3 WATER MODELLING THE WESTERN BAY WAY

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ABSTRACT

Until 2008 Western Bay of Plenty District Council's modelling data had been collected through a third party professional service provider. The intent of all stormwater, wastewater and water models was to provide input to respective Asset Management Plans. The main goal of those models was to identify undersized parts of the reticulation in need of upgrading. None of them, with the exception of the water model, were intended to be kept up to date and/or used to optimise system operation.

A review of the existing 3 water models confirmed the potential for changing Council's approach by improving the quality of models built and ensuring institutional knowledge remained with the asset owner. With the advent of an in-house Council delivery service being established in 2008, the opportunity existed to take up ownership of the modelling process.

The appointment of a Modelling Project Engineer within Council created the possibility to be more involved in model development and to gain better control over the outcome of this process. The responsibility of the Modelling Project Engineer is to manage modelling projects for Council's 3 water systems.

KEYWORDS

Hydraulic Modelling, Stormwater Modelling, Wastewater Modelling, Water Modelling

1 INTRODUCTION

The purpose of 3 water models previously developed for the Western Bay of Plenty District Council was primary to provide input to the Asset Management Plans up until the year 2008. The goal of stormwater and wastewater models was to identify undersized parts of the reticulation in need of upgrading. None of these models were proposed to be kept up to date and/or used to optimise system operation. The existing water model however was intended to be updated with the latest reticulation upgrades. The chosen software unfortunately had no versatile Geographic Information System (GIS) integration available and this complicated the data exchange between Council's GIS and the water model.

By reviewing the existing stormwater, wastewater and water models, as well as recognising the drawbacks in using modelling software without GIS integration, Council made the decision to change the approach for modelling of their 3 water systems.

Main objectives of the revised modelling approach for the 3 water systems are listed below:

- Standardise modelling of stormwater, wastewater and water supply systems
- Increase Council input to the development of models by external consultants
- Ownership of finished models
- Maintain models to extend their lifespan
- Demand / pressure management (water model)
- Flood maps (stormwater models)

Council's first step in adopting the revised modelling approach was the establishment of the 'Modelling Project Engineer' position within the utilities asset team to manage modelling projects for the 3 water systems. The next step was selecting the appropriate software capable of modelling stormwater, wastewater and water supply systems. The programme of choice should also be able to interact with Council's GIS. Council chose to purchase MIKE URBAN; GIS based urban modelling software developed by DHI Water & Environment which is fully integrated with ESRI's ArcGIS. MIKE URBAN covers all 3 water networks, including water distribution, stormwater drainage and wastewater collection in separate and combined systems.

The final step was to establish a common approach in modelling the 3 water systems of the Western Bay of Plenty. Previous model developments were, apart from Council's initial job brief, completely up to the consultant's discretion. There was little or no communication (e.g. regarding data gaps) between the data supply by Council and delivery of the finished model by the consultant. This has now been changed and models being developed for Council are required to pass through three stages; Gaps Analysis, Model Build and Model Delivery & Maintenance.

In order to optimise this approach and to establish in-house modelling standards, Council is running the first new stormwater and wastewater models as pilot projects. Council and the engaged consultants monitor the modelling process of these two pilot projects closely from data supply through to model delivery. All lessons learned are incorporated in two respective documents for stormwater or wastewater modelling. These documents can then be used as a guideline for modelling of other stormwater and wastewater systems. This will unify the development and management of those models throughout the Western Bay of Plenty independent of their location and/or catchments.

The approach for water modelling is slightly different with Council's water distribution being split into three main supply zones. Only one modelling consultant is developing Council's water model for the entire Western Bay of Plenty. The end result will be a separate hydraulic water model for each of the supply zones to assist with the operation of Council's water distribution.

2 MODELLING APPROACH

Council is working on standardising the development and use for all their stormwater, wastewater and water models. All new hydraulic models are expected to run through three consecutive stages; Gaps Analysis, Model Build and Model Delivery & Maintenance. The ownership of the model stays temporarily with the modelling consultant until the end of the model development. Council provides model objectives, guidance and assistance during all three phases of model development and takes the ownership back with the finished product.

2.1 GAPS ANALYSIS

A Gaps Analysis is the review of available asset / GIS data and monitoring records at that point in time and gives Council an opportunity to obtain missing information in order to improve the quality of the modelling outcome. The consultant checks the supplied data records and reports any detected gaps. Indicated are also the severity of any missing information for a successful model build and accurate modelling results. The benefit of the Gaps Analysis is not only the increased accuracy of modelling results, but it also improves the quality of Council's asset data / GIS information and the operational monitoring.

