

Overview of existing guidelines and manuals for the economic valuation of environmental and resource costs and benefits

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Preface

In preparation of the guidelines to be developed by AquaMoney, this short report gives an overview of a selection of existing guidelines and manuals for the economic valuation of environmental costs and benefits. These guidelines are discussed along a number of review criteria that are considered relevant and important for the development of practical guidelines for the assessment of environmental and resource costs and benefits within the European Water Framework Directive.

The review criteria fall into three main categories (see Box 1). After presenting general information about each guideline or manual, such as its goal, content and target group, the overlap with the AquaMoney objectives (as presented in the project proposal) is described. This second group of criteria includes the valuation approach and methods, practicality of the guidelines for implementation and commissioning studies, interpretation and use of results, and other policy relevant issues. The third group of evaluation criteria focuses on key methodological issues in economic valuation of surface water quality. For each guideline or manual, an indication is given of the extent to which the relevant matter is addressed.

The guidelines can broadly be categorized into three groups. The first group is highly oriented at water policy issues and evaluation; the second group focuses on one (or more) specific methodology in general; the third group looks at water and wetland valuation specifically.

The most important guidelines and manuals we were able to identify in the domain of economic valuation of the environment are included in this overview. The overview gives a broad range of examples and interpretations of guidelines. Some guidelines or manuals are not included in the overview, mainly because the topic they address is already covered somewhere else, or the topic involved is considered beyond the scope of AquaMoney (those which are not included are explicitly presented in section 1). For more guidance on specific methods (Travel Cost Method, Contingent Valuation Method, Choice Experiments), suggestions for further reading are given in section 1.

The overview is an important first step to summarize existing guidelines and manuals and to identify important gaps in the existing literature, as well as to identify and define the possible content of the guidelines to be developed in AquaMoney. It can also be used as a starting point for a lay person's reading into economic valuation. In order to facilitate easy comparison, the overview starts off with a summary table of the available guidelines and manuals reviewed in this report.

REVIEW CRITERIA

GENERAL

- Goal;
- Format: prescriptive or descriptive, academic or policy oriented;
- Content;
- Publishing details: edited, various authors or 1 author, book or online;
- Target audience: decision and policy makers, practitioners, scientists;
- Language: policy (jargon, abbreviations), popular (personal, illustrative), academic (precise, verifiable, abstract); easy-normal-advanced reading.
- Water related.

AQUAMONEY WFD IMPLEMENTATION:

- Value typology and framework: (water or ecosystem) services, uses, TEV;
- Valuation methods: methods, explanation, limitations, method choice;
- Practical guidelines on implementation valuation studies (data collection, research design, data analysis);
- Practical guidelines on commissioning and supervising valuation studies;
- Interpretation and use of results, application;
- Policy issues: distribution, evaluation criteria, and credibility of valuation.

KEY ISSUES:

- Validity and reliability;
- Benefits Transfer & Meta-analysis;
- Aggregation;
- Spatial considerations: spatial scale, level of aggregation of economic information, use of GIS;
- Risk and Uncertainty: decision and choice making, ecological models;
- Link of economic and ecological models, bio indicators.

OVERALL

Own subjective evaluation.

1. List of manuals and guidelines included in this report

1. US EPA (US Environmental Protection Agency) (1983) Guidelines for Performing Regulatory Impact Analysis, Washington, DC: US EPA.
2. US Water Resources Council (1983) Economic and environmental principles and guidelines for water and related land resources, Implementation studies, Washington, DC: US Government Printing Office.
3. Mitchell, R.C., R.T. Carson (1989), Using Surveys to Value Public Goods, The Contingent Valuation Method, Washington, DC: Resources for the Future.
4. NOAA (National Oceanic and Atmospheric Administration) (1993), Report of the NOAA Panel on contingent valuation, Federal Register 58 (10), 4601-4614.
5. USDA/NRCS (1995), Water Quality (Part 612 of National Resource Economics Handbook), Washington, DC: US Department of Agriculture.
6. Young, R.A. (1996), Measuring Economic Benefits for Water Investments and Policies, Technical Paper 338, Washington DC: World Bank.
7. Barbier, E.B., M. Acreman, D. Knowler (1997), Economic Valuation of Wetlands, a guide for policy makers and planners, Ramsar Convention Bureau, Gland, Switzerland.
8. Water Science and Technology Board (1997), Valuing groundwater, Economic concepts and approaches, National Academy Press, Washington, DC.
9. Bateman, I.J., K.G. Willis (eds.) (1999), Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries, Oxford University Press.
10. Louviere, J.J., D.A. Hensher, J.D. Swait (2000), Stated Choice Methods, Analysis and Application, University Press, Cambridge, UK.
11. Ward, F.A., D. Beal (2000), Valuing nature with travel cost models, A manual. Edward Elgar Publishing, Cheltenham, UK.
12. US EPA (US Environmental Protection Agency) (2000), Guidelines for Preparing Economic Analyses, EPA- 240-R-00-003, Washington, DC: US EPA.
13. Bergstrom J.C., K.J. Boyle, G.L. Poe (2001), The economic value of water quality. Edward Elgar, Cheltenham, UK.
14. Bateman, I.J., R.T. Carson, B. Day, M. Hanemann, N. Hanley, T. Hett, M. Jones-Lee, G. Loomes, S. Mourato, E. Ozdemiroglu, D.W. Pearce, R. Sugden and J. Swanson (2002), Economic Valuation with Stated Preference Techniques: A Manual, Edward Elgar, Cheltenham, UK.
15. T. C. Haab, K.E. McConnell (2002), Valuing Environmental and Natural Resources, the econometrics of non-market valuation, Edward Elgar, Cheltenham, UK.
16. Pearce, D., D. Moran, D. Biller (2002), Handbook of Biodiversity Valuation, a Guide for Policy Makers, OECD Publications, OECD, Paris.
17. DTLR (2002), Economic Valuation with Stated Preference Techniques, Summary Guide of Bateman, I., et al. (2002), Economic Valuation with Stated Preference Techniques, Edward Elgar, Cheltenham, UK.
18. Freeman, A.M. III (2003), The measurement of environmental and resource values, Theory and methods, Resources for the Future, Washington, D.C.
19. Wedgwood, A., K. Sansom (2003), Willingness-to-pay surveys - A streamlined approach, Guidance notes for small town water services. Leicestershire, UK: Loughborough University, Water, Engineering, and Development Centre.
20. Champ, P., K.J. Boyle, T.C. Brown, (eds.) (2003), A primer on nonmarket valuation, Kluwer Academic Publishers, Dordrecht, Netherlands.
21. World Bank (2004), Assessing the Economic Value of Ecosystem conservation, Washington, DC: World Bank.
22. Emerton, L., E. Bos (2004), Value: counting ecosystems as an economic part of water infrastructure, Gland, Switzerland and Cambridge, UK, IUCN.
23. Turner, K., S. Georgiou, R. Clark, R. Brouwer (2004), Economic valuation of water resources in agriculture, From the sectoral to a functional perspective of natural resource management, FAO, Rome.
24. National Research Council (2004), Valuing Ecosystem Services, Toward Better Environmental Decision-Making, National Academy Press, Washington, DC.
25. Dumas, C.F., P.W. Schuhmann, J.C. Whitehead (2004), Measuring the Economic Benefits of Water Quality Improvement with Benefit Transfer: An Introduction for Non-Economists, Working Papers 04-12, Department of Economics, Appalachian State University.
26. Hensher, D.A., J.M. Rose, W.H. Greene (2005), Applied Choice Analysis, a Primer, University Press, Cambridge, UK.

27. Young, R. (2005), Determining the economic value of water: concepts and methods, Resources for the Future Press, Washington, D.C.

Reviewed, but not included in this report, because not considered relevant or outside the scope of AquaMoney:

- Braden, J.B., C.D. Kolstad (1991), Measuring the Demand for Environmental Quality, Elsevier Science Publishers, The Netherlands.
- US EPA (1995), A framework for measuring the economic benefits of ground water, Washington, DC: US EPA.
- GWP TAC (1996), Water as a Social and Economic Good: How to Put the Principle into Practice, Global Water Partnership/Swedish International Development Cooperation Agency, Sweden.
- Dinar, A. (ed.) (2000), The political economy of water pricing reforms, Oxford University Press, Washington, D.C.
- IHE Delft (2001), The economic valuation of water, Principles and methods, IHE Delft, The Netherlands.
- World Bank (2003), A Review of the Valuation of Environmental Costs and Benefits in World Bank Projects, Paper no. 94, Environment Department Papers, World Bank.
- UNDESA (2003), Water for People, Water for Life: Chapter 13: Recognizing and Valuing the Many Faces of Water), UNESCO Publishing, Berghahn Books, UK.
- Schuijt, K. (2003). Valuation of water; the process of economic valuation of ecosystems in water management, Proefschrift Erasmus Universiteit Rotterdam, The Netherlands.

For more detailed information about specific economic valuation methods we recommend the following literature to AquaMoney and other international experts:

- Mitchell, R.C., R.T. Carson (1989), Using Surveys to Value Public Goods, The Contingent Valuation Method, Washington, DC: Resources for the Future.
- Ward, F.A., D. Beal (2000), Valuing nature with travel cost models, A manual. Edward Elgar Publishing, Cheltenham, UK.
- Louviere, J.J., D.A. Hensher, J.D. Swait (2000), Stated Choice Methods, Analysis and Application, University Press, Cambridge, UK.
- Hensher, D.A., J.M. Rose, W.H. Greene (2005), Applied Choice Analysis, a Primer, University Press, Cambridge, UK.

2. List of abbreviations

Methods

AB	averting behaviour
CE	choice experiments
COI	cost of illness
CR	contingent ranking
CV(M)	contingent valuation (method)
DCA	damage cost avoided
HP	hedonic pricing
MC	mitigation costs
MP	market prices
PF	production function
RC	replacement, relocation, restoration costs
RP	revealed preference
RUM	random utility model
SP	stated preference
TCM	travel cost method
UDV	unit day value

Decision making criteria, use of results

ALL	allocation
CBA	cost benefit analysis
CE	cost effectiveness
CR	cost recovery
DA	damage assessment
EIA	environmental impact analysis
LIA	liability
NA	national accounting
RIA	regulatory impact analysis

Evaluation criteria

BT	benefits transfer
MA	meta-analysis
PG	practical guidelines
TEV	total economic value
WFD	Water Framework Directive ©

3. General review of existing guidelines and manuals

Although there exists a wide variety in terms of focus, quality and level of detail between existing guidelines and manuals, they can basically be grouped into three main categories. The first group of guidelines is concerned with water policy issues and evaluation (EPA, 1983; USWRC, 1983; USDA/NRCS, 1995). The second group focuses on one (or more) specific valuation method in general, not specifically related to water (Mitchell and Carson, 1989; NOAA, 1993; Bateman and Willis, 1999; Louviere et al., 2000; Ward and Beal, 2000; Bateman et al., 2001; Haab and McConnell, 2002; DTLR, 2002; Champ et al., 2003; Freeman III, 2003; Hensher et al., 2005). The third group looks at water and wetland valuation specifically (Young, 1996; WSTB, 1997; Barbier et al., 1997; EPA, 2000; Bergstrom et al., 2001; Wedgwood and Sansom, 2003; World Bank, 2004; Emerton and Bos, 2004; Turner et al., 2004; NRC, 2004; Dumas et al., 2004; Young, 2005).

Also within categories there exists a wide variety in the level of detail and practicality of implementation. No guidelines exist which discuss environmental and resource costs and benefits specifically associated with different forms of water use. A lack is also observed when looking at surface water and associated market and non-market goods and services, which is based upon up-to-date economic valuation methodologies and manages to be practical at the same time.

The first group of more policy-oriented guidelines often present a step-by-step approach for decision-making related to specific policy evaluation criteria, such as economic efficiency. These approaches usually start with an assessment of ecological impacts, changes or damages, followed by a description of their economic assessment. The use of the economic valuation results and their translation into practical information for decision-making is made explicit in these guidelines and adds significantly to the value of the valuation exercise. In some of these guidelines also the limitations and disadvantages of certain methods are discussed shortly, but this is considered insufficient to guide policy makers in their interpretation of the valuation results and often requires a more thorough understanding of economic valuation and the methodology in general.

