and consented to accept general domestic and commercial waste, often referred to as municipal solid waste. In addition to municipal solid waste, the following types of waste may also be disposed of at the Landfill, subject to certain conditions:

    (a) special wastes: offal and dead animals; and biosolids and sludges;

    (b) liquid wastes; and

    (c) potentially hazardous wastes, provided they meet the acceptance criteria.

*Special Wastes*

106. A special waste permit is needed for the disposal of offal and dead animals, and biosolids and sludges. Section 6.2 of the LMP deals with special wastes.

107. The HDC issues special waste permits following an application process to ensure that the waste is acceptable. Last year HDC issued three new special waste permits, one of which is for the regular disposal of special waste. There are also other existing special waste permits for the disposal of regular loads of special waste which were issued prior to this past year. Last year 330 tonnes of special waste were disposed of at the Landfill.

108. The disposal of offal and dead animals does not require prior notification, but all other special waste requires 24 hours prior notification.

109. Each load disposed of requires a manifest form to be completed providing details of the material being disposed of.

*Biosolids*

110. Biosolids and sludges which may consist of a complex mixture of various chemicals and elements, such as heavy metals, which may affect the quality of leachate, may require the following additional testing to confirm their acceptability:

    (a) determination of the presence of free liquids which would otherwise cause them to be classed as “liquid wastes”; and

    (b) test for total concentration of contaminants in waste and/or test for concentration of contaminants using the Toxicity Characteristic Leaching Procedure (TCLP) test.

111. Last year HDC disposed of 850 tonnes of biosolids and sludges from its treatment plants.

*Liquid Waste*

112. Section 6.3 of the LMP details how liquid wastes are to be dealt with. It incorporates the requirements of discharge permit 7289 which deals specifically with the discharge of liquid waste at the Landfill. Liquid wastes can only be disposed at the Landfill as a contingency to normal disposal. Liquid wastes are defined as the following:

    (a) septic tank waste (septage);

    (b) grease trap waste;

    (c) sewage; and

    (d) any material that contains free liquids.

113. I understand that since the new lined Landfill has been in operation, there have been no occasions when liquid waste has had to be disposed of on site.

*Prohibited Wastes*

114. Wastes that pose a present or future threat to people or the environment by virtue of having the following nature are prohibited:

    (a) explosive;

    (b) flammable;

    (c) reactive;

    (d) toxic;

    (e) corrosive;

    (f) toxicity; or

    (g) infectious.

*Unsuitable wastes*

115. The following are also recommended as not being suitable for disposal to landfill and they are removed from the waste if found (eg. lead acid batteries and whiteware are removed for recycling):

    (a) bulk liquids;

    (b) radioactive wastes;

    (c) lead acid batteries;

    (d) used oil;

    (e) explosive, flammable, oxidising or corrosive substances – as defined under the HSNO Act;

(f) refrigerators or freezers, unless they have been degassed ; and

(g) PCB wastes.

*Hazardous Wastes*

116. Section 6.4 of the LMP deals with hazardous and potentially hazardous waste materials.

117. Condition 8 of discharge permit 6009 allows potentially hazardous wastes to be disposed in the Landfill, assuming they meet the hazard waste acceptance criteria following application for a hazardous waste permit.

118. The hazard waste acceptance criteria have been adopted from section 7 of the MfE Hazardous Waste Guidelines[5]. The acceptance criteria are based on testing of solid wastes using the TCLP test, or by testing for total concentrations. Wastes with leachable concentrations of contaminants less than those stated in the guidelines, or with total concentration values less than the screening criteria, may be accepted for disposal.

119. Where contaminants are not listed in the MfE Hazardous Waste Guidelines, TCLP limits may be set at the lesser of the following:

(a) NZS 9201 Model trade waste Bylaw limits;

(b) 100 times the NZ drinking water standard;

(c) 1000 times the guideline for protection of aquatic species.

