MATAMATA WwTP UPGRADE – UTILISING EXISTING ASSETS WITH INNOVATIVE TREATMENT TECHNOLOGIES

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ABSTRACT

The concept and objectives for the upgrade was to future-proof the WwTP and to optimise and utilise existing Council assets. The plant was to meet future increased flows and loads whilst achieving a greatly improved effluent quality. With the treated effluent discharging into the Mangawhero Stream this would provide a positive outcome for the local community and would have significant social benefits.

In June 2004 the resource consent for the discharge of effluent from the WwTP was due to expire. Consultation with Waikato Regional Council (WRC), tangata whenua, neighbours, the general public and other affected parties resulted in MPDC undertaking an iterative and innovative technical options assessment during the resource consent renewal process. The conclusion was that the most appropriate and cost effective solution for the site was to employ two relatively new treatment technologies to supplement the existing oxidation ponds, Aquamats® and ultrafiltration.

In July 2009, Opus were appointed by Matamata Piako District Council (MPDC) to project manage the full scale upgrade of the WwTP. The revised commissioning date of the new plant fully operational was 1st November 2010. The result was the construction of the largest Aquamat® installation and Membrane Filtration Plant of its kind in New Zealand.

KEYWORDS

Aquamat Treatment Technology, Ultrafiltration, Retrofitting Pond Systems, Algal Treatment, Rock Filters

1 INTRODUCTION

Matamata Wastewater Treatment Plant (WwTP) serves a population of 6,870, and receives an average wastewater flow of 2,700 m^3/d with the treated effluent discharging into the Mangawhero Stream.

Prior to the upgrade the existing WwTP comprised of a 7.9ha facultative pond and a 3.7ha maturation pond operating in series. The existing ponds were oversized for the population served with performance characteristics typical of pond technology achieving, on a yearly average, 23mg/l BOD_5, 69mg/l Suspended Solids and a Total Nitrogen of 24mg/l, with nitrification performance being good during Summer but poor in Winter.

In June 2004, with the resource consents due to expire, consultation with affected parties commenced. During the consultation period and consent renewal process, MPDC also undertook an extensive technical process options assessment. Identified during the process was that the critical discharge parameters were suspended solids (mainly algae, which at times influenced the colour of the discharge), indicator bacteria organisms, ammonia, and total nitrogen. It was these identified parameters that then drove the process selection. Membrane filtration pilot plant trials were subsequently undertaken to determine whether this technology would be suitable for Matamata.

In July 2009, following successful pilot plant trials and with the new resource consent in place, Opus were appointed by MPDC to project manage the full scale upgrade of the WwTP. The upgrade had significant social benefits, particularly for a nearby children's camp that uses the Mangawhero Stream for contact recreation activities.

The project was innovative in the way MPDC managed this scheme from initial challenge to final solution utilising the services of various consultants and contractors each with their own specific field of expertise. Project delivery was challenging, however, and this paper will also discuss some of those challenges and how they were resolved through parties working together to achieve a successful outcome.

2 CONSULTATION AND OPTIONS ASSESSMENT

Matamata Piako District Council recognising that the resource consent for the effluent discharge from the Matamata WwTP was due to expire in 2004, instigated the renewal process well in advance.

MPDC lodged a resource consent application with Environment Waikato on 23 October 2003 for the renewal of the discharge consent. Because a new consent was applied for 6 months before the old consent expired, under Section 124 of the Resource Management Act MPDC had the right to continue to discharge treated effluent under the old consent until the consent applications were determined.

At the time of lodging the consent application, MPDC had the intention of upgrading the treatment plant to improve the quality of the discharge, but the nature of the upgrade had not been finalised. What followed was a thorough consultation process, further investigations undertaken, discussions with Waikato Regional Council and a robust options assessment of potential treatment technologies undertaken.

2.1 CONSULTATION & CONSENT RENEWAL PROCESS

The consultation process was initially instigated by Opus International Consultants Ltd. (Opus) and the affected parties contacted prior to the October 2003 resource consent application being lodged. An 'Issues and Options' report prepared by Opus was attached to the October 2003 resource consent application. Included within the 'Issues and Options' report was the outcome of consultation with Te Mana Taio as tangata whenua, and a Working Party comprising Fish and Game, Department of Conservation, the Totara Springs Christian Centre, adjacent landowners and Matamata community board members undertaken from July 2003 onwards.

The October 2003 consent applications stated that an upgrade to the existing treatment plant would be completed by 2008. The nature of the upgrade was not confirmed at the time of lodging the consent applications, and the outcomes of consultation with potentially affected parties was to be taken into account in the selection of the preferred option.