The role and acceptability of economic valuation results of environmental benefits in the policy process is addressed and described in some policy documents (e.g. EPA, 2000), while others (e.g. Emerton and Bos, 2004) are more prescriptive and promote the use of valuation results in policy and decision-making. Cost-benefit analysis is the predominant framework in which the valuation procedures are presented, i.e. the assessment of an efficient allocation of water resources. Some guidelines also address the fact that besides economic efficiency also other criteria usually play an important role in policy and decision-making processes, such as distributional and equity issues or water pricing and institutional design criteria. However, practical guidelines for these other criteria are lacking.

In the second group of guidelines, most environmental valuation guidelines start with framing the valuation question, based on the concept of Total Economic Value, including a presentation of economic theory related to consumer preferences and willingness to pay. When it comes to the specific valuation methods, a wide variation is encountered regarding the amount of detail used to describe these methods. A considerable group of manuals is limited to explaining the basics of several methods and their advantages and limitations in general. Sometimes, these explanations are illustrated with references to existing studies. The more scientific-oriented guidelines test methodological issues in case studies. Most detailed descriptions of methods are found in manuals and primers of specific methods. These usually also give the most practical guidance to their actual implementation. A point of critique to the more general descriptions of specific methods is that they often seem to copy previous guidelines and sometimes lack a more detailed description of the applicability of a method to different environmental domains.

In both the policy and methodology oriented guidelines different opinions can be found regarding the selection of the most appropriate valuation method. While some practitioners and experts prefer to use market prices or revealed preference methods, others are spokesmen for stated preference studies. In general, all guidelines state that stated preference techniques are the only methods that can measure (passive) non-use values. Although the use of stated preference techniques is not limited to non-use values, some guidelines prefer (and prescribe) the use of market-based approaches as much as possible in view of the fact that observed behaviour is considered the most reliable indicator of value.

The third group of guidelines that are related to water valuation, usually start off with a description of the water related goods and services that contribute to Total Economic Value. Some guidelines link water resource characteristics, their structure and processes first to water resource functions, and then to goods and services and human uses, which generate economic value. Existing guidelines often identify and define different characteristics, functions, goods, services, and values, which are grouped in different manners. Some water valuation guidelines take a multidisciplinary approach and describe the hydrological, ecological and economics of water management. Interestingly, many guidelines focus on the benefits of water and its goods and services. These guidelines define costs as foregone benefits. The more policy-oriented guidelines assess costs and benefits separately.

Regarding the key methodological issues identified in the AquaMoney proposal, the usefulness of most of the guidelines is generally rather limited. As can be expected, the more methodologically oriented guidelines are far more informative on this than the policy oriented guidelines. The amount of information in the water valuation guidelines about these key issues is also very limited.

Linking economic values to bio-indicators is not common practice, nor described in much detail in any of the guidelines we reviewed. Although it is somewhat of a commonplace nowadays that valuation should involve both natural scientists (ecologists and water scientists) and economists, some guidelines such as the ones provided by Emerton and Bos (2004) also mention bio-economic models. Bio-indicators as proxies for water quality are mentioned in USDA/NRCS (1995), but these guidelines do not link these indicators to economic valuation and economic values. Bergstrom et al. (2001) present a damage function across nitrate levels. Hence, a more detailed and extensive examination and discussion about the feasibility of linking economic and ecological indicators and values in the light of current methodological know-how and expertise in both fields, taking also into account practical considerations.

Reliability and validity is mostly discussed in relation to contingent valuation. Although the first comprehensive CV guidelines provided by Mitchell and Carson (1989), including an extensive list of different types of validity and reliability, are still very valuable and relevant, the NOAA guidelines are since 1993 the starting point for most guidelines published after 1993. NOAA introduced an influential burden of proof assessment in CV research to explicitly test for reliability. Also Bateman et al. (2002) present tests of validity to check for biases, and discuss reliability of stated preference techniques. Freeman (2003) discusses validity of Travel Cost studies and Louviere et al. (2000) discuss cross and external validity and set guidelines for valid Choice Experiments. Champ et al. (2003) are most elaborate on the issue of validity, and argue that especially for Revealed Preference methods more validity criteria should be developed. Haab and McConnell (2002) present criteria for valid WTP estimation and the statistical problems that those criteria bring along. Bergstrom et al. (2001) discuss the validity and reliability of Benefit Transfer and end up saying that validity needs more research attention. An extensive discussion of the validity and reliability of benefits transfer is also found in Brouwer (2000), including a protocol for good practice. Bateman et al. (2001) also discuss the issue related to Benefit Transfer in terms of the required level of accuracy, but do not give explicit guidelines.

Aggregation of economic values is a very important issue in economic valuation of non-market benefits in general, including water valuation. Turner et al. (2004) mention several complications when aggregating the values of different ecosystem functions. Aggregation involves decisions regarding the relevant population of beneficiaries and the geographical scale of the water system studied. Mitchell and Carson (1989) give a good description of aggregation methods, Freeman III (2003) discusses aggregation of values across time and generations and for purposes of social welfare analysis under uncertainty, Bateman et al. (2002) gives a more practical guidance, and Bergstrom et al. (2001) discuss the underlying methodological issues that arise in application. However, there exist no guidelines on how to deal with issues such as upstream-downstream relationships, and reliable up and downscaling procedures from individual water body to basin level.

The extent to which *spatial aspects* are considered in existing water valuation guidelines is even more limited. While many guidelines state that economic valuation studies are site-specific, hardly any guideline discusses the issue of possible spatial dependency of water-related values. Freeman III (2003) discusses spatial scales of socioeconomic data, Champ et al. (2003) describe spatial dependencies in relation to hedonic models and shortly describe spatial autocorrelation, spatial heterogeneity, and the use of GIS in spatial referencing. The NRC (2004) guidelines provide most detail regarding spatial aspects in economic valuation, but practical guidelines for application are lacking.

Obviously, spatial relationships are implicitly included in travel cost studies, where economic values primarily depend upon and are derived from spatial distances between household residences and recreational (water) areas.

Benefits transfer (BT) has been suggested as an attractive, cost-effective alternative valuation method to original valuation research. No specific guidelines exist solely dedicated to BT. Existing guidelines are limited to a basic description of the procedure and listing of potential applications and limitations. Bateman et al. (2002) list conditions for satisfactory BT. Champ et al. (2003) discuss different methods. Some existing guidelines also shortly describe *meta-analysis*, but again no practical manual exists regarding the use of the economic values derived from meta-analysis. Bergstrom et al. (2001) present two BT studies of ground water values, and find that reliable BT is possible within, but not across states. Dumas et al. (2004) also present different uses of BT. BT is currently often considered insufficiently reliable (e.g. Pearce et al., 2002). Considering the important spatial dimension underlying water valuation, and the importance of study design and context, more detailed guidelines for BT are needed to make this a reliable and more acceptable approach.

Risk and uncertainty in scientific knowledge and information is often an argument to not do a valuation study at all. There is risk and uncertainty in the hydrological, ecological, and economic assessments of water policy and management, related to long-term effects and unknown aquatic ecosystem functioning. There is also risk and uncertainty in the results of valuation studies in terms of reliability and validity. The political process itself is a source of risk and uncertainty as well, but this issue is not discussed in any of the guidelines and is considered to be beyond the scope of AquaMoney. Some research has been done to reduce the risk and uncertainty in valuation results, or model uncertainty in decision-making. Haab and McConnell (2002) discuss three sources of variation in WTP measures which bring along uncertainty: randomness of preferences and of estimated parameters, and variation across individuals in the sample; they present approaches to deal with these uncertainties. Most guidelines advise to carry out a sensitivity analysis based on different assumptions. An interesting book in this field is by Bergstrom et al. (2001), who incorporate uncertainty in decision-making, modelling probabilities of contamination and testing for subjective risk perceptions. However, their findings and results are not (clearly) translated into policy guidelines. Young (2005) presents water-related risk issues such as health risks and flood risks. Freeman III (2003) discusses expected utility theory, the effect of risks on welfare changes and the implications of risk and uncertainty for policy analysis and CBA. The NRC (2004) guidelines also present an interesting discussion about this topic. It is also unclear which level of risk and uncertainty is acceptable in the scientific, economic and policy assessments, and therefore merits further attention.

4. Overview of existing guidelines and manuals

		Water related	Academic/ Policy	RP		SP		Other	Practical guidelines		Use of results	Key issues					
				HP	TCM	CV	CE	Super- vision	Imple- mentation	Val. & Rel.		BT/MA	Aggre- gation	Spatial	Risk & uncert.	Link ecology	
1	EPA (1983)	No	Policy	•	•	•		•	No	No	CBA, CE, EIA					✓	✓
2	US WRC	Yes	Policy		•	•		•	No	No	Project evaluation		✓			✓	✓
3	Mitchell & Carson	No	Academic			•			No	Yes	CBA	✓✓✓		✓✓✓		✓	
4	NOAA	No	Policy			•			No	Yes	LIA	✓✓		✓			
5	USDA/NRCS	Yes	Policy	•	•	•			No	No	CBA, CE		✓			✓	✓
6	Young	Yes	Policy, Academic	•	•	•		•	No	Yes	CBA	✓	✓		✓	✓	
7	Barbier et al.	Yes	Policy	•	•	•		•	No	Yes	CBA		✓				
8	WSTB	Yes	Policy	•	•	•		•	No	No	CBA, ALL, DA	✓				✓	
9	Bateman & Willis	No	Academic			•	•		No	Yes		✓				✓	
10	Louviere et al.	No	Academic				•		No	Yes	Market analysis	✓✓		✓			
11	Ward & Beal	No	Academic		•				No	Yes	CBA, recreation policies	✓✓	✓	✓✓	✓		
12	EPA (2000)	No	Policy	•	•	•		•	No	No	CBA	✓	✓			✓	
13	Bergstrom et al.	Yes	Academic			•			No	No	CBA, LIA	✓✓	✓✓✓	✓✓✓		✓✓✓	✓✓
14	Bateman et al.	No	Policy, Academic			•	•		Yes	Yes	CBA, CE, LIA	✓✓✓	✓✓	✓✓✓			
15	Haab & McConnell	No	Academic	•	•	•	•		No	Yes	CBA	✓✓✓				✓✓✓	
16	Pearce et al.	No	Policy		•	•	•	•	No	Yes	CBA, ...	✓	✓✓	✓		✓	✓
17	DTLR	No	Policy			•	•		Yes	Yes	CBA, CE, MCA	✓✓	✓✓	✓✓			
18	Freeman III	No	Academic	•	•	•	•	•	No	No	Policy evaluation	✓✓	✓✓	✓✓	✓	✓✓✓	
19	Wedgwood & Sansom	Yes	Policy			•			Yes	Yes	CBA, CE, CR	✓✓					
20	Champ et al.	No	Academic	•	•	•	•	•	No	Yes	CBA	✓✓✓	✓✓		✓✓	✓	
21	World Bank	No	Policy	•	•	•	•	•	No	No	CBA, CE, NA,		✓		✓	✓	

		Water related	Academic/ Policy	RP		SP		Other	Practical guidelines		Use of results	Key issues					
				HP	TCM	CV	CE		Super- vision	Imple- mentation		Val. & Rel.	BT/MA	Aggre- gation	Spatial	Risk & uncert.	Link ecology
22	Emerton & Bos	Yes	Policy	•	•	•	•	•	No	No	CBA					✓	✓
23	Turner et al.	Yes	Policy	•	•	•		•	No	No	CBA, ALL, NA	✓	✓✓	✓	✓	✓	
24	NRC	No	Policy, Academic	•	•	•	•	•	No	No	CBA	✓	✓	✓	✓✓	✓✓	✓
25	Dumas et al.	Yes	Academic	•	•	•		•	No	No		✓	✓✓✓			✓	✓
26	Hensher et al.	No	Academic					•	No	Yes	Market analysis						
27	Young (2005)	Yes	Academic	•	•	•	•	•	No	Yes	CBA		✓✓			✓✓	

Table 1 Overview of existing guidelines and manuals

4.1 US EPA (US Environmental Protection Agency) (1983) Guidelines for Performing Regulatory Impact Analysis, Washington, DC: US EPA.