2.2 MODEL BUILD

The next stage is the Model Build by the consultant as per Council's instructions. During this phase the consultant is required to liaise regularly with Council's Modelling Project Engineer to discuss progress, and any alterations to be made. This stage is expected to improve the quality of the finished model due to Council's close involvement in the model development combined with the consultant's expertise in modelling.

2.3 MODEL DELIVERY & MAINTENANCE

The final stage of any 3 water model development is the Model Delivery & Maintenance. This includes the actual handover of the finished model, training on how to operate / run the model and on-going support in maintaining the model. The benefit of such an approach is that the consultant's modelling expertise is not lost even with Council taking over full ownership of the model. This will guarantee that the quality and accuracy of the developed model can be maintained throughout all further updates.

3 WATER MODELLING THE WESTERN BAY WAY

3.1 BACKGROUND

Council's previous water model was built and maintained by an external consultant as part of a professional service provider contract for utilities services. The modelling programme used for this task was an AutoCAD-based water distribution analysis software without full GIS integration.

With the utilities services being taken back in-house in 2008, Council did not want to carry on with CAD-based modelling. The preferred option was to use modelling software with enhanced GIS compatibility. The decision to unify the modelling approach for all 3 water systems led to the purchase of MIKE URBAN; fully integrated with ArcGIS and able to model water distribution networks along with stormwater drainage and wastewater collection systems.

Council commissioned Aurecon New Zealand Ltd (Tauranga) to develop a new water supply model using MIKE URBAN's EPANET module for water distribution modelling. The new model will predict performance and potential of the existing water supply for following circumstances:

- Status Quo - demand of current water customers with active connections (metered / unmetered) and large connections (industrial, agricultural ...)

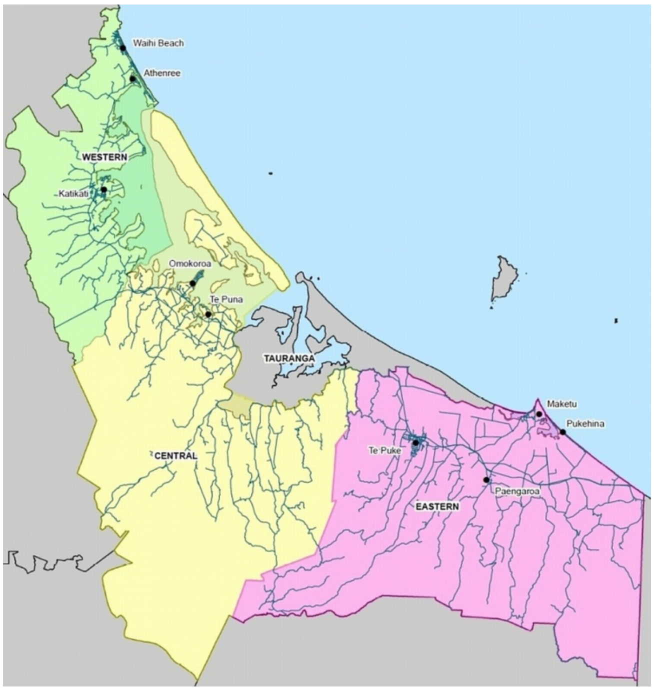
- Further Growth - demand of 'Status Quo' plus potential water customers (no active connection) along water mains

The results will identify the capacity of the existing network, potential to improve the current operation of the water supply as well as required upgrades to cope with 'Further Growth' demands.

3.2 NETWORK OVERVIEW

Western Bay of Plenty's water distribution is separated into three supply zones (see figure 1). The western and central supply zones lie to the northwest and west of Tauranga and the eastern zone to the southeast of Tauranga.

Figure 1: Overview of the water supply zones for the Western Bay of Plenty



The **western supply zone** covers the Waihi Beach, Athenree and Katikati communities. The **central supply zone** serves areas south of Morton Road including the communities of Omokoroa and Te Puna. The western supply zone links with the central zone at around Morton Road. The **eastern supply zone** serves the Te Puke, Paengaroa, Maketu and Pukehina communities. This supply zone is completely separate from the other two zones.

The topography of the land includes steep hills inland from the major townships with the Kaimai ranges lying west of the central and western supply zones and the Papamoa Hills lying southwest of the eastern supply zone. The water supply network uses the natural topography with bores, tanks and reservoirs mainly situated inland with the water running downhill to the coast.