A detailed Assessment of Effects on the Environment (AEE) was carried out between 2004 and 2005 to support the original consent applications, and a report on this assessment was completed in June 2005 by Opus and provided to Waikato Regional Council. The 2005 AEE, along with the 2003 'Issues and Options' report, concluded that improved pathogen removal was the highest priority for any upgrade to the WwTP, particularly in view of the swimming and canoeing that occurs in the Mangawhero Stream at the Totara Springs Christian Centre camp.

Subsequent to the October 2003 application MPDC also applied for an air discharge permit for the plant, as well as a land use consent for a rock outfall structure adjacent to the Mangawhero Stream. The primary purpose of the rock outfall structure is to address the cultural values, to provide some land contact for the effluent prior to it entering the Mangawhero Stream. This eventuated following consultation with iwi.

A "Summary of Additional Information" report prepared by Environmental Management Services Ltd was issued to WRC in July 2008. The report described a firm proposal of the upgrade to the Matamata WwTP, the outcomes of the ultrafiltration pilot plant trials, an assessment of environmental effects for the proposal, the consultation carried out, and the recommended conditions for the new resource consent. The report also provided an overview of the consent application process to date, for the benefit of interested parties.

Following the additional information being submitted to WRC complete with the issue of the additional 'peripheral' consent applications, the effluent discharge resource consent was issued to MPDC in May 2009. The discharge consent stipulated that the current and future WwTP at Matamata must comply with improvements to the following parameters:

- BOD_5
- Total Suspended Solids
- Ammoniacal Nitrogen
- Total Nitrogen
- Faecal Coliforms

The discharge consent also specifically stipulated that the discharge "shall be of only membrane treated effluent" and that the consent holder "shall undertake the installation of the proposed pond baffle and suspended growth media (Aquamat) by 30th June 2010".

2.2 TREATMENT PROCESS OPTION SELECTION

During the consultation period and consent renewal process, MPDC undertook an extensive technical process options assessment. Identified during the consultation process were the critical discharge parameters that then drove the process selection.

The initial 'Issues and Options' report prepared by Opus in October 2003 recommended that an option to consider was to replace the existing oxidation ponds with an activated sludge treatment plant, since this type of plant had successfully recently been installed at Morrinsville and a similar plant was proposed for Te Aroha. However, activated sludge was subsequently not adopted at Te Aroha, and this option was later considered as unfavourable for Matamata.

A relatively new wastewater treatment technology had emerged in recent years, known as membrane filtration (or ultrafiltration). The method achieves excellent removal of pathogens, the priority for the Matamata WwTP. MPDC decided in early 2006 to set up a pilot plant trial at Matamata using membrane filtration. The pilot plant operated from June to September 2006, inclusive. Further consultation with affected parties was carried out while the trial was in progress.

The membrane trial plant was very successful, and MPDC decided to adopt that treatment method, subject to obtaining resource consents. However, during negotiations, WRC advised MPDC that improved nitrogen removal was also desirable for the WwTP, given the perceived sensitivity of the Firth of Thames to cumulative nitrogen inputs, to which the Mangawhero Stream contributed.

MPDC subsequently carried out an intensive monitoring programme of the nitrogen concentration of the wastewater flowing into and out of the WwTP. This showed that the ponds were achieving relatively good nitrogen removal during summer months, but less effective removal during winter, see Figure 1.

Concurrent with the monitoring programme, a relatively new suspended growth media technology for upgrading oxidation pond performance was investigated as an option to improve nitrogen removal. These investigations showed that the suspended growth media system could significantly improve nitrogen removal during winter months. MPDC had therefore decided to adopt the suspended growth media system as part of the upgrade to the WwTP, along with installing floating baffle curtains within the ponds to improve retention times through the ponds.

The designers of the suspended growth media system had a high level of confidence in the performance of the proposed system, and had advised that the risk of not achieving the proposed limits was low. This high level of confidence was in part due to the experience gained with the system installed at the Te Kauwhata WwTP, as well as a number of systems in the United States, where the system was first developed. In the unlikely event that performance was poorer than expected, this could be remedied by installing more media and aeration.

3 DESCRIPTION OF THE EXISTING WWTP AND PERFORMANCE

3.1 DESCRIPTION OF THE EXISTING WWTP

Waste sewage reticulates from the Matamata catchment to a relatively new terminal pump station which transfers flows through a 5mm aperture mechanical fine screen in order to remove coarse solids, rags etc. This screenings material is dewatered and collected in large sealed plastic bags and the material is routinely removed to a municipal landfill. The screened waste water then gravitates through a two stage oxidation pond system operating in series. The primary pond has a surface area of 7.9 ha with the secondary pond having a surface area of 3.7 ha. Supplementary aeration and mixing was provided to each pond by means of cage aerators.