GENERAL	
Goal	The guidelines are designed to help analysts prepare regulatory impact analyses from stating the need for action to developing alternative approaches, quantifying and valuing benefits and cost, and actual decision-making. A RIA should assess the implications of alternative regulatory actions and facilitate decision-making based on economic efficiency criteria.
Format	Prescriptive, policy document, guideline.
Content	The guidelines focus on environmental and health effects resulting from the release of pollutants into the environment and are designed for specific regulations. The main decision steps are given in the guidelines, supported by appendices on the analysis of benefits (A), analysis of costs (B), choice of discount rates (C), analysis of economic impacts (D).
Publishing details	Various authors, United States Environmental Protection Agency, Office of Policy Analysis, Washington DC. EPA-230-01-84-003, December 1983 http://econwpa.wustl.edu:8089/eps/othr/papers/9602/9602003.pdf
Target audience	Policy makers EPA
Language	Policy (jargon), normal.
Water related	Not specifically. One table with linkages between programs (air, water, toxics and waste), pollutant indicators, type of environmental receptor effects and economic benefit categories and their possible measurement methods.
WFD/ AQUAMONEY	
Value typology	Benefit categories: health (morbidity and mortality); agriculture, fisheries and silviculture; materials; recreation; aesthetics; ecosystems. Ecosystem usefulness to society is determined by service flows from the resource (water purification and retention, flood control, biomass productivity).
Valuation methods	Appendix A is on assessing benefits, with consumer/producer surplus as theoretical framework. Cost savings (production), damage function, HP (housing and wages), TCM, and CVM. Short description, (dis)advantages. The book states that benefit estimates that use market prices of ecosystem property will generally understate the true impact. Not prescriptive in choice for certain method for benefit category, gives overview of existing studies.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	No guidelines on how to interpret results. Valuation is presented as a tool for CBA in environmental policy analysis, cost-effectiveness, EIA and distributional issues.
Policy issues	Discounting, distribution, and intergenerational equity are discussed.
KEY ISSUES	
Reliability, validity	Not addressed.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	Uncertainty is related to ecosystem models due to a lack of understanding ecosystem structures and component/unit of measurement. Risk is defined as the probability of experiencing an adverse outcome from the pollutant effect on health, flora and fauna, and networks (in dose-response relationships), and related to the social discount rate.
Link with ecology	Dose-response models, use of epidemiological information and ecosystem component valuation.
OVERALL	Not useful compared to other guidelines for practical implementation of valuation studies for water. Useful for policy makers in the context of valuation and policy decisions in general. CBA is the main topic.

4.2 US Water Resources Council (1983) Economic and environmental principles and guidelines for water and related land resources, Implementation studies, Washington, DC: US Government Printing Office.

GENERAL	
Goal	Guide the formulation and evaluation of water and related land resources policy implementation studies, including non-marketed goods and services.
Format	Prescriptive, policy document, guideline.
Content	The first chapter discusses the planning process of implementation studies. Chapter 2 describes the benefit evaluation of projects in municipal and industrial water supply, agriculture, urban flood damage, power, transportation, recreation, fishing, other direct benefits, and employment. The last chapter deals with environmental quality evaluation procedures, planning requirements and methods.
Publishing details	Various authors, U.S. Water Resources Council http://www.iwr.usace.army.mil/iwr/pdf/p&g.pdf
Target audience	Federal water managers.
Language	Policy (jargon), normal.
Water related	Yes, focus on production functions of water. Environmental quality is discussed separately. No description of water functions (hydrological, biological, environmental) is given. It includes a table of types of water (related) resources and measurement of effects.
WFD/ AQUAMONEY	
Value typology	No typology or framework. Non-use values not mentioned as such. Environmental quality is determined by ecological (functional and structural), cultural and aesthetic attributes; effects are measured qualitatively.
Valuation methods	Discusses TCM, CVM and UDV in relation to recreation, and the method selection process. Theoretical overview in annexes, not related to water. For other benefits than those resulting from recreation, the use of market price based methods is advised. Information provided about which method to use for measuring recreational benefits, when methods cannot be applied, brief information of limitation of methods and biases to be tested.
Practical guidelines on implementation	Practical for market priced based valuation. Brief description of steps to be taken for TCM, CVM and UDV, regarding sampling, survey design, value functions and estimation models (section VIII).
PG supervision	Not addressed.
Interpretation and use of results	Valuation studies are used as part of policy implementation studies, measuring recreational values.
Policy issues	Projects are evaluated on their contribution to the economic development (value in monetary terms of goods and services).
KEY ISSUES	
Reliability, validity	Not addressed.
Benefits transfer & Meta-analysis	BT is treated as application of information from a similar project, and context matching is mentioned. Steps for BT using TCM functions.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	Supplement 1 discusses risk and uncertainty in the formulation of water management and development plans, sources and degrees of risk and uncertainty, and methods and analysis of dealing with risk and uncertainty are mentioned (sensitivity analysis, probability distributions and preference and attitude illustrations).
Link with ecology	For each environmental quality attribute one or more indicator should be specified. No link with economic valuation.
OVERALL	The description of the valuation methods is insufficient to interpret results and insufficient as practical guidelines for implementing a water valuation study. Environmental quality is not valued in economic terms.

4.3 Mitchell, R.C., R.T. Carson (1989), Using Surveys to Value Public Goods, The Contingent Valuation Method, Washington, DC: Resources for the Future.

GENERAL	
Goal	Provide decision makers, policy analysts, and social scientists, with a detailed discussion of the use of contingent valuation to value goods not traded in private markets.
Format	Descriptive, academic, guideline.
Content	The first five chapters introduce the method, its theoretical background, the benefits to assess, and data collection. Chapters 6 through 8 discuss the major critique on CV regarding strategic behaviour, the quality of answers in terms of honesty and meaning. Chapters 9 to 12 deal with validity, reliability, and aggregation.
Publishing details	Published book. Resources for the Future, Washington D.C.
Target audience	Decision makers, policy analysts and social scientists.
Language	Academic, normal-advanced.
Water related	No (Appendix B includes a survey instrument for a water benefits study).
WFD/ AQUAMONEY	
Value typology	TEV (with an example of freshwater quality), discussion of use and non-use values.
Valuation methods	CV (other methods shortly mentioned).
Practical guidelines on implementation	Chapter 4 describes variations in scenario designs. Chapter 5 discusses survey research and its methodological issues, the consequences of research design (data collection method). Appendix C guides hypothesis testing and experimental design.
PG supervision	No guidance on commissioning.
Interpretation and use of results	Chapter 13 discusses the relevance and quality of contingent valuation studies that need to be assessed before using the results, and gives a list of questions to evaluate a CV study.
Policy issues	Chapter 1 discusses equity versus efficiency in economic theory. No further policy evaluation criteria discussed.
KEY ISSUES	
Reliability, validity	Chapter 9 discusses the 3 Cs: content, criterion, and construct validity, their origins and how to treat them. Reliability, its assessment, its sources (from the survey instrument, sampling variance, and variance in underlying true WTP) is discussed in Chapter 10.
BT & MA	Not addressed.
Aggregation	Chapter 12: sampling and method choice, non-response and sample selection biases, temporal aspects, and the assessment and aggregation of non-use values.
Spatial considerations	Geographical Sequence Aggregation Bias mentioned as bias in aggregation. No further discussion.
Risk and Uncertainty	Uncertainty and the ex-ante versus ex-post perspectives (Chapter 1), and option price, uncertainty of respondents' preferences and belief in scenario, and strategic behaviour (Chapter 3).
Link with ecology	Not addressed.
OVERALL	The book gives a very accessible, thorough overview on Contingent Valuation. It discusses most, if not all of the major methodological challenges, yet remains practical.

4.4 NOAA (National Oceanic and Atmospheric Administration) (1993), Report of the NOAA Panel on contingent valuation, Federal Register 58 (10), 4601-4614.

GENERAL	
Goal	The NOAA Panel critically evaluated the validity of CV measures of use and non-use values to develop guidelines for useful implementation of the CV technique.
Format	Prescriptive, guideline, policy document.
Content	The report discusses the main point of criticism of the CVM, the key issues concerning design of CVM studies, guidelines to which CV studies should adhere to produce information useful for damage assessment, and presents a research agenda.
Publishing details	Various authors, National Oceanic and Atmospheric Administration (Damage Assessment, Remediation and Restoration Program) http://www.darp.noaa.gov/library/pdf/cvblue.pdf
Target audience	Policy and science
Language	Academic, normal.
Water related	No. The evaluation was conducted within the specific context of the assessment of natural resource damages due to releases of hazardous substances (oil) into the environment, but has general applicability to the use of CV.
WFD/ AQUAMONEY	
Value typology	Use and passive use (existence) values.
Valuation methods	CV use for passive values, discussion of limitations and application.
PG implementation	Guidance on survey design. No practical guidance on data collection, statistical analysis, etc.
Practical guidelines on supervision	The report identifies a number of stringent guidelines for the conduct of CV studies, discusses all problems and suggests possible solutions in CV design.
Interpretation and use of results	The report is developed for using CVM studies in damage assessment.
Policy issues	Not addressed.
KEY ISSUES	
Reliability, validity	The report presents a burden of proof of reliability. The report discusses scope sensitivity, inconsistency with rational choice, budget constraints, information provision and acceptance, extent of the market, warm-glow effects, elicitation formats, embedding, and time dimensions. It does not discuss reliability levels related to phases in decision making; it suggests CV as a starting point of damage assessment.
BT & MA	Not addressed.
Aggregation	Extent of the market is mentioned, no guidelines given.
Spatial cons.	Not addressed.
Risk and Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	NOAA guidelines are very influential and have become standard to later CVM valuation guidelines. The report is very useful to assess quality of CVM studies and for CV survey design, but not specific to water related issues (even though it was set up after the Exxon Valdez oil spill for the coast of Alaska).

4.5 **USDA/NRCS (1995), Water Quality (Part 612 of National Resource Economics Handbook), Washington, DC: US Department of Agriculture.**

GENERAL	
Goal	The document's purpose is to guide on the evaluation of economic benefits of measures that reduce water pollution from non-point sources, including evaluation of offsite costs and benefits as well as those occurring onsite.
Format	Prescriptive, policy, guideline.
Content	The handbook presents the economic concepts, discusses quantifiable water quality impacts with economic value, evaluation techniques, and benefit categories.
Publishing details	Various authors. United States Department of Agriculture, Natural Resource Conservation Service. ftp://ftp-fc.sc.egov.usda.gov/Economics/Technotes/NRCS%20WQ%20Economic%20Handbook%20612.pdf
Target audience	Policy makers; more targeted at water managers than at economists.
Language	Policy (jargon), easy.
Water related	Focus on water quality. Lists several water quality indicators and water benefit categories, including non-market benefits, and key questions on the economics of water quality.
WFD/ AQUAMONEY	
Value typology	Categorisation in market benefits on site, market benefits off site, non-market benefits off site. Focus on agriculture.
Valuation methods	TCM, UDV, HP, CV. Basic introduction and advice on which method to use for which value. Refers to Principles and Guidelines (1983 USWRC)
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	The handbook uses benefit-cost analysis and cost-effectiveness analysis as evaluation criteria.
Policy issues	Distribution and technology adoption shortly mentioned.
KEY ISSUES	
Reliability, validity	Not addressed.
BT & MA	Very brief description of benefits transfer.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	The treatment of risk is discussed, but no risk analysis guidelines.
Link with ecology	Water quality indicators, including threshold values of water quality levels mentioned, but no practical link with economic valuation methods or studies.
OVERALL	Not up-to-date and very limited descriptions of methods. Good overview of benefits for water quality project appraisal, but hardly any guidelines.

4.6 Young, R.A. (1996), *Measuring Economic Benefits for Water Investments and Policies*, Technical Paper 338, Washington DC: World Bank.

