INDEPENDENT REVIEW - WHANGANUI WASTEWATER TREATMENT PLANT

PREPARED FOR WHANGANUI DISTRICT COUNCIL

An independent review of the facts pertaining to Whanganui District Council's decision-making processes from 2003 to 2012 leading to the failure of its wastewater treatment plant.

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NOTE: The content of this report reflects the outcome of the Independent Review and does not necessarily reflect the views of Whanganui District Council.

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EXECUTIVE SUMMARY

The prevailing management and governance culture within Whanganui District Council was entrenched and overly trusting in the period up to 2005 when the wastewater treatment plant was designed.

Close and longstanding relationships existed between Councillors, Council staff and engineering consultants.

Market testing was not practiced for the provision of engineering services on the wastewater treatment plant project from 2000 to 2012. The making of the original concept design contract between Council and Montgomery Watson (later MWH) in October 2000 did not accord with normal practice.

Council and senior management effectively delegated the development of the treatment plant design to a small group of Council staff and MWH consultants.

From July 2000 to October 2003, the design option identification and evaluation methodology that was pursued by Council staff and MWH through the Technical Working Group process had been sound and in accordance with the traditional risk-minimisation approach of the wastewater industry. Thirty four treatment options in total were evaluated and all were based on technologies proven in full scale use in New Zealand and/or overseas.

In a seminal decision, the Technical Working Group on 20 October 2003 deviated from this risk-minimisation approach and developed a radical, untried and untested design option that was argued would be much lower cost and 'optimised' for Whanganui's specific needs. The new option was a 'hybrid' of elements from each of the four shortlisted and proven options being considered by the Working Group. No precedent for the design was known to exist in the world.

Council confirmed the 'hybrid' option called the Optimised Lagoon Treatment Process design on 16 February 2004, subject to a peer review, after being incorrectly informed that it was relatively low risk and based on proven technologies.

The significantly lower cost of the design compared to proven options was a major consideration in Council's decision and the key driver for Council staff in advocating the Optimised Lagoon Treatment process.

The crude, low-cost and low technology design proved to be a false economy which ultimately cost Whanganui ratepayers $27 million.

In accordance with Council's February 2004 decision, an independent Peer Review Panel was briefed in March 2004 and raised significant issues and risks with MWH and Council's concept design that it argued needed to be addressed, including through the detailed design phase.

Council staff prematurely shut down the Peer Review in October 2004 without the independent panel's issues having been resolved and without the Panel having seen any detailed designs. The Council was then incorrectly advised the following month in November 2004 that the Peer Review had completed its brief and had affirmed the Optimised Lagoon design.

Council staff failed to display an adequate understanding of the concepts of risk and risk management regarding the treatment plant design.

Significantly therefore, concept design decisions made at the three critical meetings comprised of the Working Group in October 2003, the Council in February 2004 and then a newly-elected Council in November 2004, planted the seeds of the treatment plant's ultimate failure.

It is difficult to comprehend that a responsible Council in November 2004 would have approved the concept design going forward if it had been properly advised about the outcomes of the independent peer review.

By the time the new Chief Executive, Dr. David Warburton, took over in 2005 from his long-serving predecessor, the treatment plant project had developed an almost unstoppable momentum towards the 1 July 2007 date under the resource consent when the plant had to be constructed and operational. In the circumstances, there existed neither desire nor will to review the approved design.

The independent peer review gatekeepers had been summarily dismissed the year before leaving their essential task incomplete.

The treatment plant commenced operations in September 2007 and almost immediately exhibited some of the difficulties such as odour problems that had been envisaged by the Peer Review Panel. Initially, the cause was believed to be deficient aerators and it took nearly two years for replacement and additional aerators to be installed. These failed to resolve the operational difficulties however.

Throughout its troubled five years of operation, the plant was never able to achieve the terms of its resource consent even with the implementation of drastic operational measures.

Council staff adopted 'mitigation measures' in breach of the resource consent such as diverting untreated effluent directly to the sea or filling and flushing the lagoons to the sea in an effort to control the odour problems and to reduce the pressure of tradewaste loads on the plant. This had the effect of disguising the plant's operational difficulties and their underlying root cause.

Despite this and the application of a range of other short term upgrade measures costing $2.3 million, the plant continued to fail until it was finally shut down in the face of potentially costly enforcement action by Horizons Regional Council.

Many reasons such as lack of aeration, excessive wet industry loads and poor management have been publicly advanced to explain why the treatment plant failed. Some vested interests even argue that it did not fail.

Certainly Council vigorously asserted they were let down by the engineering design consultants. Their legal action against the design consultants claiming negligence has now been satisfactorily settled.

From all the evidence examined by the Independent Review, the root cause of the failure of the Whanganui Wastewater Treatment Plant traces back to 2003 and 2004 with critical shortcomings in Council's prevailing culture and decision-making processes which allowed endorsement of the plant's radical and flawed design. These issues are explored in detail throughout the report.

1 INTRODUCTION

1.1 BACKGROUND

The failed state of the Whanganui wastewater treatment plant by late 2012 was the end result of a lengthy and convoluted series of events that has caused much angst, anger and anxiety throughout the local community, which unfortunately bears the environmental and financial burden for what has occurred in the past.

The conflicting arguments about the causes of the plant's failure have quite understandably made the issue a continuing bone of contention for many within the community. Fairly or not, reputational damage has been a consequence.

In this context, it is somewhat paradoxical that the development of the treatment plant by Council had its origins in sound public policy developed to end the environmentally unsustainable practice whereby untreated domestic waste and trade waste had been discharged into the Tasman Sea via a marine outfall located 1800 metres off South Beach. Indeed, prior to the construction of the Beach Road Pump Station (BRPS) and the marine outfall, the practice had been to discharge unseparated domestic waste and stormwater and trade waste into the Whanganui River, which led to serious health risks such as typhoid.

In 1992, Council established the Whanganui River Wastewater Working Party and it recommended a scheme to end untreated waste discharge, which was subsequently approved. Resource consents were obtained for the scheme to be implemented through significant investment into necessary infrastructure and services over a fifteen year period, culminating with the commencement of a new treatment plant on 1 July 2007. The fifteen year period was considered the length of time necessary for Council to finance the new infrastructure through its existing rating base and without taking on additional debt.

In 2002, it was decided that full separation of sewer and stormwater drains was to be the ultimate objective. At that time, stormwater was to be discharged into the Whanganui River and sewage and trade waste were to be pumped together to the BRPS to be initially screened prior to the untreated effluent then being discharged through the marine outfall.

In the final and most substantial stage of the process, from 1 July 2007, the screened domestic and trade waste was to be pumped from the BRPS to the newly-built treatment plant where the resultant treated effluent was to be discharged to the sea through the marine outfall.

History shows that the treatment plant, designed by Montgomery Watson Harza ("MWH"), commenced operation a little later than scheduled in September 2007, but experienced operational difficulties almost from the beginning.

A myriad of operational difficulties such as significant odour events, aerator failures and excessive sludge generation occurred and the plant never met the full terms of its resource consent over five years of operation. Indeed, the facts demonstrate that the plant was never even fully commissioned during its period of operation due to technical shortcomings.

Horizons Regional Council finally issued an Abatement Notice on 9 January 2013 which required rectification action from Council by 7 February 2013. In the face of any inaction by Council, the next step was the granting of an Enforcement Order which in turn could result in substantial penalties being applied to Council.

Council obtained further expert technical advice and the plant was judged to be in a totally failed state. The plant's operation was closed down and the site was eventually remediated and mothballed.

Following the closure of the treatment plant operations, screened but untreated domestic and trade waste recommenced being discharged into the Tasman Sea through the marine outfall under emergency resource consent conditions, pending the development of a new plant.

Therefore, after only five years of troubled operation, Council in 2013 had determined on the basis of peer-reviewed expert advice that the plant was not viable and was obliged to commence a legal claim for damages against the plant's designer MWH. The consultants Cardno BTO, who had been advising Council on wastewater treatment matters since 2011 and struggling to make the plant operate to requirements, were engaged to design a new plant.

On 26 February 2016, it was publicly announced that following the completion of a mediation process begun in 2015, MWH and the Council had agreed to settle the legal claim lodged by Council on strictly confidential terms. Council's media release stated that both parties were 'pleased that the matter has been resolved.'

Council on 9 August 2016 reaffirmed its earlier decision of March 2016 to proceed with the construction of a new Cardno-designed wastewater treatment plant with operations scheduled to commence in December 2018.

1.2 THE INDEPENDENT REVIEW

On 4 July 2016, Whanganui District Council ("Council") following a public workshop determined to commission an inquiry into the facts surrounding the failure of its waste water treatment plant ("the plant"). The full written report resulting from the inquiry had to be presented to Council by 4 October 2016 in accordance with the Terms of Reference set out below.

Council's expressed rationale for the inquiry was: 'The Council and Whanganui community need to understand the circumstances and Council processes which led to the failure of the old plant – from concept evaluation to the final failure.'

The inquiry has been conducted by way of an independent review of the facts pertaining to Council processes throughout the relevant historical period of 2003 to 2012, which ultimately led to the complex and costly infrastructure failure. Council processes included political, administrative and technical decision-making mechanisms.

The Independent Review commenced on 13 July 2016 and the terms of engagement guaranteed 'access to all Council records, documents, Council officers, elected members and where appropriate other individuals as required to undertake the inquiry.'

Important primary source documents held by Council such as Council and Committee minutes, correspondence, technical reports, contracts and management meeting records have been relied upon, supplemented by attempts to question a number of key participants from the relevant historical period, most of whom have left Council and could not be compelled to cooperate. Unfortunately, a number did not.

The principles of natural justice have been respected by the invitation to key participants to provide voluntary input into the Independent Review. Moreover, in ascertaining the facts the Review has not basically sought to apportion blame to particular individuals and has focused instead on systemic shortcomings throughout the whole process. Systemic shortcomings within a local government bureaucracy facilitate an environment in which mistakes are capable of being made.

It is a truism that Whanganui District Council as a perpetual legal entity, albeit in a form that may change from time to time, is ultimately accountable to the public for the mistakes of any of its past officials, employees, consultants and contractors.

It has become apparent during the course of the Independent Review that the organization of Council's historical records are less than ideal. This in part reflects the rapid and ongoing technological change that has significantly transformed record-keeping over the past years, including with the transition from paper to digital and software developments. Moreover, some decision-making processes may have elements which were not formally recorded or do not form part of Council's records. The practice of verbal briefing of Councillors and private caucusing are two examples.

The large number of Council documents that have been accessed have painted a reasonably clear picture of the systemic shortcomings that occurred in the past. These are set out in this report as part of detailing the essential facts and processes followed by Council in chronological order, up to the ultimate failure of the wastewater treatment plant.

The purpose of the Independent Review is to present the Whanganui community with the facts surrounding the Council processes that were followed in the critical period between 2003 and 2012, even if these facts may represent an uncomfortable or inconvenient truth. Nevertheless, a number of the facts are already a matter of public record

This report has therefore been commissioned by Council on behalf of the community of Whanganui to ensure there is proper transparency and accountability for what has occurred and that appropriate lessons may be learned.

1.3 COUNCIL'S TERMS OF REFERENCE

The following Terms of Reference outline the parameters of this report and were determined by Council following a public workshop on 4 July, 2016:

Part 1: Technical

The technical aspects of the plant have been highly investigated, reported on and made public. The technical aspects of the plant also formed part of the mediation between Council and MWH. No further investigation is required in respect of the 'technical' aspects of the plant. The independent report shall confirm and reference the expert opinions stating that the MWH- designed plant was not salvageable.

Part 2: Process

To review the processes followed by Council from 2003 to 2012. This could include the management of the process, reporting to Council and the decisions made by Council:

1.3.1 What fault, if any, was there in Council's input into the design parameters and their decision making processes that led to the acceptance of the design and build of the 2007 plant?

1.3.2 Who was involved and what was the decision making process, starting from the initial design of the plant in 2003 to the opening of the plant in 2007?

1.3.3 What fault, if any, was in the Council operation of the 2007 plant which could have led to its failure?

1.3.4 Is there any evidence that wet industries underestimated their inputs during the design phase or added non-consented, excessive or non-permitted inputs into the plant that contributed to its inability to function?

1.3.5 Was there any failure of timely reporting by plant operations staff to Horizons Regional Council ("Horizons"), Council staff, the Mayor or Councillors of the failure of the plant?

1.4 PUBLIC COMMENTARY ON THE TERMS OF REFERENCE

The *Wanganui Chronicle* editorialized on 5 August 2016 while the Independent Review was underway that Council's Terms of Reference were too restrictive and limited the wastewater review to merely 'checking council processes and will not consider technical aspects such as the integrity or capability of any treatment plants, past, present or future.'

Nevertheless, the *Chronicle* still saw merit with the Terms of Reference in seeking to establish key facts surrounding Council processes. As such, the newspaper fell well short of labelling the Independent Review a 'sham' or a 'waste of money' as some commentary published in the media has done.

Predictably, with voting in council elections due to commence in September 2016, the wastewater treatment plant is something of a political football and associated with this has been a fair degree of public criticism of the Independent Review. Indeed, the *Wanganui Chronicle* reported on 20 August 2016 that three Whanganui District Councillors who are seeking re-election, called for the Independent Review to be called off or have its Terms of Reference widened, with one going so far to describe the inquiry as a 'whitewash' and waste of money.

The public interest dictates that a public inquiry of this nature be defined by terms of reference. By definition, they are a form of limitation or restriction to ensure that the inquiry has scope and direction. The twelve week maximum timeframe and $100,000 budget cap are two other limitations or restrictions applying to the inquiry that are also consistent with the public interest in facilitating an efficient and cost-effective outcome on behalf of ratepayers.

Another limiting factor in this inquiry is that a large amount of MWH commercial information regarding the design of the failed treatment plant was obtained by Council's lawyers confidentially under discovery for the purposes of Council's legal action against MWH. As a result of the mediation process and subsequent confidential settlement reached between Council and MWH, these documents remain privileged and cannot be disclosed. This is a matter of legal fact.

Most of the key Council staff who participated in the treatment plant project from 2003 to 2012 have now left Council's employment. Some have declined to cooperate with this inquiry by not responding to questions put to them or by not accepting the invitation to make submissions of their choice. Legally, these key participants cannot be compelled to cooperate with the Independent Review.

In accordance with the principles of representative democracy, the current Council is accountable through electoral mechanisms to the community for its current lawful decisions and it is neither common practice nor appropriate that such decisions be subject to an inquiry of this nature. Council has published on its website the expert technical advice upon which it relied in making its current decisions so the community can make their own informed judgements.

It is important to note that the Council's expert and peer reviewed advice is built upon the practical experience and knowledge gained during five years of failed operation of the original plant. As such, this has not been an academic engineering exercise.

As part of reviewing Council's historical decision-making processes, it is appropriate and indeed beneficial to make recommendations for the future conduct of Council.

The Terms of Reference have been interpreted broadly for this Independent Review to ascertain relevant facts regarding the Council processes, which necessarily included the technical processes that evaluated thirty four known and proven treatment plant options and ending up adopting a much lower-cost 'hybrid' solution of Whanganui's own creation that lacked any precedent.

Ultimately, it will be a matter for the community of Whanganui to judge whether the objectives of transparency and accountability have been achieved within the context of the issues outlined above.

2 TECHNICAL ASPECTS OF THE TREATMENT PLANT

This report is premised on the objective fact that the Whanganui Wastewater Treatment Plant failed to operate properly almost from its commencement in late 2007. The failures included never meeting resource consent requirements pertaining to effluent discharge and continued seasonal odour events. The Whanganui community are well aware of the latter failure in particular, having suffered the direct effects of the odour problem emanating from the plant.

Council and staff were engaged in continual and costly efforts, from the plant's opening in September 2007 through to its ultimate closure, trying to make the facility work efficiently and effectively.

These plant failings resulted in complex legal action instituted by Council against the plant's designer MWH which has now been settled. This process resulted in the discovery of much technical and other documentation that remains legally confidential. A good deal of information pertaining to the technical aspects of the plant's failure nevertheless already exists in Council's own records and the public domain.

Council has moved forwards and determined to build a new treatment plant based on expert and peer reviewed advice and has thus deemed it unnecessary to further investigate certain technical aspects. Rather, the Independent Review is requested to confirm and reference the key expert advice upon which Council has relied to determine that the MWH-designed plant was not salvageable and needed to be replaced.

The following summary accordingly outlines the key expert technical advice that Council has relied upon to close the failed treatment plant and proceed to construct a new plant.

2.1 CARDNO BTO ADVICE TO COUNCIL – NOVEMBER 2011

In July 2011, whilst attempting to deal with the ongoing dilemma of its failing plant, Council commissioned new technical consultants Cardno BTO (Cardno) who were tasked with comparing the actual performance and capacity of the plant to its resource consent conditions and design. The services of MWH by this stage had largely been dispensed with on the project.

The resultant Cardno report entitled 'WWTP Process Capacity Review and Optimisation' was produced in November 2011. At this point in time, Cardno were essentially commissioned to recommend ways to try and make the failing plant work better. However, the writing appeared to be on the wall by then that the plant's future was problematic.

The 2011 Cardno report advised that the plant needed upgrading to address the problems of resource consent non-compliance (faecal contaminants and suspended solids concentration) and high operating costs (aeration power usage and UV operating/maintenance). However, the report cautioned that its identified solutions were 'designed within the constraints of the existing treatment process which may limit their efficacy.' (Executive Summary p. 6)

A total of eight upgrade recommendations were made (in a staged process with each conditional on the previous stage), in addition to other specified work pertaining to contaminants within trade waste discharges and sludge quantities in the treatment lagoons which needed to be carried out (ES pp 7-8).

The significant capital costs of the proposed upgrade were to be offset in part by potential reductions in operating costs (ES p.9).

The 2011 report's upgrade recommendations were included in Council's 10 year plan.

A copy of the Executive Summary of the 2011 Cardno report entitled 'WWTP Process Capacity Review and Optimisation' is set out at Attachment A.

2.2 CARDNO BTO ADVICE TO COUNCIL – MARCH AND APRIL 2013

During the summer of 2012-2013, the plant was still experiencing operating problems, particularly with a prolonged and significant odour event. On 9 January 2013, the environmental regulator Horizons Regional Council (HRC) had issued an Abatement Notice which required Council to reduce odours emanating from the plant to an acceptable level by 7 February 2013 (this was followed up by HRC being granted an Enforcement Order by the Environment Court with Council's consent).

Despite all the actions taken by Council in accordance with Cardno's 2011 recommendations for the short and medium term, the odours had been reduced but still remained at an unacceptable level. The underlying issue of the plant's design still remained, which was regarded as the root cause of the unacceptable odour levels.

At its meeting of 17 January 2013, Council resolved to commission Cardno to provide a future options report that included advice on:

- Any additional immediate measures that could be taken to address odour and treatment
- Whether it was viable to continue with the plant
- If viable, which options to achieve satisfactory performance were available for completion over the following two years
- If not viable, then what type of plant would be suitable for Whanganui's waste and what size would that need to be

Council also required that Cardno's report be undertaken over a three month period and that it be peer reviewed concurrently by an expert independent of the project. The peer review was subsequently conducted by AECOM working alongside Cardno.

On 27 March 2013, Cardno produced an Odour Mitigation memorandum for Council's Infrastructure and Property Committee Meeting of 9 April 2013, outlining short term and medium term mitigation strategies and stating that a longer term solution involved a detailed evaluation of potential solutions.

A copy of Cardno's March 2013 memorandum to Council, to which is attached commentary from the AECOM peer reviewer, is set out at Attachment B.

Cardno's 'Evaluation of Long-Term Improvements for Consent Compliance', issued on 24 April 2013 and peer-reviewed by AECOM, determined that continuing with the plant in its then current configuration was not viable, stating that:

'The original design concept is flawed and capital improvements are required in order to reliably meet the effluent consent and minimize the risk of odours'. Whilst some use could be made of the existing infrastructure, Cardno concluded that a new type of plant was necessary.

Significantly, Cardno went on to state that, given the plant's history there was 'no opportunity to trial experimental, high risk solutions', which was seemingly a reference to the unprecedented nature of the original design of the failed plant. (Executive Summary p. iii).

In fact, Cardno described the MWH plant process design as 'unconventional in that it combines an aerated lagoon-type process on top of a 4 metre deep anaeorobic sludge layer.' (p.16 of full report).

A copy of the Executive Summary of the April 2013 Cardno report is set out at Attachment C. A full copy of the report and its attachments is available on Council's website at www.whanganui.govt.nz.

The peer review of Cardno's report was conducted concurrently by Matthew Mates from AECOM, who, along with Cardno, reported to Council at its meeting of 29 April 2013. The minutes of the meeting record the following:

Mayor Main asked Mr Mates if he had seen any wastewater plant the same as Wanganui's and what was his initial assessment of the plant. Mr Mates said he worked for a company with 50,000 employees. This plant had a very deep pond and he considered it to be a low cost solution for a treatment plant and one that he had never seen anywhere before. He said the Council was now dealing with the cumulative effect of the plant having been overloaded for a period of time and being supplied with insufficient oxygen and was now in a failure state. Mr Mates considered it a very crude system and he would not have selected this process as he dealt in a much more high tech world.

Following consideration of the Cardno report and the corroboration from the AECOM peer reviewer, Council on 10 June 2013:

- acknowledged that continuing with the wastewater treatment plant in its then current configuration was not viable given its inability to meet existing resource consents and to comply with air quality standards
- acknowledged that the cost of a completely new wastewater treatment plant (greenfield approach) estimated at $60M-$80M was an unrealistic and unaffordable option for the Whanganui community
- resolved that modifying the then existing wastewater treatment plant was the only viable option to consider.

2.3 CH2M BECA ADVICE TO COUNCIL – OCTOBER 2015

The advice to Council from the highly-respected Humphrey Archer of CH2M Beca (Beca) of 28 October 2015 clearly post-dated Council's June 2013 decision that the configuration of the MWH designed plant was not viable.

While the Beca advice was thus not considered by Council in determining the future of the MWH designed plant, it is useful to restate Beca's conclusions here as they represent further expert confirmation of Council's decision.

The Beca report concluded:

- The "Optimised Lagoon Process" [i.e. the MWH-design] did not have precedents and attempted to combine all treatment functions into one lagoon
- Significant errors were made in the estimated sludge storage volume which resulted in the storage capacity being exceeded from about 2009/10 [i.e. just over 2 years after the plant's commencement]
- Required aeration energy was significantly underestimated and no margins were applied (which is standard practice for aeration demand)
- Installed aeration energy disturbed the sludge layer and prevented full anaerobic digestion of the sludge. Further aeration would have caused more disturbance of the sludge layer
- The concerns expressed by the 2004 Peer Reviewers were not appropriately addressed by MWH

A full copy of the Beca Presentation to Whanganui District Council by Humphrey Archer is set out at Attachment D and is also available on Council's website at www.whanganui.govt.nz.

3 FACTUAL REVIEW OF COUNCIL PROCESSES – 2003 TO 2012

Council decision-making processes from 2001 to 2005 that determined the preferred design of the plant essentially followed two main concurrent streams: Reports to and discussions at formal Council and Committee meetings where Councillors and staff were present and deliberations of a Technical Working Group convened in March 2001 and officially made up of two Council staff, MWH consultants and Iwi and community representatives.

Councillors were not participants in the Working Group process, which was meant to feed into the Council decision-making process. In practical terms, the substantive deliberations of the Working Group were undertaken by MWH consultants and two Council technical staff.

The Council processes would have also included numerous internal meetings and discussions and meetings with external consultants, as well as briefings with Councillors and other forms of interaction and communication.

In order to paint an overarching and chronological picture, the Council processes from 2003 to 2012 have been divided into the three critical and consequential stages of plant design, plant construction and plant operation. The following summary thus sets out the key decision-making trail followed by elected Councillors and Council technical staff and associated processes over the three stages of the treatment plant project.

It should be noted that the normal process at Council was for wastewater matters to be first considered by the relevant committee and the records of these committee deliberations were subsequently incorporated into meetings of full Council where formal decisions were then confirmed. In setting out the decision-making trail therefore, reliance has been placed primarily on the records of the formal decision-making governing body. Where considered necessary at critical meetings, cross-referencing of committee records was also undertaken for additional accuracy purposes.

3.1 DESIGNING THE TREATMENT PLANT - 2003 TO 2005

The critical meeting of Council where the decision was made to confirm the concept of the MWH-designed Optimized Lagoon Treatment Process, subject to a peer review, was held on 16 February 2004.

By way of necessary background and completeness, the earlier Council meeting of 20 May 2002 seems the first formal meeting where Councillors were advised in detail of the process staff had been effectively following since July 2000 with the Wastewater Treatment Working Group (Technical).

The minutes of the 20 May 2002 Council meeting show that Councillors were informed that:

- having recently obtained revised consents for the project, the wastewater planning phase had shifted to analyzing the best treatment process
- this was a technically complex issue and a number of options would need to be evaluated
- the Working Group had been formed, assisted by MWH, in order to develop these options for Council's consideration
- Councillors would be subsequently asked to consider the reference case and a range of alternative treatment options

3.1.1 The Elected Council – Key Decision-Making Processes

Council Meeting - 4 November 2002

At the Council meeting of 4 November 2002, it was reported that the consultant engineers MWH made a presentation on progress of the Working Group to that point in time, specifically that the evaluation had been narrowed down from thirty four to the following four options:

- Reference case (facultative lagoon and trickling filters)
- Advanced pond system (AIWPS)
- Aerated facultative pond (aeroFAC)
- Aerated lagoon

MWH advised that the aerated lagoon option had the lowest capital construction cost at $16.4M and the advanced pond system was twice this cost. Each of the options had significant ongoing operational costs. After asking a number of questions of MWH, Council resolved to express 'confidence in the process.'

Council Meeting - 24 February 2003

At the meeting, a general discussion ensued about the process for obtaining peer reviews for engineering reports on Council projects. During this discussion, it was acknowledged that the engineering reports for the selection of the wastewater treatment process were to be peer reviewed.

Council Meeting - 3 November 2003

A report and recommendations from the meeting of the Works and Transport committee of 21 October 2003 was presented. In the report, Council staff advised that the initial thirty-three design options had been narrowed down to a shortlist of four, comprising two large pond processes and two compact 'tank' processes. All options had been rated against 'Outcome Success Criteria' and the four remaining options had been modified and costed over a 30 year life cycle. A new potential plant site near the airport had been identified which may be a good fit for an additional 'hybrid option' being considered by the Working Group, which sought to combine the best features of all shortlisted options being evaluated.

Council Meeting - 16 February 2004

The so-called 'hybrid option', which the Working Group characterized as the Optimised Lagoon Process, was put to Council on 16 February 2004 for adoption as a recommendation from the Works and Transport Committee meeting on 10 February 2004.

Staff advised Councillors that development had been undertaken by the Working Group to 'essentially select the best components of the [four shortlisted] options and produce a hybrid, which is considered to be the optimum plant for Wanganui's needs.'

MWH had also made a presentation to Councillors.

Councillors were advised that the key features of the Optimized Lagoon Process were:

- the plant had a relatively small footprint meaning it could be located closer to the city near the airport

- it was innovative and there was 'no such plant in existence, certainly in New Zealand, which combines well-established process techniques with a unique sludge management process'
- the ground conditions on site meant that major cost and operational savings could be achieved by storing and treating sludge for 20 years at least – ponds would be excavated 'up to 10 metres deep where in normal situations they would be much shallower'
- there was flexibility to cope with variations or modifications to deal with influent fluctuations and future growth
- four lined ponds or lagoons, with control and distribution systems, surface aerators on the lagoons and an ultra violet disinfection system
- a significantly lower cost than the other four shortlisted options – a 'whole of life' cost of $16.93M compared to the four shortlisted options which ranged from $26.80M to $47.15M.

Councillors were further advised by staff that the Optimised Lagoon Process was relatively low risk 'primarily because it is based on proven technologies.' Nevertheless, it was to be peer reviewed and 'any issues raised in the review will be able to be dealt with in the detailed design phase.'

The Optimised Lagoon Process was presented as a 'major positive for Council both in terms of overall cost and meeting the success criteria identified.' Indeed, staff also advised that a net $4M plus reduction in the treatment plant budget [i.e. cost saving] was to be allocated for public separation to 'maximise the benefit of the programme in addressing the needs of urban flooding.'

Only one Councillor queried the fact that the staff report did not contain a financial report and was told this would be provided at a later date.

The Council confirmed the Optimised Lagoon wastewater treatment process, subject to a peer review.

Council Meeting - 29 November 2004

The 29 Nov 2004 Council meeting was the first normal business meeting of the newly-elected governing body. It considered a report from the Works and Transport Committee of 17 November in respect to key matters relevant to the plant:

- the authorization of discussions with MWH, OPUS and Works Infrastructure Limited to formulate an alliance partnership to deliver water and wastewater engineering services
- the outcome of the peer review of the Optimised Lagoon treatment process and procurement options for construction

[NB In respect to the alliance partnership, there appears no consideration was given by staff or Councillors to undertaking a competitive procurement process for the provision of the engineering and related services. Rather pre-existing consultancy relationships were seemingly rolled over into the new contractual arrangements.]

Regarding MWH. Council was advised that the treatment plant was 'a major project that required the best skills and resources available.' The Optimised Lagoon process 'has been developed with the assistance of MWH consulting engineers [and] it is preferable that they be retained to provide specialist expertise for the next three years in the design and project management phase.'

The peer review of the MWH design was conducted by John Crawford from Opus Consultants and Cliff Tipler from URS New Zealand, assisted by a Council staff member Julian Reweti from Wanganui Water Services.

The Peer Review Panel was required by Council to answer whether the treatment plant option identification process had been robust and whether the selected options would meet Whanganui's needs.

Councillors were advised by staff that the Peer Review Panel had answered both questions in the affirmative.

The minutes record that Councillors were provided with the following single sentence extract from the Peer Review Panel: 'Generally, we are in agreement that the concept of a panel based system is a pragmatic approach to the selection and performance criteria that have been developed for the project.'

Staff further advised that the 'review also raised, not unexpectedly, a number of largely technical issues which will require resolution. These issues essentially relate to risk management.' No specific details were provided to Councillors and there was no recorded discussion pertaining to these issues.

Council's resolution did not refer to the peer review when adopting the design, tender and contract model for the procurement.

Council Meeting - 17 December 2004

Council resolved to enter into an agreement with MWH, OPUS and Works Infrastructure for the delivery of water and wastewater engineering services, based on the Alliance Partnership memorandum of understanding signed on 17 December 2004. Once finalized, the three separate contracts had to go to the Tenders Board for approval.

Council Meeting - 4 April 2005

Staff reported to the Council meeting of 4 April 2005 that MWH had been engaged to project manage the procurement of the new plant in addition to designing it 'because of their particular expertise in such projects' and because of their 'close involvement [with Council] over recent years including the development of the particular treatment technology we have selected.'

Councillors were advised that a 'Pain Gain' clause was being negotiated for procurement and construction whereby MWH would accept some of the risks involved because the 'project itself is high value and carries a number of significant risks for the Council that need to be carefully managed.'

Council Meeting - 19 September 2005

Councillors at the meeting were provided with an update on progress with the treatment plant, which was required to be completed by 1 July 2007. Councillors were advised in part that:

- the system approved by Council was an optimized aerated lagoon system
- this consisted of an aerated lagoon, a settlement lagoon and an ultra violet disinfection system plus control and monitoring systems
- the structure would allow storage of sludge without intervention for 20 years

[NB. The aerated lagoon and settlement lagoon being proposed at this time was different to the four lined lagoons concept that Council had approved in February 2004. However, former Mayor Michael Laws

submitted to the Independent Review that he was briefed on this at the time by then CEO David Warburton who assured him that this was not 'a fundamental change to the original design concept.' Report No. 11 produced by MWH for the Technical Working Group in October 2005 stated that the 'shape of the lagoons has been modified to 'natural' shapes that can fit largely within the contours of the proposed site and that are more aesthetic than the original rectangular lagoons.' The modified design represented a significant cost saving]

3.1.2 Council Staff – The Technical Working Group Process

Establishment of the Working Group

Despite MWH and Council technical staff commencing work in July 2000, the Working Group was only formally convened in March 2001 and was comprised of Council's Senior Engineer Colin Hovey, Public Utilities Manager Dean Taylor, Tupoho Representative Meriana Karauria, Ngati Apa Representative Chris Shenton and Alan Wrigglesworth from Friends of the Shoreline.

MWH provided the Working Party with professional technical assistance and their team engaged on the wastewater project was managed by Ian Robertson and included other consultants, primarily Dr. Dave Stewart.

The deliberations of the Working Group effectively followed two parallel streams, a more consultative-type, information-sharing process which included the community and Iwi representatives as stated above and another involving just MWH consultants and the two Council staff which did the more substantive technical evaluation and analysis and reported back to the broader group and Council.

The broader Working Group process including the Iwi and community representatives held nineteen meetings between 19 July 2001 and 4 December 2003, when it officially concluded for the external representatives. MWH's Ian Robertson presented to most but not all of the broader group's meetings. It was an important mechanism for engaging with Iwi and Friends of the Shoreline, thereby achieving their input and buy-in to the wastewater treatment project.

Council's former Senior Engineer and leading member of the Working Group, Colin Hovey, submitted to the Independent Review that:

'During the working group process visits with the group were made to plants at Porirua, Otaki and Palmerston North. They were accompanied by MWH staff. I also visited NZ plants at Feilding, Alliance Pukeuri, Fonterra Edendale, Winton, Gore and Bluff, in the company of Dr. Dave Stewart, the principal process designer for MWH. These visits would have taken place in 2001 and early 2002. In October-November I visited plants in USA, three, Scotland, one, and South Africa, three. I was met by MWH local engineers on most occasions. All these plants had aspects of possible options for Whanganui.'

Reflecting the parallel streams of the Working Group, the critical technical meeting at MWH's offices in Wellington on 20 October 2003 detailed below, which developed the concept of a 'hybrid option' called the Optimised Lagoon Process, was only attended by four MWH consultants and the two Council staff. Whilst the potentiality of this new treatment process design had been flagged at a meeting of the broader Working Group on 25 September 2003, it was not outlined in detail to the group until its final meeting on

4 December 2003, where Ian Robertson from MWH tabled and spoke to the Working Group Reports Nos. 9 and 10.

In fact, it was Report No. 10 produced in December 2003 and outlined below which first detailed the concept of the Optimised Lagoon Treatment Process.

MWH working with Council staff continued with the finalization of the detailed plant design over the next couple of years following the official end of the Working Group in December 2003, the Council's confirmation of the Optimised Lagoon concept in February 2004 and the subsequent Peer Review of the design concept conducted throughout that year.

The Working Group was the key technical driver in Council's decision-making process on the treatment plant and MWH produced a total of twelve reports from July 2001 up to its Stage One design report in November 2005. Whilst Councillors were not directly involved in this process, some reporting to Council did occur from May 2002 onwards.

The first seven reports of the Working Group predate the period between 2003 and 2012 being reviewed in accordance with the Terms of Reference, but they are referred to briefly below for the purposes of context, completeness and accuracy.

The Original Montgomery Watson Contract - 2000

In October 2000, Ian Robertson from Montgomery Watson (as MWH was then known) presented a proposal to Council staff to support a working group for the evaluation of wastewater treatment options. The proposal outlined matters such as proposed methodology, consultants' fee structure and professional qualifications. It stated that Ian Robertson had been 'closely involved with Wanganui since 1989' and was the consortium project manager for the Wanganui Wastewater Project Phase 3 from 1992 to 2000.

The Montgomery Watson (MW) proposal to support the working group was accepted by Council staff without any apparent evidence of testing the market for the provision of consultancy support. Moreover, a search of Council's records has not uncovered a standard professional services contract which went through the Tender Board process existing at the time.

In fact, Council sent a letter to MW dated 2 October 2000 inviting them to submit a proposal to provide consultancy advice to the proposed Working Group. This was followed by another letter from Council to MW dated 17 October 2000 accepting an MW proposal of October 2000 to support the working group. This constituted the contractual relationship.

Documents uncovered from earlier in the year 2000 show correspondence between MW and Council relating to the wastewater project which refer to a new wastewater professional services contract being adopted by Council.

On 11 May 2000, Montgomery Watson sent a facsimile transmission to the Council CEO objecting to Council's selection of a preferred professional services contractor for the Wastewater Project, including separation works and the treatment plant.

MW complained that Council was 'changing the lead project staffing from Montgomery Watson which is acknowledged as being the world's top provider of engineering services in wastewater and sewerage to a

firm whose capability comprises 5 or 6 people, mainly in Hamilton…[Council] are also taking out the most capable and knowledgeable local person.'

The MW facsimile concluded: 'We believe it will be in the interests of the Wanganui community if capability and experience is acknowledged as being of value and is retained. We therefore suggest you separate the wastewater project from the remainder of the contract services and retain your current expert advisers.'

The following day on 12 May 2000 and after a discussion with Council staff, MW expressed its concern in another facsimile transmission to Council's CEO that 'the content of the professional services contract is not clear as it relates to the Wastewater project.' Arguing that the professional services contract was virtually all about supporting wastewater separation, MW reiterated its proposal of the day before that the Wastewater [i.e. treatment] Project be shifted out of it.

MW went on to state: "I would add my concern that some people assume this is low tech work and can be done by anybody. This is not the case if you want the degree of cost control [Council has] indicated to date. The investigation methodologies, design capability and approach to the construction phase activities all have a significant impact on the final cost.'

The MW proposal of October 2000 accepted by Council on 17 October 2000 also provided that the initial engagement based on specified rates for hours worked could be converted to lump sums for identifiable items of work when 'mutually agreeable.'

Despite the letters-based contract coming into existence in October 2000, Council's financial records for the treatment plant project indicate that MW had submitted its first invoice for an amount of $11,093 in July 2000 with subsequent invoices in August and September for $7,367 and $12,942 respectively. Therefore assuming the invoices are correctly accounted for, MW claimed a total of $31,402 before Council invited them to submit a proposal in October 2000.

All up, Council records show that MW and MWH as it became, were paid a total of $413,000 over the five years from July 2000 until Contract 1181 came into existence.

Professional Services Contract 1181 between Council and MWH, primarily for detailed design and project management of construction of the wastewater treatment plant, was signed in June 2005 after having been vetted through the Tender Board process.

Overall, MWH was paid a total of almost $2.9 million from July 2000 until February 2013.

3.1.3 The Working Group Reporting Timeline

The following outlines the twelve reports produced by MWH in conjunction with the Working Group and associated Council process:

Working Group Report No. 1 - July 2001 - Treatment Terminology and Technology
This report was an introduction for Council staff on the basics of wastewater treatment.

Significantly in the light of future events, the report stated in part that: 'Technological developments in sewage treatment have tended to be incremental improvements of well-established processes rather than radical new approaches.'

Working Group Report No. 2 - September 2001 - Project Development and Delivery Process (PDDP)

Basically, this report was an introduction for Council staff on the methodology of project management. The report stated in part that the final preferred option report 'will provide WDC with a guide to an appropriate wastewater treatment plant strategy, together with background materials to emphasise that it is the result of a robust process.'

Working Group Report No. 3 - October 2001 - PDDP: Information for Development
The report set out the Project Development and Delivery Process plan elements and resourcing, including the Goal Statement, the Outcome Success Criteria and Stakeholders**.**

Working Group Report No. 4 - January 2002 - Reference Case Concept
The report detailed the Reference Case treatment process, location, costs, evaluation criteria and performance, stating that the reference case must meet the goals and success criteria sufficiently for it to be considered a realistic potential solution, 'but not necessarily the best solution.' The Reference Case was to be used to assist evaluation of alternative treatment processes.

Working Group Report No. 5 - May 2002 - Reference Case Detail
Specific details of the Reference Case were outlined. The report stated in part: 'The Reference Case treatment plant comprises anaerobic treatment in aerated facultative lagoons, aerobic treatment in trickling filters followed by UV treatment of effluent. Sludge is thickened and dewatered for disposal or potential reuse.'

Working Group Full Day Workshop Wellington - 16 May 2002
The workshop was a brain-storming session in Wellington attended by six MWH consultants, one representative from NIWA and three Council staff. The workshop identified wastewater treatment alternatives to be evaluated against the Reference Case. A total of thirty four alternatives were reduced to a 'long list.' Improvements to the Reference Case were also developed.

Working Group Report No. 6 - August 2002 - Definition of Alternatives
The 'long list' of alternatives considered were Pond Based processes, Attached Growth Processes, the Suspended Growth Process and Physical Processes (chemically assisted sedimentation).
Significantly in light of future events, the report stated that they represented 'the range of treatment processes in current use and cover the range of basic alternatives available. Whilst many are innovative, they are predominantly incremental improvements of basic processes rather than new 'breakthroughs' in treatment technology. They are all proven in full scale use, although some not in New Zealand.'

Working Group Report No. 7 - October 2002 - Results of Multi Criteria Analysis
For each Outcome Success Criteria:

- the performance of the Reference Case was assessed on a scale of 0 to 10

- the performance of the Alternatives were assessed on a scale of 0 to 10 relative to the Reference Case

The numerical performance assessments were used, together with weightings of the Outcome Success Criteria, to calculate the relative preference for each Alternative.
The end result was that a closely bunched group of the Reference Case and three Alternatives (the 'short list') were clearly separated from the remainder which were also closely bunched.

Working Group Report No. 8 - October 2003 - Alternatives - Refined Cost Estimates
Cost estimates were refined for the short list comprised of:

- Reference Case
- Partially Mixed Aerated Lagoon
- Advanced Integrated Pond System (AIPS)
- Advanced Integrated Wastewater Pond System (AIWPS)

Working Group Technical Meeting - Wellington - 20 October 2003
Present at this meeting at MWH's offices in Wellington were Council staff Colin Hovey and Dean Taylor and four MWH consultants including Dr. Dave Stewart.
Rather than the original intention of developing the shortlisted options further, the objective of the workshop was now expressed to be using these options 'to evaluate the performance and benefits of the various elements which make up the options and develop a single optimum arrangement which is specific to Wanganui's needs.'
The key factors taken into account when considering what constituted 'optimum' were:

- Cost (capital and operating)
- Reliability in achieving resource consent requirements
- Low production of sludge without a requirement for expensive, constant processing

Working Group Report No. 9 - November 2003 - Alternatives - Assessment of the Aero-Fac System
The Aero-Fac System had not been considered in Report No. 8 because its power requirements were considered too high. This report assessed three proprietary systems of aerated facultative lagoons marketed by LAS International of the USA.

Working Group Report No. 10 - December 2003 - Development of an Optimised Wastewater Treatment Process
The report followed on from the technical meeting in Wellington on 20 October 2003 where MWH and Council staff had brainstormed the concept of a new Optimised Lagoon Treatment Process.
This involved identifying the 'most desirable features' of all the shortlisted options and combining them 'in a form that could provide Wanganui with a process that best meets all the selection criteria.'
The main features of the Optimised Lagoon Process were expressed to be:

- Two aerated lagoons operated in parallel (similar to the Partially Mixed Aerated Lagoon option)

- Each aerated lagoon followed by a settling lagoon which acted as a clarifier (instead of the concrete and steel clarifiers in the Partially Mixed Aerated Lagoon option)
- The lagoons would be constructed with an additional depth of 4 metres designed to allow sludge to accumulate over a period of 20 years or more without the need for any sludge management or disposal, thereby eliminating this high cost for a significant time
- The treatment of all wastewater inflows including high flows in wet weather by including freeboard in the aerated lagoons to provide storage and control the flow to the settlement lagoons and UV system

The Optimised Lagoon Process was calculated to offer 'significant cost advantages' with a Net Present Value of 'whole of life' cost calculated to be $16.93M, compared to the four shortlisted options which ranged from $26.80M up to $47.15M.

Working Group Report No. 11 - October 2005 - Confirmed Process Design
The report outlined a modification of the Optimised Lagoon Process design and confirmed the location of the new treatment plant.
The modified design resulted in 'a single aerated lagoon and single settlement lagoon connected in series instead of two parallel aerated lagoons and two parallel settlement lagoons.
The shapes of the lagoons [were] modified to natural shapes that could fit largely within the contours of the proposed site and were more aesthetic than the original rectangular lagoons.
Key features of the modified design were:

- Treatment provided in a four hectare aerated lagoon with floating, electrically-powered surface aerators
- Effluent from the aerated lagoon flowed into a second lagoon to settle out suspended solids
- Aerated lagoon had an active depth of four metres with an additional four metres below for long-term sludge storage
- Settling lagoon had an active depth of five metres with an additional 3 metres depth below for long-term sludge storage
- Aerated lagoon had two metres freeboard to provide flow-balancing of high wet weather wastewater inflows
- Effluent from the settling pond disinfected by ultra-violet light before discharge to the ocean

Report No. 11 also included a section on the outcomes of the peer review of the Optimised Lagoon Process and this is commented on further below in 3.1.4.
Working Group Report No. 12 - 24 November 2005 - Stage 1 Design Report
This report focused on technical matters associated with the design and operation of the treatment plant, including calculations of trade waste flows and loads.

3.1.4 2004 Peer Review of the Preferred Optimised Lagoon Process Design

Council had confirmed the design for the Optimised Lagoon Treatment Process at its 16 February 2004 meeting, but only on the condition that it be peer reviewed.

The Optimised Lagoon Treatment Process is 'based on a deep aerated lagoon in which settlement, sludge storage and aerobic biological treatment are performed within a single lagoon.' (Cardno BTO)

A Peer Review Panel was briefed by Council staff in March 2004 and was coordinated by John Crawford from OPUS International Consultants. The Panel also included Cliff Tipler from URS New Zealand and was assisted by Council staff member Julian Reweti from Wanganui Water Services.

The Review Panel initially raised a number of issues and concerns with MWH and Council staff regarding the preferred treatment plant design, to which responses were provided.

On 16 September 2004, the Review Panel Coordinator, John Crawford, wrote back to Council staff confirming that a number of the issues raised by the Panel had been 'satisfactorily resolved.' However, the Panel also considered that a number of the issues raised had 'not been satisfactorily addressed.'

The Review Panel detailed the following five key points for further action or attention by MWH and Council:

- The need for a rigorous risk assessment process covering the preferred option, the sewer separation process and trade waste dischargers
- Provision of calculations used for determining the proposed aeration requirements
- Provision of raw data to support the claims made
- Confirmation of the longevity of the plant, particularly in terms of sludge inventory
- The need to formalize the trade waste bylaw and trade waste agreements with significant dischargers to ensure adequate control of discharges is enforceable

The Peer Review Panel Coordinator noted that the risk assessment would not be able to be addressed by a meeting of the parties and needed to be 'a rigorous and structured part of the procurement process from here on.' He attached to his correspondence a detailed list of the issues raised by the Panel and responses received as at that date from MWH and Council staff. The detailed list verified the significant issues that remained unresolved or where Council/MWH had not supplied the data upon which the concept design could be properly reviewed.

Council staff wrote back to the Review Panel a month later on 28 October 2004 stating in part that:

- The requirements of the March 2004 peer review brief had been 'broadly satisfied'
- A number of the issues raised by the Panel required further analysis and this would assist Council in the briefing of the design and procurement phase
- The peer review was considered complete and the Panel was requested to provide their final invoice

The Technical Working Group's Report No. 11, produced by MWH just over a year later in November 2005, commented on the Peer Review stating that it 'raised a number of questions and potential risks that have largely been addressed. However, some of the issues they raised cannot be answered with complete certainty and it is recognized that the detailed design of the treatment system will need to provide contingencies to react to the possible risks.'

