Zero Based Review

[THE CITY OF CALGARY, WATER SERVICES]

Version 11.0 (issued 23 February 2015)

Scottish Water

The City of Calgary, Water Services

Zero Based Review

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SECTION 1 – BACKGROUND TO SCOTTISH WATER

SCOTTISH WATER & SCOTTISH WATER INTERNATIONAL

Scottish Water - Introduction

In 2001, the Scottish Government decided to create a single government-owned entity to manage the water and wastewater networks for the whole of Scotland, named Scottish Water (SW). SW is a unique public organisation, based in Scotland, and owned by the people of Scotland.

SW provides clean, safe drinking water and disposes of waste water from homes and businesses across Scotland. SW operates and maintains over 47,000 kilometres of water pipes, 50,000 kilometres of sewer pipes, 1,837 waste water treatment works (including 1,206 septic tanks) and 252 water treatment works plus pumping stations, sludge treatment centres and reservoirs. SW has around 5 million customers in 2.4 million households.

This creation of SW focused on a number of key ambitions, to deliver efficiencies, both in terms of operational and capital costs, and an improvement in its effectiveness delivery, in particular the raising of customer service standards.

During the first four years of SW's existence it delivered a **40%** efficiency reduction in operating cost improvements in the delivery of its service, whilst at the same time increasing the experience that customers received from SW. SW improved its overall customer service satisfaction across all areas of its service, with customer service scores more than doubling since 2002 to 2014, meaning customers receive a better service now than ever before.

Scottish Water International - Introduction

Scottish Water International Limited (SWI) is a wholly owned subsidiary of Scottish Water, Scotland's publicly-owned water and sewerage authority, and uses SW's resources and expertise to deliver services for its international clients. SWI has access to the breadth of experience from the 3,200 employees of SW. All employees engaged by SWI for its clients are employed by SW and seconded to SWI.

A project team from SWI has been the consultant working on the Water Services Zero Based Review in conjunction with The City of Calgary.

SECTION 2 – ZERO BASED REVIEW INTRODUCTION

WATER SERVICES: ZERO BASED REVIEW

BACKGROUND TO WATER SERVICES ZERO BASED REVIEW

The Zero Based Review (ZBR) process is a systematic evaluation process with the objective of assessing the service **efficiency** and **effectiveness** of Water Services. The outcome being the provision of options and recommendations to identify:

- ✓ changes to the service level or delivery that would reduce costs or mitigate future costs increases (efficiency improvements), and
- ✓ changes to the service level or delivery that would achieve greater results within currently available resources (effectiveness improvements)

This report summarises the approach taken during the following phases of the ZBR on Water Services, and the recommendations arising:

- ✓ **Phase 2a Stage : High Level Analysis** – this phase was the identification of the services and sub-services that are efficient and effective, and to identify those with the greatest potential for efficiency and effectiveness improvements for more in-depth analysis in Phase 2b
- ✓ **Phase 2b/3 Stages : In-depth Review and Analysis** - the results of the in-depth analysis undertaken on the services and sub-services of Water Services and an outline of the key opportunities including the efficiency and effectiveness benefits associated with the implementation of these opportunities

Strengths of Water Services

Although the ZBR process is focused on the improvements that can be made in enhancing the efficiency and the effectiveness of the services provided, it is worth noting the strengths that have been observed by the SWI consultants during the ZBR, as outlined below:

Knowledagble, committed and proud work-force

Modern and efficient asset base

Service culture, passionate about their assets

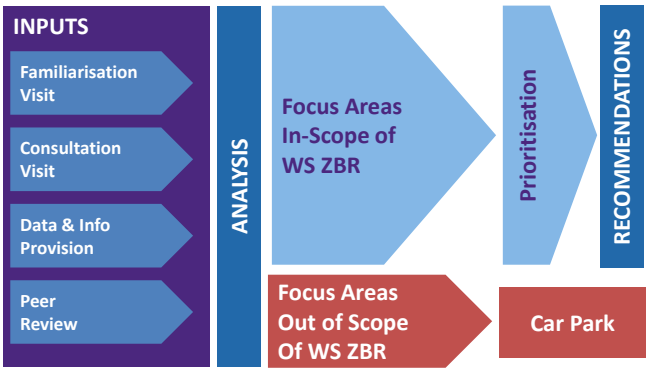
It's these strengths that provide a solid foundation for continuous improvement, including the delivery of the ZBR recommendations that are driven through this process for implementation.

As highlighted earlier in the first four years of its existence SW were able to deliver a 40% reduction in operating costs, whilst increasing customer service over the same period. This level of performance was unprecedented in the United Kingdom water industry and was enabled due to the amalgamation of three existing water authorities, who undertook the opportunity to rationalise and merge their existing resources, systems and processes in order to achieve the challenging targets, in terms of efficiency and effectiveness, placed on them through water industry regulation.

The SWI consultants' view of The City of Calgary's Water Services, gained throughout the ZBR process, is that Water Services level of maturity is much further along than SW's maturity was as a water and waste water business in 2002. Therefore, the opportunity to deliver this level of efficiency and customer service improvement is not necessarily achievable.

ANALYSIS OF WATER SERVICES

The approach for undertaking the Phase 2a analysis is summarised below:



There have been a number of key inputs into the analysis undertaken by the SWI consultants that have been crucial in understanding and assessing Water Services. These inputs have been supplemented with the SWI consultants own data in order to undertake further benchmarking analysis and provide a solid base of evidence for the recommendations emerging through this phase.

The approach undertaken in Phase 2a was to follow the ZBR process to test the services and sub-services of Water Services against the key ZBR themes of service rationale, effectiveness, level and scope, efficiency and funding. These themes have been informed through the data and information provided by The City of Calgary, as well as familiarisation and consultation visits to Calgary, resulting in the recommendations for the Phase 2b 'deep dive' analysis, coupled with a peer review of the 2a analysis to assist in testing findings and setting the Canadian context.

Key Focus Areas from Phase 2a Analysis

This Phase 2a analysis highlighted a number of key focus areas that warranted further investigation to assess the potential for efficiency and effectiveness improvements. Key focus areas that were deemed to be 'in-scope' of the Water Services ZBR were then taken forward for further analysis and prioritisation; subsequently these areas were defined further in order to enhance the prioritisation process through having a more granular view of each focus area, as outlined below:

KEY FOCUS AREAS – Areas In-Scope for Water Services ZBR	
Key Focus Area	**Granular Areas Within Key Focus Area**
Work-force planning:	1. Succession planning 2. Water and Wastewater Treatment work-force planning 3. Field Services and Construction Services work-force planning
Opportunities to optimise the utilisation of the available resources in delivering the service to the customer, including improving the integration of resources and optimisation of processes for plant and field employees supported through effective IT enablement.	

Performance measurement:	4. Financial 5. Business
Opportunities to strengthen the assessment of business performance across all Water Services divisions, including assets, people and processes. This encompasses the capture of data and the process of turning data into information that is used for reporting and to manage, understand and drive business performance and decision making.	
Asset operations and management:	6. Asset management maturity 7. Regulatory standards and dialogue 8. Fleet optimisation
Opportunities to increase efficiency by taking a risk based approach to maintenance, operation and management of the asset base	
Alternative service delivery:	9. Calgro and biosolid management
Opportunities to review the biosolid management strategies including the Calgro programme, 3rd party contracts and joint composting facilities with Waste & Recycling Services	
Alternative revenue generation:	10. On-site electricity 11. Lease opportunities on City land
Opportunities to utilise existing assets and land to increase revenue and minimise business costs.	

Car Park – Areas Out of Scope

The City of Calgary operates an integrated Water Utility with two business units, Water Resources and Water Services. As the focus of the ZBR is Water Services only, anything outside the scope of services provided by Water Services has been 'parked' in order to be assessed at some point in the future, particularly through the Water Resources ZBR in 2015. In particular:

- ✓ **Business integration –** opportunities to strengthen the integration of Water Services within The City of Calgary, in particular with Water Resources and support services
- ✓ **Billing and collection –** opportunities to realise revenue and contributions from services provided to customers and developers

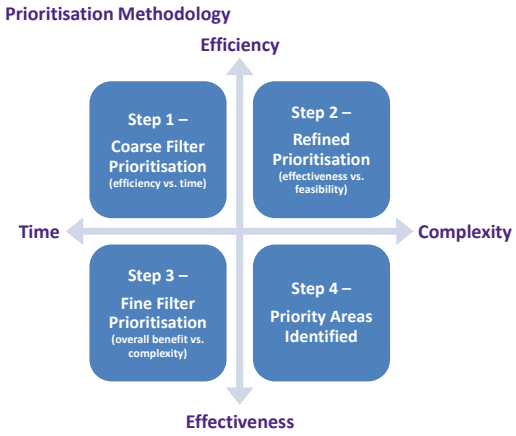
Contracting Out Opportunities in Water Services

Following the high level analysis and the deep dive assessment of Water Services the SWI consultants identified limited opportunities for further contracting out to third parties of the services currently being delivered by Water Services in-house work-force.

Prioritisation of Key Focus Areas

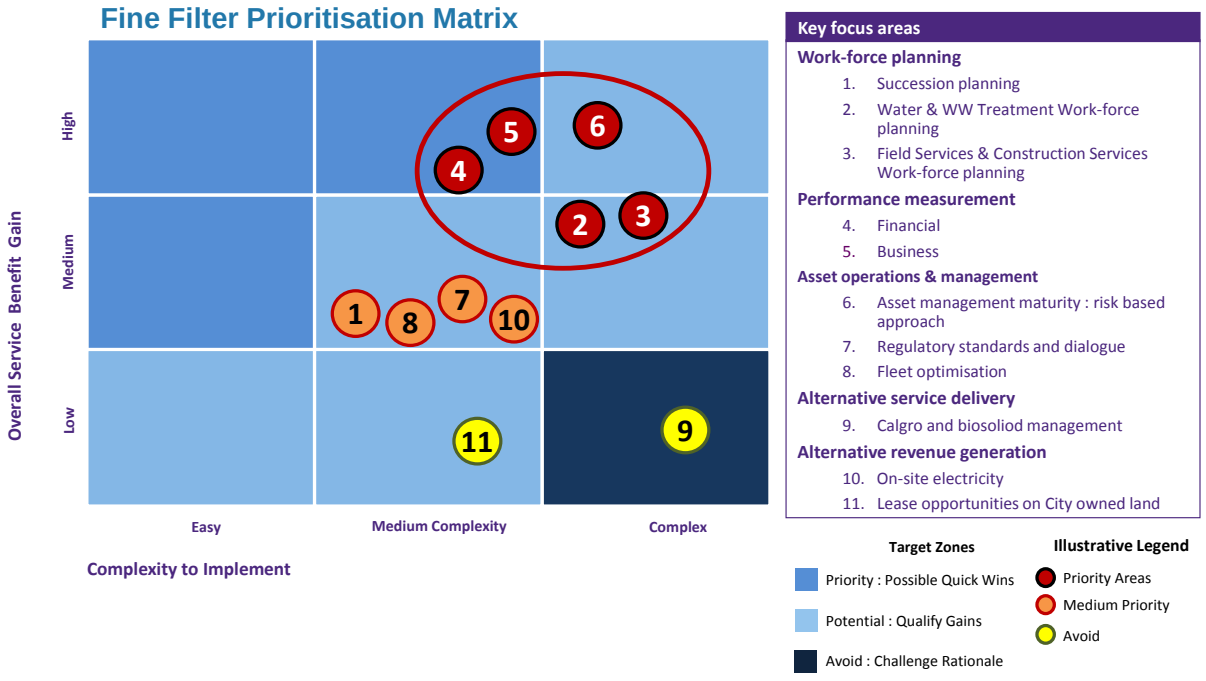
The SWI consultants undertook an iterative prioritisation process, initially through a 'coarse' assessment of efficiency against the time it might take to implement.

This was followed by a refined prioritisation that assessed effectiveness (in terms of impact on customers, water quality and employees) against feasibility to deliver (the requirement for up-front investment and the complexity of implementation).



The final stage was the fine filter prioritisation which took the overall service benefits (efficiency and effectiveness combined) and plotted them against the complexity to implement. This provided a final view on the priority, helping to make an assessment of the focus areas across the following three categories:

- ✓ **Priority focus –** medium/high or high benefit
- ✓ **Medium priority –** medium or medium/low benefit
- ✓ **Avoid –** low benefit



Recommendations from Phase 2a for the 'Deep Dive' Analysis

As highlighted in the prioritisation exercise the conclusion of Phase 2a summarised that the key areas to be assessed in Phase2b/3 were around workforce planning, asset operations and maintenance and performance measurement.

In order to ensure that the 'deep dive' analysis was comprehensive and robust, the SWI consultants focused on services and sub-services where there was the biggest opportunity in that particular workstream. This would ensure that opportunities developed would be based on evidence and tested in a number of ways with Water Services.

The concept being that this would provide the basis for the opportunities to be scaled (the learning and recommendations transferred to other areas of the business) across other services within Water Services where appropriate. The potential regarding scalability is covered in section 8.

This resulted in the final scope being agreed for three specific workstreams (risk based maintenance, performance measurement and job planning), an outline of these three workstreams is highlighted below:

LEVELS OF SERVICE	PERFORMANCE MEASUREMENT	WORK-FORCE PLANNING
	Scope for 'deep dive'	
RISK BASED APPROACH TO MAINTENANCE	**PERFORMANCE MEASUREMENT**	**JOB PLANNING**
Scope outline: Conduct in-depth analysis of risk based approach to maintenance, using clean drinking water service as focus. Analysis of operation and maintenance at each stage in the asset operation process i.e. Water Treatment Plant, Lifting Stations, Network, Reservoirs	**Scope outline:** Working with the Water Service management team in the development of key performance measures to understand and drive business performance and decision making, including data governance, processes and ownership	**Scope outline:** In-depth analysis of job planning using the sanitary service as a representative pilot area to develop opportunities to optimise the utilisation of the available resources in delivering the service to the customer
findings and learning will be scaled across the related areas of Water Services (see section 8)		

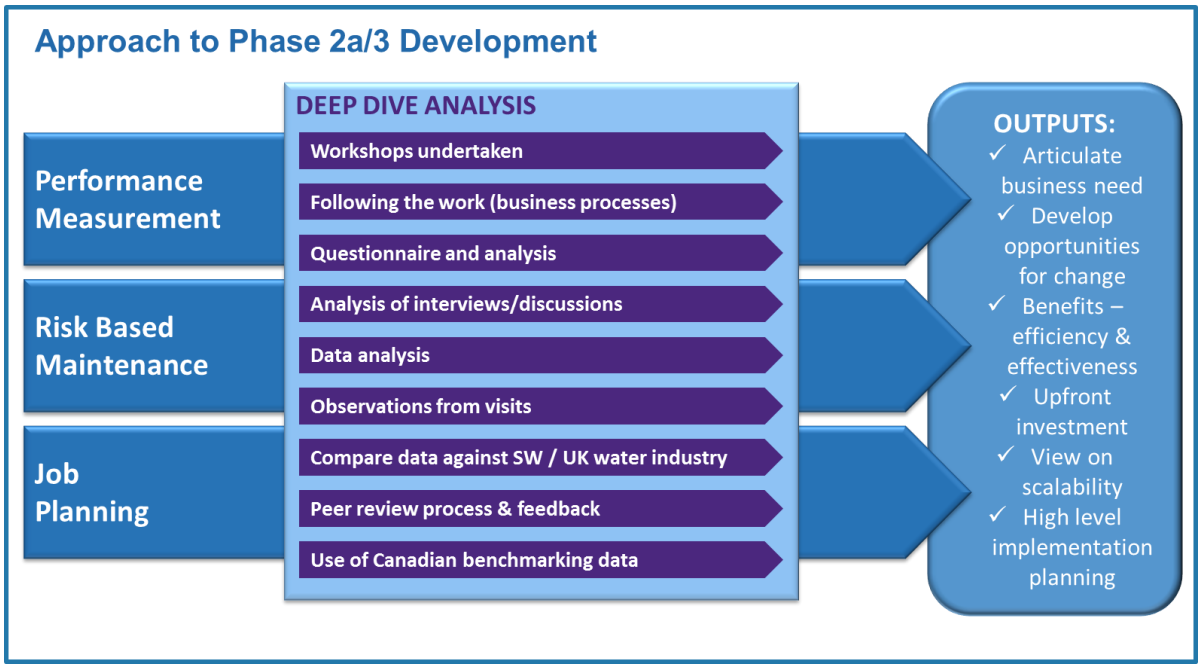
These focus areas are also supplemented by a number of underlying themes, that although could have a significant impact on efficiency and effectiveness, are better served through being integrated into the key focus areas where appropriate. These themes are:

- ✓ **Business processes and Information Technology (IT) enablement –** opportunities to improve key business processes and enabling them through the effective use of IT
- ✓ **Water Services integration –** opportunities to strengthen integration of activities within the scope of the Water Services business unit

- ✓ **Customer focus –** opportunities to leverage the existing customer service culture to strengthen the focus on customer service and less on assets

Phase 2b/3 – Deep Dive Analysis and Recommendations of Water Services

The diagram below highlights the approach undertaken to analyse the areas during the deep dive analysis. The outputs from this analysis are this ZBR report (including recommendations on performance measurement) and two fully costed business cases for the risk based maintenance and job planning areas for Water Services to use as a basis for the development of implementation planning.



The opportunities that have been identified during the deep dive are outlined in Sections 3 – 7 of this report, whilst a high level implementation plan has also been included to assist in the challenges of delivering the recommendations of the review (see section 10).

Summary of Financial Efficiencies Per ZBR Workstream

The table on the next page is a summary of the range of overall efficiencies that have been identified through the development of the opportunities within the workstreams during the deep dive analysis.

Definitions of the table columns are outlined below:

- ✓ **2013 Operating Expenditures of Services Reviewed In-depth –** this is the value of Water Services operating expenditures that has been subject to deep dive analysis during Phase 2b.
- ✓ **Range of Annual Efficiency Savings –** this is the value of the efficiencies identified, they are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented, and in a range of low (an estimate of relatively easy to achieve) to high (stretch efficiency target).
- ✓ **One-Time Implementation Costs** – an estimate of the value of the upfront investment that is required in order to realise the benefits. The IT requirements are generally unknown at this time. One-time costs will be determined by Water Services through implementation planning.
- ✓ **2013 Operating Expenditures Where Scalability May Apply** – this is a forecast of the value of Water Services operating expenditures that have been initially identified as areas where there is an opportunity for scalability of the recommendations.
- ✓ **Total Potential Application of ZBR Recommendations** – this is the total value of the Water Services operating expenditures covered by the addition of the deep dive analysis and the initial scalability estimate.

Further financial analysis broken down for each opportunity is included in Sections 3-7, with a summary table of all the efficiency projections per opportunity in Section 9.

SUMMARY OF THE WATER SERVICES ZERO BASED REVIEW FINANCIAL RESULTS (per workstream)									
Business Case & Recommendations	2013 Operating Expenditures of Services Reviewed In-depth		Range of Annual Efficiency Savings ($000s)		One Time Implementation Costs ** ($000s)	2013 Operating Expenditures of Services Where Scalability May Apply		Total Potential Application of ZBR Recommendations (In-depth + Scalability)	
	($000)	% *	Low ($000)	High ($000)		($000)	%	($000s)	%
TOTAL WATER SERVICES ZERO BASED REVIEW	**48,122**	**32%**	**2,359**	**5,011**	**at least 1,415 + IT costs (TBD)**	**59,602**	**40%**	**107,724**	**72%**
PERFORMANCE MEASUREMENT * **	n/a	n/a	0	0	30	n/a	n/a	n/a	n/a
JOB PLANNING	16,405	11%	1,854	4,212	1,300	28,262	19%	44,667	30%
Trenchless Technology			996	1,990	500				
Resource Optimisation			575	1,421	800 + IT costs (TBD)				
Customer Experience			282	801	IT costs (TBD)				
RISK BASED MAINTENANCE	31,717	21%	506	799	85 + IT costs (TBD)	31,340	21%	63,057	42%

* *Percentage of total Water Services 2013 Operating Expenditures ($150m)*

** *One-time costs of implementation are estimated, and IT requirements are unknown at this time. One-time costs will be determined by Water Services through implementation planning.*

*** *Performance measurement focused on the whole of Water Services as it is an overall business work stream, dealing with the business processes and culture throughout Water Services.*

SECTION 3 – PERFORMANCE MEASUREMENT

PERFORMANCE MEASUREMENT

BUSINESS NEED

Performance measurement within Water Services is used to assess how successfully it is performing in ensuring The City of Calgary residents and regional customers are getting the best value for the services being provided.

