

**Assessment of the efficiency of the water
footprinting approach and of the
agricultural products and foodstuff
labelling and certification schemes**

ENV.D.4/SER/2010/0051r

**Final Report:
Part A - Assessment**

**Prepared for
DG Environment**

RPA

September 2011

Assessment of the efficiency of the water footprinting approach and of the agricultural products and foodstuff labelling and certification schemes

Final Report – Part A: Assessment

prepared for

European Commission
Directorate-General Environment

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RPA REPORT - ASSURED QUALITY	
RPA Project: Ref	J735
Approach:	In accordance with Project Specifications and Meeting Discussions
Report Status:	Final Report
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Report approved for issue by:	Meg Postle, Director
Date:	27 September 2011

EXECUTIVE SUMMARY

1. INTRODUCTION

This report summarises the findings of research carried out for the European Commission (DG Environment) in preparation for the 2012 review of the water scarcity and drought policy, and the development of a Blueprint for EU water. It is one of a series of related studies, including a review of the first tranche of River Basin Management Plans, the review of water scarcity and an assessment of vulnerability in the context of climate change.

The aim of this study is to help inform the Commission in its development of policy regarding the definition and application of water footprinting and virtual water measurements. This includes considering the use of these tools for both internal EU policy and in relation to EU external water policy. The study also seeks to provide specific recommendations for product labelling and certification schemes relating to the sustainable use of water in the production process of agricultural products and foodstuffs to strengthen the development of the existing EU guidelines on best practice for certification schemes.

2. OBJECTIVES

The overall objective of this study has been:

“to provide concrete input into how the use of water footprinting and virtual water measurements, as well as agricultural products and foodstuff labelling and certification schemes, could be reliably used in water scarcity and droughts policy planning and implementation”.

The work carried out in relation to the above objective has been divided into two related Tasks:

- **Task 1 – Virtual water and water footprinting approaches:**
 - review the current applications of water footprinting and virtual water approaches;
 - identify best practice examples of practical applications of water footprinting in policy making from around the world;
 - develop proposals on if and how the water management related information presented by these approaches could be applied in policy making; and
- **Task 2 – Water management related information in agricultural product and foodstuff labelling:**
 - examine the current use of water management related information in food and agricultural product labelling and certification schemes;
 - identify the most suitable schemes for providing information on water use;
 - specify recommendations for certification schemes regarding the efficient use of water resources.

3. APPROACH

Our approach to the study was based upon the two tasks described above, with the work carried out as shown in Table 1 This study comprises two Reports, with this Report (Part A) primarily focussed on actions undertaken under Task 1. The Part B Report primarily focuses on actions carried out under Task 2.

Table 1: Approach			
Task 1			
	Task	Actions	Reporting
1A	Review the current applications of water footprinting and virtual water approaches	Data Collection, Literature Review and Stakeholder Consultation	Part A Report
1B	Identify best practice examples of practical applications of water footprinting in policy making from around the world	Identification of Best Practice Examples	Part A Report
1C	Develop proposals on if and how the water management related information presented by these approaches could be applied in policy making	Policy Options and Option Groups	Part A Report
		Impact Assessment	Part A Report
Task 2			
	Task	Actions	Reporting
2A	Examine the current use of water management related information in food and agricultural product labelling and certification schemes	Data Collection, Literature Review and Stakeholder Consultation	Part A Report, Part B Report
2B	Identify the most suitable schemes for providing information on water use	Data Collection, Literature Review and Stakeholder Consultation	Part A Report, Part B Report
		Identification of Best Practice Examples	Part B Report
2C	Specify recommendations for certification schemes regarding the efficient use of water resources	Review of key requirements for a certification scheme	Part B Report
		Review of Minimum Criteria for Sustainable Water Use in Existing Certification Schemes.	Part B Report
		Recommendations	Part B Report

4. WATER FOOTPRINT / VIRTUAL WATER

4.1 Definition

In our opinion, there is no agreement regarding the definitions of “virtual water” or “water footprint”, with both being the subject of debate amongst those interested in this field.

The term “**virtual water**” (VW) is generally used to refer to the sum of water used or incorporated in the various steps of the production processes of a commodity. It is mainly used in the context of international trade: a country producing and exporting water-intensive products is exporting water in its virtual form. It has been suggested that international trade could be used to move “virtual water” from comparatively advantaged regions to regions where water is scarce, thereby creating a means for water-poor countries to achieve water security (Allan, 2003). Conversely, such a trade also allows water-rich countries to benefit economically from their natural resources.

The term “**water footprint**” (WF) has been used as a measure of a nation’s actual appropriation of global water resources and has been defined as the “*sum of the domestic water use and net virtual water import*” (Hoekstra and Hung 2002). Some studies have used the concept to refer to water appropriation by individuals and other well-defined groups of consumers, (e.g. a city, a region or a state) and producers (e.g. a public organization, private enterprise or economic sector). The WF of an individual, business or nation has, therefore, been defined as the total volume of fresh water that is used to produce the goods and services consumed by an individual, business or nation (Hoekstra and Chapagain, 2004). Somewhat confusingly, the term WF has also been used to describe the VW content of a range of commodities and products (e.g. cotton, tea and bio-energy) summed over their life cycle.

It is generally agreed that both VW and the WF are measures of direct and indirect water consumption and only account for freshwater appropriation. It has been suggested that an important distinction between the two concepts is that a WF “*does not simply refer only to a water volume, as in the case of the term ‘virtual water content’ of a product*”, instead the WF is a “*multidimensional indicator, not only referring to a water volume used, but also making explicit where the water footprint is located, what source of water is used and when the water is used*” (Hoekstra et al., 2011).

4.2 Calculation

There are currently three approaches being applied for the calculation of a water footprint:

- **the volumetric approach**, which is based on an assessment of the volume of water associated with a particular production activity;

- **the stress weighted approach**, which is based on an assessment of the amount of freshwater consumed in a production activity combined with an assessment of the implications of that consumption in terms of water stress; and
- **life cycle assessment approaches**, which draw on estimates of water consumption using an inventory analysis similar to that of the volumetric approach but also including an element of impact assessment.

Volumetric Water Footprint Assessment

There are essentially two approaches to calculating a volumetric WF. Process-based or bottom-up approaches use individual production processes as their building blocks to calculate the WF, while top-down approaches use environmental input-output analysis. A key concept in the calculation of a volumetric WF is the ‘colour of water’. While most work on VW has considered all water together, most WF work has differentiated between ‘Blue’, ‘Green’ and ‘Grey’ water:

- **Blue water**: surface and groundwater;
- **Green water**: rainwater that is stored in the soil as soil moisture and which is available for the growth of plants; and
- **Grey water**: the volume of freshwater that is required to dilute polluted wastewater to ambient water quality standards.

Some studies have gone further to disaggregate green water into ‘net green’ water to account for the fact that even without cultivation, naturally occurring vegetation (e.g. forestry) provides a substantial evaporative demand. **Net green**, therefore, refers to the difference between evapotranspiration under cropped conditions and evapotranspiration under natural conditions.

Stress Weighted Approach

A key problem with the volumetric WF approach is that it does not reflect the potential for water consumption to cause environmental harm. In response to this, Ridoutt & Pfister (2009) have revised the water footprint calculation method to incorporate water stress characterisation factors in order to make possible quantitative comparisons between different products and between different stages of a product’s life cycle on the basis of environmental impact. The ‘stress weighted approach’ shares the same concept as the volumetric method but the calculation is slightly different. The two main differences are:

- Green water is excluded based on the argument that its consumption does not directly contribute to water scarcity as green water does not contribute directly to environmental flows and it therefore has a low opportunity cost (Ridoutt & Pfister 2010); and
- Blue water is normalized using global and regional stress factors based on the use of a Water Stress Index (WSI) to normalise water use in the calculation of the water footprint (Pfister *et al.*, 2009). The intention is to create a methodology similar to the way in which characterization factors are used to describe the global warming potential of different greenhouse gases in a carbon footprint.

Water Footprint Assessment as Part of Life Cycle Analysis

The impact of water use in LCA is also based on estimates of water consumption, and an inventory list of all inputs and outputs of water is created for a product or a service, and water consumption is determined from the difference between inputs and outputs. A key difference is that in LCA green water is not normally considered and blue water may be subdivided into many classes according to its occurrence (e.g. surface water/groundwater) or quality. Grey water is also not included as the impacts associated with pollution are dealt with elsewhere.

Many life cycle impact assessment methods use the withdrawal-to-availability¹ (WTA) ratio for calculating characterization factors, so water withdrawn from a water body that is over-exploited would have a much higher weighting than water withdrawn from an under-utilised water body. However, many other methods are also used to derive characterisation factors and several researchers (e.g. Jeswani & Azapagic, 2011; Berger & Finkbeiner, 2011) have concluded that there is no generally agreed methodology.

4.3 Key Issues

The research carried out for this study has identified several key concerns with regard to the use of water footprinting. These lie mainly with the inconsistent use and application of the competing methodologies and the failure of the methodologies to provide a reliable indicator of the environmental impacts of water consumption. These key issues can be categorised as being conceptual, methodological or interpretation related.

Conceptual issues include:

- the reduction of a water footprint to a single number;
- differences in the distinctions that are made between the different water types;
- assumptions of equality across blue water sources; and
- failure to consider the efficiency of the production activities being assessed.

Methodological issues include:

- a lack of precision in the definition of some components of the water footprint, leading to inconsistent application (e.g. in terms of calculation of gross or net green water);
- a lack of clarity regarding how much indirect water use to take into account (i.e. where to truncate the analysis) and how to account for temporal variability;
- a lack of data, with both the volumetric and water stress approaches relying heavily on data that are often unavailable and/or hard to collect at an appropriate scale. Many studies have used broadscale databases which fail to adequately account for local factors, seasonality of abstractions, annual variations in water consumption, etc. and many have relied heavily on assumptions, estimations and modelling;

¹ The withdrawal-to-availability ratio is the ratio of total annual freshwater withdrawal for human uses in a specific region to the annually available renewable water supply in that region.

- modelling approaches, with different studies relying on different base models of effective rainfall, evapotranspiration and crop use, and water availability and withdrawals; and
- a lack of clarity regarding calculation of the grey water footprint - relying heavily on the definition of water quality standards and subjective judgement, which in turn may lead to non-comparability across different assessments.

Issues associated with the **interpretation of results**:

- use of the term 'footprint' rather than account, given that the volumetric approach does not provide a measure of impact; and
- lack of consideration of the opportunity costs of water use and other social, ethical, governance and policy considerations.

Not all authors or stakeholders would agree with the above views and it is clear that businesses have found that the detailed layer of information which is embedded in the composite WF indicator can provide the information needed to develop strategies for more sustainable water use and for identifying risks. This is one of the key drivers underlying corporate interest in the use of these techniques across their supply-chains.

4.4 Applications

Practical experience of undertaking WF assessments is still limited and there are few examples of full WF studies. The assessments have been primarily used by businesses to provide an insight into the largest components and locations of water consumption in the supply-chain; this enables businesses to improve their understanding of associated risks (physical, reputational, regulatory, financial and litigation) and to inform the design of water management strategies, investment decisions and product improvement (WBCSD, 2010).

However, as the methodologies are still at a developmental stage, it has not been possible to single out specific case studies of best practice. Instead, best practice in their use is more linked to approach. In this respect, it could be argued that best practice would involve:

- i) WF as an auditing tool to identify areas of greatest water use in the supply-chain;
or
- ii) WF as a tool for water stewardship to identify which products are sourced from areas at risk of water stress.

To date, few studies have tried to apply water footprinting to water resources planning. Those which do cover a broad range of scales (international, national, regional, river-basin and local) and have primarily been conducted by research institutions, NGOs and international organisations to try to influence policy indirectly, to raise awareness of issues surrounding water use or to contribute toward the methodological development of water footprinting. At this stage though, it is difficult to identify the most appropriate role for WF methods in water resource planning.

Commodity level assessments have found a broad range of applications, including various household, industrial and energy products. These have been carried out for a range of reasons, but mainly with the aim of raising awareness of the issues surrounding water use and to inform business practice.

5. FURTHER WATER MANAGEMENT & RISK ASSESSMENT TOOLS

In addition to the virtual water and water footprint methods discussed in Section 3, it is clear that a second set of tools have been, and are continuing to be, developed with the aim of enabling companies to undertake risk assessments related to their water use, to identify ‘hot spots’ associated with that use, and / or to aid in the disclosure of water related information as part of business and investment risk management.