3.1.5 The Wanganui Water and Wastewater Partnership

The Alliance Partnership

Council records state that the Alliance Partnership 'was designed to deliver the new Wastewater Treatment Plant, the completion of the Wastewater Separation Project, miscellaneous water and wastewater related projects and also provide operational and asset support.'

An Alliance Partnership Memorandum of Understanding (MOU) between Council and MWH, OPUS and Works Infrastructure Ltd was signed on 17 December 2004.

The Alliance Partnership MOU did not create a corporate-type partnership, but rather was a single and overarching framework agreement with three separate service providers for the delivery of Council's interrelated water separation and wastewater projects and associated works.

Essentially, the alliance partnership sought to draw on MWH's professional engineering skills in wastewater treatment plant design, on OPUS's professional engineering skills in wastewater separation design and on Works Infrastructure's relevant professional, operational and maintenance engineering skills in water and wastewater activities.

Based on the MOU, separate contracts between Council and MWH, OPUS and Works Infrastructure respectively, with Tender Board approval, were developed in 2005 for the delivery of water and wastewater engineering services.

The Water Partnership Steering Group

The MOU specified that each contract would contain a requirement for MWH, Opus and Works Infrastructure to contribute one person each to a Water Partnership Steering Group which would also include two Council managers. Some of the key objectives of the WPSG were to provide overall effective management of the Water and Wastewater programmes, to foster a cooperative partnering approach to project delivery and to put in place peer review processes where applicable.

The 2005 MWH Contract

In accordance with the MOU, Professional Services Contract 1181 between Council and MWH New Zealand Ltd was made on 27 June 2005 with a negotiated tender price of $1,096,000 excluding GST for the first year of the contract.

The contract was expressed to operate until 1 July 2006 with a potential for a one year plus another one year rollover on a schedule of rates basis.

Council's financial records indicate that MWH was paid a total of about $2.4 million for the period June 2005 to February 2013 under Contract 1181. Overall, MWH was paid nearly $2.9 million in total from July 2000 to February 2013.

The MWH contract provided that its primary objectives were:

1. To project manage the Wastewater Treatment Plant and Associated Works which includes design, contract management, commissioning and achieving of performance criteria.
2. To provide emergency response support for Wanganui Water Services.
3. To project manage a range of projects, investigations, supervision, inspections and asset management functions as assigned by the Water Partnership Steering Group on instruction by the client.
4. To ensure that PR, customer interfaces and service are undertaken to at least or better than Council's service standards and policies
5. To ensure that projects undertaken are designed to best current practice and delivered in a best for project manner that considers best price and advice for whole of life asset management of the facilities.

The Council Tender Board Process

The Tender Board consisted of three elected Councillors appointed by the Mayor (but excluding the Mayor) and at least four Council staff appointed by the CEO (but excluding the CEO). The Board was normally chaired by the Deputy CEO and had to apply a number of tests to any proposed procurement coming before it and then, if satisfied, make recommendations to the CEO on particulars such as procurement methodology and whether the matter should be referred to Council. Documents associated with the June 2005 contract between Council and MWH suggest that Council staff invited MWH to submit the only tender proposal for the project and the Tender Board process was mainly concerned that the contractual paperwork was in order.

3.2 CONSTRUCTING THE TREATMENT PLANT – 2005 TO 2007

The Treatment Plant was required to be constructed and operational by 1 July 2007 in accordance with the terms of Council's resource consent. As matters transpired, the project ended up being completed over time and over budget.

The construction process had its technical and logistical challenges and the site itself produced some complications. Eleven physical works contracts were awarded overall.
Plant operations did not commence until late 2007.
The Council meeting records set out below show continuing progress reports against the background of a tight design, tender, contract and construction timeframe.
Council Meeting - 21 February 2005
Council staff reported that the financial provision for construction of the treatment plant in the Long-term Council Community Plan (LTCCP) was $22.5M.
However, through the options evaluation process, staff had been able to 'develop an option that takes advantage of the unique Wanganui situation and up-to-date technology that is estimated to significantly reduce the original projection.' The revised capital estimate was $15M and the optimized lagoon process was said to also incur lower operating costs.
Staff cautioned that these 2004 figures were subject to currency movements and escalation in construction costs. It was reiterated that Council had resolved in 2004 'to take $4M of this projected saving and apply it to flood mitigation projects.'

Council Meeting - 4 April 2005
Council resolved to purchase at market value about 21 hectares of land adjacent to the city airport that was part of the Harbour Endowment portfolio for the purposes of constructing the plant. Councillors were also advised about the 'Pain Gain' clause being negotiated with MWH to accept some of the 'significant risk' associated with the design and project management of the plant's construction.

Council Meeting - 30 June 2005
It was noted that Te Runanga O Tupoho had given approval to transfer ownership of the land near the airport from the Harbour Endowment to the City Endowment for the purposes of constructing the plant. An Iwi representative present at the meeting said approval 'was given through the goodwill of Iwi as Iwi considered the sewerage scheme important.'

Council Meeting - 19 September 2005
It was reported that MWH and Council's engineering project manager were finalizing ultimate flows, loads and peak volumes that the plant would have to cope with and be sized for. Following sizing, a Total Estimated Cost would be developed after detailed costings and designs. The two stage design process would occur from September to December 2005 followed by a confirmation of contracting strategy and tendering process from December 2005 to February 2006. Construction would then commence in April 2006 and run through to April 2007, thereby allowing commissioning of the plant in July that year.

Council Meeting - 12 December 2005
The Stage I design was reported as completed and Council resolved to move to Stage 2. The estimated capital cost of the plant was now $14.3M. The project had been optimized to allow, for example, for higher volumes of stormwater flow.
It was stated that making the plant bigger created a number of risk management opportunities for Council, for example to deal with growth or decline in wet industry and to allow for greater sludge storage. Discussions had also been held with the wet industry regarding sizing of the plant and improvements that could be made in their own tradewaste treatment systems. The Council CEO advised that it would likely be cheaper for wet industry to use Council's plant than install their own.

Council Meeting - 3 April 2006
Detailed design was reported as progressing and final tradewaste monitoring and evaluation was nearing completion. The Minister for Conservation had consented to the sale of the Harbour Endowment Land.
Council Meeting - 22 May 2006
Design was reported as still underway and other negotiations, works and tenders were progressing, such as for aerators.

Council Meeting - 3 July 2006
An update was provided on tender progress. The implementation and construction timeframe was proving challenging. Tender pricing was high risk because of the prevailing economic climate for construction works, particularly where products were sourced from overseas.

Council Meeting - 25 September 2006

A further update was provided on the progress of tenders and works. Of the projected $14M capital expenditure, contracts for $7M had been awarded to date.

Council Meeting - 27 November 2006
The Stage 2 detailed design was nearing completion and other works were continuing. Of the $13.8M budget, contracts for $13.1M had by then been awarded. Works to the value of $2.67M had been completed.

Council Meeting - 29 January 2007
All major construction contracts had by then been awarded with the projected capital cost then being $14.6M.

Council Meeting - 26 March 2007
Earthworks were substantially completed, pipe-laying and major power supplies to the site were completed. Eighteen major aerators had arrived in New Zealand and were awaiting delivery. The projected cost had increased to $14.9M.

Council Meeting - 28 May 2007
Overall, the project was six to eight weeks behind the plant's targeted commissioning date.

Council Meeting - 30 July 2007
Construction was nearing completion but the project still six to eight weeks behind schedule.

Council Meeting - 27 August 2007
Most works were completed and testing was continuing.

3.3 OPERATING THE TREATMENT PLANT – 2007 TO 2012

Operational difficulties started to occur shortly after the plant's commencement in late 2007 and regular reports were made to Council on the causes and effects. A manifestation of the difficulties was the significant odour problem that first began emanating from the plant over the summer of 2007/2008.

It should be noted that the formal reports to Council/Committee meetings on operational difficulties appear to become less frequent, at least as far as the Council minutes record, following the meeting on 19 May 2008 where it was reported that certain mitigation measures had been implemented, including diversion of untreated effluent to the sea in breach of Council's resource consent. Reporting however was occurring in other ways.

The former Mayor of Council, Mr. Michael Laws, states that he sought 'regular verbal and written updates to Council' after he first became aware of the serious odour problem in January 2008.

Further to the Council meeting of 19 May the previous year, on 8 June 2009 it was reported to Council that the 'operational procedures' which 'minimise the biological loadings sent to the plant' had effectively reduced the odour problem since March 2008 [NB. the implication being that these 'mitigation measures' were ongoing].

The following summary outlines the key reporting to Council of operational matters from 2007 onwards:

Council Meeting - 17 December 2007
It was reported to Council that biological commissioning of the new plant was completed [NB. later proven to be incorrect] but the Ultra Violet (UV) facility was not fully commissioned. Other major works had been completed. However, the new aerators were not performing sufficiently and this was reported as a contractor issue to resolve.
Council was advised that as a consequence of the aerator problem, odour was being produced by insufficient oxygenation of peak tradewaste and sewage loads.

Council Meeting - 28 January 2008
Concern was expressed by the Mayor about the continuing odour problem with the treatment plant and staff advised that a multi-pronged approach was being taken to solve it and to optimize the technical aeration level. The Mayor apologized to residents for the odour and emphasized that the Council must know first if there was a problem with any Council service and told staff that he hoped the matter would be addressed with alacrity.

Council Meeting - 25 February 2008
Councillors were advised that:

- The plant was receiving industry and residential loads and the quantity and quality of the industry loads were being assessed – these could have an impact on the plant's performance.
- The turbine and aeration capacity had been doubled but oxygen levels were only slowly increasing
- Staff were attempting to increase aeration by increasing propeller performance and pitch angles. Additionally, another aerator was being prepared for use
- The settling pond had developed a scum layer which was being sucked out and broken up – a continuing process.
- Previous non-oxygenated nutrient meant that oxygen levels would take time to rise as the nutrient was treated.
- The manufacturer had to provide under the contract eighteen replacement aerators and they would be 17% more efficient than if the original faulty aerators had been operating properly

Council Meeting - 7 April 2008
A report was provided by staff that commissioning of the UV facility had been programmed for March, that improved aeration of the main lagoon was being undertaken and further measures were being taken to control the odour problem with the settling lagoon by adding mini aerators and the installation of a sludge removal pump.

Council Meeting - 19 May 2008
Staff reported to Councillors that:

- Unpleasant odour issues had been experienced since November 2007.

- The aerator problems meant that the efficiency of converting electrical power to dissolved oxygen was being compromised
- Only partially treated effluent was being transferred to the settlement pond
- During December 2007, loads in excess of the plant's design were experienced. From January to May 2008, combined loads were consistently at the upper end of the plant's design capacity
- The plant's designer MWH was consistently stating that the basic issue was lack of efficient aeration within the aerated lagoon
- A range of mitigation measures were being undertaken until the aeration and capacity issues were resolved. These included minimizing loading to the plant (diverting to the sea in breach of the resource consent) and trial modifications to the aerators.

Significantly, staff were required to provide updates on the operational problems every six weeks to Council's Finance and Infrastructure Committee, the minutes of which in turn would be reported to the Council.

Council Meeting - 30 June 2008

With the aerator and other problems continuing, it was reported that the United States manufacturer of the aerators and their agent were working with MWH and were to submit a remedial proposal on the basis of no additional cost to Council.

Council Meeting - 11 August 2008

The second remedial proposal from the aerator supplier had been approved in principle by Council staff, who were working through the detail with MWH and the contractor. More aerators were being placed on the settlement pond. Staff reported there had been no odour issues throughout April to June 2008. Actual expenditure on the project to end June was $15.9M.

Council Meeting - 8 June 2009

Staff reported that 'operational procedures' had been adopted 'which minimize the biological loadings sent to the plant' and had 'effectively controlled the release of unpleasant odour since March 2008.'
Replacement aerators were in transit from the USA and were to be deployed on the aerated lagoon at no additional cost to Council.

Council Meeting - 20 July 2009

Twenty three new aerators had been installed comprising nineteen replacement units and an additional four new aerators. It was reported that dissolved oxygen levels had responded well to the new units and commissioning works were continuing. The costs of approximately $2.5M were fully met by the contractor who sent a team from Australia and Sweden.

Council Meeting - 31 August 2009

The plant was reported to be continuing to operate effectively but treatment quality had taken some time to adjust to increasing loads from Affco's Imlay plant as they moved to double shifts. Problems had been experienced at Beach Road Pump Station with large volumes of animal byproducts blocking the screens. Discussions were being held with major industries to identify the source of the problem and to put in place practical remedies.

Council Meeting - 19 October 2009
Council's key objectives with trade waste were outlined:

- The plant was designed to meet existing industry and domestic requirements with a modest allowance for growth based on additional aeration capacity
- A new trade waste by-law would allow Council to control and manage discharges to the wastewater system
- Industry trade waste dischargers would be granted discharge consents with monitoring to ensure compliance within agreed limits and quality
- The trade waste model would apportion capital and operational costs to industry and domestic consumers using monitored flows and loads plus long-term average data
- Fine tuning over future years would occur using better information on flow, load and plant performance

Council was seeking to change the wastewater modus operandi from an 'anything goes' mind-set to a 'responsible discharge' mind-set. The plant had capacity limits so industry needed to pre-treat its waste to various levels. Council was fully responsible for its discharge consent to Horizons Regional Council and Council's Trade Waste consents for industry were a vital control mechanism to ensure good environmental outcomes.

Council Meeting - 19 July 2010
Councillors were advised that a consent variation to the wastewater resource consent had been advertised on 3 July 2010 following liaison with Horizons Regional Council:

- To renew the existing bypass discharge to the ocean for significant weather events
- To vary some existing clauses of existing consents to avoid what was termed 'technical non-compliance' in the future

Council was seeking to discharge diluted wastewater and storm water from the ocean outfall when flows at Beach Road Pump Station exceeded 1120 litres per second at a maximum flow of 1600 litres per second. The annual frequency of the discharge was calculated at 0.37%.

Council Meeting - 14 November 2011
Staff reported that Council's application to vary the resource consent had been successful with a fifteen year coastal permit granted to discharge diluted wastewater and stormwater through the ocean outfall during high flow storm events and the discharge of treated wastewater through the outfall at other times. The fact that a full hearing on the application was not required was reported by staff as recognition of 'the success of the entire wastewater scheme, including the public and private separation works, and the commitment to improving environmental performance.'

Council Meeting - 19 December 2011
The use of suitable electronic trade waste measuring equipment was reported to be considered cost prohibitive to install at the seven largest wet industry sites. The annual trade waste for the companies was calculated by sampling and analyzing their effluent four times per year for ten consecutive work days each time at each site.

Council Meeting - 30 January 2012
It was reported that AFFCO and Tasman Tanning were disputing their trade waste charges and had withheld part of what they owed to Council.

Council Meeting - 23 October 2012
Council considered a report from the Infrastructure and Property Committee meeting of the 2 October 2012.

At the 2 October meeting, Mark Hughes, Council's new Infrastructure Manager appointed on 23 July 2012, requested that a late agenda item regarding matters at the treatment plant that required Council's early consideration. Mr. Hughes gave an outline of failures at the plant since its commencement in 2007 and advised Councillors that an independent report on the 'health' of the plant had been commissioned by staff about a year before and received in late November 2011.

The 2011 Cardno BTO report advised that the gap between the condition of the plant and its consent compliance was widening. Sludge accumulation was excessive, only seven out of twenty three aerators were operating, UV treatment was ineffective and the plant was discharging raw coliforms. Whilst a bio-augmentation process and other measures had been implemented, the plant was close to being 'dead.' Councillors were warned that the plant was not compliant with its consent conditions from Horizons Regional Council and was in a 'critical situation.'

Council Extraordinary Meeting - 17 January 2013
Infrastructure Manager, Mark Hughes, made a detailed report to Councillors going over the history of the treatment plant project and its operational failures since 2007 and informing them of activities then being undertaken and planned.

Council's resolution at this meeting has been referred to in Item 2.2 of this Report. It led to the commissioning of the Cardno BTO report of April 2013 which found that the treatment plant based on the optimized lagoon process was not salvageable and a new type of plant needed to be built. Council subsequently adopted this position.

For completeness, a full copy of the minutes of the Extraordinary Meeting of Council on 17 January 2013 are set out at Attachment E.

4 THE FIVE SPECIFIC QUESTIONS ASKED BY COUNCIL

What fault, if any, was there in Council's input into the design parameters and their decision making processes that led to the acceptance of the design and build of the 2007 plant?

Whanganui District Council's Legal Action against MWH New Zealand Ltd

In June 2013, Council formed the view that the design of the treatment plant was not viable and subsequently lodged a statement of claim against the plant's designer MWH in the High Court of New Zealand. The claim sought judgement against the plant's designer for remediation costs and repair costs along with interest and legal costs.

Council's first cause of action was that MWH was negligent in the performance of what was termed the 'Concept Design Contract' entered into by Council's letter and acceptance of MW's proposal on 17 October 2000.

Council's second and/or alternative cause of action was that MWH was negligent in the performance of what was termed the 'Detailed Design Contract' entered into by Council and MWH on 27 June 2005 (Professional Services Contract 1181).

A process of mediation occurred between the parties in November 2015.

On 26 February 2016, Council issued a media statement that the parties had agreed to settle Council's claim relating to MWH's work on the wastewater treatment plant, that they were 'pleased that the matter has been resolved' and that 'the precise terms of the settlement are strictly confidential.'

The Independent Review has not been provided with a copy of the confidential terms of settlement. Nevertheless, it is a reasonable assumption that Council's claim was settled on the basis of no admissions of liability by either party as this is a common practice with agreements of this nature.

It is a matter of public record however that Council when commencing its legal action considered MWH negligent and therefore liable for the plant's failed design.

Was there any fault in Council's input into the design parameters?

The question being asked about any Council fault arguably raises the issue of contributory negligence in the design of the treatment plant. Should the assumption be correct that Council's legal action against MWH was settled on the basis of no admissions of liability by either party, then exploring the issue of any contributory negligence may run contrary to the confidential agreement.

Nevertheless, Council staff were certainly integrally involved and providing input into the treatment plant concept design, primarily through their involvement in the Technical Working Group process. In one sense

this was necessary because MWH could not design a treatment plant specific to Whanganui's needs without accessing the corporate knowledge within Council's infrastructure team.

Council's Senior Engineer, Colin Hovey, had a close working relationship with MWH stretching back to the 1990s and was the key Council staffer engaged on development of the treatment plant design.

Mr Hovey for instance attended the critical technical meeting at MWH's Wellington office on 20 October 2003 which first formally developed the Optimised Lagoon design concept.

MWH's Report No. 11 of October 2005, which finally confirmed the Optimised Lagoon Treatment Process Design, acknowledged it was prepared by Dr. Dave Stewart from MWH with input from Colin Hovey who was also specified as one of its reviewers.

Mr. Hovey submitted to the Independent Review that he 'sized the treatment lagoon, as set out in design report 11 and the work that went into that was complex but very robust … MWH were the major designers along with myself. Various other experts assisted with the detailed design – geotechnical, electrical …'

MWH however was contractually bound to provide a high standard of professional engineering advice and support to Council and their engagement by definition evidenced the fact that Council's technical staff lacked sufficient expertise and capability to design the treatment plant themselves.

In seeking to be awarded the original contract, MWH's Ian Robertson had written to the Council CEO on 11 May 2000 asserting that Montgomery Watson was acknowledged as being '**the world's top provider of engineering services in wastewater and sewerage.'** (emphasis added)

The original contract between Council and MWH of 17 October 2000 in part contained the following legal undertaking that MW would provide technical support to Council through their:

- people and consent experience in New Zealand
- wastewater specialists in New Zealand
- international technology specialists and their reputation as a leading international provider of wastewater services
- databases and knowledge management centres relating to wastewater
- access to knowledge outside Montgomery Watson through established industry links
- understanding of Wanganui

MWH therefore was bound by its obligation to provide a high standard of professional engineering advice and support and as such was primarily responsible for the plant's design.

The question essentially being asked by Council in the Terms of Reference goes to the issue of any fault in the processes followed by Council that led to the acceptance of the plant's design and this issue is explored below.

Was there any fault in Council's decision making processes?

The evidence set out in the Independent Review shows that the processes followed by Council that led to the acceptance of the design and build of the treatment plant were flawed at critical stages. These flaws greatly increased the prospects that the project would ultimately fail, which of course it did.

The flaws or faults can be broadly characterized as deficient management and governance.

In particular they can be described as a lack of proper procurement process, an entrenched and overly-trusting senior management culture, inadequate procedural rigour at management and governance level, insufficient in-house expertise and consequential over-reliance on purported experts, inadequate risk management and the provision of incorrect advice to Council.

Objectively and despite the well-meaning efforts of many, the process that led to the adoption of the Optimised Lagoon concept design by Council in February and November 2004 was arguably fatally flawed through these systemic shortcomings. The flaws infected the decision-making process in the critical early years from 2000 to 2004 and impacted upon everything that occurred from 2005 onwards.

The following narrative sets out the systemic shortcomings up to 2007.

The Circumstances Pertaining to the Original MWH Contract - October 2000

In 2000, MWH and its earlier incarnation of MW already had a long-standing wastewater relationship with Council contractually stretching back to 1992 and in an individual sense even earlier. The senior staff MWH regularly dealt with at Council had been there for much longer periods stretching back to 1986 and 1981 and 1976 in one case. The Mayor and CEO had been in place since 1986 and 1984 respectively.

With the records indicating that MWH commenced providing consultancy services for the concept design in July 2000, Council staff subsequently went through a selection process in late October 2000 and after MWH had already apparently lodged three months of invoices for its consultancy services.

It appears MWH was the only consultancy firm invited to submit a proposal. At least there was some documentation evidencing a form of contract eventually placed on file, but Council's established process appeared not to have been adequately adhered to. The original MWH contract was not Council's standard professional services contract.

The lack of any market testing for the concept design work limited Council staff to only considering the one source of consultancy advice for what was to be one of its most important infrastructure projects. This was a serious shortcoming for it signalled a lack of procedural and intellectual rigour at the very early stage of the project.

The Working Group's Methodology - From Risk-Minimisation to Risk-Taking

The Working Group including MWH was the key technical driver for the treatment plant design and operated in two parallel streams, one mainly consultative with external participants and the other involving two Council technical staff and MWH. The latter stream did the heavy lifting on the concept design work and liaised with the consultative stream.

It was clear from the early Working Group reports produced by MWH that the consultants were leading Council staff through the basic principles and processes of wastewater treatment and project management. This was entirely appropriate for consultants when dealing with a client which may not have the requisite in-house knowledge and experience to embrace the complexities of a particular project.

It was no doubt also useful information for the Iwi and community representatives who were participating on the consultative stream.

The methodology followed by MWH in providing the Working Group with thirty four waste treatment options to evaluate against the Reference Case and defined success criteria was prima facie a robust methodology.

Indeed, the first nine reports produced by MWH for the Working Group between July 2001 and November 2003 and the refinement of the long list of treatment options to a short list of four reflected this robust methodology.

An illustration of the early soundness of the MWH Working Group approach was evidenced by the following somewhat prophetic statement contained in Report No. 6 from August 2002 which referred to the 'long list' of treatment options being evaluated at that point in time.

The 'long list' according to MWH represented the 'range of treatment processes in current use and cover the range of basic alternatives available. **Whilst many are innovative, they are predominantly incremental improvements of basic processes rather than new 'breakthroughs' in treatment technology. They are all proven in full scale use, although some not in New Zealand.'** (emphasis added)

If only MWH had adhered to this sensible risk-minimisation approach adopted by the wastewater treatment industry.

The Working Group's Seminal Fault – 20 October 2003

In Wellington on 20 October 2003, two Council technical staff and four MWH consultants held a workshop to develop a new 'breakthrough' in treatment technology that was not proven in full scale use anywhere in the world.

Rather than being an incremental improvement of basic processes then in use as MWH had previously advised, what became known as the Optimised Lagoon Treatment Process represented a quantum leap into the untried and untested.

MWH and Council staff were supposed to be at the Wellington workshop evaluating the four short-listed treatment options developed by the Working Group over more than two years and as previously advised to Council. Instead, they adopted the more radical approach of cherry picking what were considered the best features of each of the four short-listed options and combined them to produce a new and much lower-cost option that was argued would be unique and customized to Whanganui's needs.

Council's former Senior Engineer, Colin Hovey, submitted to the Independent Review that during 2001-2002 he and members of the Working Group conducted site inspections at a total of nine treatment plants in New Zealand accompanied by Dr. Dave Stewart of MWH. Mr. Hovey also visited three plants in the USA, one in Scotland and three in South Africa and on most occasions was joined by MWH local engineers.

Despite this, Mr. Hovey stated that he was 'not aware' of the existence anywhere of a treatment plant comparable to that designed for Whanganui.

Humphrey Archer from CH2M Beca was to comment in October 2015 that 'the Optimised Lagoon Process did not have precedents and attempted to combine all treatment functions into one lagoon.'

Council staff in 2004 however were referring to their recommended design as 'state of the art' and 'innovative.'

Management and Governance – An Overly-Trusting, 'Cosy and Insular' Culture

The Technical working Group with two Council technical staff and MWH providing support was officially convened in March 2001 and met for the first time with Iwi and community representatives in July 2001. Effectively however, it had been operating with MWH and Council staff since July 2000

When Council received a formal report on the deliberations of the Working Group the following year on 20 May 2002, the Group had already met a total of nine times and MWH had by then produced a total of five written reports. When the matter next came before Council on 4 November 2002 with MWH presenting four shortlisted treatment options, Councillors expressed their 'confidence in the process.'

Former CEO Colin Whitlock confirmed to the Independent Review that a very trusting environment existed between Councillors and management up until he departed in 2005.

Former Mayor Michael Laws submitted that under the administration of the long-serving duo of Mayor Chas Poynter and CEO Colin Whitlock, 'the council had become too cosy and insular.'

Effectively, Council and the CEO had delegated the task of designing the treatment plant to MWH and Council technical staff and the governing body's oversight of management of the project could best be described as overly trusting. This was consistent with the prevailing culture during this period.

Providing some context, former Mayor, Michael Laws, submitted that:

'The design and construction of the council's wastewater treatment plant – when I was mayor – was without internal or political controversy. There were any number of more exacting, controversial and immediate issues that confronted the council at the time. By contrast, the design and construction of the wastewater treatment plant was considered to be a relatively prosaic process. It was always perceived by the governance team as being properly managed by its engineering and environmental professionals. At no stage was my governance team aware of or alerted to any design risks … the subsequent operation and failure of the wastewater treatment plant was neither foreseen nor imagined by the governance teams of the time.'

Council expressed confidence with the Working Group process at an early stage and was subsequently very accepting of staff advice. This is reflected in two key meetings in February and November of 2004 which helped set the scene for the plant's ultimate failure.

However, any arguable lack of rigour on the part of the governing body at these two meetings was mitigated somewhat by two relevant facts:

- Council was misinformed at both of these meetings; and
- A new Council had been elected just before the November 2004 meeting.

Misinforming the Council Meeting of 16 February 2004

Councillors were advised at this meeting that the Optimised Lagoon Treatment Process developed by the Working Group was relatively low-risk, primarily because it was based on proven technologies.

This advice was essentially incorrect.

MWH had made a presentation to Councillors, so there existed the opportunity to question Council's professional engineering advisers. The minutes of the Committee and Council meetings reveal that the two issues raised by Councillors related to the effect on the airport of seagulls being attracted to the treatment lagoons and the lining material for the lagoons. Only one Councillor queried the fact that the Council paper did not contain a financial report, which reflected in part its deficiency as a business case.

Councillors were also advised that the recommended treatment process was 'innovative and there was no such plant was in existence, certainly in New Zealand, which combines well-established process techniques with a unique sludge management process.'

Its sludge management process was described as 'unique' because its treatment ponds were 'excavated up to ten metres deep where in normal situations they would be much shallower.'

The warning signs should have been flashing for Councillors that there was an inherent contradiction in what they were being told. How could a treatment process developed for the first time by MWH and Council staff, with a unique sludge management process involving treatment ponds much deeper than was normal, be simultaneously a process that was relatively low-risk and proven?

In fact, a clever use of language was used to smooth over the seemingly contradictory notions of the recommended treatment process being 'unique' but at the same time 'proven.'

MWH expressed it well in a subsequent 2008 paper: 'The new Wanganui wastewater treatment facility extends the conventional and well-proven technology of aerated lagoons by incorporating provision for sludge storage intended to put off for 20 years the vexing problems of sludge processing and disposal that face most wastewater treatment facilities in New Zealand and overseas.'

So the 'conventional' technology was well-proven, it was just the 'extension' of the technology that was unique.

Council's Senior Engineer at the time, Colin Hovey, submitted to the Independent Review that no comparable plant to that developed by his Working Group existed to his knowledge but it was 'understandable that the situation would not be explained to council because of its complexity.'

Nevertheless, Councillors appeared to be assuaged by the fact that the treatment plan design was to be peer reviewed.

Council's former CEO, Colin Whitlock, who attended the meeting in February 2004 told the Independent Review in August 2016 that he recalled MWH being upfront with management back then about the unprecedented nature of the recommended design and the consequent risks involved.

Importantly, Councillors were advised at the February 2004 meeting that the recommended treatment process came at a significantly lower 'whole of life cost' at $16.93 million than the short-listed options

which ranged from $26.8 million to $47.15 million. Indeed, a $4 million saving from the treatment plant construction budget was already to be re-allocated.

The search for a lower cost treatment option appeared to be a key driver in the development of the Optimised Lagoon process.

Misinforming the Newly-Elected Council – 29 November 2004

The misinforming of Council at the November 2004 meeting was arguably more serious than at the earlier February meeting, where Council had confirmed the Optimised Lagoon design concept on the condition it be peer reviewed.

This was the first business meeting of the newly-elected Council after the initial ceremonial meeting of September 2004. A new Mayor and Deputy Mayor had been elected, but some Councillors had also served on the previous administration. It was at this meeting and the preceding Committee meeting that staff reported on the outcome of the independent peer review of the Optimised Lagoon design required by the former Council.

Council was advised that the Peer Review Panel had affirmed that the treatment plant identification process had been robust and that the Optimised Lagoon design would meet Whanganui's needs.

This advice was essentially incorrect and Council was thus significantly misinformed on a critical point.

The single sentence extract from the Peer Review Panel's letter of 16 September 2004 to Council's Colin Hovey that was provided to Councillors as evidence of this affirmation did no such thing. It merely stated that 'the concept of a panel based system is a pragmatic approach to the selection and performance criteria' that had been developed for the project.

Staff downplayed the seriousness of the issues raised by the Peer Review Panel by describing them as 'largely technical issues' which essentially related to risk management. The minutes of the meeting do not record any information being given to Councillors about what these 'technical issues' were.

The staff advice on the peer review was not challenged by Councillors, some of whom were newly-elected and with no prior corporate knowledge of the plant design process.

In actual fact, the Peer Review Panel had raised a number of significant issues with MWH and Council that needed to be addressed which included the need for a rigorous risk assessment. The Panel had also sought further information that had not previously been supplied. Importantly, the Panel had only considered the plant design at concept stage and fully expected to be involved in peer reviewing the detailed design stage.

In a critically flawed decision, the Panel was shut down by Council staff in late October 2004 only a month before the November Council meeting. This was in breach of Council's intention of February 2004 that confirmed the MWH-designed Optimised Lagoon process on the condition that it be peer reviewed. Councillors in November 2004 were given the impression that the peer review was complete and had affirmed the plant's design.

Unlike MWH which presented to Council on a number of occasions and were subject to questioning, the independent Peer Review Panel members were not invited to do so.

Former Mayor Michael Laws submitted to the Independent Review that:

'At no stage were any peer group misgivings or outstanding questions related to design/operation of the projected WWTP reported to me or to the full council. This was a design and construction that had the strong and sustained support of senior council management, who confirmed such when questioned through the governance process.'

Council's Julian Reweti was appointed to the Peer Review Panel to assist the two independent panel members on operational issues. He stated in 2013 that: 'One of the main issues I recall John [Crawford] raising was in relation to odour. Another was that sludge accumulation was going to become a major problem, despite MWH's claim that sludge would not need to be removed for a period of 20 years.'

Mr. Reweti added: 'It got to a point where there was conflict between MWH's design and John's technical concerns with the plant and John's position was that MWH had not answered those concerns … In my view it became a stalemate between Opus and MWH.'

Premature Closing down of the Independent Peer Review Process

John Crawford, the Coordinator of the Peer Review Panel, submitted to the Independent Review that:

'The panel did not consider that the peer review process was completed. It was our understanding that the panel would be reconvened again, at the detailed design phase, to check that issues raised in the initial peer review (and others arising) were being appropriately addressed. The context of the initial 2004 Peer Review was that it was of a concept only, that concept being the one that the Council and its consultants had chosen as preferred from a number of options.'

Mr. Crawford further submitted that he had no knowledge as to whether any of the key points raised by the Panel were subsequently actioned by MWH and Council. 'I have had no subsequent involvement with the project since my 16 September 2004 letter and the Council response, closing the current phase of the peer review process' he stated.

Extraordinarily, Mr. Crawford states that he 'was never subsequently requested by Council to undertake any further critiques or reviews of any components of the detailed design [and] … I am reasonably certain that [fellow independent Panel member] Mr. Tipler had no further involvement either, after 16 September 2004.'

The technical issues raised by the Peer Review Panel including risks associated with the concept design may provide some insights as to why the review was abruptly terminated by Council before it had even considered the detailed design.

For instance, when queried by the Peer Review Panel about what level of risk assessment had been used in derivation of the estimates, the response from Council and MWH stated in part:

'Aerated lagoons and settlement lagoons are simple, low risk technology with a long operating history throughout the world. **The only risk element is in the innovative and un-tested use of extra deep lagoons to hold sludge for a long period.'** (emphasis added)

The Peer Review Panel replied: 'The use of un-tested technology on a plant of this size would seem to be a significant risk...'

Council and MWH responded somewhat dismissively: 'There are always risks associated with any project. It is accepted that a risk assessment should be carried out, but that has not been within the scope of the project to date.'

The Peer Review Panel also warned that 'odour will be one of the major concerns for a pond system such as proposed. Statements [from Council] such as 'It is unlikely that odour would be carried over Wanganui' offer little comfort.'

The Panel accordingly requested MWH and Council to justify their assertion that 'odour has not been an issue with any of the aerated lagoon systems designed by MWH for similar situations' by confirming the existence of any other treatment plants that had similar sludge inventories to that proposed for Wanganui.

The MWH/Council response was illuminating:

'It has been clearly explained that **the proposed scheme will differ from any other existing aerated lagoon system in that the lagoons will be very deep, designed to accumulate sludge over a long period.** The sludge inventory will therefore be much higher than in the reference plants. However, this is not a concern in relation to odour. Provided that adequate aeration is provided in the upper zone of the lagoons, odorous compounds originating from the sludge will be oxidized before they can be released to the air above the lagoons.' (emphasis added)

Early in 2004, the briefing note for the Peer Review uncovered in Council's records and apparently drafted by MWH, had stated that a presentation would be made to the Independent Panel by MWH's Ian Robertson on 10 February 2004 and that the peer review 'should be completed in a period of one month from the presentation.' Further the brief required that the 'review process and the resulting report should be the minimum necessary to satisfy Council that Council's best option is to proceed with the recommended treatment process.'

It seemed MWH and Council staff regarded the peer review as a fairly routine 'tick of the box' required by Council before they proceeded to detailed design.

Council staff when writing to the Peer Review Panel on 28 October 2004 terminating their brief, made the revealing comment which indicated some frustration that 'the review process has taken many more months than expected.'

It seems that the independent Peer Review Panel may have been doing its job a little too well and asking too many difficult technical questions of MWH and Council about their untried and untested concept design. However, the Peer Review was simply acting in accordance with their brief which expressed their essential question as being: 'Will the optimized lagoon process work?'

The Peer Review brief required the independent panel to evaluate the following seven aspects relating to what MWH/Council themselves described as 'the uniqueness of the proposal':

- Are the basic assumptions and input data valid?
- Does the selected option fit with the parameters of the Wanganui environment, the resource consent treatment standards, the influent characteristics, the existing infrastructure etc?
- Does the optimized lagoon process meet accepted principles of wastewater treatment?
- Does the key feature of sludge accumulation within the lagoons provide a satisfactory sludge management option?
- Are there significant risks with the recommendation that have not been identified?
- Is the process practical to operate?
- Do the capital and operating budgets identified represent a true picture of cost?

It is worth reiterating that staff had advised Council in February 2004 that the Optimised Lagoon design was relatively low risk and based on proven technologies and in November 2004 had advised Council that the Peer Review had affirmed the design.

It is difficult to comprehend that any responsible Council exercising its governance role properly would have endorsed the MWH concept design in November 2004 had it been made fully aware of the views of the independent Peer Review Panel. Apart from the engineering risks, the political risk would have been significant for any elected body to proceed with an untried concept over which such serious questions had been formally raised. This is particularly so given that Council's confirmation of the design in February 2004 was made conditional on the outcome of a satisfactory peer review.

The misinforming of Council in November 2004 was so serious that it infected the treatment plant project from that point onwards. The seeds for the project's ultimate failure were arguably planted at this meeting and there were no more independent safeguards to stop the forward momentum towards 1 July 2007 when construction had to be completed and commissioning had to occur.

The newly-elected Mayor at the November 2004 meeting, Michael Laws, submitted to the Independent Review that:

'Three separate senior management teams – those led by chief executives Colin Whitlock, David Warburton and Kevin Ross and comprising expert engineering personnel – endorsed and promoted the MWH design and blamed any later deficiencies upon external companies and contractors … If the optimized lagoon design was so fundamentally flawed then how could those governance teams have discovered that error, given the overwhelming support that senior management and engineering professionals indicated for the original and amended designs?'

From his perspective, Michael Laws makes a fair point.

With hindsight, the great learning however from this experience is that good governance dictates that Council should have demanded from staff the provision of any Peer Review Panel reports, particularly given that staff had purported to quote from one. Council should have also required the Peer Review Panel to make a direct presentation to Councillors so that they could be questioned face-to-face. Instead, a newly-elected Council opted to trust staff advice on the peer review outcome even though it was transparently deficient from a perusal of the records many years later.

It is a good thing for Council to trust its staff, but in a governance sense trust alone is not enough. For a major capital works project such as the wastewater treatment plant, good governance also required verification.

Councillor Sue Westwood, who was present at both the February 2004 and November 2004 Council meetings, submitted to the Independent Review on the issue of any shortcomings in governance:

'I believe in retrospect that we [Councillors] fell well short given the information that has come out since. Too much trust was placed in the capability of our staff to effectively deliver on what was a new and unique design. Had I personally been more aware of the problems clearly we would have required more in depth reports, proposed mitigation and had many discussions on this issue with MWH.'

MWH Effectively Reviews Its own Design

The Peer Review Panel may have been abruptly terminated in October 2004, but the independent members were never made clear of this fact. Council's letter to John Crawford dated 28 October 2004 advising that 'the peer review process is complete' also stated that 'it would be useful if panel members were available to critique/peer review components of the design process going forward.'

The independent panel members never heard from Council again. MWH effectively became reviewer of its own detailed design in 2005 and according to Humphrey Archer from CH2M Beca and others failed to appropriately address the issues raised by the independent panel in 2004.

Report No. 11 of October 2005 prepared by MWH for the Working Group devoted less than one page of its fifty pages of detailed content to addressing the issues raised by the Peer Review, conceding that some of them 'cannot be answered with complete certainty and … the detailed design of the treatment system will need to provide contingencies to react to the possible risks.'

Council's former Senior Engineer, Colin Hovey, was so confident of the Optimised Lagoon design that he submitted to the Independent Review that the 'SWAT analysis on page 3 of [MWH] report 10 **did not suggest any risks significant enough to not proceed in the face of such cost savings over the next best options.** I myself did not consider there was any particular risk, having seen examples of the processes to be used in the final MWH design.' (emphasis added)

Mr. Hovey added that his technical staff colleagues who reported to Council on the treatment plant design likely shared his views 'about minimal specific risks.'

MWH's Report No. 11 contained a section on 'Risk Assessment' and stated the following at page 48:

'Every effort has been made to minimize the risks by carrying out additional monitoring and testing of industrial wastewater, researching experience elsewhere of sludge generation and modifying the plant design to manage potential risks such as high wet weather flows. Nevertheless, a number of risks still remain that will not be resolved until the plant has been in operation for a number of years.'

Cost Cutting as the Key Driver

The record of the seminal technical workshop of the Working Group in Wellington on 20 October 2003 that formally developed the Optimised Lagoon process, set out the key factors that MWH and Council's technical staff considered relevant to what constituted 'optimum.' These were:

- Cost (capital and operating)

- Flexibility in achieving resource consent requirements
- Low production of sludge without a requirement for expensive constant processing

Julian Reweti, Council's former Infrastructure Manager, submitted to the Independent Review that 'the wastewater working party always wanted the most lowest cost-effective design … The treatment options recommended and preferred by the wastewater working party were always advised by the consultants as a viable solutions.'

Colin Hovey, Council's former Senior Engineer and key member of the Working Group, submitted that the 'optimised scheme' represented significant 'cost effectiveness' as its 'capital cost was $9.53m compared to the standard partial mix aerated lagoon of $14.645m (without fees etc.)'

Finding the lowest cost option was clearly the key driver for Council staff when all other factors are taken into consideration. MWH accordingly developed a new design concept that it believed achieved the client's cost-cutting objective. At the same time, MWH advised Council as client that the drastically cheaper 'optimum' design would also be viable.

Of course, any independent advice that may have been to the contrary had been prematurely dispensed with.

Later in April 2008 when the newly-operational plant was experiencing significant difficulties, Colin Hovey sent an email to Council's Infrastructure Manager and Dave Stewart of MWH which stated in part: 'MWH have been concerned about the situation and have had a major conference call about the various issues … we should not lose sight of the fact that the design by Dave [Stewart] **is a bit untried and aimed at keeping costs down.'** (emphasis added)

Michael Laws had only become Mayor of Whanganui in late 2004 and after the critical meeting of February that year that had confirmed the plant design. He submitted to the Independent Review that the new governance team was briefed by Council staff in November 2004 that 'the projected costs of the WWTP had dropped dramatically from around $23 million to $14 million … [which was] by far the cheapest option.' Mr. Laws stressed however that 'at no stage was the likely cost of the WWTP ever an issue around my council table.'

By late November 2004, the treatment plant project had developed an almost unstoppable momentum of its own. Mr. Laws submitted that he requested a report in March 2005 to review the treatment plant project and Council staff were 'strongly geared against any delay or interruption of existing policy related to the wastewater project … [and] there did not exist the political appetite to challenge this advice.'

Significantly, the former Mayor states that he had become 'wary of the impartiality of senior management advice to council' at this time. He questioned 'whether senior management was being genuinely open and co-operative.'

Who was involved and what was the decision making process, starting from the initial design of the plant in 2003 to the opening of the plant in 2007?

The Council decision-making processes from the initial design of the plant in 2003 to the opening of the plant in 2007 are comprehensively detailed in pages 13 to 29 of this report.

A representative cross-section of the key participants who were involved in Council's elected official and technical working group decision-making processes and their submissions where provided is set out in pages 61 to 102 of this report.

There were a number of other councillors and staff involved in the decision-making processes, but the key participants who were approached were considered the most relevant for the purposes of the Independent Review.

The key decision-makers from 2003 to 2007, as distinct from those involved in the process, were:

Councillors – 2003-September 2004

Mayor Chas Poynter, Councillors Sue Westwood, Ray Stevens, IG Brown, BL Bullock, PA Bullock, MH Campion, R Dahya, JL Lithgow, JR McGregor, R Mitchell-Anyon, SW Palmer, AC Stewart

Councillors – November 2004-2007

Mayor Michael Laws, Councillors Sue Westwood, Ray Stevens, BL Bullock, R Dahya, N Higgie, M Hughes, M Lindsay, JR McGregor, D McKinnon, S Pepperell, G Taylor, RM Wills

Chief Executive Officers

Colin Whitlock – until 2005

David Warburton – 2005 to 2008

Key Senior Council Technical Staff

Colin Hovey as Senior Engineer was the key Council staff member on the Working Group and on the project overall.

Dean Taylor as Assets Manager was involved with the Working Group until he left Council in 2005.

Julian Reweti was Council's Utilities Manager and then became Infrastructure Manager

Rick Grobecker as Deputy Infrastructure Manager played a key role in the construction and commissioning of the plant.

MWH

Dr. Dave Stewart primarily for the design of the Optimised Lagoon Treatment Process and Ian Robertson primarily for technical support to the Working Group. Other MWH consultants were also involved in the process.

Other Involved Council Staff

Ian McGowan

Independent Peer Review Panel

John Crawford (Co-ordinator) - OPUS Consultants, Cliff Tipler - URS Consultants

What fault, if any, was in the Council operation of the 2007 plant which could have led to its failure?

The Operational Problems from Plant Commencement

When the significant odour problem occurred at the treatment plant during the summer of 2007/2008 and shortly after it commenced operations, staff reported to Council that they were being consistently advised by the plant's designer MWH that the basic issue was the lack of efficient aeration within the aerated lagoon.

The Mayor at the time, Michael Laws, recalls that Councillors in early 2008 'were informed that all the problems were teething and mechanical and that the aerators were not doing the job they were required to do.'

Certainly staff involved in the operation of the treatment plant had been placed in an invidious position with the plant performing poorly from the beginning. They were still relying heavily on the professional advice of the plant's designer MWH at this time. That advice lay the blame on aeration difficulties but, as it transpired, the Tornado aerators manufactured in the United States that had been supplied were not fit for purpose by New Zealand specifications.

Rick Grobecker, Council's then Deputy Infrastructure Manager, stated: 'When we first switched the aerators on, they did not work as anticipated. They overloaded because they had been set to run in America, they had been set to the American electrical system of 60 hertz and 220 or 210 volts…the New Zealand electrical system operates on a lower amount of hertz…the size of the propeller was too big to run the motors at the amperage that we needed to run at.'

Council's Infrastructure Manager, Julian Reweti, provided a briefing note to the Mayor in October 2008 which stated in part:

- Staff had identified the scale of the aeration issue and separated it from the overall loading issue (NB The Mayor had been advised that 'the loads from industry this year and prior to Christmas have been the largest on record and well beyond the design parameters for the aeration system')
- Most of the aerators have suffered from mechanical failure and are required under contract to be repaired by the supplier. Parts of the aerators regularly fail. Although the supplier remedies this under the contract, this leaves Council at risk of not sufficiently treating the wastewater and having potential odour and consent risks
- The aerators perform very poorly and inefficiently and well outside the performance claimed by the supplier during tender. The key problem is that the style and type of aerators do not produce the required dissolved oxygen needed and we have now formally rejected these under contract.

It took two years before nineteen Twister aerators that had been replaced at the contractor's cost were installed with Council paying for an additional four to increase aeration capacity. These Twisters eventually failed as well, but for different reasons than the earlier Tornadoes. The Twisters were plagued by gearbox problems.

