MEASURING THE BENEFITS

OF

RETICULATED SEWERAGE:

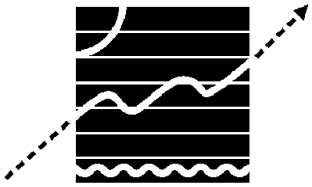
EXPECTATIONS

AND

EXPERT PROPERTY

VALUATION

Prepared by Robert Gillespie[1]



Gillespie Economics

[1] Robert Gillespie is the Principal of Gillespie Economics (a resource and environmental economics consultancy), 13 Bigland Avenue Denistone, NSW 2114.

ABSTRACT

In a competitive market, property asset prices reflect the value of the services generated by a property for its owner, including productive and consumptive environmental services. The analysis of property values can therefore provide considerable insight into the benefits of programs that have environmental, recreation, health and amenity benefits for property owners. Three property valuation approaches can be used to estimate the benefits to households of environmental programs. These include statistical models of house prices, assessment of property price differentials by property valuation experts or by surveying property owners themselves to determine the value differentials they perceive. However, great care needs to be taken in using the expert or property owner valuation approaches. Estimated property price differentials "before" and "after" an environmental program may not reflect the full economic benefit to households if expectations of an environmental improvement have already been built into property values. This can greatly affect the outcome of a benefit cost analysis. An approach to estimating the economic benefits enjoyed by households about to be connected to a reticulated sewerage scheme, when expectations were already partly reflected in property prices, is detailed. The approach is illustrated using the case study of a proposal to provide reticulated sewerage to unsewered areas in Jamberoo, Stanwell Park, Stanwell Tops, Otford, Coalcliff, Brooklyn, Dangar Island, Mt Ku-ring-gai Industrial Area, Menangle, Menangle Park, Warragamba, Silverdale, Wallacia, Mulgoa, the Oaks, Oakdale and Belimbla Park.

Key words: expert property valuation, expectations, sewerage reticulation, benefit cost analysis, property value differentials.

1.0 INTRODUCTION

Because property values reflect the future stream of services from a property including structural, access and environmental attributes they can be used to help estimate peoples willingness to pay for non-market environmental goods. This paper briefly overviews some of the different applications of the property valuation method and focuses on the potential problems with "before" and "after" expert property valuation, if expectations of an environmental improvement have already been built into property values. An approach to estimating the economic benefits to households from connection to a reticulated sewerage scheme, when expectations were already partly reflected in property prices, is illustrated using a case study of a proposal to provide reticulated sewerage to unsewered areas in Jamberoo, Stanwell Park, Stanwell Tops, Otford, Coalcliff, Brooklyn, Dangar Island, Mt Ku-ring-gai Industrial Area, Menangle, Menangle Park, Warragamba, Silverdale, Wallacia, Mulgoa, the Oaks, Oakdale and Belimbla Park.

2.0 PROPERTY VALUATION METHOD

"The property valuation method attempts to measure the environmental damage costs or environmental improvement benefits by tracing the effect of environmental quality on property prices" (James 1994). It is based on the concept that property value reflects the present value of the expected stream of benefits from the property over time less maintenance costs over the life of the asset (James 1994; Ableson 1996). In a competitive market, the asset price or willingness to pay for property depends on the bundle of attributes that each property contains including:

- structural attributes such as the size and physical characteristics of the land, the size, number and configuration of rooms, construction materials of any house or structure on the property;
- access attributes such as location from CBD and other centres, proximity to main roads etc; and
- environmental quality attributes such as views, vegetation, rivers, beaches, air and water quality, noise etc.(Abelson 1996).

Thus if all other attributes remain constant, a decline or improvement in environmental quality should be reflected in property prices. This change in property price will represent the present value of the lower or higher "economic rent" that people can expect to enjoy over the life of the property (James 1994).

The change in property value associated with changes in structural, access or environmental attributes of a property can be determined in a number of ways.