Treated flows discharged from the secondary pond to a 0.6 ha overland flow grass plot from which the flows were then collected and the final effluent discharged to the Mangawhero Stream.

Located adjacent to the South West corner of the secondary pond is a small septage storage pond that receives septage tanker waste and an associated sludge drying bed. The liquor from this septage pond was, and still is transferred to the head of the works via an old pump station which used to be the main terminal pump station that received the raw sewage.

3.2 TREATMENT PERFORMANCE OF EXISTING OXIDATION PONDS

The oxidation ponds at the Matamata WwTP are more accurately described as 'facultative ponds'. Facultative ponds have an upper layer which is 'aerobic' (i.e. contains some dissolved oxygen), while the bottom layer is 'anaerobic' (i.e. contains very little or no oxygen). While facultative pond technology is not new, with systems in New Zealand generally being about 30 years old, the system can achieve significant reductions in contaminant concentrations for municipal sewage, although performance is generally below that of more sophisticated treatment systems such as activated sludge and Membrane Bio-Reactors (MBR).

MPDC had been monitoring the contaminant concentrations in the WwTP discharge for many years as part of its consent compliance. A more intensive monitoring programme was implemented in July 2007 to determine better the pond performance, particularly in relation to nitrogen and ammonia removal. That showed that the ponds achieved good nitrogen and ammonia removal, especially during summer. Monitoring data is summarised in Table 1.

Table 1 Summary of Matamata WwTP monitoring data, July 2007 to April 2008[1]. Effluent data for December 2007 to February 2008 (i.e. summer) shown in brackets. All data is average of sampling results, in g/m^3, unless noted otherwise.

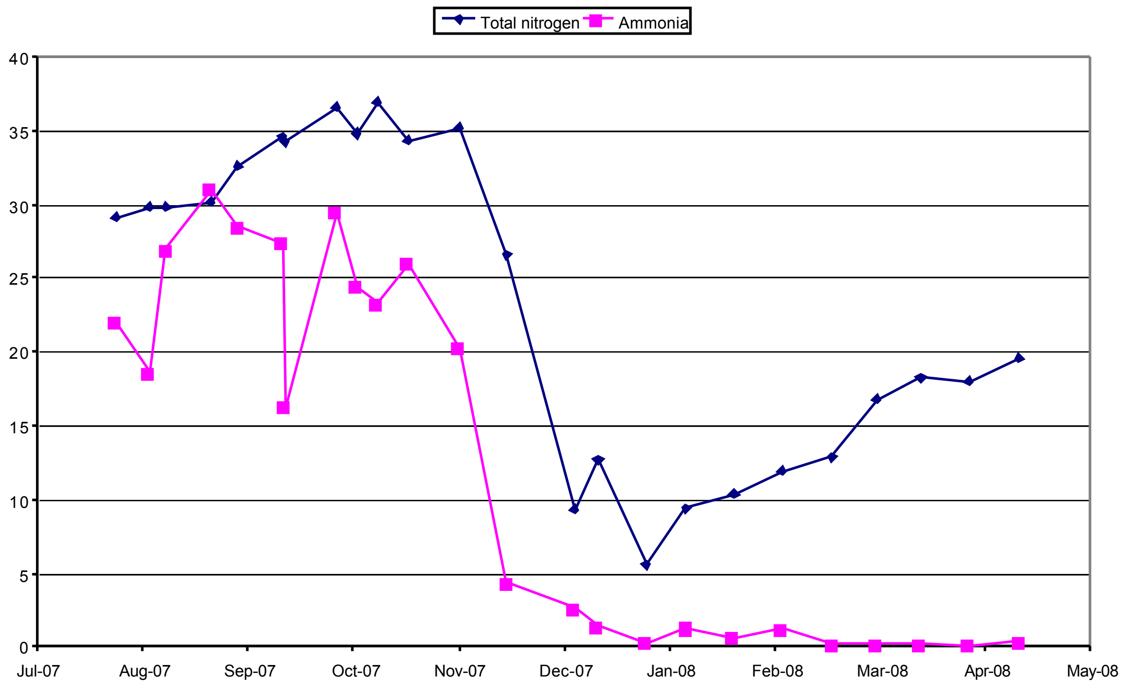
	Influent	Effluent	% removal
Suspended solids	266	69 (102)	74% (62%)
BOD_5	194	23 (30)	88% (85%)
Ammoniacal nitrogen	34	13 (1.1)	62% (97%)
Total nitrogen	56	24 (10)	57% (82%)
Dissolved reactive phosphorus	7.4	8.4 (8.6)	--
Total phosphorus	10.5	9.7 (10.4)	Not significant
Faecal coliforms[2] (median)	Not measured	2,550 per 100 mL	Not measured

Note 1: Influent monitoring July to December 2007 only. Results for this period were very consistent, so influent monitoring was discontinued after December 2007.
Note 2: Median of monthly monitoring data from March 2006 to April 2008

The results in Table 1 for suspended solids, 5-day biochemical oxygen demand (BOD_5) and faecal coliforms are very similar to those measured between 1997 and 2005 as part of the consent compliance requirements. The higher suspended solids results for the pond effluent over summer months were due to the increased concentrations of algae, which proliferate during the improved temperature and light conditions of summer.

