AUSTRALIA'S URBAN WATER SECTOR

Inquiry by the Productivity Commission

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ENGINEERS
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1. Introduction

Engineers Australia is the peak body for engineering practitioners in Australia, representing all disciplines and branches of engineering. Membership is now approximately 89,000 Australia wide and Engineers Australia is the largest and most diverse professional engineering association in Australia. All Engineers Australia members are bound by a common commitment to promote engineering and to facilitate its practice for the common good.

Engineers Australia has had a strong commitment to sustainable development principles for over 20 years. Sustainable development is an integral component of Engineers Australia's code of ethics which are agreed by all members. The views expressed in this submission reflect this commitment.

The past 15 years have seen significant changes in the provision of urban water services, in part the result of the water reform agenda that commenced in 1994, and in part in response to the circumstances flowing from rapid population growth and a decade of drought. Although there were inter-governmental agreements on water reform in 1994 and 2004, the objectives of those agreements have not been achieved. Engineers Australia believes that the objectives dealing with urban water reform were clear enough and that it is disingenious that progress was limited by lack of specificity.

By now urban water prices should be set in line with commercial principles. This has not been generally achieved and water remains under priced leading to higher consumption, the viability of other supply and demand management options has been undermined and the revenue flows required for investment to ensure that all water infrastructure is fit for present and future purposes has been less than it should be. There is excessive reliance on fixed charges compromising water pricing as a policy instrument. A more serious problem is that water prices are set in partial analyses that do not take account of the interconnectivity between potable water, waste water and stormwater costs and benefits.

Engineers Australia strongly supports integrated water cycle management (IWCM) as a complement to centrally provided water services. Engineers Australia has articulated its views on IWCM in a guide called Australian Runoff Quality, a copy of which has been provided to the Productivity Commission. IWCM is consistent with sustainable development principles and recognises that all water streams should be optimised to supply the demand for water on a fit for purpose basis.

IWCM has been included in inter-governmental water reform agreements, most recently in the agreed COAG principles for urban water planning. There are examples of IWCM in many large urban centres but in the main are projected as "icon", "demonstration" or "experimental" projects instead of serious complements to traditional water supplies. Engineers Australia believes that until two key problems are addressed the status quo will continue.

Water supply and demand options should be managed on an economically efficient systems basis. Although cost-benefit studies are now generally used, the ennumeration of costs and benefits has been restricted by attitudes and practises conditioned by the traditional one pass approach to water management. IWCM requires that the costs and benefits of potable water, waste water and stormwater options are considered simultaneously and not independently. When this is done, it can be shown that innovative IWCM techniques have the capacity to contribute asufficiently to water supplies so that investment in headwater supply infrastructure can be deferred for decades, defer investment in aging waste water treatment infrastructure by offsetting declining efficiency by taking some of the load and improve the security of water supplies while reducing energy use. In addition, IWCM techniques move the management of water supplies towards an on-going sustainable basis. Engineers Australia believes these benefits cannot be ignored because cost benefit studies are arbitrarily limited.

The second problem that must be overcome is the institutional structure of urban water planning. There are many weaknesses in current arrangements because urban water planning is largely undertaken by existing water utilities resulting in the perpetuation of status quo practises and methodologies and serious conflict of interest. Engineers Australia believes that urban water planning and the procurement of water solutions should be undertaken by an independent agency in each jurisdiction and that water planning and the delivery of water operations should be separated.

Engineers are required to design, build and maintain water and waste water solutions. When external contractors are used for this purpose, engineers are required to compile requirement specifications and to ensure that technical goods and services are delivered efficiently and economically in line with specifications. The engineering labour force employed in the water industry is very small and has an age structure that makes it much older than the engineering profession overall and there is a serious risk of losses through normal retirement. The numbers in middle age groups are comparatively small and replacement through progress in existing employment will be insufficient.