Whilst there is clear evidence that some modifications were undertaken by staff and their contractors to try and improve the aerators' performance over a period of time, it is argued that this was only done as a consequence of their regular failure and was not the cause of the failure. Moreover, as Council's then

Deputy Infrastructure Manager recalled 'all the changes were either proposed by or checked with MWH … it was still under MWH's control as to how the aerators were operated through the commissioning stage.'

Council's former Senior Engineer, Colin Hovey, disputes this telling the Independent Review that it was 'well known that council did not maintain the aerators at the plant … [furthermore] it is obvious that very little was done to ensure the plant was functioning or to operate as it was designed.'

The facts demonstrate however that plant operations staff were struggling with the situation they had inherited with obnoxious odours, mechanical problems, excessive loads from wet industry and a treatment plant apparently not operating in the manner warranted to Council by the plant's designer. Limited staff resources became an issue.

Council's Senior Wastewater Engineer, Arno Benadie, submitted to the Independent Review that:

'The MWH designed treatment plant was designed and sold to Council as a stand-alone process with minimal operator and human input necessary. In reality this was not the case when I started working at Council in February 2010. The staff members employed to operate the city networks, small pump stations and Beach Road pump station were also tasked with operating the new treatment plant. The large number of man-hours required to maintain and operate the MWH plant caused problems with the limited staff available to cover all wastewater related duties. Since the opening of the treatment plant in 2007, the operators had to spend unrealistic and unreasonable hours trying to make the plant perform better and trying to finally comply with our resource consents.'

Mr. Benadie stated that Council's waste water operating staff numbers were only increased by one Full Time Equivalent with the commencement of the treatment plant.

The Annual Consent Reports to Horizons Regional Council

Council is required to compile an annual consent report for forwarding to Horizons Regional Council which are intended to show compliance or otherwise with the resource consents. Whilst annual reports were prepared, it transpires they were not always sent to Horizons.

The 2010 annual consent report, for example, stated that operational problems at the plant continued to be experienced. These included inadequate aeration and failing aerators, odour concerns and transfer control problems.

The 2011 annual consent report, for example, stated in part that Council was only managing to achieve 39% [resource consent] compliance at the UV plant and other options for treatment were being investigated.

Council's then Deputy Infrastructure Manager, David Boothway, advised the CEO by email on 28 September 2012 that there were many similar comments in the annual consent reports, which included tables of data and graphs showing non-compliance with the resource consents.

Mr Boothway stated that Council had been 'open and clear' in its communications with Horizons asserting that:

- Council had a new treatment plant with a performance problem and was not meeting its consent limits
- Staff had been 'actively investigating and implementing changes to try and reach compliance'

Mr. Boothway's email went on to state: 'We have not actively asked Horizons why they are not fining us… and maybe it is due to the good relationship and that they know we are not sitting on our hands but actively reporting, spending millions of dollars and doing things.'

Interestingly, Mr. Boothway then urged the CEO that staff be allowed to get on with their job and that senior management 'and the politicians be circumspect and not kick any "hornets' nest" when there is "none to kick" otherwise we will all get stung unnecessarily, with unnecessary time wastage of staff time and Council money at meetings, reports, paying fines, legal fees, unnecessary newspaper attention etc. Staff numbers are very limited and we would prefer to use it wisely and get the job done.'

Council's Senior Wastewater Engineer Arno Benadie submitted to the Independent Review that:

'The annual consent report is a summary report on the compliance with all the conditions of the consent … including a summary report of the effluent quality monitoring. A detailed investigation of both Whanganui District Council and Horizons Regional Council processes showed that the annual consent reports were not sent to Horizons due to administrative errors made by both organisations.'

The submission further stated that only one annual consent report was sent to Horizons between 2007 and 2012. 'HRC however completed all their annual site visits and on-site discussions with operational staff during this time period and was aware of the operational difficulties and poor performance of the plant.'

The 'Mitigation Measures' in Breach of Resource Consent: December 2007 Onwards

Council's Senior Waste Water Operator, Phil Gilmore, stated in 2015 that around Christmas 2007 plant operations staff started to receive complaints about a strong odour at the nearby airport. He managed 'a temporary fix by filling and flushing the ponds to remove whatever was creating the problem.' He also added sodium nitrate to the ponds but the odour problem remained.

As reported to Council in May 2008 and June 2009, staff felt obliged to implement 'mitigation measures' to minimise the odour problem that occurred in the summer of 2007/2008.

These mitigation measures commenced in March 2008 and included diverting untreated effluent to the sea in clear breach of the resource consent. It appears that this practice continued on for the life of the plant both during peak times which experienced high loads and even off peak times with much lower loads.

Council's General Manager for Infrastructure, Mark Hughes, submitted to the Independent Review that 'the biological performance of the plant was substandard [and] it had failed to meet its resource consent conditions in any and every year since it started operating.'

He referred to the latest performance indicators for the quarter ending June 2012 which showed that despite that being an off peak period and therefore experiencing low loads:

- The plant was bypassed a recorded 13% of the time (i.e. untreated effluent diverted to sea)
- Despite the low loads and the bypassing, the plant still failed to comply with its resource consent conditions 61% of the time.

The Short-Term Mitigation Measures to Improve Plant Performance: 2012 to 2014

Faced with the realization that the treatment plant was consistently failing to meet the terms of its resource consent, Council staff undertook extensive and expensive measures to keep the plant operating as best it could be.

Cardno BTO was contracted in 2011 to recommend in the first instance a range of short-term mitigation measures that could correct the plant's performance. It produced a report in November 2011 and Cardno BTO's recommendations resulted in a total of nearly $2.3 million being expended between 2012 and 2014 in an ultimately futile attempt to save the plant from failure.

The following breakdown of the nearly $2.3 million of short-term mitigation measures implemented by staff and their particular costs gives an impression of the scale of the efforts taken trying to salvage the plant:

Aerators - $150.2k

Beach Road Clean Up - $25.8k

Bio-augmentation - $172k

Crane Hire - $6.4k

Electrical Works - $117.1k

Hydrogen Peroxide - $163.6k

Lime - $258.5k

Lime – Helicopter Application - $121.5k

Minor Mechanical Works - $18.8k

Odour Control Fence - $781.6k

Polymer - $104.4k

Professional Advice (various sources) - $271k

Pumps - $17.7k

Sensor Equipment – 22.1k

Sodium Nitrate - $11.7k

Vacuum Truck Services - $38.7k

MWH's Role during the Operational Phase

Council's financial records show that MWH submitted twenty three invoices for work performed between October 2007 (when a claim for $225k for work to July that year had been approved) and February 2013. These twenty three invoices totalled $136k for this period during which the plant was operational. However, the MWH invoices submitted after January 2010 were for relatively small amounts which demonstrates that their work for Council tapered off during this period.

The financial records therefore evidence that MWH remained active on the treatment plant project during its operational phase and well after construction was completed. This was particularly the case from October 2007 up to January 2010.

Phil Gilmore is Council's Senior Waste Water Operator and he made a statement in 2015 about MWH's role in the early operation of the treatment plant. According to Mr. Gilmore, 'during the initial stages of the commissioning process, MWH sent its engineers to conduct tests and make sure the WWTP was performing to industry expectations.' Mr. Gilmore's role was to maintain the treatment plant in accordance with MWH and Council directions.

The plant's operating and maintenance manuals were prepared by Dr. Dave Stewart of MWH. Mr. Gilmore stated that the manual 'contained information about most of the equipment which was on site, the design of the pond, the aeration, the control system and the plant's loading capability … [it] also gave us an indication of what we had to achieve with regards to oxygen levels.'

Council's Infrastructure Manager at this time, Julian Reweti, recalled MWH and Council staff being involved in the negotiations with the aerator supplier contractor (ITT) in 2008 to replace at contractor's cost the original nineteen under-performing Tornado aerators with higher-performing Twister aerators, with Council purchasing another four aerators additional to the original design.

Mr. Reweti stated: 'MWH was involved throughout the issues with the aerators and Rick [Grobecker] and Colin [Hovey] communicated regularly with Dave Stewart of MWH. One of the key things we followed up on was confirmation by MWH that they approved the new aerators and the new configuration … Before we proceeded with reaching agreement with ITT we were absolutely certain that MWH had given its approval…'

MWH also provided Council with a draft Commissioning Report on 19 February 2010, even though the report failed to commission the biological process.

Did Council's Operation of the Plant Lead to its Failure?

It is reasonable to assume that operational mistakes were made by Council staff during the course of attempting to manage a treatment plant that was not performing in the manner warranted by its designer. Anecdotal evidence exists to this effect.

Council's Phil Gilmore, for instance, alleged in 2015 that budgetary constraints prevented proper maintenance being undertaken at the plant. However, Mr. Gilmore failed to respond to the Independent Review's request to make a submission or the attempt to question him. No conclusive evidence has been elicited that this factor may have caused the plant's failure.

Council's former Senior Engineer Colin Hovey has asserted that Council's operation of the plant was responsible for its failure. However, his assertions in this regard must be considered in the context of his admitted close relationship and involvement with MWH in the treatment plant's design.

The objective evidence tends towards the proposition that any operational mistakes that may have been made were done so in the context of reacting to a treatment plant that consistently failed to perform to Council's expectations and requirements. A good example of this was the problems experienced with the initial Tornado aerators because they had not been set to run under New Zealand's electrical system.

Council's then Deputy Infrastructure Manager Rick Grobecker stated that the supplier and/or manufacturer modified the propeller at the end of the aerators to take off some of the load so that they would operate better. This was done by 'removing or trimming the end of the propeller, only by millimetres, to change the aerator's loading. These modifications did not work.'

The evidence demonstrates that Council staff worked very hard and tried numerous and costly strategies to make the plant operate effectively and to meet its resource consents.

Ironically, to deal effectively with emergent problems such as odour they even resorted to breaching the resource consents by 'flushing' and/or diverting untreated effluent to the sea through the marine outfall. Even by doing this, the plant never met the conditions of its resource consent between 2007 and 2012.

Far from being a largely self-operating plant as promised by the designers, the efforts of staff to make the plant work correctly proved to be labour intensive and costly over the five years of operation.

Is there any evidence that wet industries underestimated their inputs during the design phase or added non-consented, excessive or non-permitted inputs into the plant that contributed to its inability to function?

Did Wet Industries Underestimate their Inputs during the Design Phase?

The nature of Whanganui's five wet industries and their industrial location within the district of only 43,000 residents placed uncommon demands on the city's wastewater treatment plant. Whilst the wet industries only generate about 20% of the volume of the waste (or flow) going into the plant, their trade waste contains about 80% of the load (the matter contained within the flow) going through the plant. Put conversely, residential and commercial waste generates about 80% of the volume of the waste going into the plant but only about 20% of the load.

Trade waste therefore places the greatest pressure on the plant's capacity to treat influent, so calculating the wet industry inputs is integral to the initial design of the plant and controlling these inputs is also important to the plant's subsequent operation. The loads from wet industry are also seasonal, with peak loads experienced between December and June.

Report No. 11 produced by MWH in October 2005 for the Technical Working Group stated that 'a wastewater plant must be designed to have sufficient capacity to treat the highest wastewater flows and loads likely to occur.' A treatment plant cannot just be designed to treat average flows and loads.

MWH's Report No. 12 of 24 November 2005 detailed how Council carried out intensive testing to help calculate the flows and loads from major wet industries in Whanganui. During the period 5 April to 20 May 2005, 'the wastewater volumes discharged to the sewer were measured for all five industries and samples of effluent collected daily to determine the composition.' This was judged to represent peak season demand.

Post screening samples were also taken at the Beach Road pump Station and all data from 23 June 2002 to 24 June 2005 was analysed.

Somewhat presciently, the MWH report also identified the following major potential problem with the operation of the city's largest trade waste discharger, Imlay (Affco): 'This site is the biggest risk for discharging a high biological load to the treatment plant. The rendering plant in particular could discharge a load that would turn the treatment plant anaerobic and lead to odour complaints and poor effluent quality. The importance of controlling peak discharges has to be made clear to this site.'

Council's former Senior Engineer, Colin Hovey, submitted to the Independent Review that:

'At the design stage for the treatment plant intensive monitoring was carried out. Checks were made periodically on the accuracy of the flumes and samples were collected by council staff and sent off to an accredited laboratory for analysis. The sum of the loads from all the monitored sites were checked against the recorded load at the Beach Road pump station. Hence an accurate picture was built up of the loads from each of the five main wet industries. Loads varied on a seasonal and weekly basis and the design load was taken as the 90%-ile value of the total loads at Beach Road, which were sampled on three or four days per week. I do not consider that industry inputs were underestimated during the design phase and in fact council not industry measured these loads.'

The Council meeting of 12 December 2005 was advised that the plant design had been modified to increase capacity to deal with growth or decline in wet industries and to allow for greater sludge storage. Discussions had also been held with wet industries regarding sizing of the plant and improvements that could be made to their tradewaste systems.

Dr. Dave Stewart, the key MWH plant designer, wrote a paper in 2008 where he stated that in 2006 when the plant was designed it could not be known for certain what the actual wastewater flows and loads would be after separation of the combined sewer was completed in 2010. 'Therefore an extensive programme of trade waste testing was carried out to define the likely industrial loads.'

Dr. Stewart added: 'No provision was made for increased population growth in Wanganui or a major increase in industrial activity. However, a key advantage of the aerated lagoon process is the ease of extending its load treatment capacity by simply increasing the number of aerators.'

The evidence therefore suggests that, while discussions necessarily occurred with wet industries over plant sizing, a scientific exercise was undertaken by MWH and Council staff to calculate peak trade waste discharges. Therefore reliance would not have been primarily placed on discharge estimates from the wet industries.

Nevertheless, Michael Laws submitted to the Independent Review that in early 2007, close to the end of the plant's construction, CEO David Warburton briefed him that a new tradewaste by law was necessary because 'council's in-house engineering team had been "crunching the numbers" and become concerned about the plant's capacity to process all the city's industrial waste.'

It is pertinent to note in respect to this issue the following observations of Humphrey Archer from CH2M Beca who reported to Council on 28 October 2015:

- By using the bypass to the ocean outfall, Council protected the plant from higher BOD loadings during peak processing seasons

- One of the primary design faults by MWH was an 'optimistic interpretation of the mass loads during the design and construction phases and an insufficient 'safety factor' was used.'

Did Wet Industries Add Non-Consented, Excessive or Non-Permitted Inputs into the Plant?

A new Trade waste by-law was developed in 2008 to facilitate operation of the treatment plant. Wet industries were issued with discharge consents which specified agreed limits and quality of loads. Compliance was complemented by a monitoring system involving sampling and analyzing trade waste effluent four times per year for ten consecutive work days each time each wet industry site was tested.

Despite this, a number of key past and present Council staff have provided evidence to corroborate the assertion that certain of the wet industries added excessive and/or non-permitted loadings to the plant.

Rick Grobecker was Council's Deputy Infrastructure Manager from 2006 to 2009 and made a statement for Council in 2013 outlining the difficulties with the plant's operation almost from the commencement of operations in late 2007. He stated that 'the capabilities of the plant were really tested in December

2007' and the odour problems first arose. He asserted that the plant 'basically fell over virtually straight away because it could not cope with the load that was put into it.'

Mr. Grobecker firstly attributed the plant's early failure to the fact that Whanganui was experiencing drought conditions at the time which resulted in farmers destocking thereby generating a corresponding increase in wet industry operations. Secondly, he stated the problem with the operation of the aerators was exacerbated by the loads going into the plant being more than it was designed for.

Council in February 2008 was advised that an assessment was being undertaken by staff to determine the quantity and quality of loads coming from industry and that the 'quality from industry and industrial pre-treatment performance has an impact on the performance of the wastewater plant.'

On 19 May 2008, Council was further advised that from January 2008 to May 2008, 'combined loads were consistently at the upper end of the plant's design capacity.'

Staff reported to Councillors on 31 August 2009 that treatment quality at the plant had taken some time to adjust to increasing loads as one particular wet industry had moved to working double shifts. The screens at the Beach Road Pump Station had also become blocked by large volumes of animal by-products and discussions were occurring with the wet industries to find the source and to rectify the problems.

Julian Reweti, Council's Infrastructure Manager from 2007 until 2012, recalls instances of non-permitted wet industry inputs to the plant in his submission to the Independent Review. These 'added to the difficulty of the plant's operations and determining plant performance.' The plant's operators visited wet industries to try and assess their operations and talk with their staff to minimise impacts on the Council plant.

Significantly, Mr. Reweti observed that operations at the treatment plant were becoming more difficult after aeration had been repaired (i.e. two years after construction) in off peak times when loads were not considered excessive. Indeed, he states the plant was progressively worsening prior to his departure from Council in May 2012.

In comments recorded for Council in 2013, Mr. Reweti alluded to the above point when confirming that the wet industries at times exceeded their consent levels, 'but even when loads were low, the [plant] was still not meeting resource consent requirements.'

The consistent pattern of problems associated with the wet industry inputs to the treatment plant motivated Council to encourage them to progress from a culture of 'anything goes' to a more 'responsible discharge' mind-set.

Staff advised Council on 19 October 2009 that due to the plant's capacity limits, wet industries needed to pre-treat their waste to various levels. The issuance of trade waste consents and monitoring were two of Council's control mechanisms to achieve this.

In early December 2012 the plant reportedly received 'very high and unexpected trade waste loads.' Council on 17 January 2013 was advised that 'this was followed by two further discharges of unconsented waste over the Christmas and New Year periods.'

In his submission to the Independent Review, Council's current General Manager of Infrastructure, Mark Hughes, stated that the wet industries periodically sent excess and non-permitted loads to the plant and

'these were usually of short duration and were attributed to either management or mechanical failures at the source industry.'

However, given the poor performance of the treatment plant, it was not able to adequately recover from these inputs in the way a well-performing plant would have. According to Mr. Hughes, these excessive/non-permitted loads 'exacerbated the non-compliance and odour issues [and] did not on their own cause them.'

It should be noted that following Mr. Hughes' commencement at Council in July 2012 and the problems encountered at the treatment plant, staff have tightened monitoring of the wet industry loads going into the Council system and the industry's compliance with consents issued under the 2008 Trade Waste By-Law. This has included the installation of new trade waste measuring equipment at wet industry discharge points, random sampling of discharges and seeking to hold industry to account where instances of breaches are detected.

Council's then Deputy Chief Executive, for instance, wrote to a major wet industry on 10 September 2014 setting out a series of alleged trade waste breaches where previous correspondence had been entered into on the following dates:

- 8 March 2013 – non-compliant peak discharge
- 17 April 2013 – onsite tallow spill
- 29 January 2014 – non faecal gross solids eg lungs and hearts in discharge, significant fat layer, intact animal faeces, plus power lost to Council's sampler
- 24 February 2014 – significant fats and solids layer
- 21 March 2014 – Horizons Regional Council Abatement and Infringement Notices and Significant Non-Compliance Report

It therefore seems clear on the evidence that there was a consistent pattern over the years of wet industries adding excessive and non-permitted inputs into the treatment plant from time to time.

Did this Contribute to the Plant's Inability to Function?

Council's CEO wrote to a major wet industry on 8 March 2013 stating that 'the heavy trade waste loads being received by our Waste Water Treatment Plant are causing real concerns to the operation of the plant…the compliance of our industries with discharge permits is critical to the solution we all need.'

All of the above evidence leads to the logical conclusion that the excessive and non-permitted trade waste discharges to the treatment plant did occur and they significantly contributed to the operational difficulties such as odour that were experienced.

The evidence however also suggests that the plant was having major operational difficulties even when wet industry loads were not excessive.

While the behaviour of wet industries was a contributing factor in the plant's functional difficulties, it was not therefore the underlying causal factor that led to the plant's ultimate inability to function.

Was there any failure of timely reporting by plant operations staff to Horizons Regional Council ("Horizons"), Council staff, the Mayor or Councillors of the failure of the plant?

Reporting to Horizons Regional Council

Horizons Regional Council submitted to the Independent Review that:

'From reviewing the file it is clear there have been failings by WDC to comply with the provisions of its resource consent, particularly in relation to notification of non-compliances. WDC explanation for not complying with the notification conditions of the consent is that Horizons were aware of attempts to address them. This was particularly the case between 2007 and 2010 when the Annual Reports were provided to Horizons. Failure to provide the required Annual Reports occurred due to administrative errors on behalf of WDC.'

'The WWTP has been subject to a number of visual and non-visual assessments since 2007. These assessments have identified on-going issues with compliance, which typically relate to failure to comply with TSS and Enterococci concentrations. Once it became apparent the WWTP had fundamentally failed and the environmental effects were serious and ongoing Horizons took formal enforcement action.'

'Since 2013 the focus for Horizons has been to ensure WDC is progressing towards a long term solution for the WWTP. The issuing of the Enforcement Order in April 2013 was the first substantive step on this pathway. The granting of the short term consent in June 2016 was effectively the culmination of the consenting process, which now sets a clear timeframe by which a long term solution is to be achieved. Horizons are now focused on assessing compliance with this resource consent.'

Council's Senior Wastewater Engineer since 2010, Arno Benadie, submitted that in fact only one annual consent report was sent to Horizons between 2007 when the plant commenced operations and 2012 when the plant failed and Horizons submitted that no reports were provided for the 2011 and 2012 reporting years.

The two relevant provisions of Council's resource consents require notification of non-compliance to be made to Horizons within ten working days of the non-compliance. The submission from Horizons states that these reports were not being made.

The submission from Horizons refers to the explanation given by Council's then CEO Kevin Ross in correspondence dated 30 November 2012 for its failure to report non-compliances, being 'the plant has always been non-compliant and this has been discussed with HRC since 2007.'

Clearly therefore, a pragmatic approach was adopted to deal with the unexpected and ongoing difficulties that occurred from the plant's commencement. There was certainly a failure of timely reporting to Horizons because in fact there was no reporting at all of non-compliances in the manner prescribed by the resource consents. Horizons was however aware of the operational difficulties.

Reporting to Council Staff

The role of plant management staff was to report to their line management not the Mayor, Councillors or Horizons, although they would collect data for the purposes of management reports and would liaise with Horizons staff where necessary

Council's Senior Wastewater Engineer submitted that the reporting to management occurred in the following ways:

- Daily verbal reports from Senior Wastewater Engineer to the Deputy Infrastructure Manager
- Weekly reports at the Infrastructure Management meetings.
- Monthly reports to the Infrastructure Manager.
- Quarterly KPIs performance recorded on Council's KPI system. These results were reported to the Senior Management Team on a Quarterly basis.
- Reporting of important issues in the annual plan and the Long Term Plan (10 year plan). All these plans were read and approved by Council.
- Asset Management Plans
- Annual checks by the Auditor General for the annual audit. The performance of the plant was a challenge for the auditors and every year they had many questions about its performance, the consent breaches and the plans to fix the problems. All of this was reported to Senior Management.

Reporting to the Mayor and Councillors

Responsibility for reporting to the Mayor and Councillors lay with the Infrastructure Manager and not the plant operations staff.

Julian Reweti was Council's Infrastructure Manager from 2007 to 2012 and submitted to the Independent Review that:

'Council reports had regular sections on wastewater treatment issues. Councillors were aware as operational were aware of the issues. The issues however were intermittent after the aeration was repaired (after a couple of years) and were not at the same scale that was obviously experienced after 2012. The fundamental issues surrounding aeration and industry loads were a common theme, however, during 2011-2012 the inability of operations to remedy these at an operational level meant we looked to alternate consultant advice to try and remedy matters [Cardno BTO advice]. That advice however started to highlight a much greater concern that questioned the fundamental design.'

Mr. Reweti also stated that the Mayor required daily reports about the plant's operational difficulties which were widely circulated and media releases were issued when odour events occurred for example.

Former Mayor Michael Laws confirmed that he required daily reports from management after he first became aware of the odour problem in the summer of 2007/08. He stated that he 'ensured that the health of the WWTP became a focus of the senior management's reporting cycle to the governance team.'

Annette Main, who became Mayor in November 2010, submitted to the Independent Review that:

'Without going through the records of that time, I do not recall being advised of operational difficulties with the operation of the plant from when I began in October 2010 but in the year prior to the final failure

Council received regular updates on the problems and the methods being used to ensure the plant functioned. We were kept well informed on progress, including the implementation of actions suggested in a referenced report received by Council. I read the referenced report at the time. I recall being very surprised to hear that the reports as required by the Regional Council had not been provided and asked why this had not been raised with Council by the Regional Council. When the plant failed over the holiday period I was not surprised as it was clear from the updates we were being provided with that the problems were insurmountable.'

However, Mayor Annette Main added:

'We received the reports regularly but I do know now that there was information we could have been provided with which raised doubt about the ability of the plant to perform before it was built. This background would have assisted in knowing what to ask as a new councillor. I believe the Council has struggled to understand the advice on why the plant failed when it did while being bombarded with conflicting views from those with vested interests. The view that some councillors held that they knew better than staff became increasingly obvious, making it difficult for others to listen impartially to the advice of staff.'

Councillor Sue Westwood also recalled to the Independent Review that staff information regarding operational difficulties 'fell very short' of what was required.

The evidence examined throughout the course of this Independent Review suggests that the following seems to have occurred after the initial public outcry and sharp political response from the Mayor and Council to the significant odour problems of the 2007/08 summer period:

- Staff implemented 'mitigation measures' from March 2008 onwards that in part included diverting untreated effluent to sea through the marine outfall in wilful breach of the resource consent. The minutes record Councillors being formally advised of these measures on at least two occasions.

- Traditional reporting to Council meetings about operational difficulties gradually diminished as time went on after 2008 and the odour problem became less overt for a period, although other reporting was occurring in a number of ways including verbal briefings. However, the plant never achieved compliance with its resource consents throughout its whole five years of operation and the diversion of untreated effluent to the sea was effectively disguising the difficulties by mitigating their most public manifestation (i.e. odour)

- Former Mayor Michael Laws submitted to the Independent Review that he was receiving daily reports from early 2008 onwards regarding operational difficulties at the plant. What is imprecise is the extent to which he and Councillors were not fully advised of difficulties as they occurred.

- From late 2007 MWH was advising that the operational difficulties related to lack of adequate aeration and it took nearly two years resolve contractor liability issues and to install new and additional aerators imported from overseas. This had the effect of delaying staff consideration of whether there was a deeper underlying cause of the operational difficulties.

- Councillors for a significant period also believed that the problems related to faulty aerators and excessive wet industry loads were the cause of the operational difficulties

- Staff provided optimistic reports to Council from time to time that the plant was operating well when this was not always the case. A good example of this was when staff advised Council on 14 November 2011 of 'the success of the entire wastewater scheme … and the commitment to improving environmental performance.' This was the same month staff had received the first report from Cardno BTO advising on a range of measures to try and improve the plant's deteriorating performance.

The last point above illustrates the apparent disconnect existing between optimistic reporting to Council on the one hand and the practical reality on the ground at the treatment plant on the other hand. Council's former Infrastructure Manager, Julian Reweti, recalled that Cardno BTO was engaged in July 2011 to 'advise about short term fixes to enable the plant to at least comply with the consent conditions. This was our most pressing and urgent priority.' Cardno was also requested to advise on medium term and long term fixes 'to make the existing plant operate satisfactorily moving forward into the future.'

Despite the sometimes optimistic reporting, a year later by end 2012 the chickens had come home to roost.

5 KEY PARTICIPANTS IN COUNCIL PROCESSES

There were a significant number of participants involved with Council's processes associated with the treatment plant over the years 2003 to 2012. Most had a direct relationship with Council through being an elected councillor, a staff member or a contractor or consultant. Others such as Horizons Regional Council had regulatory responsibilities over Whanganui District Council.

It must be noted that the now deceased Mr. Chas Poynter was the Mayor of the City of Wanganui from October 1986 to October 1989 and the Mayor of Whanganui District Council for eighteen years from November 1989 until November 2004. Mr. Poynter was Mayor during the concept design phase of the wastewater treatment plant from 2001 to 2004 and when Council confirmed the Optimised Lagoon Treatment Process in February 2004.

The following list of individuals who were invited to make written submissions of their choice and to voluntarily respond to questions put to them by the Independent Review, were key participants and deemed to be representative of a larger group who had involvement with Council processes between 2003 and 2012. Certain consultants and individuals who were involved during that period were not invited to make submissions due to sensitivities associated with confidentiality aspects of Council's mediated settlement with MWH.

With a couple of exceptions due to their personal circumstances, the key participants listed below were invited to make written submissions by COB Friday 26 August 2016. As can be seen, a number of the key participants either declined the opportunity to provide input to the Independent Review or failed to respond to requests to do so. Others made lengthy submissions.

The Whanganui community may draw their own conclusions about individual responses to the Independent Review. However, Irrespective of whether key participants took advantage of the opportunity to make submissions or not, the pertinent questions put to them are set out below along with any responses received.

5.1 Colin Hovey

Colin Hovey, along with Dean Taylor, were the key Council members of the WDC Wastewater Treatment Working Group (Technical) including MWH that developed the concept of the Optimised Lagoon Treatment Process for ultimate recommendation to Council in February 2004. Moreover, he continued to be a key participant in the project's processes after Council confirmed the Working Group's recommendation. His permanent employment with Council as Senior Engineer commenced in November 1986 and ended in December 2009, although he continued for some time after that on a casual basis as a Contract Project Engineer. The six questions below were put to Mr. Hovey on 4 August 2016.

Mr. Hovey responded on 12 August 2016 to the two emails sent to him by the Independent Review and indicated that he intended to make a submission despite his concerns with the Terms of Reference. On the same day, the Wanganui Chronicle published a letter from Mr. Hovey where he stated that the Independent Review was a waste of time and money, based on his objection to the Terms of Reference.

Mr. Hovey however met with the Independent Review on 15 August and made the following written submission on 26 August 2016. The submission set out below, which also includes Mr. Hovey's comments on the Terms of Reference, has been edited primarily due to its length, inclusion of media articles, references to litigation and inclusion of supplementary third party documentation.

1. **CAN YOU PLEASE DETAIL YOUR PROFESSIONAL QUALIFICATIONS AND PRIOR EXPERIENCE WITH WASTEWATER TREATMENT PROCESSES?**

Up until I retired from WDC in December 2009, I had worked in the engineering field for 45 years. My qualifications were B.E Civil, CPeng, Int PE.

I joined WDC in 1986 and immediately began working on the wastewater scheme. I had taken wastewater engineering as an option within my BE, but had not worked in this field prior to joining WDC. I was tasked with preparing a new consent to continue to discharge raw sewage to the Whanganui River.

WDC pleaded financial hardship in that they were still paying off the first stage of a sewage scheme. I was also to introduce and implement a trade waste bylaw and charging regime for wet industries. This was to recover cost of the part of the scheme which had not received a government subsidy.

The consent application had elements of the impact of pathogens from human and animal waste on the river and marine environment. This called for a knowledge of such matters similar to aspects of waste water treatment.
The trade waste bylaw also had to take account of the impacts of industrial discharges on the environment, and the impact that waste treatment on--site would have. I made myself familiar with such treatment and acted as trade waste officer for WDC.

I was also aware at that time that ultimately WDC had to build a treatment plant to treat the domestic and industrial waste from the city. I attended a number of conferences on wastewater and visited a number of treatment plants around the country. I was also attending annual tradewaste conferences and visiting plants associated with those conferences.

I attended specific wastewater workshops run by well-known experts such as Wes Eckenfelder and the Australian Wastewater Institute.

By the time WDC was required to design a treatment plant I was very conversant with wastewater practice. I worked with MWH consultants in 2000 to develop a scheme with separate domestic and industrial treatment.

I went on a NZ land disposal tour to Melbourne and visited some large treatment sites in Australia.

When this separate scheme was found to be not suitable and a working group was set up under a new consent framework I was the technical representative on that group for WDC. I consider I had more than adequate knowledge to evaluate consultant processes and treatment proposals and to help advise the lay members of the group. This process began in July 2001.

When the MWH treatment plant was shut down by WDC in December 2012, I attempted to advise council. This pointed out that the scheme proposed by Cardno would not work. This demonstrated a high level of understanding of waste water processes, knowledge I possessed before the MWH plant was built.

2. DID YOU UNDERTAKE ANY SITE VISITS IN NEW ZEALAND OR OVERSEAS TO ASSIST YOU IN DETERMINING THE WASTEWATER TREATMENT PROCESS TO RECOMMEND TO COUNCIL? IF SO, WHEN AND WHERE DID YOU TRAVEL TO AND WHO, IF ANYONE, ACCOMPANIED YOU ON THE SITE VISITS?

During the working group process visits with the group were made to plants at Porirua, Otaki and Palmerston North. They were accompanied by MWH staff.
I also visited NZ plants at Feilding, Alliance Pukeuri, Fonterra Edendale, Winton, Gore and Bluff, in the company of Dr Dave Stewart, the principal process designer for MWH. These visits would have taken place in 2001 and early 2002. In October--November I visited plants in USA, three, Scotland, one, and South Africa, three. I was met by MWH local engineers on most occasions. All these plants had aspects of possible options for Whanganui.

3. WERE YOU AWARE OF ANY COMPARABLE EXAMPLES OF THE OPTIMISED LAGOON TREATMENT PLANT PROCESS OPERATING SUCCESSFULLY IN NEW ZEALAND OR OVERSEAS AND WHAT ADVICE WAS PROVIDED TO COUNCIL IN THISREGARD?

The term unit processes is often used in connection with treatment plants. For example trickling filters are a separate component of some plants where the bacteria exist on the surface of stones or manmade elements. The waste is sprayed over the surface and trickles through, undergoing breakdown by the bacteria. Another unit process is activated sludge where waste and bacteria are fully mixed in the presence of oxygen. Another process is an anaerobic lagoon where bacteria that do not require oxygen are used to breakdown the incoming waste. This takes time and requires a large lagoon, but produces less sludge than aerobic treatment.

All four options developed and costed in report 8 had unit processes. So the term optimised in the Whanganui case was used to convey the fact that selected processes were being combined to achieve treatment.

Rather than a separate process to achieve anaerobic breakdown this was to occur naturally over time in the deeper than usual treatment lagoon, thus leading to less sludge ultimately.
As some waste potion could be discharged under the consent to discharge to sea, full activated sludge treatment with its associated higher energy costs was not necessary. As the city was not yet fully separated the treatment lagoon was made larger to allow wet weather flow to go through the plant and be disinfected, hence meeting consents at all times. This was instead of building separate holding tanks to store excess flows or providing a bypass system and chlorination then de--chlorination to meet consents. This was also seen as optimising requirements.

It is thus unlikely that a comparable plant exists, and I am not aware of one.

However AIWPS plants--that is advanced integrated wastewater pond system-- do exist and I visited one in California. They have a deep say 4m pit in the middle of a larger 4m deep aerobic lagoon. The purpose of the pit is to allow anaerobic breakdown, much as was the case with the MWH plant. There are many aerated lagoons around NZ and overseas. The closest one is Palmerston North, where an aerated section is followed by a less aerated section where sludge can settle out, again like the second and third zones in the MWH plant.

It is understandable that the situation would not be explained to council because of its complexity.

Table 1 on page 7 of treatment working group report 10 shows the cost effectiveness of the optimised scheme. Its capital cost was $9.53m compared to the standard partial mix aerated lagoon of $14.645m (without fees, etc.)

4. PLEASE DESCRIBE HOW COUNCILLORS WERE PROVIDED WITH A RISK ASSESSMENT FOR THE RECOMMENDED OPTIMISED LAGOON TREATMENT PLANT PROCESS? WERE THEY ADEQUATELY ADVISED OF ANY RISKS IN YOUR OPINION?

The SWAT analysis on page 3 of report 10 did not suggest any risks significant enough to not proceed in the face of such cost savings over the next best options.

I myself did not consider there was any particular risk, having seen examples of the processes to be used in the final MWH design.

Pages 49--50 of report 11 identify risks, but none of them are specific to the final selection.

Julian Reweti presented reports to council, generally written by Dean Taylor, as I recall. I did not necessarily see these reports and cannot really offer an opinion as to whether council were advised of 'risks'. It is quite likely that Dean and Julian both shared my views about minimal specific risks.

5. GIVEN THAT COUNCIL IN FEBRUARY 2004 CONFIRMED THE RECOMMENDED MWH-- DESIGNED OPTIMISED LAGOON TREATMENT PLANT PROCESS ON THE CONDITION IT WAS PEER REVIEWED, PLEASE DESCRIBE HOW COUNCILLORS WERE SUBSEQUENTLY INFORMED OF ANY ISSUES AND CONCERNS RAISED BY THE PEER REVIEW PANEL? WERE THEY ADEQUATELY INFORMED OF THESE ISSUES AND CONCERNS IN YOUR OPINION?

6. How were any issues and concerns raised by the Peer Review Panel in 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council in this regard?

It seems to me that these questions are so related that they are better answered as one question.

I do not have an electronic copy of the peer review questions and responses but assume they have been provided.

Queries 1--3 relate to industry loads and agreements. They would have been made for any option not specifically for the optimised option.
Query 4 is about odour and is answered adequately by Dave Stewart in saying that provided enough aeration was supplied any odorous compounds would be oxidised before reaching the surface.

Query 5 about 'rising sludge' was answered by the normal action of mixing removing bubble flotation effect and by referring to the temperature in the deeper lagoon, and the absence of such a problem elsewhere. Mitigation measures were available if a problem did occur.

Query 5.3 was answered by quoting values of transmissivity from several other plants with similar operational characteristics.

Query 6 is about the estimates and risk assessments and would have applied to any of the options.

Query 8 is about sludge volumes and accumulation. It is clearly acknowledged that this is a difficult area. Technical analysis has been done using best--guess estimates for the various treatment efficiencies and 'usual' textbook parameters for kinetic coefficients. A literature search was also carried out and various rates extracted from studies around the world. Values from NZ that MWH were familiar with were also quoted. At the end of the day it was accepted that if sludge did accumulate more rapidly than estimated it would simply have to be removed from the lagoons sooner than expected.

Other queries are construction and siting related and were adequately addressed.

Query 13 is the only query that specifically talks about the optimised process design and settlement. Dave Stewart talks about the difference between partial-- mix and the design referring to a different degree of treatment and the depth of the settlement pond as well as its area. He also had specific TSS measurements done at the P.N. plant to provide evidence that settlement as proposed could produce the required design values.

It was explained to the working group that if the effluent from the settlement pond was not 'clean' enough and chemical dosing or baffles addition did not work, then clarifiers would be needed. These are costly so why not try without them initially.
I saw similar settlement ponds in S.A. which appeared to work well enough.

I don't know whether this was communicated well enough to council, but I am sure the approach would have been accepted anyway.

In my opinion there were no real risks identified that would have altered the decision by council to approve the scheme. The fact that the plant performed as designed when properly operated, and that actual sludge accumulation rates were lower than Dave Stewart's estimates supports my views.

ADDITIONAL COMMENTS BELOW BY COLIN HOVEY REGARDING THE TERMS OF REFERENCE

TERMS OF REFERENCE AS DETERMINED BY WHANGANUI DISTRICT COUNCIL FOLLOWING A PUBLIC MEETING ON 4 JULY 2016

PART 1. TECHNICAL

The technical aspects of the waste water treatment plant ("the plant") has been highly investigated, reported on and made public. The technical aspects of the plant also formed part of the mediation. No further investigation is required in respect of the 'technical' aspects of the plant.

The report shall confirm and reference the expert opinions stating that the MWH designed plant was not salvageable.

Comment

I strongly object to this part of the 'independent' enquiry.

Firstly the reference to a public meeting suggests the public had input to the TOR. They did not and had no speaking rights at the meeting. Some councillors submitted questions they wanted answered by the enquiry but they were not included.

The technical aspects of the plant were certainly part of the mediation but the responses to those expert opinions as to why the plant failed and why WDC chose to sue MWH have definitely not been made public. Neither has the settlement after the mediation process failed been made public.
To confirm and reference the expert opinions without any reference to the responses to those opinions, will suggest that the expert opinions were correct.

In my opinion the enquiry will not be accepted as being independent with the technical part of the TOR being so structured.

And further with respect to 2.3 under process:

What fault, if any, was in the Council operation of the 2007 plant which would have led to its failure?

It is well known that council did not maintain the aerators at the plant. Without addressing the expert opinions about the plant and the rebuttal of these claims, and without looking at the technical data from the plant, it will leave room to say that the aerator issue only exacerbated the problem, as BTO have said.

This is totally unsatisfactory.

PART 2. PROCESS

TO REVIEW THE PROCESSES FOLLOWED BY COUNCIL FROM 2003 TO 2012. THIS COULD INCLUDE THE MANAGEMENT OF THE PROCESS, REPORTING TO COUNCIL AND THE DECISIONS MADE BY COUNCIL.

2.1 What fault, if any, was there in the Council's input into the design parameters and their decision making processes that led to the acceptance of the design and build of the 2007 plant?

The use of the term Council would seem to include councillors as in meeting discussions, resolutions, etc. I don't consider councillors had any real input into design parameters. I believe reports that were put to Council were approved after any relevant discussion. This applies to budget decisions as well as technical details. If the term council is to include officer's input and decision making processes this is far too large a question to comment on.
I sized the treatment lagoon, as set out in design report 11 and the work and effort that went into that was complex but very robust. The plant has coped very well with the combined flows from the city in the period it was operating.
Other decisions were taken throughout the working group process and reporting.

2.2 WHO WAS INVOLVED, AND WHAT WAS THE DECISION MAKING PROCESS, STARTING FROM THE INITIAL DESIGN OF THE PLANT IN 2003 TO THE OPENING OF THE PLANT IN2007?

MWH were the major designers along with myself. Various other experts assisted with the detailed design--geotechnical, electrical--e.g. Greg Mallett.

2.3 WHAT FAULT, IF ANY, WAS IN THE COUNCIL OPERATION OF THE 2007 PLANT WHICH WOULD HAVE LED TO ITS FAILURE?

It is well known that aerators failed at the plant including the second set.
This was unprecedented but did not mean that surface aeration should not have been persevered with.
It was, like most treatment plants, a biological plant, and the bacteria needed oxygen to function. Plain and simple.

None of the alternative reasons for failure have held up. It is not possible to not present some technical data to support these claims.

This data clearly shows the plant working when supplied with adequate dissolved oxygen (DO). There would be no periods of such performance if all the claims were true.

Requirements for monitoring were well set out in the operation and maintenance manual. The requirements and purpose of the monitoring were again spelt out in the biological commissioning report dated 11 October 2010. The monitoring was intended to measure the 'health' of the biomass and to allow for adjustment in the critical F/M ratio by altering aeration in the three zones.
This monitoring was never done and no attempts were made to check F/M ratios. My request to provide monitoring data were never responded to but discussions revealed that sampling was never carried out!

It is obvious that very little was done to ensure the plant was functioning, or to operate it as it was designed.

2.4 IS THERE ANY EVIDENCE THAT WET INDUSTRIES UNDERESTIMATED THEIR INPUTS DURING THE DESIGN PHASE, OR ADDED NON--CONSENTED, EXCESSIVE OR NON--PERMITTED INPUTS INTO THE PLANT THAT CONTRIBUTED TO ITS INABILITY TO FUNCTION

I dealt with wet industries from the time I introduced the tradewaste bylaw in 1988 until just prior to the plant opening in 2007. Industry began paying tradewaste charges based on their loads from 1989. This required them to be monitored for the parameters that made up the charge. Each site had a monitoring flume which was continually monitored, and inspected to ensure it was properly maintained. At the design stage for the treatment plant intensive monitoring was carried out. Checks were made periodically on the accuracy of the flumes, and samples were collected by council staff and sent off to an accredited laboratory for analysis. The sum of the loads from all the monitored sites were checked against the recorded load at the Beach Road pump station. Hence an accurate picture was built up of the loads from each of the five main wet industries. Loads varied on a seasonal and weekly basis and the design load was taken as the 90%--ile value of the total loads at Beach Road, which were sampled on three or four days per week.

I do not consider that industry inputs were underestimated during the design phase and in fact council not industry measured these loads.

The plant was designed to be aerated and in the case of excess loads full aeration should have been supplied. Weekend periods allowed the plant to 'recover' from excess loads during the week. During the period when the plant was operating with the design number of aerators some loads well over double the design load entered the plant and were treated satisfactorily, with TSS effluent levels meeting consent. Such loads are to be expected from wet industries such as Whanganui's and should be catered for.

After the plant aerators were turned off and attempts were made to run it with introduced bacteria supplied with oxygen from chemicals (oxygain), high loads from industry made this impossible and drew attention to industry who were just going about their business as usual.

2.5 WAS THERE ANY FAILURE OF TIMELY REPORTING BY PLANT OPERATIONS STAFF TO HORIZONS, COUNCIL STAFF, THE MAYOR OR COUNCILLORS OF THE FAILURE OF THE PLANT?

Annual reports were always required by Horizons so that compliance with various consents could be monitored. I wrote and provided these reports for many years. The council's own annual reports also reported on the monitoring results.

As I understand it these reports ceased to be provided to Horizons shortly after the plant opened. Horizons apparently did not pick this up, and neither did WDC annual reports. It is conceivable that had Horizons become aware about the continual non--compliance of the plant they might have taken action to have that remedied.

I have also seen councillors reported as saying they were not made aware of any issues at the plant. It seems the horrendous smells caused by shutting down the aerators brought all the issues to light.

5.2 Dean Taylor

Dean Taylor commenced employment with Council in January 1976, progressing through various roles and becoming in 2001 a key member of the WDC Wastewater Treatment Working Group (Technical) including MWH that developed the concept of the Optimised Lagoon Treatment Process for ultimate recommendation to Council in February 2004. Moreover, he continued to be a key participant in the project's processes after Council confirmed the Working Group's recommendation up until his departure from Council in June 2005. The following questions were put to Mr. Taylor on 8 August 2016:

1. Are you aware of any site visits being undertaken in New Zealand or overseas to assist Council staff in determining the wastewater treatment process to recommend to Council? If so, please provide details.
2. Were you aware of any comparable examples of the Optimised Lagoon treatment plant process operating successfully in New Zealand or overseas and what advice was provided to Council in this regard?
3. Please describe how Councillors were provided with a risk assessment for the recommended Optimised Lagoon treatment plant process? Were they adequately advised of any risks in your opinion?
4. Given that Council in February 2004 confirmed the recommended MWH-designed Optimised Lagoon treatment plant process on the condition it was peer reviewed, please describe how Councillors were subsequently informed of any issues and concerns raised by the Peer Review Panel? Were they adequately informed of these issues and concerns in your opinion?
5. To the extent of your knowledge, how were any issues and concerns raised by the Peer Review Panel in 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council in this regard?

Response: Mr. Taylor did not respond to the questions put to him.

5.3 Colin Whitlock

Colin Whitlock was The Town Clerk of the City of Wanganui from 1984 to 1989 and then Chief Executive Officer of Whanganui District Council from 1989 until 2005, including the evaluation and design phase of the wastewater treatment plant leading up to Council's decision in February 2004 to confirm the staff-recommended Optimised Lagoon treatment process and the report to Council in November 2004 on the outcome of the peer review. The following questions were put to Mr. Whitlock on 5 August 2016:

1. Did you approve Council staff undertaking any site visits in New Zealand or overseas to assist in determining the wastewater treatment process to recommend to Council? If so, when and where did staff travel to and who, if anyone, accompanied staff on the site visits?
2. Were you aware of any comparable examples of the Optimised Lagoon treatment plant process operating successfully in New Zealand or overseas and what advice was provided to Council in this regard?