The tools that we have identified as being the most relevant to the objectives of the European Commission with regard to better water management and increased water efficiency within the EU and globally are:

- the Global Water Tool developed by the World Business Council for Sustainable Development (WBCSD);
- the Corporate Water Tool;
- the CDP Water Project;
- the Global Environmental Management Initiative Tool; and
- the Water Risk Filter Tool.

These tools are being used at the corporate level and it is clear that efforts are being made to make them more accessible to a wider range of companies – small, medium and large. Greater up-take of their use may therefore be valuable to gaining a greater appreciation of water scarcity issues, the business risks these may give rise to and, as a result, other policy goals in relation to improved water efficiency and more sustainable production and consumption.

In addition, the report by the 2030 Water Resource Group on “Charting our Water Future” (McKinsey, 2009) sets out an approach for more detailed water resource planning with an international focus. This approach is based on economic analysis methods, with the aim of setting out a framework for defining least cost solutions at a cross-sectoral level and identifying the levers to gain stakeholder commitment to such solutions. Promotion of this type of analysis may be relevant in certain EU river basins, but is likely to be equally, if not more, important at the international level as part of global policy efforts to ensure sustainable water management.

Although use of this set of tools is being driven by corporate action and development organisations, there is clearly a potential policy role for the promotion of such tools and assessments.

6. CERTIFICATION AND LABELLING SCHEMES

Certification and labelling schemes for agricultural products and foodstuffs aim to provide assurance that specified production methods or product characteristics have been met. The idea of such schemes is to make the history of products more transparent, thereby enabling consumers to express their environmental and social values through their purchasing decisions. Schemes currently in operation in the EU address a myriad of different issues and function at different stages of the food supply-chain - including the business-to-business (B2B) and business-to-consumer (B2C) level. While some labelling and certification schemes cover a single criterion, many are multi-dimensional covering a range of environmental and/or social criteria.

Certification standards have emerged as powerful tools for influencing both business practices and for responding to consumer preferences. In this regard, two key purposes for water certification have been identified (Richter, 2009):

- encouraging water efficiency or water management more generally; and
- bolstering corporate reputations in relation to social responsibility and sustainability, with this having knock-on effects in terms of attracting investors and gaining new consumers.

It should be noted, though, that the meaning of labels linked to certification is not always clear and that standards differ greatly in terms of their level of quality control. This is one of the reasons why the European Commission makes an important distinction between ‘certification schemes’ which, by definition, necessitate a third-party attestation procedure and those ‘voluntary schemes’ which operate on the basis of a label or logo (often registered as a trademark) without involving any certification mechanism (European Commission, 2010).

An analysis of existing food and agricultural product certification and labelling schemes indicates a dichotomy between schemes with a focus on providing information on the amount of water embedded within a product, and schemes that are focused on encouraging good water stewardship. Labelling on the basis of a water footprint is not currently recommended given the issues surrounding the clarity, transparency and reliability of the single footprint indicator, and its failure to address impacts. Most consumers will not have sufficient background knowledge to interpret the water footprint, and it would be difficult to communicate the concept of a water footprint and the nuances of the data to someone who knows nothing about water footprint assessment. International standards (such as those being developed by the ISO) and agreed methodologies are needed first. Industry has also expressed a concern that, if labelling was to be based on a single indicator such as the water footprint, it is essential that the scope, limitations and meaning are clear to the consumer, otherwise the label will be misleading (CIAA, pers. comm., 2011).

As a result, certification of water stewardship activities would appear to be more appropriate, with this being the focus of a range of industry driven initiatives, both within the EU and aimed at creating a more global certification standard. These initiatives focus on developing an approach to certification that can be applied through

a supply-chain, with any accompanying labelling used to promote and support change within the industry, to encourage best practice and to give reassurance that minimum standards have been met.

The Alliance for Water Stewardship (AWS) is developing performance standards which can be used globally to certify water users who voluntarily practice sustainable water management (AWS, 2011). The scheme is being developed with stakeholder involvement and will have stringent standards on water stewardship. It will be aimed at companies that use significant quantities of water in their operations (including agricultural producers, beverage manufacturers, food processors and other food producers) and water utilities. A key aspect of the standards is likely to be the use of tools to measure the water consumption (which may take the form of the water footprint) of interested business and setting standards that reduce the size and impact of the footprint. To qualify for certification, the AWS anticipates that applicants will be required to measure their direct and indirect water consumption along with other physical and chemical characteristics in the local water sheds in which they operate. The AWS is following the ISEAL² Code of Good Practice, the aim of which is to ensure that voluntary standards are effective and accessible and bring about positive, social, environmental and economic impacts.

More generally, there is a risk with focusing solely on water use, in that the environmental, social or economic burden of other aspects of the production process may inadvertently be increased. Although it has been recognised that the wider environmental, social and economic effects associated with different food supply-chains are complex and very system specific (Hogan and Thorpe, 2009), policies aimed at reducing water use should also consider these wider effects. Furthermore, consumers will wish to take factors other than just the environment into account when making purchasing decisions (e.g. price, quality, fair trade considerations, etc.). As a result, there may be more value in the creation of a multi-dimensional sustainability label which brings together information across a range of criteria of interest to consumers.

7. THE POLICY OPTIONS

Based on the findings of the above work, as well as consultation with stakeholders, a range of possible policy options was identified for further analysis. These options take into account the general view of most stakeholders that any EU policy aimed at the application of VW/WF at the business or corporate level should focus on 'promotion'. In particular, there appear to be good arguments for promoting supply-chain based initiatives, aimed at identifying key water using links within the supply-chain and addressing particular 'hot spot' issues. At the present time, it is harder to identify a clear role for WF and VW in terms of water resource planning, although there is some limited research underway and a few examples of use in practice. There would appear to be a clearer role for the development of benchmarking data for use by

² The ISEAL Alliance is the global association for social and environmental standards.

national authorities to help in both regulatory efforts to improve water resource management and in partnership approaches with different industry sectors, including the farming sector. At the international level the outputs of existing studies can be used for the purposes of awareness raising, but there are other assessment methods that may be more relevant to addressing supply and demand imbalances.

With regard to certification and labelling, as discussed above, a range of certification schemes already exist and which could be built upon. Additionally, consultees expressed the view that stewardship, rather than volumes of water used, was a more important basis for certification and that consumer-aimed labelling would not yet be of value, with a focus on consumer education preferred. The policy options have therefore been limited to promotion and education based activities, with the exception of labelling for certain types of water efficient equipment and some forward looking use of research on labelling.

The policy options are presented in Table 2, together with the types of objectives they aim to achieve. This includes objectives ranging from increasing the sustainability of water use to identifying and targeting research. Note that these objectives were developed for this project and do not necessarily fully reflect the wider objectives of the Commission's water scarcity and droughts programme, nor of the Blueprint for EU Waters.

As can be seen from Table 2, most of the options were developed with the aim of either directly or indirectly increasing the sustainability of water consumption and use, as well as to manage water related risks, although the extent to which they will deliver this is variable and in some cases highly uncertain. To a lesser degree, the options are aimed at improving consistency and agreement across practices by different actors (with this having knock-on benefits with regard to clarity and transparency), and providing better information for planning purposes.

For the purposes of impact assessment, the different options were grouped to take advantage of synergies. This resulted in the creation of five policy groups:

- Group A: Promotion, Education and Partnership (comprising options 1c, 2a, 3a, 4b, 4c, 5a);
- Group B: Promotion, Education and Analysis (comprising options 1c, 1d, 2c, 3a, 4a, 4b, 4c, 5b);
- Group C: Supply-chain Incentivisation (comprising options 1c, 2a, 4a, 4c, 5a, 5b);
- Group D: Methodology Development – Clarity, Role and Transparency (comprising 1a, 1b and 5c); and
- Group E: Research and Development, Education, Supply-chains and Partnership (comprising 1a, 1b, 1c, 1d, 2b, 2c, 3a, 4a, 4b, 4c, 5b, 5c).

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
1a: Defining best practice in water footprint assessment				•	•		•
1b: Funding research on impact assessment in water footprinting			•	•	•		•
1c: Promoting better corporate water management	•	•				•	
1d: Promotion of water use assessments	•	•	•			•	
2a: Benchmarking water use	•				•	•	o
2b: Footprinting as part of integrated planning	•	•			o	•	
2c: Economic productivity assessments	•				o	•	
3a: International Partnership and Support	•			•	•	•	•
4a: Promotion of voluntary certification	•	o				o	
4b: Information dissemination on certification schemes	o	o		o			
4c: Promotion of consumer education campaigns	•						
5a: Establishment of an EC Smart Mark	•	•					
5b: Encourage and monitor voluntary B2B labelling		•	•				
5c: Research on multi-dimensional labelling			•	•	•		•
Key: • - directly relevant o - indirectly relevant							

8. THE FINDINGS OF THE IMPACT ASSESSMENT

8.1 The Approach

Our approach to the impact assessment started with screening against the impact categories set out in the European Commission's Impact Assessment Guidelines (EC, 2009). From this, 27 relevant impact categories (which in some cases were further sub-divided) were identified and the potential impacts of each policy were assessed

against these using a simple rating system (based on five increments ranging from very significant positive change to very significant negative change).

The ratings assigned to individual options were then combined to develop an indication of the overall impacts for each of the policy groups. Synergistic, antagonistic or mitigating effects between options were then considered, alongside:

- the timescale over which the impacts could be felt;
- the geographic scale of the impacts;
- the scale of the impacts in terms of the population affected and who would be affected; and
- whether impacts reflect direct or indirect effects.

A detailed discussion of the findings from the above exercise is provided in Section 7. The main conclusions that can be drawn from this are set out below.

8.2 Environmental Outcomes

Policy Groups C and E are expected to perform the best in terms of delivering environmental benefits from improving the sustainability of water use, increasing the efficiency of water use, and mitigating the impacts of water consumption. These would then be followed by Groups A and B. These findings are driven in part by the emphasis placed on better corporate water management and water stewardship certification within the business-to-business supply-chain on the one hand, and the use of benchmarking across cohorts of businesses and the creation of an EC Smart Mark on the other hand. The international dimension (option 3a) is also important given the importance of managing global water risks and impacts.

8.3 Impacts on Businesses and Authorities

The conclusions regarding the impacts of the different options on businesses and authorities are more complex, taking into account impacts on operating cost, administrative burdens, competitiveness of SMEs versus larger companies and potential increases in the ability to attract investment. In this case, they reflect the fact that promotion of supply-chain initiatives to improve water management, and of water stewardship certification could result in significant operating costs and administrative burdens for some supply-chains, particularly agricultural producers and the associated food and drink supply-chains. As a result, Groups A and D fare relatively better than the other options; in addition, Group A has the potential for improving the relative competitive position of small companies involved in the production of water saving technologies and may help them identify water saving methods and techniques.

Offsetting the potential costs to businesses of the combined sets of actions in Group E and B, are the potential investor-related benefits that may stem from companies having addressed water risks and being able to do this through supply-chain based labelling. However, these larger sets of actions may also give rise to competitiveness issues should small companies be left behind; although the inclusion of promotion and dissemination activities could mitigate this and help ensure a level playing field.

International partnership and support is also key in this regard with respect to global suppliers of agricultural and food products, as well as other goods and services, to the EU.

Costs to authorities (including the European Commission and Member States) will arise from promotion and dissemination activities, as well as overseeing and contributing to benchmarking, establishment of an EC Smart Mark and consumer awareness and education campaigns.

8.4 Ease of Implementation

Given that each of the policy Groups involves a series of different actions, it is important to consider whether there are any institutional, capacity or other barriers to their implementation. Clearly, the combined set of options forming Group D would be the easiest to implement as they essentially involve support to existing initiatives (e.g. development and agreement of the ISO Standard on water footprint assessment) and funding of research on impact assessment in water footprinting and on multi-dimensional environmental labelling aimed at consumers.

There should also be few barriers to implementation of Groups A, C and D. In the case of Group C, the greatest difficulties may come from any requirements for economic productivity assessments to be carried out in EU river basins that are essentially water scarcity/drought ‘hot spots’; the remainder of the activities are promotion and dissemination based. For Group A, there may be both capacity and institutional constraints affecting up-take of the options involving the benchmarking of best practice and establishing an EC Smart Mark. Such issues should not arise in relation to consumer awareness and education campaigns, assuming these can be designed to complement the other consumer initiatives undertaken by DG SANCO. Similarly, there are already international initiatives in the field of water and sustainable development which can provide the focus for the types of awareness raising and assessment activities associated with option 3a on international partnership. The sheer number of options comprising Group E make its ease of implementation more complex.

8.5 Risks

This criterion has been included to provide an indication of the potential risks of either not taking the actions set out in the policy Groups or indeed by implementing the different groups.