3.3 MODEL DEVELOPMENT

Council's approach in water modelling roughly follows the Water New Zealand National Modelling Guidelines for Water Distribution Network Modelling. The guidelines suggest that such a complex task as water modelling can be managed more successfully and efficiently when it gets broken down into its components or stages, namely:

1. Setting up a new modelling project or re-establishing the existing
2. Data collection, model build (or model update)
3. Data verification and model testing
4. Model calibration and validation
5. Model use
6. Results interpretation
7. Reports and model documentation
8. Change monitoring and model management

All these components influence each other and make the water modelling an iterative process with many loops and feedbacks from previous steps.

Council adopted the break down recommended in the Water Modelling Guidelines with step 1 and 8 forming part of the utilities asset management. The asset management team recognised that a comprehensive hydraulic water model was required to assist in an efficient provision of water services. The proposed new model was to be a dynamic distribution model covering the entire Western Bay of Plenty. As defined in the Water Modelling Guidelines, dynamic models provide an overview of the system behaviour in time for a range of operational regimes, and distribution models go into fine detail analysis of the distribution network.

Steps 2 to 7 of the above list were incorporated into Council's revised modelling approach with the three main stages Gaps Analysis, Model Build and Model Delivery & Maintenance (see chapter 2).

3.3.1 GAPS ANALYSIS FOR WATER MODELS

Council's first model development stage, the Gaps Analysis includes data collection and verification. The Water Modelling Guidelines quote two critical data characteristics in the model development:

1. Data completeness - refers to ensuring that all relevant or specified data is collected
2. Data accuracy - determined by the correctness of the values used as data

Good practise is to have data as complete as reasonable and appropriate for the intended purpose, taking into account that too much emphasis on data checking might not be cost effective. A balanced approach between extensive and too little data checking should be adopted.

The main purpose of the Gaps Analysis is to provide complete and accurate data for the model build stage. Based on the consultant's data request for the model development Council supplied all available data, tried to fill in missing information and discussed options to compensate for unavailable data. All supplied data was then reviewed by the consultant resulting in the document 'Gaps Analysis and Model Build Recommendations' (Aurecon, 2010). This report covered missing network, demand and operational data. Missing network data included pipes, valves, nodes, pumps and tanks.

Most of the missing network data was obtained through field surveys by Council staff, improving quality of the water asset information along the way. Council also provided key operational data such as trigger points for bore pumps to turn on and off. However missing or unreliable SCADA data from bulk flow meters meant that mass balance testing and initial calibration could not be undertaken at that stage. Council intends to improve the quality of these data records. Improved data quality along with additional flow and pressure testing in the network will allow the model to be calibrated at a later stage. The other key gap identified was ambiguous demand data, and this became the most challenging gap. This caused the model development for the central and eastern supply zones to be put on hold until a solution has been found for the western supply zone.

The difficulties with Council's water demand data clearly showed that modelling is not an isolated activity and requires strong linkage with other corporate systems besides GIS. Information about water usage (demand) is held within Council's water billing database and recorded against valuations. Each valuation has billing information (e.g. water usage) and one or multiple parcels assigned to it. If a valuation is rated for water usage, one of the assigned parcels is then a water customer. Thus water demand allocation can only be clear if there is just one parcel per valuation. The situation becomes ambiguous when more than one parcel is recorded against the valuation, as it is not obvious which parcels is the water user.

Western Bay of Plenty's water users can be split into three groups based on billing information:

1. Metered (active connection with meter)
2. Unmetered (active connection with no meter)
3. Availability (no active water connection along water mains)

For modelling purposes metered and unmetered are parts of the scenario 'Status Quo' and availability forms part of the 'Further Growth' scenario. As mentioned above it was not possible to clearly identify each parcel rated for water usage. However the modelling team made the decision to use the first 'live' parcel ID (with a SUE number) of the water rated valuation for the demand allocation (see table 1). In order to quantify the accuracy of this water user information the reciprocal (1:1, 1:2, 1:3 ... 1:n) of parcels per valuation was assigned to the respective demand allocation in the model.

Table 1: Water demand allocation example

Valuation	Parcels per Valuation	Parcel ID	SUE	Water User Status	Accuracy	Water User Parcel (for modelling)
068xx*xxx*00*	1	1004/2	6743xxx	Metered	1:1	1004/2
068xx*xxx*07*	1	1940/2	6754xxx	Unmetered	1:1	1940/2
068xx*xxx*13*	1	1940/6	6754xxx	Availability	1:1	1940/6
068xx*xxx*00*	2	1000/21	4352xxx	Unmetered	1:2	1000/21
		1000/22	4273xxx			
068xx*xxx*00*A	2	1001/10		Metered	1:1	1001/40 (1)
		1001/40	4540xxx			
068xx*xxx*00*A	2	1002/1191	4422xxx	Metered	1:1	1002/1191
		1002/29				
068xx*xxx*31*	4	1940/13	6754xxx	Availability	1:4	1940/13
		1940/37	7083xxx			
		1940/38	7083xxx			
		1940/39	7083xxx			

(1) Parcel 1001/10 does not exist in cadastre (no SUE number), hence second listed ID (1001/40) used as Water User Parcel

Council is investigating ways to improve their water user database, which will lead to more accurate water billing information. Hence with each model upgrade the water demand allocation will become less and less ambiguous.