120. I understand that no hazardous waste permits have been issued in the past year.

*Specific Procedures*

121. The final step in controlling the entry of waste into landfills is to implement policies and procedures to detect and deter illegal disposal of these wastes. Specific procedures are stated in the LMP and include:

(a) Random load inspections – one load in every 50 commercial and industrial loads is suggested as an initial guide, but should be increased if it is found that inappropriate waste is being received at a site. Most loads come to the Landfill via a refuse transfer station (RTS) and so random inspections can be carried out at the RTS instead of at the Landfill. This year the landfill operator initiated random inspections of at least one load per day being disposed of at the Landfill.

(b) The landfill contractor is to notify the HDC if hazardous waste (other than low risk items such as batteries, LPG bottles etc) is presented at the Landfill for disposal without prior approval and appropriate documentation. HDC is, in

[5] *Module 2: Hazardous Waste Guidelines – Landfill Waste Acceptance Criteria and Landfill Classification*; Ministry for the Environment; May 2004.

turn, to notify the Horizons of such occurrences. I am informed by EnviroWaste that no loads of hazardous waste (other than low risk items noted above) have been identified this past year.

(c) If the landfill contractor identifies hazardous waste while it is in the possession of the transporter, the load is rejected and remains the responsibility of the transporter. I am not aware of loads of hazardous waste being rejected but earlier this year there was an incident of special waste (a dead cow) being turned away since the disposer did not have a special waste permit. This was subsequently obtained and the disposal effected.

(d) If hazardous waste is identified after disposal at the tipping face, then steps are taken immediately to secure the waste. If the waste is identified as being unacceptable then a plan for removal or neutralisation of the waste must be actioned as quickly as practicable. Landfill users and staff must be protected from any health and safety hazards that might be caused by the hazardous waste.

122. The contractor maintains supervision of the disposal activity at the working face when wastes are received at the Landfill to ensure the accountability of those depositing unacceptable wastes at the site.

*Tipping and Compaction*

123. Metalled roads provide all weather access to the Landfill tipping face. A turn around area is provided so that waste vehicles can easily manoeuvre to tip loads safely. Usually it is metalled but may also be surfaced using crushed glass. The roads are maintained by the operations contractor.

124. Landfilling is carried out in lifts between approximately 2 and 3 metres in depth and sloping down from the top no steeper than 1 in 3. Refuse is spread in layers not exceeding 0.5m in loose thickness and compacted by sufficient passes of the compacter. The required apparent density is between 0.6t/m³ and 0.8t/m³ but annual compaction density tests show the results have been increasing steadily and are now just over 1.0t/$m^3$, which is a high result.

125. The refuse is spread against the slope of the tip face, and the machine then moves up and down it, rather than across the tip face, thus tearing and compacting the refuse and reducing the extent of voids. If large loads of organic material or special wastes are received, they are spread and compacted near the bottom of the face so that more resilient refuse can be compacted on the top.

*Cover Material*

126. Cover material at the site falls into the following three categories:

(a) Primary or daily cover material. This is applied to minimise nuisance from vermin, odours, dust and windblown litter. It consists of sandy or other suitable materials such as cleanfill, bark or shredded greenwaste. For many landfills

cover material is in short supply and operators may offer incentives such as reduced disposal rates for materials, such as cleanfill or sawdust, which could be used for cover purposes. Sand is abundantly available on site. It is easy to excavate and transport, and is also easy to spread over the compacted waste. Its use is both practical and economical. The LMP requires the depth of compacted cover material to be approximately 100mm. This matter is subject to consent review and is discussed further in the evidence of Dr Boddy. Other effective techniques for windblown litter are available, such as tyres, nets, tarpaulins, but should not be used where problems are being experienced with odours and vermin.

(b) Intermediate cover. If landfilling operations do not commence immediately on top of a lift it is covered with (typically) between 300mm to 500 mm of intermediate cover to provide a trafficable surface for the future overlying lift. The intermediate cover may subsequently be used for primary cover is progressively "opened" to allow leachate dispersion prior to placing the overlying waste. Intermediate cover should include shredded greenwaste to assist with erosion protection of the intermediate cover.