The reduction in ammonia and total nitrogen concentrations over summer months can be seen in Figure 1. Most of the reduction in total nitrogen concentrations appeared to be due to improved nitrification of ammonia through to nitrate, and subsequent denitrification of the nitrate (to nitrogen gas), although the increase in TN during summer months indicates some assimilation of nitrogen into algal cells.

Figure 1 - Total nitrogen and ammonia concentrations in pond effluent, July 2007 to April 2008



4 PROCESS DESCRIPTIONS OF THE TREATMENT TECHNOLOGIES

It was predicted that the two relatively new treatment technologies installed at Matamata WwTP, when combined together, would achieve the new prescribed effluent discharge resource consent limits. The suspended growth media would target the BOD_5, Ammoniacal Nitrogen and Total Nitrogen limits. The membrane filtration plant, installed downstream of the suspended growth media, would target the Faecal Coliform and Total Suspended Solids limits.

A single treatment technology, such as a MBR, would achieve similar performance results as the suspended growth media and membrane filtration plant combined. However, during the options assessment exercise, the MBR option was dismissed for two main reasons. Firstly the suspended growth media supplemented and best utilised the plants existing assets as the media is retrofitted within the existing oxidation ponds. Secondly, the MBR option was not as cost effective both in capital and operating costs when compared to the suspended growth media and membrane filtration plant combined.

4.1 SUSPENDED GROWTH MEDIA – AQUAMATS

The AquaMats wastewater treatment system is a technology based on increasing the available growth area for biomass and enhancing the aeration efficiency in a wastewater treatment pond. This is achieved by installing AquaMats, which is a fabric curtain with a large surface area, in conjunction with Pressure Differential Piping (PDP) bottom deployed aeration lines.

The Aquamats become colonised with bacteria, protozoa, and higher organisms. Supplementary aeration released through the PDP diffuser pipes on the pond base provide the oxygen required by the "biomass" to provide an enhanced level of treatment, and the mixing action of the aeration ensures contact between the biomass and the nutrients in the wastewater.

Figure 2 shows a new Aquamat curtain prior to it being colonised with the biomass. Figure 3 shows the PDP bottom deployed aeration lines providing process oxygen to the biomass.

Figure 2- Aquamat Curtain (new)

Figure 3- PDP Aeration Line

At Matamata process air is supplied to the PDP diffuser pipework via three tri-lobe blowers, operating on a duty/assist/standby basis, that automatically adjust the quantity of process air required dependent on load to the plant.

To increase the retention time and to optimise hydraulic flow conditions within the pond system, floating membrane curtains were installed which also maximised the treatment capacity of the pond system. With the floating membrane curtains creating a ‘plug’ flow and preventing ‘short circuting’ across both the primary and secondary pond systems it consequentially lowered the number of Aquamats and aeration lines required.

Other Aquamat installations have also recently been undertaken at Te Kauwhata and at Raglan. The performance results from the Te Kauwhata plant where closely scrutinised during the consenting process and gave MPDC the confidence that the process would achieve the proposed limits.

Figure 6 shows the Aquamats installed within the secondary pond at Matamata WwTP, Figure 7 shows the existing operator and control building that was modified to house the new process air blowers associated with the Aquamats as shown in Figure 8. Figure 11 shows construction in progress within the secondary pond.