3.3.2 MODEL BUILD FOR WATER MODELS

With data gaps patched where possible, required assumptions and/or changes to the initial model strategy made, stage 2 of the model development, the Model Build commenced. This stage ideally groups together model build (or model update), model testing, model calibration and validation plus reports and model documentation discussed in the Water Modelling Guidelines.

The building of the actual model is driven by the consultant's modelling expertise with Council providing the general framework based on the desired modelling outcome. Council's main objective for the water model is to analyse certain asset management and operational problems, such as:

- Develop understanding of system operation
- Assess level of service and capacity of existing system
- Assess level of pressure at critical points within the system
- Low or high pressure fluctuation problems
- Identify bottlenecks in current and future systems
- Identify impact of population growth on the system
- Identify impact of industrial or commercial development on the system
- Identify and resolve operational anomalies (e.g. closed valves)
- Optimising the capital works programme
- Assessing the value and design of monitoring systems (telemetry, data loggers and SCADA)

During this stage the consultant is expected to regularly discuss progress and decision making with Council's Modelling Project Engineer to keep Council involved and up to date with the model building. Any supervision by Council to monitor the build progress is done on a working relationship rather than on traditional audit control approach. At the end both parties are working together towards the desired outcome of developing an accurate water model. Outputs from this phase are then to be summarised in the so called 'Model Build Report' to document the model build process, assumptions made and recommended calibration.

At the time this paper was prepared Council's modelling consultant, Aurecon was close to finalising the model build for the western supply zone. Any lessons learned during the model build of this supply zone will be applied for modelling of the other two supply zones, central and eastern. This will assist in keeping costs down and reducing expenditure of time to build the water models for the remaining supply zones. After all three supply zones are completed one overall 'Model Build Report' will be issued to document the model build of Council's entire water distribution network.

3.3.3 MODEL DELIVERY & MAINTENANCE FOR WATER MODELS

The third and final stage of Council's water model development loosely reflects the model use and results interpretation steps listed in the Water Modelling Guidelines. This includes setting up a simulation runs plan to satisfy the model objectives formalised at the beginning of the project and revised during the model build. The next step is the actual running of the model and subsequent verification of the results.

After successful initial model runs the water model is handed over to Council for their in-house use. The handover process includes training of Council's Modelling Project Engineer on how to use and run the model as well as a review of the network performance to feed into the water asset management.

Additional assistance by the consultant will be provided for the maintenance of the water model. This on-going support will be a long-term relationship between the consultant and Council to improve the quality of the modelling outcomes and to serve as back-up for Council's Modelling Project Engineer should it be required.

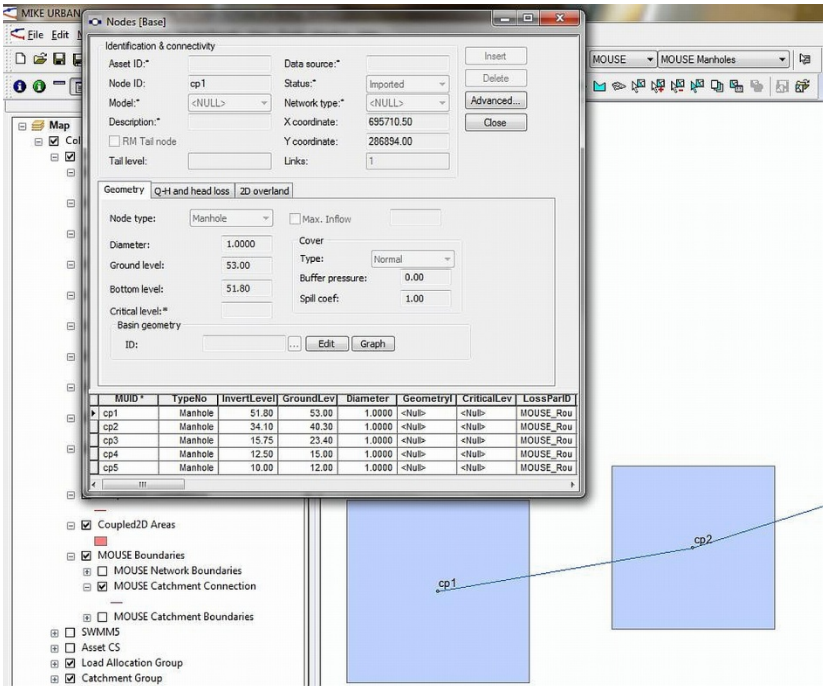
4 STORMWATER MODELLING THE WESTERN BAY WAY