The majority of water industry engineers are employed by State and Territory Government agencies, but this number is spread across 8 jurisdictions. There are no engineers employed by the water industry in the Commonwealth sector and this severely compromises the Commonwealth's role. There are less than 200 engineers employed in the local government water industry. When spread across the number of local government agencies with water responsibilities this is dangerously thin. There are relatively few engineers employed by the private sector water industry. Although, this number can be supplemented by securing contractual services from consultancy businesses, the demand for these services is very high across all industries, notably in the commodities export sector and related infrastructure industries. Engineers Australia believes that an engineering skills assessment and development program is essential.

2. Progress on Water Reform

The COAG water reform program is under-pinned by the National Water Initiative (NWI) and commentary on the progress of water reform in Australia is usually linked to NWI objectives. It is important to remember that the NWI was initiated by the Commonwealth Government to renew momentum on the inter-governmental agreement on water resource policy in February 1994. Many of the issues covered in the 1994 policy are substantively the same as the issues covered by the NWI. The NWI was needed because progress against the 1994 objectives was slow, uneven and, often bureaucratic rather than practical on the ground results. This outcome occurred despite the availability of Commonwealth payments to States and Territories under national competition policy arrangements.

Against this background, the National Water Commission's (NWC) second biennial report on the implementation of the NWI makes for disappointing reading. The recurring theme is that jurisdictions have introduced some of the necessary legislation; for water planning, to address the connectivity between ground and surface water and to define water entitlements, for example; but in most cases have exhibited a reluctance to proceed with practical implementation and, where a start has been made, have devised arbitrary restrictions that impede realisation of the intended outcome. Engineers Australia believes that the NWI outcomes do not instil confidence in the conduct of current cooperative arrangements between the Commonwealth and State and Territory Governments and new options with greater likelihood of success should be considered.

Numerous reviews of water reform in Australia have been undertaken in recent years and the most recent one by Price Waterhouse Coopers[1] for Infrastructure Australia lists 9 reviews that have been published since 2007. The common theme is progress towards addressing agreed NWI objectives has been patchy and uneven and the need for reforms in the urban water sector is becoming increasingly urgent.

Engineers Australia broadly endorses the views of the NWC in its 2009 biennial report on the NWI and the views and directions recommended by Price Waterhouse Coopers in its review of urnan water security for Infrastructure Australia. Urban water reform has been too slow, uneven, too reliant on water restrictions and unwilling to move away from historical models of water provision that require modification. Engineers Australia has particular views on water pricing and on the framework in which water planning and provision should be conducted. Rather than reiterate comments and critiques of all aspects of urban water reform, this Submission will focus on these headings.

The principles for pricing urban water supplies have been agreed by jurisdictions. But despite this implementation of commercial pricing of water products and associated independent pricing regulators is still some way off. Engineers Australia believes that failure to properly price water has major implications for urban water infrastructure, has encouraged higher water use and impedes alternatives to centralised water supply, including competitive suppliers. Further comments on this follow below.

Although much of the debate about water reform is about achieving economic efficiency in water use, this has been conducted within the historical one pass paradigm for water management with the result that benefit cost analyses do not fully ennumerate all benefits and costs. Engineers Australia believes that the boundaries for analyses of water efficiency must be integrated water cycle management (IWCM) so that all options for supplying and using water are considered. Although there are frequent references to IWCM in reports from urban water utilities, alternative options are still analysed from the perspective of the prevailing water management paradigm with the unsurprising result that most decisions favour the status quo.

3. Urban Water Pricing

The elements of the NWI dealing with urban water were limited, but the overarching outcome agreed was comprehensive and sufficient to warrant much greater progress than has been

[1] Price Waterhouse Coopers, Review of Urban Water Security Strategies, for Infrastructure Australia, May 2010, www.ia.gov.au , p11

achieved. Engineers Australia supports the adoption by COAG of the enhanced national urban water reform framework in November 2008 and incorporating the urban water planning principles agreed in October 2008. Engineers Australia recognises that there are important climatic and hydrological differences between major urban centres and that specific water supply solutions will need to reflect these differences. However, this does not apply to the principles for managing water supplies and for water reform.