- Statistical approach – This generally involve a special survey to collect data (or the use of existing data if it is available) on housing attributes, including environmental data and the estimation of a hedonic price equation indicating price of houses as a function of attributes using regression analysis. Implicit prices for each attribute can then be calculated through partial derivatives. These implicit prices are generally used as willingness to pay values, which is considered a reasonable approximation when prices do not vary with the amount of environmental quality, when changes in environmental quality are small or when households are similar[2] (Abelson 1996). The outcome of statistical approaches may be sensitive to variable selection, variable measurement and the choice of functional form and full hedonic price studies require considerable data and resources. Nevertheless the approach has been applied in numerous instances in developed countries to provide estimates of implicit prices of many environmental goods (Abelson 1996) including road noise, air pollution and water pollution.

- Expert property valuation approach – This approach preserves the central concept of the property valuation technique but instead of relying on statistical analysis relies on the experience and expert opinion of property valuers (James 1994). This

[2] "However, the implicit price schedule is not a demand curve, but a set of points on a demand curves of many households. Only if households have similar demand functions (i.e. similar incomes, preferences etc) will the implicit price curve be the same as the demand curve. If household demands for environmental goods differ, the benefits of non-marginal changes in the supply of environmental goods are the sum of the appropriate areas under the demand curve for each household. This would generally be different from the product of the estimated hedonic price per unit of environmental good and the change in the number of units provided. Ideally we would then estimate the aggregate demand schedule for the environmental good" (Abelson 1996).

may involve a survey of a range of local realtors/property valuers as was the case in Gerroa/Gerringong (Water Board 1993) or a single property valuer such as from the State Valuation Office. Expert property valuation has been used in overseas as well as domestic studies.

- Contingent property valuation – Like the expert property valuation approach contingent property valuation preserves the central concept of the property valuation approach but relies on surveying property owners themselves to determine the value differentials they perceive from an environmental improvement. The Water Board (1993) also used this approach in relation to reticulation of Gerroa/Gerringong and found that the range of values indicated by residents was comparable to the values obtained from the expert property valuation approach.

The latter two approaches, in particular the expert property valuation method, have considerable appeal to consultant economists because they are relatively inexpensive and can be undertaken in a short period of time. However, both contingent property valuation and expert property valuation rely on a "before" and "after" valuation of property prices rather than a "with" and "without" valuation and so great care must be taken in their application to ensure that true indications of the marginal benefit (or cost) of environmental improvements (or degradation) are obtained.

One particular complication in "before" and "after" property valuation may be expectations of property owners and the other potential purchasers. Anticipation of future events can influence present economic behaviour. Thus expectations of an environmental change may already be partially or fully reflected in property prices. If this is the case, a simple "before" and "after" property valuation (i.e. what is the property worth now and what would it be worth after an environmental program is implemented) will not accurately reflect the implicit price of environmental attributes. This can greatly affect the outcome of a benefit cost analysis.

An approach to estimating the economic benefits enjoyed by households if connected to a reticulated sewerage scheme, when expectations were already partly reflected in

property prices, is detailed. The approach is illustrated using the case study of sewage disposal options for priority sewerage areas in Sydney.

3.0 CASE STUDY – SYDNEY PRIORITY SEWERAGE PROGRAM

Historically, urban areas in Sydney with access to the water supply system but no access to reticulated sewerage were progressively sewered under Sydney Water's Backlog Sewer Program.

The cost of this Program was largely funded from internal funds or special government grants. In 1987, however, it was decided that Sydney Water's contribution towards the capital cost of the Backlog Sewer Program would be limited to $14,000 per lot. The remaining cost, if any, would be recovered from the local community being provided with the new sewerage service. This decision reflected the increasing cost of the Backlog Sewer Program, as well as growing demands for the (then) Water Board to operate on a more commercial basis.