There are currently publicly reported business performance measures, however, there is an opportunity to strengthen and enhance these to provide a clear set of business performance measures with targets that the whole business can relate to and see where they contribute to as part of their roles. Reporting of business performance measures should enable everyone to see the contribution they are making to a successful service.

Water Services is committed to continual improvement. With this in mind the ongoing development of key performance measures will help to define and demonstrate the improvement. In order to demonstrate the improvement required, Water Services will benefit from optimising a clearly defined set of performance measures that can be tracked internally.

EVIDENCE – NEED FOR CHANGE

Effective performance measurement is key in ensuring that The City of Calgary's strategy is successfully implemented and also for the monitoring of the effectiveness at all levels in fulfilling its goals. This will assist in ensuring better informed and more effective decision making at both strategic and operational levels.

Building on what has already been developed within Water Services provides an opportunity to optimise decision making and control, strategic planning and target setting, improving communications and ensuring robust accountabilities.

The ultimate aim is to build on the Water Services foundations in developing a clearly defined set of performance measures that are understood by the whole business, with each measure being attributed to a one of the three Results Based Accountability ™ categories:

- How much do we do?
- How well do we do?
- Is anyone better off?

OPPORTUNTIES

Outlined in this section are a number of opportunities associated with performance measurement and the benefits of these opportunities in terms of improving service efficiency and service effectiveness.

Destination Statement

The destination statement below is an outline description of a defined future point once the opportunities have been implemented and the benefits from these opportunities realised. This description of the future is likely to be a number of years away, but this timeframe will be assessed in greater detail during the implementation planning stage of the ZBR.

Destination statement for performance measurement in Water Services:

'strengthening the reporting of business performance measures so everyone can see their contribution to service delivery and improvement'

As explained previously the foundation already in place provides a platform on which to enhance performance measurement within Water Services. With this in mind the following opportunities have been developed as a result of the evidence from employee input through a survey (see Appendix 3) and meetings with employees.

The opportunities are broken down into six areas:

1. Dashboard reporting
2. Benchmarking
3. Visibility of data and performance opportunities
4. Develop an overall performance measure
5. Set internal targets
6. Technology and performance measure improvement

The opportunities that have emerged from the performance measurement theme are described in the tables below:

Opportunity	Description of Opportunity
Dashboard Reporting 	**Rename dashboard** – a dashboard is highly visual (graphs, charts, indicators etc.). What has currently been developed is not, in the usual definition, a dashboard. A similar report in Scottish Water is known as a Performance At A Glance (PAAG). Renaming the dashboard will drive common language and definitions related to performance measurement **Customer focused measures** – measures specific to Water Services should be changed to a more customer focussed measure where appropriate to measure 'is anyone better off?'
Measures for ZBR process - Include measures relating to the implementation of the ZBR recommendations, including other continual improvement initiatives across Water Services	
Make it clear what improvement looks like - What is that improvement? How will we know when we get there? Discussing and answering these questions will ensure that the correct performance measures are put in place to track improvement. This will set the focus for the business on what needs to be done to get there. This has the impact of engaging employees on what needs to be achieved on how to achieve it and can drive clear performance measures to track the improvement	
Monthly reporting - The current WMT "Dashboard" measures are reported quarterly or annually. Water Services could move to report on a monthly basis where possible, even if initially it there is a lag of more than a month. This can assist in highlighting any common issues with data across the business and embedding reporting as a business as usual process. It can help with timely decision making and the effective tracking of issues throughout the year. As part of the monthly reporting, annual measures that are not tracked throughout the year should be reviewed for their value and removed	
Report is a standing item on the agenda - A manager's performance measures should be discussed at every meeting he or she has with the director. This will enforce to the manager the importance of performance measurement	

Benchmarking

Review measures supplied for Ontario Municipal Benchmarking Initiative (OMBI) and National Water and Wastewater Benchmarking Initiative (NWWBI) - Feedback from meetings with employees highlighted an issue on the effort of providing data for OMBI and NWWBI versus the value they actually get from the results of the studies. Due to the timescales involved (OMBI reporting in June and NWWBI in October for the previous year's data) the value of the studies was questioned as results were already over a year old by the time they were made publicly available.

There is an opportunity to review the data provided as part of these studies and decide what is particularly useful and relevant and put processes in place to capture them more regularly throughout the report year.

It is also recommended as these studies do not require data until well into the following year that the process of data collection is reviewed to see if it can be spread across the year. However, it is recognised that there are corporate implications relating to the benchmarking strategy with OMBI and NWWBI that would require a wider City of Calgary discussion on the implication of any changes in this area.

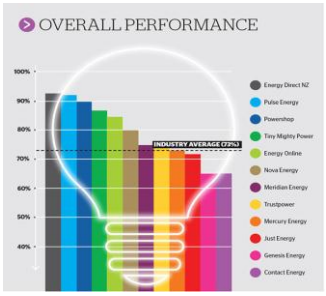
Visibility of Data and Performance Opportunities

Link all Performance Measures to the bigger picture – a common messages from meetings with employees was that they couldn't see how Council measures were relevant to their day to day work, while the measures they used to run their part of the business didn't roll-up to high level objectives. Employees at all levels should be able to see that what they are doing contributes not just to their own objectives but also to those of Water Services, UEP and the Council. Therefore, all performance measures developed by Water Services should have a 'golden thread' running through them to link to high level objectives.

Make performance data visible - The Water Centre has a number of communal areas such as coffee rooms, canteen, reception, crews' area and employee lounge that could be used to publicise performance measures.

Focus reports on the intended audience - The visibility of data needs to take into account the intended audience. In the above example something quick, snappy and visual is ideal for an audience that might be passing by but a report on the same measure for a manager or director will need to have more detail to give the story behind the numbers.

Develop an overall performance measure



Performance measures will need to be embedded as business as usual and a mature process in place for reporting. However, once this has happened a set of customer focused measures can be grouped together to form a single performance score.

This provides a clear and easy to understand measure of performance that gives a quantifiable output of improvement in performance, increasing collaboration across the business with a single measure to focus on.

Set internal targets

Owners of individual performance measures should be set increasing annual targets over the four year period to 2018.

These can be tied into personal objectives. This will enable to business to clearly track and measure performance on an on-going basis.

Technology and Performance Measure Improvement

Create a data agenda – in any organisations there are important performance indicators that can be difficult to measure but if they are measured can provide valuable performance information. Water Services can create a data agenda for such items with actions that need to be taken to allow the measure to be reported and an owner for each action. This will show a desire for improvement and the plan to make it happen.

Use a reporting tool - Water Services needs to work closely with IT to ensure that a reporting tool is fit for purpose to allow employees to build reports from their corporate data.

The current situation of employees extracting data from live systems is unsustainable due to the risk to the integrity of the systems. This will make data extraction easier and ensure the system is robust and protects the integrity of live corporate systems. Consistent data is retrieved once a report is built so improves data quality.

A single repository for reports - Feedback from managers was that it is difficult to find the information they need as it is embedded in emails, provided by multiple data owners, or in different IT folders. A single repository for all reports would resolve this. It would lead to easier access to reports, greater sharing of information, promote "one version of the truth" for reports.

BENEFITS

Efficiency Benefits

The efficiency calculations are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented. The tables below forecast efficiency cost-savings and productivity improvements as defined below:

- ✓ **Cost Savings –** these are efficiencies that result in a bottom line saving in the cost of delivering a defined activity. For example the unit cost of delivering the service is reduced through a new or different approach to delivery.
- ✓ **Productivity Improvements –** this is a change to the delivery of the service that results in achieving greater results within the currently available resources. For example the optimisation of resources on one activity allows that particular resource to be deployed on other value add activities. The productivity is measured as a saving that comes from being more efficient in delivering the output but it is assumed that these savings are reinvested to do more for the same overall cost.

It should be noted that the efficiencies shown in the tables have been calculated as **gross** efficiency numbers, any upfront investment required to realise these efficiency benefits has not been netted off at this stage. As a number of assumptions have had to be built into the efficiency forecasts then a range of efficiency is also predicted. The low estimate tends to be a view of what is relatively easy to achieve through the implementation of the opportunities with the high estimate being a stretch target for Water Services.

Efficiency Cost Savings		
Range of Efficiency	**Low**	**High**
	$0.0m p.a.	***$0.0m p.a.***
Assumptions and Calculation Methods for Ranges	Not applicable	
Rationale for Efficiency	Not applicable	

Efficiency Productivity Improvements		
Range of Efficiency	**Low**	**High**
	$0.0m p.a.	***$0.0m p.a.***
Assumptions and Calculation Methods for Ranges	Not applicable	
Rationale for Efficiency	Not applicable	

Although not quantifiable it is logical to suggest that an increased focus on performance measurement, measuring the right things and optimising decision making will drive the right behaviours that not only improve effectiveness eg customer service, but deliver value based decisions as well.

Therefore, in the longer term for Water Services there is a high probability of a correlation between good performance measurement and efficiency productivity improvements.

Upfront Investment

In order to realise some of the benefits associated with performance measurement there is potentially a requirement for up-front investment within the technology and performance measurement improvement opportunity relating to the use of a reporting tool.

As there is already an established reporting tool in-situ then the perception is that the investment that will be required for modifications to the reporting tool, and potentially the data warehouse, to ensure it is 'fit for purpose' in meeting Water Services needs for reporting and analysis. This investment is not likely to be more than **$30k**.

The exact cost, scope and the return gained on this type of investment will be analysed further during implementation planning.

Effectiveness Benefits

The table below makes an assessment of the benefits resulting from the implementation of the opportunities from an effectiveness angle. These are non-financial benefits that deliver greater results within the currently available resources. For Water Services these benefits tend to manifest themselves in improved customer experience and improved quality of data resulting in better decision making.

Effectiveness Benefits	
Data quality improvements	Increasing the visibility of performance information and the increased utilisation of the data that feeds this has a positive iterative effect on the quality of the data
Improved decision making	The visibility of the 'golden thread' and making decisions in the context of the 'bigger picture' delivers a better outcome for the customer, having a focused performance target also helps people test the decisions that they do make in the context of what's really important for Water Services. Clarity and use of common language also facilitates quality conversations, thereby, improving decision making
Optimised resource pool	Some of the opportunities such as using a reporting tool and single repository for reports will assist in more effective ways of working for teams involved in performance reporting. This will mean that data extracting and reporting is made more efficient allowing them more time to spend on analysing the data and turning into value adding information for decision making
Customer experience	Moving to even more customer focused measures reinforces the customer ethos and drives the right behaviours and decisions based on the needs of the customer

SECTION 4 – JOB PLANNING

TRENCHLESS TECHNOLOGY

BUSINESS NEED

The traditional technique for rehabilitating defective sanitary sewers is excavation and replacement. Since sewer pipes in urbanized areas are, for the most part, located in the middle of streets, excavation and replacement creates traffic disruptions which results in loss of productive time for commuters within such areas. Depending on the situation replacement is also more expensive then the use of a pro-active trenchless technology solution. In an attempt to reduce the cost and disruptions associated with excavation and replacement, the water industry has developed innovative trenchless technologies (no-dig) for sanitary sewer collection system rehabilitation.

Trenchless technology is a type of subsurface construction work that requires few trenches or no continuous trenches. It can be defined as a family of methods, materials, and equipment capable of being used for the installation of new or replacement or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic, business, and other activities, types of trenchless technology includes cured-in-place liner pipe, deform/reform liner pipe, fold and formed liner pipe, slip liner pipe, and pipe bursting.

During the deep dive analysis of the ZBR the evidence from Water Services demonstrated that an enhancement to the current approach to replacement/rehabilitation of sanitary mains could be the further use of trenchless technology. This method has the potential for efficiency and effectiveness benefits for Water Services, for example cost reduction in delivering these sanitary service improvements to customers, along with providing minimal disruption to traffic, business, and other activities and, therefore, providing effectiveness benefits to customers.

The analysis undertaken demonstrated different work streams provide input to the decision regarding whether or not to carry out a sanitary service replacement. Once that decision has been made there are alternatives to replacing the service such as pipe bursting and lining. Lining is currently carried out by an external contractor. There is also a Sanitary Mains lining program carried out by Water Resources which has a potential to input into the service lining work stream.

Highlighted below is the evidence that has contributed to the development of the opportunities related to the use of trenchless technology being utilised further within Water Services:

EVIDENCE – NEED FOR CHANGE
Move to more proactive approach
✓ Reduce rehabilitation, repair costs and repeat visits by adopting trenchless technology for widespread use
Cost effective solutions
✓ Existing lining programs not extended to sanitary services. Water Resources has a contractor for the sanitary and water mains lining programme which could be explored further for the opportunity to be utilized for sanitary service lining ✓ Lining/Slip lining/Pipe bursting is cheaper than sanitary service replacement in suitable cases ✓ Lined sanitary services can require fewer maintenance visits as less prone to root blockages ✓ Currently lining candidates are identified and carried out by a contractor that organises costs sharing with the resident for the private side. Water Services then reimburses the contractor for the public side. The current position on cost sharing is that when private contractors identify a customer that could benefit from both their private and city owned sanitary services being lined they contact the Estimators in Water Services Construction Services. The city pays the contractor to line the city owned portion of the service while the customer pays the contractor direct for their section ✓ The trend in rising costs associated with utilising the rehabilitation solution method ✓ Root Auger programme annually clears roots from sanitary services ✓ Innovation not routinely incorporated into current processes to improve services
Customer journey
✓ Customers and Water Services cost share via external contractors ✓ Customers are regularly visited to clear roots from their sanitary services

OPPORTUNTIES

Outlined in this section are a number of opportunities associated with the use of trenchless technology and the benefits arising from the adoption of these opportunities in terms of improving service efficiency and service effectiveness.

Destination Statement

The destination statement below is an outline description of a defined future point once the opportunities have been implemented and the benefits from these opportunities realised. This description of the future is likely to be a number of years away, but this timeframe will be assessed in greater detail during the implementation planning stage of the ZBR.

Destination statement for Trenchless Technology in Water Services:

'to be a leader in utilising technology for the repair and maintenance of the sanitary and water mains network'

The current view on some of the interim steps associated with the realisation of the destination statement are summarised below, with a view on the associated timeframe:

Medium Term (2 Years)

- ✓ Trenchless technology used more often instead of replacement
- ✓ Root Auger Program scope is reduced

Long Term (4 Years or longer)

- ✓ Focussed technology adoption to support business
- ✓ Improved customer experience
- ✓ The proactive identification of suitable candidates for trenchless technology solutions, delivering a successful outcome (in terms of service and cost) and the cost sharing with the customer

The opportunities that have emerged from the trenchless technology workstream are described in the table below, along with the performance measurement metric associated with that opportunity:

Opportunity	Description of Opportunity
Adoption of Trenchless Technology 	Reduce rehabilitation, repair costs and repeat visits by adopting trenchless technology where suitable. Options are the creation of an in-house trenchless crew to line, slip line or pipe burst and the procurement of an external service provider to carry out the same.
Adoption of Trenchless Technology – Reduction of Root Auger Program 	By using trenchless technology the sanitary main will have been lined meaning the regular clearing of roots under the Root Auger program and number of emergency field operations call outs to clear roots are reduced. *Performance metric for opportunity : Percentage reduction in Auger programme*
Innovation - Continuously review innovation possibilities 	By continuously reviewing the market and exploring adding innovative methods to current processes, Sanitary Services delivery and efficiency can potentially be improved.
Innovation - Cost Sharing with Customers 	Explore possibilities for cost sharing of trenchless technology with customers for private sanitary services. *Performance metric for opportunity : Number of services cost shared with customers/Costs recovered per service lining*

BENEFITS

Efficiency Benefits

The efficiency calculations are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented. The tables below forecast efficiency cost-savings and productivity improvements as defined below:

- ✓ **Cost Savings –** these are efficiencies that result in a bottom line saving in the cost of delivering a defined activity. For example the unit cost of delivering the service is reduced through a new or different approach to delivery.
- ✓ **Productivity Improvements –** this is a change to the delivery of the service that results in achieving greater results within the currently available resources. For example the optimisation of resources on one activity allows that particular resource to be deployed on other value add activities. The productivity is measured as a saving that comes from being more efficient in delivering the output but it is assumed that these savings are reinvested to do more for the same overall cost.

It should be noted that the efficiencies shown in the tables have been calculated as **gross** efficiency numbers, any upfront investment required to realise these efficiency benefits has not been netted off at this stage. As a number of assumptions have had to be built into the efficiency forecasts then a range of efficiency is also predicted. The low estimate tends to be a view of what is relatively easy to achieve through the implementation of the opportunities with the high estimate being a stretch target for Water Services.

Efficiency Cost Savings		
Range of Efficiency	**Low**	**High**
	$1.0m p.a.	***$2.0m p.a.***
Assumptions and Calculation Methods for Ranges	**Lining instead of replacement -** The financial efficiency will be achieved by reducing the number of excavated sanitary service and replacing these with a lining solution. The average unit cost for a replacement service is $24k, with the average for lining being $15k, meaning a $9k efficiency per service can be achieved. The scope of lining has been estimated in the range 100–200 sanitary services per annum (p.a.), producing an efficiency range of between **$0.9m** and **$1.8m** p.a.. **Customer contribution for private side lining -** In addition additional savings (income) will be achieved by collecting a customer contribution in the range 10% - 20% for the private side lining. It is assumed that 50no. private side linings will be undertaken per year, at an average unit cost of $15k, producing an efficiency range of between **$75k** and **$150k** p.a.. **Root auger programme -** Currently there are 1,318 programmed auger jobs p.a.. This has been increasing on average 4% p.a. The cost per job is estimated at $202. Financial savings will be delivered by a corresponding reduction in the auger program in the range 8% - 15%, producing an efficiency range of between **$21k** and **$40k** p.a..	

Rationale for Efficiency	**Cost Of Activity –** if a service has been deemed suitable for lining then there is potential for cost savings to be made in lining a service compared to replacement by reducing the number of excavated sanitary service and replacing with lining **Reduced Visits –** lined services correct almost all sewer line defects and protect from roots meaning they are less prone to blockages ensuring that there is a reduction maintenance visits

Efficiency Productivity Improvements		
Range of Efficiency	**Low**	**High**
	$0.0m p.a.	***$0.0m p.a.***
Assumptions and Calculation Methods for Ranges	Not applicable	
Rationale for Efficiency	Not applicable	

Upfront Investment

In order to realize some of the benefits associated with the use of trenchless technology then capital investment in the enabling technology is required. An initial estimate of the level of investment required is forecast to be in the order of **$500k**. The exact cost, scope and the return gained on this type of investment will be analysed further during implementation planning.

Effectiveness Benefits

The table below makes an assessment of the benefits resulting from the implementation of the opportunities from an effectiveness angle. These are non-financial benefits that deliver greater results within the currently available resources. For Water Services these benefits tend to manifest themselves in improved customer experience and improved quality of data resulting in better decision making.