Group D is considered to pose the lowest risks, in part because it does not require a large number of actions to be implemented. However, it also addresses two of the biggest concerns associated with the current level of activity surrounding the development and application of water footprint assessment. In particular, it is aimed at reducing the risk that such assessments continue to be carried out in an inconsistent manner and that practice becomes fragmented across different user groups and types of applications. Importantly, it also addresses one of the key failings of the current methods, via the incorporation of a strong, robust and repeatable impact assessment methodology.

In comparison, Groups B, C and E are assessed as being more risky due mainly to the increased emphasis on corporate water management, water stewardship certification and associated business-to-business labelling. The concern here is that this may place significant burdens on farm and other businesses and, unless properly targeted and designed, may not deliver the required environmental benefits in terms of improved water management. As Group A provides less emphasis on certification and labelling, it is viewed as lower risk in this regard, while it is still expected to deliver some benefits through the promotion of benchmarking and a Smart Mark, as well as a focus on promoting better corporate water management through the supply-chain.

8.6 Summary

In summary, it is clear that Group D is unlikely to deliver the same efficiency gains as Groups A, B, C and E and, although Groups B and E would both deliver significant benefits, they also have the potential for significant negative effects. Based on the findings of the impact assessment, policy option Groups A and C would appear preferable as they both deliver significant benefits without the potential for significant negative effects. In this regard, Group A is likely to perform slightly better (this is largely due to the inclusion of policy option 3a within Group A). Although Group C would probably provide a slightly better environmental outcome than Group A, Group C is viewed as posing slightly higher risks, with greater potential for negative impacts on businesses and authorities due to a greater emphasis on certification and labelling. We consider that the additional benefits in terms of environmental outcome and ease of implementation that would be derived from implementing Group C (rather than Group A) would not compensate for the additional risks and impacts on businesses and authorities that would be derived from implementing Group C rather than Group A. On this basis the policy options combined to form Group A appear preferred. These are:

- Promoting better corporate water management (option 1c);
- Benchmarking best practice in water use (option 2a);
- International partnership and support in the area of sustainable development (option 3a);
- Information dissemination on certification schemes (option 4b);
- Promotion of national consumer education campaigns (option 4c); and
- Establishment of an EC ‘Smart Mark’ for water saving technologies (option 5a).

9. CONCLUSIONS

Water scarcity is not only an issue for the EU but is a global concern. This stems not only from the potential impacts of scarcity on the environment, but also the wider risks to businesses and national economies in terms of food security and the sustainability of their production activities.

Although water footprinting has been valuable in raising awareness over the need for sustainable water consumption and the extent to which countries export or import water as part of international trade, its current role is probably best viewed as a tool

for corporate supply-chain management. Even in this respect though there are issues regarding a lack of consistency, clarity and transparency with the use of the methods that need to be addressed. As a result, care should be taken in promoting its use more generally, and especially as a tool to support agricultural products and food labelling, until some of these issues are resolved.

There are an increasing number of initiatives globally aimed at developing certification standards for application across commodity supply-chains. Given the inclusive approaches being taken to develop these standards, it may be more appropriate for the European Commission to support such efforts than to put forward its own ‘best practice’ recommendations.

It is clear from the analysis conducted here that the Commission could pursue policies based on the promotion, education and partnership of water footprinting that could help to reduce water related risks, with benefits for the environment, businesses and national economies.

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1. INTRODUCTION

1.1 Aims and Objectives of the Study

This Report sets out the findings from work on the “*Assessment of the efficiency of the water footprinting approach and of the agricultural products and foodstuffs labelling and certification schemes*”.

The study has been carried out in preparation for the 2012 review of the EU water scarcity and drought policy (European Commission, 2007), and the development of a Blueprint for EU water. It is one of a series of related studies, including a review of the first tranche of River Basin Management Plans, a review of water scarcity and an assessment of vulnerability in the context of climate change.

The aim of the study is to help inform the Commission in its development of policy regarding the definition and application of water footprinting and virtual water measurements. This includes the potential use of these tools for both internal EU policy and in relation to EU external water policy. The study also seeks to provide specific recommendations for product labelling and certification schemes relating to the sustainable use of water in the production of agricultural products and foodstuffs; this includes an element aimed at strengthening existing EU guidelines on best practice for certification schemes.

As outlined in the Terms of Reference, the overall objective of this study is:

“to provide concrete input into how the use of water footprinting and virtual water measurements, as well as agricultural products and foodstuff labelling and certification schemes could be reliably used in water scarcity and droughts policy planning and implementation”.

The study findings will also feed into other projects being undertaken for DG Environment on water savings potential in agriculture and a gap analysis in relation to the current water scarcity and droughts policy in the EU.

1.2 Study Approach

The work to be carried out for the study was divided into two related Tasks with the following specific objectives:

Task 1 – Virtual water and water footprinting approaches:

- review the current applications of water footprinting and virtual water approaches;
- identify best practice examples of practical applications of water footprinting in policy making from around the world;
- develop proposals on if and how the water management related information presented by these approaches could be applied in policy making; and

Task 2 – Water management related information in agricultural product and foodstuff labelling:

- examine the current use of water management related information in food and agricultural product labelling and certification schemes;
- identify the most suitable schemes for providing information on water use; and
- specify recommendations for certification schemes regarding the efficient use of water resources.

Our approach to the study was based upon the two tasks described above, with the work carried out as shown in Table 1.1

Table 1.1: Approach			
Task 1			
	Task	Actions	Reporting
1A	Review the current applications of water footprinting and virtual water approaches	Data Collection, Literature Review and Stakeholder Consultation	Part A Report
1B	Identify best practice examples of practical applications of water footprinting in policy making from around the world	Identification of Best Practice Examples	Part A Report
1C	Develop proposals on if and how the water management related information presented by these approaches could be applied in policy making	Policy Options and Option Groups	Part A Report
		Impact Assessment	Part A Report
Task 2			
	Task	Actions	Reporting
2A	Examine the current use of water management related information in food and agricultural product labelling and certification schemes	Data Collection, Literature Review and Stakeholder Consultation	Part A Report, Part B Report
2B	Identify the most suitable schemes for providing information on water use	Data Collection, Literature Review and Stakeholder Consultation	Part A Report, Part B Report
		Identification of Best Practice Examples	Part B Report
2C	Specify recommendations for certification schemes regarding the efficient use of water resources	Review of key requirements for a certification scheme	Part B Report
		Review of Minimum Criteria for Sustainable Water Use in Existing Certification Schemes.	Part B Report
		Recommendations	Part B Report

The aim of Task 1 was to provide a review of the current applications of water footprinting and virtual water approaches and to illustrate, if appropriate, best practice

examples of actual applications of water footprinting in policy or voluntary schemes. This was to be followed by a detailed assessment of the social and economic impacts of viable policy options relating to the provision of information on water use. Similarly, the aim of Task 2 was to undertake an analysis of existing food and agricultural product labelling, certification, and standard schemes relating to the sustainable use of water in production processes and an assessment of the social and economic impacts of the most suitable schemes for providing information on water use.

In the end, we have expanded the scope of the options considered under Task 1 and Task 2 to include a broader set of possible actions. This expansion of possible policy options is in line with the types of measures being considered more generally for the Blueprint, however, it has been constrained to the issues identified during research for this study.

1.3 Organisation of this Report

This study comprises two Reports, with this report (Part A) primarily focussed on actions undertaken under Task 1. This report has been organised as follows:

- Section 2 sets out our understanding of the policy context surrounding the potential use of footprinting methods and of agricultural product and food labelling;
- Section 3 provides a review of the current methodologies used for assessing virtual water and water footprints, provides practical examples of the use of these methods and examines best practice in this field;
- Section 4 examines other tools that have been and are being developed to aid companies and planning bodies to assess water risks and to identify options to mitigate or address supply and demand imbalances;
- Section 5 presents a brief overview of existing labelling and certification schemes together with stakeholder views and recommendations on certification and labelling;
- Section 6 sets out the policy options identified from the literature review and consultation;
- while Section 7 provides the results of the impact assessment of the policy options and Section 8 presents the conclusions from the study.

The Part B Report primarily focuses on actions carried out under Task 2 and provides:

- a detailed review of relevant certification and labelling schemes, standards and initiatives;
- key requirements of a certification scheme for water;
- minimum criteria for sustainable water use in existing certification schemes; and
- recommendations.

2. THE POLICY CONTEXT

2.1 Overview

In order to consider options for the use of water footprinting and agricultural and food product labelling and certification schemes, it is important to first establish the relevant policy context for this study and the potential use of such tools. We have identified four relevant EU policy areas:

- policy in relation to water scarcity and drought, together with supporting strands of activity;
- policy in relation to sustainable use and production;
- agricultural policy (although this may lay outside the scope of this study); and
- policy in relation to labelling and certification.

We also highlight some of the broader international initiatives that are being undertaken by the European Commission in relation to water quality and water quantity and that may be relevant.

2.2 Policy Related to Water Scarcity and Use

2.2.1 Water Framework Directive

The Water Framework Directive (Directive 2000/60/EC) came into force on 22 December 2000. It established a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. The Directive introduced two key changes to the way the water environment must be managed across the European Community.

The first relates to the types of environmental objectives that must be delivered. Previous European water legislation set objectives to protect particular uses of the water environment from the effects of pollution and to protect the water environment itself from especially dangerous chemical substances. These types of objectives are taken forward in the Directive's provisions for Protected Areas and Priority Substances respectively. However, the Directive also introduces new, broader ecological objectives, designed to protect and, where necessary, restore the structure and function of aquatic ecosystems themselves, thereby safeguarding the sustainable use of water resources. Future success in managing Europe's water environment will be judged principally by the achievement of these ecological goals. These objectives include ones aimed at ensuring the good quantitative status of water bodies.

The second main change is the introduction of river basin management planning. This is the key mechanism for ensuring the integrated management of: groundwater; rivers; canals; lakes; reservoirs; estuaries and other brackish waters; coastal waters; and the water needs of terrestrial ecosystems that depend on groundwater, such as wetlands.

The river basin management planning system provides the decision-making framework within which financial and environmental resource costs and benefits can be properly taken into account when setting environmental objectives. The aim is for proportionate and cost-effective combinations of measures designed to achieve the objectives of the Directive to be implemented. The planning system also provides opportunities for stakeholders to become actively involved in shaping the management of river basin districts – neighbouring river catchments, together with their associated stretches of coastal waters.

The first round of river basin management plans has been submitted to the European Commission and Member States should now be focused on delivering this first set of plans and on developing plans for the period from 2015 to 2021.

2.2.2 EU Action on Water Scarcity and Drought

Following an in-depth assessment in 2006 and early 2007 of water scarcity and droughts in the EU, the Commission presented a Communication to the European Parliament and the Council (European Commission, 2007) which outlined the major challenges facing the EU and suggested an initial set of policy options to address and mitigate these.

Although the Communication argues that the first priority should be a move towards a water-efficient and water-saving economy by improving water demand management, it also recognises the need for a wide range of policy options to be considered due to the importance of water to all human economic and social activities. In this regard, the Communication states that the aim should be to develop an integrated approach, based on a combination of policy options, which together can help address water scarcity and droughts in the EU.

In particular, the Communication identifies the following seven policy orientations for future action and suggests an initial set of policy options at European, national and regional levels:

- putting the right price tag on water;
- allocating water and water-related funding more efficiently;
- improving drought risk management;
- considering additional water supply infrastructures;
- fostering water efficient technologies and practices;
- fostering the emergence of a water-saving culture in Europe; and
- improving knowledge and data collection.

The Environmental Council of 30 October 2007 supported the Commission Communication and invited the Commission to review and further develop its water scarcity and drought policy for the EU, with the aim of feeding this into the Blueprint to safeguard Europe's water resources (see Section 2.3 below).

The most recent review of policy options for addressing water scarcity and droughts (TYPESA Group, 2010) provides a preliminary analysis of key issues and data gaps for

the 2012 policy review and provides an evaluation of the current work programme. Data on virtual water is highlighted as relevant to the work on water scarcity and drought. For example, given that agriculture constitutes a considerable use of water in the EU, particularly in southern Member States, one of the key themes in the Commission's 2012 Strategy for water scarcity and droughts is improving the management of water use in the agricultural sector. Hence, the latest review of policy options highlights the need to better understand the water required to produce different EU agricultural products, in order to target public and private sector awareness of the problem and prioritise water saving actions.

The 2007 Communication also encourages the inclusion of rules on water management in existing and future certification schemes and highlights labelling as an effective way to providing targeted information to the public on water performance and on sustainable water management practices.