A key aspect of the NWI (and the 1994 agreement before that) was that urban water prices should be set in line with conventional commercial practise. Recent reviews indicate that this has not yet occurred despite agreement by jurisdictions to principles for water prices. There are several matters of concern arising from this slow progress. First, there has been under-investment in water infrastructure resulting from financing constraints. As a result there has been accumulating pressures on water supplies leading to water restrictions and "emergency" decisions on new "insurance" water supplies involving expenditures far more costly than otherwise may have occurred.

During 2010 Engineers Australia has been updating its Infrastructure Report Cards last published in 2005. Table 1 shows the Engineers Australia infrastructure ratings for potable water, waste water and stormwater for the 6 jurisdictions where results had been released at the time this Submission was prepared. Although improvements occurred in several jurisdictions (denoted in green in the Table), in other cases the ratings deteriorated since 2005 (denoted in pink) or did not change (no colour).

The highest ratings for individual infrastructure categories were 'B' for potable water in SA and waste water in WA. These ratings mean that minor changes are required for the infrastructure to be fit for its current and anticipated future use. The lowest ratings for individual infrastructure categories were 'C-' for storm water in Victoria and in Tasmania. When the three water infrastructure categories are considered together, all jurisdictions face major changes to bring some aspect of their water infrastructure to the standard fit for current and anticipated future uses. NSW, Victoria, SA and WA have invested considerable resources in water desalination plants, but this has not led to improvements in water infrastructure in all cases and the status of waste water and stormwater infrastructure has improved only marginally with significant improvements remaining outstanding.

TABLE 1
ENGINEERS AUSTRALIA ASSESSMENT OF WATER INFRASTRUCTURE 2010

JURISDICTION	WATER	WASTE WATER	STORM WATER
NSW	B-	C+	C
VICTORIA	C	B-	C-
SA	B	B-	C
WA	B-	B	C
TASMANIA	B-	C	C-
ACT	B-	C+	C+

Source: www.engineersaustralia.org.au

There is no doubt that the availability of sufficient financial resources is part of the problem. The intention of commercial water pricing is to ensure that all water infrastructure assets are used efficiently and that sufficient revenue is recovered to meet all required maintenance costs and to provide for asset renewal. Commercial water pricing also provides for asset owners to receive commercial returns on their assets. Instead asset owners have insisted on dividends from revenues derived from uncommercial prices while the costs of water restrictions have been borne by water users.

Second, the effectiveness of water prices is compromised by the high degree of reliance on fixed charges. The fixed component of prices is intended to bridge the gap between long run marginal cost, but as Price Waterhouse Coopers note the fixed component of water prices ranges from 13% in Canberra to over 50% in Perth. However, the issue is more serious than these figures suggest because the current institutional arrangements resulting in water prices do not take into account the inter-connection between potable water, waste water and stormwater services. Further comments on this point are included in section 3 below.

Third, Price Waterhouse Coopers[2] also notes within current water pricing arrangements that there are a range of other unresolved issues, political interference, lack of consistency in pricing approaches, different water price structures, failure to include water resource costs, failure to include water resource management costs, failure to include externality costs and inconsistency in the relationships between the prices of water of different quality.

3. Integrated Water Cycle Management

Integrated water cycle management (IWCM) is a holistic multi-dimensional approach to urban water management where all water resources are used optimally based on the fit for use concept[3]. Water quality and water quantity for all streams of water, including potable water, waste water and storm water, are managed together to meet economic, social and environmental objectives in accordance with sustainable development principles.

IWCM was initially called water sensitive urban design (WSUD). State and local government regulators and the storm water industry have seen WSUD as primarily dealing with storm water matters instead of a holistic concept. This is the only reason for a distinction being drawn and to avoid confusion IWCM will be used from here on[4].