Effectiveness Benefits	
Disruption to customer	The avoidance of excavation and replacement means that there is a reduction in the disruption that is caused to traffic whilst the work is on-going, ensuring no negative customer perception of improvement works and also lessening the impact on loss in productive time for the citizens of Calgary
Demonstrating the Value of Water Services to the City	By exploring the possibilities for cost sharing of trenchless technology with customers for private sanitary services value is returned to the City and customer service is enhanced

SECTION 5 – JOB PLANNING

RESOURCE OPTIMISATION

BUSINESS NEED

During the deep dive analysis the evidence from Water Services demonstrated that an enhancement to the current approach to resources and the optimisation of those resources could be valuable in terms of improving efficiency and effectiveness and improving overall value and service to customers. The following statements are indicative of what you might hear within Water Services in providing sanitary services:

Resource Related Statements

Process

- Our process is we don't reuse any material we dig out of the ground at that time
- It can take quite a few phone calls and emails to find out what is happening with a job
- We can have an appointment on one side of the city and the next is on the other side. Then we are back again in the afternoon
- Our Construction Services maintenance crews are the same size for every job

Work Scope

- We dig up what we are requested to by another division and it affects our budget
- Our excavation permits are sometimes changed by Roads costing us more
- We do little preventative work, it is mostly all reactive

These statements reflect the reactive nature of sanitary services. Being reactive can cause additional problems due to a rapid, unplanned response, unnecessary stress and inefficiency.

Highlighted over is the evidence that has contributed to the development of the opportunity around the enhancement of resource optimisation within Water Services:

EVIDENCE – NEED FOR CHANGE
Move to more proactive approach
✓ Sanitary services are reactive to business and customer needs ✓ Water Services responds well to sanitary service emergencies, but there is limited available capacity to plan or regularly schedule preventative tasks. Work is allocated manually ✓ Scope of sanitary service replacement work is not clear between Water Services divisions ✓ More work than required may be carried out, especially in expensive asphalt ✓ Subcontractors are not regularly utilised by Water Services to provide sanitary services
Cost effective solutions
✓ Work orders are scheduled based on expert knowledge rather than resource availability and cost ✓ Work scope is often cautious, leading to more construction work than necessary ✓ The cost of road asphalt rehabilitations by The City of Calgary Roads department is proposed to increase by 200% in 2015 (resulting in an additional approx. $1.0m operating cost increase ✓ Delayed road asphalt rehabilitations by The City of Calgary Roads department result in frequent recompact work for Construction Services, approx. $10k each ✓ All excavated material is recycled by The City of Calgary for use later at a different site, External contractors stockpile material on site for the same type of work ✓ Size of the crews allocated to work orders may not be optimal for some Sanitary Service repair and replacements
Customer journey
✓ Appointment scheduling is currently accomplished with an outlook calendar shared by water and 311 operators or by Foremen on a single team basis without organised route planning ✓ There is a lack of clarity around prioritisation rating of work orders ✓ No quick visibility of crew location/job queues (Daily Activity Sheets) ✓ Currently there are only service level agreements for 311 call backs and Trouble Crew visits
Data collection
✓ Management of the field operations personnel relies heavily on paper systems to notify work orders and update records ✓ Complete costs per work order are not readily available ✓ Site history work and performance not tracked ✓ Data from video crews delayed and issues raised regarding quality on some occasions

OPPORTUNTIES

Outlined in this section are a number of opportunities associated with the optimisation of resources and the benefits of the adoption of these opportunities in terms of improving service efficiency and service effectiveness.

Destination Statement

The destination statement below is an outline description of a defined future point once the opportunities have been implemented and the benefits from these opportunities realised. This description of the future is likely to be a number of years away, but this timeframe will be assessed in greater detail during the implementation planning stage of the ZBR.

Destination statement for Resource Optimisation in Water Services:

'to deliver an efficient and effective service by being more proactive, through the optimisation of our resources'

The current view on some of the interim steps associated with the realisation of the destination statement are summarised below, with a view on the associated timeframe:

Short Term (1 Year)

- ✓ Targeted work scopes for Construction Services to reduce rehabilitations
- ✓ Increase in capacity for planned construction work
- ✓ Increase in rehabilitation quality and reduction of re-compact work
- ✓ Increase in number of planned field operations customer appointments

Medium Term (2 Years)

- ✓ Reduction of excavated material replacement material costs
- ✓ Improved video data quality from new equipment and processes

Long Term (4 Years or longer)

- ✓ Maximized productivity of Construction Services
- ✓ Potential reduction of some operational costs via external contracts
- ✓ A further Increase in number of planned field operations customer appointments
- ✓ Improvement in customer experience

Opportunity	Description of Opportunity
Optimising Construction Crews 	Optimising proactive Construction Services crews per type of sanitary replacement e.g. consider one smaller crew per area with minimal equipment (van/wheeled backhoe) to carry out small sanitary replacements/dig-ups *Performance metric for opportunity: FTEs per 100m length of Sanitary Services*
Increase spot repairs 	Increase spot repairs by improving problem diagnosis processes and adopt the 'don't dig asphalt' mantra to reduce impact of street work on citizens. *Performance metric for opportunity : Percentage reduction in rehabilitation costs*
Decision support matrix R — Responsible — Person working on activity A — Accountable — Person with decision authority C — Consult — Key stakeholder who should be included in decision or work activity I — Inform — Needs to know of decision or action	Agree a decision support matrix Responsible, Accountable, Consulted and Informed (RACI) matrix for scope of work between divisions to maximise effectiveness. *Performance metric for opportunity : Percentage of stakeholders working to RACI matrix*
Service Level Agreement with Roads 	Review the Service Level Agreement with The City of Calgary Roads Department. Should agreed upon service levels not be achieved, then Water Services and Roads may explore the use of an alternative asphalt rehabilitation subcontractor. *Performance metric for opportunity : compliance to agreed measured performance targets Average cost per road permit*

Support Challenges to Roads

Explore options to support challenges to Roads decisions on dig sizes and re-compacts to reduce their cost to Sanitary Services.

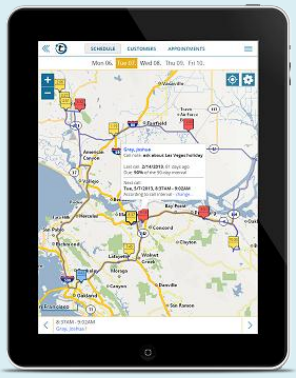
Performance metric for opportunity : Percentage reduction in re-compacts

Excavated material reuse

Explore regulations and options to reuse suitable excavated material on site to reduce recycling costs.

Performance metric for opportunity : Percentage reduction in recycled material costs

Simple Appointment route planning



Centralised appointment route planning for dedicated crews to further increase number of planned appointments for Field Services crews.

Performance metric for opportunity : Miles \ travel time per appointment

New video equipment and process 	New video equipment, interface and process for Field Services crews to capture online comments and update systems automatically for viewing by the wider Water Services.

BENEFITS

Efficiency Benefits

The efficiency calculations are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented. The tables below forecast efficiency cost-savings and productivity improvements as defined below:

- ✓ **Cost Savings –** these are efficiencies that result in a bottom line saving in the cost of delivering a defined activity. For example the unit cost of delivering the service is reduced through a new or different approach to delivery.
- ✓ **Productivity Improvements –** this is a change to the delivery of the service that results in achieving greater results within the currently available resources. For example the optimisation of resources on one activity allows that particular resource to be deployed on other value add activities. The productivity is measured as a saving that comes from being more efficient in delivering the output but it is assumed that these savings are reinvested to do more for the same overall cost.

It should be noted that the efficiencies shown in the tables have been calculated as **gross** efficiency numbers, any upfront investment required to realise these efficiency benefits has not been netted off at this stage. As a number of assumptions have had to be built into the efficiency forecasts then a range of efficiency is also predicted. The low estimate tends to be a view of what is relatively easy to achieve through the implementation of the opportunities with the high estimate being a stretch target for Water Services.

Efficiency Cost Savings		
Range of Efficiency	**Low**	**High**
	$0.5m p.a.	***$1.3m p.a.***
Assumptions and Calculation Methods for Ranges	**Increase in spot repairs** - Currently there are 1,663 road / sidewalk excavations p.a. with a total cost of Roads related permits $2.74m p.a. meaning an average cost of $1,648. The calculated financial efficiency is based reducing the number of roads and sidewalk excavations in agreed range of 5%-18% p.a. by improving diagnosis of the type of repair required to be achieved utilising spot dig techniques. Supported by roads and street works inspector to check scope and size rehabilitation works carried out by Roads meets permit specification and SLA and seek compensation re any variances. Therefore, an efficiency range of **$0.1m** to **$0.5m** has been calculated. **Support Challenges to Roads-** Based on an average of the last five years approx. 7% of all excavations need re-compacted by Construction Services. The cost for each re-compact is calculated at $9,301 each. The derived financial efficiency is based on reducing the number of re-compacts required in agreed range of 25% - 50% p.a.. Therefore, an efficiency range of **$0.3m** to **$0.5m** has been calculated.	

	Excavated Material Re-Use - Based on an average over the last five years 76,638 tonnes of recycled material are used each year to backfill excavations. The average cost is $13.40 / tonne. The derived financial efficiency is based on reusing as excavated material where possible, targeting an agreed range 10%-25%. This will have a corresponding financial saving in the recycled material required to be purchased from Roads. Therefore, an efficiency range of **$0.1m** to **$0.3m** has been calculated.
Rationale for Efficiency	**Repairs –** Less intrusive interventions and better diagnosis of the type of repair on the sanitary network means less costly repairs are undertaken per intervention **Improved Working And Decision Making –** optimizing decisions making on dig sizes and re-compacts delivers more finically efficient solutions to asset interventions

Efficiency Productivity Improvements		
Range of Efficiency	**Low**	**High**
	$0.06m p.a.	***$0.13m p.a.***
Assumptions and Calculation Methods for Ranges	**Optimised Construction crews -** Currently the cost of a four person construction crew is $209k p.a. based on an average salary of $52k p.a. per employee (excluding fleet and fuel), rising each year by 3%. Crews are generally multi-skilled and equipped to tackle any type of work. The calculated financial efficiency is based on an agreed productivity improvement range of 8%-16% p.a. by targeting 2no. (specialised) construction crews at specific types of work activities. This efficiency will result in an equivalent productivity improvement with resources being allocated to planned rather than reactive work, providing an efficiency range of between **$33k** to **$67k** p.a.. **Route Planning : Auger Video Crews -** Currently there are six two person auger/video crews. Average payroll of $52.5k per employee. Each crew cost $105k p.a. (excluding fleet and fuel). Work is planned to suit the appointment requirements of customers and results in regular excessive travel miles and time. The derived financial efficiency is based on better optimised route planning for these crews to increase the number of jobs that can be completed each day. Initially targeting an agreed range of 5%-10% will deliver productivity improvements with resources being allocated to planned rather than reactive work, providing an efficiency range of between **$32k** to **$63k** p.a..	

Rationale for Efficiency	**People Resource Optimisation –** matching the resources with work type in a pro-active manner delivers productivity savings and allows resources to be deployed on other activities resulting in savings and increased utilisation **Improved Route Planning –** these both increases the number of appointments undertaken by Water Services and improves the overall management of planning routes for crews reducing costs per visit

Upfront Investment

In order to realize some of the benefits associated with the use of the video equipment then capital investment in the enabling technology is required. The auger video crews require new video camera technology that enables the digital commentary to be stored as part of the video capture. This commentary can be captured and exported to a word document/report to save on rekeying the information back at base.

Currently two new cameras are planned at a cost of to be deployed at approx. $200k each. In the benefits captured an additional investment to replace the other four cameras at an estimate of **$200k each** over a two year period will be required. The exact cost, scope and the return gained on this type of investment will be analysed further during implementation planning.

The current thinking is that there is no technology investment required to deliver the benefits from the simple appointment route planning, and that existing processes and systems can be adjusted to deliver the opportunity. The centralised appointment system opportunity is included within the customer experience workstream, and will require technology investment (see section 6).

Effectiveness Benefits

The table below makes an assessment of the benefits resulting from the implementation of the opportunities from an effectiveness angle. These are non-financial benefits that deliver greater results within the currently available resources. For Water Services these benefits tend to manifest themselves in improved customer experience and improved quality of data resulting in better decision making.

Effectiveness Benefits	
Optimising Resource Pool	Through the proactive optimisation of City of Calgary employees time and resource is created to enable the deployment of these resources to other value adding activities
Customer Experience	Improved customer experience through reducing intervention on the sanitary network, thereby, reducing disruption for the customer
Improved Data Quality and Decision Making	New video equipment and the ability to capture more intelligent data will improve the quality of data held on the assets, thereby, improving future decision making

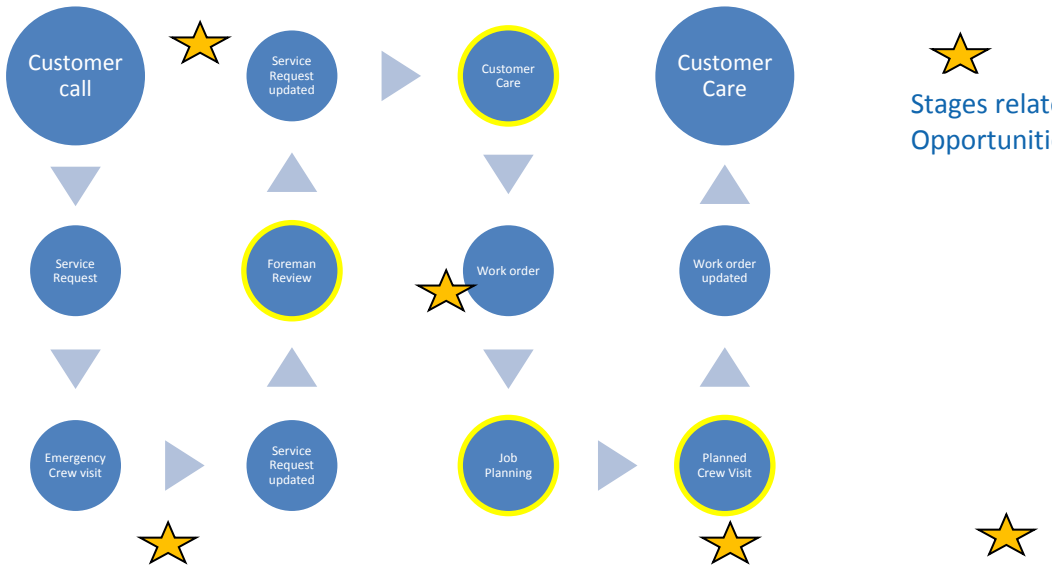
SECTION 6 – JOB PLANNING

CUSTOMER EXPERIENCE

BUSINESS NEED

During the deep dive analysis the evidence from Water Services demonstrated that an enhancement to the current approach to the customer experience could provide benefits to the business unit both from effectiveness (including customer service) and efficiency.

Whilst undertaking the deep dive analysis with Water Services the consultants observed and tracked the flow of customer data through the business unit, as shown below, with customer contact phases circled in yellow. The completed process has a minimum of 6 data collection points about the work by 6 different teams (311, Customer Care, Field Services Crews, Foremen, Estimators, and Construction Services Crews). After the initial telephone call to 311, customer contacts are requests for further information.



Highlighted below is the evidence that has contributed to the development of the opportunity around the enhancement of the customer experience within Water Services:

EVIDENCE – NEED FOR CHANGE
Cost effective solutions
✓ The potential reduction in the number of blocked service CSRs raised, as well as mitigation against an increasing upward trend in this area ✓ The potential reduction in repeat visits to private side blocked services
Customer journey
✓ Evidence of customers receiving call backs from Water Services for information and being unaware of the progress of their service request ✓ Access to information by various Water Services contacts during the customer journey can be limited ✓ Customer information does not have a streamlined flow between customer and field operations teams ✓ Some customers receive excellent service for repeat private side visits which can cause and inconsistent delivery of service for other customers ✓ The use of public money to provide a private service benefit ✓ Emergency calls for trouble crews can be difficult to allocate ✓ Currently there are only service level agreements for 311 call backs and Trouble Crew visits ✓ Some of the technology in use is not wholly supported by Business Technology
Data collection
✓ Management of the field operations relies on paper systems to notify work orders ✓ Site history information does not have streamlined flow between Field and Construction Services ✓ No central dispatch method ✓ Capturing data can be difficult and labour intensive ✓ Limited records regarding non-311 customer contact ✓ Lack of robust and secure access to site history for field operations ✓ Can be delays for address history and customer data availability from field operations due to paper system

OPPORTUNTIES

Outlined in this section are a number of opportunities associated with the optimisation of resources and the benefits of the adoption of these opportunities in terms of improving service efficiency and service effectiveness.

Destination Statement

The destination statement below is an outline description of a defined future point once the opportunities have been implemented and the benefits from these opportunities realised. This description of the future is likely to be a number of years away, but this timeframe will be assessed in greater detail during the implementation planning stage of the ZBR.

Destination statement for Customer Experience in Water Services:

'to deliver the best customer experience by providing an informed and consistent customer journey'

The current view on some of the interim steps associated with the realisation of the destination statement are summarised below, with a view on the associated timeframe:

Short Term (1 Year)

- ✓ A reduction in the number of trouble crew visits to private side jobs
- ✓ Improved Customer knowledge of their services and what Water Services does
- ✓ Continue the movement towards a customer centric view and culture in Water Services
- ✓ Compensation to Field Services for service reuse work.

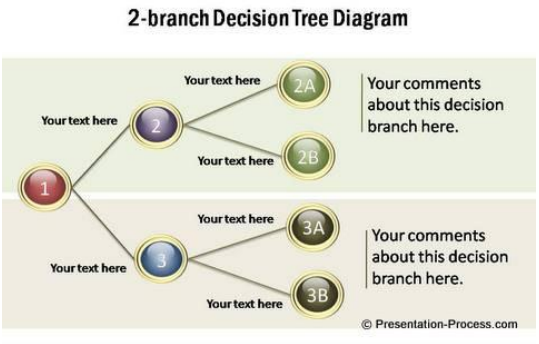
Medium Term (2 Years)

- ✓ An increase in the number of calls handled by front line call operators and first call resolution
- ✓ A reduction in customer calls to Water Services seeking information
- ✓ An increase in the number of planned appointments
- ✓ Customers feel more involved in the process

Long Term (4 Years or longer)

- ✓ Widely available site and customer data
- ✓ Improvement in customer experience
- ✓ Proactive customer journeys

Opportunity	Description of Opportunity
Customer Data - 360° Customer View 	All current customer information and site history available to view within all divisions contributing to sanitary services.
Customer Data - Access to Customer Data 	Customer data that is held outside of Water Services e.g. billing is available for viewing
Customer Data - Centralised Appointment System 	All customer appointments for planned work are received, organised and issued by a central team and appended to customer information. *Performance metric for opportunity : Number of appointments booked*

The Customer Journey - Reducing Enquiries and Self-Serve 	Working with front line call handlers to improve decisions trees and with improved customer data the number of calls passed to operations for response will be reduced. Creating a self-service portal for customers will also reduce call volumes. *Performance metric for opportunity : Percentage of calls that are follow up or repeat calls/enquiries*
The Customer Journey - Proactive Customer Notifications 	Contacting the customer before and after attending site and giving out customer information cards when on site will improve the Customer Journey and Experience. *Performance metric for opportunity : Percentage of jobs where customer receives proactive notification*
The Customer Journey - Zero Impact for repeat private visits 	By either flagging Customer/Site data so crews do not attend private visits or charge for private visits so their time is paid for, there is no impact on Water Services for repeat visits by trouble crews to private side issues. *Performance metric for opportunity : Percentage of repeat private side visits*

Partnership Working - Zero Impact for Service Reuse in Water Services 	Service reuse work which is outside of the scope of Water Services is charged to the customer. Agree standards to assist with this process.
Partnership Working - Service Level Agreements 	Negotiate Service Level Agreements for customers to assist with the Customer Experience.