4.1 BACKGROUND

Previous stormwater models were mostly created on request to assist with Council's stormwater asset management. All of the model development was left to the consultant's discretion with little input from Council. The main purpose for this modelling was to deliver input into the annual capital works programme to upgrade stormwater drainage systems of the Western Bay of Plenty. These models however were not intended to be maintained, updated to reflect new land developments or reused to regularly optimise performance of Council's stormwater drainage systems.

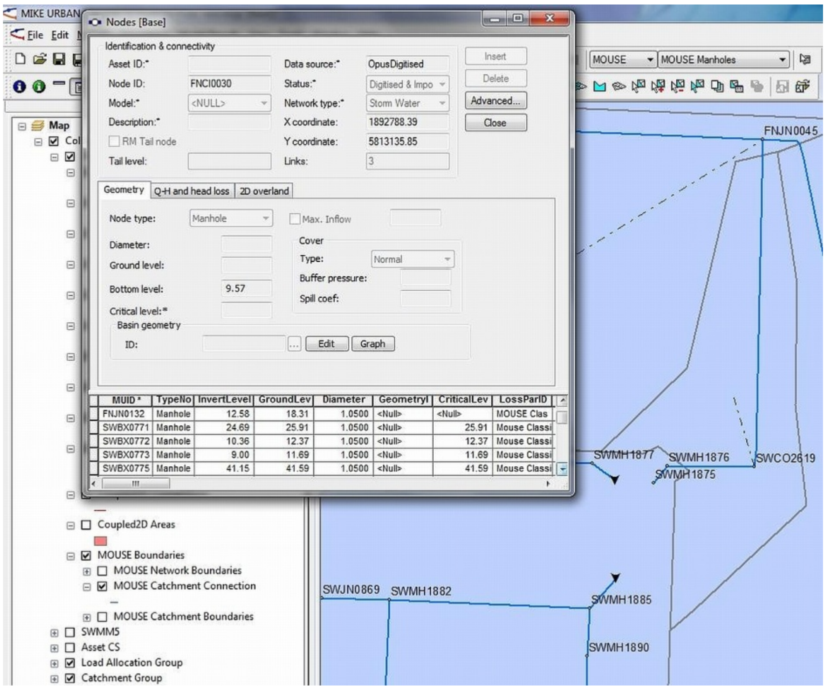
With Council's changed modelling approach, stormwater models are now expected to include all components of the drainage system and to provide continuous input into stormwater asset management. The two main objectives thereby are improved system performance and a subsequently better level of service. New stormwater model developments are supposed to make full use of MIKE URBAN's integrated GIS functionalities; e.g. showing true catchment boundaries (see figure 3) instead of simplified squares (see figure 2) as with previous models. This will enable any modeller, while maintaining and updating models at a later point, to visually identify recent land developments by using up-to-date aerial views or district maps.

Figure 2: Catchments simplified to squares in previous MIKE URBAN stormwater models



The new approach to modelling further asks for Council's GIS labels to be used for all model items imported from Council's GIS database. Each model item label will therefore either reflect their true GIS identifier or use a generated label with specific prefixes (F for fictitious or S for schematic items). This is to differentiate between GIS entities used in the model and items specifically created for modelling purposes. Fictitious model items are for example dummy links or nodes generated to model pumps and valves in MIKE URBAN. Schematic model items can be simplified pump station storages and overflows. This convention applies to all 3 water systems in order to standardise labelling throughout Council's stormwater, wastewater and water models.

Figure 3: Catchments reflecting their true shape in new MIKE URBAN stormwater models



Council commissioned Opus International Consultants Ltd (Wellington) to develop a new stormwater model for Te Puke using MIKE URBAN’s MOUSE module for collection system modelling. In the past only small portions of Te Puke’s stormwater drainage system have been modelled. This made it difficult to get a good overview of the performance of the entire stormwater catchment and to develop any long-term asset management strategies. These shortcomings will be addressed in the new stormwater model. This model will be the pilot project for modelling of all Western Bay of Plenty stormwater catchments and the results will also be used to produce flood hazard and extent maps.