In a 2008 discussion paper, the Productivity Commission[5] reproduced a diagram showing the direct costs of water supply and demand options. Costs were expressed as a range of dollars per kilolitre of water for the various options included. The approach illustrated frequently appears in reviews of options for reducing urban water demand or augmenting water supplies, including in a

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[2] Op cit, pp 26-28

[3] Ashok Sharma, Stephen Gray, Clare Diaper, Peter Liston and Carol Howe, assessing Integrated Water Management Options for urban Developments- Canberra Case Study, Urban Water Journal, 5:2, 147-159, 2008, http://dx.doi/10.1080/15730620701736829

[4] Peter Coombes, Generic Guidelines for an Eco-efficient Approach to the Development of Water Infrastructure, December 2009, prepared for The Water Security Section, Environment and Development Division, UNESCAP, pcoombes@bonacciwater.com

[5] Productivity Commission, Towards Urban Water Reform, A Discussion Paper, 2008, p90, www.pc.gov.au

position statement from the NWC on the cost effectiveness of rainwater tanks[6]. The methodology used to support the approach is benefit cost analysis in which the unit cost of rainwater tank water is compared to centrally provided mains water. As the Commission's discussion paper notes comparing unit costs for individual projects "may not capture fully the benefits from combining a portfolio of supply (and Demand) options."[7] This is because the logic of a one pass water management paradigm has been applied to an IWCM situation that requires a systems solution.

Section 2 pointed out the high reliance on fixed charges in water prices. Under IWCM, setting water prices involves simultaneous consideration of the costs arising from potable water, waste water and stormwater systems. Simply accepting potable water prices and sewerage prices as presently set shows that the proportion of a combined bill that is fixed and not dependent on usage is considerably higher than for potable water alone. Table 2 shows the combined bill for most capital cities in 2001 and 2009 for water usage of 200 kilolitres. The proportion of fixed charges shown in this Table are much higher than reported by Price Waterhouse Coopers for potable water alone. In these circumstances the role of price elasticity is substantially undermined.

TABLE 2
FIXED WATER AND SEWERAGE CHARGES AND THE BILL FOR 200KL USAGE IN CAPITAL CITIES

CAPITAL	30 June 2001			3O June 2009		
CITY	Fixed Cost	200 kl Bill	% Fixed	Fixed Cost	200 kl Bill	% Fixed
Canberra	442.60	518.60	85.3	528.82	898.82	58.8
Sydney	381.35	566.35	67.3	556.01	878.01	63.3
Brisbane	373.04	533.04	70.0	546.36	850.36	64.3
Melbourne City West	156.68	395.88	39.6	261.11	638.66	40.9
South East	148.10	400.10	37.0	249.63	639.70	39.0
Yarra Valley	165.10	415.31	39.8	260.08	655.00	39.7
Adelaide	344.00	565.46	60.8	448.40	787.25	57.0
Perth	350.00	622.00	56.2	456.40	847.44	53.9
Darwin	395.06	560.25	70.5	470.91	620.75	75.9

Source: WSAA and NWC

The issue here is not simply about the consequences of combing potable water and sewerage bills but about the true cost to consumers of the combined potable water, sewerage and stormwater services provided to them. Stormwater charges are often levied separately and usually do not reflect possible reuse of stormwater for non-potable purposes. Reduced costs of operating water treatment plants and pumping stations when demand is reduced are not fully reflected in charges to consumers. Some charges are hidden in property prices, for example, developer charges for stormwater management and augmentation of water and sewerage infrastructure. What is required is a systems approach to the economic analyses of pricing and options so that all costs, and offsetting cost savings where appropriate are fully accounted. Present approaches estimate a partial marginal cost for water and fail to fully incorporate many relevant costs.

[6] NWC, Cost Effectiveness of Rainwater Tanks in Urban Australia, Position Statement, 18 March 2007, www.nwc.gov.au
[7] Op cit, p89

Typically IWCM techniques are descibed as micro solutions and treated as expressions of consumer frustration at the current modus operandi of one-size-fits-all by urban water utilities. However, for example, aggregation of small rainwater tank storages at individual property level across an urban area or urban region can be significant and can have significant impacts on potable water and storm water management. There is now a significant body of research that has demonstrated the improvements that can be made to urban water management by recognising the volume of urban storm water exceeds urban potable water and waste water in most major Australian cities[8]. The aggregate of storm water and waste water is considerably higher than the demand for water and these facts underscore an often expressed view that there is "no physical reason for Australia's current (urban) water crisis".[9]