BENEFITS

Efficiency Benefits

The efficiency calculations are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented. The tables below forecast efficiency cost-savings and productivity improvements as defined below:

- ✓ **Cost Savings –** these are efficiencies that result in a bottom line saving in the cost of delivering a defined activity. For example the unit cost of delivering the service is reduced through a new or different approach to delivery.
- ✓ **Productivity Improvements –** this is a change to the delivery of the service that results in achieving greater results within the currently available resources. For example the optimisation of resources on one activity allows that particular resource to be deployed on other value add activities. The productivity is measured as a saving that comes from being more efficient in delivering the output but it is assumed that these savings are reinvested to do more for the same overall cost.

It should be noted that the efficiencies shown in the tables have been calculated as **gross** efficiency numbers, any upfront investment required to realise these efficiency benefits has not been netted off at this stage. As a number of assumptions have had to be built into the efficiency forecasts then a range of efficiency is also predicted. The low estimate tends to be a view of what is relatively easy to achieve through the implementation of the opportunities with the high estimate being a stretch target for Water Services.

Efficiency Cost Savings		
Range of Efficiency	**Low**	**High**
	$0.04m p.a.	***$0.09m p.a.***
Assumptions and Calculation Methods for Ranges	**Develop a charging scheme and specification for re-use of services -** Currently there are no records available on how many surveys sanitation services carry out each year as this is raised as a normal CSR for a sanitation service video inspection. A routine sanitation service video inspection currently costs $202 each. The savings will be generated in the form of revenue to Water Services based on the number of inspections carried out p.a.. For the baseline we have adopted a low range of 220 and a higher range of 440 video inspections p.a., providing an efficiency range of between **$44k** to **$89k** p.a..	
Rationale for Efficiency	**Increased Income –** Water Services would receive the income generated, however, this would not achieve zero impact across the water utility as Water Resources would continue to pay	

Efficiency Productivity Improvements		
Range of Efficiency	**Low**	**High**
	$0.2m p.a.	***$0.7m p.a.***
Assumptions and Calculation Methods for Ranges	**Reduce enquiries and introduce customer self-service -** currently there are 7,732 blocked service CSRs raised per annum (p.a.) costing between $183 and $790 per CSR depending on type of activity required, for the efficiency calculation the average unit cost of $487 has been used. The calculated financial efficiency is based on an agreed overall reduction in the number of CSRs that will be required of between 5% and 15%. This efficiency will result in an equivalent productivity improvement with resources being allocated to planned rather than reactive work, providing an efficiency range of between **$0.2m** to **$0.6m** p.a.. **Reduce repeat private side visits for blocked services -** currently there are 2,030 repeat visits to remove blockages from sanitation services. Each repeat visit costing between $183 and $790 depending on type of activity required, for the efficiency calculation the average unit cost of $487 has been used. The calculated financial efficiency is based on an agreed overall reduction in the number of repeat CSRs that will be achieved in the range 5% and 15%. This efficiency will result in an equivalent productivity improvement with resources being allocated to planned rather than reactive work, providing an efficiency range of between **$0.05m** to **$0.15m** p.a..	
Rationale for Efficiency	**Reduction In Customer Enquires** – through the reduction in customer enquiries and the utilisation of customer self-serve then the volume of customer interactions on reactive work will fall **Reduction In Private Side Work** – reducing the number of visits to deliver a service to a customer on the private side will reduce overall costs and allow for crews to undertake proactive work	

Upfront Investment

In order to realise benefits associated with the use of the centralised appointment system, customer data and customer self-serve opportunities then capital investment in enabling technology is likely to be required. However, the options around how to best deploy a solution for these areas requires further business analysis to be undertaken to fully understand the current business processes and procedures, the current technology state, as well as other technology systems being developed across The City of Calgary, before any decisions are made on how best to realise the benefits from these opportunities within Water Services.

The exact cost, scope and the return gained on this type of investment will be analysed further during implementation planning.

Effectiveness Benefits

The table below makes an assessment of the benefits resulting from the implementation of the opportunities from an effectiveness angle. These are non-financial benefits that deliver greater results within the currently available resources. For Water Services these benefits tend to manifest themselves in improved customer experience and improved quality of data resulting in better decision making.

Effectiveness Benefits	
Improved Data Quality	Customer information is enhanced as it's used, reviewed and added to in the decision making process
Customer Experience and Decision Making	The effective use of customer data will improve decisions made around customer related activities
Customer Experience	Customers will experience an enhanced service through improved appointment booking

SECTION 7 – RISK BASED MAINTENANCE

RISK BASED MAINTENANCE

BUSINESS NEED

Within the asset management maturity focus area the specific methodology around the risk based approach to maintenance was reviewed according to the scope outlined below:

Field Services	✓ Dead end main flushing ✓ Valve surveys ✓ Air Release Valves (ARVs) ✓ Pressure Reducing Valves (PRVs)
Water Treatment & Transmission	✓ Risk Based Maintenance

A risk based maintenance strategy prioritises maintenance resources toward assets that carry the most risk if they were to fail. It is a methodology for determining the most economical use of maintenance resources. This is done so that the maintenance effort across a facility is optimised to minimise the total risk of failure.

These areas were selected following a series of workshops with both Field Services and Water Treatment employees. The workshops used the ZBR process of answering the questions around service rationale, level and scope, effectiveness, efficiency and funding, in order to select the activities for the in-depth analysis.

The rationale behind the selection of the activities, based on the service questions above, can be summarised as follows:

i. the activities are planned, or are able to be planned
ii. the activities are comparable across asset types for their respective functions
iii. the activities have common skill requirements for their respective functions
iv. the activities are considerable for their 'value-add' effectiveness.

Field Services

The Field Services activities were reviewed in order to test the 'value add' of each activity. The review has presented opportunities to optimise each activity in terms of risk, effectiveness and efficiency. Efficiency is the main driver for change; however a measure of effectiveness can be gained in terms of increased productivity, and deploying resources onto other 'value add' tasks.

Whilst the existing service provides good value for the customer, there is potential to further enhance the value by increasing the effectiveness and efficiency of how the services are delivered.

A summary of the costs and plan attainment for the Field Services activities captured in calendar year 2013 is as follows, (source – the City of Calgary Business Performance team, 12/11/2014).

Activity	Cost 2013	Plan Attainment	Comments
Dead end main flushing	$40,989	74%	resource & efficiency potential
Valve surveys (< 400mm)	*$264,000	**100%	
Air Release valves	$66,483	not achieved	resource & efficiency potential
Pressure Reducing valves	$50,146	not achieved	resource & efficiency potential

**$264,000 = 40,000valves/5yrs x $33/valve*
***assuming 100% plan attainment, (current requirement of Fire Underwriter Survey)*

Water Treatment and Transmission

The Water Treatment and Transmission services, Business Performance team have already begun planning and implementing risk based opportunities. Techniques currently being applied are considered to be good practice, and should be developed to take formal account of service measures in order to be consistent and to document a risk approach strategy.

The current practice being reviewed is that in the absence of maintenance and trend analysis, maintenance activities are carried out in accordance with manufacturer's recommendations. A risk based approach towards the current maintenance practices will bring both efficiency and effectiveness benefits.

The 'in-depth' study to Water Treatment and Transmission looks at Preventative Maintenance, (PM) plans and the performance of those for calendar year 2013. Also to understand the impacts upon Corrective Maintenance (CM), by taking a risk based approach to maintenance.

OPPORTUNTIES

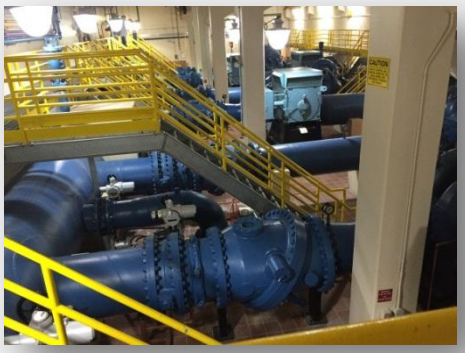
Outlined in this section are a number of opportunities associated with the optimisation of resources and the benefits of the adoption of these opportunities in terms of improving service efficiency and service effectiveness.

Destination Statement

The destination statement below is an outline description of a defined future point once the opportunities have been implemented and the benefits from these opportunities realised. This description of the future is likely to be a number of years away, but this timeframe will be assessed in greater detail during the implementation planning stage of the ZBR.

Destination statement for Risk Based Maintenance in Water Services:

'to maintain our assets effectively, at the most optimum frequency, delivering both financial efficiencies and 'best in class' asset management'



The ultimate aim of the business case is to present evidence and examples to support the opportunities arising from 'deep dive' process during Phase 2b/3 of the Zero Based Review on Water Services. The main objectives are:

- increase service effectiveness of the delivery of planned maintenance activities
- reduce costs of planned activities by developing a multi-skill approach, (where possible) to task management and planning
- consider the relationship between Planned and Corrective maintenance activities and the impacts upon both by developing a risk based approach in order to formalise existing practices, enabling the development of a maintenance strategy to inform asset intervention decision making. The strategy should aim to provide an integrated approach to pro-active maintenance for electrical and mechanical equipment throughout the asset base
- enable the development and delivery of an Asset Master Plan type strategy to give guidance on managing an asset group or type. The strategy should aim to provide cost / risk optimisation as well as predictive guidance on asset refurbishment or replacement
- explore and demonstrate the scalability of the opportunities towards those Water Services functions beyond the focus area of the 'deep dive', eg – wastewater.

The current view on some of the interim steps associated with the realisation of the destination statement are summarised below, with a view on the associated timeframe:

Medium Term (2 years)

- ✓ To develop the maintenance workshops to take account of Health & Safety, Customer Impact and return to service cost
- ✓ To develop an 'inspection driven' versus 'failed in service' understanding to validate the planned intervention and its frequency
- ✓ To develop a capital maintenance replacement and refurbishment plan for the next regulatory period

Long Term (4 Years or longer)

- ✓ To optimise new Asset Master Plans and develop / implement further plans for all major equipment unit coverage
- ✓ Complete asset lifecycle visibility for all functions, delivering 'best in class' Asset Planning capability

The opportunities in risk based maintenance have been grouped into two categories, as below:

1. Opportunities relating to specific asset types:
    - ✓ Dead end mains, valve surveys, air valves and pressure reduction valves
2. Opportunities relating to techniques that can be applied across various asset groupings:
    - ✓ Risk based maintenance, asset master plans and condition based assessment

Dead End Mains Flushing

Plan to close out dead end mains. Although there are reportedly over 4,400 in the city, the City of Calgary actively manage the flushing and sampling of 154 no. dead end mains. These 154 are known to have the greatest potential for water quality issues.

Continue to flush and sample 154 dead end mains, twice per year. The assumption is that customer expectations will not increase, thus demanding that the issue is resolved rather than treated.

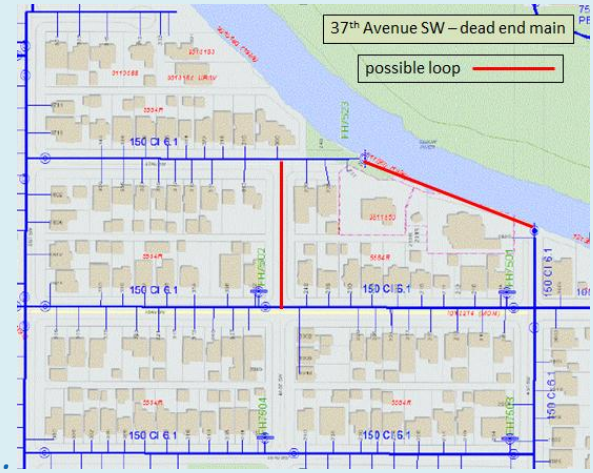
The example shown below demonstrates a typical layout of the mains currently being flushed. This example is also typical of the current practice for new developments. Whilst opportunities are taken to close new mains, this is not always possible due to site layout and resistance from the Urban Development Institute, (UDI). In some cases where dead end mains are unavoidable, flushing points are provided by Water Services for installation by developers.

Whilst it does not appear cost effective to close out existing dead end mains, it is important to work with UDI, in order to develop a best practice approach and that every opportunity is taken to close the loop on new mains, thus not adding to the current burden. The calculation to determine the cost effectiveness of the close out was based on the following analysis:

- Main flushed twice per year - crew + vehicle, 2hrs, cost = total of around $800
- Close out example (as per diagram below) - 105 meters x 150mm diameter main in carriageway = $850/m, so the cost of replacing this main would be 105m x $850 = $89,250

Therefore, it is not financially sensible to close out the main as there is no reasonable payback on that investment given it only costs around $800 p.a. to maintain it in a serviceable condition.

Performance metric for opportunity: no increase in number of dead end mains created, plus a planned approach towards addressing existing dead end mains



Valve Survey

Devise decision matrix to determine asset criticality in order to optimise valve survey programme (need to negotiate with Fire Underwriter's survey dependency).

Develop a risk scoring matrix in order to produce an optimised plan of categorised zones. Determining categories include, but are not limited to; Residential, Business, Special Needs, Hospitals, Restricted Access areas. Use optimised plan to deliver revised programme.

Dependency of the opportunity is the link to the current Fire Underwriter's survey, a process the City of Calgary undertake as a water supplier in partnership with Calgary Fire Department to support and confirm the resilience of the water supply system. One of the criteria is the inspection/operation of valves.

Performance metric for opportunity : percentage reduction in survey and maintenance programme

Air Valves

Develop electronic data capture and visibility of Waterfront GIS system. Develop an electronic system similar to small valve survey. Benefits seen as 'real-time' updates of Waterfront system. Benefits also seen as being field employees will have increased visibility of parallel programmes to assist with shut-downs for maintenance. The dependencies of this option are upon IT development although the existing small valve survey system is already developed and embedded.

Devise decision matrix to determine asset criticality in order to optimise the programme. Develop a risk scoring matrix in order to produce an optimised plan of categorised zones. Decisions upon benefits of closing air valves, ie – if all valves are closed in the Fall until Spring, does the network under-perform as a result and what are the impacts upon the assets and workload?

Devise mechanism to measure plan attainment. Upon the delivery of the air valve opportunities highlighted above, build a plan of critical valves to be maintained and operated Spring/Fall. It is known that the current plan was not achieved in 2013; however there is no measure of impact or benefit to this approach.

Performance metric for opportunity : percentage reduction in survey and maintenance programme

Pressure Reduction Valves

Devise decision matrix to enable optimisation of programme with an outcome of implementation of partial or complete system monitoring capability.

In terms of criticality, of the 194 PRVs across the city, approximately 5% of those have a telemetry system, thus enabling remote monitoring. In order to gain an efficiency saving on manual checks, a second and third level of criticality should be established.

In order to create and manage a second level of criticality, the recommendation is to install a GPRS type logging system c/w long life battery. Typical cost is around $1,000/unit which reports back to a web based portal. Updates can range from 'live feed' to an operator-predetermined timed interval. Alarm parameters can be used to warn of set point variation.

Performance metric for opportunity : percentage reduction in programme

Risk Based Maintenance Theme – Asset Techniques Opportunities
Opportunity Description and Performance Metric

Risk Based Maintenance

Opportunities / techniques applied to the asset groupings. Risk Based Maintenance is a comprehensive and site specific plan of Cost/Risk optimised maintenance tasks, frequencies, and techniques. Techniques include, spares holding, task schedules and labour saving devices. The plan should aim to improve serviceability of assets and make the most economical use of maintenance resources.

Performance metric for opportunity : reduction in non 'value add' activities and improved performance

Asset Master Plans

Opportunities / techniques applied to the asset groupings. Asset Master Planning is an optimised lifecycle plan that will define the inspection, monitoring, maintenance, and refurbishment and replacement strategies for selected asset types or groupings.

Performance metric for opportunity : improved serviceability of assets and increased long term planning capability

Condition Based Assessment

Opportunities / techniques applied to the asset groupings. Condition monitoring is the process of monitoring the performance of a machine against a measureable parameter. Monitoring can either be a physical check or a monitoring device used to determine the optimum frequency at which to maintain an asset.

Performance metric for opportunity: percentage reduction in monitoring costs, improved visibility of intervention planning.

BENEFITS

Efficiency Benefits

The efficiency calculations are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented. The tables below forecast efficiency cost-savings and productivity improvements as defined below:

- ✓ **Cost Savings –** these are efficiencies that result in a bottom line saving in the cost of delivering a defined activity. For example the unit cost of delivering the service is reduced through a new or different approach to delivery.
- ✓ **Productivity Improvements –** this is a change to the delivery of the service that results in achieving greater results within the currently available resources. For example the optimisation of resources on one activity allows that particular resource to be deployed on other value add activities. The productivity is measured as a saving that comes from being more efficient in delivering the output but it is assumed that these savings are reinvested to do more for the same overall cost.

It should be noted that the efficiencies shown in the tables have been calculated as **gross** efficiency numbers, any upfront investment required to realise these efficiency benefits has not been netted off at this stage. As a number of assumptions have had to be built into the efficiency forecasts then a range of efficiency is also predicted. The low estimate tends to be a view of what is relatively easy to achieve through the implementation of the opportunities with the high estimate being a stretch target for Water Services.

Efficiency Cost Savings		
Range of Efficiency	**Low**	**High**
	$0.0m p.a.	***$0.0m p.a.***
Assumptions and Calculation Methods for Ranges	Not applicable	
Rationale for Efficiency	Not applicable	

Efficiency Productivity Improvements		
Range of Efficiency	**Low**	**High**
	$0.5m p.a.	**$0.8m p.a.**
Assumptions and Calculation Methods for Ranges	**Valve surveys –** currently there is a programme of 40,000 valves surveyed over a 5 year period, meaning an average of 8,000 p.a. at $33 per valve surveyed. The opportunity is to optimise the surveys delivering a reduction in the number carried out of between 10% and 25%, with an associated efficiency saving of **$26k** to **$66k** p.a.. **Air valves –** currently there are 800 valves in the system which are operated twice each year at a cost of $66k (average unit cost per valve of $83). The opportunity is to optimise the programme delivering a reduction in the number carried out of between 20% and 50%, with an associated efficiency saving of **$13k** to **$33k** p.a. (this estimate is conservative as costs associated with maintenance and replacement of air valves are not fully known). **Pressure reduction valves –** there are 194 PRVs with a total cost of inspection p.a. at $50k (average unit cost of $258). Assumption is to continue with current practice to check and calibrate all valves twice per year. Cost to the City of Calgary in 2013 = $50,146. Plan attainment was not achieved in 2013**.** The opportunity around the decision matrix and criticality assessment would see a reduction in the PRV programme of between 50% and 80%, delivering an efficiency of between **$25k** and **$40k** p.a.. **Risk based maintenance (RBM), condition based assessment (CBA) and asset master plans (AMP)** – the efficiency assessment was based on Glenmore WTP, the maintenance spend across the various assets at Glenmore was analysed in order to determine the best opportunities. A total of $2.2m against the total budget at Glenmore of $4.0m p.a. (see appendix 4), was assessed. The individual assets were then analysed 'bottom-up' against the 3 risk techniques (RBM, CBA and AMP) and an assessment made on the potential efficiencies that could be made through both their adoption and increasing their existing maturity levels (see appendix 5). This resulted in the conclusion that between 20%-30% of the original $2.2m budget that was analysed could be saved (both on planned and unplanned maintenance activities), generating an efficiency of **$0.4m** to **$0.7m**.	

Rationale for Efficiency	**Valve surveys, air valves and PRVs –** enhancing risk approach optimises the programme of surveys, reducing the number carried out in a particular period **Condition Monitoring –** monitoring the performance of assets provides the opportunity for optimum frequency running providing productivity savings in the ongoing asset maintenance **Risk Based Maintenance –** optimise maintenance tasks, frequencies and techniques, all of which makes the best economical use of maintenance resources **Asset Master Plans –** provides guidance on managing an asset group or type, which in turn provides a cost : risk optimisation across assets

Upfront Investment

Highlighted below are the technology investments that will be required in order to deliver the benefits from the identified opportunities:

- ✓ PRV maintenance system for automation requires hardware and a web based system including licencing. The estimate for this investment is **$10,000**.
- ✓ A number of the condition based monitoring opportunities require the integration with monitoring / supervisory control and data acquisition (SCADA) systems. The estimate for this investment is **$75,000**.