4.2 NETWORK OVERVIEW

Te Puke is located in the Western Bay of Plenty to the southeast of Tauranga. The stormwater drainage system of Te Puke (see figure 4) consists of 1,300 pipes, more than 500 manholes and over 30 kilometres of open drains ultimately discharging into the Kaituna River.

Figure 4: Overview of the stormwater drainage system Te Puke

4.3 MODEL DEVELOPMENT

The new approach in stormwater modelling follows Council's revised general modelling approach with the three main stages Gaps Analysis, Model Build and Model Delivery & Maintenance (see chapter 2). In addition to the general approach, the final stage of the Te Puke model development was extended by two extra tasks; Flood Mapping and Guidelines for stormwater drainage modelling.

4.3.1 GAPS ANALYSIS FOR STORMWATER MODELS

The purpose of this stage is to analyse the adequacy and completeness of data available for the building of a hydraulic model to represent the stormwater drainage system and produce flood hazard maps. The consultant reviewed all data supplied by Council to identify additional data requirements to build the model of Te Puke's stormwater drainage system. Any gaps discovered were listed in the report titled 'Te Puke Mike Urban Stormwater Modelling – Stage 1: Gap Analysis' (Opus, 2011). This document summarised the lack of data and identified solutions to obtain missing information for different parts of the stormwater drainage system, such as:

- Nodes (boxes, inlets, outlets, headwalls, junctions and manholes)
- Pipes
- Open drains and watercourses
- Surface roughness
- Catchment extent and percentage of impervious area
- Historical flood event data

Most of the missing reticulation data (nodes, pipes and open drains) was obtained through multiple field surveys by Council staff. These surveys also improved the quality of Council's stormwater asset data and changed the maintenance schedule for stormwater outlets throughout the Western Bay of Plenty. During these in-house investigations it became obvious that not all outlet structures are maintained on a regular basis. Due to that a number of outlets were found blocked or overgrown by surrounding vegetation. The utilities operation team is looking into adding all stormwater outlets to the utilities maintenance contractor's scope of work.

Historical flood event data was the only significant data gap, which could not be solved though surveying, data collection or data manipulation. This however has not prevented the model from being built, but reduces the confidence placed in the modelling results. Thorough sensitivity analyses will be carried out into the key calibration parameters (e.g. pipe roughness and catchment impervious area) to quantify the level of confidence. The very limited anecdotal historical observations available will be assessed by the modelling consultant to provide some measure of verification.

4.3.2 MODEL BUILD FOR STORMWATER MODELS

After critical data gaps were solved, the model development advanced to the next stage, Model Build. During this phase the consultant is building the stormwater model as per Council's instruction based on the desired modelling outcome. The main objectives for stormwater models are:

- Understand capacity of the current drainage system
- Schedule required system upgrades (capital works programme)
- Flood mapping for 50-year ARI and 100-year ARI flood events
- Emergency management planning information

During this phase the consultant is asked to liaise regularly with Council's Modelling Project Engineer to discuss progress, challenges and any required decisions to be made. At the time this paper was prepared the modelling consultant, Opus was close to finishing the model build of Te Puke's stormwater drainage system. Experiences during this stage are to be summarised in the 'Model Build Report' to document the model build process, assumptions and any additional recommendations made.

4.3.3 MODEL DELIVERY & MAINTENANCE FOR STORMWATER MODELS

After completion of the model build and successful initial model runs the new Te Puke stormwater model will be handed over to Council. As part of the handover Councils' Modelling Project Engineer will receive instruction in the model set-up and training on how to run the model. The handover documentation will include a review of the system performance to feed into the asset management and forward replacement programme of the stormwater drainage system.

Additional long-term support by the consultant for the completed stormwater model will improve the quality of future modelling tasks and also serve as back-up for Council's Modelling Project Engineer.

FLOOD MAPS

All of Western Bay's new stormwater models are expected to produce additional flood hazard and extent maps using MIKE FLOOD. These hazard maps will indicate the extent of flooding for two specific scenarios:

- 50-year ARI rainfall event and existing stormwater drainage system
- 100-year ARI rainfall event and drainage system upgraded for 50-year ARI

The 50-year ARI scenario will predict the extent of flooding able to be mitigated economically by upgrading the drainage system, while the 100-year ARI will indicate unavoidable flooding. Upgrading the entire system to allow for a 100-year ARI rainfall can, as a matter of fact, be deemed uneconomical. Council's Development Code only requires stormwater drainage systems to be designed for a 100-year ARI to protect major infrastructure facilities.