Some examples of the results found in this research literature include:

- A combination of a wide range of water supply and demand options have the potential to defer the requirement to augment the Sydney water supply headworks between 23 and 43 years depending on the particular options implemented.[10]

- Part of the eWater CRC research program has examined the benefits associated with taking the strain off aged water and waste water infrastructure using IWCM techniques. Instead of the inflexible traditional approach to aged infrastructure of replacing like with like, IWCM techniques are used to take some of the load off infrastructure improving their management efficiency and deferring their replacement.[11]

- When rainwater tank storage is aggregated beyond household scale to estate and regional level, research has shown that the average annual mains water savings was considerable for most regions of NSW. As well as benefits to households there was considerable improvement in the security of regional water supplies, reduced operating energy use from reduced pumping from water sources and water treatment, savings on asset replacement and desalination.[12]

Engineers Australia strongly supports the application of IWCM techniques to urban water management. IWCM does not mean an end to centrally provided water and wastewater services. Instead it means supplementing centrally provided services with a range of other options, tailored to the circumstances of the location, to take advantage of all available water resources in a long term sustainable framework.

Engineers Australia has documented IWCM in "Australian Runoff Quality" published in 2006. Australian Runoff Quality provides an overview of current best practise in the management of urban stormwater within the context of IWCM and the integration of management practises into the urban built form. The publication was prepared by Engineers Australia's National Committee on

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[8] P J Coombes and M E Barry, The Relative Efficiency of Water Supply Catchments and Rainwater Tanks in Cities Subject to Variable climate and the Potential for Climate Change, Australian Journal of Water Resources, Vol 12 No 2, pp 1-16

[9] Coombes, Generic Guidelines, op cit, p7

[10] P J Coombes, Integrated Water Cycle Management: Analysis of Resource Security, Water, March 2005, pp21-26

[11] A Barton, P Coombes and A Sharma, Impacts of Innovative WSUD Intervention Strategies on Infrastructure Deterioration and Evolving Urban Form, 5th International WSUD Conference, 21-23 August 2007, Sydney.

[12] P J Coombes, Energy and economic impacts of rainwater tanks on the operation of regional water systems, Australian Journal of Water Resources, Vol 11 No 2, 2007, pp 177-190

Water Engineering and was peer reviewed by a panel of eminent scientists and practitioners prior to release. The publication includes a wide range of case studies of IWCM applications from around Australia and demonstrates the degree of commitment of Engineers Australia to the approach and demonstrates that IWCM techniques involve existing and demonstrated technologies available for immediate application in Australia. A copy of Australian Runoff Quality has been sent to the Commission as a supplement to this Submission.

4. Urban Water Planning

The NWC expressed considerable frustration about the slow progress in finalising water plans in response to NWI obligations. In its 2009 biennial review it found that 112 of 195 required plans had been finalised, an improvement from the 90 finalised at the time of the 2007 biennial review. As well as the high proportion of water plans not yet resolved, the NWC was concerned that plans were often focused on physical aspects of the water resource with limited consideration of ecological and socialogical factors, scenarios to incorporate the impacts of climate change were not a widespread feature of water plans, water interception activities are not yet identified and quantified, plan objectives are insufficiently measurable compromising accountability assessments, to highlight just a few of the issues identified.

The NWC recognised that urban water planning had improved considerably but many weaknesses remain. These include the absence of a consistent national methodology or best practise guidance on incorporating climate change impacts into water plans, failure to identify contingencies and trigger points for adaptive policy changes, arbitrary constraints on the array of demand and supply options that are included in water plans, although there has been increased recognition of IWCM, there is no systemmatic inclusion of these techniques in strategic water plans and progress has been limited to icon examples so that realistic gains will take decades to realise and the involvement of the community and stakeholders in water plans remains mixed.

