Assessment of Annual Operation and Maintenance Costs for the NSW (Hawkesbury Nepean and NSW Murray-Darling Basin) Metering Scheme

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Final

16 September 2009

Prepared for the
NSW Department of Water and Energy

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1. INTRODUCTION

The NSW Department of Water and Energy is managing the delivery of the NSW Metering Scheme, a major program to meter non urban water extraction sites in NSW. The program includes an initial project to meter 2,000 surface water extraction sites in the Hawkesbury Nepean Catchment as part of the recovery package for the Hawkesbury Nepean River[1]. A larger project is to follow, involving the installation of between 10,000 to 20,000 water meters on non-urban water extraction sites across the full extent of the NSW Murray-Darling Basin.

The metering scheme will receive funding from the Commonwealth Government. It is proposed that the Commonwealth will fund the initial capital cost of the scheme. Subsequently, the on-going annual cost of meter maintenance and meter operation will be met by the NSW Government and recovered from water licence holders through a service charge. The proposed service charge is to be called the Metering Service Charge or MSC.

The MSC will apply to holders of Water Management Act 2000 and Water Act 1912 approvals for water management works, to which government owned meters have been added. Where no government owned meters are in place then the service charge will not apply.

The MSC will be subject to regulatory pricing oversight by the NSW Independent Pricing and Regulatory Tribunal (IPART). The Department is currently preparing a submission to IPART for approval of the price levels to apply to the service charge over the next regulatory pricing period (2010 to 2014).

In establishing the price level for the MSC, the Department's preferred approach is to use actual costs from a competitively tendered procurement for the metering operation and maintenance services. This would require the program to be contracted out prior to setting of the price levels. As this is not

[1] New South Wales, Minister for Primary Industries (Ian Macdonald) and Minister for Water (Phil Costa), *$77 million boost to Hawkesbury Nepean welcomed*, Media Release 21 May 2009.

feasible at this stage the Department has elected to estimate the operation and maintenance costs of the metering scheme.

The objective of this report is to provide a preliminary estimate of the operating and maintenance costs of the metering scheme to support the Department's pricing application to IPART.

1.1 National Water Metering Standards

The NSW Metering Scheme is being undertaken in response to a commitment by NSW in conjunction with all other States and Territories to develop and implement national standards for non-urban water meters under the National Water Initiative (NWI)[2]. Non-urban water metering standards have been finalised and were publicly released in 2008. A draft National Framework for implementing the standards has been prepared and is currently subject to a regulatory impact assessment[3]. The National Framework proposes:

- Consistent adoption of the national metering standards across Australia.
- Implementation of a national quality assurance approach to meter installation, maintenance and validation.
- The requirement for all new non-urban water meters installed after 30 June 2009 to comply with the national metering standards.
- The upgrade or replacement of all existing meters that do not meet the requirements of the new national standards with new compliant meters by 1 July 2019.
- Regular auditing and reporting by jurisdictions on the implementation of the draft National Framework.

1.2 Approach

DWE has contracted Nayar Consulting to estimate the annual cost of operating and maintaining meters installed under the NSW metering scheme. The following methodology has been adopted for developing the cost estimate:

1. review of project documentation, as provided by DWE
2. briefing from DWE officers outlining the key policy positions and proposed arrangements for implementing the Metering Scheme
3. consultation with suppliers of non-urban water meter and telemetry systems, meter maintenance and reading service providers, and water businesses to determine industry metering operation and maintenance practices and estimate supply cost
4. review of the relevant literature and standards on meter operation practices, standards and costs
5. defining the scope of the operations and maintenance activity and each of the key tasks
6. preparation of a cost estimate for each operations and maintenance task

[2] Council of Australian Governments (2004). *Intergovernmental Agreement on a National Water Initiative,* Clause 88
[3] DEWHA (2008) *National Framework for Non-Urban Water Metering - Consultation Regulatory Impact Statement,* Department of Environment Water Heritage and the Arts, December 2008

7. test of the reasonableness of the cost estimates and cost model methodology through consultation with non urban water businesses O&M managers

8. preparation of a draft report

9. submission of the draft report to DWE for comment and feedback

10. preparation of a final report.

The approach taken to estimating the operating and maintenance cost of the scheme is consistent with the NSW Treasury guidelines for agency service cost estimation[4].

This report has been prepared by Mark Nayar, a water resource economist with extensive experience in planning and cost analysis of non-urban water metering and Dr Roger Vass an asset management engineer with 30 years experience in the water industry.

2. OPERATION AND MAINTENANCE COSTS FOR THE NSW METERING SCHEME

2.1 Capital Investment Activities

For both the Hawkesbury Nepean and broader NSW Murray-Darling Basin projects, it is proposed that the Commonwealth will fund that the initial capital costs of the metering scheme. The initial costs include:

- purchase of water meters and telemetry systems, and the installation and commissioning of the meter

- provision of a 3 year warranty on the meter and telemetry equipment

- purchase, installation and commissioning of an information system for managing meter readings and meter asset management data.

The scheme meters once installed will be owned, operated and maintained by DWE on behalf of the NSW Government. This represents a major departure on existing practices in NSW whereby water licence holders own the water meter(s) and are responsible for meter maintenance.

In regulated water resources (and some unregulated and groundwater areas) the metering scheme will involve replacing existing sub-standard customer owned meters with Government owned meters. In unregulated and groundwater systems, the metering scheme will typically involve installation of a government-owned meter at licensed water extraction sites that are currently unmetered.

New water license holders will have the cost of acquiring and installing a meter at their extraction site funded by the meter scheme up to the point where funds from the Commonwealth are exhausted. After that, new entrants will be required to fund the capital cost of their meter.

2.2 Operation and Maintenance Activities

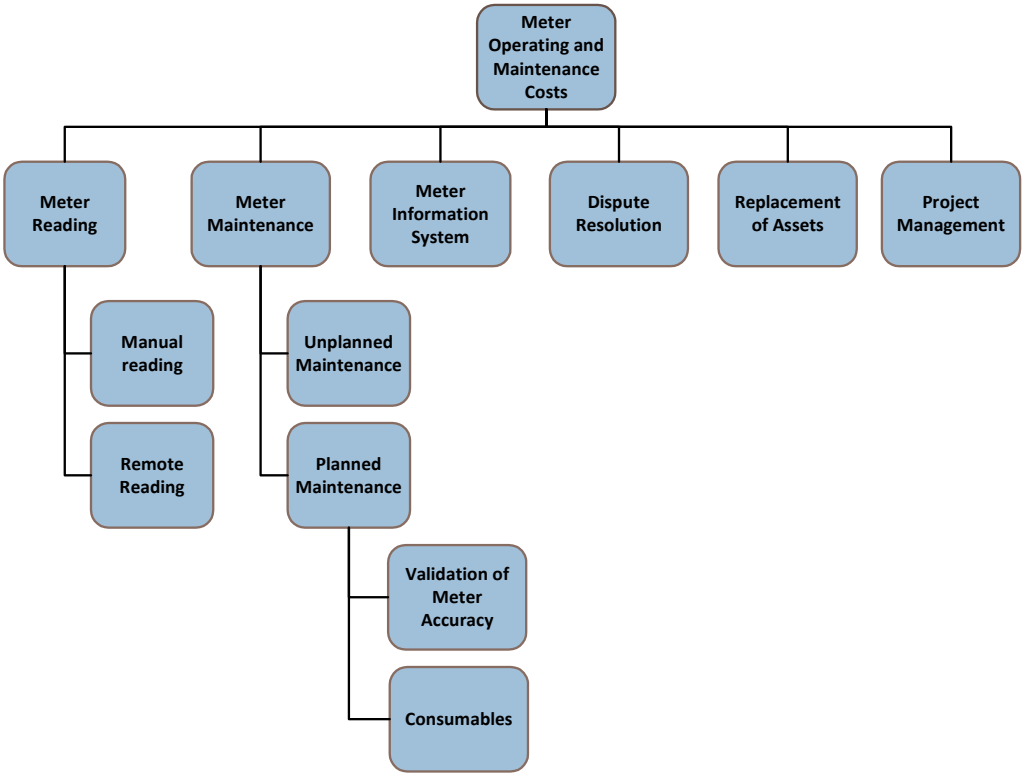
DWE will be required to operate and maintain the meter fleet and recover the costs of the service through the MSC. For this study the cost of operating and maintaining DWE's meter fleet has been assessed by:

[4] NSW Treasury (2007) *Service Costing in General Government Sector Agencies, Policy and Guideline Paper,* Reference TPP 07-3.