(c) Final cover or capping. The consent conditions require completed landfill stages to be compacted, graded and capped with soils having a permeability no greater than $1 \times 10^{-7}$m/s, and vegetated. This implies the soils consist largely of fine soils such as clayey silts. On the new lined Landfill the top of Stage 1A has been capped as well as the completed back area of Stage 2. For odour control purposes there is scope to cap areas prior to their completion, assuming they will not be completed for several years. When it is time to bring fill the stage to final level, the capping can be stripped off and stockpiled for later re-use.

*Control of Nuisances*

127. Nuisances on site and the manner in which they are dealt with consist of the following:

(a) Litter. The contractor has erected 5m high litter control fences constructed with fishing nets around the perimeter of Stages 1A and 2. Litter is cleared off the fences on a regular basis. This type of fence will be extended to Stage 3 when Stage 3C is constructed. Low litter fences (about 1m in height) are placed closer to the actual tipping face. When winds are particularly strong the Landfill site is closed.

(b) Dust. The sandy daily cover is potentially a source of dust, as are the unsealed access roads. The use of shredded greenwaste placed on top of the sand cover helps to allay dust, and the amount of traffic on site is minimal that dust is not a nuisance. The site is well screened with large pine trees which also helps to reduce the effects of dust being blown off site.

(c) Odour. As noted in my evidence above, this is considered to be a potential nuisance, particularly for the closest neighbours. The evidence of Dr Boddy

will cover the measures already put in place and proposed to control odour. From an operational point of view, wastes producing odours are to be buried and covered immediately. Should any excavations be required into the waste pile they need to be done in such a way to minimise the time that waste is left exposed and the extent of exposure.

(d) Noise. Noise levels on site are restricted by the District Plan standards. All plant and equipment used on the site is appropriately muffled to ensure the noise standards are met and complies with the manufacturer's requirements.

(e) Vermin/Cats. Compacting of waste immediately after dumping and spreading, and covering of waste are measures required to reduce vermin and cats. Food waste is covered immediately. The contractor sets baited traps to control vermin and also shoots cats.

(f) Seagulls. Birds are discouraged by limiting the working area, and by daily covering of refuse. The contractor also shoots seagulls and uses a gas-powered bird-scarer to frighten them away when there is no operator at the tipping face.

(g) Flies are controlled by regular covering of refuse with soil.

(h) Spillages from refuse vehicles which occur at any point on their approach to the Landfill, including the access road from Hokio Beach Road, are cleared up promptly by the landfill operator and are brought to the driver's attention.

(i) Leachate breakouts are identified through regular inspections of the Landfill for signs of seeps, settlement and/or vegetation die-off. Seeps are remediated by excavating a soakage hole into the Landfill face and allowing leachate to soak back into the body of the waste. Maintaining a shallow drain at the bund or side of the Landfill also ensures that any leachate seep cannot escape off the lined footprint of the Landfill. Where permanent capping is placed on part of a completed stage of the Landfill, care is needed to ensure there is a bund of sufficient height to prevent run-off from the operational area over the capped surface. An incident of this nature occurred in August 2016 when dirty stormwater (considered to be leachate) spilled over the capped area at the back of Stage 2. It was identified and remediated within a day.

*Site Records*

128. The LMP sets out the requirements for recording keeping on site and provides pro-forma site recording forms. It covers:

(a) Maintenance Records providing details of any maintenance work carried.

(b) Complaints Record including details to be provided and process to be followed on receipt of a complaint. There have been numerous odour complaints in recent years from the Landfill neighbour, and the process for dealing with these complaints is being reviewed as part of this resource consent review

process. Doug Boddy will address this matter specifically in his evidence. Other than the complaints for odour, there have been no registered complaints with respect to the landfilling operations. The NLG meetings have provided opportunity for a variety of concerns to be raised. These include: waste vehicles speeding along Hokio Beach Road; incidents of litter occurring on the roads; fly tipping occurring at the Landfill gate; and leachate contamination of Tatana Drain.