Engineers Australia strongly supports the COAG urban water planning principles agreed in October 2008. Current urban water planning is primarily the responsibility of vertically integrated and Government owned monopolies and oligopolies in major urban areas and in many instances local government councils in regional towns and centres. Engineers Australia is concerned that current institutional arrangements are not consistent with the successful implementation of the COAG principles. Engineers Australia agrees with the Price Waterhouse Coopers analysis of the weaknesses inherent in current arrangements. Without labouring the details these include:

- Information asymmetry between water supply businesses and third parties.
- Dispersaed responsibilities for achieving water supply security.
- Risk of sterilisation of future water supply sites due to coordination failure.
- Poor coordination and duplication.
- Selection of expensive and lumpy options with inadequate attention to rigour and scrutiny.
- Less than a full suite of options investigated.
- The cost of sub-optimal options is not transparent.
- Lack of standardisation in defining water security.
- Customers valuation of water is ignored in favour of the providers valuation.

Engineers Australia's members believe that the traditional centralised water management paradigm is deeply imbedded in Australian institutions, governance arrangements, professional practises, education and politics[13]. In addition, most urban water businesses are government owned and owning governments derive significant dividend flows from their activities resulting in serious conflicts of interest for urban water planning. These factors have been major impediments to more complete implementation of IWCM and the development of sustainable water planning and water use. The inclusion of planning urban water on an integrated water cycle basis in the COAG water planning principles (item 4) is of itself not sufficient to overcome these impediments.

Engineers Australia strongly supports the creation of new centralised water planning institutions in each jurisdiction as recommended by Price Waterhouse Cooper[14]. The new planning institution should be independent of the operational functions of water businesses and providers, independent of government and, in line with water security decisions taken by government, indentify water supply requirements for the whole jurisdiction.

Engineers Australia is convinced that Australia's urban areas must become more water sensitive. The limiting factor is not technology but institutional structure and willingness to accept that the one pass paradigm does not offer all the answers. Price Waterhouse Coopers[15] recommends that national guidelines for urban water planning should be prepared to complement agreed COAG national urban water planning principles. The guidelines would spell out the expected level of detail, accepted evaluation methodologies and expectations of parties involved in the planning process. The NWC goes further by calling for a national strategy as well as national guidelines on the methodologies for achieving water sensitive urban design. Engineers Australia strongly endorses these views and commends Australian Runoff Quality and the Generic Guidelines prepared by Professor Coombes as the starting points for this work.

5. Engineers and the Water Industry

Engineers have a key role to play in urban water reform. There will be a continuing requirement for engineers to construct and maintain large scale water and waste water infrastructure. The character of IWCM means that specific options are tailored to the circumstances of the location. As well as being being involved in the construction of individual solutions, engineering expertise is required to choose the most cost effective solutions from the range available. There have been some passing references to the engineering skills base in the water industry but to date no hard statistics. This section provides a brief overview based on the 2006 population census.

The water industry is defined as ANZSIC 2810 Water Supply, Sewerage and Drainage Services, ANZSIC 2811 Water Supply and ANZSIC 2812 Sewerage and Drainage Services. The engineering labour force is the population possessing formal engineering qualifications consistent with Engineers Australia's concept of the engineering team that is either employed or unemployed and actively looking for work. The engineering team comprises professional engineers (at least a 4 year bachelors degree in engineering), engineering technologists (at least a three year bachelors degree in engineering) and engineering associates (at least a diploma or advanced diploma in engineering).

[13] Coombes, Generic Guidelines, op cit, p7
[14] Price Waterhouse Cooper, op cit, pp37-38
[15] Op cit, p38

Table 3 shows the structure of the employed engineering labour force in the water industry in the 2006 population census. There were 3,059 individuals with formal engineering qualifications employed, 88.3% male and 11.7% female. There were 242,421 individuals with formal engineering qualifications employed in the Australian economy; thus the employed engineering labour force in the water industry was 1.3% of the entire engineering labour force. For completeness, in the economy overall 7,367, or 2.9% of members of the engineering labour force were unemployed.