The exact cost, scope and the return gained on this type of investment will be analysed further during implementation planning.

Effectiveness Benefits

The table below makes an assessment of the benefits resulting from the implementation of the opportunities from an effectiveness angle. These are non-financial benefits that deliver greater results within the currently available resources. For Water Services these benefits tend to manifest themselves in improved customer experience and improved quality of data resulting in better decision making.

Effectiveness Benefits	
Improved Data Quality and Enhanced Decision Making	Undertaking risk based maintenance activities facilitates the building of a knowledge bank around how assets perform; this is valuable for analysing asset data, optimising the asset performance and taking decisions around maintenance, replacement and capital projects. There are short term gains such as 'optimising day to day activities' as well as benefits, such as determining longer term planning horizons.
Optimised Resource Pool	Optimising the tasks, maintenance and achieving the plans undertaken across the asset base increases productivity allowing the time and space for maturing the overall approach taken to asset management across Water Services.
Customer Experience	Understanding the assets and in particular risk builds resilience and creates optimised asset performance ensuring service is maintained to the customer whilst driving out efficiency from the operation and maintenance of the assets.

MATURITY MODEL

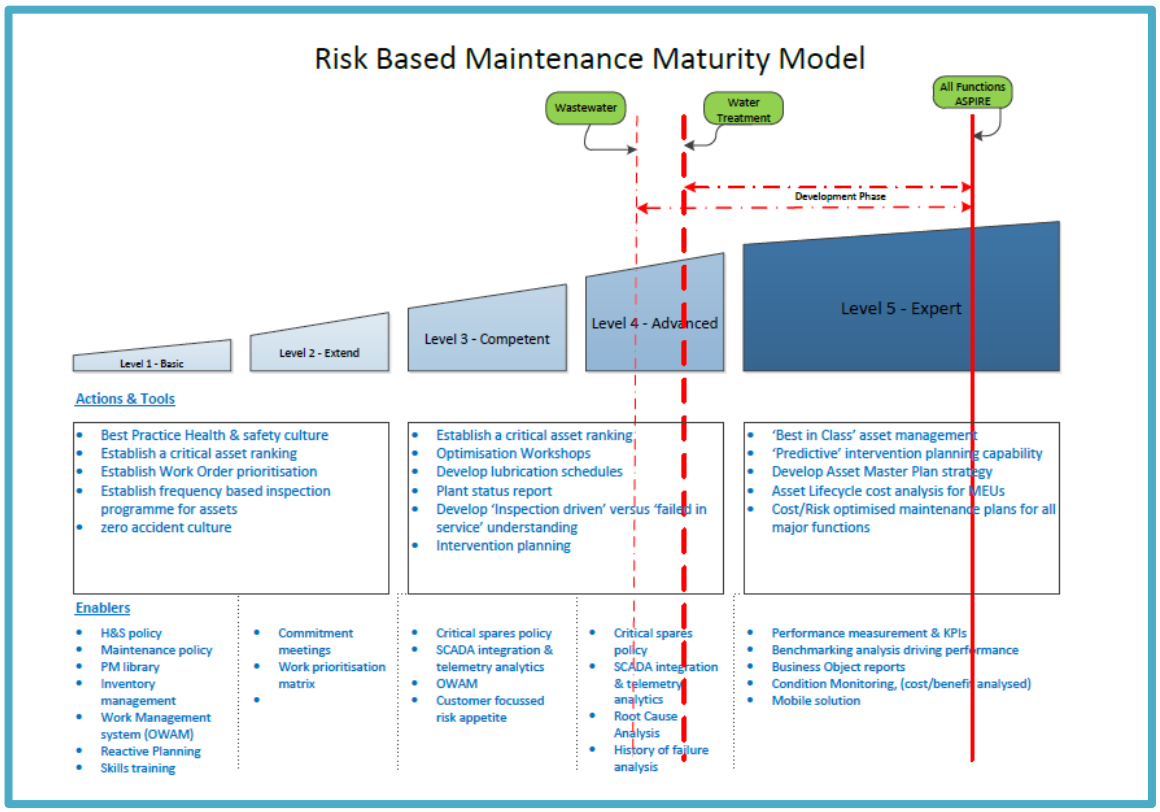
Risk Based Maintenance Maturity Model

In order to give a view of asset management risk based maintenance maturity, this can best be represented on an asset management maturity model (see diagram below).

For Water Services water treatment and transmission services, the level of maturity is considered as **'advanced'**. This score is reflective of the current work being done by the Business Support Team to 'risk optimise' maintenance plans and beginning to understand the operational performance and lifecycles of the asset stock. It is anticipated that an **'expert'** level of maturity can be achieved if the current level of commitment and alignment with practices recommended in this RBM business case are fulfilled. A realistic estimate of the timescale for this level of maturity is somewhere between 2-3 years.

For wastewater functions, an initial level of maturity was based on a brief analysis and interview conversations. Further, detailed analysis revealed that a more accurate level is considered as **'lower advanced'**. A similar road map of maturity of between 2-3 years working towards an **'expert'** level is considered achievable.

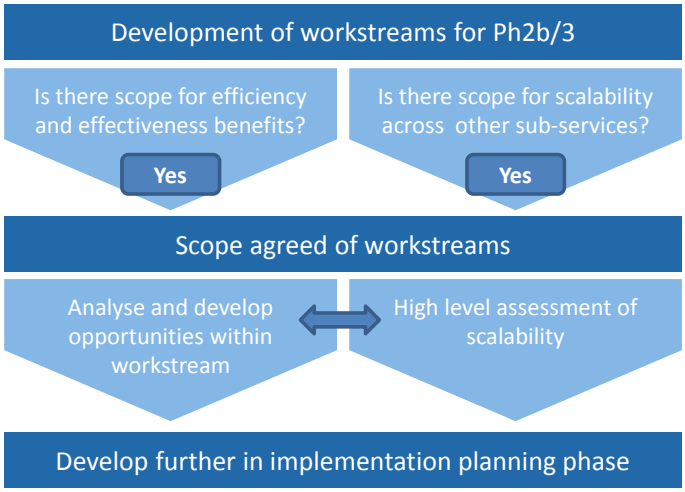
A strong recommendation in order to achieve 'maintaining our assets effectively, at the most optimum frequency, delivering both financial efficiencies and 'best in class' asset management', is that a collaborative approach is developed between functions. This will deliver a consistent approach towards achieving the vision for Water Services, delivering 'best in class' Asset Management for The City of Calgary.



SECTION 8
SCALABILITY

Scalability Approach

As stated in the report introduction the scope of the 'deep dive' was designed to ensure that the analysis across the three workstreams was comprehensive and robust, in order to facilitate a full understanding of the opportunities for improvement in the sub-services within Water Services. These areas were also chosen due to the fact that they provided the basis for the opportunities identified to be scaled (the learning and recommendations transferred to other areas of the business) across other services where appropriate.



Scalability Analysis

The table over the page highlights the services and sub-services within Water Services and the operating budget covered through the ZBR. The headline numbers being:

- ✓ the green blocks on the table highlights the sub-services that were subject to the deep dive analysis, this totals almost a third of Water Services operating budget, at **32%**
- ✓ the blue blocks on the table being the sub-services that have been initially identified as areas where there is an opportunity for scalability of the recommendations, this equates to a further **40%** of Water Services overall budget, meaning the total potential application of the ZBR recommendations covers **72%** of the total Water Services operating budget

One of the workstreams, performance measurement, is not included on the table, as this area was focused on the whole of Water Services, as performance measurement is an overall business work stream, dealing with the business processes and culture throughout Water Services.

Water Services will further consider the scalability of the recommendations, including the efficiency and effectiveness benefits, along with a timetable for scalability during the implementation planning phase.

Water Services Sub-services Reviewed In-Depth and Assessment of Scalability

Water Services Services and Subservices		2013 Operating Expenditures ($000)	2013 % of Total Water Services Operating Expenditures	Reviewed In-Depth: Job Planning	Reviewed In-Depth: Risk Based Maintenance
Collect and treat stormwater					
1.1	Operate and maintain retention factilities	2,039	1.4%		
1.2	Operate and maintain the stormwater collection system	5,871	3.9%		Opportunity for Scalability
1.3	Operate and maintain lift stations	650	0.4%		Opportunity for Scalability
1.4	Repair the stormwater collection system	2,091	1.4%	Opportunity for Scalability	
Produce and deliver clean drinking water					
2.1	Operate the water treatment plants	7,263	4.9%		
2.2	Maintain the water treatment plants	7,162	4.8%		Reviewed In-Depth
2.3	Transmit and store water	7,632	5.1%		Reviewed In-Depth
2.4	Maintain pumping and storage	6,323	4.3%		Reviewed In-Depth
2.5	Maintain the water distribution system	8,043	5.4%	Opportunity for Scalability	Reviewed In-Depth
2.6	Distribute water	2,557	1.7%		Reviewed In-Depth
2.7	Meter water consumption	1,196	0.8%		
2.8	Repair the distribution system	18,128	12.2%	Opportunity for Scalability	
Collect and treat wastewater					
3.1	Operate the wastewater treatment plants	18,090	12.2%		
3.2	Maintain the wastewater treatment plants	11,149	7.5%		Opportunity for Scalability
3.3	Manage biosolids	11,461	7.7%		
3.4	Operate and maintain the wastewater collection system	11,513	7.7%	Reviewed In-Depth	Opportunity for Scalability
3.5	Operate and maintain lift stations	2,157	1.5%		Opportunity for Scalability
3.6	Repair the wastewater collection system	4,892	3.3%	Reviewed In-Depth	
Business Support					
4.1	Provide strategic direction and management for the business (i.e. Director's Office)	8,252	5.6%		
4.2	Provide operational business support services	12,185	8.2%		
	Total Water Services Operating Expenditure	***148,654***	***100.0%***		
	Reviewed In-Depth	**48,122**	**32.4%**		
	Opportunity for Scalability	**59,602**	**40.1%**		
	Total Potential Application of ZBR Recommendations	**107,724**	**72.5%**		

SECTION 9
SUMMARY OF EFFICIENCY BENEFITS

Summary of Financial Efficiencies at Opportunity Level

Within sections 3 to 7 the detailed opportunities within the three workstreams of performance measurement, job planning and risk based maintenance have been detailed, including the effectiveness benefits and a calculation of efficiency benefits stated.

The table on the next page is a summary of the range of these overall efficiencies at opportunity level, as developed during the deep dive analysis of Water Services.

Definitions of the table columns are outlined below:

- ✓ **2013 Operating Expenditures of Services Reviewed In-depth –** this is the value of Water Services operating expenditures that has been subject to deep dive analysis during Phase 2b.
- ✓ **Range of Annual Efficiency Savings –** this is the value of the efficiencies identified, they are represented as per annum (p.a.) savings, taking into account the full value of the efficiency once the opportunity has been fully implemented, and in a range of low (an estimate of relatively easy to achieve) to high (stretch efficiency target).
- ✓ **One-Time Implementation Costs** – an estimate of the value of the upfront investment that is required in order to realise the benefits. The IT requirements are generally unknown at this time. One-time costs will be determined by Water Services through implementation planning.
- ✓ **2013 Operating Expenditures Where Scalability May Apply** – this is a forecast of the value of Water Services operating expenditures that have been initially identified as areas where there is an opportunity for scalability of the recommendations.
- ✓ **Total Potential Application of ZBR Recommendations** – this is the total value of the Water Services operating expenditures covered by the addition of the deep dive analysis and the initial scalability estimate.

SUMMARY OF THE WATER SERVICES ZERO BASED REVIEW FINANCIAL RESULTS (per opportunity)										
Business Case & Recommendations		2013 Operating Expenditures of Services Reviewed In-depth		Range of Annual Efficiency Savings ($000s)		One Time Implementation Costs ** ($000s)	2013 Operating Expenditures of Services Where Scalability May Apply		Total Potential Application of ZBR Recommendations (In-depth + Scalability)	
		($000)	% *	Low ($000)	High ($000)		($000)	%	($000s)	%
TOTAL WATER SERVICES ZERO BASED REVIEW		**48,122**	**32%**	**2,359**	**5,011**	**at least 1,415 + IT costs (TBD)**	**59,602**	**40%**	**107,724**	**72%**
PERFORMANCE MEASUREMENT* **		**n/a**	**n/a**	**0**	**0**	**30**	**n/a**	**n/a**	**n/a**	**n/a**
1	Dashboard reporting			0	0	0				
2	Benchmarking			0	0	0				
3	Visibility of data and performance opportunities			0	0	0				
4	Develop an overall performance measure			0	0	0				
5	Set internal targets			0	0	0				
6	Technology and performance measure improvements			0	0	30				

Business Case & Recommendations		2013 Operating Expenditures of Services Reviewed In-depth		Range of Annual Efficiency Savings ($000s)		One Time Implementation Costs ** ($000s)	2013 Operating Expenditures of Services Where Scalability May Apply		Total Potential Application of ZBR Recommendations (In-depth + Scalability)	
		($000)	% *	Low ($000)	High ($000)		($000)	%	Low ($000)	High ($000)
JOB PLANNING		**16,405**	**11%**	**1,854**	**4,212**	**1,300**	**28,262**	**19%**	**44,667**	**30%**
Trenchless Technology				**996**	**1,900**	**500**				
7	Adoption of trenchless technology			900	1,800	500				
8	Reduction of root auger program			21	40	0				
9	Review innovation possibilities			0	0	0				
10	Cost sharing with customers			75	150	0				
Resource Optimisation				**575**	**1,421**	**800 + IT costs (TBD)**				
11	Optimising construction crews			33	67	0				
12	Increase spot repairs			137	493	800				
13	Decision support matrix			0	0	0				
14	SLA with Roads			0	0	0				
15	Support challenges to Roads			271	541	0				

Business Case & Recommendations		2013 Operating Expenditures of Services Reviewed In-depth		Range of Annual Efficiency Savings ($000s)		One Time Implementation Costs ** ($000s)	2013 Operating Expenditures of Services Where Scalability May Apply		Total Potential Application of ZBR Recommendations (In-depth + Scalability)	
		($000)	% *	Low ($000)	High ($000)		($000)	%	Low ($000)	High ($000)
16	Excavated material reuse			103	257	0				
17	Simple appointment route planning			32	63	0				
18	New video equipment and process			0	0	0				
Customer Experience				**282**	**801**	**IT costs TBD**				
19	360 customer view			0	0	IT				
20	Access to customer data			0	0	IT				
21	Centralised appointment system			0	0	IT				
22	Reducing enquires and self-serve			188	564	IT				
23	Proactive customer notifications			0	0	0				
24	Zero impact for repeat side visits			49	148	0				
25	Zero impact for Service Reuse			44	89	0				
26	Partnership working - SLAs			0	0	0				

Business Case & Recommendations		2013 Operating Expenditures of Services Reviewed In-depth		Range of Annual Efficiency Savings ($000s)		One Time Implementation Costs ** ($000s)	2013 Operating Expenditures of Services Where Scalability May Apply		Total Potential Application of ZBR Recommendations (In-depth + Scalability)	
		($000)	% *	Low ($000)	High ($000)		($000)	%	Low ($000)	High ($000)
RISK BASED MAINTENANCE		**31,717**	**21%**	**506**	**799**	**85 + IT costs (TBD)**	**31,340**	**21%**	**63,057**	**42%**
27	Dead end main flushing			3	3	0				
28	Valve surveys			26	66	0				
29	Air valves			13	33	IT				
30	Pressure reduction valves			25	40	10				
31	Risk based maintenance			438	656	IT				
32	Asset master plans					IT				
33	Condition based assessment					75				
OVERALL TOTALS		**48,122**	**21%**	**2,359**	**5,011**	**at least 1,415** + IT costs (TBD)	**59,602**	**40%**	**107,724**	**72%**

* *Percentage of total Water Services 2013 Operating Expenditures ($150m)*

** *One-time costs of implementation are estimated, and IT requirements are unknown at this time. One-time costs will be determined by Water Services through implementation planning.*

*** *Performance measurement focused on the whole of Water Services as it is an overall business work stream, dealing with the business processes and culture throughout Water Services.*

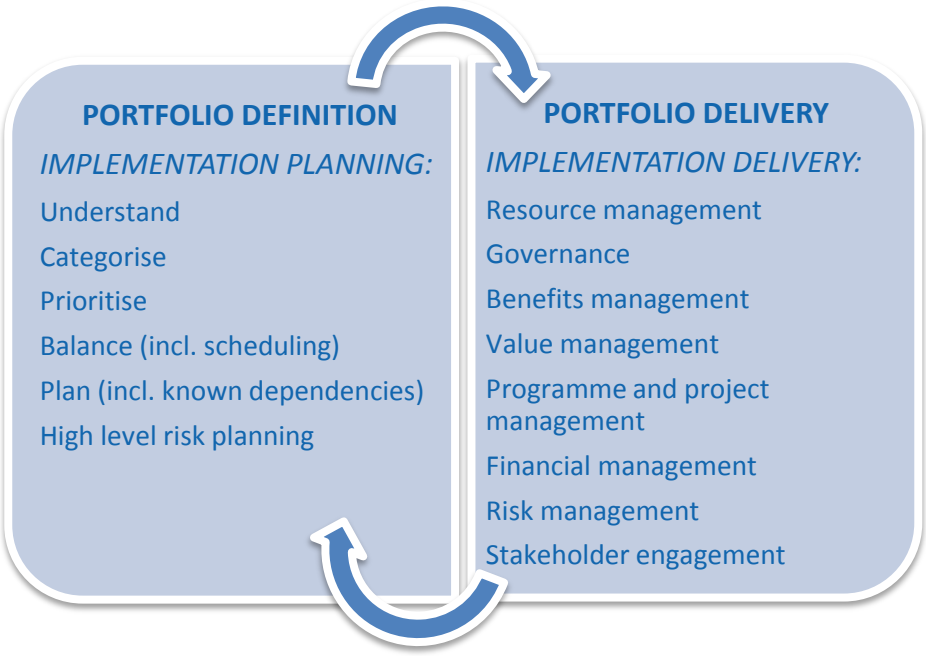
SECTION 10
HIGH LEVEL IMPLEMENTATION PLANNING

This section outlines the basis of a high level implementation plan in order to assist Water Services in the early stages of the implementation planning phase of the ZBR methodology. The objective is to provide Water Services` with a starting point on implementation structure, suggestions and approaches pertaining to the embedding of the opportunities and, therefore, the realisation of the benefits.

IMPLEMENTATION PLANNING

The diagram below identifies the key elements of delivering a portfolio of change; the ZBR process has delivered a foundation for the creation of the **portfolio definition**, particularly the stages around understanding and categorising. The purpose of the portfolio definition stages are to bring together all the key information that will provide clarity of which changes will contribute the greatest benefits to the strategic objectives.

The key output of this will be the implementation plan which will allow Water Services to make confident decisions regarding the scope of the portfolio of change, the justification for making the changes and determine how and when the portfolio will be delivered. Defining the portfolio does not mean that everything in the portfolio must be planned in detail, that will be the responsibility of programme and project management, however, being able to understand a high level schedule, supported by a description of the change, estimated resource requirements, timescales and risks will enable a way forward to be agreed and also facilitate the portfolio being understood by other key stakeholders eg council, other business units, employees.



Appendix 7 provides a definition of each of the stages of portfolio definition with an assessment of progress made to date on these stages through the ZBR with Water Services.