GENERAL	
Goal	The book is intended for project task managers to evaluate water-related allocation decisions. The aim is to provide such analysts with a practical, yet theoretically sound procedural handbook to help guide their analyses.
Format	Monograph, descriptive, academic.
Content	This book reviews, assesses and describes the operational use of the concepts and methods for estimating the economic benefits of investment and allocation decisions related to water. A conceptual framework for non-market valuation of water is presented, the assumptions and procedures for implementing the methods, specific cases of economic valuation of water resource issues and the difference between water quantity and quality issues are discussed. Chapter 3 describes the techniques for measuring water value. Chapter 4 discusses valuing water as an intermediate good, while chapters 5 and 6 focus on water as a private and a public good.
Publishing details	World Bank technical paper, Washington D.C. (1996), online.
Target audience	Project task managers in water-related allocation decisions, field practitioners possessing some training in applied economics.
Language	Academic (economic jargon), advanced.
Water related	River basins management context, with focus on issues of water supply, but attention is also paid to measuring benefits of improved water quality. Difference made between intermediate and producers' goods and consumers' goods, and between private and public goods and services. Water value is related to place, form and time; it is a bulky commodity with a site-specific value.
WFD/ AQUAMONEY	
Value typology	Economic benefit classes: (a) commodity benefits (withdrawal or off stream or consumptive uses versus in stream or non-consumptive uses), (b) public and private aesthetic and recreational values; (c) waste assimilation benefits (related tot the assimilative capacity of water); and (d) dis-benefits or damages or negative benefits. Non-uses are another category next to commodity benefits.
Valuation methods	Market transactions: water rights, HP, water utility sales, residual imputation, input-output, value added, alternative cost. TCM, HP, CVM, UDV. Basic theoretical background, strengths and weaknesses, applications and limitations. Suggests methods for each type of water use (intermediate, private, public), but not exhaustive - summarizes existing studies.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	Focus on economic efficiency in the development and allocation of the water resource, i.e. for CBA. First: investments in water supply. Second: reallocation among water using sectors.
Policy issues	No discussion of political economics (focus on efficiency).
KEY ISSUES	
Reliability, validity	Describes biases (strategic behaviour, compliance, starting point bias, relational bias, scenario misspecification) but no special advice on how to increase validity or reliability.
BT & MA	Very brief on BT and MA, referring to articles, no guidelines.
Aggregation	Not addressed.
Spatial considerations	It is mentioned that values may differ between locations (conceptual issue, no further discussion), and that in determining the accounting stance one needs to take into account upstream-downstream relationships.
Risk and Uncertainty	Section 2.10 discusses long-term unpredictability, risk and uncertainty and suggests using sensitivity analysis or switching value tests to acknowledge uncertainty.
Link with ecology	Not addressed.
OVERALL	Very sound theoretical and economic foundation. No guidelines for practical implementation. Gives enough background information to interpret results of valuation studies, but does not give

	practical guidance to supervising a study. Key issues are partly discussed.
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- 4.7 Barbier, E.B., M. Acreman, D. Knowler (1997), *Economic Valuation of Wetlands, a guide for policy makers and planners*, Ramsar Convention Bureau, Gland, Switzerland.

GENERAL	
Goal	The aim of the book is to provide guidance to policy makers and planners on the potential for economic valuation of wetlands and how such valuation studies should be conducted.
Format	Descriptive, policy, guideline.
Content	Synthesis of literature about various techniques and examples of wetland valuation studies together with guidance on planning and managing a study and putting the result into a wider decision-making framework. Chapter 1 groups the features of ecosystems into components, functions and attributes. Chapter 2 explains the role of valuation in decision-making. Chapter 3 describes the valuation framework and methods, with examples of studies in Chapter 4. Chapter 5 provides a step-by-step guidance on planning and conducting a study.
Publishing details	3 editors, several co-authors. Ramsar convention Bureau, Gland, Switzerland. 1997 http://www.ramsar.org/lib/lib_valuation_e.pdf
Target audience	Policy makers and planners, both developing and developed countries.
Language	Popular-policy, easy-normal.
Water related	Focus on wetland systems with several components and their interactions (functions) and attributes and wetland-specific value components.
WFD/ AQUAMONEY	
Value typology	TEV (direct, indirect, option, existence), ecosystem functions and uses.
Valuation methods	Appendix 3 gives a brief overview of valuation methods with their purpose, advantages and disadvantages. MP, shadow prices, HP, TCM, PF, Related good (substitute), CVM, CR, IOC, RC, DCA. The book relates the various components/functions/services/attributes to the economic value in use types, and relates these use values to valuation techniques.
PG implementation	Not addressed.
Practical guidelines on supervision	Chapter 5 presents a step-by-step guide to undertaking a valuation study, including the preparation of the implementation and describes the resources required, study team and sample terms of reference. Also describes the choices to be made in assessment (scope, information needs, data collection and valuation method), and limits of valuation.
Interpretation and use of results	CBA assessment framework: to do impact analysis, partial valuation or total valuation.
Policy issues	Not addressed specifically, valuation is used to indicate economic efficiency of competing uses.
KEY ISSUES	
Reliability, validity	Not addressed.
BT & MA	BT is discussed, but it is stated that well-defined protocols are missing.
Aggregation	Not addressed.
Spatial considerations	Not addressed.
Risk and Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	Very general, yet interesting starting point when dealing with the valuation of natural environments/ecosystems. Good communication tool to explain the importance of valuing wetlands, and sources of undervaluation. Useful for supervising and using valuation studies (economic valuation assessment framework), but does not give enough practical guidance on actual implementation. No discussion of key (methodological) issues.

4.8 Water Science and Technology Board (1997), Valuing groundwater, Economic concepts and approaches, National Academy Press, Washington, DC.

GENERAL	
Goal	The book presents various approaches to assessing the future economic value of ground water and the economic impact of the contamination or depletion of these resources. It takes an interdisciplinary approach to develop a conceptual framework and common terminology.
Format	Descriptive, policy, guideline.
Content	After presenting the groundwater background, Chapter 2 integrates hydrology, ecology and economics of groundwater. Chapter 3 presents a framework for the valuation of ground water. Chapter 4 gives a short overview of the history of economic valuation of natural resources, describes indirect and direct valuation methods, and summarizes valuation studies. Chapter 5 discusses the interaction between valuation and institutional issues (legal considerations and policy). Chapter 6 presents seven case studies. Each chapter ends with main recommendations.
Publishing details	Various authors of NRC, multidisciplinary. National Academy Press, Washington DC.
Target audience	Water managers, policy makers.
Language	Academic, advanced.
Water related	Focus on groundwater. The hydrological cycle, groundwater services and functions, stock and flow issues are described. The similarity and overlap with surface water is discussed: "there is no way to divide up benefits neatly and analyze value simply".
WFD/AQUAMONEY	
Value typology	Total Economic Value concept. The book distinguishes extractive values and in-situ uses and focuses on benefits of groundwater.
Valuation methods	PF, MP, COI, TCM, AB, HPM, CVM. Chapter 1 includes a table of ground water functions/services and applicable valuation methods. Table 4.1 presents the advantages and disadvantages of the methods, especially of CVM.
PG implementation	Not addressed. The appendix includes part of a CVM questionnaire.
PG supervision	No practical guidelines.
Interpretation and use of results	Chapter 5 relates the valuation exercise to water allocation decisions, water rights transfers, quality protection, damage assessment, regulatory impact assessment, property rights and human health risks. The valuation principles can be used as input to, but are distinct from CBA.
Policy issues	Chapter 5 deals with water allocation, efficiency, institutional setting, discounting over time.
KEY ISSUES	
Reliability, validity	Mentioning that the method should match the context, service/function of interest, avoid double counting. Validity of CVM is related to information effects in surveys.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial cons.	Only mentioning the fact that every assessment should be site specific.
Risk and Uncertainty	The uncertainty involved in analyzing complex hydrologic and ecological functions and their service flows, ecosystem performance and boundaries of successional trajectories, and inability of economists to measure the consequences of complex phenomena over the long run are mentioned (including heterogeneity of natural systems, inadequate data for quantity and quality, habitat functioning).
Link with ecology	Not addressed.
OVERALL	The theoretical framework and approach are very useful. The description of the methods is useful to interpret valuation studies, but important validity and reliability issues are not addressed. The case studies do not present actual valuation studies, and the book does not provide practical guidelines.

4.9 Bateman, I.J., K.G. Willis (eds.) (1999), *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*, Oxford University Press.

GENERAL	
Goal	The book presents the state of the art in Contingent Valuation and embraces all aspects of the debate: theoretical, methodological, empirical, and institutional.
Format	Academic, no guideline, descriptive.
Content	The book consists of four parts. The first part considers the conceptual theoretical context of CV: neo-classical economic theory, passive-use values, and public goods. The second part explores detailed questions of the methodology: psychology of choice, uncertainty, modelling. Part III looks at specific topics in 3 case studies: option value, elicitation effects, and developing countries. Part IV discusses the use of CV in the US and EU and the adaptation of CV in public decision-making.
Publishing details	2 Editors, published book: Oxford University Press.
Target audience	Academics.
Language	Academic (economic jargon, abstract, verifiable), advanced.
Water related	Not addressed specifically.
WFD/ AQUAMONEY	
Value typology	TEV deriving from functions, and discussion of Total Value.
Valuation methods	CV and CE. Many biases and design issues (bid design, estimation method/model, non-response, sampling, anchoring, compliance, strategic, hypothetical, etc.) discussed and tested.
PG implementation	No explicit guideline. Chapter 8 addresses the demands of fieldworkers and psychological impacts in survey design and data collection. Chapter 13 provides a step-by-step approach to Choice Experiments.
PG supervision	Not addressed.
Interpretation and use of results	CBA is the main evaluation framework. Chapters 17 & 18 present several applications as well as future use possibilities of valuation results. Interpretation of multi-level modelling results explicitly discussed.
Policy issues	Application in CBA, cost-effectiveness, EIA, Damage Assessment, and purposes of awareness, optimal choice, justification of policy. Role of CV in laws in EU and US discussed.
KEY ISSUES	
Reliability, validity	Focus on non-use/passive values. Many design issues discussed to increase validity.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial considerations	Not addressed.
Risk and Uncertainty	Chapters 7 and 14: uncertainty, option price, and probabilities. Chapter 9: uncertainty and information provision.
Link with ecology	Not addressed.
OVERALL	Fundamental academic discussion, of which the results could be used for the guidelines for survey design, data collection and analysis. No further practical guidelines.

4.10 Louviere, J.J., D.A. Hensher, J.D. Swait (2000), *Stated Choice Methods, Analysis and Application*, University Press, Cambridge, UK.

GENERAL	
Goal	Demonstrate the benefits of using the tools of data specification, modelling and application of stated choice methods, in a formal structure, to investigate the responsiveness of actual and potential participants in markets for particular goods and services.
Format	Descriptive, academic, manual.
Content	The first part of the book explains the general methodology, including an introduction to logit and other stated preference models, specific topics in stated choice methods (choosing a model and relaxing the IID assumption) and the experimental design. SP data and study implementation are covered in the second part (chapters 8 and 9); examples of applications are found in the third part (chapter 10-12), and external validity is discussed in chapter 13.
Publishing details	Published book, 3 authors. Cambridge University Press, UK.
Target audience	Practitioners and researchers using Choice Experiments
Language	Academic, advanced reading.
Water related	No. Chapter 12 presents environmental valuation studies, but these are not related to water.
WFD/ AQUAMONEY	
Value typology	Not addressed.
Valuation methods	Choice Experiments. Chapter 2 discusses the difference between and limitations of RP and SP data. Chapter 3 describes theoretical choice models, statistical estimation procedures and model outputs.
PG implementation	Chapter 9 presents a step-by-step approach for conducting a choice study and brings the information of previous chapters together. Practical implementation regarding the experimental (factorial) design is discussed in chapter 4, and chapter 5 describes the design of the choice experiment. Chapter 6 and 7 discuss adjusted methods for complex problems (e.g. nested models, non-IID (independently and identically distributed) multiple choice designs). Chapter 8 discusses the advantages of combining SP and RP data.
PG supervision	Not addressed.
Interpretation and use of results	Chapter 9 discusses the use of results for policy analysis, and Chapters 10-12 give examples of applications in marketing, transportation and environmental valuation.
Policy issues	Policy issues regarding the environment include valuation, but also analysis of behaviour towards environmental quality changes are presented in Chapter 12.
KEY ISSUES	
Reliability, validity	Chapter 13 discusses cross validity and external validity to seek regularities in consumer choices. The manual focuses on modelling to satisfy the Independence-from-Irrelevant-Alternatives criterion, full factorial designs, and presents solutions for non-IID models.
BT & MA	Not addressed.
Aggregation	Rules for aggregation of elasticities of choice are listed in chapter 3. Aggregation of value estimates is not addressed.
Spatial cons.	Not addressed.
Risk, Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	Very useful and thorough explanation of the choice model methodology and the econometrics behind modelling. Specific information about water valuation or examples using choice experiments are not included.