TABLE 3
THE ENGINEERING LABOUR FORCE EMPLOYED IN THE WATER INDUSTRY

AGE	Post Graduate			Bachelors Degree			Diploma Quals			All qualifications		
GROUP	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
15-19 years	0	0	0	3	0	3	0	0	0	3	0	3
20-24 years	0	3	3	78	36	114	14	0	14	92	39	131
25-29 years	20	4	24	201	105	306	17	0	17	238	109	347
30-34 years	35	14	49	245	61	306	45	3	48	325	78	403
35-39 years	59	19	78	173	33	206	81	4	85	313	56	369
40-44 years	72	8	80	152	19	171	86	3	89	310	30	340
45-49 years	76	7	83	177	11	188	114	3	117	367	21	388
50-54 years	111	6	117	211	6	217	152	0	152	474	12	486
55-59 years	69	6	75	193	0	193	109	3	112	371	9	380
60-64 years	30	0	30	73	3	76	51	0	51	154	3	157
65 and over	11	0	11	24	0	24	20	0	20	55	0	55
Total	483	67	550	1530	274	1804	689	16	705	2702	357	3059

Source: ABS, 2006 Population Census TableBuilder

TABLE 4
THE ENGINEERING LABOUR FORCE EMPLOYED IN THE ENGINEERING PROFESSION IN THE WATER INDUSTRY

AGE	Post Graduate			Bachelors Degree			Diploma Quals			All qualifications		
GROUP	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
15-19 years	0	0	0	3	0	3	0	0	0	3	0	3
20-24 years	0	0	0	72	37	109	8	0	8	80	37	117
25-29 years	17	4	21	176	93	269	11	0	11	204	97	301
30-34 years	31	9	40	213	52	265	22	0	22	266	61	327
35-39 years	48	18	66	148	25	173	30	3	33	226	46	272
40-44 years	64	5	69	126	20	146	42	3	45	232	28	260
45-49 years	71	6	77	151	10	161	68	0	68	290	16	306
50-54 years	97	7	104	171	6	177	88	0	88	356	13	369
55-59 years	55	5	60	152	0	152	70	0	70	277	5	282
60-64 years	24	0	24	69	3	72	29	0	29	122	3	125
65 and over	12	0	12	20	0	20	16	0	16	48	0	48
Total	419	54	473	1301	246	1547	384	6	390	2104	306	2410

Source: ABS, 2006 Population Census TableBuilder

The engineering labour force responds to labour market incentives in the same way as other individuals. The result is that not all members of the engineering labour force actually work in engineering. Some are attracted to equivalent status occupations in other areas and others through choice or weight of circumstances are employed in lower skill level occupations. Table 4 shows the structure of the engineering labour force employed in the water industry in engineering occupations[16]. The collection of engineering occupations is referred to as the engineering profession. Of the 3,059 employed engineering labour force in the water industry, 2,410 are

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[16] The methodology employed is descibed in The Engineering Profession in Australia: A Profile from the 2006 Population Census available from policy@engineersaustralia.org.au

employed in the engineering profession, a skills utilisation rate of 78.8%. This compares to skills utilisation of 57.2% for the engineering labour force overall.

FIGURE 1: THE AGE STRUCTURES OF THE ENGINEERING LABOUR FORCE AND THE ENGINEERING PROFESSION EMPLOYED IN THE WATER INDUSTRY AND THE ENGINEERING PROFESSION OVERALL