2.2.3 Blueprint to Safeguard Europe's Water Resources

As indicated above, the Blueprint to safeguard Europe's water resources is an evaluation of EU water policy, and has a twofold purpose (European Commission, 2010a):

- to “look back and assess the implementation and achievements of policies and measures in place to ensure the protection and availability of EU water resources, while identifying gaps and shortcomings”; and
- to “look forward at the evolving vulnerability of the water environment to assess the sufficiency of existing measures and tools, and evaluate potential new instruments to ensure a sustainable use of good quality water in the EU in the long term”.

The Blueprint is based on three main pillars (European Commission, 2010a):

- the assessment of the River Basin Management Plans delivered by the Member States under the Water Framework Directive (WFD);
- the review of the policy on water scarcity and drought; and
- an assessment of the vulnerability of water resources to climate change and other man made pressures.

One of the strands of analysis to be carried out in developing the Blueprint is a ‘fitness check’ of EU water policy, with another being an impact assessment of policy options. This work is scheduled to start later in 2011 and be completed in 2012.

The outcome of the Blueprint will be a set of policy recommendations (which may include legislation, standardisation, incentives, funding, communication instruments etc.), accompanied by a number of reports and new initiatives. These policy options will be mainstreamed into Europe's 2020 objectives, in particular to become a more resource efficient, competitive and green economy.

2.2.4 European Water Initiative (EUWI)

In addition to the EU action on water scarcity and droughts, the EU has also launched the European Water Initiative (EUWI) as part of its sustainable development programme. The aim of the initiative is “*to create the conditions for mobilising all available EU resources (human and financial), and to coordinate them to achieve the water-related Millennium Development Goals in partner countries*”.³ The EUWI is international in scope and involves dialogue with national governments, NGOs, the water industry and other stakeholders outside the EU, in Africa, Latin America, Eastern Europe, the Caucasus and Central Asia.

The stated goals of the EUWI are:

- to reinforce political commitment towards action and innovation oriented partnership;
- to promote better water governance, capacity building and awareness;
- to improve efficiency and effectiveness of water management;
- to strengthen cooperation by promoting river basin approaches in national and transboundary waters; and
- to identify financial mechanisms and resources to ensure sustainable financing.

2.2.5 UN System of Environmental-Economic Accounting for Water (SEAAW)

The System of Environmental-Economic Accounting for Water SEAAW, prepared by the United Nations Statistics Division together with the London Group on Environmental Accounting, is a conceptual framework developed with the objective of standardizing concepts and methods in water accounting. It provides a conceptual framework for organising economic and hydrological information, as a means of enabling a consistent analysis of the contribution of water to the economy and the impact of the economy on water resources.

The SEAAW elaborates the United Nations *et al.* (2003) framework on *Integrated Environmental and Economic Accounting* (which describes the interaction between the economy and the environment and covers the whole spectrum of natural resources and the environment – often referred to as the SEEA-2003) to cover in more detail all aspects related to water.

There are two features that distinguish the SEEA-2003 and the SEAAW from other information systems about the environment (UNSD, 2003):

- both the SEEA-2003 and the SEAAW are satellite systems of the 1993 SNA (the standard used for the compilation of economic statistics). They directly link environmental data (i.e. natural resource stock accounts while also emphasising flow accounting) to economic accounts through a shared structure, set of definitions and

³ See www.euwi.net/about-euwi

classifications. The advantage of this is that they provide a tool to integrate analysis of environmental (including water) and economic issues.

- the SEEA-2003 and the SEEAW cover all important environmental-economic interactions, enabling cross-sectoral issues, such as integrated water resource management, to be considered.

2.2.6 European Water Accounts

In response to the EU actions on water scarcity and drought, the European Environment Agency has begun development of catchment scale water balances for Europe based on the United Nations system of environmental-economic accounting for water (SEEA-Water). The water accounts focus on physical flows of water into and out of the economy, providing an indication of water flows between the different economic activities (NACE), an accounting of changes of stocks in terms of water quantity and pollutant loads, as well as a demonstration of monetary flows related to water supply, water use and waste water collection and treatment.

The approach uses both measured and modelled data and will provide accounts on a monthly basis, therefore reflecting water stress throughout the year. The water account methodology is also able to distinguish the impact of water abstraction on observed water availability from that of drought. Moreover, it quantifies the relative contribution of each sector to total water use providing a framework for economic analysis of water management.

The intention of this work is to provide an overview of exploitation (e.g. to identify where it is occurring) and to inform impact assessments of policy options by relevant national and relevant EU bodies such as the European Commission⁴. Among other aspects, it will feed into the 2012 Review on Water Scarcity and Droughts. It is important to recognise that these accounts are focused on a macroeconomic quantification compared to the more catchment level focus of water footprint assessments when used at the corporate or location specific levels.

In May 2011, the European Environment Agency hosted a meeting of the Working Group on Water Efficiency within the UN Resource Panel. This group is currently producing a report on water accounting and water footprint assessment.

2.3 Sustainable Use and Production

2.3.1 EU Strategy

At the World Summit on Sustainable Development in 2002, countries committed themselves to promoting sustainable patterns of consumption and production. In 2003, the European Council identified the development of a 10 year framework for sustainable consumption and production in the EU as a key priority. The aim of

⁴ Personal communication with the EEA.

sustainable consumption and production policy is to maximise business' potential to transform environmental challenges into economic opportunities and provide a better deal for consumers. The challenge is to improve the overall environmental performance of products throughout their life-cycle, to boost the demand for better products and production technologies and to help consumers in making informed choices.

In 2008, the Commission set out its strategy to support an integrated approach in the EU, and internationally, to further sustainable consumption and production and promote its sustainable industrial policy (European Commission, 2008). The strategy includes a range of actions which are aimed at improving the energy and environmental performance of products and foster their uptake by consumers.

The key aspects of the strategy of potential relevance to this study are described below.

Work with Retailers and Consumers

In relation to retailers, the Communication notes that they are in a strong position to influence more sustainable consumption through their own operations, supply-chains, and consumer behaviour. In particular, it highlights that further effort is needed for retailers to reduce the environmental footprint of the retail sector and its supply-chain, promote more sustainable products, and better inform consumers.

A Retail Forum has been set up which acts a platform for retailers to:

- identify key areas to be tackled and define the baseline of existing initiatives;
- share best practices, extend the geographical coverage of existing initiatives and look to launch new initiatives; and
- report on progress of their actions on an individual basis.

The aim of the Commission's activities in this area is to gain the commitment of individual large retailers to ambitious and concrete actions with clear objectives, timelines, deliverables, and monitoring indicators. These commitments also relate to the Commission's call on business to increase its level of activity in relation to Corporate Social Responsibility.

EU Consumer Policy

EU consumer policy is also relevant in this regard as part of its aim is to provide citizens with the tools that they require as consumers to make sustainable environmental choices. The Commission therefore supports and promotes actions that are aimed at increasing consumers' awareness and which helps them to make more informed choices. A number of tools currently exist for these purposes (e.g. the Europa Diary, Dolcetta, etc.), with some of these currently under review as to their value and future direction.

Boosting Resource Efficiency

Improving resource efficiency is aimed reducing the level of resources consumed per unit of productivity, as measured by GDP. Over the 10 year period up to 2008, resource

efficiency had improved by 2.2% per annum in real terms, indicating that the EU has been able to stabilise resource use within the growing economy; the aim is for such improvements in resource productivity to continue at least at the same pace.

With this in mind, the Communication (European Commission, 2008) identifies the need for further tools to monitor, benchmark and promote resource efficiency, taking into account a life-cycle perspective and including trade. Detailed material-based analysis and targets are to be addressed over time, based on environmental significance and on access to natural resources.

Ecolabelling

The Communication (European Commission, 2008) also makes reference to revisions to the Ecolabel Regulation, with the revised regulation (Regulation (EC) No 66/2010) published on the 25th November 2009. The regulation simplifies and streamlines the ecolabel scheme, which is aimed at providing a signal to consumers on those products that perform at such a level when many environmental criteria are considered over the whole life-cycle. This includes extending the product coverage of the ecolabel to cover products for which ecodesign criteria have not been set.

The Regulation notes that the EU Ecolabel scheme is intended to promote those products which have a high level of environmental performance by setting criteria which are based on best environmental performance achieved by products on the Community market, and which are based on scientific evidence, taking into consideration the latest technological developments. The criteria should also be market oriented and limited to the most significant environmental impacts of products during their whole life cycle.

With specific reference to food and feed product groups, the preamble to the Regulation notes that a study should be undertaken to ensure that criteria are feasible and that added value can be guaranteed. It also states that for food and feed products, as well as unprocessed agricultural products that lie within the scope of Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products, the option that only those products certified as organics would be eligible for award of the EU ecolabel should be considered, to avoid confusion for consumers.

2.3.2 Joint Research Centre Study on Environmental Footprinting

Linked to EU policy on sustainable production and consumption is a study being carried out by the JRC for DG Environment to develop a technical guidance document for the calculation of the environmental footprint of products and of companies. The aim of this work is to develop a harmonised methodology for ‘environmental footprinting’ that includes a broad suite of environmental performance criteria (including carbon) that can be used to determine the environmental performance of products and corporations. Water is likely to be included in the technical guidance, based on the use of life cycle impact assessment approaches (LCIA) (JRC, personal communication).

This study is still in its early stages, so no detailed review of its implications can be carried out for the purposes of this study.

2.4 Agricultural Policy

The EU Common Agricultural Policy provides comprehensive support to farmers through a combination of direct income support (Pillar I) and other mechanisms (Pillar II), including payments for agri-environment and market development. Together these two approaches either require or provide incentives for good environmental practice, including measures to protect freshwater water resources and the environment. In the case of water, many of these requirements and options are linked to provisions under the Water Framework Directive and associated directives. Some aspects of water use efficiency are also covered under the Integrated Pollution Control Regulations for the vegetable processing and the intensive livestock sectors.

The greater part of agricultural water use involves irrigation, with considerable variation in irrigation cropping and water management practices across Europe. While CAP reforms have removed the direct subsidies on crops that previously applied on some irrigated crops, local arrangements often means that water charges do not reflect the full costs of water supply and/or the value of water itself. In the future, water scarcity and rising costs are likely to encourage increased irrigation water efficiency, including precision and low energy application technologies. Consultation with several actors indicates that this trend already appears to be taking place with farmers responding to increased energy prices, hence pumping costs, through reduced use of irrigation water.

The CAP regime for 2013 to 2020 is currently under review (European Commission, 2010b; European Commission, 2010c; European Commission, 2010d) and it is too early to determine the outcome. However, more attention will be paid to ‘greening’ agriculture, developing and promoting technologies that can simultaneously improve productivity and sustainability. Improved irrigation water management, including the adoption of crops with low water requirements, will be a critical aspect of managing the relationship between farming and the environment; by definition irrigation is practiced in areas of potential water stress.

It is possible that incentives may be provided for new investments and practices in improved water use efficiency in agriculture. The ability to verify compliance with targeted improvements could be part of such a program of support, running alongside incentives provided by the water industry and/or the food industry. This, and a growing realisation of the value of water, is likely to induce technology change in favour of adopting and reporting measures to improve water use in agriculture.

2.5 EU Policy in Relation to Product Labelling and Certification

2.5.1 Green Paper on Agricultural Product Quality

The Green Paper on Agricultural Product Quality (CEC, 2008) and the subsequent Communication (European Commission, 2009) was produced in response to the need to ensure that agricultural producers within the EU are able to take advantage of the quality of their produce due to the high level of safety ensured across the food chain. The aim of the Green Paper was to identify measures for ensuring that the existing regulatory framework is the most suitable one for protecting and promoting quality

agricultural products. This includes consideration of certification schemes aimed at providing information on product characteristics to buyers and consumers.

One of the further possible schemes identified in this Green Paper is an Ecolabel scheme for application to processed agricultural products. It notes that any new EU-level quality scheme must correspond to policy needs that could not adequately be met by a national or private-sector schemes or some other instrument; in this respect, water use was highlighted as being one of the highest priorities by the Health Check of the Common Agricultural Policy (alongside climate change impacts conservation and biodiversity).

The Green Paper also indicates that such schemes could be based in legislation or could be more voluntary and based on guidelines. Mandatory schemes might have advantages in particular for legally and scientifically complex backgrounds (e.g. animal welfare). In other cases, voluntary schemes could be sufficient and designed to assist scheme owners in developing and improving practices. In either case, the administrative burden for farmers and other stakeholders, as well as Member State administrations and the Commission, would need to be taken into account.