(c) Incident Register. Recording any incident which could cause or did cause any adverse effects on the environment at or beyond the boundary or caused a complaint. The record shall include reasons for the incident, measures taken to mitigate any effects and measures taken to prevent recurrence.

(d) Weight of material received at the Landfill including location and quantities of any special wastes disposed of in the Landfill where required by legislation.

*Site Closure*

129. Prior to closure the LMP needs to be amended into a *Closed Landfill Aftercare Management Plan* (CLAMP) which will specifically address the issues that may arise upon closure and during the aftercare period.

130. On completion of landfilling operations, the site will be re-vegetated for after-use. The final planned end use has not been determined. Possibilities include using the site for grazing of light stock that would not damage the Landfill cap or retiring it as a reserve. It is also possible that parts of the site may continue to be used for waste management activities (eg. composting of greenwaste).

131. All areas of filling will have a minimum cover of 700mm of suitable low permeability material and topsoil. All finished slopes will be graded to no steeper than 1 in 3 to ensure long term stability. Minimum finished slopes will not be less than 1 in 20 (to encourage the drainage from, rather than infiltration of surface water into the Landfill).

132. When the final cover is completed, the Landfill will be vegetated and landscaped to provide visual screening, stabilise slopes, reduce run-off and enhance evapotranspiration. The vegetation species must be selected with care to ensure that the Landfill capping will not be damaged by root systems, can be monitored on an ongoing basis and to ensure that if localised settlement occurs in part of the Landfill that it can be remediated easily.

133. The site will need to be monitored and after-care provided for a minimum period of 30 years, or such other period as set by the planning consent. After closure, regular inspection of the site will be required to identify areas needing maintenance, including:

(a) leachate/stormwater system;

(b) sediment control;

(c) landfill gas control;

(d) final cover and vegetation;

(e) subsidence and slope stability;

(f) monitoring of site integrity; and

(g) monitoring of groundwater, surface water and landfill gas.

**ENVIRONMENTAL MONITORING**

*LMP Requirements*

134. Following the 2010 resource consent review process, MWH prepared a report[6] that summarised the requirements for environmental monitoring and reporting at the Landfill. Extracts from that report have been included in the LMP, including guidance on areas listed below:

(a) field sampling procedures;

(b) sampling schedule and site plans;

(c) tasks and assigned responsibilities; and

(d) methodology for contaminant mass loading projection calculations.

135. The following sampling occurs:

*Groundwater Sampling*

(a) Natural Background Groundwater (Bores G1S, G1D)

(b) Shallow Aquifer Down-gradient to Old Landfill (Bores E2S, B1, B2, B3, C1, C2, C2DS, G2S)

(c) Deep Aquifer (Bores E1D, C2DD, E2D)

*Surface Water Sampling*

(e) Hokio Stream

(d) Tatana Drain

(f) Leachate Pond

*Landfill Gas Sampling*

(g) Carried out at all bores when groundwater sampling is done.

[6] *Levin Landfill – Environmental Monitoring & Reporting Requirements; report prepared by MWH for HDC*; November 2010.

**TATANA DRAIN**

*Description of the Drain*

136. The “Tatana Drain” is situated on private land owned by the Tatana Family which lies immediately to the north of the Landfill site, as shown on **Figure 6** below. The property has been split into several paddocks and it is currently being used for the disposal of fill (described below), and on occasions cattle graze the property.


**Figure 6**: Aerial photograph (2013) showing Tatana property to the north of the Landfill site.

137. The drain runs adjacent to the fence line (see **Photograph 19** in **Appendix 3**) for a distance of about 420 metres, before turning roughly at right angles to the right for a further 110 metres, terminating at the Hokio Beach Road. A culvert is located under the road which drains water to the Hokio Stream. The start of the drain is at a location where a sand dune extends from the Landfill site property into the Tatana property, as can be seen in **Photograph 19**.