4.11 Ward, F.A., D. Beal (2000), Valuing nature with travel cost models, A manual. Edward Elgar Publishing, Cheltenham, UK.

GENERAL	
Goal	Present a self-contained treatment of TCM along with a wide range of applications to natural resource and environmental policy questions.
Format	Descriptive, academic, manual.
Content	The first chapter discusses relevant policy issues that TCM can support; chapter 2 gives a brief overview of TCM until now. Chapters 3-5 discuss demand theory and estimation, theory and measurement of benefits, and different forms of TCM models. Chapter 6-8 discuss implementation issues, questionnaire development and data analysis. The book ends with a chapter on emerging issues and more complicated issues.
Publishing details	Published book, 2 authors, Edward Elgar, Cheltenham, UK. Series: New horizons in Environmental Economics.
Target audience	Environmental politicians with little economic or statistical background.
Language	Academic, normal-advanced reading.
Water related	Not addressed, except in a short paragraph about the effect of water quality and quantity on recreation sites.
WFD/ AQUAMONEY	
Value typology	Different value typologies and TEV shortly listed in chapter 2.
Valuation methods	TCM. Chapter 2 discusses TCM issues such as the value of time, multi-site and multi-purpose trips, effect of substitutes and demographic characteristics, zonal, individual or hybrid TCM, which travel cost to count, visit length effects, site quality, model selection and specification. Limitations of TCM are also described. Chapter 3 discusses model estimation and elasticities; chapter 4 introduces benefits theory concepts and the use of these concepts in complex models.
PG implementation	Chapter 6 describes the design and administration of surveys: survey techniques, questionnaire development, pre-testing and sampling. Chapter 7 discusses the measurement of different types of variables and zoning. Data management and analysis is discussed in chapter 8, including an explanation of regression analysis.
PG supervision	No discussion of terms of reference. Chapter 7 shortly discusses controlling data collection costs.
Interpretation and use of results	Chapter 5 explains different policy choices for which TCM can be used: site management and restoration, pricing, for both single and multi-site analysis.
Policy issues	The book uses CBA as an economic analysis tool for environmental policy analysis.
KEY ISSUES	
Reliability, validity	Some tests of statistical significance are shortly mentioned in chapters 8 and 9.
BT & MA	Short paragraph in chapter 9, but no detailed description.
Aggregation	Short paragraph in chapter 9 discusses zonal versus individual modelling.
Spatial cons.	Short paragraph in chapter 9 discusses the spatial limits of a TCM, travel distances and market areas.
Risk, Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	Very profound yet accessible, general description of TCM, discussing most if not all relevant methodological issues. The book is not water related and does not provide a detailed discussion of the key issues.

4.12 US EPA (US Environmental Protection Agency) (2000), Guidelines for Preparing Economic Analyses, EPA- 240-R-00-003, Washington, DC: US EPA.

GENERAL	
Goal	To establish a sound scientific framework for performing economic analysis of environmental regulations and policies
Format	Prescriptive, policy, guideline.
Content	Chapter 7 (Analyzing Benefits) discusses the economic framework of benefit assessment, benefits analysis process, types of environmental policy benefits, methods for valuation, and ends with an overview of applications to major benefit categories. Accompanying chapters are more policy oriented and deal with the application and use of economic analysis.
Publishing details	EPA, various authors, Washington, D.C. http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html/\$file/Ch6-7.pdf
Target audience	Policy makers and contractors.
Language	Policy, easy-normal.
Water related	No special focus on water. Focus is mostly on human health issues and general ecological benefits.
WFD/ AQUAMONEY	
Value typology	Categories of Benefits: human health (mortality and morbidity), amenities, ecological benefits (market, non-market, indirect ecosystem services, non-use values), material damage.
Valuation methods	Market methods, RP: TCM, RUM, HP (wage and property), AB, COI; SP: CVM, CA/CR, (no CE), BT. Overview, short description and major (dis)advantages. Overview of general benefit categories, service flows and commonly used valuation methods, to guide method choice.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	For each method, a "considerations in evaluating xx valuation studies" section shortly outlines the main issues of debate (e.g. data requirements, modelling issues, validity). Section 7.3 describes a step-by-step "effect-by-effect" approach, use of values in CBA. It also presents some general implementation principles (focus on key issues, policy coordination, double counting, uncertainty, and non-monetized effects).
Policy issues	Chapter 6 discusses social discounting, and chapter 9 deals with distribution and equity issues. Chapter 10 discusses the use of economic analysis in decision-making.
KEY ISSUES	
Reliability, validity	Description of content, construct and criterion validity. Reliability is also implicitly discussed in the "considerations in evaluating valuating studies" sections.
BT & MA	Steps to take and considerations in evaluating/understand Benefit-transfer shortly described, also very brief description of Meta-analysis.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	Risk assessment is discussed related to quantifying the significant physical effects. Uncertainty in valuation estimates can be reduced if many studies of the same effect present the same results. Confidence assessment and uncertainties should be described, focusing on the implications for decision-making. Chapter 5 gives guidance on uncertainty analysis and welfare considerations.
Link with ecology	Not addressed.
OVERALL	Very general, basic introduction to the valuation of benefits of environmental resources/ecosystems. No practical guidelines, not focused on water issues, and little discussion of key issues.

4.13 Bergstrom J.C., K.J. Boyle, G.L. Poe (2001), *The economic value of water quality*, Edward Elgar, Cheltenham, UK.

GENERAL	
Goal	Improve and apply methodology for valuing groundwater quality and testing the potential for benefits transfer as applied to groundwater quality.
Format	Academic, descriptive.
Content	A conceptual model of determinants of economic value of water quality to different individuals is presented, including (objective and subjective) probabilities of contamination. In 4 case studies, issues such as supply and contamination probabilities, importance of information, determinants of groundwater values (especially non-use values), and valuation of enhancements are discussed.
Publishing details	3 Editors, several co-authors presenting case studies. Edward Elgar, Cheltenham, UK.
Target audience	Scientists and water managers. Focus on USA.
Language	Academic (verifiable, abstract), advanced.
Water related	Focus on groundwater quality for safe drinking water. Theory and techniques that can be applied to the specific case of valuing potable water provided by groundwater supplies.
WFD/AQUAMONEY	
Value typology	Chapter 1 defines water quality generally as the commodity to be valued through its uses and services.
Valuation methods	Chapter 1 mentions all general methods, but in the case studies only CVM is used.
PG implementation	Not addressed. Several examples of CVM survey questions are reported.
PG supervision	Not addressed.
Interpretation and use of results	In the conclusions of the case studies, the policy implications and interpretation of the results are outlined. Valuation can be used for CBA, damage assessment, water management.
Policy issues	Specific policy issues not addressed.
KEY ISSUES	
Reliability, validity	Discussed in relation to BT: in some cases transfers may suffice - the expected cost of doing BT (including cost of wrong decision) outweighs cost of new valuation study. Information effects and subjective perceptions tested. Validity needs more research attention
Benefits transfer & Meta-analysis	Two chapters on BT and one on MA. Benefit function transfers preferred above direct transfers in terms of accuracy. Study design is highly important for relative accuracy of BT, and also for MA.
Aggregation	Chapter 5 discusses different aggregation levels and substitution effects, including downstream effects. Chapter 6 discusses aggregation effects and benefit transfer.
Spatial considerations	No discussion on spatial dimension. BT found that credible transfers could be made within, but not across states.
Risk and Uncertainty	Uncertainty conditions are modelled in a utility difference framework to account for probabilities of contamination. In Chapter 2, subjective risk perceptions are tested, chapter 3 tests for uncertainty and information about health risks.
Link with ecology	Chapter 3 presents damage function across nitrate levels.
OVERALL	The book sharpens discussion on several key research questions about CVM valuation. It is very useful for modelling uncertainty issues. It would be useful to translate the summary and conclusions into the practical CVM and BT guidelines, such as including information about contamination probability. The book does not include practical guidelines, and does not discuss other methods than CVM.

- 4.14 Bateman, I.J., R.T. Carson, B. Day, M. Hanemann, N. Hanley, T. Hett, M. Jones-Lee, G. Loomes, S. Mourato, E. Ozdemiroglu, D.W. Pearce, R. Sugden, J. Swanson (2002), *Economic Valuation with Stated Preference Techniques: A Manual*, Edward Elgar, Cheltenham, UK.

GENERAL	
Goal	Detailed overview of how to carry out economic valuation of non-market goods using stated preference techniques (both CE and CVM).
Format	Manual, prescriptive.
Content	It discusses the economic conceptual background, some guidelines for study-commissioners, a typical work plan for a SP study for method choice, description of methods, issues of validity, reliability and aggregation. The book ends with combining techniques and current issues in the SP debate.
Publishing details	Published book, various authors. Edward Elgar, Cheltenham, UK.
Target audience	Policy makers and valuation practitioners.
Language	Academic, normal-advanced.
Water related	Some examples of wetland/water quality studies are mentioned, but no information provided about specific water issues or values.
WFD/ AQUAMONEY	
Value typology	Chapter 1 discusses value issues: TEV and non-use values.
Valuation methods	Mainly CE and CVM, short sections on Contingent Rating and Contingent Ranking, and the combination of SP with RUM/TCM are discussed. Chapter 1 also mentions other techniques and deals with issues of discounting and aggregation. Chapter 3 guides the choice of method.
Practical guidelines on implementation	Chapter 3 guides the identification of target population and sampling- and survey mode. Chapter 4 describes the design of a CV questionnaire, including the management of no-responses versus zero WTP bidders, and the formulation of questions. Chapter 5 prescribes the analysis of CVM data based on the underlying theoretical model. Chapters 6 and 7 discuss the design of a choice experiment from questionnaire development to data analysis. Differences between CE and CV are outlined. Chapter 9 describes different approaches to aggregation. Chapter 10 provides suggestions about the presentation of results. Chapter 12 discusses issues as embedding, WTP versus WTA, and public preferences.
Practical guidelines on supervision	Chapter 2 presents guidelines for commissioners of valuation studies: framing, credibility, costs, choosing a technique, possible combinations with other (valuation) data and analyses.
Interpretation	Chapter 1 mentions CBA, awareness, priority setting, damages, national accounting, and liability.
Policy issues	Shortly in introduction: efficiency versus equity. Chapter 2 discusses the credibility of results.
KEY ISSUES	
Reliability, validity	Chapter 8 discusses reliability and validity of CV studies and gives an overview of potential biases and the types of validity testing (content and construct). Paragraph 2.4.2 gives suggestions on the required level of accuracy, but no guidelines are given. Paragraph 5.4 presents models for testing the validity of WTP values. Chapter 7 includes a paragraph on internal validity of CE.
Benefit Transfer & Meta-analysis	Annex 1.2 describes the basic elements of BT, average and adjusted WTP, MA and value functions, the conditions for valid transfers and criteria for valuation study selection. The book states that reliability of BT should be improved and the motives and context of SP studies need more attention.
Aggregation	Chapter 9 discusses conditions for valid aggregation procedures and presents three approaches: administrative area, ad-hoc zonal, and by non-response and bid functions.
Spatial considerations	Chapter 1 mentions that aggregation can be done over socio-economic groups, geographical units, or generations over time, but only explains the first and the latter.
Risk, Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	Very accessible and practical guideline, both for analysis and commissioning valuation studies.