3. Please describe how Councillors were provided with a risk assessment for the recommended Optimised Lagoon treatment plant process? Were they adequately advised of any risks in your opinion?
4. Given that Council in February 2004 confirmed the recommended MWH-designed Optimised Lagoon treatment plant process on the condition it was peer reviewed, please describe how Councillors were subsequently informed of any issues and concerns raised by the Peer Review Panel? Were they adequately informed of these issues and concerns in your opinion?
5. How were any issues and concerns raised by the Peer Review Panel in 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council in this regard?
6. Did you have any issues or concerns with the evaluation and design process for the treatment plant? If so, did you raise these issues or concerns with staff under your management or with the Mayor or any other councillors?

Response: Mr. Whitlock responded by telephone message on 15 August 2016 and declined to make a submission. He did however meet with the Independent Review on 24 August 2016 and provided some useful insights into the trusting senior management culture prevailing in 2004 and his concerns held over the premature termination of the Peer Review Panel in late 2004. Mr. Whitlock also recalled that MWH was quite upfront with Council management that the treatment plant concept design had no precedents and therefore entailed significant risks.

5.4 Councillor Ray Stevens

Councillor Ray Stevens has been on Whanganui District Council for nineteen years, covering the evaluation and design phase of the wastewater treatment plant leading up to Council's decision in February 2004 to confirm the staff-recommended design for the Optimised Lagoon treatment process, the construction phase of the treatment plant and the operational phase of the treatment plant from 2007 to 2012. The following questions were put to the Councillor on 5 August 2016:

1. Were Councillors advised by staff of any comparable examples of the Optimised Lagoon treatment plant process operating successfully in New Zealand or overseas?
2. Please describe how Councillors were provided by staff with a risk assessment for the recommended Optimised Lagoon treatment plant process? Were they adequately advised of any risks in your opinion? Did Councillors raise this issue with staff at the relevant time in your recollection?
3. Given that Council in February 2004 confirmed the recommended MWH-designed Optimised Lagoon treatment plant process on the condition it was peer reviewed, please describe how Councillors were subsequently informed by staff of any issues and concerns raised by the Peer Review Panel? Were Councillors adequately informed of any issues and concerns in your opinion? Did Councillors raise this issue with staff at the relevant time in your recollection?
4. To your knowledge, how were any issues and concerns raised by the Peer Review Panel in 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council by staff in this regard?

5. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 up until the end of 2012. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties in your opinion?
6. With hindsight, do you believe that Councillors were sufficiently robust in exercising their governance function in respect to staff management of the treatment plant project during the period 2003 to 2012?

Response: The Councillor was unable to respond within the deadline for submissions.

5.5 Councillor Sue Westwood

Councillor Sue Westwood has been on Whanganui District Council and its predecessor for thirty years, covering the evaluation and design phase of the wastewater treatment plant leading up to Council's decision in February 2004 to confirm the staff-recommended Optimised Lagoon treatment process, the construction phase of the treatment plant and the operational phase of the treatment plant from 2007 to 2012. The following questions were put to the Councillor on 5 August 2016 and her responses are set out below:

1. Were Councillors advised by staff of any comparable examples of the Optimised Lagoon treatment plant process operating successfully in New Zealand or overseas?

Response: Not that I can recall.

2. Please describe how Councillors were provided by staff with a risk assessment for the recommended Optimised Lagoon treatment plant process? Were they adequately advised of any risks in your opinion? Did Councillors raise this issue with staff at the relevant time in your recollection?

Response: We were assured that a peer review of the whole operation had been done (I assumed by professionals and did not question this process). No specific risk assessment was tabled. We were not adequately advised of risks. Had we been I would have questioned mitigations to be undertaken. As we did not know any potential risks clearly questions were not raised.

3. Given that Council in February 2004 confirmed the recommended MWH-designed Optimised Lagoon treatment plant process on the condition it was peer reviewed, please describe how Councillors were subsequently informed by staff of any issues and concerns raised by the Peer Review Panel? Were Councillors adequately informed of any issues and concerns in your opinion? Did Councillors raise this issue with staff at the relevant time in your recollection?

Response: In hindsight Councillors put too much trust in the professionalism of our engineers. The only report to Council in my recollection was that the aerators had failed and would need to be replaced as they were too small to be effective with the aerobic level. We falsely assumed that the replacements fixed the problem and I was not aware that these replacements were different from the originals, were raising the anaerobic level into the aerobic and thus the aerobic level was not effective in its oxygen levels.

I do not believe that we were adequately informed of any subsequent issues. My assumption was that the plant was working satisfactorily.

4. To your knowledge, how were any issues and concerns raised by the Peer Review Panel in 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council by staff in this regard?

Response: To the best of my memory the technical requirements were left to staff and their reporting regime left a lot to be desired. Again I assumed that there were no problems as none of significance were reported to Council that I can recall.

5. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 up until the end of 2012. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties in your opinion?

Response: As you are probably aware I was not part of Michael's VISION team. On many issues I felt his 'In Team' who caucused many positions possibly were more aware. This is purely my own opinion. Apart from the aerator problem I can't honestly recall being told of other problems. In retrospect staff information fell very short.

6. With hindsight, do you believe that Councillors were sufficiently robust in exercising their governance function in respect to staff management of the treatment plant project during the period 2003 to 2012?

Response: I believe in retrospect that we fell well short given the information that has come out since. Too much trust was placed in the capability of our staff to effectively deliver on what was a new and unique design. Had I personally been more aware of the problems clearly we would have required more in depth reports, proposed mitigation and had many discussions on the issue with MWH.

5.6 Allan Wrigglesworth

Allan Wrigglesworth was an original member of the WDC Wastewater Treatment Working Group (Technical) including two Council staff, the consultants MWH and Iwi representatives that was established in 2001. Council staff on the Working Group subsequently engaged with MWH in an evaluation process to recommend a preferred treatment plant design to Council. The following request was put to Mr. Wrigglesworth on 5 August 2016:

Please include a description of the nature and extent of your role on the Working Group in any submission that you may make.

Response: Mr. Wrigglesworth did not respond to the two emails sent to him. However, on 8 August 2016, the *Wanganui Chronicle* published a letter from him which stated he was boycotting the Independent Review in objection to the Terms of Reference and encouraged others to do the same.

5.7 John Crawford

John Crawford is a consultant with OPUS and was the Coordinator of the Peer Review Panel that was commissioned by Council in 2004 to review the MWH-designed Optimised Lagoon Treatment Process. Council had confirmed the process in February 2004, subject to peer review. The other member of the Peer Review Panel was Cliff Tipler from URS New Zealand and the Panel was assisted by Julian Reweti representing Council as client. The following questions were put to Mr. Crawford on 11 August 2016 and his responses received on 25 August 2016 are set out below:

1. On 16 September 2004 you wrote to Council on behalf of the Peer Review Panel and appended to your letter a table which detailed the issues the peer review had identified and Council's initial response to those issues and stating that a number of issues identified had not been adequately addressed. Your letter set out five key points for further action or attention, including the need for a rigorous risk assessment process covering the preferred option. Did the Panel consider that the peer review process was completed by the sending of this letter to Council or after any subsequent discussions with Council staff?

Response: The panel did not consider that the peer review process was completed. It was our understanding that the panel would be reconvened again, at the detailed design phase, to check that issues raised in the initial peer review (and others arising) were being appropriately addressed. The context of the initial 2004 Peer Review was that it was of a concept only, that concept being the one that the Council and its consultants had chosen as preferred from a number of options.

2. Are you aware whether the rigorous risk assessment process that the Panel required to be undertaken in fact occurred or whether any of the other four key points (eg. provision of calculations determining aeration requirements, provision of raw data to support claims made, confirmation of the longevity of the plant particularly in terms of sludge inventory) were ever actioned?

Response: No I have no knowledge as to whether any of those key points were subsequently actioned. I have had no subsequent involvement with the project since my 16 September 2004 letter and the Council response, closing the current phase of the peer review process.

3. Is it correct that the Panel had only reviewed design concepts and that a detailed design did not exist at that point in time in 2004?

Response: That is correct. It is possible that some detailed design already existed. But the panel was certainly not aware of it.

4. Council replied to your letter on 28 October 2004 stating in part that the peer review process was complete, but that it would be useful if the Panel was available to critique/review components of the design process going forward. Were you or the Panel ever requested by Council to undertake any further critiques or reviews of any components of the detailed design?

Response: I was never subsequently requested by Council to undertake any further critiques or reviews of any components of the detailed design. I cannot speak conclusively for Mr Tipler. However, on the basis of conversations that the two of us had shortly after the issues became public knowledge, I am

reasonably certain that Mr Tipler had had no further involvement either, after 16 September 2004. I cannot speak for Mr Reweti, the Council representative on the panel.

5.8 Michael Laws

Michael Laws was the Mayor of Whanganui District Council from November 2004 to 2010 and a Councillor from 2010 to 2014. His period on Council covered the final stage of the detailed design phase of the wastewater treatment plant, its construction and its operational phase from 2007 to 2012. The following nine questions were put to Mr. Laws on 5 August 2016 and he replied with a lengthy submission on 26 August 2016. Mr. Laws' submission is set out in full below:

1. Are you aware of Councillors being advised by staff of any comparable examples of the Optimised Lagoon treatment plant process operating successfully in New Zealand or overseas?
2. Were Councillors during your period as Mayor provided by staff with a risk assessment for the recommended Optimised Lagoon treatment plant process? Were they adequately advised of any risks in your opinion? Did Councillors raise this issue with staff at the relevant time to your knowledge?
3. Given that Council in February 2004 and prior to your commencement as Mayor, had confirmed the recommended MWH-designed Optimised Lagoon treatment plant process on the condition it was peer reviewed, please describe to the best of your knowledge how Councillors were subsequently informed by staff of any issues and concerns raised by the Peer Review Panel? Were Councillors adequately informed of any issues and concerns in your recollection? Did Councillors raise this issue with staff at any relevant time?
4. To your knowledge, how were any issues and concerns raised by the Peer Review Panel in late 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Were they adequately addressed in your opinion and what advice was provided to Council by staff in this regard?
5. Was the wastewater project budget sized correctly to deliver a viable treatment outcome in your opinion? Do you believe staff held any perception that they had to deliver a lower cost option?
6. From your experience, do you believe that Council's internal technical and engineering staff had the requisite knowledge and expertise to adequately contract manage Council's external technical and engineering consultants on the treatment plant project?
7. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 up until the end of 2012. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties in your opinion?
8. Did you in your capacity as Mayor receive regular staff briefings from 2007 to 2010 on the plant's operational difficulties and, if so, what was the nature and extent of those briefings?
9. With hindsight, do you believe that Councillors were sufficiently robust in exercising their governance function in respect to staff management of the treatment plant project during the period 2003 to 2012?

Submission of Michael Laws to the WWTP Inquiry-August 2016

My name is Michael Laws. I was elected as Mayor of the Wanganui District Council in October 2004 and re-elected to that role in 2007. I had not served on the district council prior to my election.

I retired from the mayoral role on October 2010 but was elected as a Wanganui district councillor in 2010 and re-elected in 2013. I resigned from the council in 2014 because I had re-located with my family outside of the district.

Previously, I had served as the Member of Parliament for Hawke's Bay from 1990 to 1996.

This is relevant only in as much that Iwas familiar with parliamentary policy making and inquiry functions, and served on Parliament's education and science, Maori Affairs, and electoral law select committees for two parliamentaryterms.

Submission to the Wanganui District Council Inquiry

Although I have publicly stated my support for an inquiry into the failure of the Wanganui wastewater treatment plant, I must record my substantial misgivings around the terms of reference that frame this inquiry.

The details of those concerns I have communicated to the independent reviewer Mr Robert Domm and the chief executive of the Wanganui District Council, Mr Kym Fell.

I have been asked a series of questions by Mr Domm, which I attach as an appendix to this submission. I believe that the content of this submission answers those queries.

However, I believe that in simply answering Mr Domm's questions, that I would not be presenting a sufficiently full, transparent and accurate portrayal of the information that I hold, and that is relevant to this inquiry. Hence this more formal and detailed submission.

There will be gaps in my evidence and perhaps the occasional error. They will not be deliberate: rather, the result of my memory of some ten to twelve years ago rearranging facts and impressions out of order.

One final point.

The design and construction of the council's wastewater treatment plant when I was mayor was without internal or political controversy.

There were any number of more exacting, controversial and immediate issues that confronted the council of the time. By contrast, the design and construction of the wastewater treatment plant was considered to be a relatively prosaic process. It was always perceived by the governance team as being properly managed by its engineering and environmental professionals.

At no stage was my governance team aware of or alerted to any design risks associated with the wastewater treatment plant.

The subsequent operation and failure of the wastewater treatment plantwas neither foreseen nor imagined by the governance teams of the time.

Election as Mayor 2004

I was elected to the Wanganui mayoralty in October 2004 as the leader of a' team' collectively calling ourselves *' Vision Wanganui'.*

Following parliamentary precedents, we published a detailed manifesto of policy objectives and agreed on governance principles and policy priorities should we be elected.

At the 2004 local body elections,' *Vision Wanganui'* candidates were elected to the mayoralty, six district council seats, two district health board seats and one Horizons regional council seat.

I appointed then local hotelier and businesswoman, **Cr Dot McKinnon,** as deputy mayor.

I also appointed *non-Vision* and experienced senior councillor **Don McGregor** as chairman of the infrastructure committee that oversaw the wastewater separation and treatment plant.

I took the advice of then council chief executive **Colin Whitlock** on this appointment as Mr Whitlock considered that Don McGregor had a good grasp of the related issues, even though Cr McGregor was not part of the '*Vision Wanganui'* team. He had good experience of the wastewater separation project including the design of the wastewater treatment plant.

For the second term of my administration, **Cr Ray Stevens** chaired the infrastructure committee responsible for the council's water and wastewater services.

The Wanganui District Council Senior Management

As a new mayor, with a reform agenda, there was a palpable wariness in my early relationship with the council's senior management.

The senior management that I had the most to do with comprised of chief executive **Colin Whitlock,** deputy chief executive **Ian McGowan,** finance manager **Dave Foster,** and infrastructure manager **Dean Taylor.**

Within twelve months, all would be gone from the district council -either retired (Whitlock/McGowan) or resigned (Foster/Taylor) .

The district council appointed a new chief executive in late 2005 to replace Colin Whitlock - **Dr David Warburton.** It also appointed Dr Warburton's deputy, the council's then corporate services manager, **Mr Kevin Ross.**

Dr Warburton came highly recommended by recruitment specialists. He was seen by the governance team as having the right mix of leadership and private sector experience to complete the reform of the council's administration and operations.

In my dealings with all three chief executives that served whilst I was mayor - Colin Whitlock, David Warburton and Kevin Ross I never once had cause to doubt their professionalism nor honesty.

The relationship between Opus, MWH and the district council

Prior to my election as mayor, I had expressed concerns at the close relationship between private engineering company, Opus, and the senior management of the district council. This relationship had

been publicly cemented with the mutual secondment of infrastructure manager Dean Taylor to Opus, and his Opus equivalent to the role of council infrastructure manager in 2003/4.

My concern was that the council was overly reliant upon one single agency for most of its infrastructure policy advice and its operational capacity. I doubted the ability of senior council management to properly monitor the quality of advice and work contracted to the council, especially given the close personal relationships.

I expressed this view strongly to both Colin Whitlock, and his successor David Warburton. I saw a need to have sound engineering expertise and overview located within council, and on the council payroll. I was assured, especially by Dr Warburton, that such capacity would be added to the council team.

Briefing Papers of issues in transition

Upon my election as mayor, and with seven new councillors similarly elected, the new governance team looked to senior management to update them as completely as possible after their election and swearing-in.

I found the council's s briefing papers to be both brief and inadequate and communicated this view to the chief executive.

The briefing papers on the wastewater treatment plant contained no different information to that published in the 2003-13 Long Term Council Community Plan (LTCCP). They simply recorded that a policy and design decision had been reached and consulting engineers MWH engaged to further the design and project manage the construction.

Wastewater Separation Project & Treatment Plant

One of the first questions I posed to the council's senior management, upon being elected as Mayor, was how I might halt the above projects until a fundamental and external review had been completed.

It was my view, at that time, that the quantum cost of the project being the public and private separation and the projected WWTP - was fiscally unsustainable.

In addition, I came to realise that the district council's published plans and financial statements could not be relied upon.

In part, that was because local government was moving towards a new accounting regime and new audit requirements, and in part because the previous council had not made public a severe downgrading of the council's projected income over the next decade, especially from forestry dividends.

It also seemed bizarre - at least to this lay outsider - that we were about to construct a wastewater treatment plant that would have the capacity of ten times the population of our district/city. Although the latter was not my immediate focus: in terms of the overall cost of the wastewater separation project it made up a relatively minor proportion of the total cost.

I had extensive private meetings with Colin Whitlock, Dave Foster and Dean Taylor around these issues.

All advised that *"the ship had sailed"* with regard to halting the wastewater separation project and revisiting previous council decisions. Capital works were underway, legal contracts had been let and community consultation had concluded.

On the **wastewater treatment plant,** Dean Taylor provided briefings to both myself and to the full council on how the plant was to be constructed, the technology behind its construction, how the plant would function, and its likely cost and timing. ·

At no stage did he inform the new governance team that the design for the WWTP was untried and untested anywhere in New Zealand. Nor did the chief executive. However, Mr Taylor had provided such information to the previous governance team led by Mayor Chas Poynter.

On 10 February 2004, Mr Taylor informed the then council's works and transport committee that -

"*There is no such [wastewater treatment] plant in existence, certainly in New Zealand, which combines well-established process techniques with a unique sludge management process."*

He also informed council that *"the process is considered to be relatively low risk primarily because it is based on proven technologies. In* order *to assist with the management of risks. ...a peer review group will examine the proposal in the context of all other possible options ... Any issues raised will be able to be dealt with in the detailed design phase."*

I would not read these full Council minutes until years later - I seem to recall after the first problems became apparent at the commissioned plant.

Mr Taylor also addressed the issue of council's relationship with Opus, MWH and Works infrastructure *[see Works & Property Committee minutes 1 7* Nov *2004]* and suggested a path ahead to expand council resources ahead of the construction of the WWTP for June 2007.

In his advice to my governance team, Dean Taylor noted that the design of the WWTP had already been subject to peer review (Opus, URS and Wanganui Water Services) and all had said that the optimised lagoon design would work.

Financial cost of the WWTP

Dean Taylor also noted, in his November 2004 briefing to the new governance team that the projected cost of the WWTP had dropped dramatically from around $23 million to $14 million. I later understood that this information came from the original decision to recommend the "optimised lagoon" choice to Mayor Chas Poynter's council in February 2004. It was, by far, the cheapest option.

At no stage was the likely cost of the W WTP ever an issue around my council table.

My view, and that of all councillors, was that whatever it would cost, it would cost. We needed an estimate for budget purposes but it was the lesser of the overall expenditure of around $120 million on the entire wastewater separation project.

Senior management explains the WWTP project

I was dissatisfied with the initial management briefings. I asked Dean Taylor to prepare a report for Council (in confidence) in March 2005 to review the WWTP, its construction, timing and operation.

By now, I'd become wary of the impartiality of senior management advice to council.

There had been unsatisfactory explanations around information on the Sarjeant Art Gallery extension and the forestry receipts, unbudgeted contracts being ·1et for an upgrade of upper Victoria Avenue, a Code of Conduct complaint by a senior manager against a councillor, and management resistance to a nil rates increase - all of which made me question whether senior management was being genuinely open and co operative.

Dean Taylor duly presented his report on the WWTP in March 2005.

It was strongly geared against any delay or interruption of existing policy related to the wastewater project. It suggested major government, regional council and local opposition to any delay and financial costs in the hundreds of thousands of dollars. These risks were also emphasised in the verbal reports of the chief executive Colin Whitlock and the finance manager Dave Foster to the same meeting.

There did not exist the political appetite to challenge this advice. Returned councillors strongly endorsed the project (Crs Don McGregor, Ray Stevens,

Randhir Dahya, Sue Westwood and Barbara Bullock) whilst new councillors lacked the expertise or experience-often both-to properly question expert and senior management advice and argument.

None of the governance team-myself included-came from a technical nor engineering background.

We were given no reason to doubt the conclusions reached and promoted by senior council management. Namely, that the optimised lagoon design of MWH, considered by peer reviewers, and endorsed by the council's engineering leadership, was the most effective and efficient choice to meet the wastewater treatment needs of the Wanganui community.

Appointment of Dr David Warburton

Colin Whitlock had served over twenty years in his role as the chief executive of the Wanganui District Council and had enjoyed a strong and close working relationship with my predecessor **Mayor Chas Poynter.**

It was my view that the council had become too cosy and insular, had run out of creative energy, and had adopted a cost-plus mentality in its dealings with Wanganui ratepayers.

Dr David Warburton was appointed to the role of chief executive and I supported that choice because he possessed private sector experience alongside solid engineering credentials and recent experience of change management.

In addition, Dr Warburton had a doctorate in environmental engineering from Massey University where he had also held senior lecturer positions. I saw such academic qualifications as invaluable in assisting the council through the next phase of the wastewater project. The governance team agreed.

New faces in the senior management team

Dr Warburton set about reforming the organisation as was his brief. He flattened the management structure of council, put a focus on improving customer and client service, started building in-house engineering capacity, and took an active role in creating a more responsive building consent team.

We had daily briefings, usually around midday.

Among Dr Warburton's appointments were **Julian Reweti** as infrastructure manager, senior engineer **Rick Grobecker** and a heightened role for then council engineer **Colin Hovey.** Sometimes Mr Reweti would accompany Dr Warburton for the daily mayoral briefings especially if it related to relevant issues.

The appointment of Dr Warburton would also offer the potential of revisiting the WWTP construction, as to whether the right decision had been reached.

Advice thus far to Mayor and Council from Senior Staff

It is important to note that ALL senior management advice and papers made available to myself and district councillors, for the first twelve months of my mayoralty, were in support of the existing council policy with regards to both stormwater separation and the design and construction of the wastewater treatment plant.

In addition, the benefits of having MWH as design engineers and project managers, were extolled by Mr Taylor, Mr McGowan and Mr Whitlock, in conversations with both myself and my council colleagues.

It was stated privately, and implied publicly at full council meetings, that any misgivings were unjustified. The right design and the right decisions had been made.

An example of this advice is taken from the minutes of 23 March 2005

"Dean *Taylor, Assets Manager, reported* as *follows:*

The Council has resolved to negotiate with MWH Limited (M WH) to design and *project* manage *the procurement* of *the* new *Wastewater Treatment Plant, which is to be constructed over the next two years* and *located near the Wanganui airport.*

MWH have been selected because* of *their particular expertise in such projects and also because they have had a close involvement with* us *over recent years including the development* of *the particular treatment technology we have selected."

In other words, Council governance was being told that MWH had the design expertise and the experience to both design of the W WTP and project manage its construction. This advice was personally reinforced to me by Dean Taylor and Colin Whitlock.

At no stage were any peer group misgivings or outstanding questions related to design/operation of the projected WWTP reported to me or to the full council. This was a design and construction that had the strong and sustained support of senior council management, who confirmed such when questioned through the governance process.

The Optimised Lagoon Design-an amendment

After the retirements of Colin Whitlock and Ian McGowan, and the appointments of David Warburton and Kevin Ross as chief executive and deputy chief executive respectively, Council began to settle. A new finance manager Julian Harkness was appointed and a new senior engineer in Rick Grobecker.

The infrastructure committee was receiving regular updates at its scheduled meetings on the design detail and construction progress of the new WWTP.

The only issue being flagged to that committee was a 6-8 week delay in construction and the potential for the Wanganui district council to be in breach of the Horizons regional council resource consent. My understanding was that the consent to discharge would expire on 1 July 2007 and the plant would not be operational by this date. I didn't see this as a major issue: I did not believe that Horizons would prosecute over a construction delay and neither did David Warburton.

At some time in 2006, David Warburton briefed me in my mayoral office that the W WTP designers and project managers, MWH, had revised their earlier design and reduced the number of settling ponds for the W WTP. That they considered that the quality of their design worked just as effectively with two ponds instead of four.

Dr Warburton said that he did not consider this to be a fundamental change to the original design concept, rather a matter of detail. His view was endorsed by Julian Reweti and Colin Hovey, in subsequent or concurrent briefings in my mayoral office.

From memory, I asked them to provide the same information to infrastructure committee chairman Cr Don McGregor. Cr McGregor was responsible for organising the meeting agenda for the infrastructure committee in concert with Julian Reweti.

I did not pursue a peer review of the amended design for three reasons.

First, the changes were not considered by senior management or the council's senior engineering staff to be fundamental to the design of the wastewater treatment plant.

Second, as will be illustrated later, the capacity for overview and review was available to the council through its existing relationships with Opus and Works Infrastructure.

Third, the amendment had the *imprimatur* of the chief executive Dr Warburton. I had no reason to doubt his judgement on engineering matters especially in the area of environmental engineering, for which he had been awarded a doctorate.

The optimised lagoon amendments were relayed to the infrastructure committee in the formal six-weekly updates by Julian Reweti. It was also likely to have been conveyed to the full Council (who were all members of the infrastructure committee) during the drafting and deliberations on the Long Term Council 2006-2016 Community Plan (LTCCP).

Around this same time - June 2006 - David Warburton appointed Rick Grobecker as a senior engineer and deputy infrastructure manager and he subsequently attended most WWTP-related meetings.

At the full Council meeting of 6 June 2006, Dr Warburton is recorded as informing his governance team of the appointment and -

"He explained that the Council should be able to challenge engineering designs by an internal review, but that he was loathe to undertake external peer reviews of the Project due *to the present engineering consultancy arrangements."*

I took that statement and similar briefings to mean that 'the Alliance' of Opus, MWH and Works Consultancy were still providing engineering overview as a result of their existing contracts with Council.

Council's view of senior management

It would be fair to say that despite the differing personalities and policy priorities around the Wanganui district council table, all thirteen of the elected governance team had come to trust and rely upon the advice and information provided to us.

Simply, we had no reason to doubt either the information being provided nor the professionalism of the senior managers providing it.

We had also come to trust our colleagues. Cr Don McGregor, as chairman of the infrastructure committee, was an experienced councillor of significant military background and of unimpeachable integrity. He was regarded by all council, including myself, as a safe pair of hands with that military eye for detail.

Dr Warburton's engineering background, especially as he had gained his doctorate in environmental engineering, also eased my initial concerns around the quality of management advice. Julian Reweti was a personable and approachable infrastructure manager and his presentations to council were always concise, clear and consistent.

The strengthening of the council's in-house engineering capacity also eased any concerns.

The design of the wastewater treatment plant

As at the middle of June 2006, the governance team had the assurance of not one but two sets of senior council management that the design of the wastewater treatment plant was robust and that it would provide Wanganui with the capacity for current treatment and future growth.

That's an important point to make: two sets of senior district council management - quite different in skills, experience and personality - endorsed and promoted the W WTP design as a fitting end solution to our $120 million wastewater project.

Any amendment to the design of the WWTP was perceived and marketed as minor. The design concept of the WWTP plant wasthe issue with its mix of aerobic and anaerobic treatments, the extensive use of aerator machines and a separate UV treatment facility.

The WWTP design had been endorsed not just by council engineering staff but external reviewers too. So stated two different senior management teams in their reports to the same governance team.

The wastewater trade by-law

At the start of 2007, Dr Warburton and Julian Reweti briefed me that the council would require a new by-law to deal with the expected trade wastes from Wanganui's 'wet' industries.

As explained, there was a concern around both volume and costings. The concerns were that the untreated trade waste might compromise the

WWTP's biological capacity. In addition, there were concerns around the right price to charge the wet industries for the treatment of their waste.

I can remember being surprised that the by-law was necessary and that this issue had come so near the end construction of the W WTP. I expressed such to Dr Warburton. His reply was that the council' s in-house engineering team had been "crunching the numbers" and become concerned about the plant' s capacity to process all the city' s industrial waste.

From memory, Cr McGregor and his infrastructure committee took policy responsibility for overseeing the formation of a by-law and any public consultation. There was an element of haste as to its formation and I noted the concern of senior management that this by-law be completed before the plant became operational.

At that time, the plant was still 6-8 weeks behind in its construction so it appeared that the statutory window was slightly ajar to meet all the necessary deadlines even if the Horizons resource consent might need to be extended.

The WWTP is opened

The local government election cycle began in July 2007 with nominations being opened for the district council.

There were also a number of council capital works either under construction or being completed at the time - the wastewater treatment plant, the Splash aquatic centre, the ' soft water ' and aquifer explorations, the Wanganui airport refurbishment, the construction of the riverfront jetty and walkway, and the completion of the Upokongaro landing jetty.

Senior management reported that their engineering staff were working at capacity.

In September 2007, I officially opened the wastewater treatment plant. It was a bleak and grey day and any guests were pleased to do a quick tour of the facility and get out of the cold. There was a general sense of relief that Wanganui's river was no longer going to be contaminated with sewage and industrial waste and could be restored as a major recreational focus for the city.

Problems start almost immediately

The first that I became aware that there were problems at the new wastewater treatment plant was after the October 2007 local government elections had been completed and I' d concluded my morning talkback show from the *Radio Live* studio on Ridgway Street. I came down the stairs, opened the entranceway to the street, and was assaulted by the odour of sewage.

I did not automatically assume that the new treatment plant was the cause. I met with Dr Warburton, mentioned the smell (it was not discernible in the council offices) and he returned later that afternoon with Julian Reweti.

From that day on, Dr Warburton reported to me on the daily health of the plant. At the time, we were also experiencing a similarly malodorous problem with Virginia Lake after it had been invaded by an algal bloom. Of the two, the latter seemed the more pressing and persistent issue.

As explained to me by Dr Warburton and Julian Reweti, the WWTP was not performing properly because of both mechanical and wet industry dumping issues. The former - a failure of the installed aerators - was considered to be the primary cause.

As was my governance style, I ensured that all councillors were briefed immediately.

I used to do this by email, direct from my mayoral office. It had the virtue of always being immediate and allowed councillors to answer any constituent queries without waiting for formal briefings at formal meetings. Believe it or not, it was not council policy to email councillors before I was elected.

I also ensured that the health of the WWTP became a focus of the senior management's reporting cycle to the governance team. The smell from the plant could often be discerned at the entranceway to Wanganui airport and that rather militated against the new visitor and awareness strategy that we had developed.

What's the problem with the new WWTP?

I must confess to becoming quite agitated at the under-performance of the wastewater treatment plant, and expressing some fairly direct views to senior council management.

My expressed upset focussed on both the multi-million cost of a plant that wasn't working and that -in terms of aesthetics and Wanganui's reputation - it had actually made things worse than before the plant was opened. I demanded remedial action and management priority in fixing the problem.

I'm sure all of the governance team shared my sentiments and concerns.

Around the council table, there had been some changes in personnel since the last election. Cr Graeme Taylor had resigned to become chief executive of the Sports Foundation, Cr Sue Pepperell had left Wanganui for career and personal reasons, Cr Murray Hughes had not been returned by the electors, and Cr Don McGregor was re-elected but unable to serve because of terminal cancer.

New councillors elected to replace the above were Philippa Baker-Hogan, Allan Anderson, Rana Waitai and Rob Vinsen.

At the beginning of 2008, Dr Warburton also flagged that he would be returning to the private sector and was to be appointed as chief executive of engineering consultants Downer EDI. He resigned in June 2008 and the council appointed his deputy **Kevin Ross** to the chief executive role.

The council reports of 2008 detail the ongoing attempts of senior management to rectify the ills of the WWTP.

They report exactly the same information as I was privately presented in my mayoral briefings. Again, it was my view that we should be as open and transparent as possible and there were media releases and council publications that shared the available information with the wider Wanganui public.

Senior management repeatedly reported the same causes for any failings of the WWTP; namely that the aerators were either under-powered or poorly designed or unfit for purpose thereby compromising the biological processes within the plant's ponds.

In turn, the governance team made the same demands of senior management: fix the problem as quickly as possible. We gave the senior management team approval to employ short term, medium term and long term strategies and we effectively told them to forget the likely costs.

My instruction (endorsed unanimously by council) was: Just get the plant functioning properly and we can worry about who is to blame, and who is going to pay, afterwards. On that latter point, the likely expenses to repair and refurbish were anticipated to fall upon the manufacturers and installers of the aerators.

Julian Reweti would spend a good portion of time, every council and committee meeting, on explaining progress to the governance team. His reports were often augmented by the verbal contributions of Rick Grobecker and sometimes Colin Hovey.

As I mentioned, Dr Warburton resigned as chief executive in May/June 2008 and was replaced by Kevin Ross. If anything, Mr Ross had even more credibility with the governance team, especially the more experienced councillors, because of his long association with the district council and staff.

Eventually the more immediate problems of smell and malfunctioning equipment began to abate. There were occasional issues: again, senior management considered that both industrial dumping and summer drought conditions were chiefly to blame.

For the rest of my mayoral term -until October 2010-the plant seemed to be slowly working itself into the operational capacity for which it was designed.

But the management and engineering advice to the governance team was constant: that any failures were of equipment and machinery.

There was never a suggestion that the design of the plant was at fault.

There was never a suggestion that council staff had improperly managed the facility.

And there was no suggestion that the plant lacked the capacity to cope with Wanganui's wastewater needs.

WWTP 2010 onwards ·

I stepped down from the Wanganui mayoralty in October 2010 and former Horizons regional councillor Annette Main was elected as my successor.

Ms Main and myself are different personalities with different philosophies, principles, policies and governance styles.

I served no role in the subsequent council bar being an ordinary councillor. The papers presented to me were mostly in the public domain and I have little additional insight from 2010 onwards to contribute to the inquiry.

However, it is important to note that, as a member of the wider governance team, I received no indication that there were ongoing issues at the WWTP.

In fact, the first I became aware was when the stench of the plant wafted through all of Wanganui one Sunday afternoon, and caused myself and my children - playing on the back lawn of our distant St John's Hill address - to hold our noses and exclaim at the stench that had invaded our home.

I remember thinking: dear Lord, if it's this bad this far away, what's it like closer to town?

Thousands of Wanganui residents would subsequently suffer a diminished quality of life, for months and months afterwards, as a consequence. That effect will be long lasting.

The anticipated cost of replacing the failed wastewater treatment plant is going to cripple the council's finances for years to come. It will reduce council investment in necessary infrastructure, community facilities and community services.

Conclusion

It still staggers me that the Wanganui wastewater treatment plant failed.

Because of the legal papers that remain hidden from the Wanganui public and ratepayers, I still cannot properly discern all the evidence as to why the plant failed. Whether the cause was a cataclysmic design fault or the council operation of the plant or some combination of the two - the evidence is not available for me to make a final judgement.

What I can say - having inherited the original WWTP design and overseen the construction process - is that senior council management at the Wanganui District Council presented a unified and unwavering view that the design concept and the design detail of the WWTP would work.

Any potential risks concentrated upon the costs of the project, its timing and its resource consent guidelines - not its design.

In addition, the peer group reviews did not state that the MWH design would not work. Their contributions seemed around operational detail rather than stating there was a fundamental flaw in an otherwise untried and untested design.

Three separate senior management teams - those led by chief executives Colin Whitlock, David Warburton and Kevin Ross and comprising expert engineering personnel - endorsed and promoted the MWH design and blamed any later deficiencies upon external companies and contractors.

In such circumstances, the questions are rightly posed.

Even with the benefit of hindsight, what could the governance teams led by Chas Poynter, Michael Laws and Annette Main have done different?

If the optimised lagoon design was so fundamentally flawed then how could those governance teams have discovered that error, given the overwhelming support that senior management and engineering professionals indicated for the original and amended designs?

Finally, how could the governance teams have later discovered the fundamental design flaw in the optimised lagoon option, when all the evidence available made available to the governance teams was that the inadequate operation of the constructed WWTP was due to aerator and sub contractor under-performance?

I shall be fascinated by the inquiry's replies.

Michael Laws

26 August 2016

5.9 David Warburton

David Warburton was the Chief Executive Officer of Whanganui District Council from 2005 to 2008, which included the pre and post construction periods for the treatment plant but not for any significant periods of time. The following questions were put to Dr. Warburton on 5 August 2016:

1. Based on your knowledge and expertise at the time of your commencement with Council in 2005, did you hold any concerns or issues with the Optimised Lagoon Treatment process design that had been confirmed by Council in February 2004?
2. To your knowledge, how were any issues and concerns raised by the Peer Review Panel in late 2004 addressed by MWH in the subsequent detailed design of the Optimised Lagoon Treatment plant? Are you aware whether they were adequately addressed and whether any advice was provided to Council by staff in this regard?
3. Was the wastewater project budget sized correctly to deliver a viable treatment outcome in your opinion? Do you believe staff held any perceptions that they had to deliver a lower cost option?
4. From your experience, do you believe that Council's internal technical and engineering staff had the requisite knowledge and expertise to adequately contract manage Council's external technical and engineering consultants on the treatment plant project?
5. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 and up until your departure. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties in your opinion?
6. Did you brief the Mayor on the plant's operational difficulties in 2007 and, if so, what was the nature and extent of those briefings?

Response: Dr. Warburton responded by email on 10 August 2016 and declined to make a submission.

5.10 Julian Reweti

Julian Reweti was employed at Whanganui District Council from 1993 to May 2012, including as Infrastructure Manager from 2007 onwards. The following five questions were put to Mr. Reweti on 5 August 2016 and his written responses to each question received on 12 August 2016 are set out below:

1. Was the wastewater project budget sized correctly to deliver a viable treatment outcome in your opinion? Do you believe staff held any perceptions that they had to deliver a lower cost treatment plant option?

Response: The budget was determined and indicated to Council prior to 2007. Construction was completed in 2007. It was my understanding that the wastewater working party always wanted the lowest cost- effective design and had recommended options which were considered viable. The Resource Consents that were approved were fundamentally based on the design options of the working party. The treatment options recommended and preferred by the wastewater working party were always advised by the consultants as a viable solutions. Once the design was finalised (based on the working party option), it was further being refined before 2007. At one later stage however prior to construction, the staff asked the consultant if it was possible to marginally INCREASE the size of the plant (ie higher cost) so as to potentially take slightly more storm water. This would allow potential reduction or delay of stormwater pipeline separation and hence costs in the City. The consultant advised that this was possible and hence the plant pond was made bigger in design prior to construction. A report went to Council on this matter which was called the optimised solution taking into account separation works. Hence, in my view, the working party had determined the options and had very much set in place the actual outcome and costs that followed to be constructed. The plant was made bigger and hence cost increased to potentially accommodate more stormwater and/or provide a larger buffer.

2. Did the plant operations staff provide adequate and timely reports to management, including yourself, of the operational difficulties that occurred from 2007 onwards?

Response: This question covers a number of years and is not a singular issue nor event. There were significant operational difficulties immediately after construction. This started with major mechanical issues of aeration and aerators failing. The ability to remedy this was significant and ultimately required complete overhaul and replacement of the aerators and lengthy and difficult supplier contract resolution. (this was not a short period of time, approx. 2 years). Management, Council, and Regional Council were fully informed about this during and through the aerator replacement and repair, as the plant was not able to be "tested" and any outputs of the plant were meaningless at that time. The plant could not be tested as to performance as the major mechanical system had failed which required repair and then subsequently, because of timing (winter and much lower loads) the ongoing process issues took much longer to become significantly apparent. There were initial indicators and the starts of complaints of some odour early on, but it took a few seasons before it was becoming apparent that odour and operational issues were increasing but only initially during hot weather and what was thought may have been increasing industry loads. Once a winter season came again the issues appeared to reduce, but not totally. As operators, after the aerators were finally replaced, and only after peaks started to occur, that actually starting the long process of plant performance was possible. It was initially assumed that aeration difficulties and industry loads were key matters for the developing issues.

3. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 and up until your departure in May 2012. Were Councillors adequately informed of the nature, extent and cause of these difficulties in your opinion?

Response: Aeration matters were part of Council reports, and discussions with Regional Council. Subsequently, a few seasons on from construction and intermittent odour became an issue, there were daily media releases which went to all Councillors. This lasted generally for the duration of an event (and generally not in winter). Council reports had regular section on wastewater treatment issues. Councillors were aware as operational staff were aware of the issues. The issues however, were intermittent after the aeration was repaired (after a couple of years) and were not at the same scale that was obviously experienced after 2012. The fundamental issues surrounding aeration and industry loads were a common theme, however, during 2011-2012 the inability of operations to remedy these at an operational level meant we looked to alternate consultant advice to try and remedy matters. That advice however started to highlight a much greater concern that questioned the fundamental design. I had left Council prior to the same consultant shortly thereafter being more fully commissioned by staff to provide this fundamental assessment.

4. Did you brief the Mayor on the plant's operational difficulties from 2007 onwards and, if so, what was the nature and extent of those briefings?

Response: As per above, the Mayor required daily reports which were widely circulated (and as media releases as well) for events and what actions were being taken. Plus reports to Council.

5. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant that may have contributed to its inability to function?

Response: From recollection, one industry had dumped either milk and another industry had dumped acid of some sort, which added to the difficulty of operations and determining plant performance. The staff had once noticed that the machines were shiny in the wet wells of Beach Rd (almost an acid clean). We subsequently installed warning systems in the well areas to protect our operators. Operators during these times visited industries to try and assess their operations and talk with their operators to minimise impacts on the treatment plant. However, these problems were intermittent and difficult to be conclusive. The wastewater industry consents had been in place but since the plant did not perform in the early days of aeration failure anyway, substantial time passed before industry was started to be scrutinised in terms of compliance sense other than our operators regularly visiting their sites to ensure basic operational housekeeping was being done. Prior to my departure these consents were being more closely scrutinised. However, my observation was that the wastewater treatment plant was becoming more operationally difficult after aeration had been repaired (2 years after construction) in off peak times when loads were not considered excessive. The system was progressively worsening but still hadn't reached the difficulties that were obviously experienced after 2012.

5.11 Kevin Ross

Kevin Ross was the Chief Executive Officer of Whanganui District Council from 2008 until 2015. The following questions were put to Mr. Ross, who responded to the email sent to him on 3 August 2016 and advised he would be travelling to remote areas in South America and returning to Whanganui in September 2016. Mr. Ross returned to Whanganui just in time to make an abbreviated submission, which is set out below:

1. Please explain how plant operations staff provided reports to management of the operational difficulties that occurred at the plant from 2007 to 2012. Was the reporting adequate and timely in your experience?
2. Who was responsible for reporting any significant operational difficulties and breaches of resource consent to Horizons Regional Council?
3. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 up until the end of 2012. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties?
4. Did staff regularly brief the Mayor about these operational difficulties between 2007 and 2012?
5. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant that may have contributed to its inability to function? If so, please detail.

Response:

You have asked for my recollection on how the Council politicians were informed by staff of operational difficulties at the Treatment Plant from 2007 until 2012.

From 2007 until the end of 2012 my recollection is that the normal monthly reporting practices were followed for all updates on the operation of the new Wastewater Treatment Plant.

Obviously the Mayor and Chairman of the relevant Committee would have been briefed on any infrastructural issue by the Manager responsible for Wastewater and then Councillors informed, either by the normal monthly report, or by a separate report on any particular issue should one be warranted. Bearing in mind this was a huge investment for Whanganui, interest in progress was significant.

From my recollection there were always issues arising from the operation of the new plant, but at no stage did we (management), ever contemplate that the new plant had the potential to suffer a catastrophic failure. Consequently, the Council engineering team, with the support of the professional designers, were focussed on addressing the initial teething problems. The aerator issue that arose almost immediately undoubtedly focussed the team on resolving that problem. As time went on, biological expertise was sought to supplement the advice being provided by MWH. To my knowledge, all the issues and potential solutions were reported through the normal Council committee rounds or through the Annual/ Long Term planning rounds.

Both with Mayor Michael Laws and Mayor Annette Main there was a clear "no surprises" culture promoted within the organisation, so I see no reason why any significant information would have been deliberately withheld during this period.

5.12 Rick Grobecker

Rick Grobecker was employed at Whanganui District Council during the period of 2006 to July 2009, which included being Deputy Infrastructure Manager from 2008 to 2009. The following questions were put to Mr. Grobecker on 5 August 2016:

1. Did the plant operations staff provide adequate and timely reports to management, including yourself, of the operational difficulties that occurred from 2007 onwards?

Response: The commissioning of the WWTP commenced in July 2007 once the effluent discharge from Beach Rd began to be pumped to the treatment plant. The "failure" of the Tornadoes [aerators] to perform to specification was identified during the construction phase - pre July 07 - this together with the initial "foaming" and "lack of settlement" issues - post July 07- was reported at the time. I don't recall any formal report(s) from the plant operators to myself, but as I was working closely with MWH on the delivery of the WWTP, I was already aware the issues that they were encountering.

2. Who was responsible for reporting any significant operational difficulties and breaches of resource consent to Horizons Regional Council?

Response: I believe that the WWTP was not able to commence its formal commissioning phase until July 2009 (post Twister installation) and the delivery of the design aeration capacity. Collection of data for Resource Consent compliance was undertaken. I don't know who was directly responsible for providing information to Horizons. Reports may have gone out under either my or [Infrastructure Manager's] name. I do recall taking HRC around the plant whilst we were encountering our difficulties and advising them of the measures we were taking to address issues.

3. Please describe to the best of your knowledge how Councillors were informed by staff of the operational difficulties at the treatment plant after the plant commenced in 2007 and up until your departure in 2009. Were Councillors adequately informed of the nature, extent and cause of these difficulties in your opinion?

Response: I believe Council / Councillors were kept informed, or had the facility to be kept fully informed, via the Activity Reporting process.

4. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant that may have contributed to its inability to function?

Response: I was made aware of occasional blockages at Beach Rd - probably caused by "excessive input" rather than "non-consented" effluent.

5.13 Phil Gilmore

Phil Gilmore is a long-time Council employee, commencing in 1984, and Senior Waste Water Operator. The following questions were put to Mr. Gilmore on 5 August 2016:

1. Please explain how plant operations staff provided reports to management of the operational difficulties that occurred at the plant from 2007 onwards?
2. Who was responsible for reporting any significant operational difficulties and breaches of resource consent to Horizons Regional Council?
3. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant that may have contributed to its inability to function?

Response: Mr. Gilmore did not respond to the questions put to him.

5.14 Mayor Annette Main

Annette Main has been Mayor of Whanganui District Council since 2010. The following questions were put to the Mayor on 5 August 2016 and her responses are set out below:

1. Please describe how Councillors were informed by staff of the operational difficulties at the treatment plant during your period as Mayor and up until the end of 2012. Were Councillors adequately informed by staff of the nature, extent and cause of these difficulties in your opinion?

Response: Without going through the records of that time, I do not recall being advised of operational difficulties with the operation of the plant from when I began in October 2010 but in the year prior to the final failure Council received regular updates on the problems and the methods being used to ensure the plant functioned. We were kept well informed on progress, including the implementation of actions suggested in a referenced report received by Council. I read the referenced report at the time. I recall being very surprised to hear that the reports as required by the Regional Council had not been provided and asked why this had not been raised with Council by the Regional Council. When the plant failed over the holiday period I was not surprised as it was clear from the updates we were being provided with that the problems were insurmountable.