The remainder of this section covers some of the other key elements of the definition of the portfolio and has been broken down into three components to assist in implementation planning:

1. Risks and mitigating suggestions
2. Prioritisation of opportunities
3. Scheduling of opportunities

RISKS AND MITIGATION

All change portfolios, programmes and projects carry risks as they are fairly unique to the specific organisation, constrained, based on assumptions, performed by people and often subject to external influences. To assist in managing those risks it is vital to define and understand the risks and develop mitigating actions to allow for the risks to be pro-actively managed, ensuring that the success of the change is optimising through minimising threats and maximising opportunities. To 'kick-start' this risk process identified below are some of the high level risks and mitigating implementation suggestions aimed at the pro-active management of these risks that specifically relate to the implementation of the opportunities as identified through the ZBR process:

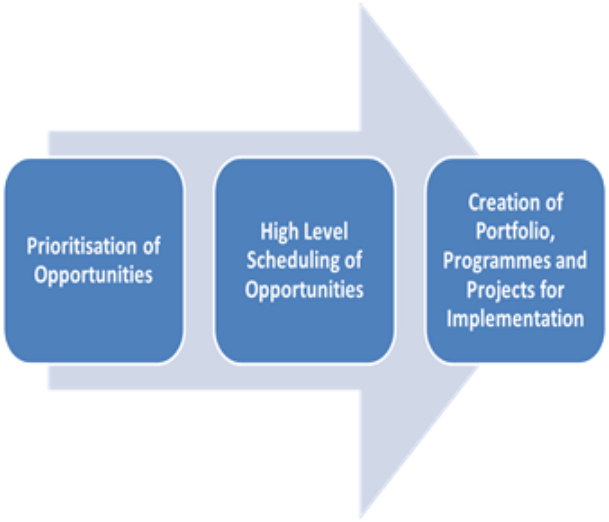
	Risk Description	Mitigating High Level Implementation Suggestions
1	Failure to deliver project outcomes due to lack of project resources caused by conflicting work priorities	Create a dedicated business change portfolio with structured programmes and projects and accountable programme managers with individual workstream project managers responsible for implementation and delivery of outcomes with dedicated full time project resources with suitable programme and project governance.
2	Poor communication to employees leads to a reluctance to support the project implementation	Develop and implement a detailed communications strategy and plan aligned to programme and project plans. Driven by a robust vision and mission by key sponsor / stakeholders / programme board.
3	Productivity benefits are not realised due to lack of structured business process analysis and planning	Establish clearly defined 'as-is' and target business processes linked to project plan outcome delivery, considering the full end to end business process and changes to existing activities and work practices.

4	No suitable service provider can sourced/procured or equipment to support trenchless technology in Canada/Northern America	Liaise closely with The City of Calgary Procurement business unit. Consider joint venture with suppliers to road show technology in Calgary. Alternatively consider joint procurement with other city Water Services business units to make sure the service is commercially viable for service /equipment suppliers.
5	Equipment purchased to deliver service is not utilised due to lack of skills resulting in wasted investment and failure to deliver business benefits	Ensure skills and training is provided along with proper onsite training, supervision and handover. Consider technician /operator for extended period as part of equipment supply and warranty to ensure proper skills transfer.
6	Water Services capacity for change	Undertake an assessment of the teams and individuals that will be impacted by the programme of change to be implemented. This will assist in determining the scheduling of the ZBR recommendations (and also any continual improvement initiatives) to ensure that change is pro-actively managed to maximise the chances of the changes being accepted and the benefits being realised. Linked to risk #2 also undertake pro-active change management activities eg engage teams in change development, create more visibility of the change, paint a picture of the future state, which will also assist in the acceptance and delivery of the change.
7	Not measuring performance so cannot demonstrate/ measure improvement or success of initiatives.	Develop and track performance measures related to ZBR initiatives. Develop measures that are able to define, track and demonstrate the success of implementation. To ensure that this is even more meaningful for Water Services expand the measurement to encompass the continual improvement initiatives undertaken by Water Services.

PRIORTISATION, SCHEDULING AND PORTFOLIO DEVELOPMENT

Introduction

As can be seen from the risks highlighted in previous section it will be essential to manage the recommendations from the ZBR as a change portfolio[#1] of programmes and projects, and to take into account any ongoing or future continual improvement initiatives as well. However, to be able to develop an effective portfolio of change it is essential to analyse the ZBR opportunities to develop an effective, efficient and deliverable portfolio.



The first two steps in this process are covered in this section (priortisation and scheduling). Portfolio management is important in implementing this level of change because it ensures that the 'right' programmes and projects are started and delivered in the right priority order with dependencies understood and managed pro-actively. The right programmes and projects are those that collectively make the greatest contribution to The City of Calgary's strategic objectives and targets.

[#1] *Portfolio Management is a co-ordinated collection of strategic processes and decisions that together enable the most effective balance of organisational change and business as usual.*

Prioritisation of Opportunities

Therefore, one of the first steps is to analyse the opportunities from the ZBR in terms of overall benefit that they will provide versus their complexity of implementation. This assists in the process of informing some key questions associated with priortisation around:

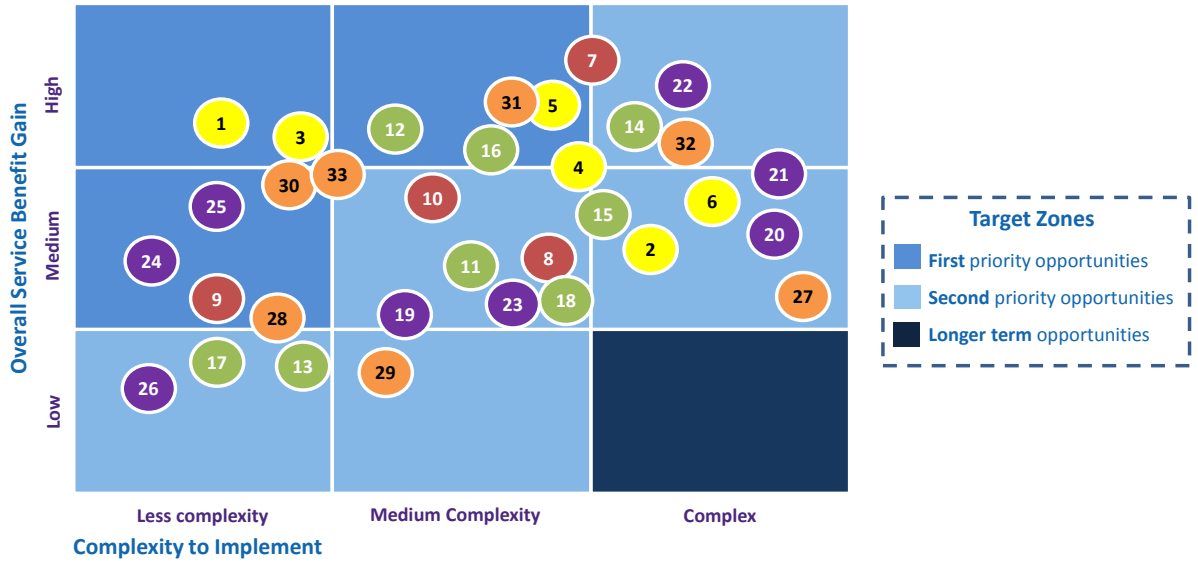
- ✓ What are the most important changes?
- ✓ What changes should be resourced above all others?

The priortisation matrix, over the page, assists in demonstrating the opportunities in this fashion; the matrix is further broken down into three target zones:

1. **First** priority opportunities
2. **Second** priority opportunities
3. **Longer term** opportunities

The rationale for the high complexity of some of the opportunities can be around their reliance on up-front investment, in particular technology investment, to realise the benefits, or these areas that are relatively new to Water Services. Equally some of the less complex opportunities are likely to be a continuation of some of the activities that are already being undertaken by Water Services and the opportunity here is around maturing those activities to deliver greater benefit.

Priortisation Matrix of Opportunities *(overall benefit vs. complexity)*



Performance Measurement

1. Dashboard reporting
2. Benchmarking
3. Visibility of data and performance opportunities
4. Develop an overall performance measure
5. Set internal targets
6. Technology and performance measure improvements

Job Planning: Trenchless Technology

7. Adoption of trenchless technology
8. Reduction of root auger program
9. Review innovation possibilities
10. Cost sharing with customers

Job Planning: Resource Optimisation

11. Optimising construction crews
12. Increase spot repairs
13. Decision support matrix
14. SLA with Roads
15. Support challenges to Roads
16. Excavated material reuse
17. Simple appointment route planning
18. New video equipment and process

Job Planning: Customer Experience

19. Customer data – 360 degree view
20. Customer data – access to customer data
21. Customer data – centralised appointment system
22. Reducing enquires & self-serve
23. Proactive customer notifications
24. Zero impact for repeat private visits
25. Zero impact for Service Reuse in Water Services
26. Partnership working – service level agreements

Risk Based Maintenance

27. Dead end main flushing
28. Valve surveys
29. Air valves
30. Pressure reduction valves
31. Risk based maintenance
32. Asset master plans
33. Condition based assessment

Scheduling of Opportunities

The priortisation matrix has developed a starting point for the creation of scheduling the opportunities identified during the ZBR. This is an integral stage towards the development of the programmes and projects that will be delivered during the implementation. Highlighted in this section is a high level view on the scheduling of these opportunities, breaking them down into an implementation timeline, as defined below:

1. **Quick Wins** (delivered within 12 months)
2. **Short Term** (1-2 years)
3. **Medium Term** (2-4 years)
4. **Long Term** (4+ years)

The scheduling of opportunities is based on the following assumptions/ comments/ calcifications:

- ✓ Water Services, will through its implementation planning, determine the actual cost of implementation, including any information technology requirements, and calculate the net benefit of implementing the recommendations (ie efficiency savings vs. cost of implementation)
- ✓ It should be noted that as further business analysis is undertaken by Water Services and the implementation planning work matures it will revise the scheduling assessment outlined in the tables
- ✓ As this assessment has been carried out without a full understanding of other business activities being planned or currently undertaken, therefore, there is a risk that business priorities within Water Services will have an impact on the scheduling of these opportunities, potentially meaning that the timeline is adversely affected, for example short term could possibly become medium term implementation.
- ✓ In the tables it should be noted that the first 12 months does not necessarily begin in 2015. The starting point for the programme, taking into account other priorities, will be determined by Water Services during implementation planning
- ✓ Scheduling does not include scalability to other areas in Water Services. The timing and approach to integrating scalability will be determined by Water Services through their implementation planning

Also identified in the table are the current known dependencies, either between opportunities or to areas outside of the ZBR eg reliance on information technology.

SCHEDULING OF OPPORTUNITIES	
Quick Wins (delivered within 12 months)	**Short Term (1-2 years)**
PERFORMANCE MEASUREMENT 1 Dashboard reporting 3 Visibility of data & performance opportunities	**PERFORMANCE MEASUREMENT** 4 Develop an overall performance measure 5 Set internal target
JOB PLANNING: TRENCHLESS TECHNOLOGY	**JOB PLANNING: TRENCHLESS TECHNOLOGY** 7 Adoption of trenchless technology **#1** 8 Reduction of root auger programme **#1 #1b** 10 Cost sharing with customers
JOB PLANNING: RESOURCE OPTIMISATION 13 Decision support matrix 17 Simple appointment route planning	**JOB PLANNING: RESOURCE OPTIMISATION** 11 Optimising construction crews 12 Increase spot repairs 14 SLA with Roads **#2** 18 New video equipment and process **#1**
JOB PLANNING: CUSTOMER EXPERIENCE	**JOB PLANNING: CUSTOMER EXPERIENCE** 24 Zero impact for repeat private visits 25 Zero impact for Service Reuse in Water Services 26 Partnership working – service level agreements
RISK BASED MAINTENANCE	**RISK BASED MAINTENANCE** 28 Valve surveys 29 Air valves 30 Pressure reduction valves **#3** 31 Risk based maintenance
Identified Dependencies for Quick Wins	**Identified Dependencies for Short Term**
None identified to date	**#1** Opportunity requires up-front investment to be able to deliver benefits **#1b** Opportunity depends on the adoption of trenchless technology opportunity being implemented to deliver root auger benefits **#2** Dependency on Roads engagement with the opportunity to refresh SLA **#3** Opportunity requires up-front Information Technology investment to be able to deliver benefits, although assumption is this will be funded from Water Services budget

SCHEDULING OF OPPORTUNITIES	
Medium Term (2-4 years)	**Long Term (4+ years)**
PERFORMANCE MEASUREMENT 6 Technology & perform. measure improvements **#1** 2 Benchmarking	**PERFORMANCE MEASUREMENT**
JOB PLANNING: TRENCHLESS TECHNOLOGY 9 Review innovation possibilities	**JOB PLANNING: TRENCHLESS TECHNOLOGY**
JOB PLANNING: RESOURCE OPTIMISATION 15 Support challenges to Roads 16 Excavated material reuse	**JOB PLANNING: RESOURCE OPTIMISATION**
JOB PLANNING: CUSTOMER EXPERIENCE 19 Customer data – 360 degree view **#1** 22 Reducing enquires & self-serve **#1** 23 Proactive customer notifications	**JOB PLANNING: CUSTOMER EXPERIENCE** 20 Customer data – access to customer data 21 Customer data – centralised appointment system **#1**
RISK BASED MAINTENANCE 32 Asset master plans 33 Condition based assessment **#3**	**RISK BASED MAINTENANCE** 27 Dead end main flushing
Identified Dependencies for Medium Term	**Identified Dependencies for Long Term**
#1 Opportunity requires up-front Information Technology investment to be able to deliver benefits (dependent on UEP IT Strategic Plan)	**#1** Opportunity requires up-front Information Technology investment to be able to deliver benefits (dependent on UEP IT Strategic Plan)

SECTION 11
APPENDICIES

APPENDIX 1 - JOB PLANNING TAXONOMY	
Word	**Definition**
Root Auger	An auger has a rotating head that spins around the interior of a sewer pipe. Fed into the line at an entrance point, a control line attached to the auger supplies mechanical power and flexibility during its trip through the pipe. The auger head has sharp teeth or blades that cut away tree roots and other obstructions
Mains lining	The lining of drinking water mains to prolong the life span of the pipe for less than the cost of replacing the pipe and with fewer service disruptions to residents as opposed to completely replacing the water main,
Pipe bursting	Is a trenchless method of replacing buried pipelines without the need for a traditional construction trench through fracturing a pipe from the inside and forcing the fragments outwards while a new pipe is drawn in to replace the old one
Sanitary service	The collection of wastewater in sewers, including treatment in wastewater treatment plants for disposal in rivers, lakes or the sea.
Trenchless technology	Trenchless technology is a type of subsurface construction work that requires few trenches or no continuous trenches. It can be defined as "a family of methods, materials, and equipment capable of being used for the installation of new or replacement or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic, business, and other activities
Rehabilitation	Work carried out to restore the surface of the ground to its original condition – for example, resurfacing a road after work to lay mains
Customer service	A general term for the service that customers experience. For example, if a pump is unreliable it will give poor service, but if it is always repaired promptly before supplies to the customer are affected, then service to the customer will be good
Slip lining	Slip lining is used to repair leaks or restore structural stability to an existing pipeline. Slip lining is completed by installing a smaller, "carrier pipe" into a larger "host pipe", grouting the annular space between the two pipes, and sealing the ends.
Water service line	A water service line brings fresh, clean water to a customer home from the water provider's connection through a pipe. Property owners are only responsible for repairs required to the water line on their own property
Customer experience	is the sum of all experiences a customer has with a supplier of goods and/or services, over the duration of their relationship with that supplier.
Customer experience excellence	An excellent customer experience is one where employees put customers first; treat them as an individual; demonstrate expertise; and deliver what they say we will, when they say we will

Customer journey	Customer journeys document each step that a customer takes when interacting with an organisation – as viewed from the customer perspective. Customer journeys show all the crucial moments of truth which indicate opportunities to improve the customer experience.
Stakeholders	A person, group or organization that has interest or concern in an organisation. Stakeholders can affect or be affected by the organisation's actions, objectives and policies
Service Reuse	Connecting a new house to existing service connections - water & sewer connection reuse
Increased visibility	Where the information on the site and the customer can be quickly and easily accessed by appropriate employees in Water Services
Roads permit	The application to dig up a road submitted to the Roads Department. Also used to charge Water Services for the road rehabilitation
As-dug/excavated material	Soil that has been excavated from the ground to gain access to the buried water services
Innovation	The process of translating a new industry invention or process into a service that creates efficiency or effectiveness savings for customers.
Private Side Service	The portion of the service connection that is within the property boundary and the responsibility of the home owner, not the City of Calgary.
Trouble Crews	Two man emergency first responder crews. They are active 24 hours a day and attend sanitary service blockages to clear.
Recompact	When a roads rehabilitation must be dug up again to recompact the soil to make it suitable for a road surface. Every time this is done the initial road permit charges are incurred again

APPENDIX 2 – RISK BASED MAINTENANCE TAXONOMY

Word	Definition
Asset management	Managing the capabilities of physical assets so that customers can continue to access services, at a level & price that is acceptable to them
Risk based maintenance	A risk based maintenance approach prioritises maintenance resources toward assets that carry the most risk if they were to fail. It is a methodology for determining the most economical use of maintenance resources. This is done so that the maintenance effort across a facility is optimised to minimise the total risk of failure
Capital maintenance	Planned activity to replace and renovate water and sanitary assets to provide continuing services to customers
Capital programme	Planned construction work to build new assets, or replace or renovate existing assets, such as water treatment works and water mains
Infrastructure assets	Mainly below- or underground assets, such as water mains and sanitary services
Non-infrastructure assets	Mainly above-ground assets, such as water and waste water treatment works, lifting stations, depots and workshops
Operating costs (opex)	Day-to-day spending on running the services, for example, employee costs and power. For example, it comprises power, rates, payroll costs and materials and consumables, but excludes capital-related costs such as depreciation.
Risk	Part of the risk = probability x consequence formula applied to future events. Risk is the product of the probability, or likelihood, that an event will occur and the consequence of that event's occurrence
Risk based approach	Targeting our resources more effectively on those areas where there are material risks to customers, society, the environment and the economy.
Serviceability	The capability of a system of assets to deliver an expected level of service to consumers and to the environment now and into the future
Preventive maintenance (PM)	The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects.
Planned maintenance	a scheduled service visit carried out by a competent person, to ensure that an item of equipment is operating correctly and to therefore avoid any unscheduled breakdown and downtime
Condition based maintenance (CBM)	Maintenance when need arises. This maintenance is performed after one or more indicators show that equipment is going to fail or that equipment performance is deteriorating.
Supervisory control and data acquisition (SCADA)	Is a system operating with coded signals over communication channels so as to provide control of remote equipment (using typically one communication channel per remote station)
Service valves	Service valves control the water running to a home or building from The City of Calgary water main. Service valves are usually located outside the residence, either in the front, back or side of the property (for example: lawn, driveway, or private sidewalk) and occasionally they are located just outside the fence line in the back alley.

APPENDIX 3 – PERFORMANCE MEASUREMENT

Performance Measurement Survey

Prior to SWI's last visit to Calgary a performance measures survey was developed to look at the current measures reported to Council and the National Water and Wastewater Benchmarking Initiative (NWWBI). The survey was distributed to managers and leads and asked them to assess the current measures in terms of data quality, availability and usefulness. They were also asked which measures were important to them in terms of their area of the business and which measures they considered most important to the business as a whole. Finally they were asked in an ideal world what measures they would report on.

Measures for Wastewater Treatment and Water Treatment were ranked as better overall than those for Field Services and Construction Services. Wastewater Treatment's three top measures all scored over 4 out of 5 overall (average of data quality, availability and usefulness) while Water Treatment's three top measures all scored 3.9 or better. In contrast only one measure scored better than 3.5 for both Field Services and Construction Services and that was the measure that assessed customer satisfaction with frontline employees.

In terms of "ideal world" measures the survey produced a wide range of answers including measures covering areas such as energy costs and optimisation, work order planning and completion, reliability of assets, a customer satisfaction index to cover all customer interactions and costs per job. The majority of answers (87%) were measures that would be in the How much and How well categories in Results Based Accountability methodology.