	One of the best practical guides on SP techniques we found so far, though not specifically linked to water or any other environmental medium, and therefore still somewhat theoretical. Could be used together with (or after reading) DTLR report.
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4.15 T. C. Haab, K.E. McConnell (2002), *Valuing Environmental and Natural Resources, the econometrics of non-market valuation*, Edward Elgar, Cheltenham, UK.

GENERAL	
Goal	To make empirical approaches to non-market valuation available in a single location, covering stated preferences and behavioural approaches, with a focus on the estimation of models for non-market valuation.
Format	Descriptive, academic, manual.
Content	Chapter 1 describes the theory of welfare economics for non-market valuation, Chapter 2-5 are about CV, Chapter 6 and 7 discuss TCM, Chapter 8 is about CE, and 9 about HP. Chapter 10 discusses new developments. The discussion of models is divided into two topics: parameter estimation and welfare measure calculation.
Publishing details	Published book, 2 authors, Edward Elgar, Cheltenham, UK. Series: New horizons in Environmental Economics.
Target audience	Economists (professionals and students) with some knowledge on valuation and econometrics.
Language	Academic, advanced reading.
Water related	No.
WFD/ AQUAMONEY	
Value typology	Not addressed.
Valuation methods	SP: CV, CE. RP: TCM, HP. The book discusses basic parametric models for dichotomous CV, including elicitation formats, NOAA guidelines and RUM (chapter 2), distribution-free models for CV, including the Turnbull model (chapter 3); distribution of WTP and valid WTP estimation (chapter 4); and some topics in discrete choice CV: double-bounded, payment cards, and spike models (chapter 5). The role of time and demand estimation when using TCM are discussed; chapter 7 discusses single site demand estimation and sampling. CE models, nested and conditional, are explained. HP is shortly described, including heteroscedasticity and spatial autocorrelation.
PG implementation	General discussions about parameter estimation (parametric, distribution-free) and data analysis, and welfare measure calculation; steps in implementation are only shortly described. The book gives many examples of case studies to explain the model estimation.
PG supervision	Terms of reference issues not addressed.
Interpretation and use of results	For each model, welfare measure estimation is discussed, but there is no reference to policy issues.
Policy issues	Valuation is used for the efficient allocation of natural resources.
KEY ISSUES	
Reliability, validity	The NOAA panel guidelines are presented in Chapter 2. Chapter 4 outlines three criteria for valid WTP estimation and the statistical problems associated with those criteria.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	Chapter 4 discusses three sources of variation in WTP measures cause uncertainty: randomness of preferences, randomness of estimated parameters and variation across individuals in the sample, and presents approaches to deal with them.
Link with ecology	Not addressed.
OVERALL	The guidelines for choosing a model when using a specific method are very clear and detailed: differences between applicability of models and methods are well explained. The book does not discuss specific water-related issues.

4.16 Pearce, D., D. Moran, D. Biller (2002), *Handbook of Biodiversity Valuation, a Guide for Policy Makers*, OECD Publications, Paris.

GENERAL	
Goal	The handbook focuses on economic aspects of biodiversity valuation to include valuation tools in effective management of biodiversity.
Format	Policy, guideline, descriptive.
Content	The handbook discusses the ways in which value can be attached to biodiversity, and the procedures and results of applying economic values. Biodiversity and its value are explained. The book describes value typologies, their role in decision-making, procedures for eliciting values, and values in time. Chapter 6 explains CBA and chapter 7 through 9 describe valuation methods. Finally, values and their role in the policy process are discussed.
Publishing details	3 authors, published book, OECD. http://www1.oecd.org/publications/e-book/9702021E.PDF
Target audience	Policy-makers and practitioners in management of biodiversity
Language	Policy, advanced.
Water related	Not addressed.
WFD/ AQUAMONEY	
Value typology	Broad discussion of the concept of value from different disciplines (economic, philosophy). Chapter 6 presents TEV and considers both economic and non-economic values.
Valuation methods	Related good, PF, RC (replacement, restoration, relocation preventative), TCM, RUM, AB. SP: CVM, CE, CR. Summary of each method, application in biodiversity valuation, and comments on (dis)advantages. Short comparison of CVM and CE. Chapter 10 presents a valuation flowchart to guide the choice of method related to the change in environmental quality.
Practical guidelines on implementation	The handbook describes the main steps in a simple TCM and the design and analysis of a CVM study referring to the NOAA guidelines.
PG supervision	Not addressed.
Interpretation and use of results	Chapter 6 presents the use of economic values in CBA.
Policy issues	Chapter 10 discusses many different policy contexts for which valuation results can be used: awareness, damage and liability, revising national accounts, setting charges, land use decisions, CBA, cost-effectives of measures, safe minimum standards, assessing biodiversity impacts, priority setting.
KEY ISSUES	
Reliability, validity	The handbook lists various biases in CVM and points at tests for reliability and validity in the literature. Reliability and validity of BT are discussed for BT using TCM value functions.
Benefit Transfer & Meta-analysis	Chapter 9 discusses BT (estimate transfer, function transfer, MA based) and does not consider BT valid enough yet.
Aggregation	Aggregation bias mentioned, but no further explanation provided.
Spatial considerations	Not addressed.
Risk and Uncertainty	The book discusses the risk of ecosystems and resilience. No economic context.
Link with ecology	The book provides links between biodiversity values and ecological consequences (ecosystem functions and resilience), and values biodiversity as a support function. Chapter 2.4 on measuring diversity describes the difference between economics and ecology in trading-off, and difficulty of defining bio-indicators (levels, practical inventory)
OVERALL	Good discussion of value of biodiversity, good argumentation as to why valuing biodiversity is important and how values can be used in decision-making. Information about methods might be enough to interpret the results, but insufficient for implementation, for which practical guidelines are missing.

4.17 DTLR (2002), *Economic Valuation with Stated Preference Techniques, Summary Guide* of Bateman, I., et al. (2002), *Economic Valuation with Stated Preference Techniques*, Edward Elgar, Cheltenham, UK.

GENERAL	
Goal	The aim is to increase the accessibility of SP techniques and to set out what the literature tells about best practice, to promote the use of SP techniques and improve the quality of studies that are undertaken.
Format	Prescriptive, policy, guideline.
Content	Summary of the essential steps for conducting high quality stated preference valuation studies and pointers to how SP work should be approached and the issues that need to be addressed in order to get reliable and credible outputs. After explaining economic value, the guide sets out the valuation techniques, stages of study design, and analysis of the SP data.
Publishing details	DTLR, 2 Editors, Edward Elgar, Cheltenham, UK. www.odpm.gov.uk/embedded_object.asp?id=1142274
Target audience	Policy community, including those who commission or manage valuation studies and need to understand the nature and quality of the results. It is useful to the non-specialist and anyone else who needs to understand the results of stated preference studies. Written for the British policy community, but also useful for other countries.
Language	Policy, normal-advanced.
Water related	Not specifically related to water or the environment in general.
WFD/ AQUAMONEY	
Value typology	TEV.
Valuation methods	SP: CVM and CE. Other techniques (RUM, HP, AB) are only mentioned. The differences between CV and CM are outlined.
Practical guidelines on implementation	The book discusses designing and testing questionnaires (choice of survey method, identifying target population, choosing sample), and analysing the data (issues of validity and reliability, aggregation and reporting).
PG supervision	Guidelines are given to manage and control outsourcing a SP-study (steering groups, policy context, time and money constraints)
Interpretation and use of results	The book states that valuation results can be used for CBA, cost-effectiveness analysis, MCA. Drawbacks of methods for different uses are discussed. No further guidelines on actual use of results for different uses are provided.
Policy issues	Not addressed.
KEY ISSUES	
Reliability, validity	Chapter 14 presents tests of validity to check for biases (content, construct, convergent, and expectations based, survey design issues), and discusses reliability, but not possible acceptable reliability levels in practical implementation - only in BT context.
Benefit Transfer & Meta-analysis	Chapter 6 discusses BT and lists conditions for satisfactory BT. Brief description of the use of MA.
Aggregation	Chapter 15 discusses sampling problems and definition of the relevant population.
Spatial cons.	Section 15.13 mentions goods with a spatial dimension - related to aggregation.
Risk and Uncert.	Not addressed.
Link with ecology	Not addressed.
OVERALL	The guidelines related to supervising the process and interpreting the results are excellent, but the book does not give enough information to enable someone to carry out and analyze a practical SP study on his own. Given the summary nature of the book, not much detail about methodological key-issues is provided, but this can be found in the companion manual (Bateman et al. 2002), which also provides a more comprehensive and detailed guidance on the statistical procedures.

4.18 Freeman, A.M. III (2003), *The measurement of environmental and resource values, Theory and methods*, Resources for the Future, Washington, D.C.

GENERAL	
Goal	Provide an introduction and overview of the principal methods and techniques of resource valuation and give an up-to-date reference on recent developments in the theory and methods underlying the practice of resource valuation.
Format	Descriptive, academic, manual.
Content	Chapter 1-4 are the theoretical introduction to welfare measurement, economic theory and revealed preference methods. Chapter 5 and 6 discuss nonuse values and stated preference techniques. Chapter 7 and 8 go deeper into time and risk issues. Chapter 9-13 present applications of different methods applied in the area of productivity, health, housing, and recreation.
Publishing details	Published book, 1 author, Resources for the Future, Washington, D.C., USA.
Target audience	Professional economists, graduate students, practitioners in the field.
Language	Academic, advanced reading.
Water related	No, but water quality valuation is often used as an example.
WFD/ AQUAMONEY	
Value typology	Chapter 2 relates values to direct and indirect uses; Chapter 5 discusses nonuse values.
Valuation methods	RP: TCM, RUM, HP, hedonic wages, DCA, COI, AB. SP: CV, CR, CE. TCM, Hedonic pricing and wages and CV and the economic models underlying these methods are well explained, as well as their limitations and advantages.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	Chapter 9-13 relates different policy issues to applicable methods, the limitations of these methods and the interpretation of the results, and the differences between RP and SP data.
Policy issues	Chapter 1 shortly describes the role of economic valuation in public policy. Chapter 3 discusses social welfare and aggregation.
KEY ISSUES	
Reliability, validity	Chapter 6 discusses content, criterion, construct and convergent validity of SP welfare measures. Reliability is not discussed.
BT & MA	Chapter 14 describes BT and MA, but does not give implementation guidelines.
Aggregation	Chapter 7 discusses aggregation of values across time and generations and aggregation of WTP values for purposes of social welfare analysis under uncertainty. No discussion about aggregation over space.
Spatial cons.	Chapter 11 discusses spatial scale of socioeconomic data and mentions spatial interdependence related to property values and HP.
Risk and Uncertainty	Chapter 8 presents expected utility theory, the effect of risks on welfare changes, and the implications of risk and uncertainty for policy analysis and CBA.
Link with ecology	Not addressed.
OVERALL	The economic principles of economic valuation (theory and methods) are well described. The chapters on risk and uncertainty, aggregation and social welfare are very detailed. The book does not give much guidance on implementation and supervision and does not focus on specific water-issues.

- 4.19 Wedgwood, A., K. Sansom (2003), *Willingness-to-pay surveys – A streamlined approach, Guidance notes for small town water services*. Leicestershire, UK: Loughborough University, Water, Engineering, and Development Centre.