With respect to certification schemes, these are identified as being important as they provide retailers with a means of reacting to consumer demand and of providing assurances as to a product's characteristics or production methods (which helps underpin a retailer's reputation and provides farmers with an opportunity to communicate product qualities). From the consumer's perspective, they provide guarantees on a product's specific qualities. However, the Green Paper also highlighted that the proliferation of such schemes has given rise to concerns over the transparency of different schemes' requirements and the credibility of the claims being made. Other issues raised include the fact that the costs to small and medium sized enterprises of having to belong to a range of schemes can be prohibitive and that such schemes can act as a barrier to market access for producers in developing countries.

2.5.2 Best Practice Guidelines for Voluntary Certification Schemes

In response to the issues raised by the Green Paper and the subsequent consultation responses, the Communication on agricultural product quality indicated that legislative action was not warranted but that guidelines for certification schemes would be more appropriate. As a result, in 2010, the European Commission issued guidelines setting out best practice for the operation of voluntary certification schemes in relation to agricultural products and foodstuffs. These guidelines were developed in light of the increasing number of quality assurance schemes for food and agriculture. A 2006 inventory of such schemes carried out for the European Parliament identified 330 such schemes, with the figure increasing to over 400 identified schemes for the 2010 inventory; 54 of these schemes relate to the sustainable use of resources (with those that are most relevant to this study discussed further in Section 5).

This inventory covers schemes which are voluntary in nature and which enable stakeholders to claim that products or processes fulfil defined quality requirements. It therefore includes schemes ranging from those referred to as "quality management systems" or "within-chain standards" (i.e. B2B), also sometimes known as "liability

schemes”, as well as those schemes that explicitly aim to segment the final product market by differentiating the product(s) covered by the schemes, using labelling or using branding to signal specific quality attributes to consumers (i.e. B2C schemes).

The Guidelines make a distinction between certification schemes, which by definition employ third-party attestation, and other schemes which operate on the basis of a label or logo (often registered as a trademark) without involving any certification mechanism, and adherence to which is based on self-declaration or selection for membership by the scheme owner.

One of the key objectives of these guidelines is to offer guidance on how to avoid consumer confusion and increase the transparency and clarity of the scheme requirements, thus enabling customers to make more informed purchasing decisions and promote greater market efficiency. They also highlight the legislative provisions under which such schemes must operate and set out best practice in their operation, with a focus on scheme developers and operators. As such, the guidelines set out recommendations on:

- scheme participation and development;
- scheme requirements and corresponding claims;
- certification (impartiality and independence) and inspection requirements;
- costs in terms of publishing information on costs and on any discrepancies in the fees charged to different participants;
- qualification principles for auditors and inspectors;
- provisions for small-scale producers; and
- mutual recognition and benchmarking where there may be overlaps with other schemes.

2.5.3 ISO Standards

Standards for Ecolabelling

A range of policies are in place to improve the environmental performance of products. As indicated above, one of the more relevant of these is the Ecolabel Regulation⁵. Eco-labels are generally divided into three different types, which have been defined by the ISO (IISD, 2010) as follows:

- **Type I:** a multi-attribute label developed by a third party;
- **Type II:** a single-attribute label developed by the producer;
- **Type III:** an eco-label the award of which is based on a full life-cycle assessment.

The ISO has developed a series of standards and guidelines for ecolabelling, with these including the ISO 14020 standards and the ISO 14024 standards. These set out standards for environmental labels and declarations and established guiding principles

⁵ Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community ecolabel award scheme (OJ L 237, 20.9.2000, p. 1).

and procedures for the development and use of environmental labels and declarations. These principles are set out in Table 2.1 (next page).

Table 2.1: ISO Principles for Environmental Labelling
<ul style="list-style-type: none"> • Principle 1: <i>“Environment labels and declarations shall be accurate, verifiable, relevant and not misleading”.</i> • Principle 2: <i>“Procedures and requirements for environmental labels and declarations shall not be prepared, adopted, or applied with a view to, or with the effect of, creating unnecessary obstacles to international trade”.</i> • Principle 3: <i>“Environmental labels and declarations shall be based on scientific methodology that is sufficiently thorough and comprehensive to support the claim and that produces results that are accurate and reproducible”.</i> • Principle 4: <i>“Information concerning the procedure, methodology, and any criteria used to support environmental labels and declarations shall be available and provided upon request to all interested parties”.</i> • Principle 5: <i>“The development of environmental labels and declarations shall take into consideration all relevant aspects of the life cycle of the product”.</i> • Principle 6: <i>“Environmental labels and declarations shall not inhibit innovation which maintains or has the potential to improve environmental performance”.</i> • Principle 7: <i>“Any administrative requirements or information demands related to environmental labels and declarations shall be limited to those necessary to establish conformance with applicable criteria and standards of the labels and declarations”.</i> • Principle 8: <i>“The process of developing environmental labels and declarations should include an open, participatory consultation with interested parties. Reasonable efforts should be made to achieve a consensus throughout the process”.</i> • Principle 9: <i>“Information on the environmental aspects of products and services relevant to an environmental label or declaration shall be available to purchasers and potential purchasers from the party making the environmental label or declaration”.</i>

At end of 2010 more than 1,150 Type III ecolabel ‘licences’ were awarded across 26 product groups. These include a wide range of products, across different sectors with some sectors undertaking specific initiatives to further develop labelling standards.

For example, work is currently underway to develop an EU ecolabel for buildings, which will consider consumption of freshwater resources – looking at each part of a building’s life cycle, with this method likely to be built on the use of life cycle impact assessment techniques. The assessment is to be carried out in accordance with ISO 14040, with documentation and calculations prepared in accordance with CEN/TC 350 – prEN 15978 on the sustainability of construction works (Assessment of environmental performance of buildings - Calculation method). In addition, under ISO 21930 or the system of Fiches de Declaration Environnementale et Sanitaire, suppliers of construction products are currently producing environmental product declarations, using LCA techniques which provide information on total water volume used in producing a product (including evaporated water and cooling water).

Other organisations have also set out criteria or standards for ecolabelling of products and services. These include the Global Ecolabeling Network’s Internationally Coordinated Eco-labelling System (GENICES), which was produced in 2003. The

Global Ecolabeling Network (GEN) is a non-profit association of Type I ecolabelling organizations, which aims to improve, promote, and develop the ecolabelling of products and services.

Similarly, the International Social and Environmental Accreditation and Labelling (ISEAL) Alliance, a global association for social and environmental standards, are working with established and emerging voluntary standard systems to develop guidance and to help strengthen the effectiveness and impact of these standards. The ISEAL Code of Good Practice for Assuring Compliance with Social and Environmental Standards appears to build on the ISO principles listed above.

It also:

- sets out requirements for auditing, certification and accreditation bodies that support the credibility, accessibility and growth of these activities;
- this Code builds on existing good practice in assurance to provide additional guidance specific to social and environmental standards systems;
- this Code is in development as of January, 2011 with an anticipated completion date of June, 2012.

ISO Standards and Footprinting

The ISO is also considering the development of a water footprint standard (both inventory and impact based) which will deliver principles and requirements for water footprinting of products, processes and organizations. It is hoped that this work will provide internationally harmonized metrics for water footprints (thus avoiding unjustified claims) and will fill an important gap in its environmental management portfolio which would allow freshwater use to be considered in Life Cycle Analysis (LCA) studies. The standard would *inter alia*:

- deliver guidelines for a water footprint metric;
- define how the different types of water sources should be considered and how local environmental and socio-economic conditions should be treated; and
- address the communication issues linked to water footprinting (based on ISO 14020 series on environmental labels and declarations).

The ISO standard on 'water footprint requirements and guidelines' (ISO 14046), aims to be consistent and coherent with ISO14000 series, and with environmental metrics such as carbon footprint, LCA (ISO14040 and ISO 14044), GHG accounting (ISO 14064-1,-2,-3 and ISO 14067-1), and with environmental communication (ISO 14020, ISO 14067-2). Working Group 8 has recently proposed a scope for the standard as specifying "*requirements and guidelines to assess and report water footprints based on LCA*". It is not being proposed that the standard should offer a methodology for calculating offsets or compensation, but it would address positive aspects, such as the benefits of decreasing the water footprint (Raimbault and Humbert, 2011). Work on the standard began in 2009 and was due to last three years, with an end date in June to September 2011. Consultation with the ISO, however, has indicated that a standard is not likely to be established until 2013 to 2014.

The intention in developing the ISO water footprint standard is to fill an important gap in the ISO's overall environmental management portfolio – and in particular the fact that freshwater use is rarely considered as an impact category in present LCA studies and in other ISO standards. In LCAs, water consumption is typically treated as an intermediate product to be used for the life cycle inventory, without further consideration of whether the water is used from limited resources in dry areas, or from abundant and renewable resources in wet areas. The resulting information is therefore of limited use in decision making. The aim is therefore to provide a standard that can explain and describe what a water footprint is to provide coherence with other environmental metrics used in life cycle assessments, as well as with other indicators.

2.5.4 Certification, Labelling and Trade

Several authors have noted that the compatibility of ecolabelling schemes with current WTO law is unclear. Currently, two committees of the WTO discuss provisions for eco-labels: the Committee on Trade and Environment and The Technical Barriers to Trade Committee. The fact that ecolabels are discussed in two committees, however, has created uncertainty regarding which WTO provisions might apply to eco-labels (Stein 2009). There also appears to be some debate regarding which of these committees is better suited for the task.

The work programme of the Committee on Trade and Environment (CTE) includes discussing “*the relationship between trade rules and environmental requirements for products, including packaging, labelling and recycling standards and regulations*” (Item 3b) and in 2001 the Doha Declaration asked the CTE to focus on environmental labelling.

The WTO Agreement on Technical Barriers to Trade (TBT) deals explicitly with eco-labelling, but there is ongoing debate about how the obligations of the TBT Agreement apply to eco-labelling initiatives (FAO, n.d.). The aim of the TBT Agreement is to try to ensure that regulations, standards, testing and certification procedures do not create unnecessary barriers to trade and to ensure that Members of the WTO do not use technical regulations or standards to disguise protectionist action⁶ (FAO, n.d.). According to the TBT Agreement, WTO Members cannot use technical regulations or standards to deny market access or discriminate against imported goods (except where they are operating by an internationally accepted set of standards or regulations). However, the agreement also recognizes that countries have a right to adopt the standards they consider appropriate for the protection of the environment.

⁶ Under the TBT Agreement, “technical regulations” refer to mandatory requirements for products or related processes and production methods (PPMs) while “standards” refer to voluntary requirements for products of related PPMs. Note that both regulations and standards may relate to “*terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method*” (TBT Agreement, Annex I).

2.6 International Considerations

2.6.1 European Neighbourhood Policy (ENP)

The ENP, developed in 2004, is designed to strengthen “*prosperity, stability and security*” in countries ‘neighbouring Europe’ (e.g. the Near East, Northern Africa and Russia /non-EU Eastern Europe) with the objective of preventing new dividing lines from emerging between the enlarged EU and its neighbours.

The ENP aims to build an increasingly close relationship between the EU and its neighbours by working with partners to reach agreement on reform objectives across areas of ‘common’ interest (democracy and human rights, rule of law, good governance, market economy principles and sustainable development). In support of partners’ own efforts, the EU provides financial and technical assistance to support the implementation of these objectives.

2.6.2 Horizon 2020 (H2020)

The aim of the ‘Horizon 2020 Initiative’ is to reduce pollution in the Mediterranean by the year 2020 by tackling the sources that account for around 80% of the overall pollution of the Mediterranean Sea (municipal waste, urban waste water and industrial pollution).

The initiative is built around four elements (European Commission, 2011b):

- projects to reduce the most significant pollution sources focussing on industrial emissions, municipal waste and urban waste water, responsible for up to 80% of pollution in the Mediterranean Sea;
- capacity-building measures to help neighbouring countries create national environmental administrations that are able to develop and police environmental law;
- using the Commission’s Research budget to develop and share knowledge of environmental issues relevant to the Mediterranean; and
- developing indicators to monitor the success of Horizon 2020.

The initiative operates within the framework of existing and developing policy instruments, and supports the implementation of the commitments undertaken in the framework of the Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution.

3. VIRTUAL WATER AND WATER FOOTPRINT METHODS

3.1 Introduction

The aim of the first task for this study was to review current applications of water footprinting and virtual water approaches and to illustrate best practice in water footprinting for policy or voluntary schemes. Thus, the aim has been to address the following types of issues.