- breaking down the maintenance and operating function into individual tasks of a related nature
- identifying and defining the details of each task and agreeing (with DWE) on the task standard of service and performance objectives
- assessing the level of resourcing required for each task and the likely cost of the resources. The information on resourcing levels and costs has been sourced from water meter suppliers, meter reading service providers and water businesses.

The metering scheme operation and maintenance activities can be broken down into related categories as shown in the following diagram.

Figure 1. Non-urban Water Metering – Operating and Maintenance Cost Activities



From the diagram above the ongoing annual costs of the metering scheme comprise:

- meter reading including manual reading of meters at site and the remote logging of meter readings
- meter maintenance comprising planned and unplanned maintenance including scheduled preventative activity and unscheduled or reactive intervention
- periodic validation of meter accuracy in line with the requirements of the metering standard
- operation of the meter information system including collection and processing of meter readings and meter asset data

- dispute resolution activities

- asset replacement – DWE have determined that during the regulatory pricing period covered by this study (2010-2014), no costs for asset replacement of the installed meter fleet will be recovered from water entitlement holders. Replacement costs will be recovered in later pricing determinations as meters reach the end of their useful lives.

- project management costs incurred by DWE in managing, supervising and monitoring the project performance, project staff and project contractors.

These cost categories are examined in more detail in the following sections.

3. METER READING

DWE as the asset owner will be required to read the installed base of water meters at least once a year and possibly more frequently. The key drivers for water meter readings are:

- Compliance monitoring to ensure license holders comply with annual allocations. The frequency of reading for this purpose is a minimum of once per year. However, some water businesses prefer to read meters more frequently than once a year in order to ensure that users do not inadvertently exceed their water entitlement or allocation.

- Licence restrictions and conditions e.g. a water licence may contain conditions that restrict pumping to certain river heights. As river heights vary from day to day, monitoring for compliance requires frequent meter reading.

- Compliance monitoring to protect environmental flows in rivers from extraction or ensuring users adhere to flow rate restrictions. For compliance purposes, water meters in unregulated rivers may need to be read on multiple occasions per year including daily or more frequent readings.

- River operational reasons in regulated supply systems. Information on the volume of water taken by larger users is required on a real time basis as a key input to State Water river operations models.

- Billing for the water use in situations where the water user or licence holder pays a consumption linked water charge. Water license holders in NSW regulated rivers and some unregulated rivers are charged on the basis of usage. Bills for water use are sent to users at least once per year. In order to bill users for usage, meters must be read at least once a year by the 30th June, the end of the water year.

Meters can be either read manually at the meter site or if the meter is equipped with a telemetry system then the reading can be undertaken remotely.

The frequency of manual (at site) meter readings is a key cost driver for the meter service charge. The table (below) outlines current practices regarding meter reading frequency in comparative water businesses.

Table 1. Selected Non-urban Water Supply Businesses – Manual Meter Reading Frequency

Water Business	Locations of Meters	Meter Reading Practices	Source of Information
QLD DERM	QLD unregulated rivers and groundwater	Once per year minimum for all meters. Twice for large volume meters.	Pers. comm. DERM QLD, 2009
NSW State Water	NSW regulated river meters	Manually read on average 4 times per year. Some valleys read meters 12 times per year and in others the reading occurs only twice a year. The frequency of reading is driven by valley water account management issues	Pers. comm. State Water, 2009
Western Australia Department of Water	Gnaggara groundwater area	Monthly or quarterly reading water depending on user water use characteristics	DoW (2008) *Western Australia's Metering Implementation Plan Next crucial steps for water reform*
South Australia Department of Land Water and Biodiversity Conservation	Non-urban water meters	At least once per year but typically three times per year.	MJA (2008) *South Australian Implementation Plan NWI Non-urban Water Metering Standards*, report prepared for the SA Department of Water, Land and Biodiversity Conservation and DWLBC website.
Victoria, Goulburn Murray Water	Water meters in irrigation districts, and surface and groundwater systems	Four times per year for meters with high usage and twice a year for other meters.	GMW (2007) *Customer Service Charter* Document No 2207878 v3
NSW, Coleambally Irrigation Cooperative Ltd	Water meters in the Coleambally Irrigation Area	Manual read meter are read once a month or up to twice a month in low allocation years. Automated (remote read) meters are not manually read at all. However, the finance department of the Cooperative manually checks about 25% all remotely read meter reads by visiting the meter site once a year.	Pers. comm. Coleambally Irrigation Cooperative Ltd, 2009
NSW Department of Water and Energy	Existing water meters in unregulated areas and groundwater zones	Current policy is for quarterly readings. The reading can be by undertaken by a DWE contractor (State Water) or could be self reporting by the license holder.	Pers. Comm. DWE, 2009

For the NSW meter scheme, it is assumed that most of the manually read meter installations will be equipped with data loggers in line with advice from State Water and QLD DERM[5]. Loggers remove the scope for meter reading error and provide a data record that is useful for compliance checking and reporting. Meter data is stored in the data logger and can be downloaded manually (at least once per year) or remotely using mobile phone or satellite telemetry.

[5] pers comm. Greg Hillis, State Water , July 2009, Stuart Wade, Department of the Environment and Resource Management, July 2009.

For this cost analysis it is assumed that DWE (or its contractor) will be required to manually read each meter at least once a year. This will apply to both locally read and remotely read meters. The once a year read is the primary meter read for a locally read meter. It also provides for a once a year quality assurance check on remotely read meter data for a remotely read meter.

Self reporting of meter readings by licence holders is also an option where appropriate.

4. METER MAINTENANCE

Water meters require periodic on-going maintenance as a preventative measure against performance failure necessitating an unplanned response and as a guarantee for expected asset life. Meter maintenance requirements, performance standards and costs for the metering scheme will be driven by:

- Good asset management practice: DWE as the asset owner will be required to comply with good industry practice in relation to meter maintenance including ensuring meters are operating correctly, faults and equipment breakdowns are minimised to industry expectations and/or manufacturer's specifications and, faults or breakdowns are rectified in a timely manner.

- National Water Meter Standards: The standard sets out specific requirements in relation to meter maintenance. The key requirement of the standard is a water meter must operate in the field within an error limit of plus or minus 5%. The standard states that a meter must be[6]:

  - Maintained periodically in accordance with the Pattern Approval certificate and relevant Australian Standards or Technical Specification.

  - Periodically validated by a certified validator on an ongoing basis.

  - Able to provide an acceptable level of confidence without *in situ* verification that performance of the meter is within the maximum permissible limits of error (±5%) in field conditions.

  - Re-verified (either in a laboratory or *in situ* when and where practical and preferred) by a Verifying Authority or certified licensee under the *National Measurement Act 1960* (Cth) following maintenance affecting the metrological performance of the meter.

  - Audited on a regular basis by water service providers, government agencies or independent auditors in accordance with national and state implementation plans.

  The scope of the compliance requirements under the National Water Meter Standards are currently subject to a Regulatory Impact Statement review being conducted by the Commonwealth Government[7]. Accordingly, the precise requirements of the standards, including the types of water use metering (e.g. bulk water, irrigation, stock and domestic etc) to be subject to the standard, the timeframe for implementation of the standards and the on-going maintenance and verification obligations, are still to be determined.

[6] Water Metering Expert Group (2008) *National Framework for Non-urban Water Metering-Policy Paper*, December 2008, p 14

[7] DEWHA (2008) *National Framework for Non-Urban Water Metering - Consultation Regulatory Impact Statement*, Department of Environment Water Heritage and the Arts, December 2008.

For this costing analysis it is assumed that all meters installed under the NSW metering scheme, will be subject to the maintenance and validation requirements of the National Standards from the date of the meter's commissioning into service.