138. The drain is approximately trapezoidal in shape with a flat invert of about 1m width, and side slopes at about 45°. The depth of the drain varies along its length with the deeper section being along the first 120 metres of the drain. Along this section the land has been built up by the land owner using fill materials (heaps of unspread fill can be seen in **Figure 6** above and **Photograph 20** in **Appendix 3**) and the depth of the drain is estimated to be about 0.7m. Further downstream (see **Photograph 21** in **Appendix 3**) the depth is estimated to be about 0.4m. The drain is not fenced off from the rest of the Tatana property and stock (cattle) can access it easily (see **Photograph 22** in **Appendix 3**).

139. As can be seen in **Figure 6** there are several other drains on the property which connect into the main “Tatana Drain” before it terminates at the Hokio Beach Road.

140. The drain intercepts shallow groundwater that flows in a northerly direction. At a site visit on 17 February 2015 the level of the water in the drain was compared to the water level in bore C2 which is located close to the head of the drain. At that time there was a seep in the side of the drain and it was about 200mm below the level of the water in the bore. The top of the drain (on the Landfill property side) was only 130mm higher than the level of the groundwater in the bore. In other words, depth to groundwater at this location (and this was measured in summer), is extremely shallow.

141. The shallow groundwater is assumed to be the reason why Mr. Tatana has decided to raise the level of the property by progressively filling it with fill. **Figure 7** below shows an aerial photograph of the site in 2005 when filling had commenced at the eastern end of the property. As filling occurs, so the heaps of fill have been progressively flattened and the ground raised. **Figure 7** appears to show that the drain used to extend around the base of the dune which projects into Tatana property, as described previously. Presumably it has since been filled in as part of the operations to elevate the property above the groundwater table.