- Nomenclature and terminology: what is the difference between a water footprint and virtual water?
- What are the main methodologies/approaches for assessing water footprints and virtual water, including those under development?
- Who has developed these methodologies/approaches and what level of application are they intended for (for example, individual consumer level, community or country level, product level, or business/organisation level)?
- What are the limitations of current approaches and subsequent future challenges?
- What are the main examples of the best practice application of these approaches around the world in policy making and/or voluntary schemes?
- What is the most appropriate methodology for different types of users and levels of decision making (individual, business, local versus regional government)?
- What is the position of different stakeholders with regard to the use of water footprinting and virtual water as a way of providing information on water management practices?

This section summarises our findings from examining the above issues through an approach based on a combination of literature review and consultation. The latter has included consultation with Member State authorities, international organisations, stakeholders involved in development of footprinting methodologies as well as corporate entities experienced in their application.

We start by considering the nomenclature and the main methodologies, with this followed by a discussion on the different levels of application for these methodologies and the key issues that arise from their use at these different levels. Overall the discussion provides an indication of what may constitute best practice; however, given the on-going development of the methods and the continually evolving nature of their use, we have been unable to reach conclusive recommendations on those applications that reflect best practice models for promotion as part of future policy.

3.2 Key Definitions

3.2.1 Virtual Water and Water Footprint

In our view, there is no agreement regarding the definitions of “virtual water” or “water footprint”, with both being the subject of debate amongst those interested in this field.

Originally referred to as ‘embedded water’, the term ‘**virtual water**’ was first used by Professor Tony Allan during a seminar in 1993 (Allan, 2003). “Virtual Water” is defined as the sum of water used or incorporated in the various steps of a production process of a commodity (hence, it a production-based indicator). Allan published one of the first articles outlining the use of the concept (Allan, 1998a), showing how international trade in food can move “virtual water” from comparatively advantaged regions to regions where water is scarce. In other words, a country producing and exporting a water-intensive product to another country is exporting water in its virtual form (Hoekstra, 2003).

It has been suggested that importing water-intensive products creates a means for water-poor countries to achieve water security, rather than having to produce all water-demanding products domestically. Conversely, such a trade allows water-rich countries to benefit economically from their natural resources. However, there is also concern over water-poor countries exporting scarce resources in the form of water-intensive products to water-rich countries (Allan, 2003).

Allan (2003) did not attempt to expand the scope of virtual water beyond agriculture, although others have since done so. In addition, he did not attempt to quantify virtual water. This was because gaining acceptance of the notion of virtual water was a politically-charged issue, since national governments did not wish to appear dependent on others for their water security. Allan (2003) considered that quantification of the detail would be time-consuming with ambiguous and inconclusive outcomes and any numbers would be rejected along with the rejection of the idea.

However, quantification of virtual water has occurred as the notion has gained greater acceptance over the past 10-15 years. For example, the work undertaken by the ‘Value of Water’ research group at the UNESCO-IHE Institute for Water Education in the Netherlands (Hoekstra and Hung, 2002), the World Water Council (WWC) in collaboration with the FAO (Renault, 2003 and Zimmer & Renault, 2003); many other are also now working in this field, as reviewed later in this section.

The term ‘**water footprint**’ was introduced by Hoekstra & Hung (2002) in analogy to the well known concept of ‘ecological footprint’ developed by Wackernagel & Rees (1996). They defined the term as the “sum of the domestic water use and net virtual water import”, and suggested that it is a measure of a nation’s actual appropriation of the global water resources. Subsequent studies have used the concept to refer to the water appropriation by individuals and other well-defined groups of consumers (e.g. a city, a region or a state) and producers (e.g. a public organization, private enterprise or economic sector). The water footprint of an individual, business or nation has been defined, therefore, as the total volume of fresh water that is used to produce the goods and services consumed by an individual, business or nation (Hoekstra and Chapagain 2008) and can be considered to be the sum of all the virtual water in the supply-chain.

Somewhat confusingly, the term ‘water footprint’ has also been used to describe the virtual water content of a commodity or product, summed over its life cycle. Such studies have been carried out for a range of commodities/products, for example, cotton (Chapagain *et al.*, 2006); tea & coffee (Chapagain & Hoekstra, 2007); bio-energy (Gerbens-Leenes, *et al.*, 2009); food-waste (Ridoutt *et al.* 2010); wheat (Mekonnen &

Hoekstra, 2010a). In these cases, the water footprint is equivalent to the virtual water content.

In as much as Allan found the term ‘virtual water’ more resonant with the public than ‘embedded water’, so the term ‘water footprint’ has become widely used. Figure 3.1 shows the rapid increase in the number of publications in the field.

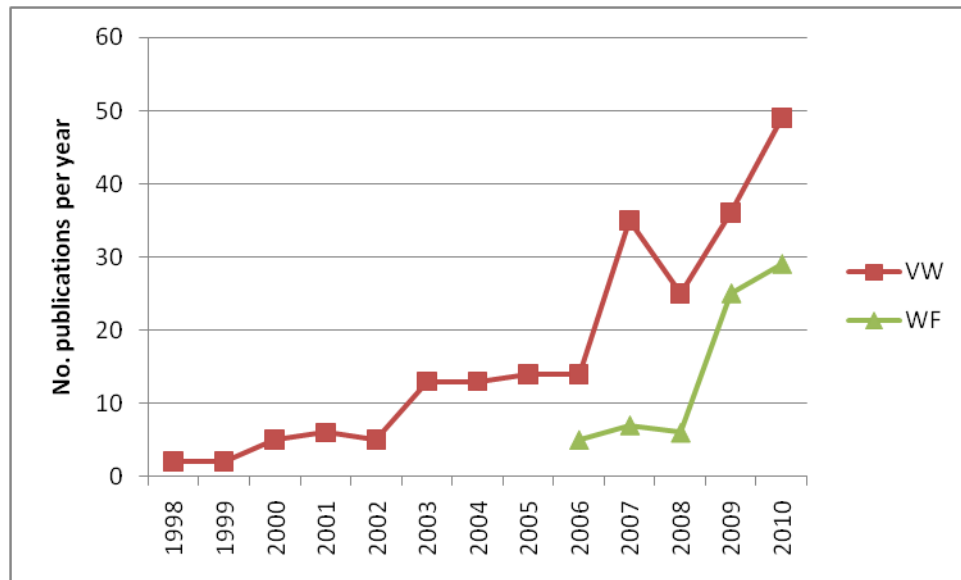


Figure 3.1: Number of publications in ‘Web of Knowledge’ with the terms ‘virtual water’ (VW) or ‘Water Footprint’ (WF) in the title or abstract by year

It is clear that the term ‘virtual water’ has been most widely used in the context of international trade. For example, of the 76 academic publications (between 1998 and 2010) with the term in the title, two thirds also contain the words ‘trade’ or ‘trading in the abstract or title. The remainder refer to the use of the concept in strategic planning or are reviews.

It has been suggested that an important distinction between virtual water and the water footprint is that a water footprint “*does not simply refer only to a water volume, ...*”, instead it is a “*multidimensional indicator, not only referring to a water volume used, but also making explicit where the water footprint is located, what source of water is used and when the water is used*” (Hoekstra *et al.*, 2011: 167). That is, the water footprint is more than simply a number (although it is clear that most studies have reported the water footprint as a number).

It is worth noting that the term ‘water footprint’ is generally used to imply the level of impact of human activity on freshwater resources and the environment. For the most part, however, water footprints measure the water content of products and not the impacts of water use (this issue is discussed further in Section 3.6).

3.2.2 The Assessment Methodologies

As the water footprint of a good or service is based on the sum of the virtual water content in its constituent parts, we will only consider here methodologies for calculating water footprints.

A water footprint assessment refers to the full range of activities to: quantify and locate the water footprint of a process, product, producer or consumer or to quantify in space and time the water footprint in a specified geographic area; assess the environmental, social and economic sustainability of this water footprint; and formulate a response strategy. Thus there are four distinct phases (after Hoekstra *et al.*, 2011 and others):

1. Setting goals and scope;
2. Volumetric water footprint accounting;
3. Sustainability / impact assessment; and
4. Response formulation.

Some elements of each of the above four phases are not defined in detail and are left to be specified by the individual study. As a result, it can be difficult to compare the results of different applications of the methodology. As discussed later in this Section, this has been a problem in the past as different users of the method have adapted the methodology for their specific use or over time.

In this respect, three basic approaches to the calculation of a water footprint can be identified:

- the **volumetric approach**, which is based on an assessment of the volume of water associated with a particular production activity; and
- the **stress weighted approach** which is based on an assessment of the amount of freshwater used in a production activity combined with an assessment of the implications of that use in terms of water stress; and
- the **Life Cycle Assessment (LCA) approach** which is aimed at indicating the environmental impact of the volume of water abstracted for production purposes.

Process-based, or bottom-up, approaches to calculating the water footprint (as part of volumetric water footprint accounting) use individual production processes as their building blocks to calculate water footprints. Feng *et al.* (2011) distinguish between those studies which apply life-cycle assessment (LCA) and essentially account only for direct water use, and those which account for both direct and indirect water use by accounting for virtual water flows, as advocated by Hoekstra *et al.* (2011).

Top-down approaches use environmental input-output analysis (EIOA) (see, for example, Dietzenbacher & Velazquez, 2007; Zhao *et al.*, 2010). For example, the Stockholm Environment Institute (UK) used the 2004 UK national input-output table from the Office for National Statistics (Feng *et al.*, 2011).

3.3 Volumetric Water Footprint Accounting

3.3.1 Water Consumption

The human appropriation of freshwater can be considered under two headings; water consumption and water pollution.

Consumption refers to loss of water from ground or surface water bodies in a basin. 'Consumptive water use' therefore refers to one of the following four cases⁷:

- water evaporates, where this includes the water that is transpired by plants and evaporation from storage (for example, from reservoirs), transport (for example, from open canals), processing (for example, evaporation of heated water that is not recollected) and collection and disposal (for example, from drainage canals and from wastewater treatment plants);
- water is incorporated into the product;
- water does not return to the same water body, for example, it is returned to another basin or the sea; and/or
- water does not return in the same period, for example, it is withdrawn in a scarce period and returned in a wet period.

As such, the volume of consumption is less than or equal to the volume of withdrawal (or abstraction). The difference between consumption and withdrawal is termed 'borrowed water' is water that is temporarily removed from the water body but returned to the same water body in an unaltered condition. This water is available for use elsewhere in the basin and therefore is a non-consumptive use.

The "Colour of Water"

Most work on virtual water has considered all water together, however, most water footprinting work has differentiated between 'green' and 'blue' water. The distinction between the blue and green water footprint is important because the hydrological, environmental and social impacts, as well as the economic opportunity costs of surface and groundwater use for production, differ distinctively from the impacts and costs of rainwater use.

i) Green Water

Green water refers to the precipitation consumed during the production process and is the fraction of precipitation on land that does not run off or recharge the groundwater, but evaporates or transpires or is incorporated in the biomass (although the latter is generally a very small proportion of the total green water consumption). This is particularly relevant for agricultural and forestry products (products based on crops or wood). The argument for including green water use is that the historical engineering focus on blue water (below) has led to the undervaluation of green water as an important factor of production (Falkenmark, 2003; Rockström & Gordon, 2001).

⁷ These definitions are informed by, but not strictly based on, Hoekstra *et al.* (2011).

ii) **Blue Water**

Blue water refers to fresh water resources (rivers, lakes reservoirs and groundwater). The blue water footprint refers to the consumptive use of blue water; in other words, the abstraction of water from the basin insofar as it does not return to the basin in the form of return flow. Blue water resources are generally scarcer and are considered to have a higher opportunity costs than green water and, as a result, some water footprint studies focus on accounting of the blue water footprint only.

Hoekstra *et al.* (2011) suggest it may be relevant (depending on the scope of the study) to distinguish between different sorts of blue water, for example surface water, flowing (renewable) groundwater and fossil groundwater. In practice, this is often very difficult because of insufficient data.

Where the blue water footprint is specified by source, special consideration must be given to the use of harvested rainwater. In most cases, rainwater harvesting refers to the collection of rain that otherwise would become run-off, thus it can be considered as blue water rather than green water. In addition, water recycling and reuse can be instrumental in reducing the blue water footprint only when it effectively reduces consumptive water use.

3.3.2 Water Pollution

It is argued that pollution is a form of water appropriation, in that pollution of freshwater limits its availability for subsequent uses. Some (e.g. Hoekstra *et al.*, 2011) have attempted to express the degree of pollution in terms of the volume of freshwater that is required to assimilate the load of pollutants based on natural background concentrations and existing ambient water quality standards, and termed this 'grey water'⁸. Although ambient water quality standards often exist in national or state legislation, they do not exist for all substances and for all places. Thus, if grey water is included in a footprint, it is important to specify which water quality standards and natural concentrations have been used in its calculation.