- DWE's implicit obligation to water licence holders to provide a fully operational water meter. A number of water access licence conditions imposed on water users require a functional and operating water meter including a requirement not to take water from a metered work if the meter isn't working properly[8]. Accordingly, it has been suggested that DWE must be able to respond to meter faults or breakdowns in a timely manner (48 hour response time) so that licence holders can comply with their licence conditions.

For this costing analysis the maintenance of meters has been categorised into three components:

- Planned maintenance: This includes preventative maintenance and parts replacement carried out according to a fixed plan and schedule. Typically for water meters this involves activities such as[9]:
  - Visual checks for integrity of the meter seals and of the pipework and fittings for structural integrity and internally for blockages
  - Inspection of electronics for condensation or insect ingress, integrity of electrical connections and electronic equipment
  - Testing of electronic components
  - Rectification of faults or anomalies in field if possible otherwise scheduling a dedicated maintenance visit
  - battery replacement.
- Unplanned maintenance: This task covers corrective maintenance typically in response to component failure, vandalism, accidental breakage, flood and storm damage etc. During the first three years of a meter's life the cost of component failures (but not damage caused external sources) will be met through a 3 year meter supplier provided parts and replacement warranty. An increase in the MSC commencing 3 years from installation may be required to reflect the cost of unplanned repairs of meter or telemetry faults which will apply post the 3 year warranty period.
- Re-validation: The National Water Meter Standard require that the accuracy of water meters be periodically re-validated[10]. The Standard states that the re-validation must be conducted by a certified meter maintainer and outlines the type of activities to be undertaken. The activities include visual inspection of the meter and ancillaries and internal checks of meter clearances. The standard provides for re-verification using a NATA accredited in situ volumetric testing facility where it is feasible.

[8] DWE (2008) *Water Management Act 2000 – New Compliance Powers – Questions and answers*, Department of Water and Energy, December, 2008

[9] See for example: GMW (2008) *G-MW's Metering Plan*, Goulburn Murray Water, Tatura, Doc No: #2458347

[10] Ibid Water Metering Expert Group (2008) p 16

5. METER INFORMATION SYSTEM

DWE will collect, process, store and analyse meter reading data. The data processing tasks to be undertaken include:

- entering manual meter reads into the data system
- downloading manually collected logger data into the data system
- quality assurance and checking of remotely logged data
- monitoring of meter data for meter failures and licence condition non-compliance
- reporting non-compliance events and meter faults
- validation of the data record against quality control curves
- rectification of data problems and errors
- recording quality assurance/reliability attributes against meter readings.

As the asset owner, DWE will need to maintain an asset management information system. Basic asset management information system tasks include:

- updating information on the type, purpose, size, location, access, value, condition and age of a meter and meter installation
- listing the details of alterations and additions to an asset
- scheduling maintenance activities and preparing work programs
- recording corrective and preventive maintenance undertaken
- recording budgets and associated procedures.

In addition, the National Standard requires that meter owners establish an information system to record details for each meter including[11]:

- pattern approval certificates
- initial verification certificates
- periodic validation certificates
- details of certified / trained personnel
- compliance with documentary requirements of national water meter standards.

The technical standard ATS4747 requires meter authorities to establish and maintain a meter database. It states that[12]:

[11] Op. Cit. Water Metering Expert Group (2008)

"The meter database shall provide accurate, sufficient and complete information such that the authority can adequately demonstrate its metering standards. In demonstrating this compliance analysis of the meter database shall provide the following information for meter replacement purposes:

i. *The period that a meter has been installed and operating together with a total volume of water registered;*

ii. *The metrological accuracy class of the meter (e.g. MNI M10-1 Clause 3), its type, its size, its model and a typical error (signature) curve ;*

iii. *The type of user and the associated typical consumption (usage) pattern for that type of consumer;*

iv. *Cost details such as purchase price of meter and the water tariff."*

It is proposed that DWE own and operate a computerised meter information system. The design, development and installation of the information system (and the initial populating of data) will funded by the Commonwealth. The system will be housed at a DWE office and operated by DWE staff. The system will receive data from meter reading and maintenance contractors as well as remotely logged meter reading and performance data. The ongoing costs of operating and maintaining the meter information system will be recovered through the MSC.

6. DISPUTE RESOLUTION

As the metering scheme meters are to be owned and operated by the Department, meter users have the right to dispute the Department's meter readings and the accuracy of the Department supplied meter.

A common problem with manually read water meters is meter reading error. The NSW Meter Scheme will deploy mostly data logger equipped water meters thus eliminating the scope for manual meter readings errors and avoiding the need to return to the site and take another meter reading.

Meter accuracy disputes whereby water licence holders dispute the accuracy of their meters can be expected with the metering program. Water supply businesses generally have well defined policies and practices for dealing with meter disputes. DWE propose to adopt the standard industry approach of requiring users to lodge a claim and pay a refundable deposit equivalent to the meter testing cost.

In response to the lodgement of a dispute claim, a DWE officer would first carry out a field accuracy assessment of the meter. If the field accuracy assessment does not resolve the issue, the meter will then be tested. The meter test can be done in-situ or the meter removed from the site and tested at a NATA certified laboratory such as Manly Hydraulics. The cost of a meter test varies depending on factors such as remoteness of site, ease of access and the extent of the testing required. Typical costs for a once off in-situ volumetric test of a 20ML/day irrigation meter at a remote location is $5,000 per test[13].

If the tested meter accuracy, at a flow rate approximating field conditions, is within the agreed standard the deposit will be forfeited and the readings will stand. If the laboratory test indicates that the meter is not within the agreed standard the deposit will be refunded, the meter repaired or replaced at the cost of DWE and the previous readings will be adjusted.

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[12] ATS 4747: Part 8 - *Code of Practice For the In-service Metrological Assurance of Non-Urban Water Meters in Full Flowing Pipes (Closed Conduit In-service Compliance)* , Clause 5.1, Draft January 2008.

[13] pers comm. Brett Kelly, AWMA, General Manager, AWMA July 2009

DWE will only install pattern approved meters (or meters which comply with interim NSW standards if pattern approved meters of the necessary type or size are not available) . All meters will be maintained in accordance with the National Water Meter Standard. The use of pattern approved meters and compliance with the national standards is designed to minimise the incidence of accuracy disputes.

DWE's decision to deploy highly reliable and accurate electromagnetic meters will also reduce the likelihood of accuracy disputes.

Given the high quality of the meters and the maintenance regime in place, it is assumed that the net cost of resolution of meter disputes will be small. It has been estimated by DWE that the work could involve an extra 1 effective full-time officer, but will be spread at various locations throughout NSW, plus an allowance of an additional 50% for cost and equipment.

DWE is responsible for monitoring and enforcing compliance with the WMA2000 and other relevant water legislation and employs compliance officers to enforce the legislation. Activities undertaken by such compliance officers are not a component of the MSC.

7. REPLACEMENT OF ASSETS

This cost line item is for the replacement of meters components as they wear out or reach the end of their planned useful lives. Generally speaking it is water industry policy that supply assets should not be run until they fail. Rather, equipment replacement should be undertaken to minimise unexpected breakdowns and failures of equipment before they actually occur.

Typical expected lives for the components of a non urban water meter are shown in the table below.

Table 2. Expected life of water meter components

Meter component	Expected Life (yr)
Batteries	3
Modem/data logger	10
Signal converter / Solar panel	15
Mechanical meter stem and propeller	10
Mechanical meter body and assembly	20
Electromagnetic meter transducer	25
Valve / Penstock	30
PVC / ABS pipe	30 - 60
Concrete emplacement, Pits & pipes	60

Source: GMW (2008) *G-MW's Metering Plan*, Goulburn Murray Water, Tatura, Doc No: #2458347 and pers. comm. Darren Humphries, Manager Water Flow & Quality, Tyco Environmental Systems, July 2009

The scope of this cost review is limited to the first four years of the NSW Metering Scheme corresponding to the IPART regulatory pricing period. Over this period the only planned component replacement in a water meter would be the battery. This would apply to electromagnetic meters and mechanical meters equipped with a datalogger.

DWE has determined that the cost of replacing the longer lived components of the meter will be recovered in the later years of the program. It is expected that the MSC will increase over time to

reflect replacement of equipment and meters as they reach the end of their life cycle. This cost, however, will be addressed in the later pricing determinations.