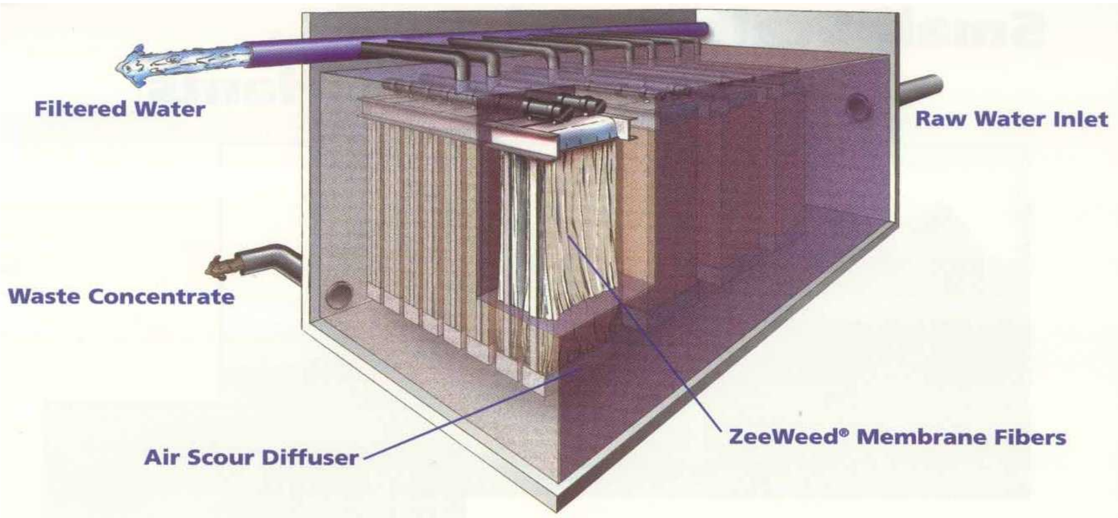
4.2 MEMBRANE FILTRATION PLANT (ULTRAFILTRATION)

Ultrafiltration uses a Membrane as a physical barrier, which catches particles of a size approximately greater than 0.2 μm. Ultrafiltration (UF) is used in many water and wastewater applications.

Membrane filtration uses a semi-permeable membrane to separate materials according to their physical size and chemical properties when a pressure differential is applied across the membrane. They are classified by the membrane pore size and the size of the particles removed.

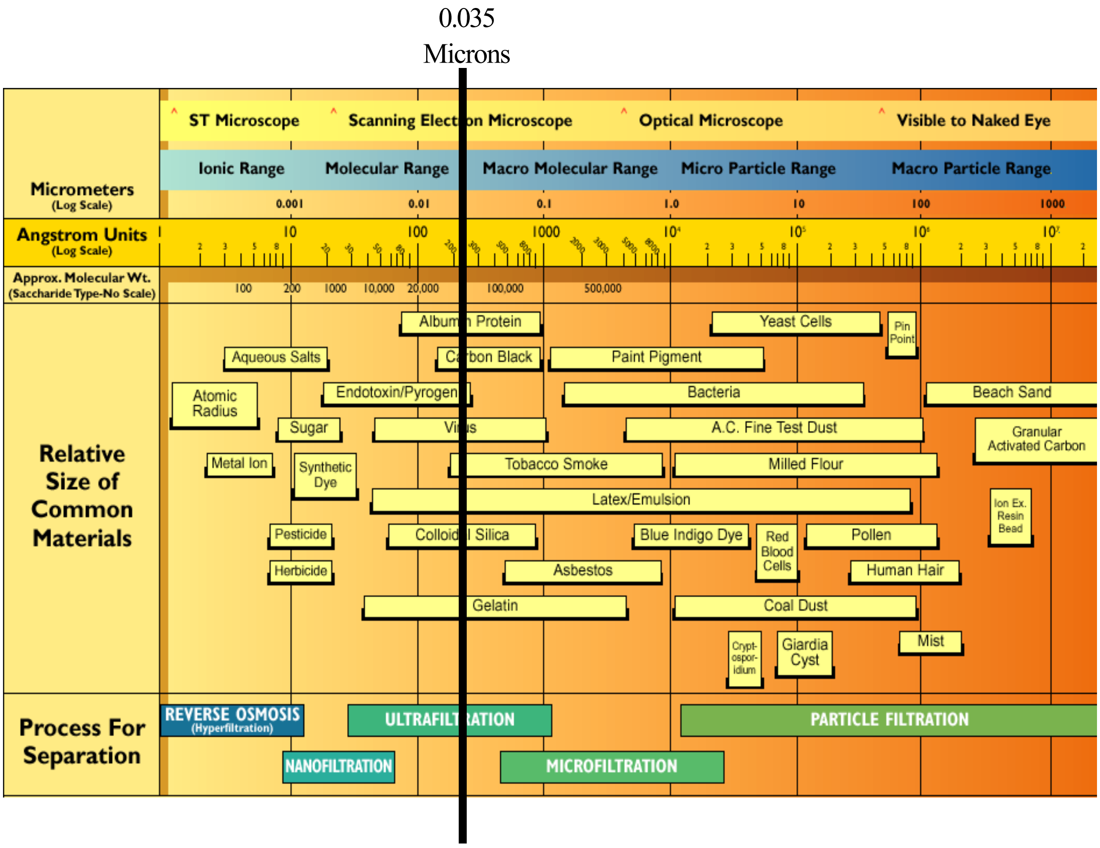
Figure 4 shows the membrane filtration plant configuration as follows:

Figure 4



Modules that comprise of thousands of hollow porous fibres, each 2 mm diameter and 2 metres long, are bundled together and installed on a frame to make a cassette. The fibres consist of a woven inner core for strength and durability with the membrane film applied to the exterior. The nominal pore size is 0.035 micron, the absolute pore size is 0.1 micron. These inhibit the passage of protozoa and bacteria and most viruses to the filtered water. Figure 5 indicates where the 0.035 micron membrane sits on the filtration spectrum compared to other filtration methods and the typical materials that it will remove at this level of filtration.

Figure 5 - Filtration Spectrum



Cassettes are immersed vertically in rectangular tanks to form a train. The Matamata membrane filtration plant consists of four trains of Zenon ZW500C submerged membranes, three cassettes per train, 26 modules per cassette.

The membranes installed at Matamata are actually second hand and had become surplus to requirements from the Tuakau Water Treatment Plant. They have had a current operational life of 4 years when installed in the Matamata membrane filtration plant in November 2010. The life expectancy of membranes in a waste water treatment plant is normally 10 years. The membranes cassettes, submerged within a tank of semi-treated wastewater, draw the waste water through the membrane via a dedicated permeate pump under suction conditions.

For the ZW 500C membrane cassettes, water is drawn though the top of the fibre. Flow through each membrane train is controlled by a variable speed drive on the permeate pump. The set points for the pump are determined by the incoming flow to the membrane filtration plant.

Aeration of the cassettes is continuously undertaken to agitate the fibres to reduce the rate at which solids accumulate on the membrane surfaces. At intervals reverse flow (backwash) is applied to the membranes for a short period of time to dislodge any accumulated solids from the membrane surface. Following a backwash the dirty water / solids are automatically returned back to the head of the works.

Figure 9 shows the completed membrane filtration plant at Matamata WwTP, Figure 10 shows the below ground pump and pipe gallery within the membrane filtration plant, with Figure 12 showing the membrane filtration plant under construction.

5 PROJECT DELIVERY

Following the issue of the effluent discharge resource consent to the consent holder (MPDC) in May 2009, Opus was appointed by MPDC to project manage and coordinate the design and construction of the full scale upgrade of the WwTP using Aquamats and ultrafiltration technology. The effluent discharge resource consent stipulated that the upgraded plant shall be operating within the new consent limits by 30th June 2010. This was a relatively short period of time to deliver the project and would require some innovative procurement strategies with commitment from multiple parties who had been and continued to be involved with the project. It was recognised early on by WRC that the Ammoniacal Nitrogen and Total Nitrogen limits would be difficult to achieve by the consent date as it would take several months for the Aquamats to 'seed' and develop the biomass.

The effluent discharge resource consent delivery date of 30th June 2010 was subsequently revised by WRC to the 1st November 2010, at the request of MPDC. The reason for this revised date is discussed later in this paper.

Following the appointment of Opus as project managers, the project core delivery team was established and the responsibilities of each party was agreed throughout the design, construction and commissioning of the upgrade. The project team was unique in that the main process partners had been heavily involved from the early inception stage of the project and the team recognized that to meet the programme it would need to rely and make best use of their knowledge in their field of expertise. This approach required commitment, flexibility and close working together from all parties to meet the common goal. With the multiple party involvement and the additional unique procurement strategy employed to meet the challenging programme, this required many interfaces and project management issues which was unusual for a project of this size.

The two main process design partners involved with the early development of the project including membrane filtration plant pilot trials and the concept design development for the enhanced nitrogen removal element were:

- Canadian Pacific Limited (CPL) for the design, construction and commissioning of the Membrane Filtration Plant

- Global Environmental Engineering Limited (g2e) for the design of the treatment pond baffling and suspended growth media (Aquamat) systems and the integration of this technology alongside the membrane filtration plant.

CPL and g2e continued to develop the scheme throughout the project life and had been appointed as the main process partners and as such were key to the successful delivery of the project.

5.1 BASIS OF DESIGN

Throughout the initial scheme development, the populations flows and loads had been assessed and developed by MPDC based on influent flow data, census data and community growth rates identified in MPDC's Asset Management plan.

The projected flow and load data included the provision of two local communities connecting onto the Matamata sewer network in 2010 plus 184 proposed new sections, a school, public toilets and a marae. A population growth factor of 0.91% based on census data was also included up to year 2024.