3.3.3 Spatiotemporal Explication

Water footprints can be assessed at different levels of spatiotemporal detail depending on intended use and data availability (Table 3.2).

⁸ The term grey water in this context is an imaginary volume of water required to dilute pollutants and should not be confused with recycled waste water.

	Spatial explication	Temporal explication	Source of required data on water use	Typical use of the accounts
Level A	Global average	Annual	Available literature and databases on typical water consumption and pollution by product or process.	Awareness-raising; rough identification of components contributing most to the overall water footprint; development of global projections of water consumption.
Level B	National, regional or catchment-specific	Annual or monthly	As above, but use of nationally, regionally or catchment specific data.	Rough identification of spatial spreading and variability; knowledge base for hotspot identification and water allocation decisions.
Level C	Small catchment or field-specific	Monthly or daily	Empirical data or (if not directly measurable) best estimates on water consumption and pollution, specified by location and over the year.	Knowledge base for carrying out a water footprint sustainability assessment; formulation of a strategy to reduce water footprints and associated local impacts.
<p><i>Note: The three levels can be distinguished for all forms of WF accounting (e.g. product, corporate, national)</i></p> <p><i>Source: Hoekstra et al. (2011)</i></p>				

3.4 Stress Weighted Approach to Water Footprint Assessment

In order for a water footprint to act as an indicator of impacts on the environment, it needs to not only reflect the volume of water used but also the sustainability of that resource appropriation. Thus, the impact of water use will vary by method of production, local soil type, local climate, variety of product, and time of year among other factors (Segal & MacMillan, 2009). It is argued therefore that if, for example, different production stages take place in different locations or at different times, the single volumetric water accounting number is not able to convey the impact of that water use on the environment and would not be comparable from one product or service to another.

As there is no clear relationship between a volumetric water footprint and the potential for water consumption to cause social and/or environmental harm, attempts have been made to modify the methodology to bring it more in line with the principles of LCA (Pfister *et al.*, 2009; Ridoutt & Pfister, 2009). This has given rise to the 'stress weighted approach' to estimating a water footprint.

The approach proposed by Ridoutt & Pfister (2009) is effectively an adaptation of that put forward by Hoekstra *et al* with the aim of incorporate water stress characterisation factors into the footprint assessment. By so doing, they argue it is possible to make quantitative comparisons between different products and between different stages of a product's life cycle on the basis of environmental impact. Blue water is normalized

using global and regional stress factors⁹ adapted from Koehler *et al.* (2009). The ‘Water Stress Index’ (WSI) to serve as a characterisation factor that indicates the portion of consumptive water use that deprives other users of freshwater. In this respect, the methodology is more in keeping with the way in which characterization factors are used to describe the global warming potential of different greenhouse gases in a carbon footprint.

Ridoutt & Pfister (2009) argue that green water has a low opportunity cost, as it would not be available for other uses were it not to be used for crop production; it is further suggested that in many cases, agricultural production uses less green water than natural vegetation may use. They further argue that, as green water does not contribute directly to environmental flows, its consumption does not directly contribute to water scarcity. As a result, green water is given a characterisation factor of zero and is effectively ignored.

To calculate a stress weighted water footprint, Ridoutt & Pfister (2009) begin by calculating a volumetric water footprint for blue and grey water components. Although the grey water concept is seen by Ridoutt & Pfister (2009) as an “*imperfect*” measure, it is included in the calculation due to the importance of considering the impacts of degraded water quality on usable water quantity. The volumetric footprint is broken down into the different stages of the supply-chain, and the water stress factor is developed from the location of these. Once the volumetric footprint has been calculated, the value for each distinct stage of the life cycle for the components of the product are multiplied by the WSI value for the relevant areas of production to produce a stress-weighted water footprint. Where exact locations could not be established, water stress indices for the region are averaged. This is then aggregated to represent the product total. The grey water component is calculated separately in order to make its inclusion in the water footprint optional and to facilitate comparisons.

The final stage is the conversion of the stress-weighted water footprint into a local ‘equivalent’ footprint, based on the water stress factor for wherever the ‘audience’ the water footprint is intended for are located. This step is included in order to facilitate a contextualised communication of the results, rather than an actual measure of the water used.

For example, in their 2009 report, they convert the stress-weighted water footprint of Dolmio® pasta sauce (141 litres per 575g jar) into an Australian ‘equivalent’ by converting the footprint by the averaged Australian water stress factor, 0.402, (this gives an Australian equivalent stress-weighted water footprint of 350 litres per 575g jar).

It is important to note that the result reported using the stress weighted approach is not the same as the volume of water used in production. Firstly, by definition the water footprint is scaled according to a stress factor. Secondly, as green water is the largest component of the water footprint of many agricultural products, this leads to much

⁹ Where water stress is defined as the ratio of total annual freshwater withdrawals to hydrological availability.

smaller estimates of water use than those calculated by researchers following the conventional WFN methodology. However, in contrast to most volumetric studies which have ignored water consumption in the use phase, in their assessment of Dolmio® sauce and Peanut M&M's®, Ridoutt & Pfister (2009) include not only water used in agricultural production and ingredient processing but also operations, packaging and the product use phases.

3.5 LCA Approach to Water Footprint Assessment

Life cycle assessment (LCA), also known as life cycle analysis, is a methodology for assessing the environmental performance of a product or service over its life cycle (i.e. “from cradle to grave”). As such, it considers all environmental impacts including energy use, emission of green house gasses, pollution and water use, although water has frequently been neglected (Berger & Finkbeiner, 2011).

A broad range of methods have been developed to incorporate water use in life cycle analysis (LCA). Most of these have been developed to support life cycle inventory (LCI) and life cycle impact assessment (LCIA) modelling within LCA (Berger & Finkbeiner, 2011). Guidance for carrying out a LCA is provided by the International Organisation for Standardisation (ISO), within the series ISO 14040 and 14044.

As with water footprinting, the impact of water use in LCA is based on estimates of water consumption. In Life Cycle Inventory (LCI), an inventory list of all inputs and outputs of water is created for a product or a service, and the water consumption is determined from the difference between inputs and outputs. The inventory analysis stage is similar to the water accounting stage of water footprinting. According to Hoekstra *et al.* (2009), the volumetric Water Footprint approach provides a potentially useful methodology for quantifying water use for LCI; however, in the volumetric water footprint approach, water consumed is separated into green, blue and grey water, whereas in LCA green water is not normally considered and blue water may be subdivided into many classes according to its occurrence (e.g. surface water/groundwater) or quality. Grey water is not considered in LCI and the impacts associated with pollution are dealt with elsewhere. Jeswani & Azapagic (2011) provide an overview of the types of water included in current LCA databases. They conclude that not only are the terminology and categorisation used in the databases inconsistent, key parameters for assessing water use impacts (e.g. geographic location) are missing.

When considering water, it is important that the indicator reflects the impacts (both environmental and social) of water use. In Life Cycle Impact Assessment (LCIA), the effects of the resource use and emissions generated are grouped and quantified into a limited number of impact categories which may then be weighted by importance. Water consumption from the LCI is then weighted according to appropriate characterisation factors to account for the differing impacts associated with using water from different sources. Many LCIA methods use the withdrawal-to-availability¹⁰

¹⁰ The withdrawal-to-availability ratio is the ratio of total annual freshwater withdrawal for human uses in a specific region to the annually available renewable water supply in that region.

(WTA) ratio for calculating characterization factors, so water withdrawn from a water body that is over-exploited would have a much higher weighting than water withdrawn from an under-utilised water body. It should be noted, however, that many other methods are also used to derive characterisation factors. Methodological frameworks for the integration of water use impacts in the LCIA stage of LCA have recently been proposed by Frischknecht *et al.* (2009), Mila i Canals *et al.* (2009) and Pfister *et al.* (2009).

Jeswani & Azapagic (2011) and Berger & Finkbeiner (2011) have comprehensively reviewed LCA approaches to water footprinting. They conclude that there is no generally agreed methodology. There is variability with regard to the types of water use accounted for, the inclusion of local water scarcity conditions, as well as the differentiation between watercourses and quality aspects. These are some of the drivers behind the work being undertaken by the ISO to establish an international standard to assess water use in LCA.

3.6 Critiques of Footprinting Concepts and Assumptions

3.6.1 Overview

From both the literature and consultation, we have identified a number of issues surrounding the application of the different footprinting concepts and methods which are relevant to the potential role of these tools within EU policy. These are summarised below in the following order:

- conceptual issues;
- methodological issues; and
- interpretation issues.

A more detailed discussion on some of these issues is provided in Annex 1, which also provides an expanded discussion of the different levels of application of footprinting assessments.

3.6.2 Conceptual Issues

Virtual Water as a Concept

It is important to note that not all commentators accept the concept of virtual water. For example, Wichelns (2010) objects to:

- a) the notion of net national water savings; and
- b) the notion that consumers are to blame for water resource issues.

In relation to the first point, Wichelns (2010) refutes the notion of saving something that does not exist, for example estimates of net national water savings which result from calculations regarding hypothetical production scenarios that do not represent actual or potential water savings. Wichelns (2010) also suggests that consumers respond to prices and it is not their fault if prices do not reflect negative externalities. This raises

the question of language used in presenting the results, for example ‘blaming’ consumers for water resource issues. Wichelns (2010) states “*public officials in Moscow long ago chose to develop irrigated agriculture in Central Asia at the expense of the Aral Sea. European consumers could not have prevented the inevitable outcome of that policy decision.*” Wichelns (2010) also argues that negative impacts could persist even if one country changes trading habits (international trade does not happen in isolation). It is suggested that a more helpful approach to improving resource management is to focus on the policy environment in producing regions as responsibility lies with state and national governments e.g. public policies do not provide correct signals regarding water scarcity or water-quality issues.

Reduction of Water Footprint to a Single Number

A major problem with the water footprint is that it is an attempt to convey more than one piece of information in a single number. A water footprint must not only look at the total water use per unit of product across the value chain, but must also consider where that water is used, what proportion that water use represents of the total available resource in that area, and whether this proportion of water use presents risks to the environment, communities, or business now or in the future (WWF and SABMiller, 2009). The impact of water use will vary by method of production, local soil type, local climate, variety of product, and time of year among other factors (Segal & MacMillan, 2009). If, for example, different production stages take place in different locations or at different times, a single number is not able to convey the impact of water use on the environment (King, 2010).

Distinction between Water Types

Many volumetric water footprint studies have made the distinction between green and blue water. Wichelns (2010) notes, however, that this distinction is problematic as the two components are not mutually exclusive, e.g. soil moisture moves through the soil profile and contributes to groundwater while rainfall contributes both to soil moisture and directly to surface water flow in lakes and streams. In other words, the amount of green water used in production will affect the amount that can go to recharge or runoff.

In contrast, the stress weighted approach does not consider green water. This is considered an advantage by some commentators as it is argued that most agricultural production systems do not limit the availability of freshwater for the environment or other social purposes through their consumption of green water (WBCSD, 2010).

Similarly, the standard LCA methods do not make a distinction between the different types of waters with inputs withdrawn or abstracted from surface, ground, sea, rain and drinking water supplies usually aggregated together within the total estimate of water inputs (i.e. they are not individually differentiated).

Assumption of Equality Amongst Blue Water Sources

Most water footprint applications assume that all sources of blue or green water are equal, irrespective of the source of the water (lake, river, groundwater sources with varying recharge rates, etc.) or the timing of its withdrawal and use. However, in reality

there are many different ‘shades’ of blue and green water. For example, one could make a distinction between surface water, recharging groundwater and fossil groundwater. As noted earlier, this distinction is seldom made in practice as the data are generally not available (Hoekstra *et al.*, 2011).

Although the Stress Weighted Water Footprint approach attempts to account for the inequity between different sources of blue water, approach Hoekstra *et al.* (2011) suggest that, as impacts depend on the local context, it is impossible to design universally valid weighting factors.

Failure to Consider Efficiency of Production Activities

Another limitation which has been raised in relation to both volumetric and stress based water footprinting is that the water footprint has no capacity to show how efficiently a product is being produced (Segal & MacMillan, 2009). Some products (for example, cotton and paper) are inherently water intensive, even if water use is kept to a minimum in every stage of production. Efficiency can only be established by comparing how much water is used to make similar products, i.e. through some form of benchmarking.

3.6.3 Methodological Issues

One of the key concerns with regard to the use of water footprinting lies with the inconsistent use and application of water footprint methodologies in general. This has occurred for a number of reasons.