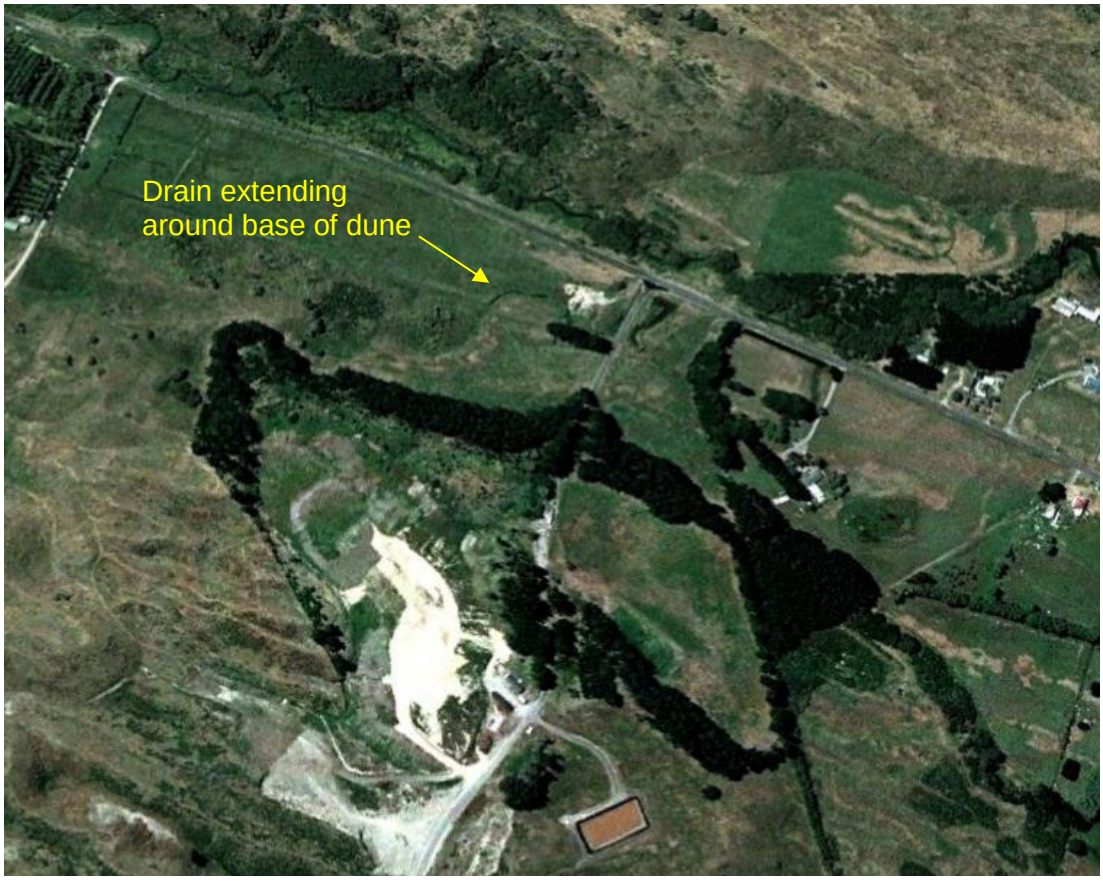



**Figure 7**: Aerial photograph (2005) showing filling operations commencing on the Tatana property.

142. It appears that the drain is being maintained, presumably by the landowner. At the time of a site inspection in February 2015 the drain had recently been cleared of silt which was piled up on the side of the drain (see **Photograph 21** in **Appendix 3**).

143. **Photograph 19** in **Appendix 3** shows the Tatana property is somewhat elevated when compared to the ground levels along much of the adjacent Landfill property. This is quite obviously because of the filling operations carried out on the property. If the drain was not in existence then the filling operations would essentially have created a low dam along that length of the property where filling has occurred. This could possibly have caused localised ponding of water along the low-lying area of the Landfill property, but it would not have made any real difference to the flow of groundwater under the property.

*Why was the drain developed?*

144. I understand that the decision to construct a drain along the northern boundary of the Landfill is a result of the March 1998 decision on the Landfill consents, following a Horizons hearing. This was noted in an MWH report[7] which discussed the Tatana Drain, and extracts from that report are used in sections 145, 147 and 148 below.

145. The Hearing Committee's decision report includes a summary of submissions and evidence presented to the hearings panel. Section 76 of the report records that Mr Ivan Jones, an adjacent landowner (since passed away), raised concerns regarding water ponding on his property adjoining the existing (now closed) landfill. He considered that the water ponding was due to the discharge of leachate from the landfill. It was recorded that the applicant (the HDC) indicated a willingness to install a drain on the landfill site adjacent to the boundary with Mr Jones property.

146. I am aware of the concerns raised by Mr. Ivan Jones since my first involvement in the Levin Landfill in 1997 was to re-design the shape of the old landfill to reduce the amount of stormwater flowing off the site to the north. When I first got involved, the old landfill was more elevated at its south-western end which, ostensibly would have caused water to flow off the landfill in a northerly direction. Given the sandy nature of the soils on site it is doubtful whether surface flow of water could occur from the base of the old landfill to the northern boundary. However, because the ground is low-lying and the groundwater table located close to the surface, at times intersecting the surface and causing ponding of water, it is easily understood how Mr. Ivan Jones could have interpreted the ponding water as coming from surface water stemming from the Landfill.

147. The requirement to install such a drain was imposed in the Horizons decision by way of Condition 3, which stated: *The Permit Holder shall construct and maintain a drain along the north-western boundary of the existing landfill site, by 30 June 1998. The drain shall be designed to capture leachate running off the site on to neighbouring properties. The exact location of the drain shall be determined in consultation with Regional Council, but shall be at or about the position defined in Fig 2 attached to this consent'*. Figure 2 is shown in section 12 of my evidence and the drain is drawn in by hand along the edge of the old landfill. To the best of my knowledge no drain was constructed in the location shown in Figure 2.

[7] *Levin Landfill Water Quality Investigation*; prepared by MWH for HDC; March 2015.