8. COST MODEL

This section describes the cost model that has been prepared to support the development of cost estimates for the MSC.

8.1 Meter Types

Five generic types of meter/telemetry combinations have been identified for costing purposes:

1. Mechanical Meter - without data logger
2. Mechanical Meter - with data logger
3. Electromagnetic meter – with basic data logger (State Water Area of Operations)
4. Electromagnetic meter – with programmable data logger and mobile phone modem
5. Electromagnetic meter – with programmable data logger and satellite modem

The characteristics of the five representative meter types and potential application are discussed below.

a. Mechanical meter – without Datalogger

This metering arrangement comprises a mechanical meter equipped with a totaliser (accumulator). It is a relatively low cost meter suitable for metering extractions where there is little or no weed or abrasive substances in the water e.g. groundwater extractions in high water quality aquifers[14].

b. Mechanical meter – with Basic Datalogger

This metering arrangement comprises a mechanical meter equipped with a totaliser (accumulator) producing a pulse output and a battery operated data logger collecting hourly or daily pulse data.

It is assumed that most, but not all, metering scheme mechanical meter sites will be equipped with a basic datalogger. The datalogger enables DWE to monitor the annual pattern of usage which is potentially important for compliance and operational purposes.

c. Electromagnetic meter – with Datalogger

This is an electromagnetic meter (or equivalent) equipped with a combined totaliser/datalogger. It would be a replacement meter for a non compliant meter in the State Water area of operations. The meter would be to be manually read and maintained as per existing State Water practices and policies. The data logger used is built into the totaliser.

A reduced MSC will apply to these meters sites as meter reading and dispute resolution would be undertaken by SWC staff with the costs built into existing bulk water charges.

d. Electromagnetic meter – with Programmable Datalogger and Mobile Phone Modem

[14] pers comm. Steve Vasiliadis, Sales Manager Water Metering, Elster Metering Pty Ltd, July 2009

This is an electromagnetic meter (or equivalent) equipped with a totaliser, separate programmable datalogger and a mobile phone modem. It is a higher cost metering option providing remote interrogation of the meter and the ability to analyse and respond to the data record and any system failures. This type of meter would be installed in larger volume extraction sites in areas with mobile phone coverage.

e. Electromagnetic meter - with Programmable Datalogger and Satellite Modem

This meter is an electromagnetic meter equipped with a separate programmable data logger and satellite modem.[15] It would be used in areas outside of mobile phone coverage.

The above metering configurations assume that each of the remotely logged sites will be equipped with a telemetry modem. It may, however, be more cost effective to share a single modem between multiple meters. The modem would be located at a local base station and each metering site would be equipped with a short range radio communicating to the base station modem. This configuration has the potential to reduce the cost of telemetry data plans by sharing a single plan amongst multiple meters. However, offsetting this cost savings is potentially higher costs associated with maintaining the local radio network.

A small number of extraction sites may require open channel measurement devices. However, open channel sites have not been explicitly considered in the analysis.

8.2 Application

DWE has advised that the standard technical configuration for metering scheme meters will be meter type no 4, an electromagnetic meters equipped with a programmable data logger and mobile phone network modem. Beyond a pipe size of 600 mm electromagnetic meters become very expensive and other potentially more cost effective technologies will be considered such as Doppler meters or ultrasonic time of flight meters.

Mechanical meters (type 1 or 2) will be deployed to low volume extraction sites or in special circumstances.

[15] for example: http://www.iridium.com/products/product.php?linx=0002&cat=Embedded Products

8.3 Meter Reading Costs

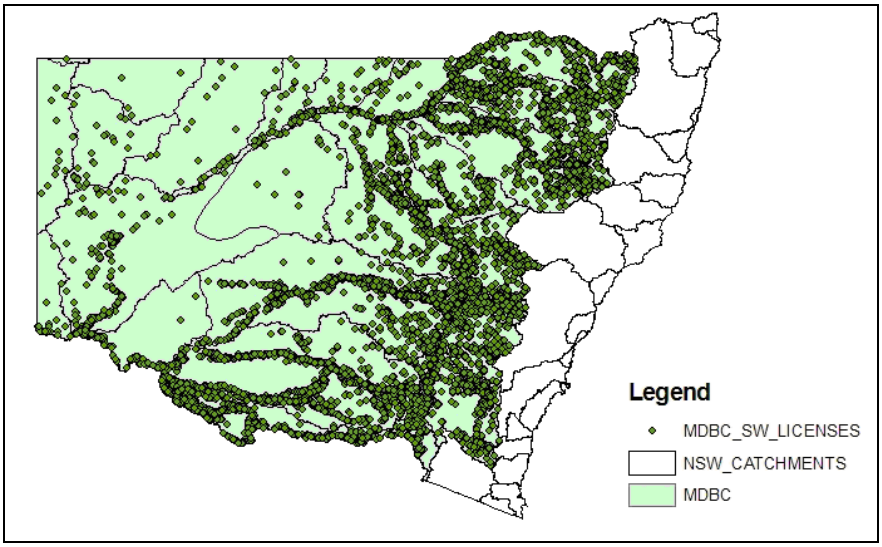
All meters are assumed to be read manually at least once per year. The once per year read is the primary meter read for locally read meters and provides a quality assurance (QA) check on remotely read data for billing and compliance purposes.

The task of meter reading is fairly straightforward and requires only a short time at the site by one person. Typically, a meter reader would undertake a meter run visiting multiple adjacent meter sites in a day. For example, State Water customer service officers (CSOs) in the Murrumbidgee catchment undertake a meter reading run several times a year. The catchment contains some 1,200 water meters and State Water employs 3.5 CSOs who each read between 5 to 20 meters per day[16].

The cost of meter reading will vary depending on the distance to be travelled to (or between) meter sites. The sites to be metered under the NSW meter scheme are located over the full extent of the Murray-Darling Basin (and Hawkesbury Nepean) in NSW (see maps below). The actual distance to be travelled by a meter reader is usually greater than the linear distance between meters as there are typically no access tracks along river banks and access to a meter site is through the license holder's property. Thus, even though two adjacent meter sites might be physically close together on a river they can only be accessed by travelling a much longer distance through each of the relevant properties. Access through a property will involve travelling along rudimentary farm tracks and negotiating farm and paddock gates.

For the purpose of this costing analysis we have assumed, in consultation with DWE, that across all meters in the NSW metering scheme the average travel distance between meter sites is 10 km.

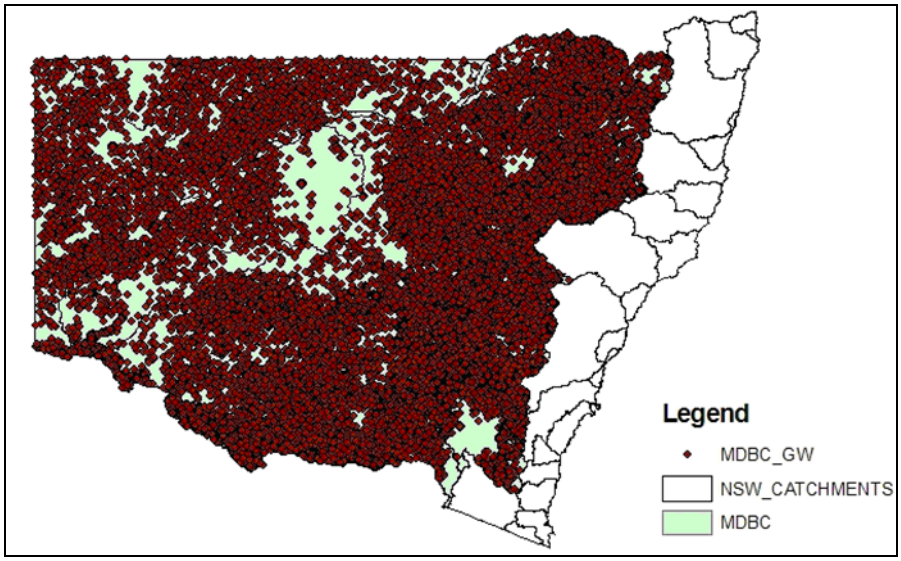
Figure 2. Location of Surface Water Licences in the NSW MDB