The survey also asked for general comments and common themes that emerged were getting data from corporate systems such as OWAMS, lack of clarity on performance measures' definitions, the lack of QA on data captured in the field and the effort versus value of the benchmarking exercises. This survey formed the basis of interviews with Operational Performance Leads. During these interviews current levels of reporting to managers was also investigated to get an idea of what type of information managers asked for on a regular basis.

These interviews were followed up with one to ones with the four managers to test the issues and opportunities that arose from the survey and that the interviews with the Leads were how they perceived the situation to be. All four were largely in agreement with the findings and raised no further questions that needed to be pursued.

A SWI consultant also met with Finance and IT representatives to understand the corporate support provided to Water Services in terms of reporting and performance measurement.

The documentation gathered in support of this workstream included the following:

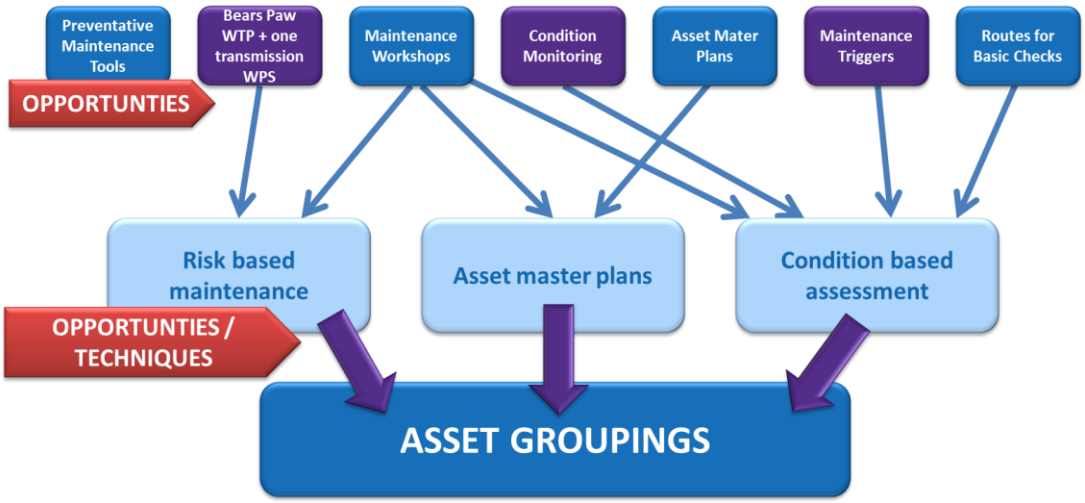
- Management reports from all four teams in Water Services
- Financial reports provided to Water Services from the corporate function
- The current Water Management Team "Dashboard"
- The draft UEP business plan to Council

APPENDIX 4 – RISK BASED MAINTENANCE: PROCESS FOR THE CREATION OF OPPORTUNITIES RELATED TO ASSET TECHNIQUES

During the phase 2b analysis period, it was recognised that the opportunities for Water Treatment and Transmission could be grouped into three distinct themes:

1. Risk based maintenance
2. Asset master plans
3. Condition based assessment

It was then considered that the benefit options should be presented for a series of Asset Groupings against each theme. The following diagram explains the rationale to this approach.



The original business case 'Opportunities' (highlighted on the top row of the diagram) may still be relevant for implementation, and although not detailed in this business case they have been captured for future reference in support of the three main themes of Risk Based Maintenance, Asset Master Plans and Condition Based Monitoring.

Asset Groupings

Asset Groupings were chosen following a workshop with the Business Performance team at Glenmore WTP. The groupings were created by considering the spend profile for each of, (a) Preventative Maintenance (PM), (b) Corrective Maintenance (CM), and (c) Capital Upgrade work, over a two year period. The following diagram lists the groupings and considers which of the themes are applicable in order to gain effectiveness and efficiency benefits.

Row Labels	P20	R20	R40	Grand Total	RBM Technique	AMP Technique	CBM Technique
ACTIFLO	72,728	75,347	42,780	190,855	yes	no	yes
ACTUATOR	8,920	40,504	40,638	90,062	yes	yes	yes
ANALYSER Rounds	125,066			125,066	yes	yes	no
ANALYZER - REG	21,169	7,175		28,345	no	no	no
ANALYZER-NON	105,913	83,245	185,935	375,093	yes	yes	maybe
MAJOR ELECTRICAL	34,328	101,669	82,469	218,466	no	yes	yes
ENGINE/GEN	50,896	137,567		188,463	yes	yes	yes
PUMPS/MOTORS (LARGE)	32,834	194,816	317,426	545,076	no	yes	yes
Rounds/Site	73,051	71,023	188,939	333,013	yes	no	no
SAND/SLUDGE PUMP	15,381	77,787		93,168	no	yes	yes
sub-total	**540,286**	**789,134**	**858,187**	**2,187,607**			
BOILER ROUND	13,259			13,259	for further consideration by Business Performance/Maintenance Planning team		
HOIST		38,517	56,788	95,305			
LAGOON		48,138	109,369	157,508			
RAW GATE			83,575	83,575			
RTF	26,931	101,008	32,881	160,820			
SBS UPGRADE			472,209	472,209			
SM PUMPS	19,342	28,478		47,820			
TANK	3,589	71,099	91,850	166,539			
VALVE	13,198	53,848	95,241	162,287			
x (OTHER_	98,148	214,405	82,707	395,260			
sub-total	**174,467**	**555,493**	**1,024,621**	**1,754,581**			
Grand Total	**714,753**	**1,344,627**	**1,882,808**	**3,942,188**			

APPENDIX 5 – RISK BASED MAINTENANCE: FINANCIAL ASSUMPTIONS

The following information relates to the assumptions that have been made in the risk based maintenance workstream relating to individual asset groupings:

Actiflo
Current required PM is $110k/yr. – potential to move to $55k/yr.
Enabler 1 – investment in Condition Based Monitoring hardware and training
Enabler 2 – adopt Risk Based approach and Master Plan

Actuator
Change from 1yr PM to 5yr PM – already optimised
Enabler 1 – investment in Critical Spares
Enabler 2 – Risk Based approach based on spares holding and historical knowledge

Analyser
Enabler 1 – investment in Critical Spares
Enabler 2 – Asset Master Plan, (AMP) to determine lifecycling programme
Enabler 3 – optimise current maintenance plan (RBM)

Major Electrical
Enabler 1 – to optimise equipment lifecycling
Enabler 2 – maximise use of existing Condition Based Monitoring
Enabler 3 – move resources to equipment with emerging needs – HV maintenance

Engine / Gen sets
Enabler 1 – Asset Master Plan to determine lifecycling rate
Enabler 2 – optimise current maintenance programme (RBM)

Pumps / Motors
Enabler 1 – develop AMP to inform rebuild frequency
Enabler 2 – Use 'run time' data to drive maintenance needs
Enabler 3 – Make better use of existing Condition Based Monitoring systems

Rounds / site
Develop programme to upskill operators to perform low skill craftsman tasks

Sludge/Sand pumps
Enabler 1 – investment in Critical Spares
Enabler 2 – Asset Master Plan, (AMP) to determine lifecycling programme

APPENDIX 6 – RISK BASED MAINENANCE: EXAMPLES

Water Treatment and Transmission

Preventative Maintenance Tasks – Review of estimated hours
Opportunity - review estimated hours to complete preventative maintenance tasks, based on actual time spent. This is in order to present a more accurate representation of Plan Attainment.
Option 1
Review and adjust estimated hours based on history of actual time spent on individual preventative maintenance tasks. It is recognised that this is an ongoing activity aligned to the maintenance workshops. This opportunity also explores the relationship between Planned and Corrective work which is relevant for a risk based approach towards maintenance

Business case development – Option 1

'Review of estimated hours' data is presented in the example below.

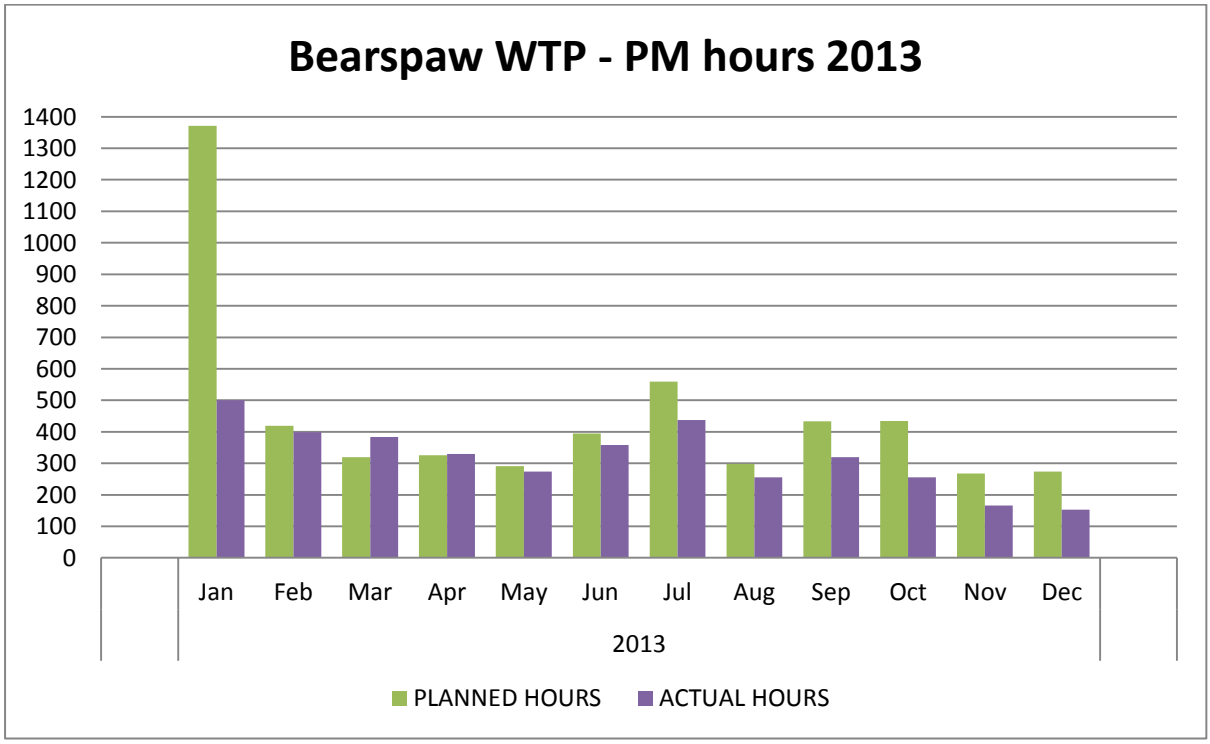


Diagram 1 – source, CoC Water Treatment, Operational Performance Team

Total no. of hours planned = 5,978hrs. / Actual achieved = 4,022hrs (67%). (sample of 1964no. tasks recorded as 'finished'). (source – email 'BP WOs with costs an hours' KFletcher 01/10/2014).

Whilst the diagram presents the relationship between estimated hours against those achieved, it is acknowledged that the differences shown in Jan'13 were due to an asset failure resulting in extensive corrective maintenance having to be carried out and thus took priority.

The NPV calculation assumes a small increase in productivity related to more accurate planning.

It is valid at this point to explore the relationship between Preventative Maintenance (PM) and Corrective Maintenance (CM).

Planned (PM) v Corrective (CM)

For Water Treatment, there is good data capture and understanding of Planned and Corrective work. A third element of data/cost capture is capital maintenance 'upgrade' work. A representation of each dataset is presented below, (Kristine Fletcher – 'BP WOs with costs and hours 2013' – email 01/10/2014).

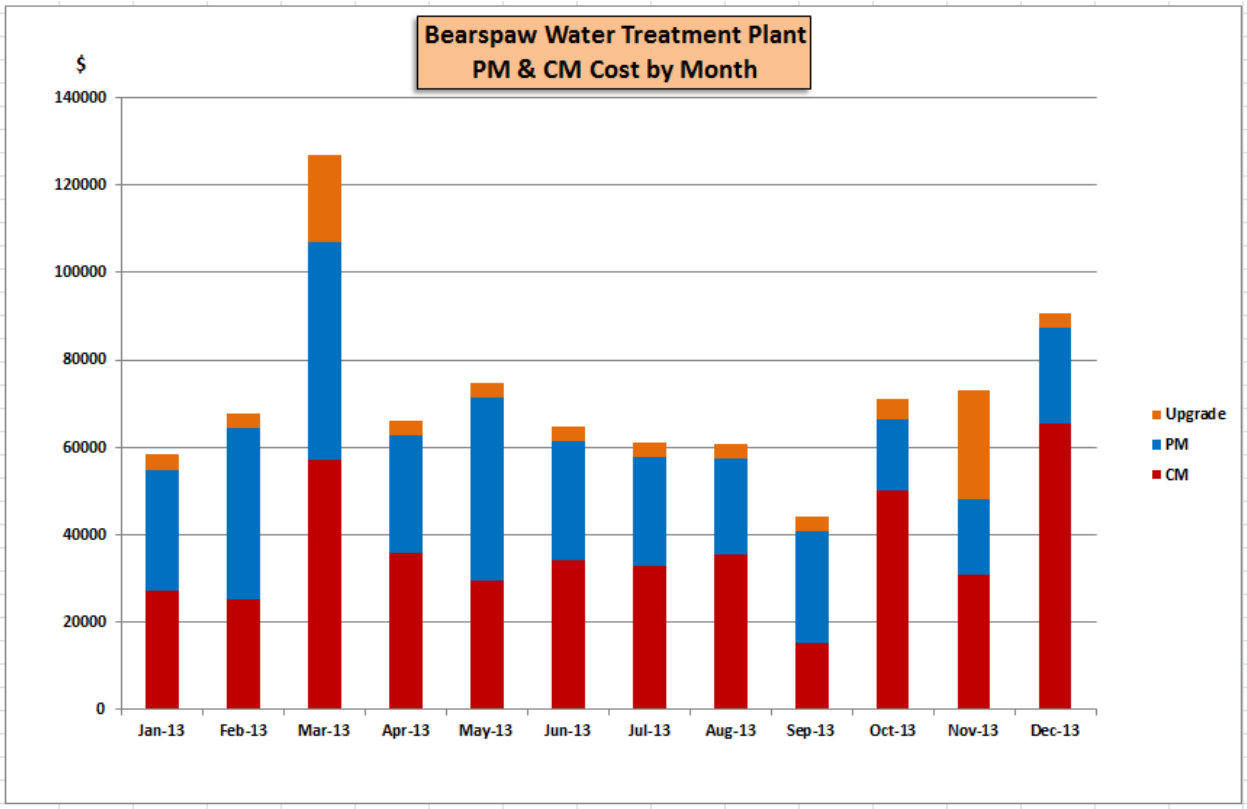


Diagram 2 – Bearspaw WTP PM & CM cost per month

Month	CM	PM	Upgrade
Jan-13	27155	27695	3464
Feb-13	24963	39259	3333
Mar-13	57051	49982	19853
Apr-13	35592	27160	3333
May-13	29546	41898	3333
Jun-13	34257	27237	3333
Jul-13	32880	24734	3333
Aug-13	35548	21675	3333
Sep-13	15173	25444	3456
Oct-13	49960	16535	4441
Nov-13	30891	17284	24953
Dec-13	65433	21864	3333
	$438,448	**$340,767**	**$79,501**

- $3333 each month is divided across the year from a $40,000 cost capture on small 'upgrade/capital' items.
- $340,767 represents the cost of an average plan attainment at 65% for 2013.
- Upgrade costs are relatively low in 2013 compared to adjacent years where examples have included pump replacements at $300,000+
- $79,500 is relatively low cost in comparison to adjacent years

In order to gain an understanding of the relationship between Preventative and Corrective work, the maintenance workshops, should consider whether the corrective work is **inspection driven** (by PM), or has **failed in service**.

If an intervention is inspection driven, then the maintenance workshop considers whether the frequency can be increased and still maintain adequate warning in order for the intervention to be planned. The cost impact of allowing the equipment to fail must also be considered.

In terms of cost impact, it is understood via Scottish Water experience that some reactive failures can cost 2 – 3 times that of completing the task in a planned way.

Conversely, there will be equipment items assessed by the workshops as having a 'run to fail' strategy being the optimum level of maintenance. Examples of these will be where the cost and ease of replacement is less than to perform regular maintenance. Small chemical dosing pumps are candidates for this type of approach where commonality exists across the asset base and spares are kept, or replacements are readily available.

Data capture and visibility of intervention history is key to understanding risk and consequences of differing approaches to maintenance whether applying a risk based and/or a longer term, asset lifecycle planning approach.

The Water Treatment Business Performance team are currently carrying out data/cost analysis of their Major Equipment Units, (MEUs) to help present and understand failure rates based on the balance of PM versus CM input. A recent presentation of intervention history associated with MEUs demonstrates a trend of equipment failure which can be used to inform risk based decision making. (part of maintenance workshop). A further representation of planned work versus corrective/upgrade work is a direct comparison of work order volumes.

Month	PM	CM
Jan	202	69
Feb	316	50
Mar	177	63
Apr	164	54
May	167	55
Jun	171	81
Jul	249	56
Aug	112	39
Sep	162	49
Oct	221	77
Nov	88	57
Dec	75	43
	2104	693

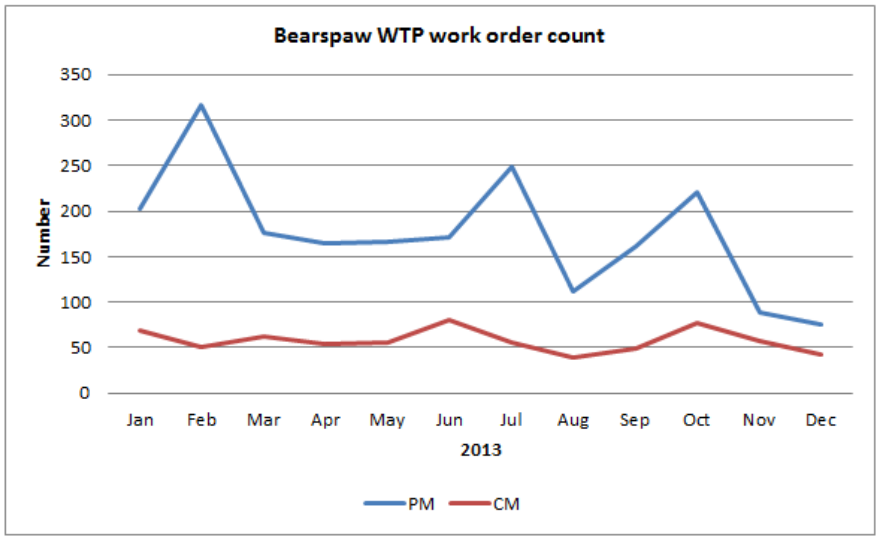


Diagram 3 – Bearspaw WTP PM & CM work order count per month

Diagram 3 demonstrates that whilst PM work varies by as much as 100no. work orders between months, the CM work remains relatively constant at an average of 58no. work orders. The conclusion is that for this example the CM work does not appear to be dramatically affected by the PM programme. Therefore the levels of PM activity in February, July and October could be assessed for risk potential.

Diagram 4 – example WWTP PM & CM work order count per month

In terms of scalability towards wastewater assets which are understood to be mostly CM driven, a conservative estimate of 25% (assumes 1.5 x planned cost) savings could be achievable by carrying out more planned work.

Bears Paw WTP plus one transmission WPS
Opportunity - carry out a full Risked Based Maintenance optimisation exercise
Option 1
Fully cost/risk optimise all preventative maintenance tasks associated with Bears Paw and one WPS. Provide measure of potential efficiency and fully document findings. This option will serve as a pilot for the remainder of the asset base within this function. Scalability throughout the asset base can be implemented once the benefits of the pilot are captured and realised.

Business case development – Option 1 (effectiveness and efficiency benefit)

It is known that a risk based maintenance planning approach already exists within Water Services, Treatment function. It is anticipated that a pilot review and optimisation of maintenance will be done at **Bearspaw WTP** and **'a chosen' WPS.**

The Maintenance Planning team are currently reviewing and optimising sets of asset types. A recent example from one maintenance workshop is a review of actuator maintenance, (230no.) at Bearspaw WTP.