148. The 1998 Horizons Hearing Committee's consent decision was appealed to the Environment Court but the parties reached an agreed settlement. The consent was subsequently granted by the Environment Court by way of a Consent Order in 2002. It is noted that Condition 3 of the 1998 decision is not included in the 2002 decision, presumably because the drain had already been installed by this time. Condition 2 which provides that "*landfill leachate shall not contaminate adjoining land*" is retained as a consent condition, however given that the drain was installed on the neighbouring property it appears that there was no consequential change made to Condition 2 to acknowledge the fact that some leachate may flow over a small part of the neighbouring property and within the drain. This matter is discussed further in the evidence of Dr. Olivier Ausseil.

149. **Photograph 23** in **Appendix 3** is an oblique aerial view of the Landfill property which clearly shows the Tatana Drain. The earliest date on the photograph is 17 January 2002 but this may have been the date when it was provided to MWH (the photograph indicates it is a "modified" date, rather than a "created" date), so it is possible that the photograph was taken earlier than that date. Irrespective, it is clear that the drain had been constructed prior to the 2002 consent decision.

150. In Mr Brown's evidence he shows an aerial photograph (section 17 of his evidence) taken in 1995 which shows that there was already a drain along the property boundary at that time. Another drain was not constructed parallel to it, indicating to me that either it was agreed between Horizons and HDC and the landowner that the existing drain would serve the same purpose as the drain proposed in original consent condition 3, or that the drain was deepened to serve that purpose.

**COMMENTS ON S42A REPORTS**

*Evidence of Mr. Standen*

151. In section 31 of his report Mr. Standen supported the retention of condition 2 of resource consent 6010 with the following statement: *"For example, condition 2 would be useful in a situation where leachate from the leachate pond discharged onto and into land and contaminated adjoining property".*

152. The leachate pond (refer to **Photograph 15** in **Appendix 3**) is located approximately 133 metres from the Landfill property boundary. The ground around it is shaped so that the only possible area where overflowing leachate could flow more than about 40 metres from the pond would be along the access road. The road has a defined watertable drain which drains stormwater to a sump, from where it is piped back to a small inter-dune depression adjacent to the leachate pond. So it is practically impossible for leachate to discharge onto land from the leachate pond and contaminate an adjoining property.

153. To the best of my knowledge leachate levels in the pond have never risen to the extent that an overflow has occurred from the pond.

**Phillip Sverre Landmark**

**2 September 2016**

## APPENDIX 1

**See overleaf:**

**Figure 1: 2005 Aerial Photograph**

**Figure 2: 2015 Aerial Photograph**

**APPENDIX 2**

**See overleaf:**

**Site Plan**

## APPENDIX 3

**See overleaf:**

**Photograph 1: Capping of old landfill (2010)**

**Photograph 2: Side liner of Stage 1A (2004 – 2005)**

**Photograph 3: Side liner of Stage 1A (2004 – 2005)**

**Photograph 4: Benching to sides of Stage 3A (2013)**

**Photograph 5: Benching to sides of Stage 3A (2013)**

**Photograph 6: HDPE liner construction Stage 1A (2004)**

**Photograph 7: GCL and HDPE liner construction Stage 1A (2004)**

**Photograph 8: Mixing bentonite for GCL liner joins Stage 1A (2004)**

**Photograph 9: HDPE liner welding Stage 1A (2004)**

**Photograph 10: HDPE liner quality assurance marks Stage 3A (2013)**

**Photograph 11: Placement of sand protection layer Stage 1A (2004)**

**Photograph 12: Placement of sand protection layer Stage 1A (2004)**

**Photograph 13: Electric dipole integrity testing Stage 3A (2013)**

**Photograph 14: Placement of first layer of waste Stage 1A (2004)**

**Photograph 15: Leachate pond**

**Photograph 16: Stage 2 liner completed**

**Photograph 17: Stage 2 liner completed**

**Photograph 18: Capping at edge of Stage 1A**

**Photograph 19: Tatana Drain looking upstream**

**Photograph 20: View across Tatana property looking north-east**

**Photograph 21: Tatana Drain looking downstream**

**Photograph 22: Cattle in Tatana Drain**

**Photograph 23: Oblique aerial photograph taken prior to 2002**