Source: DWE

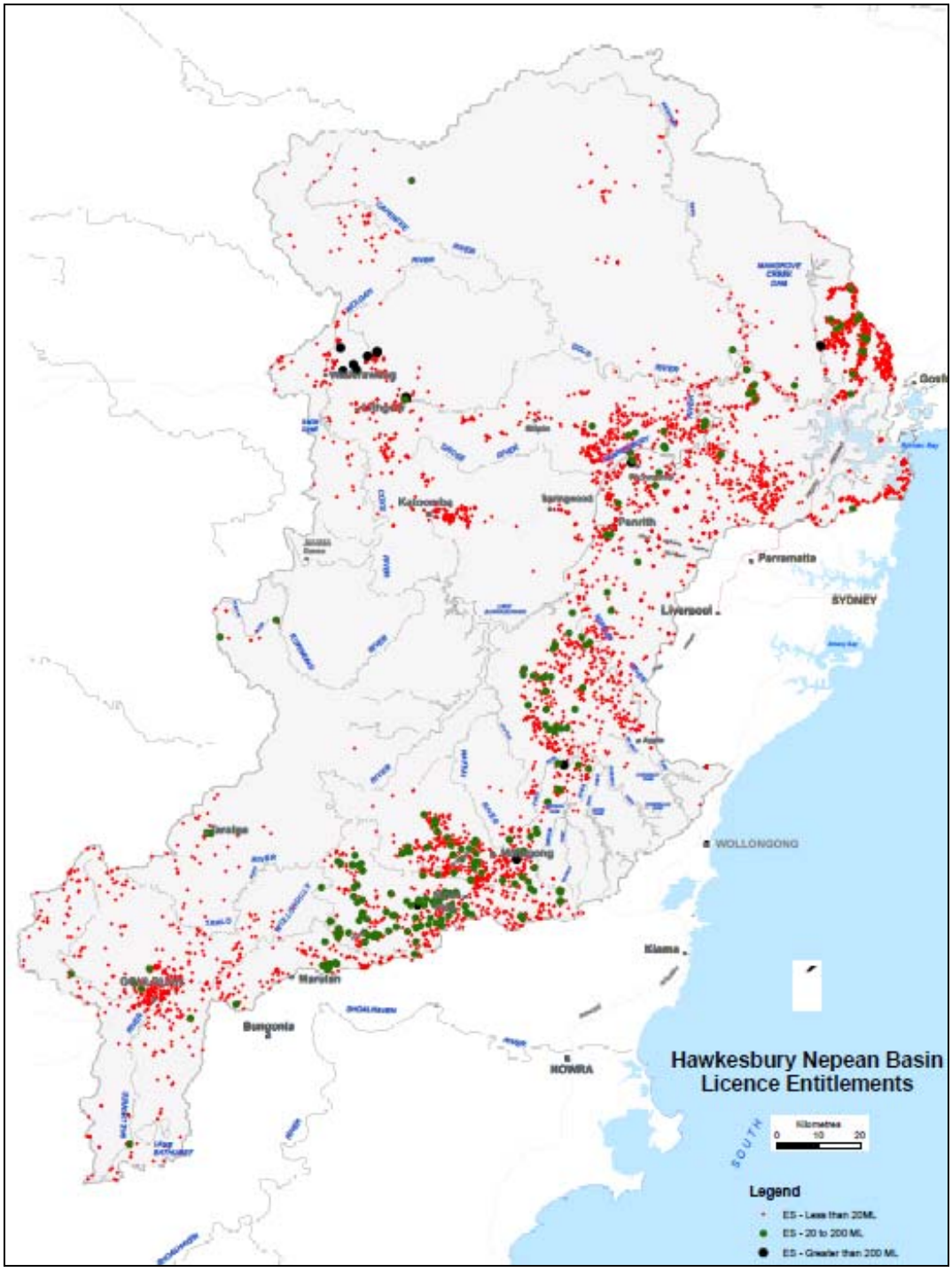
[16] pers comm. John Skinner, Project Director , Water for Rivers, July 2009 and Greg Hillis, State Water, August 2009.

Figure 3. Location of Groundwater Licences in the NSW MDB



Source: DWE

Figure 4. Location of Surface Water Licences in the Hawkesbury Nepean Catchment



Source: DWE

It is the Department's intention to contract out the meter reading activity. To determine a typical contractor cost for meter reading, Nayar Consulting consulted with AMRS Pty Ltd, a major provider of meter reading services to utility industries in Australia. Based on a broad outline of the scope of the NSW metering Scheme, AMRS provided, based on their experience in reading non-urban water meters for the SA Department of Land Water and Biodiversity Conservation, indicative cost estimates for meter reading of[17]:

- Between $30 to $400 per meter read or a set fee of $60 per meter read (includes uploading of data into the DWE meter information system), plus

- $1.50 per km travelled.

These costs provided by AMRS are consistent with information provided by other industry informants[18] and have been adopted in this study for the purpose of calculating the MSC. The cost of a manual meter reading, averaged across all meter scheme sites in NSW is therefore:

- 10 km per meter x $1.50 per km + $60 per meter = $75 per meter per annum.

The cost is the same irrespective of the type or model of meter.

Telemetry Data Plans

The cost of fees and charges for access to public wireless networks and the cost of sending data are a significant component of the cost structure for meters equipped with telemetry modems.

According to industry sources consulted and a review of the literature, the most cost effective options in the telemetry sector as at July 2009 for mobile phone and satellite data plans are:

- Telstra Next G network. This network provides coverage across rural NSW particularly near roads and regional towns. In some areas Vodafone and other GSM networks offer viable alternatives.[19]

- Iridium satellite short burst data service. This satellite data platform is widely used in Australia for remote monitoring including water metering in areas outside of the range of mobile phone networks.[20]

[17] pers comm. Shannen Rumney, Operations Manager SA & QLD, AMRS Pty Ltd, July 2009

[18] pers comm. Paul Hudson, Irrigation Agronomist, CropSol Soil & Irrigation Management, July 2009; Michael Bate, CEO, Batescrew Pumps, July 2009.

[19] pers com Darren Humphries. Manager Water Flow & Quality , Tyco Environmental Systems, July 2009; John Skinner, Project Director, Water for Rivers, July 2009 ; Greg Hillis, State Water, August 2009; Stuart Wade, Principal Engineer, Water Use, QLD Department of Environment and Resource Management, July 2009; John Hayes, Water Data Systems Manager, NSW Department of Water and Energy, Parramatta.

[20] see for example Aaron Hawdon, Rex Keen and Jamie Vleeshouwer (2008) *A Remote Automated Water Quality Stream Gauging System Design*, CSIRO Land and Water Science Report 24/09 and pers comm. Brian Heaven, Business Development Manager, Pivotel Group Ltd; Mark Wolf , Principal Consultant, Greenspan Technical Services, July 2009; Steve Vasiliadis, Sales Manager Water Metering, Elster Metering Pty Ltd, July 2009

Mobile Phone Network

The Telstra Next G lowest cost data plan is $5 per month[21] yielding a total cost of $60 per meter per annum. This provides 5 MB per month which is sufficient to provide for a daily log of the meter reading and basic meter status.

Satellite Network

Casual data plans for the Iridium Short Burst Data service are priced at $30 per month[22]. This type of data plans provides for 12 by 30 second data calls per month. The modem is programmed to dial out (no incoming call costs are incurred by the data centre).

Industry sources indicate that cheaper and better specified satellite data plans will be entering the market in the near future including services from the Thuraya[23] and Globalstar systems[24].

The cost estimates adopted in this report for meter data telemetry plans for mobile phone and satellite networks are therefore:

- Mobile phone networks: 12 months x $5 monthly data plan = $60 per meter per annum
- Satellite networks: 12 months x $30 monthly data plan = $360 per meter per annum.

For meters installed in the State Water area of operations it is assumed that the cost of manual meter reading is already recovered through existing water charges.