2. With hindsight, do you believe that Councillors up to the end of 2012 had been sufficiently robust in exercising their governance function in respect to staff management of the treatment plant project?

Response: We received the reports regularly but I do know now that there was information we could have been provided with which raised doubt about the ability of the plant to perform before it was built. This background would have assisted in knowing what to ask as a new councillor.

I believe the Council has struggled to understand the advice on why the plant failed when it did while being bombarded with conflicting views from those with vested interests.

The view that some councillors held that they knew better than staff became increasingly obvious, making it difficult for others to listen impartially to the advice of staff.

5.15 Arno Benadie

Arno Benadie is a current employee of Council who commenced as Senior Wastewater Engineer in early February 2010. The following questions were put to Mr. Benadie on 8 August 2016 and his responses received on 23 August 2016 are set out below:

1. Please explain how plant operations staff provided reports to management of the operational difficulties that occurred at the plant from the time of your commencement in February 2010 and onwards? Was the reporting adequate and timely in your experience?

Response: The MWH designed treatment plant was designed and sold to Council as a stand-alone process with minimal operator and human input necessary. In reality this was not the case when I started working at Council in February 2010. The staff members employed to operate the city networks, small pump stations and Beach Road pump station were also tasked with operating the new treatment plant. The large number of man-hours required to maintain and operate the MWH plant caused problems with the limited staff available to cover all wastewater related duties.
Since the opening of the treatment plant in 2007, the operators had to spend unrealistic and unreasonable hours trying to make the plant perform better and trying to finally comply with our resource consents. The reporting to management was happening in one of the following ways:

- Daily verbal reports from myself to the Deputy Infrastructure Manager
- Weekly reports at the Infrastructure Management meetings.
- Monthly reports to the Infrastructure Manager.
- Quarterly WDC KPIs performance recorded on our KPI system. These results were reported to the Senior Management Team on a Quarterly basis.
- Reporting of important issues in the annual plan and the Long Term Plan (10 year plan). All these plans were read and approved by Council.
- Asset Management Plans
- Annual checks by the Auditor General for our annual audit. The performance of the MWH plant was a challenge for the auditors and every year they had many questions about the performance of the plant, the consent breaches and the plans to fix the problems. All of this was reported to Senior Management.

2. Who was responsible for reporting operational difficulties at the plant to the Mayor and Councillors?

Response: It was the responsibility of the Infrastructure Manager.

3. Who was responsible for reporting any significant operational difficulties and breaches of resource consent to Horizons Regional Council?

Response: This question attracted a lot of attention in 2012 when the MWH plant finally failed. The annual Consent Report is a summary report on the compliance with all the conditions of the Consent. This includes all consent conditions including a summary report of the effluent quality monitoring. A detailed investigation of both Wanganui District Council and Horizons Regional Council processes showed that the

annual Consent reports were not sent to Horizons due to administrative errors made by both organisations.
Since the start-up of the plant in 2007, and up to the failure of the plant in 2012, only one annual consent report was sent to Horizons Regional Council. HRC however completed all their annual site visits and on-site discussions with operational staff during this time period, and was aware of the operational difficulties and poor performance of the plant.

4. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant that may have contributed to its inability to function? If so, please detail.

Response: At the time when the plant failed, the monitoring of the wet industries were done in accordance with the 2008 trade waste bylaw, and in accordance with the agreed trade waste monitoring methodology that accompanied the trade waste charging model. According to the agreed monitoring methodology, all wet indust6ries was sampled for 10 working days at a time over four sampling periods per year. The idea with the four sampling periods was to capture the changing seasonal nature of some of our wet industries. Unfortunately this form of monitoring did not allow us to record all industrial loads deposited into our system at all times of the day and night, and as such we do not monitor all load variations at all times, other than the loads produced during the four sampling periods per year.
Since then we have improved the monitoring of our wet industries, and today we have 24/7 online monitoring at all the large industrial effluent points. The online equipment is connected to our SCADA system, and the data recorded on a data management system. Notwithstanding the improvements we have made to date, the monitoring of the industrial effluent is still a challenge with the monitoring equipment subject to tampering and third party interferences. In an effort to overcome these problems, we are planning on making further improvements with the installation of new, dedicated effluent monitoring stations for every wet industry, before the commissioning of the new plant.

5.16 Mark Hughes

Mark Hughes is the current General Manager of Infrastructure at Council who commenced as Infrastructure Manager in July 2012 shortly before the failing treatment plant ceased operations. The following two questions put to Mr. Hughes on 8 August 2016 and his responses received on 16 August 2016 are set out below:

1. Based on your prior knowledge and experience, please detail your assessment of the viability of the treatment plant following your commencement in July 2012.

Response: I commenced working for Council on the 23rd July 2012. During August 2012 I was made aware of complaints from the public of odour emanating from the wastewater treatment plant. On enquiry, it was apparent that the odour had been an issue with the plant from when it first started in 2007.
Further enquiry revealed that the biological performance of the plant was substandard. It had failed to meet its Resource Consent conditions in any and every year since it started operating.

An analysis of the latest performance indicators for the quarter ending June 2012, showed that despite this period being one of low (off peak) loads that:

- The plant was bypassed a recorded 13% of the time i.e. the wastewater was pumped directly out to sea instead of to the plant for treatment first.
- Despite the low loads and the amount of bypassing it still failed to comply with its Resource Consent Conditions 61% of the time.

Historically, there had been issues with the plant aerators and these had been replaced. However, the data indicated that following their replacement in 2009, the apparent improvement in performance was accompanied by a large amount of bypassing and a period of low load.

A "commissioning" report prepared in early 2010, after the new plant aerators were installed, failed to commission the biological process.

Visually the plant was showing some very worrying signs. The aerators were dragging large amounts of sludge from within the pond to the surface and indeed throwing it into the air. Other areas of the pond were sparging (releasing large amounts of gas into the surface from within its sludge). Both causing significant odour issues.

The viability of this plant had to be seriously questioned and this concern was communicated to the Chief Executive and Council during September and October 2012.

2. Are you aware of any evidence that the wet industries added non-consented, excessive or non-permitted inputs into the treatment plant from 2007 onwards? If so, in your opinion would this factor have contributed to the plant's inability to function?

Response: The wet industries had and continued to periodically send excess/non permitted loads to the plant. These were usually of short duration and were attributed to either management or mechanical failures at the source industry. A well performing plant could have been able to absorb and recover from these loads relatively quickly. However, given the performance of the existing plant was so poor, there was little chance of recovery and these loads exacerbated the non-compliance and odour issues, they did not on their own cause them.

5.17 Horizons Regional Council

Horizons Regional Council is the environmental regulator for Whanganui District Council. The following three questions were put to HRC on 8 August 2016 and discussed at a telephone conference on 10 August 2016. Horizons responded with a lengthy detailed submission addressing the questions on 26 August 2016 and this is set out in full below:

Submission from Horizons Regional Council

Introduction

The Whanganui District Council (WDC) has initiated an independent review into the processes followed by it in relation to the wastewater treatment plant for the period 2003 to 2013.

As part of this independent review Horizons Regional Council has been invited to respond to a number of questions.

The purpose of this memorandum is to respond the questions raised in the request.

General Comments

Prior to responding to the questions raised in the request I think it is important to make the following general comments:

1. The nature and scale of the WWTP failure would not have been identified via the compliance monitoring programme associated with the resource consent. The conditions of consent are set to control the environmental effects associated with the WWTP as opposed to measuring operational performance.

2. As a regulator, Horizons role is to ensure the environmental effects associated with activities are appropriate. Horizons, does not look at the design of WWTP and how they are operated.

3. Since the WWTP became operational, there have been non-compliance issues. Horizons initial approach was to record these non-compliances and ensure that WDC was making attempts to resolve the non-compliant issues. Upon coming aware of the fundamental failure of the WWTP and the consequential serious environmental effect in relation to objectionable odour Horizons took more formal enforcement action.

Question 1

Was Horizons Regional Council notified by the Whanganui District Council of any breaches of the terms of its resource consent covering the operation of its treatment plant after it became operational in 2007. If so, please detail the nature of any such notification and any action taken by Horizons as a consequence of any breaches.

Resource consent 101706 has two conditions that require WDC to notify Horizons in the event of a non-compliance, namely conditions 13(a) and 23. These conditions are detailed below.

Condition 13(a)

The Permit Holder shall report any non-compliance with the conditions on these Permits to Manawatu-Wanganui Regional Council Environmental Protection Manager ***within 10 working days*** *of the non-compliance. That report shall detail the steps that have been taken to remedy the non-compliance, whether further remedial work is necessary and what changes to the monitoring frequencies outlined under Conditions 11, 12 and 13 will occur as outlined under those conditions.*

Condition 23

The Permit Holder shall report any non-compliance with the conditions on these Permits to ***horizons.mw*** *Team Leader Compliance within 10 working days of the non- compliance. That report shall detail the steps that have been taken to remedy the non-compliance, and whether further remedial work is necessary.*

The WWTP has, on a number of occasions, failed to comply with the conditions of its resource consent since it became operational[1]. Information in the file indicates the primary source of notification of non-compliances has been via the Annual Report, which is required to be provided to Horizons be condition 24. Information in the Annual Reports identified on- going issues with WWTP performance and continued non-compliance with those conditions that related to Total Suspended Solids (TSS) and enterococci concentrations in the discharge[2].

It is clear from the file that WDC have consistently failed to notify Horizons as per the requirements of conditions 13(a) and 23. Failure to notify Horizons as required by these conditions has been recorded in various reports to WDC.

Question 2

Is Horizons Regional Council aware of any failure by the Whanganui District Council to comply with its reporting obligations to Horizons regarding the operation of its treatment plant from 2007 onwards? If so, please detail the nature of any failure to report and any action taken by Horizons as a consequence.

As noted above the WWTP has consistently failed to comply with TSS and Enterococci concentrations in the resource consent. It is clear that WDC failed to report these non- compliances as per conditions 13(a) and 23, but rather seemed to rely on reporting this in its Annual Report. The only explanation given by WDC was that *"the plant has always been non-compliant and this has been discussed with HRC since 2007"*[3]. It appears that, given HRC were aware of the non-compliance issues, WDC did not believe it needed to report non- compliance as per conditions 13(a) and 23.

Secondly, WDC failed to provide Annual Reports for the 2011 and 2012 reporting years. The only explanation in relation to this non-compliance was that whist the reports were prepared, due to an administrative error, they were not sent to Horizons[4].

On 5 October 2012 WDC advised HRC the WWTP was significantly non-complying across a broad range of conditions. This was the first notification HRC received that there was a serious ongoing issue with the WWTP.

In relation to WDC's failure to comply with its reporting obligations, Horizons has not taken any formal enforcement action. However, Horizons was advised of steps being considered to improve the performance of the WWTP during the initial stages of its operation. Horizons took formal enforcement action when it was advised the WWTP had fundamentally failed and it was evident this was having a significant and on-going effect on the environment.

Question 3

What was the process followed by Horizons Regional Council for monitoring Whanganui District Council's compliance with the terms of its resource consent covering the operation of the treatment plant from 2007 onwards?

HRC takes a risk based approach to assessing compliance with resource consents. Accordingly the compliance monitoring programme is based around key factors, including risk to environment, compliance history, complexity of resource consent conditions and public interest. Based on these factors a site is given a category between 1 and 5, with 1 being the highest category and a 5 being the lowest category.

Between 2008 and 2012 the WDC was classified as Category 2 site. Due to the serious on- going issues the WWTP was reclassified as a category 1 site in 2013. These respective classifications meant the site was subject to a number of compliance assessments throughout the year, including site inspections and reviewing the Annual Compliance Report (ACR) required by condition 24.

When assessing compliance with conditions of consent, these assessments can be divided into visual and non-visual assessments. Visual assessments relate to those conditions that can be assessed by the naked eye, or nose (e.g. for odour), whilst non-visual assessments relate to assessing conditions which require scientific analysis or provision of reports. Since the inception of resource consent 101706, the WWTP has been subject to a combination of visual and non-visual compliance assessments.

From reviewing the file it is clear there were numerous site inspections undertaken of the WWTP itself (these are summarised in Appendix 1). The purpose of these site inspections was to assess how the WWTP was complying with those visual conditions, which typically relate to odour and colour of discharge. It was also an opportunity to identify other factors that may either contribute to, or lead to a non-compliance (e.g. colour of the pond, lack aerators etc)

Desk top assessments were also undertaken once Annual Reports were provided. As noted above there was a period of two years, which covered the 2011 and 2012 reporting periods, where WDC failed to

provide the required Annual reports. These reports were provided to Horizons on or about November 2012, where they were subsequently assessed.

Upon becoming aware of the fundamental failure of the WWTP, Horizons initiated formal enforcement action. This commenced with the issuing of a formal warning and culminated in the Environment Court issuing an Enforcement Order on WDC.

In June this year Horizons granted WDC a short term (three year) consent authorising the discharge of preliminary treated wastewater into the CMA. In summary this consent provides a pathway, by which WDC must have an operational WWTP that complies with the conditions of resource consent 101706. Horizons focus over the next three years will be to ensure that WDC comply with the provisions of this short term consent.

Summary

From reviewing the file it is clear there have been failings by WDC to comply with the provisions of its resource consent, particularly in relation to notification of non-compliances. WDC explanation for not complying with the notification conditions of the consent is that Horizons were aware of attempts to address them. This was particularly the case between 2007 and 2010, when the Annual Reports were provided to Horizons. Failure to provide the required Annual Reports occurred due to administrative errors on behalf of WDC.

The WWTP has been subject to a number of visual and non-visual assessments since 2007. These assessments have identified on-going issues with compliance, which typically relate to failure to comply with TSS and Enterococci concentrations. Once it became apparent the WWTP had fundamentally failed and the environmental effects were serious and ongoing Horizons took formal enforcement action.

Since 2013 the focus for Horizons has been to ensure WDC is progressing towards a long term solution for the WWTP. The issuing of the Enforcement Order in April 2013 was the first substantive step on this pathway. The granting of the short term consent in June 2016 was effectively the culmination of the consenting process, which now sets a clear timeframe by which a long term solution is to be achieved. Horizons are now focused on assessing compliance with this resource consent.

[1] In a Wanganui District Council compliance report dated 3 September 2008 at page 6 it is noted under comments associated with conditions 5 and 6 there has been significant operational problems that have had to been overcome over the past year. These issues included inadequate aeration, failing aerators, odour problems and transfer control problems. As a consequence of these issues dry weather flow bypassed the plant and were sent directly to the coastal outfall.

[2] Annual reports reviewed were those for the periods 2007- 2008, 2008-2009, 2010- 2011, 2011-2012 and 2012-

2013.

[3] Refer to Letter from WDC CEO Kevin Ross to Michael McCartney, dated 30 November 2012 and attached responses to list of questions, paragraph 11.

[4] Ibid paragraph 10.

APPENDIX 1. COMPLIANCE EVENTS 2007-2013

Date	Event
January 2007	Horizons assess the Annual Report. Non-Compliance grading given due to WDC failure to undertake sampling as required by condition 13. Failure to comply with sulphide and total chromium concentrations also noted (condition 10)
June 2007	Horizons advises WDC they can use own laboratory for testing, provided they follow standard procedures and send an audit sample to an accredited laboratory every fortnight. Comply rating given.
September 2007	WDC submit Annual Report.
September 2008	WDC submit Annual Report
December 2008	Horizons assesses Annual Report. Assessed as complying Horizons completes inspection report, based on site visit on in December 2008. Report notes the disposal of sludge from the pond to the outfall was not authorised by the resource consent nor was the discharge of wastewater to land, via a spillway.
September 2009	WDC submit Annual Report
January 2010	Horizons assess Annual Report. Failure to comply with dry weather flow maximums noted (condition 2), and suspended solid, faecal and enterococci concentrations (condition 10)
August 2011	Horizons undertake a site inspection to assess compliance. WDC graded as complying against those conditions assessed as part of the site inspection.
May 2012	Horizons undertake a site inspection to assess compliance. WDC graded as complying against those conditions assessed as part of the site inspection
October 2012	WDC reports to Horizons the WWTP is failing to comply with the conditions of resource consent.
November 2012	WDC reports to Horizons on options to mitigate the odour effects associated with the WWTP.
November 2012	Horizons write to WDC advising it has commenced a formal investigation into the WWTP failure to comply with consent conditions and odour issues. Horizons provide a list of questions for WDC under caution.

November 2012	WDC provide a reply to Horizons questions. WDC also provide an update on options it is considering to implement to mitigate the odour effects.
November 2012	Horizons assess the Annual Report for the 2009-2010 period. Report grades the WWTP as non-compliant. Reasons for non-compliance included: failure to comply with enterococci and suspended solids concentrations (condition 10), failure to undertake the required samples (conditions 11, 12 and 13), failure to notify Horizons of non-compliances (condition 13(a)) and failure to provide Annual Report on time (condition
November 2012	Horizons assess the Annual Report for the 2010-2011 period. Report grades WDC as non-complaint. Reasons for non-compliance include: failure to comply with enterococci and suspended solids concentrations (condition 10), failure to undertake required sampling (conditions 11,12 and 13), failure to report non- compliances to Horizons (condition 13(a)) and failure to provide the Annual Report on time (condition
December 2012	WDC updates Horizons on the current situation facing the WWTP in relation to odour generation.
December 2012	Horizons issues WDC with a formal warning in relation to the objectionable odour beyond the property boundary.
January 2013	Horizons issue WDC an abatement notice requiring it to cease the discharge of objectionable odour beyond the boundary of the WWTP.
5 March 2013	WDC notify Horizons that is has used section 330 of the RMA to by-pass the WWTP due to high hydrogen sulphide concentrations at the Beach Road pump station.
23 April 2013	Environment Court issued Enforcement Order

Note: When Horizons was aware of the on-going issues at the WWTP and the objectionable odour effects manifested themselves, a specific monitoring programme was developed around assessing the objectionable odour. This programme occurred over the period January to March 2013 and was a combination of pro-active and reactive monitoring.

6 FINANCIAL IMPLICATIONS OF FAILED PLANT

A review of Council's financial system has captured the following breakdown of the costs of designing, building, operating and eventually decommissioning the failed wastewater treatment plant. The total cost to the ratepayers is estimated to be $27.1 million as detailed in the table below.

The $27.1 million figure would be partially offset by certain elements of the failed plant being able to be utilized in the future construction and operation of the new plant. This would include matters such as the land that was purchased at 1 Airport Road, basic power infrastructure to the site, the pipeline under the Whanganui River from the Beach Road Pump Station, roads and security infrastructure, elements of the aerated lagoon and settling pond etc.

Whilst a copy of the confidential legal settlement reached between Council and the failed plant's designer could not be provided to the Independent Review, were that settlement to involve a payment to Council in excess of its legal costs then this amount would also be an offsetting factor against the $27.1 million cost of the failed plant.

It should be noted that, Council as a public sector entity would ordinarily be obliged by its auditors to account for all financial transactions in the financial statements contained within the 2015/2016 Annual Report.

Costs Incurred by Council as a Result of the Failure of the MWH-Designed Wastewater Treatment Plant

Cost Category		**$M**
1.MWH design fees	$	2.9
2.Capital costs	$	17.3
3.Short term mitigation	$	2.3
4.Desludging and decommissioning	$	4.6
	$	**27.1**

Notes:

1.July 2000 to February 2013 - (including peer review costs OPUS & URS totalling $21.9k)

2.2006 - 2010 - includes Westbourne, easements, river crossing etc

3.February 2012 to March 2014 - includes odour control, bioaugmentation, lime dosing, hydrogen peroxide, replacement aerators etc

4.August 2013 to June 2015 - includes bypass pipeline, sludge removal, removal of aerators etc

5.The figures in the table above represent external costs only, not Council internal costs

7 CONCLUSIONS

The objective facts examined during the course of the Independent Review reveal a number of critical shortcomings in the decision-making processes followed by Council from 2003 to 2012 which have tended to be marginalized by the prevailing technical debate about the causes of the plant's failure.

These shortcomings created the circumstances where significant mistakes in the early design phase of the wastewater treatment plant were made which had flow-on consequences for the duration of the project until the treatment plant eventually failed.

Critical shortcomings in Council decision-making processes led to significant operational shortcomings and then to total plant failure.

Council had been compelled by its resource consent to have the new treatment plant operational by 1 July 2007.

Cost reduction was a key driver for Council staff in developing a new treatment process.

The cost and time factors created the circumstances where the design and construction phases of the project gained an almost unstoppable momentum of their own after critical decision-making mistakes were made by the Working Group in October 2003 and by a Council that was misinformed in February and November of 2004.

The following is a summary of the major systemic and consequential operational shortcomings commented on throughout the Independent Review:

A. SUMMARY OF MAJOR DESIGN PHASE SHORTCOMINGS – 2003 TO 2005

- Council's management and governance culture in this period was entrenched and overly trusting.
- The notion of testing the market for consultancy services appears not to have been considered.
- The procurement practice at the time lacked rigour
- Too much responsibility was effectively delegated to a small number of staff and consultants to develop the concept design.
- Council did not have sufficient in-house engineering expertise to adequately contract manage its consultants on the project.
- Council's staff and the consultants enjoyed a close and long-standing working relationship which mitigated against objectivity being applied to the preferred design.
- The preferred Optimised Lagoon treatment plant design was untried and untested anywhere in the world and was a hybrid option created entirely by Council staff and their consultants.

- Council technical staff and consultants meeting in Wellington on 20 October 2003 unilaterally decided to develop the hybrid option instead of evaluating the four shortlisted options as Council had previously been advised. Cost reduction was expressed as a key driver for the development of the hybrid option.

- Council was misinformed at critical decision-making meetings in February and November of 2004.

- Council was advised at its meeting of 16 February 2004 that the Optimised Lagoon design was relatively low risk and based on proven technologies and at the same time it was also innovative and unique. Council was not adequately advised that the proposed design was untried and untested and by definition therefore it entailed significant risk at that point. Staff promoted the big cost savings associated with the recommended design but Council nevertheless only approved it subject to a peer review.

- The newly-elected Council on 29 November 2004 was seriously misinformed that the independent Peer Review Panel had affirmed the Optimised Lagoon design. This advice was incorrect. Council was not adequately advised by staff of the outstanding Issues and risks raised by the Peer Review Panel.

- The independent Peer Review was shut down prematurely by Council technical staff in October 2004 and before even viewing any detailed design. The outstanding issues and risks the Peer Review had raised were not adequately addressed during the subsequent detailed design phase.

- Council staff did not appear to have an adequate appreciation of the concept of risk and risk management.

- Cost cutting was clearly the key driver in selecting the preferred design and risks were consequently downplayed

B. SUMMARY OF MAJOR CONSTRUCTION PHASE SHORTCOMINGS

- Construction was completed over time and over budget.

- The original aerators that were supplied were faulty.

- Trade waste loads were miscalculated.

- Sludge accumulation was underestimated

C. SUMMARY OF MAJOR OPERATIONS PHASE SHORTCOMINGS

- Inadequate advice was provided to Council regarding the operational difficulties after 2008.

- Replacement and additional aerators were unable to provide sufficient aeration given the plant's fundamental design flaw.

- Staff failed to comply with their statutory reporting obligations to Horizons Regional Council, particularly regarding non-compliances.
- Resource consents were consistently breached, for example to mitigate odour problems.
- The plant never fulfilled its resource consents in five years of operation
- The plant struggled to cope with wet industry loads.
- Plant management staff were under-resourced and under stress as a consequence of the operational difficulties.

THE TIME TO MOVE FORWARDS

The Independent Review has looked at the failure of the treatment plant from a management perspective rather than the more limited engineering perspective.

The evidence is very strong that significant flaws at critical early stages of Council's decision-making process in 2003 and 2004 allowed an untried and untested plant design to be constructed, contrary to the historically more risk-averse and sensible approach of the wastewater treatment industry.

The motivation to reduce capital and operating costs had a disproportionate influence on the development of a plant design without any known precedent. Significant risks were downplayed.

Councillors were incorrectly advised at critical decision-making stages.

A crude, low-technology, low-cost plant was constructed. It ultimately failed, at a cost to the Whanganui community of $27 million.

There are those in the community who argue that the failed plant could still be made to work with the expenditure of say another $15 million and that this would be a low-cost solution compared to building a more sophisticated and proven design.

This is the same false economy that prevailed in 2003 and 2004 resulting in great cost to ratepayers.

The Whanganui community needs to move forwards by learning from mistakes of the past, not by repeating them.

The following recommendations are proffered in this spirit.

8 RECOMMENDATIONS

8.1 The Auditor General's Expectations

The Assistant Auditor General for Local Government in the Office of the Auditor-General (OAG) wrote to Council on 29 July 2016 setting out the OAG's expectations in respect to the proposed new Whanganui wastewater plant.

The OAG expects that Council will have:

- Independent quality assurance over the project
- Good contract management
- Strong project management
- Good governance over the project, and
- Clear and transparent reporting about the project's progress

It is recommended that the current practice of Council in accordance with the OAG's expectations be reflected in policy where appropriate.

8.2 Reform of Procurement Policy for Major Procurements

It is recommended that the Whanganui District Council Procurement Policy 2014 be amended to incorporate enhanced provisions for Major Procurements.

'Major Procurements' may be described as procurements for goods and/or services with a contract value greater than say $1 million. A contract may not be divided into smaller contracts bring it under the limit.

The policy should require that all Major Procurements as defined be submitted to competitive market tender, except in a special case (eg. only one supplier of the goods and/or services exists in the market) or in the case of an emergency (eg. a natural disaster which necessitates a rapid response). Special cases or emergency procurements may only be approved by the Chief Executive in accordance with the Procurement Policy.

Any special case and emergency exceptions for Major Procurements approved by the Chief Executive should be reported to Council on a periodic basis with full particulars provided pertaining to the reasons for approval.

The onus on staff should be to seek major procurement through the competitive market rather than direct negotiation, subject to the two exceptions.

Council's current procurement policy already contains requirements for procurements greater than $200,000, however there seems to be no onus to undertake open or closed market-based tendering. Rather, it seems that currently it is up to the Tenders Board to approve the contract manager's proposed procurement methodology and process and then the Board in turn makes its recommendation to the Chief Executive.

8.3 Reform of the Tenders Board

Consistent with 8.2 above, it is recommended that the Tenders Board processes contained within the Council's Procurement Policy be reviewed to consider their efficiency and effectiveness in fostering good procurement outcomes such as value for money, quality, fairness and probity.

In order to enhance good governance, the review of the Tenders Board should include consideration of whether the outcome of all Major Procurement tender processes should be considered by all Councillors.

8.4 Policy Encompassing Council Reporting, Peer Reviews and Risk Assessments

It is recommended that current reporting practices be formalized into Council policy which includes that independent peer reviews and risk assessments related to major projects must be considered and approved by the full Council. The policy should require staff to provide Council with all consultancy reports on these matters and not just provide advice on what the reports contain. Wherever possible, the peer review panel should also be invited to present their reports directly to Council.

The policy should also establish proper processes on matters such as clear and transparent reporting to Council on a project's progress – for example through the design, construct and operations phases where applicable. The project should be assessed throughout against the original business case approved by Council.

8.5 Improved Resource Consent Compliance Reporting

It is recommended that Council's internal procedures for providing annual consent reports and notices of non-compliance to Horizons Regional Council be revised and strengthened so that in future Council's statutory obligations are complied with. This should also include concurrent reporting to Whanganui District Council of all reports required to be provided to Horizons Regional Council. Failure by management to comply with reporting requirements without reasonable cause may be treated as a disciplinary matter by the Chief Executive.

8.6 National Approach to Wastewater Infrastructure

It is recommended that Local Government New Zealand and the Central Government consider the development of consistent national development guidelines for water and wastewater treatment infrastructure. Importantly, the proposed national development guidelines should seek to assist smaller councils to avoid having to 'reinvent the wheel' with their development of water and wastewater infrastructure and deter them from taking unacceptable and unaffordable risks by experimenting with untried and untested treatment processes.

8.7 Enhancing best practice and social responsibility of wet industries

It is recommended that Council revise and strengthen its Trade Waste By-Law to enhance the best practice and social responsibility of wet industries in their operational relationships with Council's wastewater treatment plant. During the course of the Independent Review, it has become apparent that the existing Trade Waste By-Law has struggled to promote best industry practice and social responsibility.

ATTACHMENTS

A. WWTP Process Capacity Review and Optimisation. Executive Summary. Cardno BTO – 28 November 2011.
B. Wanganui WWTP Odour Issues – Odour Mitigation Memo for Infrastructure Meeting - Cardno BTO - 27 March 2013.
C. Wanganui Wastewater Treatment Plant – Evaluation of Long-Term Improvements for Consent Compliance - Executive Summary.
   Cardno BTO - 24 April 2013 (full report on Council website)
D. Wanganui WWTP – Presentation to Wanganui District Council by Humphrey Archer, CH2M BECA - 28 October 2015 (also on Council website)
E. Minutes of Meeting of Whanganui District Council - 17 January 2013.

Better Technical Options Ltd
environmental solutions

Wanganui District Council

WWTP Process Capacity Review and Optimisation

Draft Report
Monday, 28 November 2011

EXECUTIVE SUMMARY

Wanganui District Council (WDC) commissioned Better Technical Options (BTO) to prepare a 10 Year Upgrade Plan for the Wanganui Wastewater Treatment Plant (WWTP).

A capacity review, hydraulic review, process performance review, and asset condition assessment were carried out to compare the actual performance and capacity of the WWTP to that of its design and the resource consent requirements. The review highlighted areas of the plant that are under performing. In summary, the Wanganui WWTP plant requires upgrading to resolve the following issues:

- Resource consent non-compliance:
  - Faecal contaminants (Faecal coliforms and enterococci)
  - Suspended solids concentration
- High operating costs
  - Aeration power usage
  - UV operating/maintenance costs

Identified Solutions

A variety of options were investigated as well as various configurations of some solutions; capital and operating costs were prepared for each solution in order to select a suitable solution and compile an upgrade plan. The solutions were based on the wastewater quality data available during the review (from mid 2009 to mid 2011).

Solutions were designed from first principles, and then checked with BioWin modelling where appropriate. However, the solutions are designed within the constraints of the existing treatment process which may limit their efficacy; trade waste discharges may also be affecting the treatability of the wastewater. Detailed design must be carried out to determine precise biological process design parameters for the selected solution.

The treatment performance objectives of any proposed upgrades are:

- TSS < 50g/m^3.
- BOD <50g/m^3.
- Faecal contaminants to meet resource consent conditions.
- UVT >40% (note this recommendation was made when the UVT of the settling pond effluent was assumed to be approximately 17-25%).

Workshop

At a workshop with Arno Benadie of WDC on the 11th October 2011, the plant's issues and the range of investigated solutions were presented. During the workshop the following recommendations were formulated (in conjunction with Mr Benadie and BTO staff):

- Carry out jar testing to better determine the dose rate of chemicals required for chemically aided sedimentation (CAS) and hence the operating costs.
- Investigate disinfection solutions further as UV has high replacement and operating costs.
- "Option 1.1" was the preferred solution for the biological process upgrade. Option 1.1 is an activated sludge upgrade including the installation of a buffer curtain to create a

zone in which to retain biomass. Aeration is provided by a surface mounted coarse bubble aeration system and new blowers, for highly efficient aeration and mixing.

- Further wastewater analysis to be carried out as required, to help to identify wastewater treatability issues.

Chemical Jar & Process Testing

Chemical jar testing for chemically aided sedimentation and disinfection was carried out on the 18th October 2011 at site. The results demonstrated that chemically aided sedimentation was not a cost effective solution. The quality of the wastewater used in the testing was significantly poorer than the data had indicated it would be therefore dosage rates were higher.

Surprisingly, the required dosage rate of chlorine (as hypochlorite) for effective bacteriological kill was minimal – at 5mg/l. The use of chlorine (or other oxidising agents) may be considered a more suitable disinfecting agent for this particularly quality of wastewater than UV, as faecal contaminant 'kill' appears to be preferential to oxidation of long chain organics. The use of chlorine is dependent on resource consent approval.

The efficacy of chlorine dosing warranted further investigation of the wastewater to determine if long chain organics are present in the wastewater, and whether these were also affecting its "treatability". Spectroscopic analysis has identified the presence of some long chain organic compounds which may also be affecting the UVT of the solution. The identified compounds have an absorbance in a similar range to the UV wavelength, thus reducing UV efficacy. This demonstrates that the current treated effluent is not suited to UV disinfection; these long chain compounds may also have a significant effect on the treatability of the wastewater. A trade waste source control study will more accurately identify contaminants of concern, which can then be reduced or separated, to optimise the performance of the current or upgraded biological treatment processes.

Recommendations

Based on all the results of the investigations included in this report, BTO's recommendations for the upgrade of the Wanganui WWTP are as follows:

1. Implement a chemical dosing trial for chlorine disinfection; first confirm dosing rates at bench scale, then pilot scale as appropriate. Dosing rates, dosing location and mixing requirements, need to be tested and confirmed before a full scale installation. At pilot scale, the trial will need to be discussed with the regional council in terms of consent compliance. The pilot scale dosing trial will also need to be investigated closely to determine the efficacy and environmental effects before proceeding to a full scale installation. If the solution is proven to be a success, WDC could then apply for a permanent consent as long term disinfection solution. This solution is aimed to resolve the faecal contaminant non-compliance for the resource consent.
2. Investigate aerator optimisation as a means of improving plant performance (based on Operator's anecdotal evidence). This would be used as a short term solution to potentially reduce solids concentrations in the effluent.
3. If aerator optimisation has considerably improved wastewater quality, investigate efficacy of chemically aided sedimentation at bench scale again. This solution would aim to reduce suspended solids concentration in the effluent, most likely as a short term solution.
4. Commence detailed design of Option 1.1 (note this is the preferred Stage One biological process upgrade solution). This solution is designed to resolve both suspended solids effluent quality and the high operating costs. Therefore the sooner it is implemented, the sooner operating cost savings can be realised.
5. Install Stage One of the biological process upgrade (Option 1.1).

6. Evaluate Stage One performance. Also review the disinfection performance after the biological process upgrade has operated for a period of time. If necessary, carry out detailed design of Stage Two of the biological process upgrade (likely to be Option 2 – a dedicated settling zone). This will further improve resource consent quality compliance issues as well as optimising operating costs.
7. Install Stage Two of the biological process upgrade, as necessary (Option 1A).
8. Carry out sludge management strategy, as required.

Note that items 6 and 7 may need to be repeated as an iterative approach to the biological process upgrade. An iterative approach may be required since the performance of any upgrade solution is fairly difficult to explicitly guarantee.

Regardless of the upgrade recommendations provided above, the following work must also be carried out:

- An investigation into specific contaminants incorporated into the trade waste discharges, and an update of contaminant limits for any trade waste components which are deemed to impair biological process performance. Recommendations for industries to achieve these updated limits would be made. The trade waste charging strategy should be reviewed to ensure it meets the costs incurred in delivering the upgraded treatment process. This investigation would aim to reduce or stop the discharge of contaminants which may be inhibiting or affecting the treatment process to achieve consent compliance and affecting operating costs. The results of this investigation should be carefully considered when designing any of the recommended upgrade solutions.
- An investigation into sludge quantities in the treatment lagoons – this is currently commissioned to be carried out by NIWA. Once the results of this survey are available, BTO will be able to better prepare a sludge management strategy – including sludge removal methods, sludge disposal routes, and scheduling. The results of this investigation should be carefully considered when designing any of the recommended upgrade solutions.

Implementation Plan

Table 1 summarises the above recommendations as a Proposed Implementation Plan with scheduling.

BTO recommends that the biological process upgrade of the aerated lagoon is designed and implemented as soon as practically possible. This solution is most likely to effectively improve the wastewater quality, and reduce aeration power costs.

For budgetary purposes, the capital costs used in the Proposed Implementation Plan are plus 30% from the capital cost estimates given in the section which describes the upgrade. This is to ensure that the figures used in the budget are adequate to cover eventualities in the upgrade. The costs are prepared in 2011, and are exclusive of GST.

Conclusions

The main recommendations of this report are contained within the Upgrade Implementation Plan. The recommended upgrades are designed to provide WDC with a resource consent compliant plant and optimised operating costs, within the constraints of the existing process design.

Table 1 – Proposed Implementation Plan

Proposed Upgrade	Timeline	Estimated CAPEX for Budget	Upgrade Target		
			Consent Compliance (Solids)	Consent Compliance (Faecals)	Potential OPEX Reduction
Trial Chemical Dosing for Disinfection: • Jar Testing (Chlorine) • Pilot Scale Testing • Consent Approval • Full Scale Implementation	2011-2012	Full Scale Installation $390,000		Yes	Yes $150,000 c.f. $200,000
Aeration Optimisation	2011-2012	$90,000	Yes		TBC
Carry out Trade Waste quality investigation to set effective trade waste controls and charging.	2011-2012	$100,000	Yes		N/A
Review Sludge Survey results and prepare a suitable Sludge Strategy	2011-2012	TBC	Yes		N/A
Carry out detailed design of Stage One of the Biological Process Upgrade (Option 1.1)	2012	$175,000	Yes		Yes $420,000 c.f. $560,000
Install Stage One of the Biological Process Upgrade (Option 1.1). Aeration power costs estimated only.	2013	$1.37 million			
Review performance of Stage One upgrade; Design Stage Two of the Biological Process Upgrade, as required (Option 1A).	2014	$100,000	Yes		Yes $480,000 c.f. $560,000
Install Stage Two of the Biological Process Upgrade, as required (Option 1A). Aeration power costs estimated only.	2015	$650,000			
Implement sludge removal strategy, as required	TBC	TBC	Yes		Yes

Cardno BTO
Shaping the Future

Memorandum

To	Mark Hughes, Wanganui District Council (WDC)
From	Mike McCoy (Cardno BTO)
Subject	375 - Wanganui WWTP Odour Issues - Odour Mitigation Memo for Property & Infrastructure Meeting 9 April 2013
Copy	Arno Benadie (WDC), David Boothway (WDC)
File Number	375-P-003-V2
Date	27 March 2013 for Council Meeting 9 April 2013

1 Background

Wanganui District Council (WDC) has commissioned Cardno BTO to provide odour control support at the Wanganui Wastewater Treatment Plant (WWTP). The Wanganui WWTP, commissioned in 2007, has not consistently achieved discharge consent compliance and has experienced seasonal odour events that have become a significant issue for the Council and the public. Cardno BTO is providing on-going assistance to the WDC to immediately reduce odours at the WWTP and identify medium- and long-term strategies to improve odour and resource consent compliance. This memorandum provides a summary of actions to-date and discussion on issues to be considered in the medium-term. Evaluation of long-term upgrade options will be provided in the future in a separate document.

Cardno BTO conducted an investigation and resulting report *Wanganui WWTP Process Capacity Review and Optimisation Study* in November 2011. The objective of this study was to compare the actual performance and capacity of the WWTP to that of its design and resource consent conditions. Subsequent testing and further recommendations were developed as a result of the original study findings.

Cardno BTO also prepared a *Plant Odour Mitigation Discussion Report* for WDC in March 2012. This report provided a review of the odour issues experienced at the WWTP and within the reticulation system and presented interim and long-term mitigation strategies.

Separate from the above investigation, Cardno BTO visited the Wanganui WWTP on 18 January 2013 to meet with WDC staff and better understand the odour issues that are of concern to the Council and the public. It was at this meeting that Cardno BTO was provided a scope of work by WDC, summarized subsequently in a WDC Resolution included below:

> "Cardno BTO are on site late this week and advice will be sought on:
>
> - Any additional immediate measures that can be taken to address odour and treatment;
> - To determine whether it is viable to continue with this plant;
> - If viable, which options to achieve satisfactory performance are available for completion over the next two years;
> - If not viable, then establish which type of plant would be suitable for Wanganui's waste and what size that would need to be."

Matt Mates, Wastewater Treatment Technical Leader for AECOM Ltd., has been engaged by WDC to be the technical peer reviewer for the project. Matt has over 30 years' experience and

is based in AECOM's Auckland office. Appendix A contains Matt's comments to the ongoing odour mitigation effort.

2 Short-Term (Odour Mitigation)

The beginning of the current odour event at the WWTP was first identified in late December 2012. Cardno BTO were contacted in mid-January and visited the WWTP on 18 January 2013. WDC implemented some changes at the WWTP prior to Cardno BTO's involvement. These changes included:

- Addition of an odour neutralising fence around the treatment ponds;
- Addition of two products to the aerobic pond supplied by Parklink Limited;
- Intermittent sodium nitrate dosing at the Beach Road Pump Station;
- Turning off the floating twister aerators in the aerobic pond. It was communicated that the existing floating twister aerators should not be turned back on since they introduce oxygen into the wastewater through vigorous surface mixing which encourages the release of odorous compounds.

Subsequent to the initial site visit, Cardno BTO investigated and discussed short-term odour mitigation options with the WDC and a number of items were actioned. Short-term strategies, as defined by those that could be put into action within an approximate two-week timeframe, are discussed in this section.

It is important to note that the short-term odour mitigation strategies are not permanent solutions to address the operational and design issues at the WWTP, but rather those enhancements that were available for implementation within a two-week timeframe and would provide some benefit for reducing the odour caused by the Wanganui WWTP. The short-term strategies do not address the root cause of odours at the WWTP or present methodology to improve consent compliance.

2.1 Hydrogen Peroxide

The objective of hydrogen peroxide dosing is to reduce odour emissions from the WWTP by oxidising odorous compounds, including hydrogen sulphide from the wastewater before it enters the WWTP. 1,000 litre IBC containers of 50% hydrogen peroxide (H_2O_2), a strong oxidizing agent, were delivered to the Beach Road Pump Station on 31 January 2013. Hydrogen peroxide is currently being added to the raw wastewater in the pump station through a dosing pump at an approximate rate of 8 g/m^3 (based on an average daily flow of 24,000 m^3/day). The hydrogen peroxide is added upstream of the Beach Road pump wet well and good chemical mixing is achieved through the pumps. Hydrogen peroxide dosing will continue at least until aeration is well-established in the aerobic pond and there is a step reduction in odour production.

Hydrogen peroxide dosing is a well-known and established method of reducing odours in networks. Sulphide samples were collected by WDC staff on 14 February 2013; samples were collected at the Beach Road Pump Station wet well and the final sample point bucket. It is believed that insufficient contact time between the two sample points resulted in no observed sulphide reduction. Downstream sampling immediately upstream of the WWTP aerobic pond inlet would be preferred but is not feasible.

2.2 Hydrated Lime

The addition of hydrated lime (calcium hydroxide) to wastewater sludge is a common and established method to control odours and stabilise sludge by increasing the pH of the sludge. The objective of hydrated lime addition to the WDC wastewater ponds was not simply to raise the pH but also to aid settlement of the sludge to avoid release of H_2S from the sludge layer and to react with odour constituents in the liquid layer through localised pH correction. A rise in pH is beneficial since only 10% of H_2S can exist as gas at a pH of 8. The rest remains as sulphides in solution. At a pH of 9 practically no H_2S gas will be present.

In order to dose hydrated lime WDC contracted Websters Lime to dose lime across the top of both ponds on site. Lime is mixed with water to form a slurry and is applied by a monsoon bucket attached to a helicopter. Lime dosing is currently taking place two days a week. A summary of lime dosing to-date is summarized below.

Quantity (tonnes)	Application Date	Quantity (tonnes)	Application Date
14	30 January 2013	17	5 March 2013
35	1-2 February 2013	17	8 March 2013
21	8 February 2013	17	9 March 2013
21	11 February 2013	10	11 March 2013
11	13 February 2013	24	13 March 2013
20	15 February 2013	23	16 March 2013
20	18 February 2013	24	19 March 2013
24	20 February 2013	22	22 March 2013
17	22 February 2013	22	26 March 2013
16	26 February 2013		
13	28 February 2013		
20	2 March 2013		

2.3 Polymer

Coagulant dosing was stopped on 21 February 2013, two weeks after the first venturi aerator was successfully deployed in the aerobic pond. It was observed that sludge was not being reintroduced into the top layer of the pond where aeration is taking place. This is mostly due to the improved hydraulics of the new aerators. The continued use of the polymer is no longer warranted as aeration continues to be introduced. Furthermore, the cost of the L3RC polymer is high and the relative benefit is low.

2.4 Bio-Augmentation

WDC began a six-month trial of a "bio-augmentation" process. "Bioaugmentation" involves the addition of microbial constituents to wastewater in order to achieve a targeted result. The trial was conducted by Parklink Limited, who fed two proprietary products into the aerobic pond: RD338 and Oxygane. RD338 is identified as a biological suspension intended to enhance solids breakdown. Oxygane is identified as a two-part system claiming to chemically increase oxygen levels when added to wastewater.

Cardno BTO recommended that all "bio-augmentation" be stopped. While the specific composition of the products is unknown, increasing the rate of digestion of the sludge and increasing the soluble BOD within the liquid level of the pond is not advisable based on the high likelihood that it increases the odour forming mechanism within the anaerobic layer of the pond. Without an effective operational plant with an aerobic process to control the release of these compounds an increase in odour events is likely. It is important to note that quantifying the results of the "bio-augmentation" is difficult and reintroducing this regime is not recommended at this stage and should be carefully evaluated for any future need at the plant.

2.5 Other Chemicals – Nitrates/Biocides

Cardno BTO investigated the potential use of nitrate formulations and biocides for short-term odour control. Sodium nitrate ($NaNO_3$), historically fed intermittently at the Beach Road Pump Station, stops H_2S generation through two mechanisms. Firstly, it provides an alternative substrate for sulphate (SO_4^{2-}) reducing bacteria. As long as sufficient oxygen or nitrate is in solution, there will be minimal conversion of sulphate to sulphide. Secondly, the nitrate is used as an oxygen source to promote biological oxidation of sulphide to sulphate.

A biocide is a formulation which can exert a controlling effect on a biological or chemical process. In this case, the proprietary chemical Bioxide was evaluated. Bioxide is a patented Siemens Water Technologies product that would have to be shipped from Australia. The application of nitrate or biocide formulations will be dependent upon the pH of the pond. The potential need for a nitrate formulation or biocide is evaluated on an ongoing basis. However, the benefit of peroxide and lime has aided odours in the short-term and costs associated with the use of nitrates (and biocides) are estimated to be high due to the high BOD load and oxygen demand of the wastewater.

3 Medium-Term Strategies

This section discusses medium-term strategies. Implementation of these strategies is ongoing. The objective of medium-term strategies is to control odours from the WWTP while the long-term solution is developed and implemented.

3.1 Aeration

Although the final design configuration of the pond system and its effectiveness will be evaluated over the coming months, the current configuration of the pond system fundamentally depends on aerobic conditions through the top 3 to 4 meters of the pond to have any opportunity to carry out some treatment and minimise the significant odour event that is currently taking place.

Although the design of the pond system is not a point of discussion for this paper, the current configuration of the pond allows for significant anaerobic activity within the sludge layer of the pond. This anaerobic activity produces significant odour components that bubble up through the pond. Without a biological aerobic layer on the pond these compounds are released causing the odour issues that the Council and community are currently experiencing. The aerobic layer acts to oxidise the odour compounds prior to the release to the atmosphere. This aerobic layer does this both by having a positive dissolved oxygen (DO) and more importantly by having aerobic biomass that oxidises the odour components.