GUIDELINES

The Te Puke model is the first stormwater model following Council's revised approach in modelling their 3 water systems. The consultant will document all lessons learned during the model development and combine them in a generic document called 'Western Bay of Plenty District Council - Guidelines for Stormwater Drainage Modelling'. This document will describe the default approach for modelling of stormwater catchments throughout the Western Bay of Plenty.

5 WASTEWATER MODELLING THE WESTERN BAY WAY

5.1 BACKGROUND

Council's situation with existing wastewater models is similar to that experienced with the stormwater modelling. Previous models were also primary developed for the asset management on an ad-hoc basis with the wastewater model development entirely up to the discretion of Council's modelling consultants.

The revised modelling approach now expects newly developed wastewater models to comply with the following:

- All public sewers to be included (no trimming)
- Rising mains to be modelled as pressure pipes
- Coding consistent with Council's labelling convention (true GIS identifier or generated label)
- Each property to be modelled as own subcatchment
- Finished model to provide continuous input into the asset management

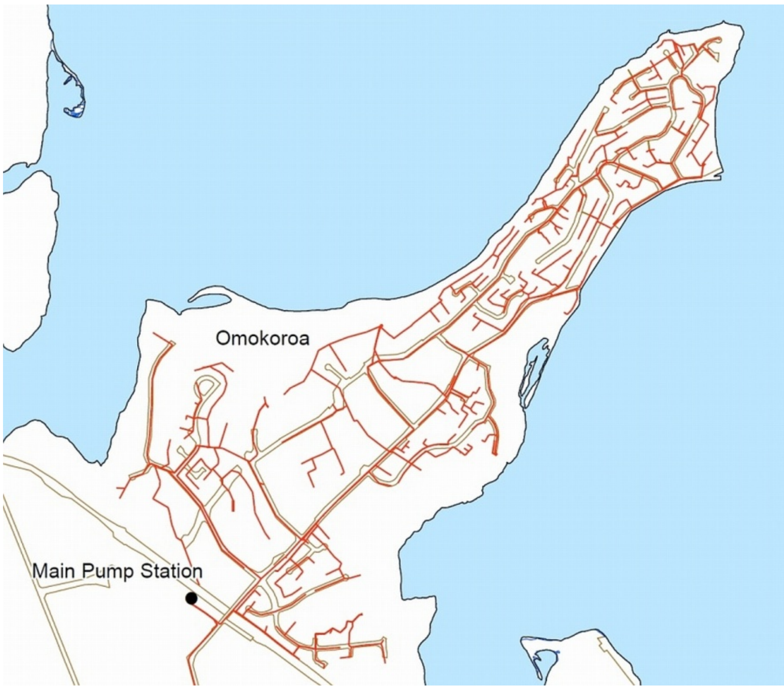
These adjustments were made to satisfy the same two main objectives as for the stormwater modelling, namely improved system performance and better level of service.

Opus International Consultants Ltd (Auckland) was commissioned by Council to develop a new wastewater model for Omokoroa using MIKE URBAN's MOUSE module for collection system modelling. The main initiation for this project was the need for Council to understand the hydraulic performance of the wastewater collection system that services Omokoroa. This model will also be a pilot project, for the modelling of all wastewater catchments in the Western Bay of Plenty.

5.2 NETWORK OVERVIEW

Omokoroa is located approximately 15 kilometres northwest of Tauranga. It is a coastal town with a population of 1,635 people (2006 census). The Omokoroa wastewater collection system (see figure 5) consists of more than 700 manholes and around 35 kilometres of gravity pipes with diameters ranging from 150 to 475 millimetres. There are 14 pump stations including one booster pump on the rising main pumping to the Tauranga wastewater network.

Figure 5: Overview of the wastewater collection system Omokoroa



5.3 MODEL DEVELOPMENT

The development of Omokoroa's wastewater model began prior to modifying Council's approach in modelling. However the wastewater modelling has finally been aligned with the revised modelling approach, causing initial model runs and documents provided by the consultant for the Omokoroa model to be superseded. The modelling for wastewater collection systems now also passes through the three consecutive stages; Gaps Analysis, Model Build and Model Delivery & Maintenance (see chapter 2). Further to the general approach one extra task was added to the Omokoroa model development; Guidelines for wastewater collection system modelling.

5.3.1 GAPS ANALYSIS FOR WASTEWATER MODELS

The purpose of the Gaps Analysis is to review the accuracy and completeness of data available to develop a comprehensive model representing the wastewater collection system. The modelling consultant documented all the gaps in a memo titled 'Omokoroa Wastewater Model - Data Supply & Gaps Analysis' (Opus 2011). This document summarised the lack of asset data, indicated the impact of assumed data on modelling and provided recommendations to rectify missing information. The following wastewater system components were reviewed during the Gaps Analysis:

- Manholes
- Gravity sewers (conduits)
- Pump stations

Council's supplied manhole and conduit information was generally satisfactory with the exception of some missing manhole depths and conduit invert levels. This data was collected through a follow-up survey undertaken by the consultant. This for once again improved the quality of Council's asset data records.