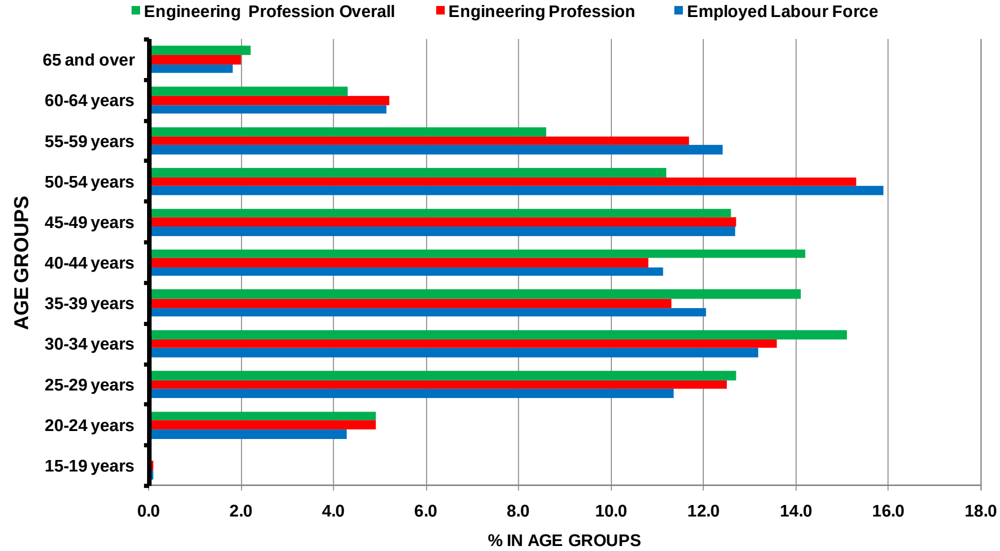

Figure 1 compares the age structures shown in Tables 1 and 2 to the age structure for the engineering profession as a whole. Instead of the conventional population-age pyramid, a one-sided diagram is used to avoid the distortions resulting from the gender imbalance in engineering. There is considerable similarity between the age structures shown in Tables 1 (blue bars) and 2 (red bars). The major difference in Figure 1 is between the age structure in the water industry and the engineering profession overall. From age 30 years to age 45 years, there are comparatively fewer engineering practitioners in the water industry than in the engineering profession overall. In age group 45 to 49 years the three age groups are almost identical. From age 50 years to age 64 years, the proportions in the water industry are considerably higher than in the engineering profession overall. Engineers in the water industry have an older age structure than the engineering profession at large and there is a relative shortage in the replacement middle age groups. Without remedial action these figures suggest that normal retirement poses serious risks for the adequacy of engineering skills in the water industry.

TABLE 5
THE DISTRIBUTION OF THE EMPLOYED ENGINEERING PROFESSION IN THE WATER INDUSTRY BY ECONOMIC SECTORS

SECTOR	Post Graduate	Bachelors Deg	Diploma Quals	All Quals
Commonwealth	0	0	0	0
States & Territories	350	1153	258	1761
Local Government	38	110	41	189
Private Sector	92	282	86	460
All Sectors	480	1545	385	2410

Source: ABS, 2006 Population Census TableBuilder

Table 5 looks at the employed engineering profession in the water industry by economic sector. There are no Commonwealth employed engineering practitioners in the water industry. This may have changed since the census but Engineers Australia submits that this total absence of engineering skills in water means that Commonwealth input to water reform is compromised.

Almost three quarters of engineering practitioners are employed in the water industry in the States and Territories. Only 189 engineering practitioners are employed by the local government water industry. When this number is spread around the large number of local government agencies with water responsibilities, the coverage is very thin. This fact underscores the view expressed above that urban planning should be centralised in each jurisdiction.

There were 460 engineering practitioners employed in the private sector water industry. One of the complications of this analysis is that 38,821, or 27.2% of the engineering profession overall is employed in ANZSIC M Professional, Scientific and Technical Services, in other words, in engineering consulting businesses. These businesses regularly provide engineering consultancy services to other industries, including the water industry. The statistics reported here do not cover these services.

The engineering skill base in the water industry is relatively small and there is a serious risk of losses through normal retirement. This skill base is responsible for all in-house planning, construction and maintainence of water infrastructure. It is also responsible for planning, engaging and supervising the provision of external engineering consultancy services for the full range of water related activities. Although there is a larger base of engineering consultancy businesses that can be drawn upon, these businesses require appropriate project specifications and oversight to deliver cost effective high quality work. In addition, engineering consultancy businesses compete for work across a wide range of industries, including mining and other infrastructure industries.