Aeration is required to supply oxygen to the aerobic pond in order to aerobically oxidize constituents within the wastewater. Creating an aerobic environment in the pond is essential to the elimination of odours. It is not expected that sufficient aeration can be deployed in the ponds in the medium-term to oxidize all BOD, but creating a "layer" of DO in the ponds will help. Unfortunately the establishment of an aerobic biomass is far more complex than simply adding oxygen, but this is a discussion for the long term solution. It is, however, important to note that aeration alone will not eliminate odours as there will still be untreated sewage that is contained in the ponds that will continue to release some levels of odour constituents.

Cardno BTO and WDC staff are working hard to source and install aeration equipment that may be suitable for medium-term operation, over the next year or more until more long-term solutions are implemented. We cannot stress enough the importance of the effective implementation of aeration as the primary medium-term strategy.

WDC have sourced six venturi aerators from Central Hawkes Bay and these are currently on-site at the WWTP. One aerator was successfully deployed into the aerobic pond on 7 February 2013; the second on 8 February 2013, the third on 12 February 2013. The fourth aerator was installed the week of 4 March 2013; the fifth was installed the following week. One additional venturi aerator must still be obtained from Central Hawkes Bay and the logistics for removal and transport of this aerator is being worked out by the WDC. WDC staff reinstated two of the original directional blower-assisted Tornado type aerators and they are proving to be helpful in providing air to the lagoon.

WDC has assembled a few other trial designs for alternative aeration using equipment owned by the Council that is no longer in service. While these systems are beneficial, the impact they will have on increasing the DO level on the top surface of the pond is small relative to larger equipment that can be procured. Once the most effective design for the use of coarse bubble aeration has been identified, the middle and back section of the lagoon will be aerated using this new design. If this trial design is successful larger equipment might be procured.

WDC has procured five new ABS venturi jet aerators. These aerators are currently being transported from Australia; WDC staff is working with a local fabricator to retrofit the existing mounting pontoons to accommodate the new aerators such that installation can be expedited upon equipment arrival.

Dissolved oxygen is measured at three locations within the aeration lagoon. The first location where DO is measured is located in the middle of the aerobic pond amongst the venturi aerators from Central Hawkes Bay. The DO reading at this location has increased from 0 mg/L when the first aerator was deployed to approximately 0.2 mg/L on 26 March 2013. The DO readings at the two other locations continue to measure 0 mg/L and this is unlikely to change until additional, larger aeration equipment is installed.

3.2 Chemicals

Chemical dosing was employed as a short-term strategy for odour management and was not intended as a medium-term strategy due to cost. The use of chemicals, hydrogen peroxide and

hydrated lime, in the medium-term should continue (but regularly reviewed) as they have had a positive impact in the short-term.

4 Long-Term

Implementing a solution to address plant issues in the long-term will include detailed evaluation of potential solutions and must be followed by detailed design and construction of the chosen solution. The peer reviewer is involved in providing feedback to Cardno BTO as part of this ongoing effort. A report evaluating options for improvements for consent compliance will be presented to the WDC by the end of April.

Yours faithfully,

Mike McCoy

BUSINESS UNIT MANAGER – CARDNO-BTO
PRINCIPAL PROCESS ENGINEER
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Appendix A
Peer Reviewer Comments

AECOM

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Memorandum

Attention	Mark Hughes, Infrastructure Manager	File No.	
Company	Wanganui District Council	Date	02-Apr-2013
Address	PO Box 637 Wanganui 4540	Total Page	3
Project Name	Wanganui Wastewater Treatment Plant Review	Project No.	60289820
From	Matthew Mates		
Service	Consulting Services on Odour Mitigation		
Fax No./Email			

We report on an inspection as follows:

Topic	Comments from site inspection, workshop discussion and desktop review of document	Inspection Date	Plant Site - 22/03/13, Workshop - 27/3/13
Attendees	Mike McCoy, Sarah Lothman		

'Cc' Distribution Details

Attention	Organisation	Email Address:
Sarah Lothman	Cardno BTO	sarah.lothman@cardno.co.nz
Mike McCoy	Cardno BTO	Mike.McCoy@cardno.co.nz

Attachments ☐ Yes ☒ No **Mode of Delivery** ☐ Fax ☒ Email ☐ Hand ☐ Mail

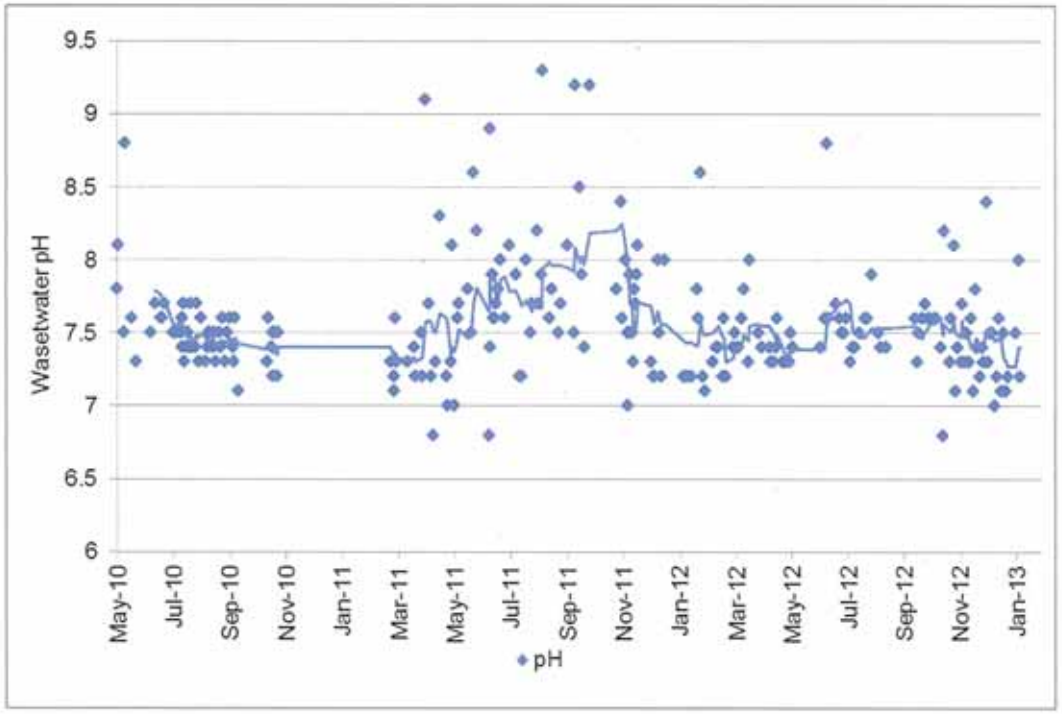
Comments are related to the short and medium term technical direction of odour mitigation.

Short Term

- Hydrogen Peroxide – continue use as needed
- Hydrated Lime – Shorter term solution for pH increase and H_2S decrease. Over the medium term time frame there are other alternatives to lime. Lime used in an anaerobic system removes the weak acid (CO_2) in the immediate gas phase and increases the pH. This is good but the microbiology tries to adjust and overcome this by generating more CO_2. So while lime is a short term solution, the longer term approach for anaerobic digestion of solids in the sludge blanket needs to be considered (Biological Wastewater Treatment, Daigger, Grady, Lim 3rd Ed. 1999). Lime as calcium hydroxide over time has an inert material fraction that at some point has to be removed from the ponds. Lime or hydrated lime tends to build up calcium carbonate over time which accounts for more of a maintenance issue, although at the ponds not as large an issue as with a more mechanically intensive WWTP. A hydroxide sludge tends to accumulate over time. Ammonia release in the sludge can occur with pH of 9.5 or greater.
    - If better digestion of solids is achieved, while a desire for greater improved aerobic layer treatment, then adopting an approach of metering in chemical in the pre-treatment or combined stream into the plant might be considered. It is critical that biomass growth in the aerobic layer be achieved.

- There are a multitude of chemical options with pros and cons to each (Caustic Soda, Sodium Bicarbonate, Soda Ash, Magnesium Oxide etc.). Bicarbonate alkalinity is preferred for pH adjustment and its impact is longer lasting. The idea would be to monitor the WW for pH and have the ability to adjust the pH over time in an easy manner rather than do a spot corrective action. So a chemical that can be easily dosed would be an objective (Bicarbonate or NaOH for example). There probably is not a way to drop dry sodium bicarbonate in the pond and let the aerators do the mixing within localized areas. This however is not really practical from an operations aspect so NaOH is an easier alternative.
- Based on review of Figure 1 depicting a graph of wastewater pH from May 2010 thru January 2013 there seems to be an increase in pH to the plant from approximately May 2011 thru December 2011. The reason is not available at time of writing but it could be related to product lines and clean in place (CIP) procedures. Perhaps some discussion with Industrial Waste dischargers and monitoring may shed some information as to why this is occurring.

Figure 1 Influent Wastewater pH



- Agree that polymer is not really effective for the odour issues.
- Agree that bio augmentation is not a fix with regards to being an effective solution. The measured effectiveness with these enzyme additives or bio augmentation solutions is questionable.

Medium Term

- Data seems to be limited. Consideration of baseline monitoring of wastewater characterization at industry and as a combined flow and load to the plant is normally encountered in situations similar to Wanganui. This sampling and analysis process in a phased approach is necessary for effective process engineering in the short, medium, and long term. This will give some confidence to decisions both on a technical and financial level at various phases of the project for all parties involved.
- Some on-line monitoring of pH both upstream (Pump Station and Plant combined inlet) and downstream of the treatment process (prior to settling pond) would give a good profile of pH related to alkalinity dosing.
- Agree that aeration is critical for medium term odour reduction and for promoting biomass growth (for both odour reduction and some level of treatment). Aeration with no biomass is an odour generator as it releases H_2S. Biomass growth and seasonal effectiveness is a function of proper environmental conditions, Food to Microorganism ratio, pH, temperature, the oxygen transfer and standardized oxygen transfer so that residual DO is maintained. There are elements of industrial waste that can inhibit or not promote growth as well. There is a wide range of substances (metals, toxic organics, petrochemicals) than inhibit both anaerobic and

aerobic systems. There are also substances and environmental conditions that do not act as an inhibitor; rather they affect the biology and the quality of the sludge for settling (Sulphides, low DO, low molecular weight compounds, etc.). Considering approximately 80 % of the plant load is industrial there is probably a range in loads that aeration has to meet. So understanding the peak oxygen demand conditions considering the SRT/HRT of the pond is more important. Equipment that can meet peak field oxygen transfer conditions in summer is important. This ties in with some sampling and analysis and internal monitoring of the ponds such as oxygen uptake rates (OUR), microbiological analysis (gross morphology), DO's, MLSS, MLVSS, ORP (field). The approach should be to get sufficient oxygen dissolution technology at the greatest field transfer rate per kW.

- Sludge removal will help, as to how much becomes a bit unknown without having more specific analytical information. Considering that the ponds have been overloaded and the data that has been generated as to volume and mass, it's probably fair to say that developing a plan for addressing sludge removal in the medium term is prudent.
- The aeration should not be so vigorous that it stirs up the anaerobic sludge layer. This would definitely generate odours. A lagoon system generally relies on liquefaction and biodegradation of the sludge solids in an anaerobic base layer to reduce the DO demand in the supernatant effluent.

Wanganui Wastewater Treatment Plant

Evaluation of Long-Term Improvements for Consent Compliance

375

Prepared for
Wanganui District Council

24 April 2013

Cardno BTO
Shaping the Future

Document Information

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Project Name	Evaluation of Long-Term Improvements for Consent Compliance
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Date	24 April 2013

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Document Control

Version		Author Initials	Reviewer	Reviewer Initials
D1	Internal Review	AS, LS, SL , MMc	Mike McCoy	MMc
D2	Internal Review 1st Draft	AS, LS, SL , MMc	Mike McCoy	MMc
D3	Internal Review 2nd Draft	AS, LS, SL , MMc	Mike McCoy	MMc
R1	For client review	AS, LS, SL , MMc	Mike McCoy	MMc
V1	Final	AS, LS, SL , MMc	Mike McCoy	MMc
V2	Revised Final	AS, LS, SL , MMc	Mike McCoy	MMc

Executive Summary

The Wanganui Wastewater Treatment Plant (WWTP) has experienced various problems since it was opened in 2007, including failure to meet discharge effluent consent standards and seasonal odour events. Most recently, a significant and prolonged odour event occurred over the 2012/13 summer. Cardno BTO were engaged by Wanganui District Council (WDC) to assist with short-term odour mitigation measures and long-term strategies to achieve consent compliance. Specifically, the WDC set forth the terms of reference for the long-term options study in a WDC Resolution:

- To determine whether it is viable to continue with (the present) plant;
  - *Cardno's assessment is that continuing with the plant in its current configuration is not viable. The original design concept is flawed and capital improvements are required in order to reliably meet the effluent consent and minimise the risk of odours.*
- If viable, which options to achieve satisfactory performance are available for completion over the next two years;
  - *Continued operation of the plant in its current configuration is not viable. Despite this, consideration has been given within this evaluation to make best use of existing infrastructure when possible.*
- If not viable, then establish which type of plant would be suitable for Wanganui's waste and what size that would need to be.
  - *A facility that consists of a biological treatment process that produces a settleable floc and continuous sludge handling is critical. This evaluation concludes that overall most cost effective improvement scenario includes:*
    - *Anaerobic pond to provide primary treatment*
    - *Contact stabilisation with new secondary clarifiers for secondary treatment or sequencing batch reactors (SBRs)*
    - *UV disinfection*

Co-wasting of primary sludge and WAS from the anaerobic pond to solids handling

Given the plant's history, there is no opportunity to trial 'experimental,' high-risk solutions. This report evaluates long-term options that can confidently meet the resource consent and minimise the risk of odour events. Cardno BTO recognise that process options outside of those presented herein exist; however, only those solutions evaluated in detail in this report are suitable to meet the strict objectives set forth by WDC.

A number of significant issues affect the Wanganui WWTP; these are discussed in detail in the appendices of this report. These issues include a long-standing history of consent non-compliance, historical odour events, the need to address removal and disposal of sludge in existing ponds, historical surface aerator mechanical issues, impacts of trade waste, and the potential for beneficial use of plant effluent in the future.

Evaluation of the original design concept is a necessary component of this study. The original design for the Wanganui WWTP was based on a deep aerated lagoon in which settlement, sludge storage, and aerobic biological treatment are performed within a single lagoon. The design flaws associated with this design concept include:

- Suspended solids settle in the parts of the lagoon not fully mixed by the surface aerators
  - Incomplete mixing to allow for solids to settle means that maintaining a mixed liquor in the aerobic zone is difficult. Maintaining a mixed liquor is essential for treatment in order to provide time for biomass growth, BOD consumption, and generation of a settleable floc.
- Storage, compaction, and anaerobic digestion of settled sludge in the base of the lagoon
  - Anaerobic digestion intended to take place in the base of the lagoon is impacted by the aerobic process occurring in the lagoon. Anaerobic digestion occurs in the absence of oxygen; supplying

oxygen to the upper layer of the pond has likely partially inhibited the anaerobic digestion process in the lower layer of the pond. It is likely that inhibition of anaerobic digestion has been occurring since the plant was originally opened and that the most recent odour event was exacerbated when surface aerators were turned off. When the bottom layer of the pond was no longer inhibited by the oxygen being introduced by the aerators, the rate of digestion accelerated, releasing odourous compounds that were previously bound in undigested solids.

- Aerobic biological treatment in the upper layer of the lagoon
  - The upper layer of the pond is not fully mixed and growth of a biomass is difficult. Mixing in the aerated lagoon is only provided by the surface-mounted aeration equipment. Once solids settle past the aeration equipment area of influence, it cannot be resuspended.
- Storm flow storage in the 2 metres of depth above the dry weather operating level of the lagoon
  - Storm flows routed to the lagoon facilitate washout of any aerobic biomass that may be in the upper layer of the pond.

This design is unconventional and enhancing the original design concept will not meet the resource consent suspended solids standard and will present an unacceptable odour risk. Since these two primary objectives cannot reliably be met, options that maintain the original design concept are not considered.

The figure below summarises the improvement options that have been identified for the Wanganui WWTP based on what is physically practical at the existing site. The options have been broken down into the main treatment areas: primary treatment, secondary treatment, sludge management, storm flow management and disinfection. Each shortlisted alternative, highlighted in yellow in the matrix, is evaluated in detail in the report.

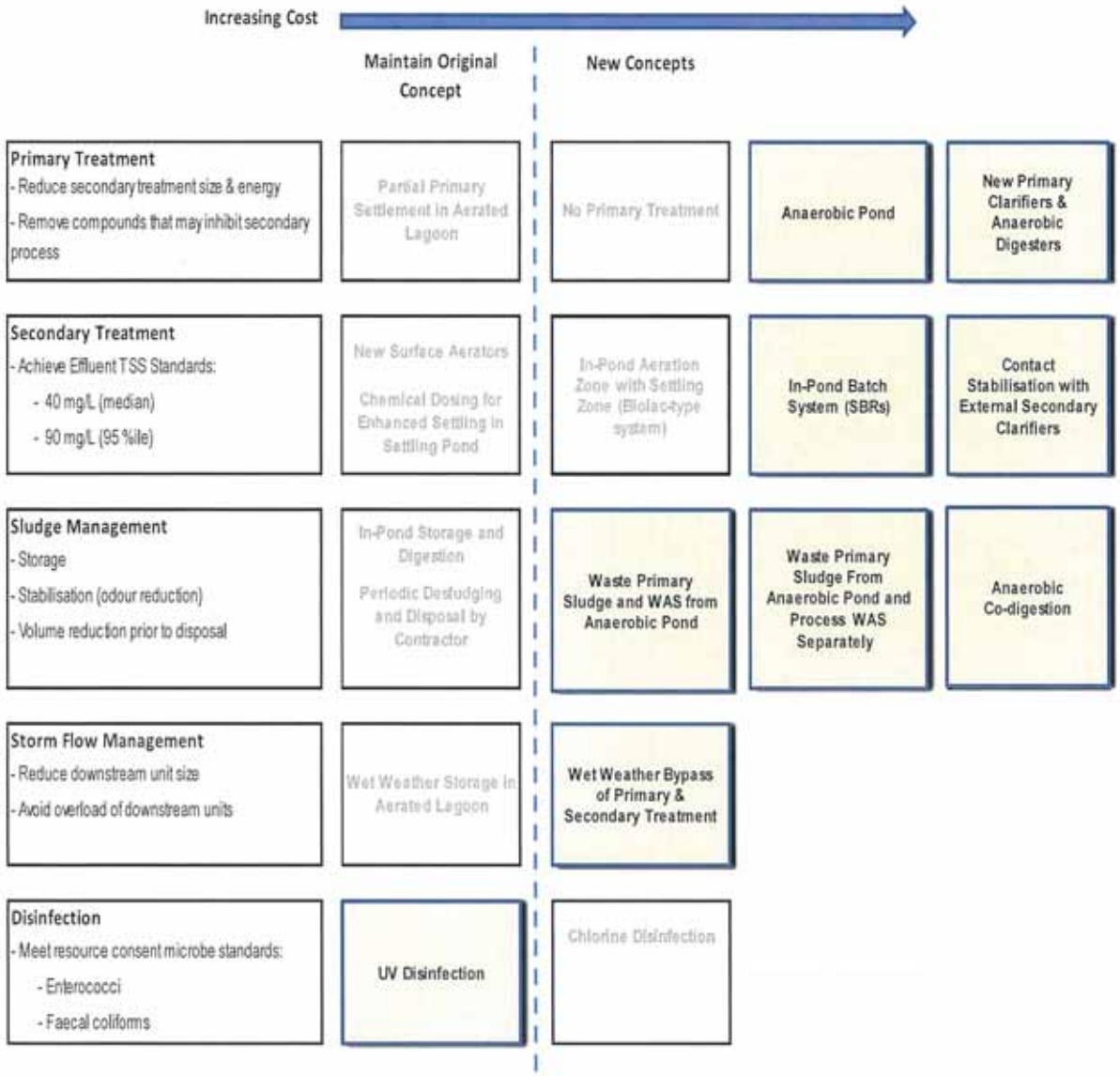

Figure ES-1: Wanganui WWTP Long-Term Options Matrix

It is critical that the upgraded treatment plant meets the resource consent standards; therefore as with any design, a margin of safety must be provided between the plant's design effluent standards and the resource consent standards. The size of the safety margin selected is a balance between risk of non-compliance and cost.

The design flows and loads for the upgraded WWTP were developed based on historical flows and loads to the WWTP. Maximum flow to UV disinfection and the WWTP is limited to 650 l/sec (56,000 m^3/day) and 1,120 l/sec (97,000 m^3/day), respectively.

For the purposes of this report a 20% contingency has been added to the historical flows and loads to ensure there is sufficient capacity to treat the current consented trade waste loads and to allow some spare capacity. All designs are flexible and can be adjusted in future to accommodate any changes to the design flows and loads as the design progresses.

In order to assess the relative pros and cons of the improvement options in a structured fashion, each option is evaluated against a set of criteria. Meeting the required effluent quality and odour standards is not optional, therefore these are not included as assessment criteria but form part of the design basis for the improvements. Criteria include constructability, process risk, future upgrade complexity, completion time, and cost.

Detailed assessments of the options are presented in the report and include sizing criteria, performance against stated criteria, and costs. The overall most cost effective improvement scenario includes:

- Anaerobic pond to provide primary treatment
- Secondary treatment with contact stabilisation with new secondary clarifiers *or* sequencing batch reactors (SBRs)
- UV disinfection
- Co-wasting of primary sludge and WAS from the anaerobic pond to solids handling

The total capital cost of this option is estimated to be in the range of $17-$19 million. Table ES-1 presents a summary of cost estimates for the preferred options.

Table ES-1: Summary of Costs for Preferred Options

	Option 1	Option 3
	Capital Cost	
Primary Treatment		
Anaerobic Pond	$2,343,000	$2,343,000
Primary Clarifiers		
Secondary Treatment		
SBRs	$14,707,000	
Contact Stabilisation with New Secondary Clarifiers		$13,551,000
UV Disinfection	$0	$0
Sludge Management		
Storage in Anaerobic Pond	$1,738,000	$1,738,000
Primary Sludge Storage in Anaerobic Pond, Separate WAS Treatment		
Anaerobic Codigestion		
Capital Cost ($)	***$18,788,000***	***$17,632,000***
	20-year NPV of Operating Cost	
Primary Treatment		
Anaerobic Pond	$838,000	$838,000
Primary Clarifiers		
Secondary Treatment		
SBRs	$10,221,000	
Contact Stabilisation with New Secondary Clarifiers		$5,041,000
UV Disinfection	$3,829,000	$3,829,000
Sludge Management		
Storage in Anaerobic Pond	$13,644,000	$13,644,000
Primary Sludge Storage in Anaerobic Pond, Separate WAS Treatment		
Anaerobic Codigestion		
20-year NPV of Operating Cost ($)	***$28,532,000***	***$23,352,000***
	20-year Net Present Value	
Primary Treatment		
Anaerobic Pond	$3,181,000	$3,181,000
Primary Clarifiers		
Secondary Treatment		
SBRs	$24,928,000	
Contact Stabilisation with New Secondary Clarifiers		$18,592,000
UV Disinfection	$3,829,000	$3,829,000
Sludge Management		
Storage in Anaerobic Pond	$15,382,000	$15,382,000
Primary Sludge Storage in Anaerobic Pond, Separate WAS Treatment		
Anaerobic Codigestion		
20-year Net Present Value ($)	***$ 47,320,000***	***$ 40,984,000***

There are a number of recommendations that stem from this evaluation:

- Special sampling should be conducted over a one-month period in order to gain an understanding of the composition of the wastewater such that the process design of any long-term improvements is appropriate.
- Discussions with Horizons Regional Council regarding potential consenting requirements are recommended.
- It is recommended that WDC continue to take a collaborative approach to engage industry, as an open consultation process where industry and WDC can work together to address trade waste discharges. This will result in a positive outcome.

Desludging of the existing ponds, discussed in Appendix C, is an activity that must take place prior to construction of a facility upgrade. The timing of a desludging operation is flexible but there are a number of factors that influence when the activity should commence.

1. Time of year. Commencement of desludging prior to summer will help to decrease odours generated in the warm months.
2. Timing of construction. It is desirable that desludging take place at a time such that maximum sludge can be removed. If the desludging operation takes place too far in advance of construction there is a possibility that additional desludging may be required when the ponds must be emptied for construction.

The timing presented in Table ES-2 presents a preliminary suggested programme that can be modified dependent upon budgets and priorities.

Table ES-2: Programme

Task	Timing
Special Sampling	Immediate
Design of WWTP Improvements	Must begin immediately
Sludge Survey	June 2013
Resource Consents Coordination with Horizons Regional Council	September 2013
Trade Waste Bylaw Update	To be initiated within 9 months
Project Tendering	December 2013
Completion of Construction	December 2014

Table ES-3 presents a summary of costs that are required over the next year in order to meet the proposed programme.

Table ES-3: Total Costs

Task	$ million
Capital Improvements at WWTP	$18.79
Annual Operating Cost for WWTP*	$1.93
Sludge Removal and Disposal (mechanical dewatering to 20%)	$3.90
Trade Waste Monitoring	$1.00
Wastewater Characterisation	$0.05
Medium-term Odour Control	$1.00
Total	$26.67

*assumes operation of option with SBRs in 2013 dollars

CH2M Beca

Wanganui WWTP – Presentation to Wanganui District Council 28 October 2015

By Humphrey Archer

CH2M Beca reference 6518753/NZ1-11543197

FINAL

Primary MWH Design Faults In Our Opinion

- Incorrect assumptions in the calculation of required aeration energy for aerobic treatment of the design 90 percentile BOD load
- Excessive energy input to a Facultative Aerated Lagoon (labelled by MWH as the Optimised Lagoon Process – OLP)
- Incorrect assumptions in the calculation of solids mass (sludge) to be stored in the base of the lagoons
- Incorrect assumption of an average 12% solids content in the sludge layer (actual measured value was an average of 3.1%)
- Optimistic interpretation of the mass loads during the design and construction phases and insufficient 'safety factor' used
- Secondary design faults are not discussed in this summary

CH2M Beca

Features of Aerated Lagoons

- So that the significance of technical issues can be appreciated, the types of aerated lagoons need to be explained
- The normal arrangement comprises a fully-mixed aerated lagoon, followed by one to three partially-mixed facultative aerated lagoons-in-series
- Facultative means having 'two environments' – an aerobic upper layer and an anaerobic base layer. Another term is a 'stratified lagoon'

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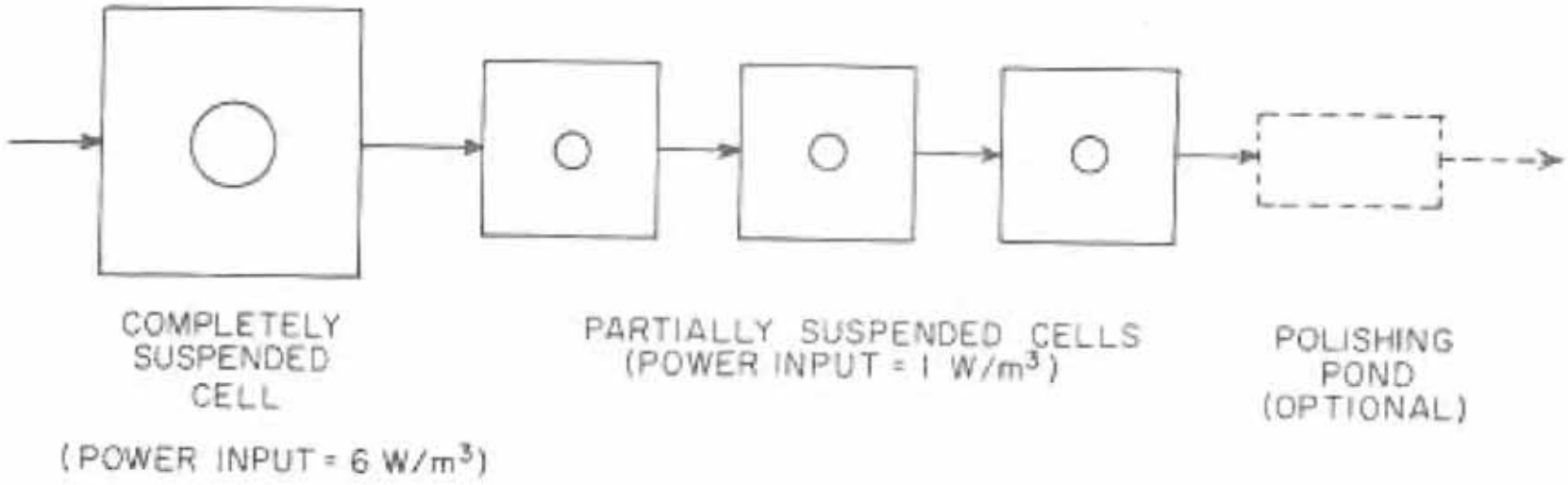
Dual Power Lagoons (Prof Linvil Rich 1980)



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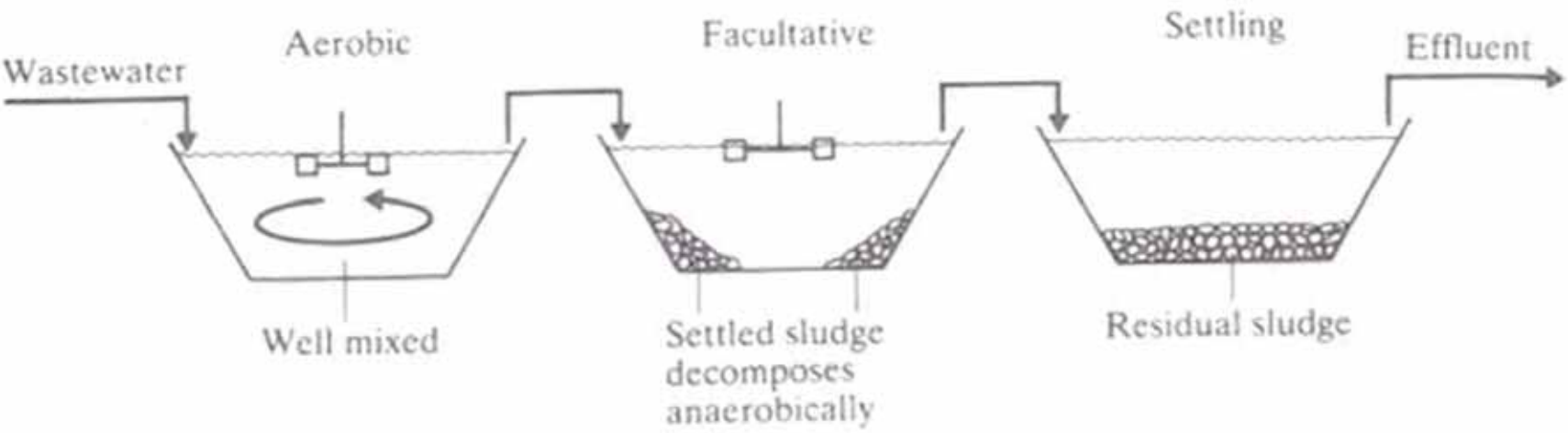
Industrial Wastewater Treatment Lagoons (Eckenfelder 1989)



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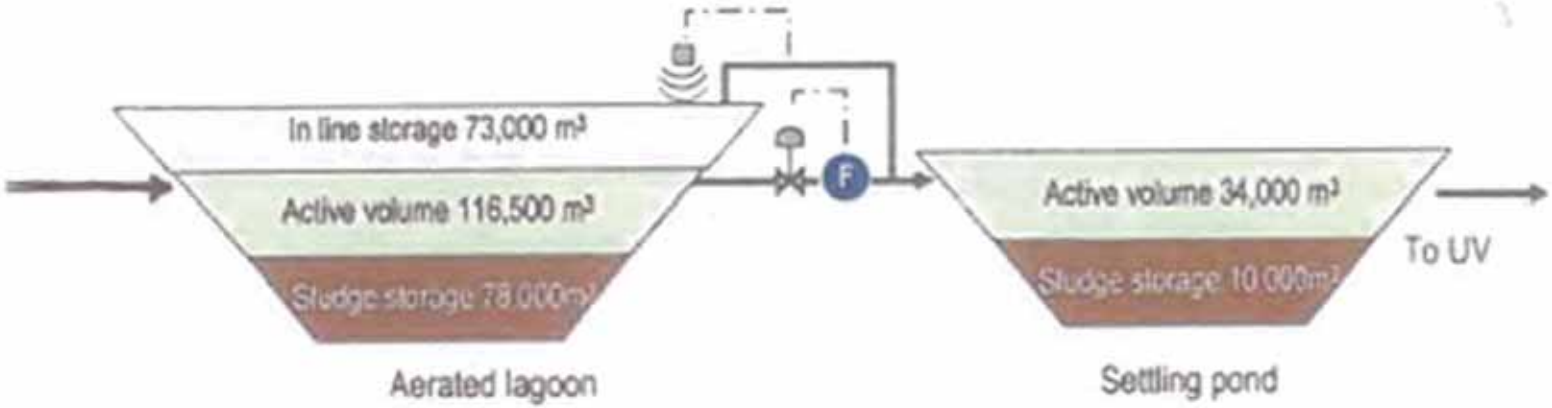
Wanganui Optimised Lagoon Process (from MWH O&M Manual, Fig 1.4)



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Aerial view of the Wanganui Wastewater Treatment Facility prior to commissioning the aerators

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Incorrect Assumptions in the Calculation of Aeration Energy

CH2M Beca

Required Aeration Energy – Calculation Comparisons

Revised Table B1– Aeration Requirement Comparison (Abbreviation of Table B1 in CH2M Beca Review. Differences or uncertainty in assumed values are in red)

Line Ref		MWH Calculation	CH2M Beca Calculation (22/9/15)	CH2M Beca Calculation (14/10/15)
A	90%ile BOD load (kg/d)	23,536	23,536[i]	23,536[i]
C	BOD_5/BOD_L ratio	0.77	0.65	0.65
D	Ultimate mass of BOD treated [A / C] (kg/d)	30,550	36,209	36,209
G	Mass of organisms wasted (kg/d)	13,630	9,600	3,635
H	Daily aeration requirement for	16,920	26,609	32,574
	BOD reduction [D – G] (kgO_2/d)	705	1,109	1,357
	(kgO_2/h)			
K	Actual Oxygen Requirement (AOTR). Could be 0.6? (kgO_2/kWh)	0.77	0.77[ii]	0.77[ii]
L	Installed power required [H / K] (kW) (with no diurnal peaking factor)	915	1,440	1,763
N	Benthic oxygen demand at 80g/m².d and 20,000m² [iii]			
	(kgO_2/d)	Not calculated	1,600	1,600
	(kgO_2/h)		67	67
P	Installed aeration power required for benthic load (kW)	Not calculated	93	93[iv]
S	Overall peak aeration demand (BOD removal and benthic demand) at			
	high BOD loadings (kgO_2/d)	16,920	28,209	34,174
	(kgO_2/h)	705	1,175	1,424
T	Overall installed aeration power (kW) (required for BOD removal and benthic oxygen demands, with no diurnal peaking factor applied)	915	1,526	1,850

i. From MWH calculations supplied to WDC on 13 December 2007 – MWH.02058.00
ii. MWH value assumed. This could be optimistic given that testing did not achieve the target.
iii. Rich (1980) assumes the 80 g/m².d value. 20,000m² area at top of sludge layer, is estimated from Section 6.2, MWH Report 11
iv. If the Eckenfelder method is used, Benthic oxygen demand in summer = 40% of soluble BOD_L , which would be 9,120 KgO_2/d or 380 KgO_2/hr. This would require an extra 493 kW aeration power for the benthic demand alone – not included above.

Comments on Aeration Energy Calculations

- Aeration calculations were not included in MWH Reports 10 and 11
- The 2004 Peer Reviewers requested the aeration calculations, but these were not provided by MWH
- Aeration calculations were sent to WDC on 13 December 2007 – about six months after the plant start-up
- MWH adopted optimistic values for a number of factors, which resulted in a substantial difference in aeration power required (MWH = 915 kW vs CH2M Beca estimates of 1,526 kW to 1,850 kW)
- MWH also did not include the 'feedback' oxygen demand from the sludge layer

CH2M Beca

Excessive Energy Input to a Facultative Aerated Lagoon

CH2M Beca

Excessive Energy Input to a Facultative Aerated Lagoon

- The purpose of a facultative aerated lagoon is to have a quiescent layer at the base, where organic solids can be stabilised by anaerobic digestion (which converts solids to biogas thus reducing the mass solids)
- To avoid disturbance of the base layer, energy input at the surface is limited to 2 W/m^3, based on the aerobic zone volume (Rich 1983)
- For Wanganui, the aerobic volume was approximately 116,000m^3, so the installed power should have been a maximum of 232 kW

CH2M Beca

Excessive Energy Input to a Facultative Aerated Lagoon (cont'd)

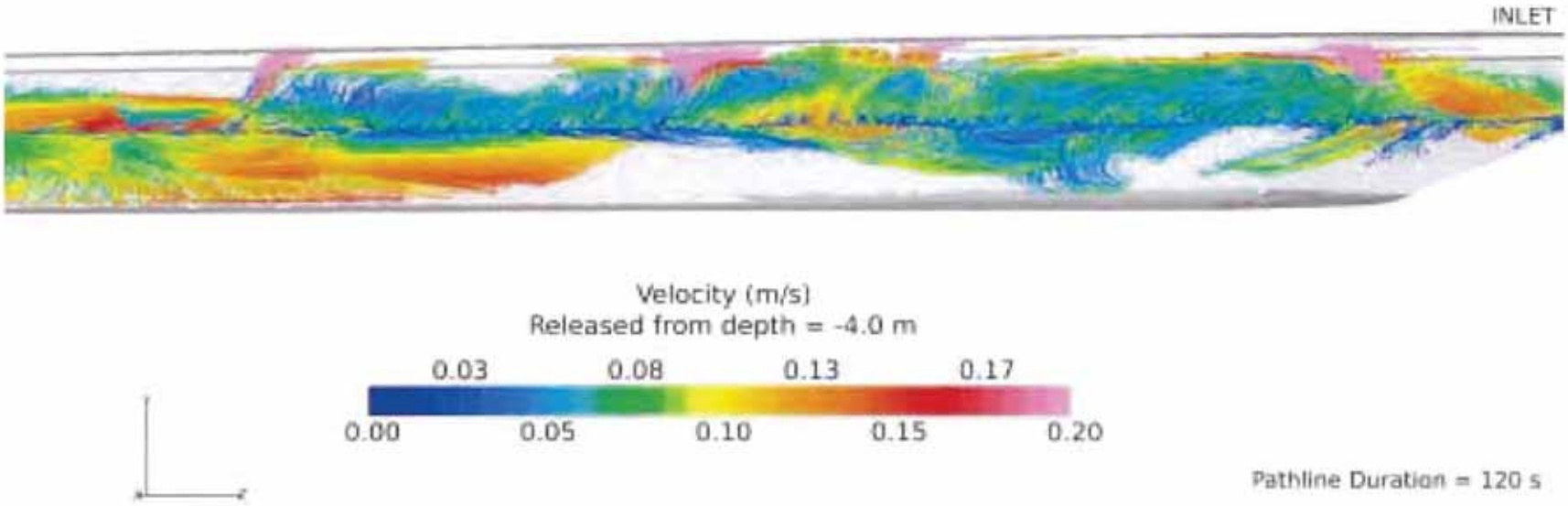
- MWH calculated required power at 915 kW and initial installed power (Tornados) was 17 x 45 kW = 765 kW (excluding the boost blowers which do not contribute to mixing) – From July 2007 start-up
- Increased power with 20 Twisters and 3 Tornado, was 23 x 45 kW = 1035 kW – From July 2009
- The CH2M Beca estimate for aeration power is 1,526 kW or 1,850 kW (see revised Table B1 earlier)
- This is 6 to 8 times the allowable power to avoid disturbing the base layer
- More aerators would have disturbed the base layer

CH2M Beca

Depth of the Aerated Lagoon

- The main aerated lagoon has a normal water depth of 8 m and maximum of 10 m for peak wet weather flow storage
- Lower 4 m was designed for sludge storage
- Upper aerobic zone was 4 m deep
- Typical facultative aerated lagoons are 4 to 5m total depth
- Did the extra depth allow the sludge layer to be undisturbed?
- WDC commissioned a Computational Fluid Dynamics (CFD) study of the mixing currents in the aerated lagoon

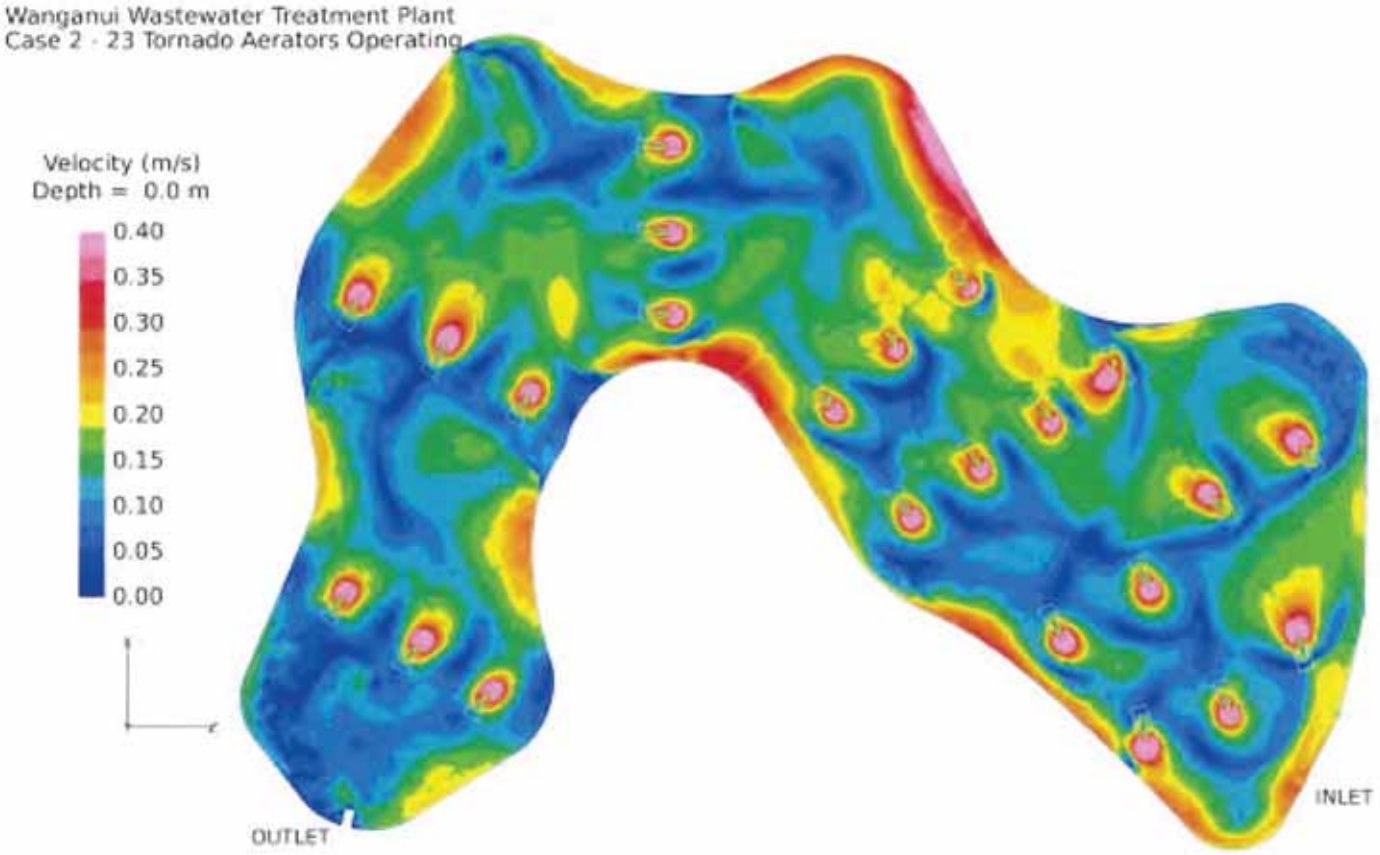
Fig 3-12 Case 1 – 120s pathlines released from 4m depth (17 Tornados)



CH2M Beca

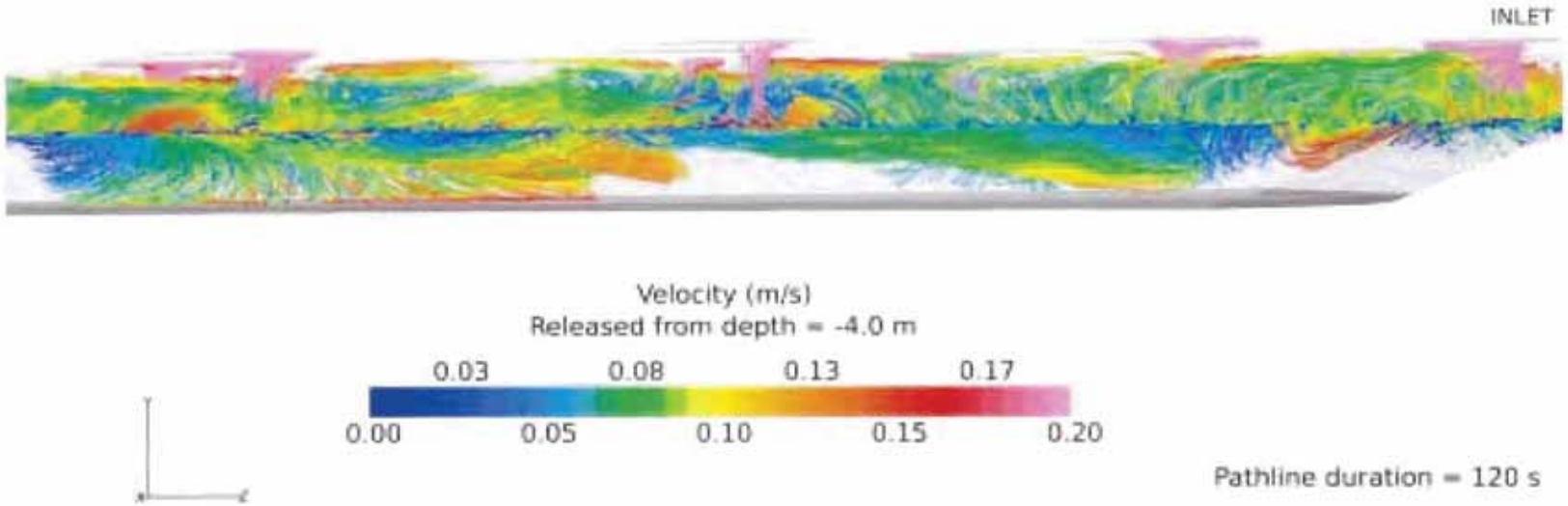
CFD Modelling Results for Mixing of the Aerated Lagoon (Figures from CFD Design & Engineering Report Oct 2015)

Fig 3-14 Case 2 – Surface Velocity Contours (23 Tornados)