GENERAL	
Goal	The purpose of the guidelines is to promote the facilitation of high-quality contingent valuation surveys in small towns to be used in decisions concerning improved water supply systems.
Format	Prescriptive, policy, manual.
Content	These guidelines describe a framework and good practice for conducting a reasonably robust CVM survey and cover how the data obtained could be used. After introducing CV and the planning process in chapter 1, chapter 2 discusses survey preparation and the valuation context, chapter 3 guides the implementation in the field, and chapter 4 discusses data analysis and interpretation. Chapter 5 is concerned with how to use the WTP and consumer survey results effectively.
Publishing details	2 authors, WEDC, Loughborough University, Leicestershire, UK. http://www.schoolsanitation.org/Resources/Readings/Willingness%20to%20Pay.pdf
Target audience	Researchers, government staff, water sector managers and other practitioners based in developing countries and working in the water and sanitation sector.
Language	Popular-policy, easy.
Water related	Mostly on municipal water supply in developing countries.
WFD/ AQUAMONEY	
Value typology	Not addressed.
Valuation methods	Only CVM.
Practical guidelines on implementation	Chapter 2 outlines the survey design, sampling, scenario development and elicitation method.
Practical guidelines on supervision	Chapter 1 gives a short overview of planning process and costs. Chapter 3 addresses management issues of implementing a survey, training, timing, the role of a field manager.
Interpretation and use of results	Chapter 4 discusses cleaning data, validity and reporting.
Policy issues	Valuation is used for decisions concerning the type, scale and cost of improved municipal water supply schemes, ensuring cost-recovery, tariff setting, technical design options, institutional arrangements, subsidies, etc.
KEY ISSUES	
Reliability, validity	Discusses biases (strategic, hypothetical, information, starting point, interview and compliance, payment method) and how to avoid them in survey preparation, and check them in data analysis. States that econometric reliability checks are more important in big town samples than in small towns.
BT & MA	No, only statement that it is difficult to apply number of towns to village level.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	Simple, down-to-earth approach to CV and how to use CV in policy processes to assess public support, but only focused on developing countries and small town municipal water supply. The book uses CVM as a consumer survey and is not so much concerned with econometric analysis. It does not give much guidance on the econometric analysis, nor does it deal with key issues in great detail.

4.20 Champ, P., K.J. Boyle, T.C. Brown, (eds.) (2003), *A primer on nonmarket valuation*, Kluwer Academic Publishers, Dordrecht, Netherlands.

GENERAL	
Goal	The book gives a thorough understanding of how to design and implement a non-market valuation study, and how to analyze the data and estimate values.
Format	Prescriptive, guideline.
Content	The book focuses on non-marketed environmental goods and services of all types of environments. The first three chapters provide background on the policy context, the economic theory of non-market values and collecting valuation data. The valuation methods are presented in two sections, one section on SP and the other on RP. The last part of the book goes into the usefulness of non-market valuation for Benefit Transfer, and in policy decisions. It explicitly suggests literature for further reading, and websites with further information and tools.
Publishing details	3 Editors, Published book, Kluwer Academic Publishers, Series: the Economics of Non-Market Goods and Resources, Series Editor: Ian Bateman.
Target audience	Policy makers, attorneys, students. Main focus on US and Canada.
Language	Academic, normal.
Water related	All types of environments
WFD/ AQUAMONEY	
Value typology	Value description is scattered. Chapter 1 quickly describes types of environmental services: classification based on media, on channel that affects human wellbeing (marketed or non-marketed goods), or on direct vs. indirect use. The concept of non-marketed goods is explained in chapter 2, while chapter 3 describes passive/non-use values.
Valuation methods	RP: TCM, HP, Defensive behaviour and damage cost methods. SP: CVM, attribute-based methods (CE), method of paired comparison. No clear guidance on which method to use for what good/service. Chapter 14 states that RP methods have much content validity, but suffer from data availability, variation in data, extrapolation problems; CVM is therefore necessary. RP methods do not have enough application possibilities (recreation, partial analysis of some quality changes in some cases).
Practical guidelines on implementation	Chapter 3 elaborates survey development and data collection applicable to RP and SP studies, with step-by-step guidance (tables) for measurement of values and conducting studies.
PG supervision	Supervision or commissioning the study process are not explicitly described.
Interpretation and use of results	The use of results briefly discussed in Chapter 13 based on a number of studies, including one on water quality. Valuation results are used for CBA.
Policy issues	Failure to include equity and fairness issues is regarded as a major limitation to the economic approach.
KEY ISSUES	
Reliability, validity	Chapters 4 and 5 discuss validity of CV studies. Chapter 4 presents the theoretical 3Cs (criterion, content and construct validity), Chapter 5 discusses tests of criterion validity and non-incentive compatibility, CV question format; scope effects and survey design. Validity of choices in multiple-good valuation is shortly discussed. Chapter 14 gives overview of content, criterion and convergence validity of methods, applications and approaches. Content validity control questions are formulated for CVM studies. It is pointed out that more RP validity criteria should be developed. Less discussion on theory or results of criterion and construct validity.
Benefits transfer & Meta-analysis	Chapter 12 discusses different methods of BT: value transfer (point, central tendency, and administratively approved estimate), function transfer (including a well-described meta-regression analysis function transfer). The information should be enough to critique a BT/MA study.”
Aggregation	Not addressed.
Spatial considerations	Spatial considerations are described in relation to hedonic methods. Test for the two main issues (spatial dependence (autocorrelation) and spatial heterogeneity in software packages, and GIS use for spatial referencing are shortly discussed. No results or examples of practical

	application are given.
Risk and Uncertainty	Chapter 1 discusses choice making under uncertainty. Advice is to compare upper and lower bound value estimates, although this ignores quality of results, or to use probability analysis and present uncertainty intervals.
Link with ecology	Not addressed.
OVERALL	The advantage of this book lies in its practicality, especially regarding the survey and data collection set-up. It recognizes many of the key issues and discusses some of them. Disadvantages are (1) the lack of (clearly presented) case studies, comparisons or actual questionnaires, (2) more guidance is needed regarding choice of valuation method, scenario development, and uncertainty, (3) some issues are scattered over several chapters. For CV and TCM it is very useful; its usefulness for CE application is limited.

4.21 World Bank (2004), Assessing the Economic Value of Ecosystem conservation, Washington, DC: World Bank.

GENERAL	
Goal	The paper seeks to clarify how valuation should be conducted to answer specific policy questions regarding the value of ecosystems. The aim is not to provide detailed instructions on how to undertake valuation studies of ecosystem services or apply valuation techniques, but to frame the valuation question properly.
Format	Policy document, prescriptive, guideline.
Content	Chapter 2 describes the importance of ecosystem services, Chapter 3 gives an overview of the main valuation techniques, Chapters 4-7 discuss the 4 aspects of the value of ecosystems: the value of total flow of benefits, the net benefits of interventions that alter ecosystems, the distribution of costs and benefits, potential financing sources for conservation. Chapter 8 lists common pitfalls and describes the limits and potential of economic valuation. Chapter 9 presents 10 case studies.
Publishing details	Pagiola, S., K. von Ritter, J. Bishop, Environment Department Paper, No.101 http://econwpa.wustl.edu/eps/othr/papers/0502/0502006.pdf
Target audience	Politicians in conservation.
Language	Policy, normal.
Water related	Not specifically. Chapter 2 gives an overview of the main ecosystem types and their services, following the typology of the Millennium Ecosystem Assessment. There are some references to water studies, and some examples of water-related benefits studies.
WFD/ AQUAMONEY	
Value typology	Chapter 3: TEV. Considers many non-use values, identification of benefits (to improve systematic valuation), and also costs of conservation.
Valuation methods	PF, COI, RC, TCM, HP, CV, CM and BT. Chapter 3 gives a short overview of the main economic valuation techniques, their approach, applications, data requirements and limitations. The book warns for misuse of RC and BT.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	Chapter 8 presents a list of common pitfalls of valuation studies: use net benefits; include opportunity costs; don't use RC/BT, unless ...; don't use value estimates based on small changes in service availability to assess the consequences of large changes; avoid double-counting; don't include global benefits for national studies; adjust for price distortions; avoid spurious precision; submit results to sanity checks.
Policy issues	The four aspects (approaches) are related to specific policy issues. Social value of ecosystems and Adjusted Net Savings, efficient intervention (CBA of decisions), equity and distribution, and funding of conservation.
KEY ISSUES	
Reliability, validity	Not addressed.
Benefit Transfer & Meta-analysis	Chapter 4 mentions BT and warns for un-systematic, un-representative studies, studies that ignore interrelations between benefits, and use incompatible units. Advice: only use BT when context of the original valuation is extremely similar. Meta-analysis is not addressed.
Aggregation	Not addressed.
Spatial considerations	Considerations: distance and impact (upstream-downstream), location and impact, distribution of benefits (across national borders, across stakeholders upstream-downstream), scale and applicability of prices. No guidelines.
Risk and Uncertainty	It is stated that measuring benefits can narrow the uncertainty over the net effect of the proposed intervention.
Link with ecology	Not addressed.

OVERALL	Practical and to-the-point guideline for framing the valuation question and using valuation studies in different types of policy decisions. Clear outline of economic benefits of ecosystem services and impacts on valuation. No practical guidelines for the implementation/supervision of valuation studies.
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4.22 Emerton, L., E. Bos (2004), Value: counting ecosystems as an economic part of water infrastructure, Gland, Switzerland and Cambridge, UK, IUCN.

GENERAL	
Goal	The book presents techniques for the valuation of ecosystem services, the incorporation of their results in decision-making, how to generate persuasive arguments for more sustainable and equitable development decisions in water resources management.
Format	Descriptive, policy guideline.
Content	The book starts off by stressing the importance of different ecosystem services in water management and making the benefits of those services explicit, using a TEV framework. Chapter 3 describes different valuation techniques and the applicability and limitations of economic valuation. Chapter 4 presents a step-by-step approach to include valuation in water management. Chapter 5 describes the political context of valuation and strategies to include valuation in decision-making. The book includes many case studies, mostly from developing countries.
Publishing details	2 authors, IUCN Publication Services Unit, 2004 www.waterandnature.org
Target audience	Water & Environmental Managers, developing countries.
Language	Popular (illustrative), easy.
Water related	Focus on forest and wetland ecosystems related to water and all its water services, presented in a list.
WFD/ AQUAMONEY	
Value typology	Chapter 2: TEV, with short list of services related to use and non-use values.
Valuation methods	RP: MP, PF, TCM, HP. Cost-based approaches: RC, MC, AC, DCA; SP: CVM, CA, CE. Basic introduction, data collection and analysis requirements, and applicability, general strengths and weaknesses. Advice on which method can measure what kind of service.
PG implementation	No guidance on implementation, no examples of surveys.
PG supervision	Not addressed.
Interpretation and use of results	No information about interpretation of results. Many examples are given how to use valuation. Chapter 4 presents a step-by-step approach to use ecosystem valuation to generate information for decision-making, in CBA and other economic decision-support tools.
Policy issues	Chapter 5 discusses communication to maximise the impact of valuation on decision-making, political agendas and stakeholders. No discussion of equity or water pricing.
KEY ISSUES	
Reliability, validity	Not addressed.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial considerations	Not addressed.
Risk and Uncertainty	Chapter 3 mentions that valuation can only provides estimates depending on ecological, hydrological institutional and social aspects of ecosystem management.
Link with ecology	Chapter 4 describes bio-economic models, but no bio-indicators.
OVERALL	Good communication tool. Good introduction to valuation of ecosystem services. Information about techniques and models is too short and general to be useful for practical implementation.

4.23 Turner, K., S. Georgiou, R. Clark, R. Brouwer (2004), *Economic valuation of water resources in agriculture, From the sectoral to a functional perspective of natural resource management*, FAO, Rome.