[21] http://www.telstrabusiness.com/business/portal/online/site/productsservices/pricing.60007
[22] see for example http://endeavourconnectnetworks.businesscatalyst.com/SatellitePhones/CallPlans/IridiumCallPlans and
http://www.iridiumphones.com.au/Call%20Plan%20Brochure%20-%20Post-paid.pdf
both accessed August 6 2009
[23] see for example http://www.asta.net.au/Uploads/Images/sac-thuraya-australia-0709.pdf accessed August 6 2009
[24] see for example http://www.pivotel.com.au/gstar_data_rates.html accessed August 6 2009

8.4 Planned Maintenance

Planned maintenance encompasses the routine cleaning of meter parts such as solar cells and visual displays, checking and inspecting the integrity of the meter and its ancillaries, consumable replacement and the periodic validation of the meter accuracy.

It is proposed that during the annual meter reading the meter reader inspect the meter for any obvious problems and undertake the basic cleaning of parts and replacement of consumables such as batteries if required. The more intensive planned maintenance activities, including the periodic validation of meter accuracy would be conducted during a dedicated planned maintenance visit to the site.

Validation and Planned Maintenance

DWE has indicated that the accuracy of each meter should be validated once every two years. On this basis it has been assumed that the planned maintenance visits would occur with the same frequency.

For mechanical meters the planned maintenance visit would involve the following activities:

- visual check of meter seals and of the meter for tampering
- inspect meter totaliser for condensation or insect ingress
- visual check of meter pipework for structural integrity
- validation of the meter accuracy by disassembling the meter and assessing the tolerance of components
- inspect logger connections and integrity of unit (if a logger is installed).

For electromagnetic meters equipped with telemetry systems the planned maintenance visit would comprise:

- visual check of meter seals and of the meter for tampering
- inspect meter totaliser for condensation or insect ingress
- visual check of meter pipework for structural integrity
- inspect meter totaliser for condensation or insect ingress
- download the meter electronic parameters onto a PC for checking against factory settings
- inspect meter internally for blockages using an inspection pit on the pipeline and a video camera.

The final two tasks provide for the validation of the meter accuracy at relatively low cost. This approach is in line with practices adopted by the Queensland Government non-urban metering program[25]. However, it is noted that the proposed arrangement for validation does not provide traceability of measurement accuracy to the National Standards. Full traceability of measurement accuracy would require more complex and expensive forms of re-verification such as:

[25] pers. comm. Stuart Wade, Principal Engineer, Water Use, QLD Department of Environment and Resource Management, July 2009.

- electronic testing using NATA certified instruments – estimated cost of $750 per meter[26]

- in-situ volumetric testing using a NATA certified mobile test rig – estimated cost of $5,000 per meter[27]

- removal of the meter from site and testing in a NATA certified testing laboratory – estimated cost of between $1,000 to $4,000 per meter excluding the cost of removing and transporting the meter.[28]

The proposed validation procedure, involving the checking of the meter electronic fingerprint against the factory settings and a visual inspection of the meter bore (using a camera), does not provide NATA traceability but is a cost effective means of achieving a basic validation of the meter accuracy.

If faults are discovered in the meter during the planned maintenance visit, the maintenance contractor would if possible rectify the problems in the field. Otherwise the fault would be reported for further action (by scheduling an unplanned maintenance visit or notifying the suppliers of a warranty claim).

The cost of the planned maintenance visit including validation has been estimated on the basis of the following assumptions:

- the cost of a trained certified technician is $90/hr (from a quote provided by meter service provider AMRS Pty Ltd and confirmed by reference to meter technician hourly costs information sourced from Batescrew Pty Ltd and Goulburn-Murray Water)

- one technician is required

- the time required at site and for travel between sites and the preparation and lodging of the required reporting paperwork is adopted as 2 hour for mechanical meters and 4 hours for electromagnetic meters

- the travel distance between meters is 10 km per meter

- each meter is assumed to be validated once every two years.

The annual cost of a once every two year planned maintenance and meter validation is then calculated as:

- Mechanical meters: (2 hr x 1 person x $90/hr + 10 kms x $1.50/km) x 0.5 = $97.5 per meter per annum.

- Electromagnetic meters: (4 hr x 1 person x $90/hr + 10 kms x $1.50/km) x 0.5 = $187.50 per meter per annum.

The validation costs are not insignificant. After reviewing these costs, DWE has recommended, as a more economical means of achieving accuracy limit compliance, that consideration be given to using a sampling approach to validation rather than testing each meter individually.

Validation by sampling

[26] pers comm. Greg Latch, Sales Manager Instrumentation & Control, ABB Australia Pty Ltd, July 2009, based on a contract involving 1,000 tests per year

[27] pers comm. Brett Kelly, General Manager, AWMA, July 2009. Based on 1 test conducted per day.

[28] pers comm. Michael Bate, CEO, Batescrew Pumps, July 2009.

To ensure the on-going accuracy of the meter population, validation based on sampling from the fleet of meters rather than testing every meter individually is widely practiced in the urban water industry.[29] This testing is generally in accordance with the procedures specified in the Australian Standard for in-service meter testing (AS 3565.4-2007[30]). Under this approach:

- the meter fleet is grouped into uniform populations
- a random sample of each meter population is tested (in-situ testing or at a testing laboratory) every year
- a weighted meter accuracy is calculated to determine the population performance
- populations of water meters are replaced when they no longer maintain the required accuracy limits as determined by the sample testing.

To estimate the cost of this approach for the NSW metering scheme the following assumptions are used:

- the meter fleet is grouped into two populations mechanical meters and electromagnetic meters
- the breakdown of the installed meter base is 2,000 mechanical meters and 8,000 electromagnetic meters
- the annual sample size is taken from recommendations in AS 3565.4-2007 and is 80 for mechanical meters and 125 for electromagnetic meters (based on the population size)
- the cost of meter testing including removal, provision of a temporary alternate meter transportation and reinstallation is $5,000 per meter for electromagnetic meters and $1,500 per meter for mechanical meters[31].

The unit cost of meter validation based on sampling can then be calculated as:

- Mechanical meters: (80 sample meters tested x $1,500 per meter test)/2,000 meter population = $60 per meter per annum
- Electromagnetic meters: (120 sample meters tested x $5,000 per meter test)/8,000 meter population = $78 per meter per annum

Consumables

Mechanical meters equipped with loggers and electromagnetic meters will require a new battery every 3 years[32]. The cost of batteries varies widely depending on size and type. Typically the size of the battery required will vary according to the power consumption of the meter and its ancillaries. Most non-urban meters use cheaper lead acid gel batteries which are charged using a solar cell[33]. Some

[29] MJA (2007) *NWI Metering Implementation Plan – Regulatory Arrangements*, Report prepared by Marsden Jacob Associates for the NWI Metering Expert Working Group, 20 June.

[30] AS 3565.4-2007 *Meters for water supply – In-service compliance testing*

[31] pers comm. Michael Bate, CEO, Batescrew Pumps, July 2009. Note the average electromagnetic meters within the NSW metering scheme fleet will be considerably larger and therefore more difficult and expensive to remove, transport and test than the average mechanical meter.

[32] Battery life and cost will vary, however batteries should be changed before they fail. Suppliers and water businesses consulted have suggested that the battery should be changed once every 3 year.

[33] For example a Rubicon Flumegate or a Tyco Irriflow electromagnetic meter.

purely battery powered meters use more expensive lithium batteries. For this analysis we have assumed that:

- Mechanical meters equipped with a datalogger will require a $30 battery every 3 years
- Electromagnetic meters will require a $60 battery every 3 years.

The cost of replacing batteries can then be calculated as:

- Mechanical meters equipped with a datalogger: $30 per battery x 1/3 = $10 per meter per annum
- Electromagnetic meters: $60 per battery x 1/3 = $20 per meter per annum.

8.5 Unplanned Maintenance

Unplanned maintenance is required in response to component failure, vandalism, accidental breakage, flood and storm damage etc. Typically unplanned maintenance would be triggered by:

- an equipment failure or exception alarms generated by the meter information system
- the licence holder reporting a meter fault to DWE
- the meter reader or planned maintenance contractor detecting a problem with the meter.

DWE would alert the relevant maintenance contractor of the problem. The contractor would then schedule a maintenance visit to the relevant meter site and a maintenance crew would travel to the site and undertake the repair or part replacement.