The biggest challenge of the Gaps Analysis was to sort out misleading information on installed pump types throughout the Omokoroa wastewater collection system. Pump identifications written down by the utilities maintenance contractor during annual inspections were inconclusive and/or different to as-built records. The decision was made to use the as-built information for the initial model build and verify all installed pump types prior to the first model runs. For the future the utilities operation team will work on improving the quality of stored information on all installed wastewater pumps in the Western Bay of Plenty.

5.3.2 MODEL BUILD FOR WASTEWATER MODELS

During this stage the consultant is building the actual model as per Council's job brief based on the desired modelling outcome. Council's main objectives for wastewater models are:

- Understand capacity of the current collection system
- Identify impact of population growth
- Operation of the collection system
- Schedule required system upgrades (capital works programme)

The consultant is required to liaise with Council's Modelling Project Engineer on a regular basis to discuss progress and decisions to be made. At the time this paper was prepared Council's consultant, Opus was finishing the model of Omokoroa's wastewater collection system. Experiences during this stage will then be summarised in the 'Model Build Report' documenting the model build process.

5.3.3 MODEL DELIVERY & MAINTENANCE FOR WASTEWATER MODELS

With the completion of the model build and successful initial model runs the wastewater model for Omokoroa is handed over to Council. The handover involves training of Council's Modelling Project Engineer on how to operate the model as well as a review of the system performance to feed into the wastewater asset management.

The consultant's long-term support for the wastewater model will improve quality of future modelling tasks and also serve as back-up for Council's Modelling Project Engineer.

GUIDELINES

The Omokoroa model is the first wastewater model developed as per Council's revised modelling approach. A generic document named 'Western Bay of Plenty District Council - Guidelines for Wastewater Collection Modelling' will summarise lessons learned during all stages of the model development. This document will set out the default approach for modelling of wastewater catchments throughout the Western Bay of Plenty.

6 CONCLUSION

The revised approach in modelling provides Western Bay of Plenty District Council with an effective tool to get more control over model developments for their 3 water systems. The main benefits of such an approach are:

- Increased quality of the modelling outcome due to the Council and consultant working together as a team during the model development
- On-going support by the consultant for the completed model
- Improved quality of Council's asset data records, asset operation and maintenance caused by the Gaps Analysis of any model development
- Continuous input to the asset management and operation as long as models are maintained and updated
- Cost reduction and less time expenditure for model developments as per Council's Modelling Guidelines

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NOMENCLATURE

3 water: General term for stormwater drainage, wastewater collection and water distribution systems

ArcGIS: Geographic Information System (GIS) for working with maps and geographic information (developed by ESRI)

ARI: Average Recurrence Interval is the average period of time between rainfall events which exceed a certain magnitude

AutoCAD: Computer-aided design (CAD) programme for 2-D and 3-D design and drafting (developed and marketed by Autodesk Inc.)

DHI: DHI Water & Environment, formerly known as the Danish Hydraulic Institute, is a research and consulting organisation developing and applying advanced methods and technologies within hydraulic and water resources engineering.

EPANET: Software to model water distribution systems (developed by U.S. Environmental Protection Agency); also included as simulation engine in MIKE URBAN

ESRI: Software development and services company providing Geographic Information System (GIS) software and geodatabase management applications

MIKE FLOOD: Modelling software combining 1- and 2-dimensional modelling techniques to simulate urban drainage systems, flood plains and inundation for rivers (developed by DHI Water & Environment)

MIKE URBAN: GIS-based urban modelling software for water supply networks, stormwater reticulations and wastewater collection systems (developed by DHI Water & Environment)

MOUSE: MOdel for Urban Sewers is a computer program that models collection system for urban wastewater and stormwater (developed by DHI Water & Environment)

SCADA: Primary purpose of SCADA (Supervisory Control and Data Acquisition) to monitor, control and alarm plant or regional operating systems from a central location

SUE: Static and Unique Entity identifier is a distinct reference made to a Landonline record of a parcel of land and considered not to change for the life of that record.

Valuation: Rating number assigned to a piece of land (single or multiple lots) common to one owner or group of owners

REFERENCES

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Western Bay of Plenty District Council (2009) *Development Code: Section 4 Design Standards - DS5 Stormwater, 4*

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