Future proofing beyond 2024 was included within the design. With the suspended growth media this can be simply achieved with the addition of Aquamats, PDP diffuser pipework and possibly an additional blower. For the membrane filtration plant, permeate water utilised for the purpose of back wash of the membranes is stored within two permeate storage tanks. The permeate storage tanks are identical in size to the tanks (cells) within which the membrane trains are installed. If future flows and loads increased significantly beyond 2024, one of the permeate storage tanks would be modified into a fifth membrane treatment cell relatively easily.

5.2 THE PROCUREMENT PROCESS AND IMPLEMENTATION

Table 2 below summarises the types of contracts and the procurement strategies utilised for the various elements of the project.

Table 2

Element	Supply	Form	Install	Form
Main Civil Works	Main Contractor	-	Main Contractor	NZS 3910

Element	Supply	Form	Install	Form
Process Air Blowers	MPDC Free Issue to Main Contractor	AS/NZS 4911	Main Contractor	NZS 3910
Aquamats and PDP	MPDC Free Issue to Main Contractor	AS/NZS 4911	Main Contractor	NZS 3910
Membrane Curtains	MPDC Free Issue to Main Contractor	AS/NZS 4911	Main Contractor	NZS 3910
Electrical / Instruments / Control Packages	Main Contractor	-	Main Contractor	NZS 3910
Rotary Drum Screen (installed upstream of MFP)	MPDC Free Issue to CPL	ORGALIME S200	CPL	NZS 3910
Membrane Filtration Plant	CPL	-	CPL	NZS 3910

From Table 2 above it can be seen that the Aquamats, the blowers and the membrane curtains were supply only contracts to be installed by the main contractor. The primary reason why these items were not supplied under the main contract and free issued instead to the main contractor was because these items had long lead delivery times. That is, by the time the main contract had been awarded and the main contractor had placed orders for the long delivery items, there was a risk that there would be limited time left to install the items and not meet the consent compliance date.

Another advantage of free issuing the long lead items for the main contractor to install was that the items were high in value thus did not attract the main contractors overhead and profit. However, this provides additional management with increased project interfaces and client side management between MPDC and Opus, as well as balance programme risk, which would be normally undertaken by the main contractor and the costs hidden.

The main contract was a modified NZS 3910 contract which went open tender via tender link with the award based on a lowest conforming bid. Spartan Construction was the successful contractor and they were given possession of the site on 19th June 2010.

As CPL had been involved with the project from the early inception stage with the undertaking of trials with the zenon membranes and were the only company able to supply second hand membranes at a reasonable price taking into account the reduced life, MPDC took the decision not to go open tender for the design, construction and commissioning of the membrane filtration plant and went directly to this single contractor.

To procure a contract through a single source is a risky strategy as the question stands: how can it be demonstrated and ensured that MPDC obtains a fair price for the work if there is only a single supplier and hence no price tension?

In reaching this decision the procurement strategy had considered three options for procuring the membrane filtration plant:

1) Produce a generalised performance specification and send this to several technology providers to tender thereby ensuring a demonstrably competitive pricing process. These providers will most likely be the companies already approached during the preliminary design process and this method, if nothing else, will validate any budget prices previously received.

2) Produce a generalised performance specification and send this only to CPL. Providing that CPL are unaware that they are the sole tenderer there will be the illusion of a competitive pricing process and this should ensure a competitive price.

3) Produce either a generalised performance specification or a specification more tailored to the CPL process and send this only to CPL and inform them that MPDC is going to enter negotiations with them. This option will also have programme advantages.

Sending an enquiry to a variety of technology providers when there is no intention of using them is an inefficient use of time and resources within the industry and is likely to result in MPDC receiving poor service from the same suppliers at a later date. On this basis Option 1 was not adopted.

Options 2 and 3 are variations on a similar theme, with Option 3 being the most pragmatic and open and avoids any form of deception. After all, an assessment route had already been completed following which the membrane filtration plant process was selected so, providing that the costs upon which that decision was based are not exceeded, then all parties should be satisfied and any perception of not achieving value for money removed.

Negotiation had an additional and significant benefit to the Matamata WwTP project of expediting the procurement process for a package which was on the programme critical path. In the end this approach was adopted however with hindsight going out to the open market to test technical and equipment choice and to demonstrate value for money would have been perhaps advantageous. To do this and approach other technology providers would have required a completely different project structure and strategy from the outset however.

5.3 IMPLEMENTATION

With the resource consent compliance date stipulated as being 30th June 2010 it was identified early on that the design, construction and commissioning of the membrane filtration plant was on the critical path. During the design stage of the membrane filtration plant, it would be fair to say that progress was slow as several parties with different drivers (eg. cost, process, efficiency, programme) were involved with the review process and agreement on detail between parties was often a challenge.