The $14,000 per lot policy was subsequently amended in November 1993, when it was decided that, in future, the provision of sewerage services to currently unsewered lots would only be funded if a commercial rate of return could be achieved on that investment. In those cases where a commercial rate of return could not be achieved, the cost of providing sewerage services would be funded either by the NSW Government (in the form of a Community Service Obligation payment), a financial contribution from the property owners, or a combination of these two sources.

In April 1996, the NSW Government initiated a review of the 53 remaining unsewered urban areas within Sydney Water's area of operations. The purpose of the review was to develop a priority listing of the remaining areas, based on the level of environmental problems in each area and the potential for improvement if it was sewered. Based on the outcomes of this review, the Government announced its Priority Sewerage Program (PSP) in February 1997. Seven of the unsewered areas were assessed as having sufficiently high environmental or public health priority to warrant detailed investigations into options for the provision of improved sewerage services ahead of the remaining unsewered areas. The seven areas identified were:

- Jamberoo
- Stanwell Park/Stanwell Tops/Otford/Coalcliff
- Brooklyn/Dangar Island
- Mt Ku-ring-gai Industrial Area
- Menangle/Menangle Park
- Warragamba/Silverdale/Wallacia/Mulgoa
- The Oaks/Oakdale/Belimbla Park.

The remaining unsewered areas are to be re-assessed by the NSW Environment Protection Authority on a regular basis to establish whether additional areas should be added to the priority list.

In each of the seven priority areas a mix of sewage disposal systems were present including:

- Absorption trench systems;
- Aerated wastewater treatment systems (AWTS); and
- Pumpout systems.

The release of pollutants into the environment from the on-site septic systems and pump-out systems in the priority sewer areas potentially has an affect on the health of local residents as well as negative impacts on local amenity and the environment. There may also be downstream environmental effects on both Class P and S waters. Previous studies investigating the performance of on-site systems similar to those in the PSP areas indicated that existing systems may impact on:

- eutrophication of waterways (lowering oxygen, reducing biodiversity and increasing algae growth);
- altering the terrestrial environment by favouring weed species;
- contaminating groundwater;
- adding human pathogens to the environment; and
- reducing public amenity due to odours, water logging and insects.

Sydney Water was requested by the NSW Government to investigate options for long-term sustainable management of wastewater services in these areas and manage the environmental approvals process for the seven priority sewerage areas.

As part of the Environmental Impact Assessment process, financial and economic evaluations were undertaken of a number of options including:

- upgrading existing onsite sewage disposal systems to AWTS, pumpout or ECOMAX; and
- conventional reticulated sewerage.

One of the potential benefits to landowners of upgrading their sewage disposal systems relates to the change in net operating costs together with residential amenity changes related to recreational enjoyment of yard and gardens and exposure to potentially harmful bacteria. These impacts are reflected in changes in property prices.