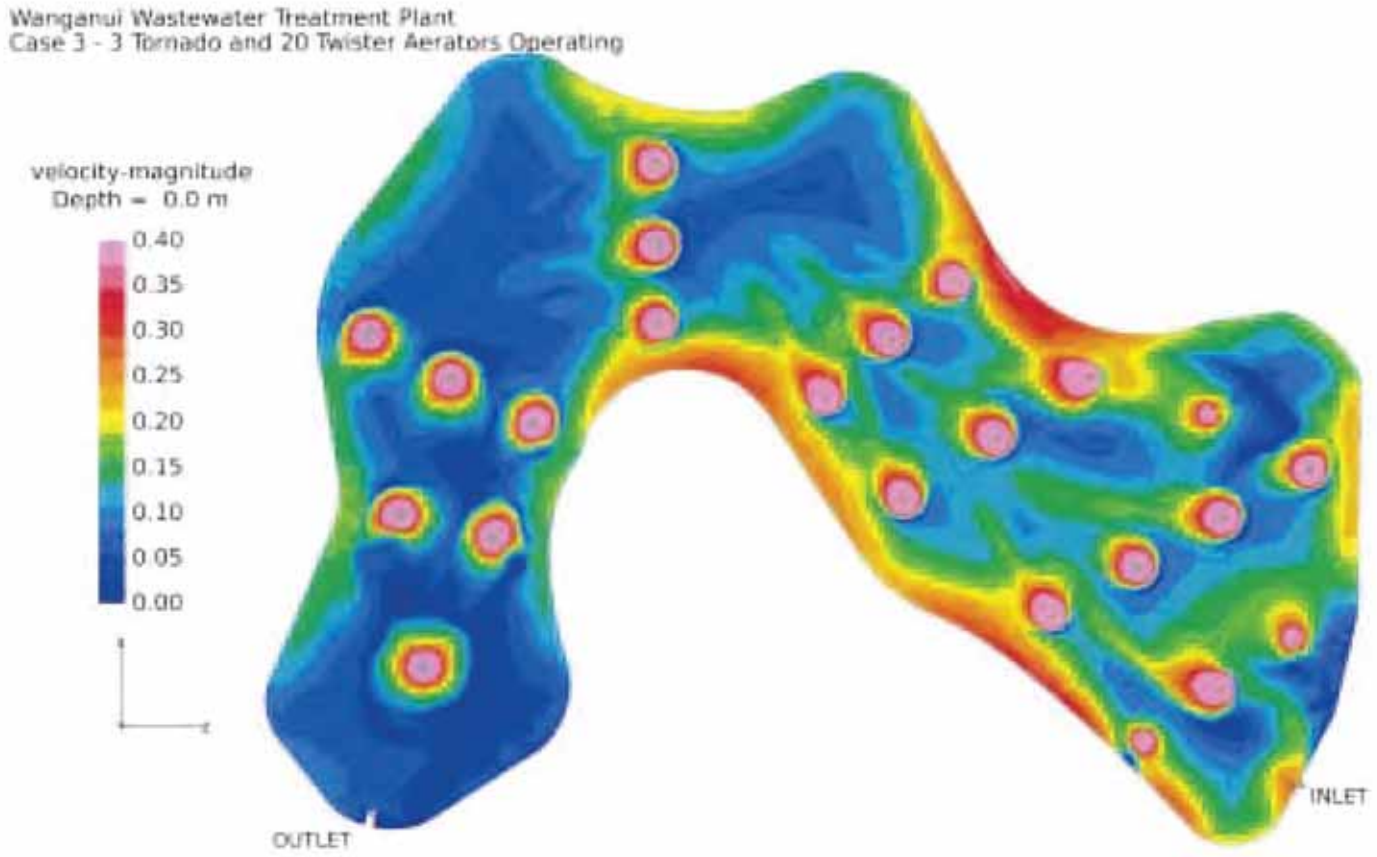
CH2M Beca

Fig 3-20 Case 2 – 120s pathlines released from 4m depth (23 Tornados)



CH2M Beca

Fig 3-22 Case 3 – Surface Velocity Contours (20 Twisters & 3 Tornados)



CH2M Beca

Fig 3-28 Case 3 – 120s pathlines released from 4m depth

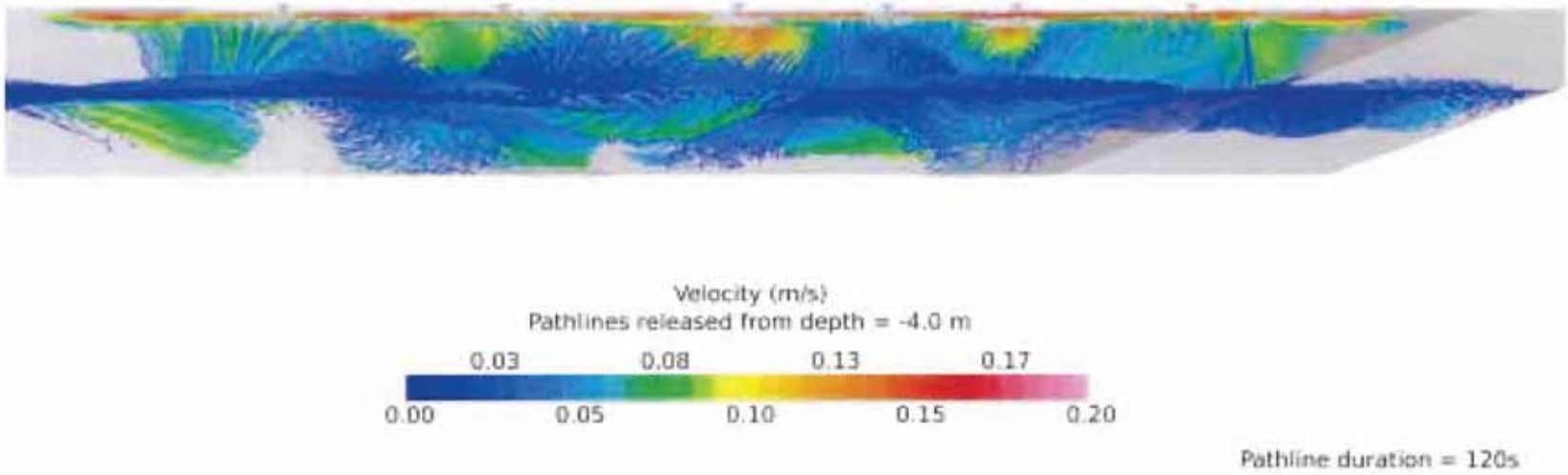


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Fig 3-29 Case 3 – Location of Aerator Rows 2 and 5

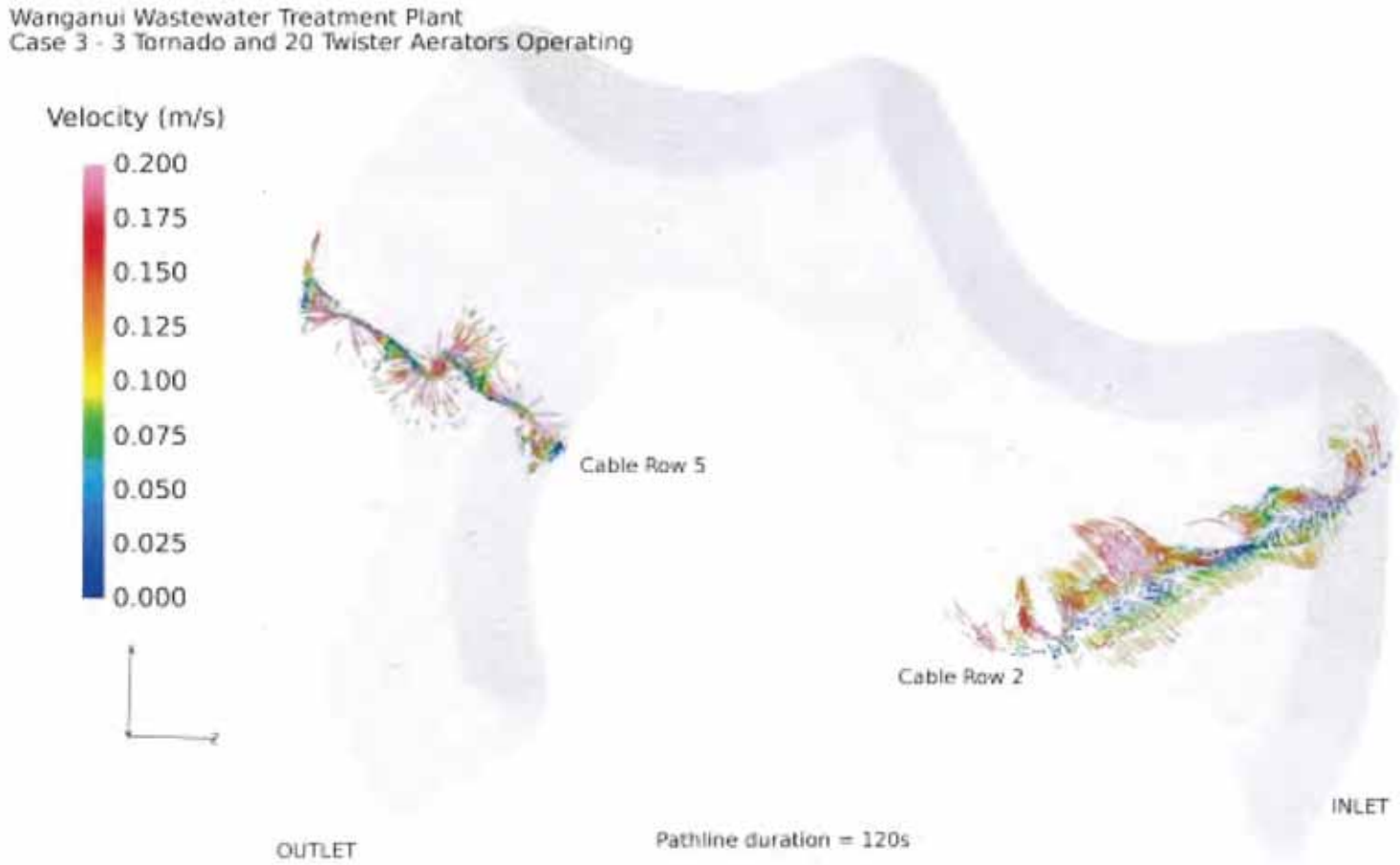

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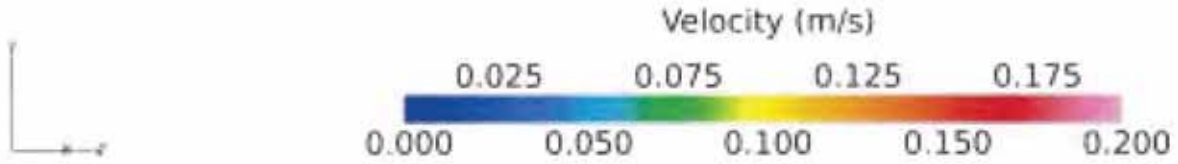
Fig 3-30 Case 3 – Streamlines through full 8m depth along Aerator Row 2



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Twister Aerator with Sludge Uplift

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Twister Aerator with Clean Water

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CFD Modelling Conclusions

- The mixing currents from the Tornado and Twister aerators extended below the 4 m plane (interface of aerobic and anaerobic zones)
- These currents would have entrained gas-buoyed sludge and carried it into the upper aerobic zone causing increased oxygen demand, or carried oxygen into the anaerobic zone causing incomplete anaerobic digestion
- Stabilised and well-consolidated sludge may not have been entrained by the deeper currents, but as the sludge surface rose, more sludge would have been disturbed
- CFD modelling supports the guideline value for mixing energy input limit of 2 W/m^3

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Sludge Storage Incorrect Assumptions

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Sludge Storage Calculation

- The key reason for selecting the 'Optimised Lagoon Process', was the expected '20 years sludge storage', first stated in Report 10 (2003)
- However, the sludge storage volume of 160,000m^3 in Report 10, was reduced to approximately 90,000m^3 in Report 11 (2005), and an 'as-built' of 78,000m^3
- The reduction in available sludge storage volume was not highlighted in Report 11 (Nov 2005)
- Report 11 in Section 7.4, predicts 13 years sludge storage in the aerated lagoon and 8 years for the settling lagoon
- The O&M Manual (2010) and a 2008 Conference paper by MWH, re-stated the predicted 20 years sludge storage

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Comparison of Sludge Consolidation Factors (Table 4-1)

Location	Sludge Dry Solids Content
MWH Report 10 – assumption for Wanganui	12.0%
MWH Report 11, Section 7.4.2 – assumption for Wanganui	12.0%
MWH Report 11, Section 7.5 (Regina, Canada aerated lagoons)	7.5% and 7.14%
MWH Report 11, Section 7.5 (Meze, France anaerobic lagoon)	8.0%
Dual Power Lagoons USA (L. Rich, 2003)	Range from 4.8% to 7.4% at base of lagoons after typically 15 years storage
Hawera Anaerobic Lagoon (meat processing wastewaters)	3.4% (weighted average)
Wanganui (measured by Cardno-BTO May 2013) Aerated Lagoon Settling Lagoon	 3.1% (average) 1.6% (average)
Loughran MWH	6 to 8%
Hoffmann MWH	3 to 5%

- The 2004 Peer Reviewers questioned the Report 10 12% consolidation factor but MWH replied with anaerobic lagoon examples (with no surface aeration)
- The Dual Power Lagoon range from 4.8% to 7.4%, would have been more appropriate in our opinion

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Summary Comparison of Sludge Volume Estimates (Table 4-2)

Parameter	MWH Report 11 – Nov 2005	MWH Loughran Estimate 8/07/2005	CH2M Beca Estimate 2014/15
Long term storage sludge mass (kg/d dry solids)	2,496	4,627	4,943
Sludge accumulation m^3/day (a)	20.8	Not calculated	123.6
Total sludge storage volume available m^3	90,000	-	90,000
Storage time years	13	Not calculated	2

Note: a) See Appendix A, Table A2 for details

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Sludge Storage Conclusions

- The CH2M Beca estimate is 2 years sludge storage. The difference in estimated storage time is due to the combination of differences in the sludge mass load and the sludge consolidation factor
- MWH internal review recommendations were:
  - Loughran (MWH) estimated a significantly greater mass of solids – 4,627 Kg/d compared to 2,496 Kg/d in MWH Report 11
  - Loughran (MWH) recommended sludge consolidation to 6% or 8%, compared to 12% in MWH Report 11
  - Hoffmann (MWH) recommended sludge consolidation in the range 3% to 5%, compared to 12% in MWH Report 11
  - Report 11 does not explain why the Loughran and Hoffman recommendations were not adopted
- Also, the 2004 Peer Reviewer's concerns were not adequately addressed

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Load Characterisation

Full load as measured at the Beach Road Pump Station (BRPS) before bypass to Ocean Outfall

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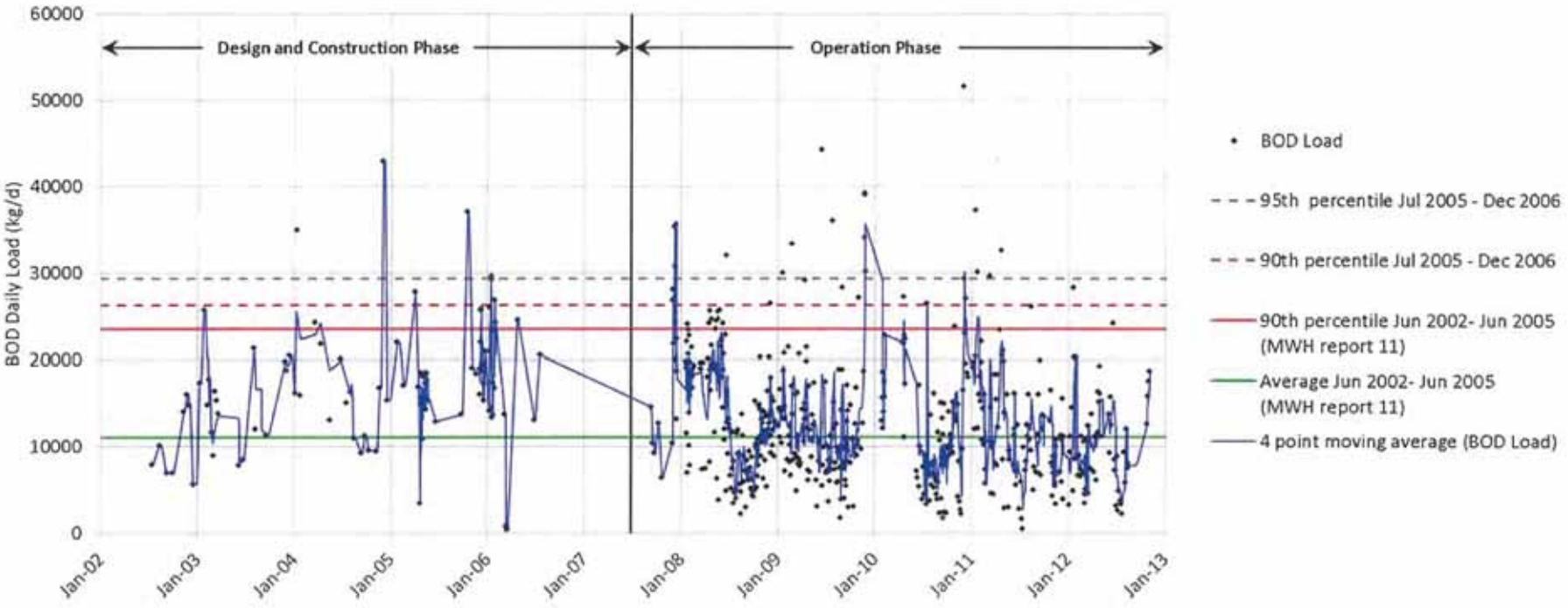
Full BOD Daily Load at Beach Rd Pump Station



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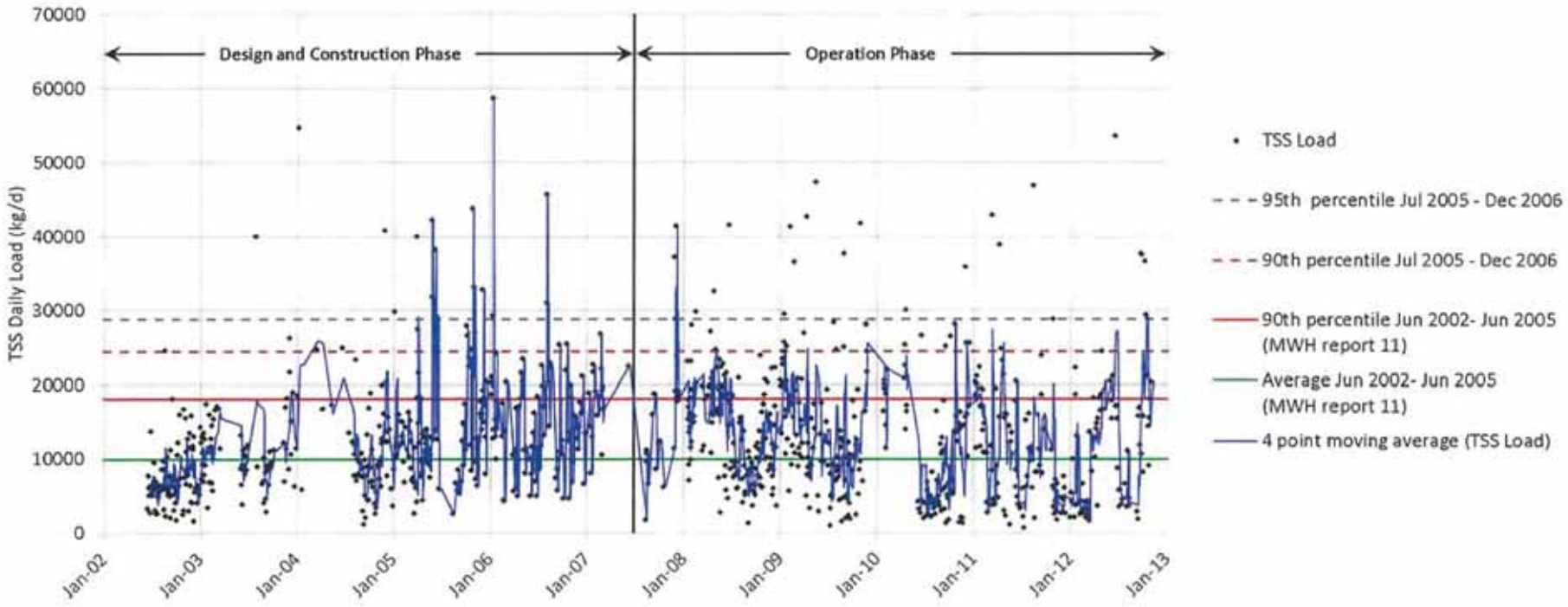
Full TSS Daily Load at Beach Rd Pump Station



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Effects of Bypass to the Ocean Outfall During Operation from 2007

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Loading Comparisons (for full year data); Accounting for Bypass to Ocean Outfall

		2007	2008	2009
	Average Design Value	WWTP Inlet	WWTP Inlet	WWTP Inlet
Flow	32,000	22,178	15,259	26,881
TSS Load	10,000	12,033	6,742	11,957
BOD Load	11,000	13,092	7,026	10,686
COD Load		20,783	15,823	30,126
BOD % above average design load		19%	-36%	-3%
TSS % above average design load		20%	-33%	20%

- The overall **average BOD** load for 2007 was higher than the design value, but much lower in 2008 and about the same in 2009, and similar for TSS (except 2009 where it's very high overall).
- Note that these are average values. The design 90%ile BOD value was generally not exceeded – see next slide.

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Loading Comparison (peak season 90 percentile loads); Accounting for Bypass to Ocean Outfall

		2007/2008	2008/2009	2009/2010
	Design Loads	WWTP Inlet	WWTP Inlet	WWTP Inlet
Average TSS	10,000	11,552	10,678	16,070
90%ile TSS		20,218	22,670	25,392
Max TSS		39,966	36,596	52,721
Average BOD	11,000	12,452	9,168	12,942
90%ile BOD	23,536	23,944	16,573	25,391
Max BOD		34,097	33,358	52,721
Average BOD % above design load		13%	-17%	18%
90%ile BOD % above design load		2%	-30%	8%

- We have assumed the peak season is from November 1 to February 28

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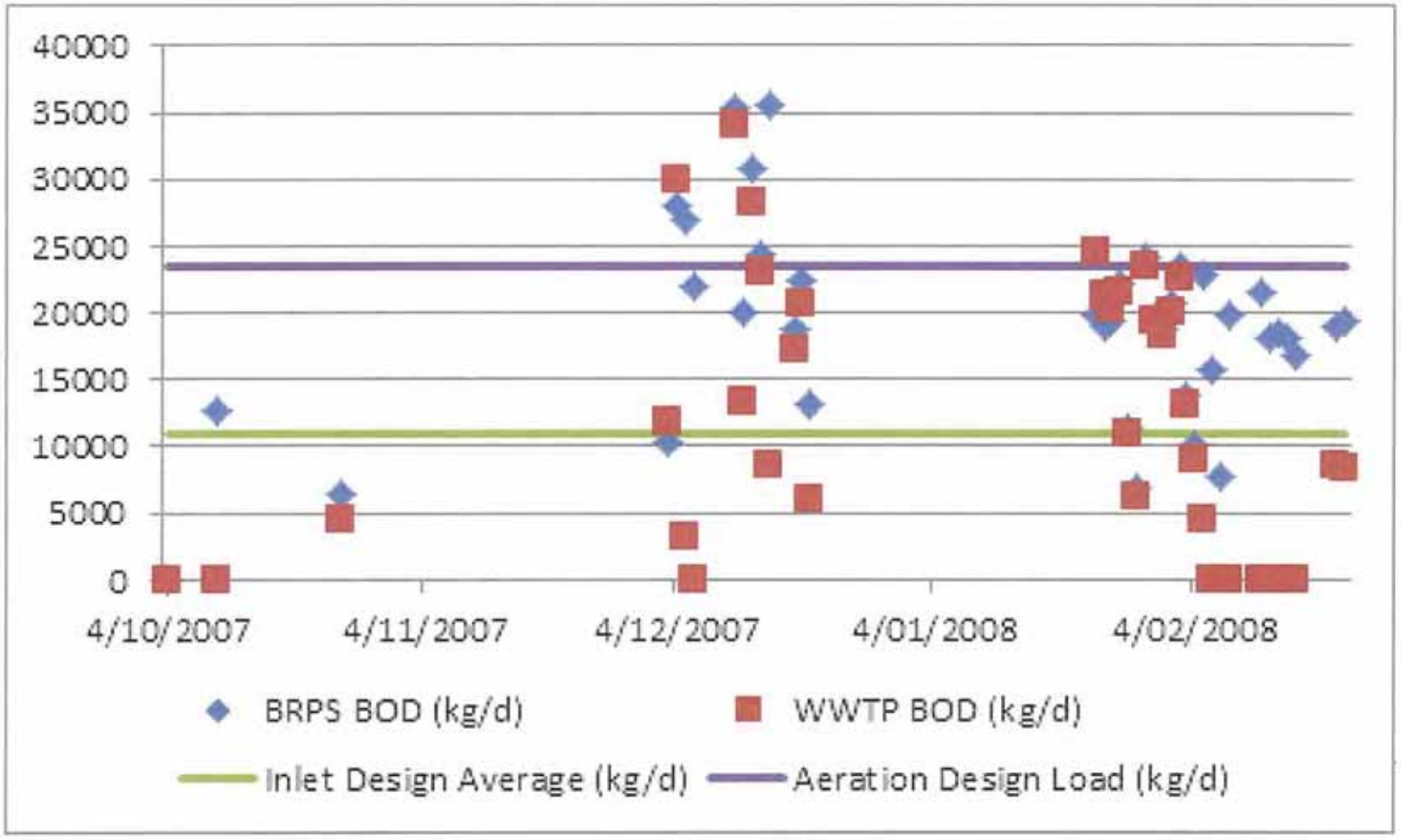
Peak Season 2007/08 BOD Loads on WWTP



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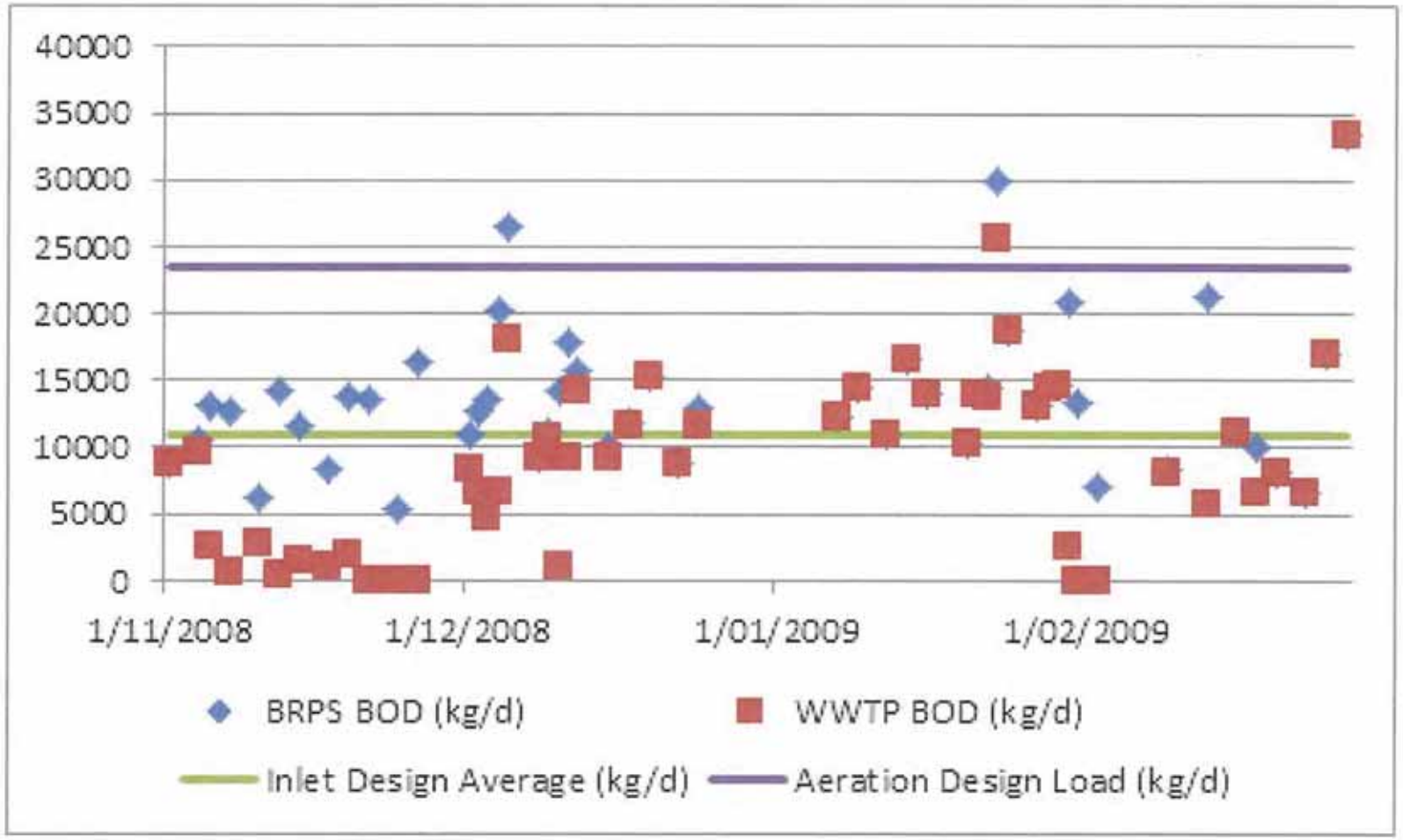
Peak Season 2008/09 BOD Loads on WWTP



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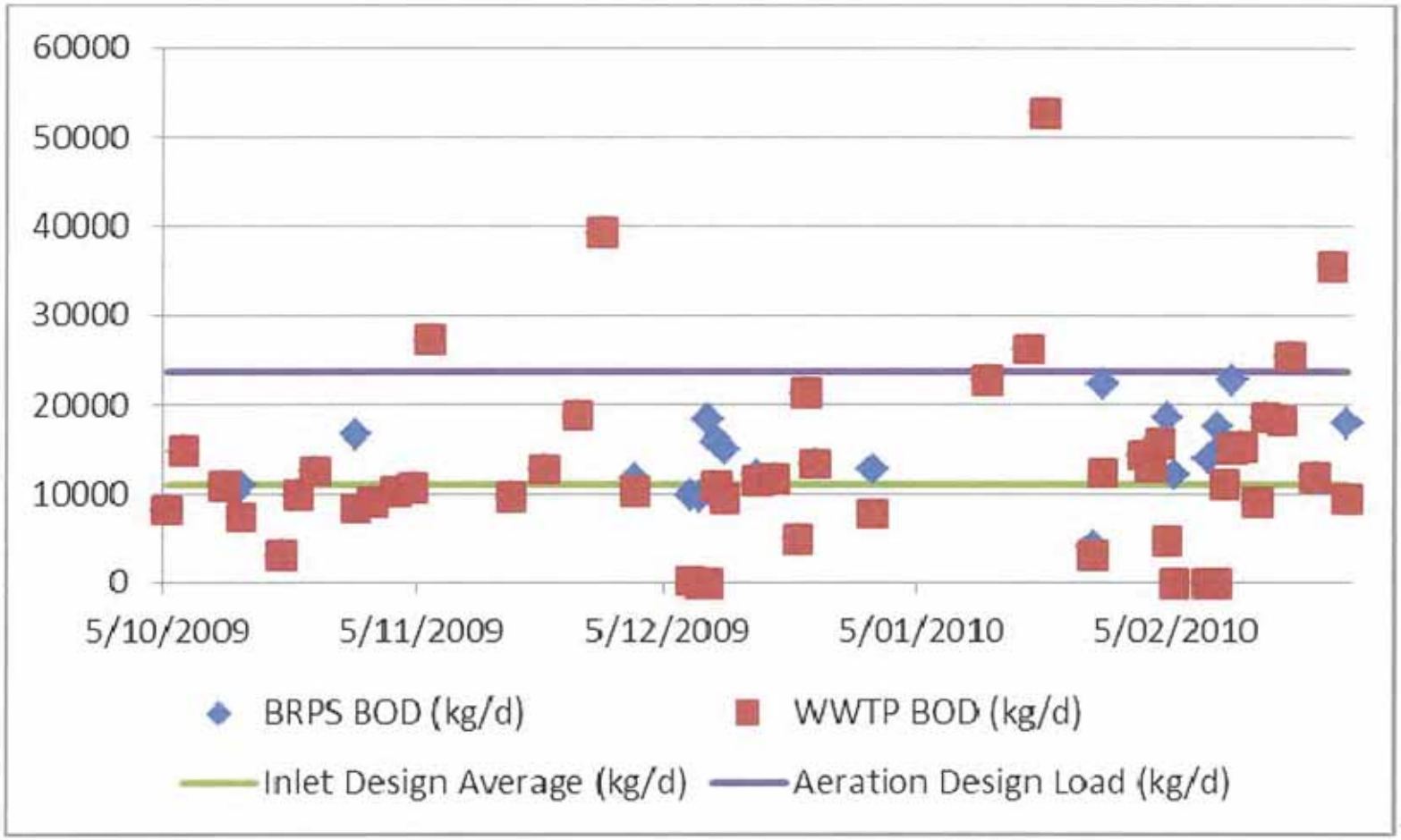
Peak Season 2009/10 BOD Loads on WWTP



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Actual Load on WWTP due to Bypassing to Ocean Outfall

- It is expected that 1 in 10 values would be greater than the 90 percentile design load
- There are some points above the 90 percentile aeration design load in 2007/08, but few in the next few seasons.
- By using the bypass to the ocean outfall, WDC protected the plant from higher BOD loadings during peak processing seasons.

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Overall Conclusions in Our Opinion

- The "Optimised Lagoon Process" did not have precedents, and attempted to combine all treatment functions into one lagoon
- Significant errors were made in the estimated sludge storage volume which resulted in the storage capacity being exceeded from about 2009/10
- Required aeration energy was significantly underestimated and no margins were applied (which is standard practice for aeration demand)
- Installed aeration energy disturbed the sludge layer and prevented full anaerobic digestion of the sludge. Further aeration would have caused more disturbance of the sludge layer.
- The concerns expressed by the 2004 Peer Reviewers were not appropriately addressed by MWH

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Questions

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Additional Slides

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Peer Reviewers Main Concerns in 2004

- *"The panel considers a number of the issues raised have not been adequately addressed. We raise what we consider to be five key points for further action or attention as follows:*
  - *The need for a rigorous risk assessment process covering the preferred option, the sewer separation process and trade waste dischargers;*
  - *Provision of calculations used for determining the proposed aeration requirements;*
  - *Provision of raw data to support claims made;*
  - *Confirmation of the longevity of the plant, particularly in terms of sludge inventory (refer to Section 8 of the query table);*
  - *The need to formalise the trade waste bylaw and trade waste agreements with significant dischargers to ensure adequate control of discharges is enforceable."*

Comment

- In the time available for this review, it has not been possible to determine the actions taken regarding the five matters listed above.
- It appears that the Peer Review Panel was not reconvened to review the Confirmed Process Design Report (MWH Report 11, October 2005), nor later design documentation.

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Table 5-1 Wanganui WWTP Effluent Monitoring Results Summary (2009 – 2012)

Parameter	Units	Basis	2009	2010	2011	2012	Resource Consent Standard
BOD	g/m^3	Median	76	121	84	80	n/a
TSS	g/m^3	Median	99	89	159	184	n/a
		95 %ile	222	212	241	390	100
Enterococci	cfu/100ml	Median	3,900	20,000	24,000	51,000	4,000
		Maximum	160,000	2,100,000	1,600,000	620,000	12,000
Faecal Coliforms	cfu/100ml	Median	7,500	22,000	86,000	260,000	10,000
		90 %ile	56,600	91,000	300,000	501,000	25,000

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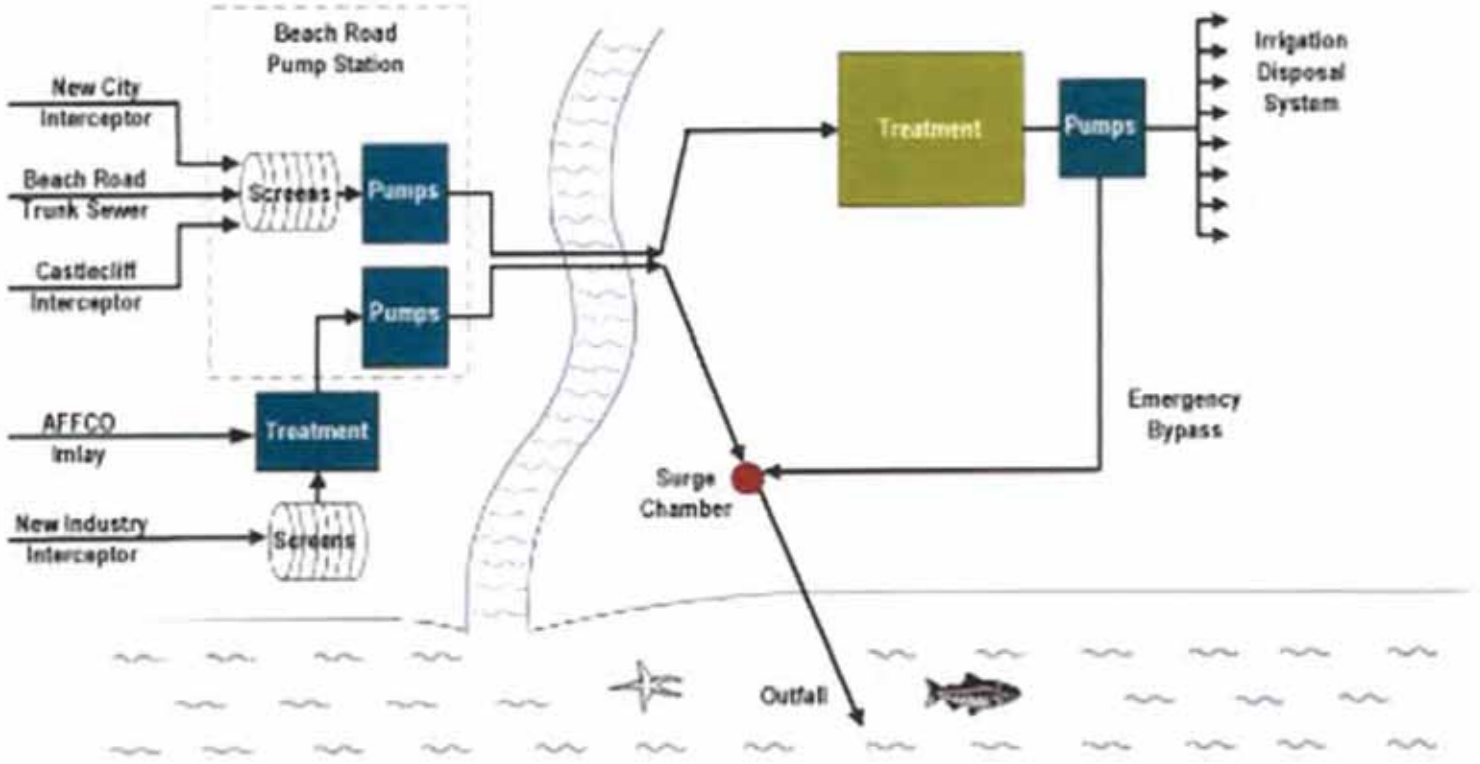
Figure 2-1 The 1992 Wastewater Scheme (from the AEE Summary March 2001)



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CH2M Beca Review Report
Appendix D Flow Diagrams

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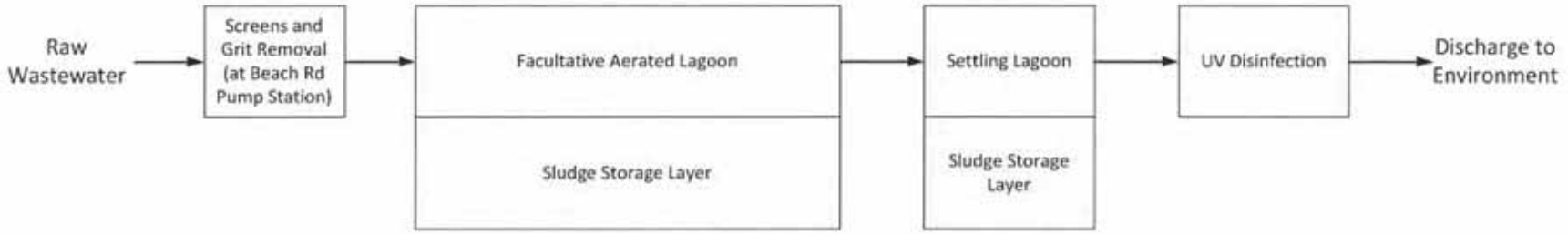
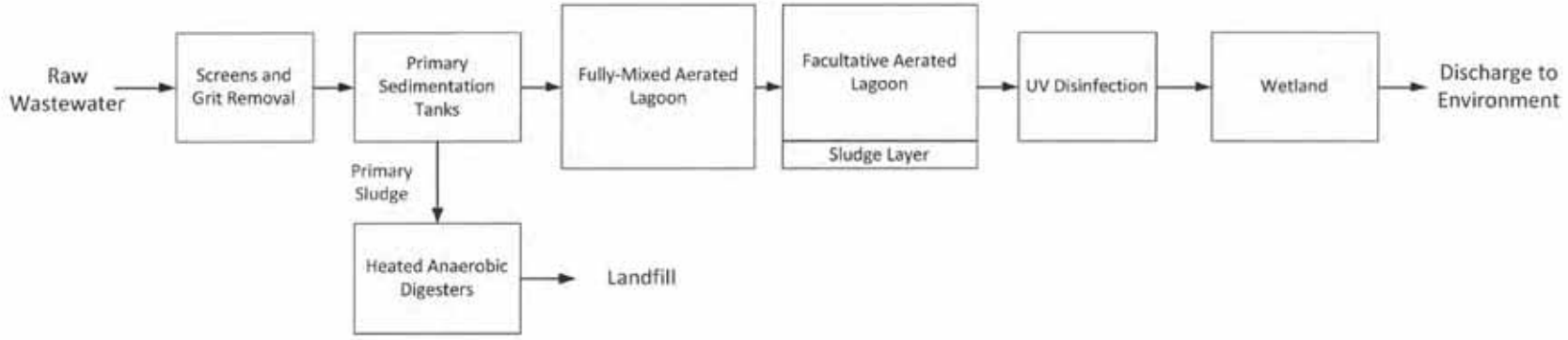
Comparisons of Wanganui to Other Aerated Lagoon Treatment Plants Referred to by MWH



Wanganui WWTP Flow Diagram (Municipal plus major industries)



Palmerston North WWTP Flow Diagram (Municipal)

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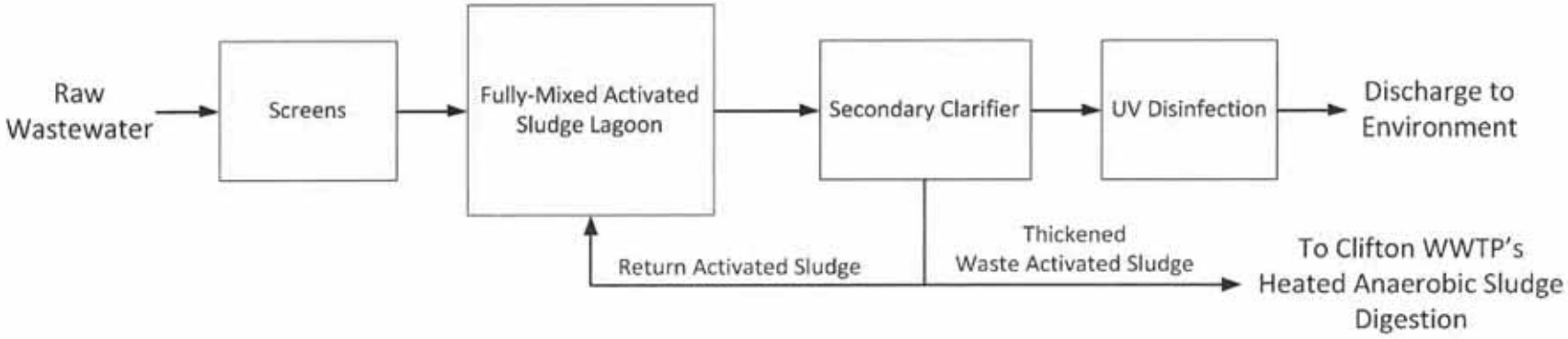
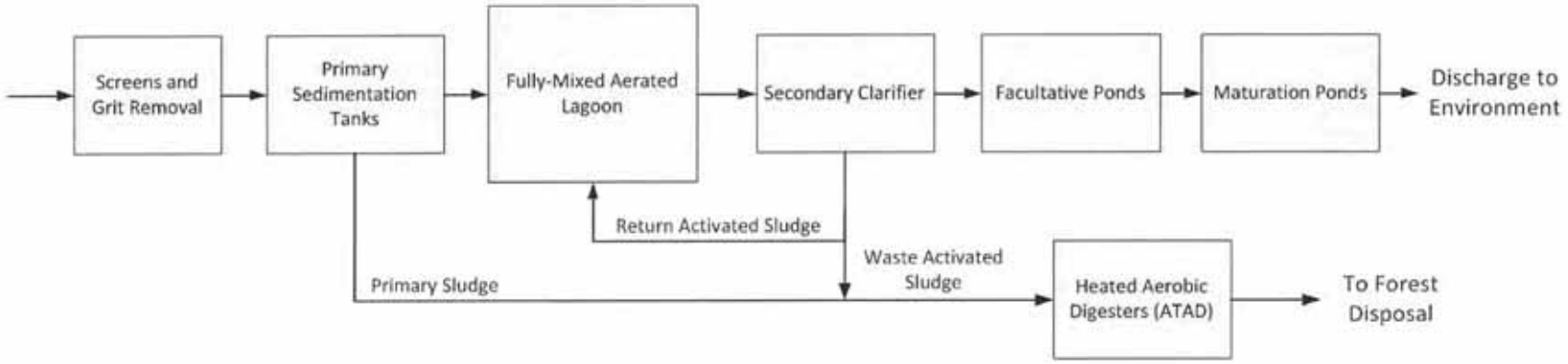
Comparisons of Wanganui to Other Aerated Lagoon Treatment Plants Referred to by MWH



Bluff WWTP Flow Diagram (Municipal plus Seafood Processing Industries)



Bell's Island WWTP (Municipal plus Major Industries)