These design delays resulted in the unusual approach of MPDC having to place a minor works agreement contract with CPL in order for them to place orders for their long lead items in the membrane filtration plant and to commence construction prior to them signing to NZS3910 contract. This approach came with some risk as the detail design was still incomplete at this point in time. CPL commenced construction of the membrane filtration plant and given possession of the site on 4th May 2010.

Throughout the construction period of membrane filtration plant there were significant further delays to such an extent that the resource consent compliance date was compromised. Nevertheless, WRC were kept informed by MPDC of progress throughout the project, and after WRC had witnessed that construction progress was well advanced, revised the resource consent compliance date to the 1st November 2010, which was met. The reason for the delays during the construction of the membrane filtration plant are complex and varied, and the outcome is still subject to negotiation between the parties. However there were two clear contributing factors that caused these delays:

1) The project structure required all parties to collaborate from the onset. This happened but with each party having different drivers, consistency was hard to achieve throughout the design review. In parts the membrane filtration plant was being designed as it was being built.

2) Unavoidably, as programmed to meet the consent date, the membrane filtration plant was constructed during the Winter months which undoubtedly did cause some construction difficulty.

As for the main contract, this was implemented relatively smoothly and was completed on time with the commissioning of Aquamats commencing on 1st November. Any issues or problems that did occur during construction period where proactively dealt with by the main contractor.

On the 9th April 2011 a public open day was held where the upgraded treatment plant was officially opened by the Mayor of Matamata Piako District Council.

5.4 PERFORMANCE

Early performance results post upgrade reveal that the suspended growth media is typically achieving less than 2mg/l BOD_5 and <10mg/l for total nitrogen. The membrane filtration plant, is also performing well, with TSS less than 3mg/l and indicator organisms achieving Limits of Detection.

6 SUMMARY

From project inception through to completion, there are of course lessons to be learnt with the benefit of hindsight. Whilst on paper, to design, procure, construct and commission a $5.2 million WwTP upgrade within a 12 month period would appear to be achievable, it was recognised early on that it would be a real challenge to meet the resource consent compliance date of 30th June 2010. The procurement strategy was driven by this compliance date as was the need to use parties who had early involvement.

Whilst the procurement strategy of free-issuing large value items to the main contractor has its advantages, the effort and resource required to prepare six separate contracts and then to evaluate and award each tender, all in a relatively short period of time, is considerable. In addition to this, the additional management and risks associated with multiple interfaces that would normally be managed by the main contractor has also to be considered. Whilst this approach was mainly undertaken due to time constraints, careful consideration should be taken case by case as to how much to separate out of a main contract and whether it is ultimately efficient bearing in mind the extra number of interfaces and management risk taken by the client.

As for the procurement of the membrane filtration plant and the decision to procure this through negotiation. This decision at the time was based on CPL being the only company that had installed this type of plant elsewhere within New Zealand and due to their early involvement with the pilot plant trials. With hindsight however, enquiries to other technology providers and going the competitive tender route to test technical and equipment choice, to demonstrate value for money and other attributes, would have been preferable in this instance. The membrane filtration plant was procured on the basis that it was a propriety item and that the “design element’ was relatively small. This however, turned out not to be the case and had this been appreciated earlier then a FIDIC contract, which includes for design by contractors, would have been a more appropriate contract rather than the NZS 3910 contract that was used.

The adage of, whenever possible, avoid heavy construction during the Winter period certainly proved true with one of the wettest Winters being recorded causing construction difficulty for both the main contractor and CPL.

The upgraded WwTP performance after commissioning completion was initially encouraging with the plant achieving all of its resource consent limits. Indeed, significant improvements in effluent quality could be seen almost immediately with the installation of the floating membrane curtains alone, preventing “short circuiting” across the pond system. However the real test for the upgraded plant, particularly the Aquamats, would be over the Winter period, see Figure 1 above. This Winter period has revealed residual installation defects which are currently being resolved.

To conclude, this project was innovative in many ways from the technical solutions adopted utilising existing assets to meet the specific environmental needs, through to the unusual procurement strategy and multi party team adopted to meet the tight project programme. At times the project delivery was challenging but the end goal was never lost and the eventual product is an accolade to the various parties to the project, including Council, contractors and consultants working together, each bringing their particular expertise to bear.

Figure 6 – Aquamat Installation at Matamata WwTP

Figure 7- Existing Building Housing Aquamat Process Air Blowers

Figure 8- Process Air Blowers Associated with Aquamats

Figure 9- Membrane Filtration Plant

Figure 10 – Membrane Filtration Plant Pump & pipe Gallery (Below Ground)

Figure 11 – Construction in Progress within Secondary Pond

Figure 12- Membrane Filtration Plant During Construction

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