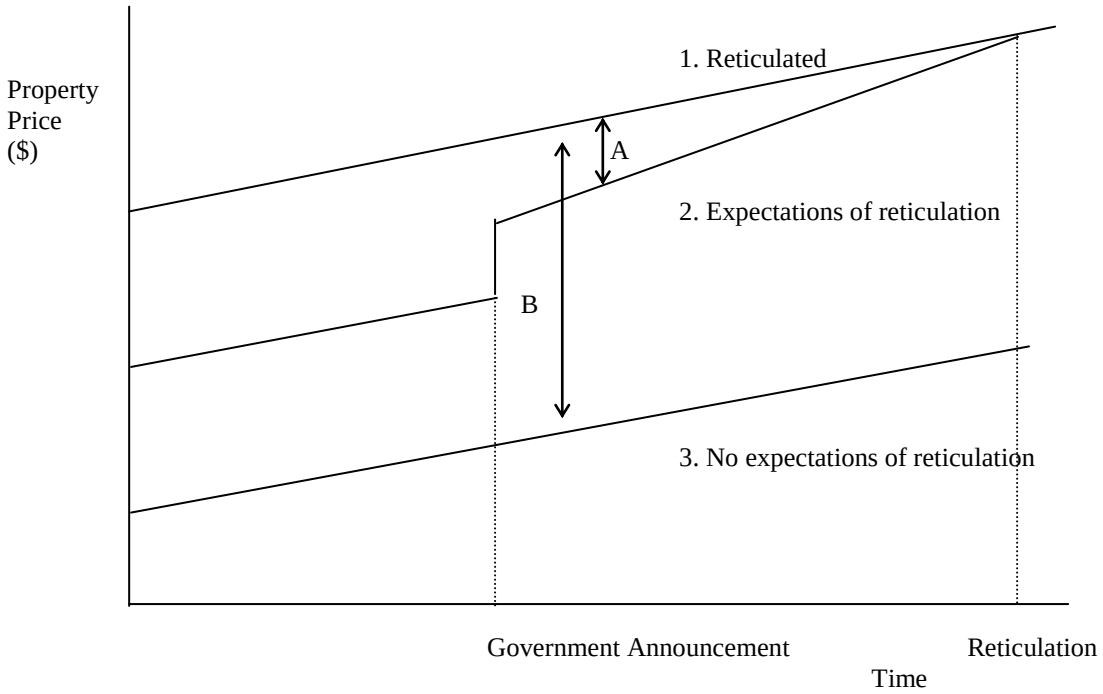
From an economic perspective, to gauge the benefits that accrue to property owners from upgraded sewage disposal systems it is necessary to consider property prices "with" and "without" the proposed upgrade.

A simple application of the expert property valuation approach would involve the estimation of the property value before the sewage upgrade compared to prices with the sewage disposal with the difference reflecting net benefits to residents (health, amenity, recreation, costs of sewage systems). However, a complication with the application of this approach to the PSP was community expectations. Because there had been a gradual sewering of unsewered areas in the Sydney region there has been a community expectation that lots would be sewered in the short to medium term. This expectation would have been heightened by Government and Ministerial announcements relating the seven PSP areas and the Environmental Impact Assessment process.

These expectations would already be built into existing property prices and so some of the benefits of reticulation would already be reflected in property prices. A "before" and "after" consideration of property prices would therefore underestimate the true benefit of reticulation.

The impact of expectations on property prices is illustrated in Figure 1. Line 1 represents the property price of a lot over time if it had reticulated sewerage. Line 3 represents the property price of a lot over time if it was unsewered and there was no expectation of it being sewered. The difference (B) is the desired estimation of property price differential "with" and "without" reticulation. Line 2 shows an increase in property price associated with expectations of future reticulation. The differential from reticulated property prices (A) is decreased after the Governments announcement of future sewering of unsewered lots. Gradually as sewering gets closer to fruition, property prices approach that of a sewered lot.

Figure 1 – Illustration of Expectations and Property Price Differentials



To address the fact that expectations would have already been at least partially reflected in property prices and to facilitate the estimation of the full household

benefit of different sewage disposal upgrades the NSW State Valuation Office was engaged to provide some expert property advice. The brief to SVO required it to provide an estimate of the property price for a single hypothetical vacant site[3] for each of the seven PSP areas assuming that when developed the site would have access to the following sewage disposal methods:

- Septic absorption trench (with no prospects of ever being connected to reticulated sewerage);
- AWTS (with no prospects of ever being connected to reticulated sewerage)
- Pumpout (with no prospects of ever being connected to reticulated sewerage);
- ECOMAX (with no prospects of ever being connected to reticulated sewerage); and
- Conventional reticulated sewerage.

From the property valuation advice provided by the NSW State Valuation Office the following property price changes were identified for different upgrades in sewage disposal systems. It should be noted that the reference point is the land value, not land plus house values.

[3] That exhibits typical characteristics for the area.