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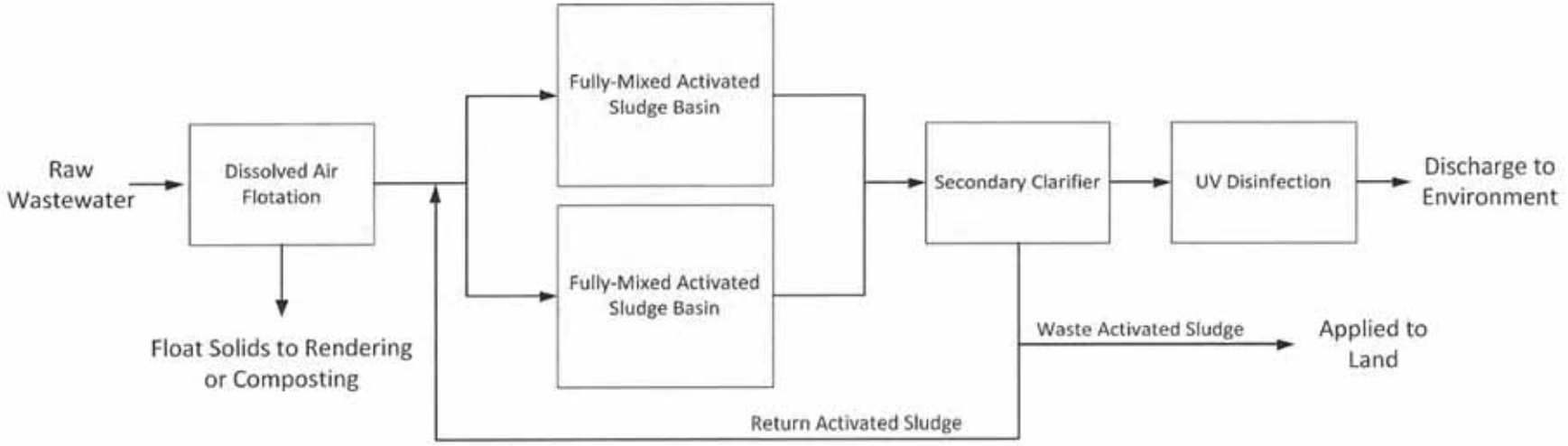
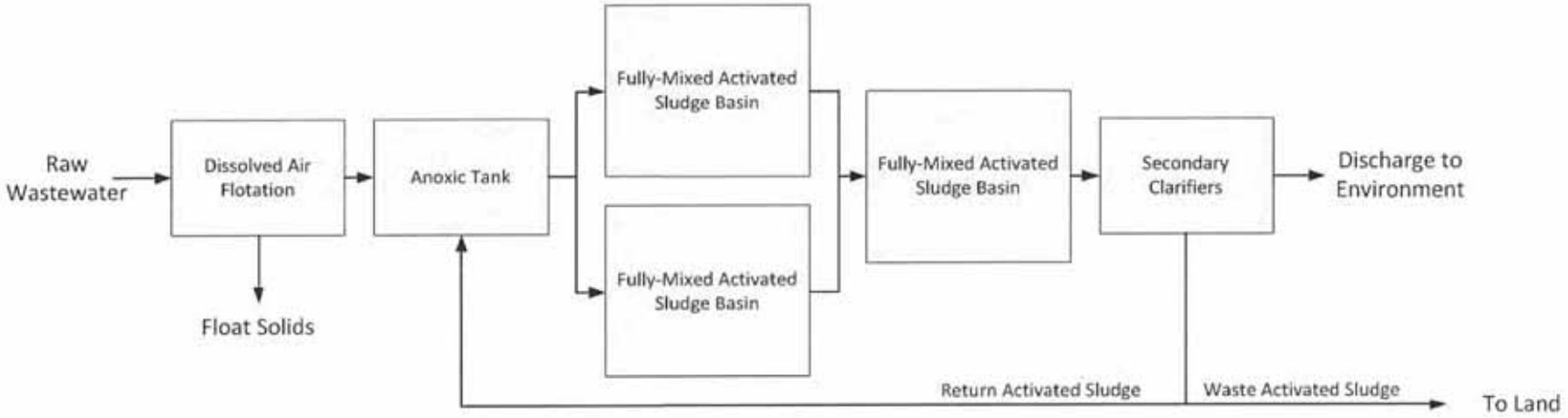
Comparisons of Wanganui to Other Aerated Lagoon Treatment Plants Referred to by MWH

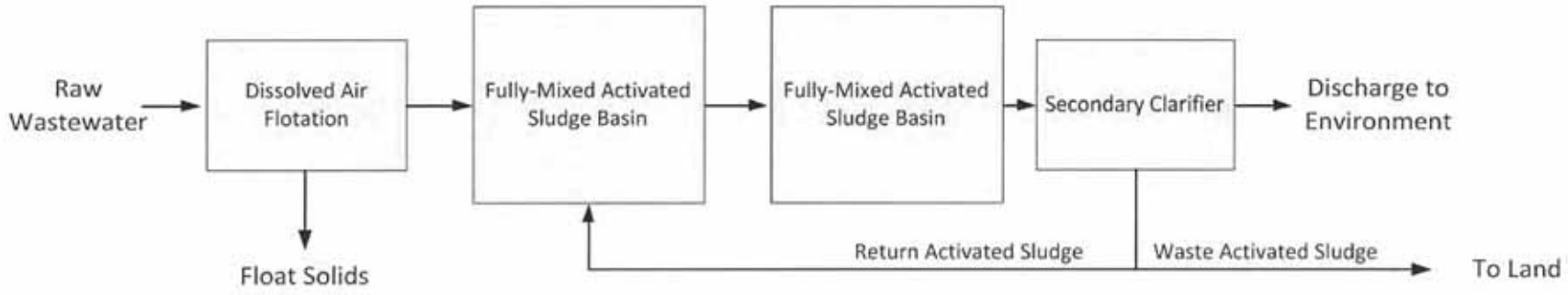


Alliance Pukeuri WWTP Flow Diagram (Large meat processing plant)

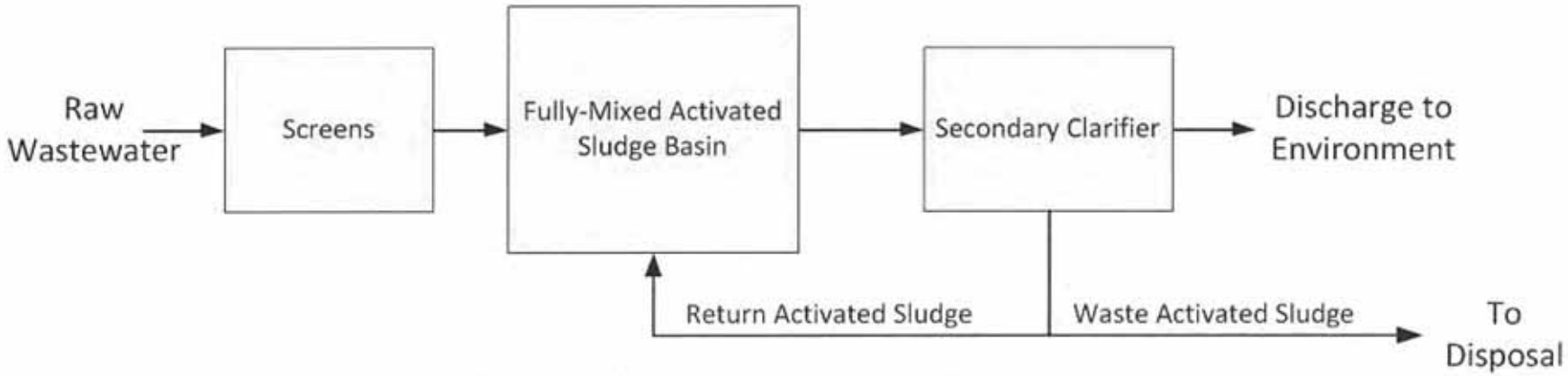


Fonterra Edendale WWTP Flow Diagram (Dairy Processing)

Comparisons of Wanganui to Other Aerated Lagoon Treatment Plants Referred to by MWH

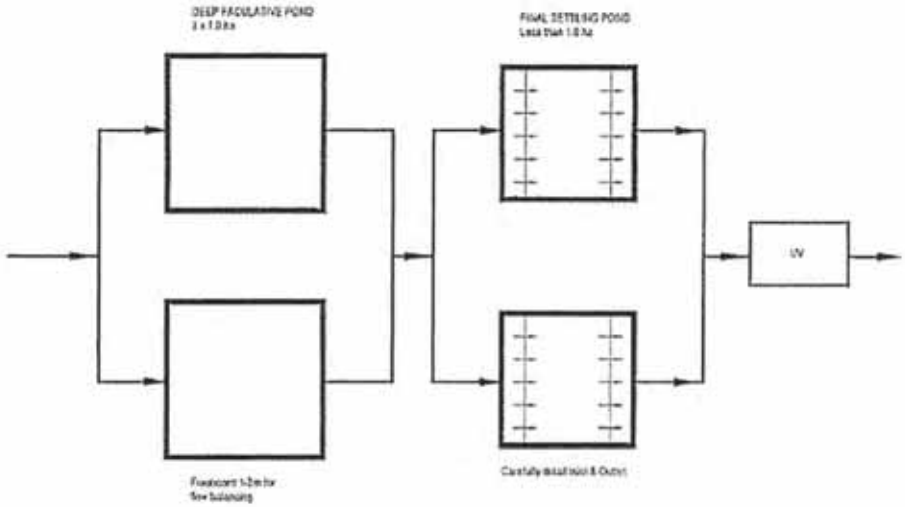


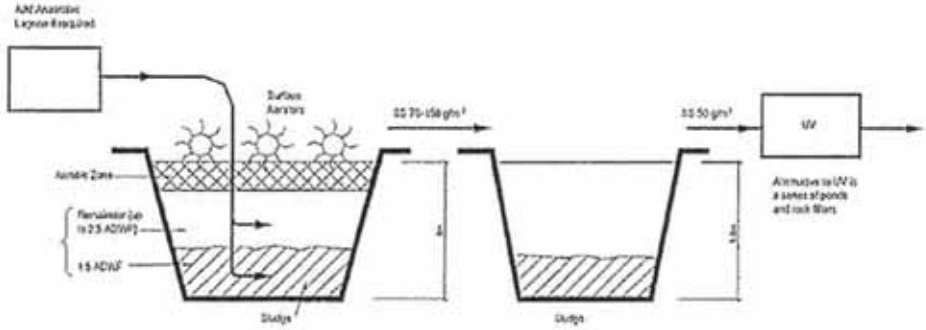
Fonterra Waitoa WWTP Flow Diagram (Dairy processing)



Open Country Dairy Waharoa WWTP Flow Diagram (Dairy Processing) Waikato

MWH Concept from Report 10 (2003)





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Minutes of the Meeting of the Wanganui District Council held at 2.00PM on Thursday, 17 January 2013 in the Council Chamber, Municipal Office Building, 101 Guyton Street, Wanganui

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Present: Ms Annette Main – the Mayor – in the Chair, Deputy Mayor Cr RM Wills, Crs AR Anderson, P Baker-Hogan, J Bullock, R Dahya, NA Higgie, MB Laws, HCS McDouall, RM Stevens, RV Vinsen and SM Westwood.

In Attendance: Mr AR Taylor (Chairman, Wanganui Rural Community Board).

Absent: Cr C Solomon.

Officers in Attendance: Mr K Ross (Chief Executive), Mr J Harkness (Deputy Chief Executive), Mr M Hughes (Infrastructure Manager), Mr D Boothway (Deputy Infrastructure Manager), Mr A Benadie (Senior Wastewater Engineer), Ms S Dudman (Communications Co-ordinator), Ms A Brown (Executive Assistant). Secretary: Mr M Hunt (Governance Services Manager).

Mayor Main opened the meeting and welcomed all present including several members of the public.

Council's Resolution
Proposed by Cr Bullock, seconded by Cr Higgie:

THAT Cr McDouall's apology for lateness be accepted.

CARRIED

Chief Executive's Comment

Kevin Ross, Chief Executive, advised the Council that an article in today's Wanganui Chronicle newspaper, written by retired Council Engineer, Colin Hovey, was Mr Hovey's own view of the Wastewater Treatment Plant Project and was not the view of the Council's present officers. He explained that Mr Hovey was not aware of some information on the Wastewater Treatment Plant project now held by the Council.

Cr Baker-Hogan joined the meeting at 2.05pm.

1. Wanganui Wastewater Treatment Plant

Significance statement – In terms of the Policy on determining significance, the recommended decision is not significant.

Mark Hughes, Infrastructure Manager, reports:

"**Introduction**
The purpose of this report is to outline the history and status of the Wastewater Treatment Plant and associated issues of trade waste and compliance, and to inform on the current activities being undertaken and planned.

Historical Timeline

Early 1960s – cases of typhoid prompt Medical Officer of Health to urge the Council to investigate the city's sewage disposal system. As a result, the Castlecliff interceptor, the Beach Road Pump Station and the sea outfall 1800 metres off South Beach were constructed.

Until 1972 – a 'single pipe' system collects both sewage and stormwater in Wanganui's streets and private properties and disposes of it via the Whanganui River.

1979 – Council begins upgrading wastewater system to improve the quality of the water in the Whanganui River and the Tasman Sea by stopping discharge of sewage into the river.

1992 – Council obtains resource consent for continuing combined sewage discharge to the Whanganui River, but future improvements are required. The Whanganui River Wastewater Working Party is formed and recommends a scheme to the Council. The scheme is adopted and resource consents obtained for it to be implemented over a 15-year period to 1 July 2007.

1993-1996 – interceptor system built.

2001 – stormwater separation begins in public streets.

2002 – stormwater separation begins on private property.

2002 – wastewater scheme amended, requiring full separation into separate sewers and stormwater drains, both on and off private property using the interceptor system to convey separated sewage and industrial trade waste (together) to the Beach Road Pump Station for screening. In the short term, the screened sewage and trade waste is pumped to the outfall. From July 2007, the screened sewage and trade waste will be pumped to a treatment plant and the treated effluent is disposed of to the outfall. Stormwater is discharged to the river.

Treatment Plant Design

At the meeting of the Wanganui District Council (WDC) Wastewater Treatment Working Group (comprising consultants MWH, Councillors and Council officers) held on 25 September 2003, Report 8 was presented which gave refined costs for the following options:

- Reference Case
- Partially Mixed aerated lagoon
- Advanced Integrated Pond System (AIPS)
- Advanced Integrated Wastewater Pond System (AIWPS)

The AeroFac system, a proprietary system of aerated facultative lagoons marketed by LAS International of the USA, was not included in Report 8 but was reported on in Report 9.

All of the options that were short-listed for consideration are based on aerated facultative lagoons with different variations such as lagoon size, aeration power inputs, and in some cases 'add-on' features such as trickling filters, clarifiers, or algae growing and settling ponds.

It appeared to MWH and WDC staff that it should be possible to identify the most desirable features of all the options and put these together in a form that could provide Wanganui with a process that best meets all the selection criteria.

MWH accordingly met with WDC staff and together developed an optimised lagoon process. The main features of the Optimised Lagoon Process are:

- It is based on two aerated lagoons operated in parallel (similar to the Partially Mixed Aerated Lagoon option)
- Each aerated lagoon is followed by a settling lagoon which acts as a clarifier (instead of the concrete and steel clarifiers in the Partially Mixed Aerated Lagoon option)
- The lagoons are all constructed with an additional depth of four metres designed to allow for sludge to accumulate over a period of 20 years or more without the need for any sludge management and disposal. This eliminates the high cost of sludge management and disposal for at leats 20 years. Several options have been identified for the sludge management after this time
- Effluent from the settlement lagoons is disinfected by a ultra violet (UV) system
- The process is designed to treat all wastewater inflows including high flows in wet weather by including freeboard in the aerated lagoons to provide storage and control the flow to the settlement lagoons and UV system.

This 'four pond option' was presented to the Wastewater Treatment Working Group by Report 10 in March 2005.

In August 2005, Report 11 'Confirmed Process Design' stated:

> **5.2 Revised Process Design**
> The initial process design as described above has been re-assessed to identify ways in which the capital cost might be reduced and the process simplified. As a result, the two aerated lagoons have been re-designed as a single lagoon with a 'natural' shape that can be fitted into the existing 'valley' at the site to minimise earthworks and improve the aesthetics of the treatment plant. The two settlement lagoons have been reduced to a single lagoon with a 'natural' shape that can be located within the contours of the site.

A peer review process was also reported on:

> **5.3 Peer Review of the Optimised Lagoon Process**
> A peer review of the Optimised Lagoon Process was carried out by Opus and URS. Their review raised a number of questions and potential risks that have largely been addressed. However, some of the issues they raised cannot be answered with complete certainty, and it is recognised that the detailed design of the treatment system will need to provide contingencies to react to the possible risks.
>
> The main issues that concerned the reviewers were as follows:
>
> - The Optimised Lagoon Process is designed to provide a solution over the term of the existing consent and postpones the management of sludge. The reviewers were concerned that Council realised that the proposed scheme may not be viable beyond the period of the consent if conditions in a new consent change.

- The reviewers raised the need to define as well as possible the trade waste discharges and raised the need for Council to formalise trade waste agreements with the industries. A detailed assessment of trade waste discharges has now been made and is contained in Appendix 2. Council intends to formalise trade waste agreements when the charges can be confirmed following confirmation of the costs of the Optimised Lagoon Process.
- The reviewers raised the risk of defining the wet weather flow impact on the Optimised Lagoon Process after separation is completed. The risk is recognised, and considerable effort has been made in preparing this report to assess the probable wet weather flows after separation.
- The reviewers questioned the calculation of sludge generation and storage. It is recognised that the estimates made were theoretical and will not be able to be substantiated until the Optimised Lagoon process has been in operation for some time. Nevertheless, literature reports support the calculations (see Section 7.5). In addition, there are contingency options available if the sludge accumulation exceeds the estimate, particularly the option of pumping sludge out of the lagoons for disposal as discussed in Section 8.
- The reviewers questioned the estimated extent of carry-over of SS from the aerated lagoon into the settlement lagoon in the Optimised Lagoon Process. In order to investigate this concern, tests were carried out at the Palmerston North wastewater treatment plant on the SS concentration in the aerated zone of the aerated lagoon and the SS concentration in the effluent from the settlement zone. These tests confirmed the estimated performance of the settlement lagoon in the Optimised Lagoon Process.

Up to this point the new wastewater treatment plant was designed to treat all the flows that were expected to occur after completion of the stormwater/sewage separation works.

However, it was realised that the anticipated costs of achieving complete separation of the Wanganui sewage system were much higher than the estimated costs of enlarging the capacity of the proposed treatment plant to treat the wastewater flows from a partially separated sewage system. Therefore, in early November 2005 the decision was made to enlarge the design capacity of the proposed treatment plant and thereby defer some of the separation works.

Minutes show that at the Council's meeting of 19 December 2005"

> 'The Wastewater Project has been reviewed to ensure that the project has been optimised prior to commitment to final design and works programmes for the treatment plant and public separation. This optimisation review requires Wanganui District Council's approval before proceeding further.'

The Council approved the revised works programme and budget and that detailed design of the wastewater treatment plant be commenced.

Detailed design and tender were completed and construction started in July 2006.

Wastewater Treatment Plant Operation

The treatment plant began operations on July 2007 with an official opening in September 2007.

Odour problems arose soon after commencement of operations. Media reports and releases by the Council referred to 'Ponganui' and daily updates on programmes for alleviating the various problems were prepared for the Mayor and Councillors.

The minutes of the December 2007 Council meeting records:

> **'Issue**
> During commissioning it was found that the aerators were not performing to full aeration capacity. This is key in terms of the odd days where very high peak tradewaste and sewage loads going to the plant and not being full oxygenated. Odour is a result of insufficient oxygen on these days providing full process.
>
> The settling pond (the smaller pond) has received low oxygenated effluent and therefore requires over-oxygenation and flushing.'

The contractor delivered and installed greater capacity turbines to double the aerator capacity.

The minutes of the January 2008 Council meeting record:

> 'Mayor Laws expressed his further concern about the continuing problems with odour from the wastewater ponds and asked Julian Reweti, Infrastructure Manager, to comment. Mr Reweti said a team of engineers and scientists were taking a multi-prong approach to solving the odour problem and to optimise the technical aeration level. The aeration of the large pond had been doubled in capacity and MWH, consultants, advised oxygen levels would rise in time.'

The minutes of the February 2008 Council meeting record:

> **'Wastewater Treatment Plant**
> - Aeration and performance update
>
> Currently the waterwater treatment plant is receiving both industry and residential loads. An assessment is under way to determine the quantity and quality of loads coming from industry. The quality from industry and industrial pre-treatment performance has an impact on the performance of the wastewater plant.
>
> A sampling programme is two weeks into a four week schedule.
> - The turbine/aeration capacity has been doubled but at this stage oxygen levels are only slowly increasing.
> - Additional work is under way to further increase aeration by increasing propeller performances and pitch angles. Trialling commences beginning of February 2008. Plus a further aerator is being prepared for use, and a compressed air system being considered.
> - The settling pond has developed a scum layer which is being sucked out and broken up. This will continue as any scum appears.
> - The previous non-oxygenated nutrient at the plant means that oxygen levels will take time to rise as the nutrient is treated.'

The minutes of the April 2008 Council meeting record:

'Wastewater Project Treatment Plant

- Commissioning of the UV facility is programmed during March 2008.
- Improved aeration of main lagoon is being undertaken:
  - Trial modification of aerators suggests that further improvement is possible without compromising warranties with the suppliers.
  - Stage II (2008/09) main lagoon aeration increase included within the Council's Draft Annual Plan 2008/09.
- Odour control of settling lagoon:
  - two mini aerators are in operation to provide a surface layer that is oxygenated.
  - two further mini aerators are due for installation between 17 and 24 March 2008.
  - Installation of a sludge removal pump is being undertaken from 18 March 2008 (this may generate temporary odour issues).'

The May 2008 Council meeting minutes record a summary and update of the issues:

'Wastewater Project: Upgrade and Odour Issues
Rick Grobecker, Deputy Infrastructure Manager, reports:

"The Wanganui Wastewater Plant was designed by MWH and constructed under eleven physical works contracts, managed jointly by Wanganui District Council and MWH. Biological commissioning of the plant commenced in July 2007.

Unpleasant odour issues have been experienced from the plant since November 2007.

The design loadings to the plant were determined from industrial and combined flow testing undertaken in 2005. The plant is designed on a two pond basis, an aerated lagoon in which the biological load is broken down followed by a settlement pond. Aeration to the effluent is provided through 17 floating surface aerators.

The specification for the aerators required that 935kW (17x55) of aeration be provided. This specification was based upon a normally aspirated aerator with a transfer efficiency of 1 kg O^2 per 1 kW Hr.

Wanganui District Council contract 1260 was awarded to Trimate for the sum of $766,646 for an alternative 'blower assisted' aerator with a transfer efficiency of 1.33kg O^2 per kW hr.

17 @ (45+5.75)kW x 1.33 implies 1147kW equivalent output.

Payment for the 'high efficiency' motor is dependant on satisfactory test data.

'On site commissioning and testing' by Trimate was restricted to functional testing only and not oxygen transfer testing.

During commissioning of the aerator, it was identified that:

- The main motor was 'overloaded';
- The blower motor was not adequately 'matched' to the main motor.

The combined effect of these issues being that the efficiency of converting electrical power to dissolved oxygen was being compromised.

The supplier progresses these issues by modifying the propeller and replacing all blower motors with higher capacity units.

The supplier has not fully commissioned the units or satisfactorily demonstrated that the unit, as installed, is capable of achieving 1.33kg O^2 per kW, and as such payment ($175K) in this regard is being withheld.

The process design of the plant requires that the effluent at transfer from the aerated lagoon to settlement pond has a dissolved oxygen content of 1%. Currently readings are 0.3%, marginally higher than 0.25% recorded before the blower motor upgrade.

It is evident that only partially treated effluent has been transferred to the settlement pond, this in turn has created anaerobic conditions and resulted in unpleasant odour being released from the settlement pond. The odour of the aerated lagoon is considered 'normal'.

During December 2007 loads in excess of the plant's design were experienced. In the period January 2008 to date, combined loads to the city's main pump station have consistently been at the upper end of the plants design capacity. The design report for the plant acknowledges that industry contributes approximately 80% of the load to the plant and, as such, limited overloading can be accommodated by using the non-industrial periods (weekends) for the plant to recover. The addition of the further aerators was always envisaged to deal with plant expansion. The plant's biological designer has visited the plant on a number of occasions and maintains that the basic issue is a lack of efficient aeration within the aerated lagoon.

In order to minimise unpleasant odour release until the aeration efficiency/capacity is resolved, the following actions have been undertaken.

- Minimise loading to the plant. (Divert to sea, breaches Resource Consent);
- Adjust – remove scum baffles;
- Addition of chemical – oxidization agents at transfer;
- Introduce sludge pump to settlement pond;
- Alter angle of aerators;
- Trial modification to aerators;
- Introduce surface aerators to settlement pond.

Since the introduction of these measures unpleasant odour release has been minimised. However the dissolved oxygen levels at transfer have yet achieve the 1% required – as such the addition of more aeration capacity to the aerated lagoon is being progressed in conjunction with continued attempts to improve the efficiency of the existing aerators.

An upgrade design has been received from the designers – which has been modified further due to Wanganui District Council staff concerns.

With the exception of the aerator supply the upgrade packages have been awarded to the original plant contractors as variation to their original contracts, on a negotiated basis.

Alternative methods of aeration have been considered and a trial aerator from an alternative supplier is to be tested (in situ) by Wanganui District Council's staff prior to committing an order for any further lagoon aerators. Delivery will probably be ex-USA and will take, typically, three to four months.

A number of the existing aerators have developed bearing failures to their lower shaft assemblies. These are being investigated and replaced by the supplier. The supplier is questioning the original aeration capacity (kW) of the plant. Testing is on-going to determine the biological process currently occurring through the lagoon and to determine if any short circuiting of the process is occurring."

Discussion
The Finance and Administration Committee agreed the Wastewater Project: Upgrade and Odour Issues report be updated six weekly.'

Further concerns on performance and odour are recorded in June 2008. In August 2008 improved odour control is reported and in June 2009 Council minutes record:

'8 June 2009
Wastewater Treatment Plant Update
Rick Grobecker, Deputy Infrastructure Manager, reports:

"Physical construction of the wastewater treatment plant was largely concluded in June 2007. The plant was officially opened in September 2007.

In December 2007 the plant was overloaded with considerably higher biological loadings than it was designed for. This resulted in unpleasant odours being experienced. This situation was exacerbated throughout the summer of 2008 by the prolonged drought.

Operational procedures have been adopted which minimise the biological loadings sent to the plant and have effectively controlled the release of unpleasant odour since March 2008.

One of the issues identified, which contributed to the odour was the non-performance of the mechanical aerators. These were procured and installed under a single contract. Negotiation with the contractor eventuated in a replacement aerator being offered, at no additional cost to Wanganui District Council. These replacement aerators are currently in transit from USA, and are due for deployment on the aerated lagoon from the end of May 2009.

A number of other modifications have been undertaken to the plant which have continued to improve its performance.'

Further, the July 2009 minutes record:

> **'20 July 2009**
> **Wastewater Treatment Plant**
> Twenty-three new aerators have now been installed at the treatment plant, comprising 19 replacement units and an additional four new aerators. Dissolved oxygen levels have responded well to the new units. Commissioning works will continue over the next few weeks.'

August 2009 minutes record some problems arising with trade waste:

> **'31 August 2009**
> **Wastewater Treatment Plant**
> The new wastewater treatment plant continues to operate effectively, although treatment quality took some time to adjust to increasing loads from Affco's Imlay plant as they moved to double shifts. Operational commissioning works continues.
>
> Problems have been experienced at Beach Road pump station, with large volumes of animal by-products blocking the screens. Discussions are being held with the major industries to identify the source of the problem and put in place practical remedies. Levels have responded well to the new units.'

October 2009 minutes record:

> 'In parallel with the construction of the new Wastewater Treatment Plant, the Council has been undertaking betterments to the monitoring and control of trade waste discharge . . .
>
> **Conclusion**
> The Council is in the process of changing the wastewater modis operandi from an 'anything goes' mindset (historically all wastewater was discharged directly river to sea) to a 'responsible discharge' mindset. The Treatment Plant has limitations of treatment capability which necessitates Industry pre-treatment to various levels and requires good 'housekeeping'. It must be remembered that WDC is fully accountable to meet its discharge consent with Horizons Regional Council, and that the Council's Trade Waste consents for industry are a vital tool for control to ensure excellent environmental outcomes.'

Trade waste calculations continued and a model to apportion costs to industries refined to reflect the loads each were sending to the plant.

Trade waste industries were invited to participate in tours and discussion and also made submissions.

By 2011 the WWTP had still not performed as designed. WDC had not met the requirements of its Resource Consent for any year since opening including the last 2010/11 year.

Odour complaints were still being received, mainly from the airport users and residents of Castlecliff and Gonville.

The operating costs (mainly for electricity) to run the aerators, pumps and UV plant were far higher than expected.

WDC commissioned Cardno BTO, a well respected international group of specialists in wastewater treatment and process engineering, to review the WWTP and prepare a ten year upgrade implementation plan.
A capacity review, hydraulic review, process performance review and asset condition assessment we carried out to compare the actual performance and capacity of the WWTP to that of its design and Resource Consent requirements.

Some relevant extracts from this report state:

> The Wanganui WWTP was commissioned in July 2007. The plant treats a consented average daily flow of 30,000 m^3/d; up to 80% of the load to the plant is from industrial trade waste discharges (MWH Design report, Nov 2005)
>
> . . .Since the plant was commissioned, it has struggled to achieve consent compliance through poor performance of the treatment process, meaning that the UV cannot operate effectively.
>
> . . . As the treatment process does not follow a standard textbook design and it has a sludge storage "layer" underneath the aerobic treatment 'layer', it is not possible to guarantee the performance of any of the proposed upgrades. The upgrades are based on first principles parameters, biologically modelled, and thoroughly reviewed to determine their feasibility based on best practice engineering design.
>
> However, the exact effect of the sludge storage layer is difficult to define given there are minimal other examples to compare with; there is minimal information or studies available on the effects of mixing sedimentation and subsequent release of organics from the sludge to the liquid phase in the treatment configuration. The upgrades provided in this report are designed to improve the performance of the plant, but an alternative approach to the implementation may be required.
>
> . . .The lagoon was designed to be a 'plug flow' reactor (approximately 80-100m wide by 400m long) but shaped in a curve. The curved shape was supposed to provide a 'natural' looking lagoon which fitted into the existing environment. In reality it provides areas of dead zones which are not covered by the mixing action of the current surface aerators.
>
> . . .A deficiency of the design is that there is no mechanism of retaining the biomass in the area where the raw sewage or 'food' is discharged into the lagoon, as is possible in a typical process such as a completely mixed lagoon or an activated sludge treatment process which has a return activated sludge stream. There is also no mechanism to maintain the biomass in the active treatment layer of the lagoon. The horizontal mixing provided by the aerators, and also the plug flow effect of the lagoon shape, means that any biomass produced in the inlet area (where it is most required for treatment of the load into the lagoon) is constantly being moved to the far end of the lagoon and settling out into the bottom storage layer of the lagoon.

. . .Aeration is concentrated in the first 'zone' of three zones in the lagoon. The zones themselves are not separated by baffles so wastewater flows through the pond via the shortest circuit.

The original aerators were designed to direct flow as well as provide aeration. The original aerators were replaced, due to concerns with condition and poor motor performance; the replacement aerators are a non-directional type of aerator designed for efficient surface aeration. Since the new aerators have been installed, varying number of aerators have been operating. Currently a large number of aerators are sitting on the side of the lagoon, un-operable, due to mechanical issues with these motors also.

. . .While the aerators maintain relatively good surface aeration in the immediate vicinity of each aerator, they are unlikely to provide effective vertical mixing. The aerator selection would probably be different (i.e. targeting effective vertical mixing to maintain biomass in suspension in the treatment zone), if the process design focus was to provide effective biological treatement like in an aerated lagoon or activated sludge process. The overall effectiveness of the mixing/ aeration over the entire lagoon surface was not discussed in the Commissioning report; based on observations during the BTO site visit, some side areas of the lagoon not covered by aerators appeared 'dead'.

Originally the plant was only designed for a BOD load capacity of 23,536 $kgBOD_5/d$, as calculated by the installed aeration capacity. Since the aerators have been changed, the new aeration capacity is theoretically equivalent to 35,820 $kgBOD_5/d$ (MWH Commissioning report, 2010).

. . .Trade waste consents for six major industries have a total maximum BOD load of 32,280 $kgBOD_5/d$. The load contribution from domestic wastewater is estimated by the designers to be 2,430 $kgBOD_5/d$, from a contribution of 65g BOD per capita per day. This is a maximum total load of 34,710$kgBOD_5/d$. While the aeration capacity appears to be directly sufficient for the BOD load, this calculation does not take into account the effectiveness of the aeration transfer, the biomass present in the lagoon for oxygen uptake and subsequently wastewater treatment, or whether industrial contribution is accurate.

. . .There are several older directional aerators located on the settling pond; these are used periodically in an attempt to reduce odour from the plant. These will decrease the sedimentation action of the pond. These should not be required if the treatment performance is working correctly in the aerated lagoon.

. . .When sizing the treatment capacity, the designers made no provision for expansion of the population or industry over the 25 year life of the consent. This was because the designers considered that the population is decreasing rather than increasing, and it is impossible to determine industrial expansion or reduction as it depends largely on economic factors rather than population monitoring.

. . .The Wanganui wastewater treatment plant process does not follow any standard wastewater process design.

. . .The quality of the effluent at the transfer station is indicative of the poor treatment performance of the aerated lagoon.

. . .The treated wastewater out of the settling pond has a high solids concentration – it consistently does not meet the resource consent suspended solids limit 100g/m^3. Therefore, it also does not meet the UV system feed specifications of 75g/m^3.

. . .**Summary of Process and Capacity Issues and Risks**
Based on the plant reviews, a list of process and capacity issues and risks have been identified, as summarised in table 3.8. It is not straightforward to categorically state whether each piece of the treatment process has 'failed', since relatively few design and operational performance parameters were provided by the designers for the aerated lagoon and settling pond. However, the accumulation of poor performance through the treatment processes ultimately results in a failure of the resource consent.

Table 3.8 – Summary of process and Capacity Issues and Risks

System Issue	Risk/ Effect
Lack of a viable biomass in aerated lagoon, resulting in poor treatment i.e. poor solids removal.	Without a biomass population effective treatment performance in the aerated lagoon cannot be achieved.
High aeration power use for relatively poor effluent quality.	High operating cost.
Plant does not achieve consent compliance – TSS, faecal coliforms, enterococci.	Effect on discharge environment. Prosecution from Regional Council.
UV system difficult to operate; treated effluent outside of quality specifications for UV system.	High operational costs (manual cleaning, bulb replacement, high power usage). High faecal coliform concentrations in effluent (resource consent failure).

In relation to asset condition, detailed assessments were made. In summary:

. . .The condition of the WWTP is good overall, as expected for a plant of four years. The expected life of equipment of this type of asset would usually be approximately 20 years.

The report identified a number of potential short and long term options to upgrade the plant. These options were iterative and each next step was dependant on the success of the previous. The most likely options for the next four years were selected for the purpose of including the capital costs in the 10-Year Plan.

A sludge survey was conducted in December 2011. This confirmed the assessment by Cardno BTO that the biomass was quickly moving to the rear of the pond and the sludge build up was higher than forecast especially at the transfer, where it had reached 4.37 metres.

As a first step chemical dosing was jar tested. It found that whilst dosing could be installed at the transfer station to improve wastewater quality, the treatment performance in the

aerated lagoon was poorer than had been previously reported and the costs of this option would be too high (an additional $710K per annum), plus other measures would still be required as well to reduce bacterial levels.

An alternative to chemicals was sought and the option of bio-augmentation for the treatment of the active anaerobic sludge pursued.

By now the 2011/12 resource consent report had shown that the consent conditions were still not being met and the gap was continuing to increase.

In addition aerator failures were increasing at a very high rate and the ever present odour issues were increasing as the capacity of the plant to handle the waste being sent to it decreased.

Proposals were sought and a tender undertaken for the bio-augmentation treatment of the sludge.

This treatment commenced at the end of October 2012 for a trial period of six months. Its aim was to try and stop the sludge accumulating any further and to encourage the anaerobic treatment of the sludge already there.

Six weeks into this trial the plant received very high and unexpected trade waste loads which it was unable to cope with. This was followed by two further discharges of un-consented waste over the Christmas and New Year periods.

Intensive manual supplementary treatment and waste product removal slowly brought the plant back to where it was before these wastes were received but they were unable to prevent an increase in odour production from the plant. The effect of the odour was very noticeable and the City was affected badly due to the low wind speeds and its direction for the period being over the City.

The actions undertaken during this time have been reported to the Councillors and the media three times a week, every week.

Current Activities

Bio-augmentation of the sludge is continuing. A sludge survey conducted last week has shown that the increase in sludge has stopped.

An 'atomised fence' around the ponds is due for completion this week. This will help to mitigate the odour leaving the plant. It will not eliminate it but will reduce it and help to address the Abatement Notice issued by Horizons Regional Council. Please note it will take a few days of trials with different products at different concentrations to find the most effective mix.

The existing aerators have been switched on for trial periods but have dragged too much sludge to the surface causing even more odour to be released.

Variable speed drives have been fitted to two aerators and trials are underway with these.

Submersible directional aerators are being obtained from Central Hawke's Bay Council where they are surplus to their needs. The first batch is expected by Friday ready for installation to commence next week.

Manual dosing of waste stream at Beach Road Pumping Station is continuing.

Manual nitrate dosing at the transfer station is continuing.

Surface dosing of the ponds by boat is continuing.

NIWA has assisted with measuring dissolved oxygen levels at different levels and different locations in the main lagoon. As a result; the existing probes are to be replaced urgently; biomass is not being held in the main lagoon and this has to be corrected as soon as possible (the CHBC directional aerators will assist).

The trade waste entering Beach Road is being closely monitored and samples taken from individual industries when any heavy loadings are received. Alternative sampling methods are being actively pursued and trials on a new semi-automatic method will commence in two weeks.

Next Steps

Recent investigations have cast doubt on the trade waste assumed to flow into the plant over both the design and operating periods to date. Recalculations were still being done in 2010 and now all measurements and assumptions are considered suspect and will be built up from scratch over the next month.

Cardno BTO are on site late this week and advice will be sought on:

- Any additional immediate measures that can be taken to address odour and treatment
- To determine whether it is viable to continue with this plant
- If viable, which options to achieve satisfactory performance are available for completion over the next two years
- If not viable, then establish which type of plant would be suitable for Wanganui's waste and what size that would need to be.

The time frame for the above with indicative costs is estimated at three months."

Discussion

Mr Hughes answered Councillors' questions:

There had not been an independent examination of Wastewater Treatment Plant (WWTP) project documents or operation prior to 2012.

In 2011 Cardno BTO was asked to assess options to improve the WWTP. Mr Hughes thought the report was not given to Councillors.

The previous Infrastructure Manager (Julian Reweti) had not been contacted by Mr Hughes to discuss the Cardno BTO report, as current engineering staff were actively involved in commissioning the report and working with the recommendations. The Chief Executive had contacted Mr Reweti to discuss the matter.

Mr Ross, Chief Executive, explained that the implications of the Cardno BTO report were included in the 10-Year Plan discussions and the current 10-Year Plan. The level and extent of the present problems, however, had not been anticipated.

Mr Hughes considered that project documentation from 2004 and the Cardno BTO report indicated some design short-comings. Since the WWTP's opening in 2007 staff had taken action without addressing the underlying causes of plant failures. He believed that a review of the WWTP should have been done before 2011. Whilst reports suggested that the WWTP was under control and operating properly, the review recognised that the plant had never met the conditions of its resource consent, although it had operated within those conditions during winter months.

In response to a Councillor's question about the early changes to the aerated lagoon design Mr Hughes and the Chief Executive explained that as the Waste Water project was large the Council was always seeking ways to be more efficient and to save funds. Mr Ross said three consultants had reviewed the plant proposal and were consistent in their findings. The design changes were adopted by the wider Council in 2004.

Responding to a Councillor's suggestion that the Wanganui WWTP was experimental and whether the Council was made aware of any risk in the design, and was there any professional liability by MWH (NZ) Ltd, Kevin Ross explained that the original design changes were made as part of a project process but since then further design alterations to the WWTP have been made causing difficulty in apportioning responsibility for a design fault. To a further question Mark Hughes said the Cardno BTO report identified performance options in their 2011 report. These, now subject to the Council's 10-Year Plan would move forward over a four year period.

Councillors queried points in Colin Hovey's Chronicle newspaper article. Referring to page 8 of his report Mark Hughes explained that whilst the WWTP did not meet the Resource Consent requirements, the plant was functioning. The Resource Consent only allowed diversion to the sea in an emergency situation. The ponds could be 'flushed' now but a lot of nasty material would be discharged into the sea in breach of the Resource Consent. Mr Hughes further explained the intricacies of 'flushing' the lagoons, the reason for 'odour' and the work undertaken during the Christmas/New Year period to clear sludge.

Cr Westwood left the meeting at 2:42pm and returned at 2:45pm.

Mark Hughes commented on the aerosol/atomiser deodorisers being strategically located around the lagoons to counter the odour, emphasising that this system should contain the odour within the WWTP boundary but would not eliminate the odour.

Asked if the WWTP performance could be improved to meet the Resource Consent conditions Mr Hughes referred the Council to page 15 of his report, noting Cardno BTO would be on site later this week to advise and determine whether it is viable to continue with this plant. To a further question Arno Benadie, Senior Wastewater Engineer commented on Cardno BTO, explaining that this company had unique wastewater treatment process skills and he had no reason to doubt their expertise. Mr Hughes noted that the Council's sludge survey mirrored Cardno BTO's report, though done a month later.

Kevin Ross noted that Councillors wished the opportunity to meet with Cardno BTO staff and receive their report if the Council decided today to commission the company to undertake an independent revue of the WWTP project. Mr Hughes noted that Cardno BTO agreed that the plant's aerator design was untried, did not follow accepted design principles, and was inadequate for the volume of waste being treated.

Cr Laws left the meeting at 3:10pm and returned at 3:12pm.

Mr Hughes explained that immediate work at the WWTP was to treat the symptoms and bring the odour level under control. The review of the plant and identification of remedial work to ensure compliance with the Resource Content would take some time, and he would prefer this work be undertaken by Cardno BTO.

To a Councillor's question on tradewaste monitoring Mr Hughes explained industry responsibility under the Council's 2008 by-law. Monitoring could not be done on line, a tradewaste officer visited each contributing industry 3 to 4 times per year on a predetermined date to take tradewaste water samples. Arno Benadie further elaborated noting that volume and load content was very important and could not be measured by a 'flow meter' alone. Also hydrogen sulphide gas would not be captured by a flow meter. Mr Hughes explained that the overload of fat received at the WWTP recently was dense material not measurable by a flow meter. To a Councillor's question Mr Hughes explained that WWTP operating costs were covered by a wet industry 'targetted rate' that varied from industry to industry dependent on the composition of the tradewaste. There was equipment available that could measure specific compounds in discharged tradewaste. Tracking tradewaste to source was difficult as, for example, sulphides were used by most industries in Wanganui and protein could originate from varied animal processing plants.

The Council discussed engaging Cardno BTO to undertake an independent review of the WWTP. It was agreed that if Cardno BTO prepared a report then that report would be peer reviewed.

Council Resolutions

Proposed by Cr Laws, seconded by Cr Westwood:

THAT the Wanganui District Council commissions Cardno BTO to provide a future options report that includes:

- Any additional immediate measures that can be taken to address odour and treatment.
- To determine whether it is viable to continue with this plant.
- If viable, which options to achieve satisfactory performance are available for completion over the next two years.
- If not viable, then establish which type of plant would be suitable for Wanganui's waste and what size that would need to be.

THAT the report is peer reviewed by an agency independent of the project.

Discussion

Mark Hughes explained that the investigation would be in steps over a three month period and the peer review would track alongside the investigation. Reports could therefore be

provided to the Council about every three weeks, through the Infrastructure and Property Committee or by direct report to a Council meeting.

Mayor Main put the motion. CARRIED

ACTION: Mark Hughes

Discussion

In response to a Councillor's question Mr Hughes advised that the WWTP allocated budget was $400,000. The cost for the emergency work over the Christmas/New Year period was currently approaching $200,000. To a further question he explained that Horizons Regional Council would decide if an acceptable reduction in odour level had been achieved. Mayor Main said a standard update report on WWTP issues would be provided with all future Infrastructure and Property Committee meeting agendas.
ACTION: Mark Hughes

Cr Laws considered a review of how the WWTP project arrived at this present situation was necessary. He suggested the review by an independent agency should consider the quality of advice provided to the Council (Governance) and the quality of the Council's decision making.

Cr Laws proposed, seconded by Cr McDouall:

- That Wanganui District Council commission an independent review of the process of the design and the operation of the WWTP from 2003 to 2012, including the quality of information provided to the Governance of Council.

Discussion

Both Cr Anderson and Cr Stevens were against this proposal. Kevin Ross reiterated that the project had been reviewed three times. Mayor Main believed that the Council had learned much about the WWTP project over the past few weeks. She said the project was the biggest spend that the Council would face and everyone had worked on it within the advice and information then available. Mayor Main questioned the Council spending time and funds on a review when it needed money and people to achieve a solution.

Cr Baker-Hogan said that the Council had to find out if the WWTP could be made to work. She did not support the proposal. Cr McDouall, however, considered the review appropriate for the Council to be accountable to Wanganui's ratepayers. He said if the WWTP was completely useless it would be the present Councillors who would take the blame — so he wanted to know why reports on plant deficiencies, lack of monitoring by Horizons Regional Council, failed aerators and an apparent design change by two officers were not reported to the Council.

Cr Wills, however, suggested that had the present Councillors been in office in 2002 they would have made the same decisions based on the officers' advice. He said finding someone to blame was not necessary and the Council should put its effort into fixing the WWTP.

Cr Bullock left the meeting at 4:12pm.

Cr Vinsen and Cr Higgie also spoke against the proposal. Cr Westwood commented that the proposal placed her and Cr Dahya in a difficult position as they were members of the Council during the periods in question.

In his 'right of reply' Cr Laws thought it interesting that the two Councillors with parliamentary experience agreed on this matter of accountability. He considered the Council had collectively 'stuffed up' and should not run away from examining why. Cr Laws said the Council should ask where it went wrong as a Council on the WWTP project. If it did not learn the process failures – were they governance, management or information errors – it was condemned to repeat them.

Mayor Main put the motion. LOST

Cr Laws and Cr McDouall voted FOR the motion.

Comment: Cr Sue Westwood's New Year Queens Honours Award

Cr Laws noted that Cr Sue Westwood had been awarded the Queen's Service Medal in the New Years Honours.

Council Resolution:

Proposed by Cr Laws, seconded by Mayor Main:

THAT the Council acknowledges and congratulates Cr Sue Westwood on being awarded in the Queen's New Year Honours List 2013, the Queen's Service Medal for services to the community.

CARRIED

The meeting closed at 4:20pm.

* * * * *

CERTIFICATE OF CONFIRMATION OF MINUTES

The minutes of the Extraordinary meeting of the Wanganui District Council held on 17 January 2013 were confirmed as a true and correct record of that meeting at a meeting of the Wanganui District Council held on 28 January 2013.

.....

Annette Main
Mayor of Wanganui District

5-3-13

Date