DWE must ensure that non-operational or faulty meters are repaired in a timely fashion. The need for DWE to respond rapidly to meter faults is driven by the fact that NSW water licence conditions forbid a water user from taking water from a metered extraction point when the meter is not operational[34].

For the first three years of a meter life the cost of repairing a component failure attributed to faulty manufacture or materials used will be meet through a 3 year meter supplier provided parts and replacement warranty. During the warranty period the MSC will only need to recover the cost of repairing failures and damage due to external causes.

For the cost analysis, the cost of unplanned maintenance has been assessed using the following assumptions:

- the assumed equipment failure rate due to external causes e.g. lightning strike, animal or insect intrusion, flooding, storms, vandalism etc is 1.5% per annum for mechanical meters and 3% for electromagnetic meters over the 4 years of the pricing period (based on industry advice[35]). The higher failure rate for electromagnetic meters is due to the fact that this type of meter consists of many connected but separate components. A typical non-urban electromagnetic meter will have at least 3 separate components a meter sensor, a meter totaliser and the power supply with a battery and solar panel mounted above ground next to the meter. The addition of a data logger and a wireless or satellite modem adds further potential failure modes. A mechanical meter is much less complex, consisting of only two parts a meter impeller and a mechanical totaliser, housed together in one steel body.

- the annual cost of unplanned maintenance is a proportion of the prime cost of the meter asset. In most instances only part of the meter (or a component of the meter) will be replaced. For this analysis it is assumed that the unplanned maintenance cost is equivalent 25% of the prime cost of the meter transducer and electronic equipment. The 25% figure is derived from industry advice.

- for a mechanical meter, the prime cost is based on a 80mm Elster R2000 meter plus a basic data logger. Based on a report prepared for DWE by engineering consultants, the prime cost of a R2000 meter cost is $945 per unit[36]. The cost of a basic data logger is $500 per unit[37].

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[34] DWE (2008) *Water Management Act 2000 – New Compliance Powers – Questions and Answers*, Department of Water and Energy, December, 2008

[35] Pers comm. Bill Heslop, Project Manager Measurement, Goulburn Murray Water, July 2009 and Mark Wolf, Principal Consultant, Greenspan Technical Services, July 2009

[36] Parsons Brinckerhoff (2009), *Flowmeter manufacturers in Australia and meter information*, Report prepared for DWE.

[37] per comm. Glen Klinberg, Business Development Manager, Tyco Environmental Systems , July 2009

- for an electromagnetic meter, the prime cost is based on 300mm Tyco IR2060 plus a programmable data logger and modem if applicable. The prime cost of the meter asset is:

    - IR2060 meter (and basic datalogger): $6,200 per unit[38]
    - Mobile phone modem and antenna: $1,000 per unit or a satellite network modem and antenna: $3,000 per unit[39]
    - programmable data logger is $1,000 per unit[40].

- the cost of the maintenance visit is based on a 50 km return travel distance from the contractor's maintenance base to the meter site. This assumes maintenance contractors are based in regional centres.

- the repair requires 2 hours of labour time at site using one accredited technician

- the cost of a meter repair technician is $90/hr [41]

- the travel cost is $1.50/km[42]

- the cost of project managing and scheduling the maintenance visit is included in the technician costs.

The total cost of an unplanned meter maintenance arising from break down of equipment due to external events such as lightning strikes, animal or insect intrusion, flooding, storms, vandalism, etc is therefore estimated as:

- Mechanical meter without a datalogger: cost of unplanned maintenance = 1.5% annual failure rate x prime cost ($945) x prime cost factor (0.25) + repair labour cost (4 hrs x $90/hr)+ repair travel cost (50 km x $1.50/km) = $10 per meter per annum.

- Mechanical meter with a basic datalogger: cost of unplanned maintenance = 1.5% annual failure rate x prime cost ($945+$500) x prime cost factor (0.25) + repair labour cost (4 hrs x $90/hr)+ repair travel cost (50 km x $1.50/km) = $12 per meter per annum.

- Electromagnetic meter with a basic datalogger (State Water Area of Operations): cost of unplanned maintenance = 3.0% annual failure rate x prime cost ($6,200) x prime cost factor (0.25) + repair labour cost (4 hrs x $90/hr)+ repair travel cost (50 km x $1.50/km) = $60 per meter per annum.

- Electromagnetic with a programmable data logger and a mobile phone network modem: cost of unplanned maintenance = 3.0% annual failure rate x prime cost ($6,200+$1,000+$1,000) x prime cost factor (0.25) + repair labour cost (4 hrs x $90/hr)+ repair travel cost (50 km x $1.50/km) = $75 per meter per annum.

- Electromagnetic with a programmable data logger and a satellite network modem: cost of unplanned maintenance = 3.0% annual failure rate x prime cost ($6,200+$1,000+$3,000) x prime cost factor (0.25) + repair labour cost (4 hrs x $90/hr)+ repair travel cost (50 km x $1.50/km) = $90 per meter per annum.

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[38] Parsons Brinckerhoff (2009), op cit
[39] pers comm Brian Heaven, Business Development Manager, Pivotel Group Ltd, July 2009
[40] Mark Wolf op cit
[41] per comm. Shannen Rumney, AMRS Pty Ltd, op cit
[42] Ibid

The same level of costs identified above are assumed to apply over the 4 years of the applicable pricing determination including the final year which is not covered by a supplier equipment warranty.

8.6 Meter Information System

A meter information software system is required for the processing, storage and assessment of the meter reading, asset and maintenance data collected from the Department's meter fleet. The data system will integrate with the Departmental and State Water billing and licensing systems, and allow water users to view and retrieve their meter usage data over the internet.

The metering information system and associated hardware is to be acquired, installed and commissioned using funds from the Commonwealth. It will then be operated and maintained by DWE staff.

While the general concept of the meter information system is well understood, a detailed definition of the system is not yet available. As a result a specification could not be provided to suppliers against which to provide indicative quotes. Accordingly, DWE has provided an indicative cost estimates for this cost component.

DWE advise that 4 EFT persons will be required to operate and maintain the meter information system principally for data processing, coding, cleaning, correction and reporting, and responding to meter failure alarms and faults. DWE also advise that the cost of an EFT is at least $114,000, but could be up to $163,000 if overheads and indirect costs are included. DWE recommend that the cost analysis use a value of $114,000 per EFT person but recognising that specifically that this amount does not include staff overheads and indirect costs.

Based on DWE advice, a provision of $100,000 or $10 per meter is provided for on-going information system software licensing costs.

Agency indirect operating costs for the meter information system such as rent, telephone, electricity, travel, training, corporate support have been excluded.

Accordingly, the estimated cost of operating and maintaining the meter information system is:

- labour costs: 4 EFTs x $114,000 per annum = $456,000/ 10,000 meters = $46 per meter per annum plus
- annual software licensing costs: $100,000/ 10,000 meters = $10 per meter per annum
- meter information system cost = $46 (labour) + $10 (software licence) = $56 per meter per annum.

This cost estimate has been provided by DWE. We note that industry sources suggest that the annual cost of processing and quality control of meter information could be considerably greater than the estimate provided above. For example, industry sources have indicated that the cost may range from $250 to $500 per meter site[43]. However, unlike the estimate provided here of $56 per meter, these estimates include a component for recovery of the capital cost of the meter information system.

8.7 Dispute Resolution

[43] pers comm. David Aughton, CEO, Rubicon Systems Australia Pty Ltd, and per comm. Mark Wolf, Principal Consultant, Greenspan Technical Services, July 2009

As discussed in Section 6 above, the use of high quality, pattern approved meters, coupled with national standard compliant maintenance practices is expected to minimise the likelihood of meter accuracy disputes. It has been estimated by DWE that the task of managing metering disputes arising from the Metering Scheme could involve an extra 1 effective full-time officer, but will be spread at various locations throughout NSW, plus an allowance of an additional 50% for cost and equipment. It is assumed that the net cost of resolution of meter disputes will be:

- labour costs: 1 EFTs x $114,000 per annum = $114,000/ 10,000 meters = $11.14 per meter per annum plus
- equipment: $114,000*0.5/ 10,000 meters = $5.70 per meter per annum
- dispute resolution costs = $17.14 per meter per annum.