Table 1 – Summary of Expert Property Valuation Results

CURRENT SYSTEM	**ABSORTION TRENCH**				**AWTS**			**PUMPOUT**		**ECOMAX**
PROPOSED SYSTEM	**AWTS**	**Pump out**	**ECO MAX**	**Retic. Sewerage**	**Pump out**	**ECO MAX**	**Retic. Sewerage**	**ECO MAX**	**Retic. Sewerage**	**Retic. Sewerage**
Illawarra										
Jamberoo	5%	15%	15%	29%	10%	10%	23%	0%	12%	12%
Stanwell Park	6%	10%	12%	20%	4%	6%	13%	2%	9%	7%
Stanwell Tops	3%	7%	10%	20%	3%	6%	16%	3%	13%	9%
Otford	4%	10%	13%	26%	6%	8%	21%	2%	14%	12%
Coalcliff	5%	9%	10%	20%	3%	5%	14%	1%	11%	9%
Greater Western										
Menangle	6%	9%	11%	33%	3%	5%	26%	2%	22%	20%
Menangle Park	2%	4%		10%	2%		8%		6%	
Silverdale Industrial									55%	
Silverdale Residential	5%	8%	20%	38%	3%	15%	32%	11%	29%	15%
Wallacia	18%	9%	35%	45%	-8%	14%	23%	23%	33%	8%
Mulgoa	13%	8%	30%	50%	-4%	15%	32%	20%	38%	15%
The Oaks	4%	7%	21%	36%	3%	17%	31%	13%	27%	12%
Oakdale	9%	11%	22%	56%	2%	12%	43%	10%	40%	27%
Belimbla Park	2%	3%	10%	20%	1%	8%	18%	6%	16%	9%
Northern										
Brooklyn	10%	16%	19%	32%	6%	9%	21%	3%	14%	11%
Dangar Island	10%	16%	19%	61%	6%	9%	47%	3%	39%	35%
Mt Ku-ring Gai	10%	10%		24%	0%		13%		13%	
AVERAGE	**7%**	**10%**	**18%**	**33%**	**3%**	**10%**	**24%**	**7%**	**23%**	**14%**

Property value differentials "with" and "without" different sewage disposal methods were found to be quite significant, with the property value improvements associated with reticulation being:

- the greatest i.e. 33% on average, when the underlying sewage disposal system would otherwise have been absorption trenches;
- the least i.e. 14% on average, when underlying sewage disposal system would otherwise have been ECOMAX;

- 24% and 23% on average, when the underlying sewage disposal system would otherwise have been AWTS and pumpout, respectively.

These percentage property value improvements are substantially greater than those that have been obtained from other studies where allowances have not been made for the impact of expectations on existing property prices.

For example, Aquatech (1996) suggested property value improvements associated with reticulation of unsewered lots at Picton at between 10 and 15%. While the Water Board (1993) found from a survey of estate agents and a contingent property valuation approach that reticulation would improve land values by between 5% and 10% or 3% of total property value.

The property price differentials "with" and "without" reticulation, summarised in Table 1, were one of the primary economic benefits quantified in the benefit cost analyses which were undertaken of different sewage disposal options for each of the PSP areas and included in the Environmental Impact Statements. It was not within the budget of analyses to also undertake primary valuation studies of other environmental benefits of reticulation. However, even without quantitatively including these downstream environmental benefits it was found that reticulation of most PSP areas was economically efficient and preferable to onsite and pumpout options. Qualitative consideration of other non quantified benefits of reticulated sewerage further supported this finding.

4.0 CONCLUSION

Expert property valuation can provide a practical means of valuing the non-market benefits of environmental programs even when community expectations have lead to some of the environmental benefits already being factored into property prices. Proper regard to community expectations and "with" and "without" principles in commissioning and undertaking expert property valuation can make a dramatic difference to the outcomes of benefit cost analyses.

5.0 REFERENCES

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