The savings in terms of labour hours are summarised below and quantified in $$ savings in the NPV section.

Pre-workshop – PM time per actuator over five years: 7.5hrs x 230no. = 1725hrs

Post-workshop – PM time per actuator over five years: 4.0hrs x 230 = 920

\- (90 x 0.5) = 45

875hrs

The workshop review includes the re-writing of the PM 'master' instruction document to take account of the task changes in alignment with the revised frequency. This practice is clearly scalable towards Glenmore WTW where there is a similar stock of actuated valves.

The above example demonstrates that following a risk based workshop, a saving of almost 50% is achievable, **with no predicted or measureable impact** upon the risk of corrective work increase. This

theory will be tested as the revised maintenance plan is rolled out and intervention triggers are recorded.

The Water Treatment Business Performance team are very focussed on optimising, then measuring the performance of their 'Major Equipment Units' (MEUs). This is in alignment with the Plant Status report which gives a good spatial view of the assets and their operational status based on work order volumes. The vision is that this type of analysis and review will be effective in terms of productivity gain, be efficient by incurring less cost performing tasks, and enable a predictive planning approach towards capital replacement items in the longer term.

Diagram 4 is an example review for a Pre-Treatment MEU. Whilst the predicted saving is 9hrs, (42%), the consequences of failure must consider associated 'penalty' costs. If costs are identified and are in excess of the savings predicted, it is not recommended to change the PM.

Asset Information			Existing PM			Consequence of Failure Scores					Av Conseq Of Failure Score	L of F Score	Risk Score	Post-Review Recommendations	Annual Saving
MEU	EQUIP NR	EQUIPMENT DESC	PM DESCRIPTION	FREQ	EST HOUR	H&S Risk	Customer Impact	Environ. Impact	Process Impact	Return to Service Cost				coments	hrs
P-A-01	40062085	Scraper Drive	1Year Electrical PM on Settling Tank Rake Drive SR4PT-0111 Perform 1Year Electrical Tasks from att	1YR	4	4	1	1	4	3	2.6	3	8	leave as existing	0
P-A-01	40066727	Volumetric Feeder	6 Month Mechanical PM GROUP on Volumetric Feeders on Actiflo Sand Silo, H-B030, VF4PT-0131, SEW -	6 MTH	1	2	1	2	2	3	2.0	2	4	move to 12 months	1
P-A-01	40066727	Volumetric Feeder	2 Year Mechanical PM GROUP on Volumetric Feeders on Actiflo Sand Silo, H-B030, VF4PT-0131, SEW -	2YR	2	2	1	2	2	3	2.0	2	4	leave as existing	0
P-A-01	40075846	Turbidity Analyzer	1 Month Instrumentation PM GROUP on Bearspaw PTF Solitax Turbidimeter (AIT4PT-0161) Refer to attache	1MTH	1.5	1	1	1	4	2	1.8	3	5	move to 2 months	6
P-A-01	40075846	Turbidity Analyzer	2 Year Instrumentation PM GROUP on Bearspaw PTF Solitax Turbidimeter (AIT4PT-0161) Refer to attached	2YR	2	1	1	1	4	2	1.8	3	5	leave as existing	0
P-A-01	40128254	Pressure Transmitter	1Year Instrumentation PM for Pressure Transmiter in PTF, H-B030, PIT4PT-0150 1. Perform calibratio	1YR	2	2	1	1	3	2	1.8	1	2	move to 24 months	1
P-A-01	40128255	Pressure Transmitter	1Year Instrumentation PM for Pressure Transmiter in PTF, H-B030, PIT4PT-0153 1. Perform calibratio	1YR	2	2	1	1	3	2	1.8	1	2	move to 24 months	1
OTHER	08010955	Pretreatment Facility	1 Week Mechanical PM ROUNDS on Bearspaw Pretreatment Facility PTF (Millwright), H-B030 Perform weekl	1WK	1						#DIV/0!		####	leave as existing	0
														total	9

Diagram 4 – example review of PM programme scoring matrix

It is understood that part of the MEU shown in the example above (not shown), is currently being risk optimised by the maintenance planning team. A summary of tasks and those currently in optimisation review is as follows, (13% of entire PM programme for Water Treatment and Transmission is currently undergoing optimisation review).

	No. of PM tasks	Total est'd hrs	currently in optimisation review	% in optimisation review
Bearspaw WTP	1390	3135	463	33%
Glenmore WTP	1399	4944	0	0
Transmission	775	3344	0	0
Total	3564	11367	463	13%

Summary of tasks and optimisation – (source CoC WS Business Performance team – KFletcher)

It is recommended that the pilot for this opportunity should follow the process for the maintenance workshops and record/document/cost the perceived risks associated with optimising the PM programme.

The NPV calculation predicts savings based on a conservative estimate of impact upon the increase in corrective work arising.

The NPV calculation makes the following assumptions,

1. The volume of PM will reduce by 25% by yr4
2. based on Scottish Water experience, reducing the PM by greater than 25% over four years will increase the CM by 2% in yr 1, rising to 8% in yr4, then no further increase as PM programme is embedded. This has not been factored into the NPV calculation to assume a conservative approach, to be measured in years 1 & 2.

Business case development – Option 2 (effectiveness and efficiency benefit)

It is known that for the Water Treatment asset stock, a criticality ranking already exists. An 'A/B' system identifies elements of the process as being on the critical path/non-critical path for the production of potable water. This system works in association with the process for prioritising corrective work, (CM), as follows, (source – Kendal Martins, email 30/09/2014).

CODE	DESCRIPTION	DEFINITION
1	**No Impact**	Asset not required for plant operation and equipment failure would have no impact on plant operation. Little or no impact.
2	**Minor Impact**	Asset is required for plant operation yet failure would not disrupt treatment operation. Non production equipment.
3	**Moderate Impact**	Asset is required for plant operation yet failure could disrupt treatment operation. Production equipment.
4	**Severe Impact**	Asset is critical in plant operation or health and safety and failure would disrupt treatment operation. Repairs to asset are treated as same day.
5	**Critical**	Asset necessary for plant operation or health and safety and must be available at all times. Repairs to asset are treated as an emergency. Immediate response. Severe production or safety impact.

The recommendation for the maintenance workshop opportunity is to build upon the current practice for criticality and prioritisation. The proposal is to use 'Consequence versus Likelihood' analysis to score assets for their risk based maintenance potential.

Effectiveness and consistency of a structured approach is the immediate benefit of this opportunity. Efficiency gains will be upon the implementation of revised plans taking account of the cost of risks.

The following criterion is an example of considerations for **Consequences of Failure**, (adaptable for Calgary criteria),

Health & Safety

Consequence of failure	Score	Example
No increased H &S risk	1	Non hazardous process
Risk of minor injury	2	Slippage or handling problem
Risk of injury to immediate personnel	3	Pressure release, minor chemical release.
High risk of major injury to immediate personnel or minor injury to a larger number of personnel	4	Explosion risk or localised gas release. Structural member failure.
Severe risk to the surrounding area including members of the public	5	Large explosion risk, major gas release to atmosphere, major tank rupture.

Customer Impact

Consequence of failure	Score	Example
No impact on service levels	1	
Minimal impact on service level	2	Discoloured water, visual impact, odour problem
Partial loss of service	3	Short term loss of service (< 4 hrs) or medium term quality problem (< 1 week).
Major impact on service or quality standard	4	Undrinkable water or loss of sanitary service, property flooding.
Complete service loss/ severe quality failure.	5	No water service > 8 hours, Unsafe drinking water supplied, property flooding.

Environmental Impact

Consequence of failure	Score	Example
No environmental impact	1	
Discharge kept within works boundary	2	Chemical spill to bund, discharge to storage tanks.
Minor discharge to watercourse/land external to works, exceeds discharge licence limit	3	Sludge overflow due to pump failure, chemical seepage following plant failure.
Major discharge exceeds licence limit	4	Major plant failure leading to failure to properly treat discharge. Major oil leak from equipment.
Gross discharge, major water contamination	5	Untreated discharge directly to watercourse. Pollution, potential prosecution.

Impact on Process

Consequence of failure	Score	Example
No impact on overall process	1	level alarm or switch failure
Standby or backup able to run automatically	2	Standby unit operating after duty failure
Medium effect on part of the process. Manual intervention required.	3	Aerator failure. Manual shutdown required. Control instrument failure. Manual operation required.
Part process failure but works still running	4	Ph adjustment fail. Screen failure. Primary treatment stage failed.
Major impact causing plant shutdown	5	Disinfection failure, contamination of process water / sewage.

Return to Service Costs

Consequence of failure	Score	Example
Total costs to repair and re-commission < $500	1	Sample pump, level probe, minor mitigating action required.
Total costs > $500 but < $5,000	2	Replacement part required, minor equipment hire required until item repaired.
Total costs > $5,000 but < $15,000	3	Major part required, long-term equipment hire required, ex - overpump or minor tankering of waste.
Total costs > $15,000 but < $35,000	4	Plant needs replaced, temporary solution required, long downtime.
Total costs > $35,000	5	Project or upgrade, contracted assistance, major equipment hire, long term temp removal of waste.

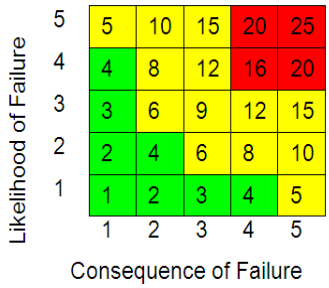
The equipment should then be scored for **Likelihood of Failure** using the following table. Where no history exists, future probability can be based on manufacturer's recommendations or historic information on similar items where this is known.

Element	Likelihood of Failure	Score
Historic Performance	No failures in last 12 months	1
	1 failure in last 12 months	2
	2 or 3 failures in last 12 months	3
	4 or 5 failures in last 12 months	4
	More than 5 failures in last 12 months	5
Future Probability (where no failure history is available or existing planned maintenance has significantly reduced failures)	No failures expected in next 12 months	1
	1 failure expected in next 12 months	2
	2 or 3 failures expected in next 12 months	3
	4 or 5 failures expected in next 12 months	4
	More than 5 failures expected in next 12 months	5

Asset Risk Score

The average **Consequence of Failure** is multiplied by the **Likelihood of Failure** value to give an overall risk of failure score to that plant item. Should any individual consequence of failure element be scored as 5 it is recommended that the overall consequence of failure value be considered as 5. This would give a risk score that reflects major concerns on an individual consequence element.

The risk scores are then tabulated utilising the matrix below the relevant maintenance regime can be applied.



There are 3 main levels of maintenance provision, based on the values of the risk scores.

High Risk

Scores above 15 would be recommended to have an RCM (Reliability Centred Maintenance) study carried out on them including a Failure Mode and Effects Analysis. However, due to levels of equipment redundancy at water treatment plants, it is not anticipated that risk scores will exceed 15, and most likely fall into either the medium or low risk categories below.

There does look to be opportunities for RCM type techniques in the form of Condition Monitoring equipment.

Equipment items which score borderline high risk would be considered to receive a level of maintenance in accordance with manufacturer's recommendations.

Medium Risk

Plant items that score between 5 and 15 will be given a basic level of maintenance that will allow them to operate at a reasonable level. This maintenance will usually include tasks that prevent damage occurring to the item, for example, lubrication changes, bearing monitoring, periodic functional checks.

Low Risk

Scores below 5 indicate that there is minimal impact caused by the item failing. There would only be reactive maintenance done on these items, i.e. they would be operated until they failed, and either

repaired or replaced. Only very basic maintenance such as minimal lubrication and ad-hoc functional checks would be considered for these items.

For some assets a 'low risk' score is more reflective of their usage than criticality (standby diesel generators are a prime example) and a 'safety net' should be used to ensure such assets are given an appropriate level of planned maintenance.

It should be noted that the maintenance provision outcomes are not absolute. Consideration must be given to particular conditions and experience which is known to affect maintenance needs.

The NPV calculation assumes an increase in productivity based on a revised PM programme once all asset have been optimised.

Asset Master Plans

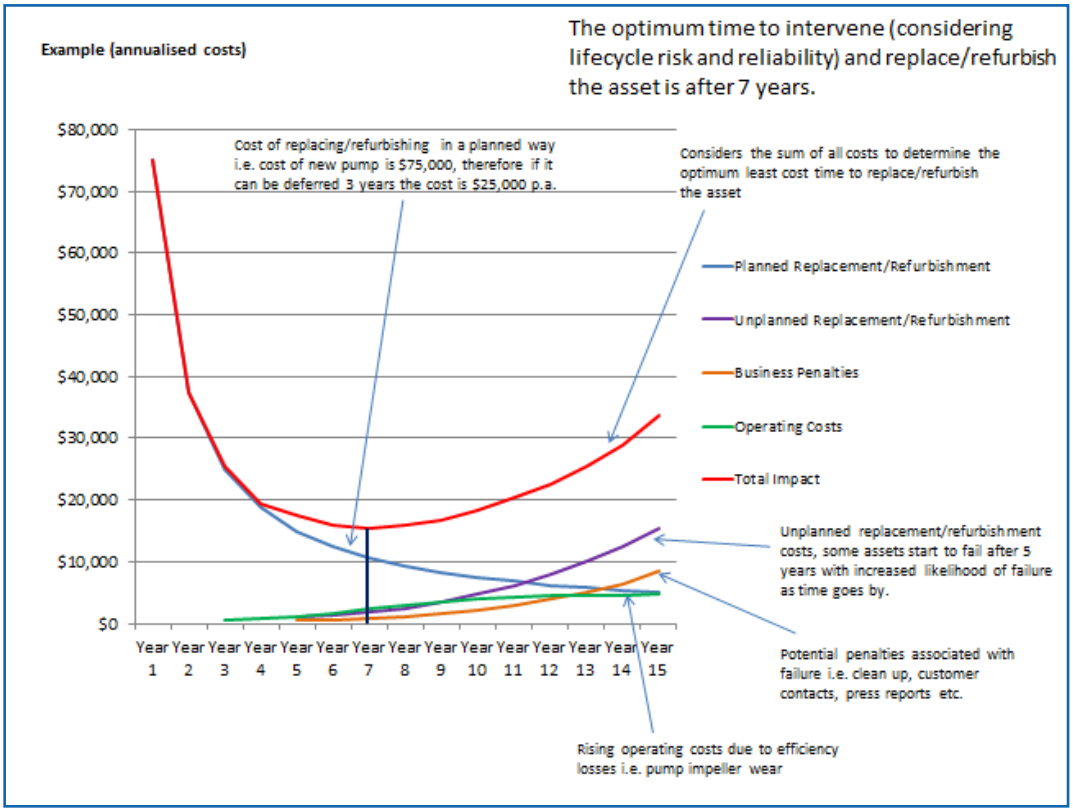
Asset Master Plans are a key building block towards Asset Lifecycle Planning and Asset Management excellence. Created using best industry knowledge and historical data, Asset Master Plans are effectively optimised lifecycle plans which give guidance on:

- ✓ monitoring
- ✓ inspection
- ✓ maintenance
- ✓ refurbishment
- ✓ replacement

AMP will promote a consistent approach to management of critical asset types – reducing operational risk, reducing potential service impact on customers, and considering total cost of decisions made.

The benefit of this opportunity is seen as having a longer term planning approach towards asset refurbishment and replacement. This includes budget forecasting for both Opex and Capital expenditure.

*An example of where asset planning considers the optimum time to carry out an intervention is as follows,



Considerable factors which influence the optimum point at which to carry out an asset intervention include:

i. Life expectancy. Example – some pumps may start to fail after 5 years but others comparable may remain trouble free well beyond this point. It is necessary to make an assessment of the expected lifespan, ie – failures start at year 5 and 95% would be expected to fail by year 15.
ii. Planned replacement or refurbishment costs.
iii. Unplanned replacement or refurbishment costs. This may be the same as doing in a planned way, but in some instances there may be additional costs associated with premiums paid to accelerate repairs, employee overtime, consequential damage etc.
iv. Penalties associated with failures, ie – dealing with customer contacts, adverse press interest etc.
v. Potential rising operating costs associated with efficiency losses.

In the example above, the optimum time to replace, (or refurbish) the asset is after 7 years. However it is recognised that potentially some assets may have failed before this point. Therefore it is essential that consequences of failure are fully understood and adequate costs allocated to ensure that the correct strategy is adopted.

An example of Asset Master Plan detail is shown below:

Asset Equipment	**Vertical Shaft Drive Pump (Centrifugal, Large)**
Size Band	>50kw
NEED to Intervene	**What triggers the need to intervene:** Condition & Performance monitoring: • Vibration monitoring of bearings • Temperature monitoring of bearings • Flow monitoring • Pump Efficiency (power consumption, longer running times etc).

SCOPE of Planned Intervention	**Refurbishment as per scope below**: Remove pump Strip pump Re-machine impeller Renew bearings Renew seals Renew wear plates Re-balance drive shaft Renew drive coupling Re-install pump **Typically not included in standard refurbishment scope**, (unless identified by regular inspection and downtime opportunity to refurbish exists) Non Return Valve Isolating Valves Drive Shaft Motor Pump Starter MCC Unlikely to replace pump – other than through obsolescence – as they should run for years and survive multiple refurbishments. Current practice is to replace pump if refurbishment cost is greater than 60% to 65% of the new cost.
COST of Interventions	**Planned intervention cost:** Refurbishment - $$, (possibly a range) Replacement - $$, (possibly a range or quotation)
Frequency of Planned Intervention	Plan for refurbishment after 7 years. Monitoring and operator observations may allow the intervention frequency to be refined (brought forward or pushed out) on a site specific basis to ensure efficient and evidence based investment decision making. Frequency may depend on operating environment and site conditions.

APPENDIX 7 – ASSESSMENT OF PORTFOLIO DEVELOPMENT

Implementation Planning Stage & Definition		Progress to date
Understand	The understanding of the need for change (ie to meet strategic objectives and what the current and future changes might look like	ZBR process has identified new change in the context of the broader need for change (efficiency and effectiveness). Water Services need to combine with any continual improvement initiatives (and business as usual) to develop full understanding. Water Services will also need to fully understand the costs of implementation to determine if there is a net benefit to the recommendations (efficiency gains vs. cost of implementation).
Categorise	Organise the changes into groups of similar organisational needs ie themes of work, strategic objectives, technology	The areas identified through the ZBR process have been themed around work types (job planning, performance measurement and risk based maintenance). Within these themes the opportunities have been placed in sub-themes with clear reference to the benefits of efficiency and effectiveness
Prioritise	Prioritising ranks the change within the portfolio based on defined measures. This type of prioritisation helps answer questions around: • Should we do it? • What are the most important changes? • What changes must be resourced above all others? • What changes have the most risk attached?	A high level prioritisation (based on benefit vs. complexity) has been undertaken to answer some of the questions of prioritisation and start the process around scheduling. A refinement of the prioritisation exercise has been the completion of a scheduling table with a view of high level dependencies.
Balance	Balancing a portfolio means judging all portfolio elements in order to find the ideal mix of changes. For example, the mix that has the greatest potential collectively to achieve the organisation's strategic objectives within the constraints of resources (people, money etc.)	Although the scheduling exercise does attempt to balance the portfolio of change, it does not take account of any existing or future planned initiatives or BAU activities or any resource constraints within Water Services or any other business unit within The City of Calgary eg Information Technology.
Plan	The plan focus on collecting all the information from the stages above along with other information regarding on going change eg continual improvement initiatives, to enable stakeholders to fully understand the full portfolio and make informed decisions about it	
HL Risk Planning	Define the high level risks that would have an impact on the delivery of the overall portfolio of benefits and set in place mitigating actions to pro-actively manage their potential impact	A very high level view of the risks associated with the delivery of the benefits identified through the ZBR process has been undertaken. This needs to be refined and further levels of granularity included to undertake effective risk management practices.