GENERAL	
Goal	The purpose of the report is to produce a review of water resource valuation issues and techniques specifically for the appraisal and negotiation of raw water resource allocation for agricultural development projects.
Format	Policy, guideline, descriptive.
Content	First, the role of water in agricultural development and water as an economic good are discussed. A framework for multidisciplinary analysis of water allocation options to include economic values is presented, describing ecosystem functioning at catchment scale, based on six generic principles. Chapter 3 describes the economics of water allocation and policy. Chapter 4 describes valuation methods and the use of results.
Publishing details	Several authors, FAO, Rome (2004) http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5582e/y5582e00.htm
Target audience	Agriculture policy makers and managers.
Language	Academic (abstract), advanced.
Water related	The use of surface and ground water, with special attention to agricultural uses. Presents list of impacts of water resource functions on human welfare and uses, valuation techniques used in water studies, and an overview of existing water related valuation studies.
WFD/ AQUAMONEY	
Value typology	Presents general framework for valuation, links ecosystem functioning to associated socio-economic benefits. Based on TEV. Role of water resources in natural systems and important aspects of the ecology of natural systems, which are not included in TEV, introduces Total Systems Value.
Valuation methods	MP, derived demand, PF. RP: HP, TCM, DCA, RC, Dose-response. SP: CV, CR. Summary of valuation techniques, their application use/indirect/non-use values, their pros and cons, and current issues of debate.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation and use of results	The practical issues concerning economic valuation are listed: scale, aggregation and double counting, time, risk and uncertainty, irreversible change, data limitations.
Policy issues	Agriculture (irrigation, food security, poverty), CBA, cost-effectiveness, allocation, pricing, modification of national accounts, priority setting, project evaluation.
KEY ISSUES	
Reliability, validity	Mentioned for CV (biases description), BT and MA, but no guidelines or tests provided.
Benefit Transfer & Meta-analysis	Under Environmental value transfer, Chapter 4 lists criteria for selection of useful studies listed, and shortly explains three broad approaches: average value estimates, adjusted average value, value function. MA is shortly described, including its (dis)advantages
Aggregation	Chapter 4 shortly discusses aggregation issues related to double counting of benefits of ecosystem functions, mutually exclusive functions and interacting functions.
Spatial considerations	Taking an extended spatial and temporal perspective is one of the six principles. Chapter 4 discusses the scale of valuation studies and mentions distance-decay of non-use values.
Risk and Uncertainty	Different sources of risk and uncertainty described in Ch4: physical outcomes and economic consequences, and future conditions. Mentions sensitivity and scenario analysis, Safe Minimum Standards, and incorporating risk by attributing probabilities to possible outcomes. No guidelines or examples.
Link with ecology	Not addressed.
OVERALL	Strong theoretical framework, gives good guidance on how to identify and incorporate all relevant benefits of water ecosystems. Useful overview of the practical issues concerning economic valuation. The book provides neither practical guidelines, nor examples and therefore

	remains rather theoretical.
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4.24 National Research Council (2004), Valuing Ecosystem Services, Toward Better Environmental Decision-Making, National Academy Press, Washington, DC.

GENERAL	
Goal	Evaluation methods for assessing the economic value of the goods and services provided by aquatic and related terrestrial ecosystems, in order to contribute to a better understanding of the nature of aquatic and related terrestrial ecosystems, how human actions may affect them, and what value society places on the services of regulatory agencies.
Format	Academic and policy, guideline, descriptive.
Content	The report starts with the meaning of value in environmental policy decision-making. It gives an overview of aquatic ecosystems, their structure and function, goods and services. Chapter 4 discusses the economic approach to valuation and methods for non-market valuation and their application. Chapter 6 presents issues of judgment, uncertainty and valuation.
Publishing details	National Resource Council, National Academies Press, Washington DC. http://www.nap.edu
Target audience	Resource managers and policymakers, USA.
Language	Policy, advanced.
Water related	The report focuses on aquatic ecosystem and related terrestrial ecosystems, mostly on freshwater and estuarine systems, eschewing marine and groundwater systems. Chapter 2 describes the key elements of aquatic ecosystems, how issues of scope, system dynamics, intrinsic value and incomplete knowledge influence economic valuation, and presents lists of services and goods.
WFD/ AQUAMONEY	
Value typology	TEV related to aquatic ecosystem services. TEV is regarded as a framework to identify all relevant goods, services and functions, and corresponding value components. Chapter 5 distinguishes between the valuation of one or multiple ecosystem services, and total ecosystem valuation.
Valuation methods	RP: RUM, TCM, HP, AB, PF (dose-response). SP: CVM, CE. The report states that Replacement and Restoration Cost Methods should be used with great caution if at all. The main advantages and limitations, and applicability to water benefits of the methods are discussed. It states that Choice Experiments are very promising, but does not provide any guidelines on the methods.
PG implementation	Not addressed.
PG supervision	Not addressed.
Interpretation	Mostly CBA. Case studies of drinking water supply, also flood protection to illustrate use of results.
Policy issues	Discounting over time, damage assessment, and liability are discussed. The report states that policy context influences the framing of the policy question and therefore the valuation results.
KEY ISSUES	
Reliability, validity	The report states that the validity of conjoint estimates of value, and the level of acceptable accuracy of SP are relatively unexplored areas of research. Scope validity is discussed related to SP.
Benefit Transfer & Meta-analysis	The report states that BT should only be used with caution and following appropriate guidelines. No guidelines are given. No discussion of MA.
Aggregation	Discussed in relation to scale, the report states there are no simple rules for aggregating values from small to larger scales, and danger of double-counting exists.
Spatial considerations	Discussion of scale, interrelations, spatial heterogeneity (and limitations to BT), complementarity and substitutability, upstream-downstream effects. Spatial scale has two dimensions: spatial boundaries of ecosystem and spatial delineation of relevant population.
Risk and Uncertainty	Chapter 6 contains issues of judgment and reporting, risk aversion, ambiguity and probability, model and parameter uncertainty. Adaptive management, decision criteria under uncertainty (maximin, safe minimum standards, precautionary principle) and treatment (monte carlo simulation) are discussed.
Link with ecology	Integrating ecologic and economic models and knowledge is stressed, but no practical guidelines are provided or recommendations given related to the use of bio-indicators.

OVERALL	The most interesting contributions of this book are the discussion of judgment and uncertainty (chapter 6), the checklist for valuation (chapter 7), the focus on freshwater, ecology and valuation issues (thresholds, partial valuation) and the discussion about discounting (utility vs. consumption).
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4.25 Dumas, C.F., P.W. Schuhmann, J.C. Whitehead (2004), *Measuring the Economic Benefits of Water Quality Improvement with Benefit Transfer: An Introduction for Non-Economists*, Working Papers 04-12, Department of Economics, Appalachian State University.

GENERAL	
Goal	Provide a primer on economics of water quality valuation and an example of benefits transfer.
Format	Descriptive, academic, guideline.
Content	The report provides an introduction to water quality benefit estimation for non-economist. The report discusses the economic non-market benefits of water quality, the economic theory behind the methodology of valuation. It describes and compares TC, CV, (RUM) and the outcomes of benefit transfer, illustrated with a case study.
Publishing details	Dept. of Economics, Appalachian State University, Working Papers 04-12 (2004) http://econ.appstate.edu/RePEc/pdf/wp0412.pdf
Target audience	Non-Economists.
Language	Academic (verifiable), normal.
Water related	Focus on water quality and urbanisation, and in-stream benefits.
WFD/ AQUAMONEY	
Value typology	Does not mention TEV, but uses categories of use and non-use, and makes distinction between withdrawal benefits and in-stream benefits. Explains public good characteristic of water quality.
Valuation methods	Focus on non-market techniques. RP: TCM, RUM, AB, HP, SP: CV, CA, and BT (function and value). Short description of technique and strengths and weaknesses. Advice about which method to use for what benefit.
PG on implementation	No details on implementation, nor on survey design.
PG on supervision	Not addressed.
Interpretation and use of results	Compares the BT results of different methods. No guidelines provided.
Policy issues	Not addressed
KEY ISSUES	
Reliability, validity	Mentioned, no guidelines provided though.
Benefit Transfer & Meta-analysis	BT description, discussion of four different BT methodologies put in water context: point estimate and function transfer, MA and preference calibration transfer. Presents case study with BT (function and estimate of TCM, HP and CVM values). MA description, discussion of MAs of water values, 3 major weaknesses.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk and Uncertainty	BT is considered an acceptable approach to obtain order of magnitude estimates of benefits. Discussion of costs of wrong policy decisions and claim that in many cases these costs will be small and BT is preferred.
Link with ecology	Only link changes in aquatic system parameters, such as fish population - being the underlying cause - with a change in economic benefits.
OVERALL	Good introduction to water economics. Very useful information about BT. No practical guidelines for supervision or implementation.

4.26 Hensher, D.A., J.M. Rose, W.H. Greene (2005), *Applied Choice Analysis, a Primer*, University Press, Cambridge, UK.

GENERAL	
Goal	Provide an introduction to the main techniques of choice analysis and detail on themes such as data collection and preparation, model estimation and interpretation, and design of choice experiments.
Format	Descriptive, academic guideline.
Content	The first part of the book discusses the basic topics, e.g. the basics of statistics, choice theory, paradigms of choice data, processes in setting up stated choice experiments, data collection, analysis of data using NLOGIT software, modelling and practical issues. Part II discusses advanced topics: similarity of alternatives and nested logit estimation, mixed logit models and their estimation.
Publishing details	Published book, 3 authors, Cambridge University Press, UK.
Target audience	Students, researchers and experts in Choice Analysis.
Language	Academic, normal-advanced reading.
Water related	Not specifically.
WFD/ AQUAMONEY	
Value typology	Not addressed.
Valuation methods	Choice Experiments. Paragraph 10.6 discusses measures of WTP.
PG implementation	Part I (chapter 2-12) is focussed on implementation: processes in setting up stated choice experiments, including experimental design (chapter 5), data collection and questionnaire development (chapter 6). NLOGIT is used for data analysis, model and parameter estimation (chapters 7 and 8, 10 and 11).
PG supervision	Not addressed.
Interpretation and use of results	Chapter 11 presents methods to get as much information out of the model as possible. Chapter 12 discusses the practical implementation of choice models, e.g. from forecasting to developing a decision support system.
Policy issues	Not addressed.
KEY ISSUES	
Reliability, validity	Not addressed specifically.
BT & MA	Not addressed.
Aggregation	Not addressed.
Spatial cons.	Not addressed.
Risk , Uncertainty	Not addressed.
Link with ecology	Not addressed.
OVERALL	This book provides a very practical guideline to choice analysis and enables the reader to implement a basic Choice Experiment. The use of statistical software is also well guided. The manual is not water or environment related and does not discuss key issues that come along with valuing water or any other environmental resource.

4.27 Young, R. (2005), *Determining the economic value of water: concepts and methods*, Resources for the Future Press, Washington, D.C.

GENERAL	
Goal	Introduction to the application of welfare economics principles to the measurement of economic benefits in the context of assessing water-related policies and provide a consistent conceptual foundation for comparing the economic values of water across alternative uses and with costs of investments.
Format	Descriptive, academic, manual.
Content	Part I describes the role of economics in water policy context, the conceptual framework and special problems in water valuation, methods for valuing producers uses of water and applied methods of valuation of water as environmental public goods. Part II describes the applications of valuation methods for water used in irrigated crop production, by industry, in municipal uses, and valuation of a selection of water-related public goods.
Publishing details	Published book, 1 author, Resources for the Future, Washington, D.C., USA.
Target audience	Professional economists (field practitioners and advanced students).
Language	Academic, advanced reading.
Water related	Yes, with emphasis on offstream and private good issues, and on direct benefits.
WFD/ AQUAMONEY	
Value typology	Chapter 2 presents different types of water values: long-run versus short-run values, at-site versus at-source values, per period versus capitalized values, and use, nonuse and total economic value.
Valuation methods	Chapter 2 lists inductive and deductive methods, their characteristics and uses. Inductive: MP, PF, TCM, HP, AB, MC, DCA, CVM, CE (and compares CVM and CE), BT, MA. Deductive: Basic Residual Method, Change in Net Rents, Mathematical Programming, Value-added, Computable General Equilibrium Models, Alternative Cost. Chapter 3 and 4 describe the methods and their advantages and limitations into more detail, separating between the valuation of private (producers) and public goods.
PG implementation	Brief overview of model estimation, steps in implementation.
PG supervision	Terms of reference are not addressed.
Interpretation and use of results	Chapter 1 describes the role of economic valuation in water management. Part II addresses the different policy areas for application: municipalities, industry, agriculture, and public good aspects (health, flood protection, recreation).
Policy issues	Chapter 1 mentions alternative viewpoints other than neoclassical economics, but CBA is the main economic evaluation technique used throughout the book
KEY ISSUES	
Reliability, validity	Not specifically addressed.
BT & MA	Short (4 pages) overview in Chapter 4 on BT, benefit function transfer and MA
Aggregation	Only mentioned related to residual method.
Spatial cons.	Not addressed.
Risk and Uncertainty	Chapter 1 shortly describes sensitivity analysis to deal with uncertainty. Chapter 8 discusses issues of health risks shortly and goes somewhat deeper into the measurement of benefits of flood risk reduction.
Link with ecology	Not addressed.
OVERALL	Comprehensive overview of approaches, value types and methods for water valuation. Description of methods is not enough to guide implementation. Very interesting for areas where competition over water resources among producers is the main problem.