8.8 Project Management

DWE is likely to incur project management costs arising from the procurement and management of meter reading and meter maintenance contractors. DWE has advised that the costs of procuring and managing contractors over the four years of the relevant pricing period will be recovered through funding provided by Commonwealth. Accordingly, it is assumed that project management costs will initially be zero.

However, it is acknowledged that project management costs will rise in the next pricing period once Commonwealth funding stops.

8.9 Contingencies

A base estimate of the cost of operating and maintaining the metering scheme has been provided in this report. This base estimate is the sum of the calculated quantities multiplied by the estimated market rates.

A contingency allowance is usually added to a base cost estimate for a project to provide for forecasting uncertainties and unforseen price or scope changes. An estimator would typically provide a contingency amount for each individual line item which would then be rolled up to provide a project contingency amount[44].

A formal contingency analysis has not been provided for in the scope of this study. Accordingly, a single across-the-board percentage contingency amount of 20% has been adopted for this study - providing for a reasonably high degree of uncertainty associated with the cost forecasts provided in this study.

It is noted that a contingency provision of 30% was used in the funding application (and agreement) for the metering component of the Hawkesbury-Nepean project[45].

9. CONCLUSIONS

Table 3 below summarises the estimated cost for each cost activity and type of meter based on the assumption outlined in this report.

Table 3. Estimated Operating and Maintenance Costs for the NSW Metering Scheme by Meter Type and Extraction Site Status

[44] New South Wales Government (2006) *Capital Project Estimating Guidelines*, NSW Government Procurement Guidelines
[45] per comm. DWE, August 2009

Type of Meter	Extraction Site Status	Annual Operating and Maintenance Costs ($ per meter per year)									Project management	Contingency for inherent risk	Estimated total cost ($/meter/year)
		Meter Reading		Meter Maintenance			Meter Information System	Dispute Resolution	Replacement of Assets	Sub-Total Direct Cost			
				Planned Maintenance		Unplanned Maintenance							
		Manual	Remote	Validation	Consum-ables								
1a. Mechanical meter	Greenfield metering site	75	0	60	0	10	56	17	0	**218**	0	20%	**262**
1b. Mechanical meter - with data logger	Greenfield metering site	75	0	60	10	12	56	17	0	**230**	0	20%	**276**
1c. Electromagnetic meter – with data logger	Greenfield metering site	75	0	78	10	60	56	17	0	**296**	0	20%	**355**
1d. Electromagnetic meter – with data logger and mobile data modem	Greenfield metering site	75	60	78	20	75	56	17	0	**381**	0	20%	**457**
1e. Electromagnetic meter – with data logger and satellite data modem	Greenfield metering site	75	360	78	20	90	56	17	0	**696**	0	20%	**835**
2a. Mechanical meter	Existing metering site	0	0	60	0	10	56	17	0	**143**	0	20%	**172**
2b. Mechanical meter - with data logger	Existing metering site	0	0	60	10	12	56	17	0	**155**	0	20%	**186**
2c. Electromagnetic meter – with data logger	Existing metering site	0	0	78	10	60	56	17	0	**221**	0	20%	**265**
2d. Electromagnetic meter – with data logger and mobile data modem	Existing metering site	0	60	78	20	75	56	17	0	**306**	0	20%	**367**
2e. Electromagnetic meter – with data logger and satellite data modem	Existing metering site	0	360	78	20	90	56	17	0	**621**	0	20%	**745**

Note: For meters installed at existing metered sites it is assumed that the costs of manual meter reading is already recovered through existing water charge levied by either State Water or DWE.

The installed meter fleet will include a variety of meter sizes or diameters depending on the application. For example, the size of an electromagnetic meter could vary between 150 mm and 600 mm. However, it is noted that the unplanned maintenance cost is the only modelled cost factor that varies with the meter size and this impact of size on this cost is relatively minor. Accordingly, the operating and maintenance costs estimates are approximately the same irrespective of the size of the meter.

Where there are multiple meters at one site, a single meter read visit to the site could read all the meters at the site. In addition, telemetry costs (mobile or satellite data plans) could be shared across multiple meters at the one site. Accordingly, the unit operating and maintenance cost at sites with multiple meters will be lower than the single meter costs reported in the table above.

REFERENCES

Name	Position	Organisation	Area of Expertise	Telephone	Email
John Skinner	Project Director - NSW	Water for Rivers, NSW	Water for River is undertaking a trial of non-urban water metering in the Murrumbidgee River catchment	02 6058 6006	john@waterforrivers.org.au
Shannen Rumney	Operations Manager SA & QLD	AMRS Ltd, QLD	AMRS are Australia's largest provider of meter reading and maintenance service. AMRS read non urban meter for the SA Department of Land, Water and Biodiversty Conservation and SA Water Corp as well as many electricity distribution businesses..	0412 465 100	shannen.rumney@amrs.com.au
Mark Wolf	Principal Consultant	Greenspan Technical Services, NSW	Greenspan install and service remote monitoring systems and telemetry for urban and non-urban water business in Australia and internationally.	02 66519830	markwolfgts@gmail.com
Glen Klinberg	Business Development Manager	Tyco Environmental Systems, QLD	Tyco Environmental System are the largest non urban water meter supplier in Australia and are currently undertaking a pilot telemetry based metering project for DWE in the Bega catchment	07 3260 2171	gklinberg@typac.com.au
Darren Humphries	Manager Water Flow & Quality	Tyco Environmental Systems, QLD	As above	07 3260 2170	dhumphris@typac.com.au
Greg Latch	Sales Manager Instrumentation & Control	ABB Australia Pty Limited, Vic	ABB are a water meter supplier and provide meters to most non urban water business in Australia ABB also provide services for meter calibration.	0408 352 166	greg.latch@au.abb.com
David Aughton	CEO	Rubicon Systems Australia Pty Ltd, Vic	Rubicon are a supplier of non urban water meters, and, related data and telemetry system. Rubicon's systems are widely used in irrigation districts including in NSW the Coleambally Irrigation Area and the, Murrumbidgee Irrigation	03 9832 3000	David.Aughton@rubicon.com.au

Name	Position	Organisation	Area of Expertise	Telephone	Email
			Area		
Michael Bate	CEO	Batescrew Pumps Pty Ltd, NSW	Batescrew install and service non urban water meters. Batescrew is developing a non-urban water meter test facility with funding from the Commonwealth Government	03 58742101	michael@batescrew.com
Yash Modi	Sales Executive - Industrial Automation & Control	Siemens Ltd, Vic	Siemens are a water meter supplier and supply meters to the QLD non urban metering program	03 9721 2818	yash.modi@siemens.com
Steve Vasiliadis	Sales Manager Water Metering	Elster Metering Pty Ltd, Vic	Elster are a major non urban water meter supplier.	03 9355-2000	steve.vasiliadis@au.elster.com
Brian Heaven	Business Development Manager	Pivotel Group Pty Limited, QLD	Pivotel provide satellite equipment and data plans for all the major satellite systems available in Australia	07 5630 3000	brian.heaven@pivotel.com.au
Brett Kelly	General Manager	AWMA, Vic	AWMA build non urban water meter installations and telemetry systems. AWMA also provide in situ meter testing and meter testing laboratory services.	03 5456 3331	brett.kelly@awma.au.com
Paul Hudson	Irrigation Agronomist	CropSol Irrigation & Soil Management, NSW	CropSol supply, install, and maintain remote monitoring equipment for the irrigation industry.	02 6962 9407	paulhudson@cropsol.com.au
Greg Hillis		State Water, NSW	Non urban water business	02 65424409	
Stuart Wade	Principal Engineer, Water Use	Department of Environment and Resource Management, QLD	Non urban water business	07 3896 3555	stuart.wade@derm.qld.gov.au
Bill Heslop	Project Manager Measurement	Goulburn Murray Water, Vic	Non urban water business	03 545 10150	billhe@g-mwater.com.au
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John Hayes	Water Data Systems Manager	Department of Water and Energy, NSW	Water resource management	02 9895 7922	

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