Definition of Terms

There is a lack of precision in the definition of some of the components of the water footprint, with this then leading to inconsistent application. For example, the Coca-Cola Company (TCCC & TNC, 2010) modified the WFN methodology by calculating the blue water footprint of sugar beet not as the difference between the crop water requirements and green water, but instead through site-specific data provided by sugar companies.

Lack of Agreed Boundaries

At present there are no agreed boundaries for the truncation (i.e. how far along the supply-chain should be taken into account) of water footprints, thus creating problems for comparing different water footprints. This applies equally to the volumetric and stress-weighted approaches, and is an important consideration when examining the comprehensiveness of a water footprint assessment; although the general rule is to include in the water footprint all processes within a production system (production tree) that ‘significantly’ contribute to the overall water footprint (Hoekstra *et al.*, 2011). Three significant issues occur in relation to the truncation of boundaries:

- **Labour** - an input factor in nearly all processes. In order to avoid a never-ending loop of double, triple counting and so on, it is common practice to exclude labour as a factor;

- **Transport** - in general, whether the water footprint of transport is to be included in the analysis depends on the rule chosen with respect to truncating the analysis. When transport is expected to have a minor contribution to the overall water footprint of a product, Hoekstra *et al.* (2011) suggest that this component can be left out of the analysis. However, Hoekstra *et al.* (2011) recommend including the water footprint of transport when biofuels or hydropower are used as the source of energy, because these forms of energy are known to have a relatively large water footprint per unit of energy; and
- **Energy** - again, in most cases the contribution of the energy as an input to production will be a small percentage of the overall water footprint of a product. An exception may be when energy is sourced from biofuel or from electricity from biomass combustion or hydropower, because those forms of energy have a relatively large water footprint per unit of energy.

Indirect water use (e.g. associated with labour, transport or energy) can be significant but general guidelines as to what to include have not yet been developed (Hoekstra *et al.*, 2011). In addition, it of note that most volumetric studies have ignored water consumption in the use phase. As such, there is some concern that users can ‘tweak’ methodologies to serve their own interests. In addition, different users may apply different definitions and criteria when reporting water use in environmental reports, in product packaging or documentation.

Data Availability

Ideally, the practical application of water footprint methodologies would use local data, however, all approaches rely heavily on local data that are often unavailable and/or hard to collect. Hoekstra *et al.* (2011) do not provide many guidelines for dealing with situations where few data are available (nor do Ridoutt & Pfister (2009) in relation to the stress weighted approach).

In order to overcome problems with data availability, many studies have used broad scale databases which fail to adequately account for local factors (e.g. variations in local farming practices). This fact may have important consequences for the robustness of the end results as the footprint calculations can be highly sensitive to just a few input parameters. Thus, a critique which is often made of both the volumetric and stress weighted approaches is that they rely heavily on assumptions, estimations and modeling.

For example, the use of agro-climatic models for estimating green and blue water use by crops usually relates *optimal* water use to *actual* yields (see also below). Very often crops are not fully irrigated (due to water availability, equipment or labour constraints). For example, TCCC & TNC (2010) found that actual irrigation of sugar beet was less than projected.

Data uncertainties in water footprint assessments can be very significant. While Hoekstra *et al.* (2011) note that carrying out an uncertainty analysis is definitely advisable; they do not indicate how this should be carried out. Indeed, so far, there has been no attempt to quantitatively analyse uncertainties using either a volumetric or

water stress approach (Hoekstra *et al.*, 2011). This and the other above data issues mean that water footprints may fail to adequately represent spatial/temporal variability.

Modelling Approaches

Most water footprint studies have used the CROPWAT model to estimate monthly effective rainfall. Although the software offers several alternative methods, the method referred to as the “USDA SCS method” has often been used due to its simplicity; being only a function of monthly precipitation and not requiring local calibration (e.g. Chapagain, *et al.*, 2006; Galan-del-Castillo & Valazquez, 2010; Chapagain & Orr, 2009). The alternative is to use a water balance simulation approach. Hess (2010) has shown that in a temperate environment using the USDA SCS approach underestimated the green water footprint, while in irrigated conditions it overestimated the blue water component of the water footprint.

Other models have also been developed to provide the basis for simulating crop water use. For example, the Global Crop Water Model (GCWM) was developed by the University of Frankfurt and aims, like the CROPWAT and the WaterGAP¹¹ models, to simulate crop water use. It simulates water use in ‘rainfed and irrigated agriculture’, and makes a distinction between blue and green water. It is said to vary from the other models such as WaterGAP, as it includes VW flows in order to facilitate analyses which draw on the concept of VW flows to discuss water scarcity and food security.

As part of the stress weighted method, Pfister *et al.* (2009) use the WaterGAP2 global model to calculate the water stress index. This model describes the withdrawal-to-availability (WTA)¹² ratio of more than 10,000 individual watersheds. However, it consists of both a hydrological and a socio-economic part and, therefore, is not a pure measure of resource stress. The quantification of annual freshwater availability and withdrawals for different users for each watershed take into account the availability of water related infrastructure.

As a result, the WSI is influenced has the potential to be misleading. For example, water stress within the index may stem from a lack of storage capacity within a watershed or high evaporation of stored water (Berger & Finkbeiner, 2011). To correct for such impacts on effective water stress, Pfister *et al.* introduce a variation factor (VF) to calculate a modified WTA which differentiates watersheds with strongly regulated flows.

¹¹ The GCWM is most commonly compared to WaterGAP, presumably because WaterGAP is also a project of the Goethe Universitat. WaterGAP is also the basis for the Water Stress Index used by Ridoutt/Pfister.

¹² WTA is defined as the ratio of total annual freshwater withdrawal for human uses in a specific region to the annually available renewable water supply in that region (Berger & Finkbeiner, 2011). Hence, WTA serves as an index for local water scarcity.

Time Period for Analysis

An issue which all footprinting methodologies face is how to deal with temporal variability. Many sorts of water use (particularly in the agricultural sector) vary from year to year and from season to season. Water footprint calculations are generally based on average climate data and therefore fail to account for year-to-year variability. Neither the volumetric nor the water stress methodologies yet fully account for temporal variability.

Grey Water Calculation

There is a lack of clarity lack of clarity regarding how to account for the impact of an activity on water quality degradation (grey water footprint). The main criticism is that the grey water calculation relies heavily on subjective water quality standards and thus, where there are objective standards, this may lead to non-comparability across different assessments.

There is also concern that estimation of pollutant loads is particularly difficult in agricultural applications, and will vary between farming practices and seasons. As a result, application of the WFN methodology for example is left making crude assumptions about diffuse emissions from farmland.

It appears that the grey water footprint is one of the most contentious aspects of the water footprint for many potential corporate users (WBCSC, 2010). For example, a Workshop held for corporate pilot testers of the methodology identified a number of issues with regard to both its calculation and to what its inclusion in the assessment is aimed at achieving; they conceptually challenge the value of grey water as an indicator of the degree of pollution, particularly in the context of countries with strict standards and in the absence of any fate and transport modelling.

Gross or Net Green Water?

In their application of the WFN methodology, SABMiller & WWF (2009) made an important change to the standard volumetric water footprint methodology by disaggregating green water into “net green” water. Essentially, the idea behind ‘net green’ water is to account for the fact that even without cultivation, naturally occurring vegetation (e.g. forestry) provides a substantial evaporative demand. Net green water, therefore, refers to the difference between evapotranspiration under cropped conditions and evapotranspiration under natural conditions.

As discussed earlier, Pfister (2009) has also suggested that in many cases natural vegetation has a higher evaporative demand than crops (implying that in such cases agriculture is a water-saving land use). At the limit, this gives way to arguments that net green water could, in some situations, be considered a negative input to the water footprint.

3.6.4 Interpretation of Results

Vocabulary

A volumetric water footprint is intended to provide an ‘account’, summarising water consumption as part of production activities; however, it is frequently interpreted as being a proxy indicator of the impact of an activity on the environment.

This arises in part from the accepted definition of a footprint which includes “the impact on the environment of human activity”. Thus, the implication is that a big footprint has a big impact and a bigger footprint has a bigger impact.

As this is not necessarily the case with the end number produced through a volumetric footprint assessment, its meaning can be confusing and there is the scope for misinterpretation by those new to the concept.

Use in Decision-making

Although the volume of water used per unit of product is a measure that consumers and businesses can easily understand, it is not considered by some to be a particularly useful tool for water resource or sustainability management (King, 2010).

The use of the footprint for policy making purposes has therefore been criticised for:

- lack of consideration of social, ethical issues, policy considerations or governance and stewardship concerns (Segal & MacMillan, 2009); and
- lack of consideration of opportunity costs of water use (Segal & MacMillan, 2009).

As long as water is not priced or allocated in ways that reflect opportunity costs or scarcity values, then decisions regarding water use are not optimal from society’s perspective. Wichelns (2010) therefore suggests that better policies are needed to ensure that water is used more efficiently. In this respect, public authorities will be better informed through a more accurate description of the importance and opportunity costs of water in agricultural and other production activities than through a footprint assessment.

Although the stress weighted methodology does address water use in terms of water scarcity, neither the stress weighted nor volumetric methodologies enable consideration of the wider environmental, social and economic aspects of sustainability, (climate change, land degradation, loss of biodiversity, poverty and so on). In contrast, LCA approaches do try to address these issues as part of the overall aggregation of effects into an indicator of impact.

Not all authors or stakeholders would agree with the above views. For example, although the volumetric water footprint can be presented as one aggregate number, it is in fact a multidimensional indicator which shows different sorts of water consumption and pollution as a function of space and time (Hoekstra *et al.*, 2011). The detailed layer of information which is embedded in the composite water footprint indicator can therefore provide the information needed by users to develop strategies for more

sustainable water use. It is argued that this is one of the key drivers underlying corporate interest in the use of these techniques across their supply-chains. Examination of the detailed information is said to enable companies to identify key water use issues across their suppliers and thus allows them to work with suppliers to better manage their activities.

3.7 Review of Best Practice

3.7.1 Overview

Although the water footprint concept has now lived in the academic literature for nearly a decade, it was not until the second half of 2007 that the concept entered the world of business, government and civil society (Hoekstra *et al.*, 2011). This means that practical experience of undertaking water footprinting studies is still very limited and there are few examples of full water footprint studies. In particular, given the fact that the latest guidance on the WFN approach to footprinting has only been released in 2011, there are no published examples of its full application to act as a model for best practice.

Furthermore, because the development and application of water footprinting methods is still relatively new, it has not been widely reviewed within the academic literature (although this is changing).

Against this background, this section presents information drawn from the literature and includes feedback from consultation on practical applications of footprinting. From this, we have identified four main levels of assessment for footprinting:

- the commodity or product level;
- corporate level applications, where this may relate to a single business entity or a supply-chain;
- the water resources planning level, which may be local, regional or national; and
- the consumer level, with the aim of educating consumers about the level of water consumption associated with their behavior.

A summary of the types of applications identified at all four levels through the literature review and consultation is provided below. This includes conclusions on those applications which would appear at the present time to reflect best practice.

3.7.2 Commodity Level Applications

Range of Applications

Water footprinting at the commodity level has found a wide range of applications from food and drink to household, agricultural and industrial products (see Annex 1 for an example list of studies).

The majority of water footprinting studies undertaken at this level have been for agricultural products, including wheat (Mekonnen & Hoekstra, 2010a), rice (Chapagain

& Hoekstra, 2010), barley and oats (Ridoutt & Poulton, 2009), livestock products (Mekonnen & Hoekstra, 2010), tea and coffee (Chapagain & Hoekstra, 2007), and pizza and pasta (Aldaya & Hoekstra, 2010). Commodity level water footprint assessments have also been carried out on industrial and energy products including biofuel and biofuel-based products (Gerbens-Leenes *et al.*, 2008; 2009; and 2010), cotton (Chapagain *et al.*, 2006) and paper products (Van Oel & Hoekstra, 2010).

However, given the great diversity of industrial products, the complexity of their production chains and the fact that production methods differ greatly between nations and companies, few studies have tried to calculate the water footprint of specific industrial products. The WFN has suggested that in order to calculate a global estimate for the water footprint of industrial products, we can look at the average water need of industrial products not per unit or per kilogram but per unit of value (e.g. water use in litres per US\$).

Stated Aims

Commodity level water footprint assessments have been carried out for the following purposes:

- to assess the usefulness of the water footprint concept and/or to contribute to methodological development (e.g. by extending existing data to more localised levels, or to include factors such as water stress etc.);
- to increase the academic literature on water footprints of a certain product and/or to address issues specific to that product;
- to raise awareness of issues surrounding water use; and
- to inform business practice.

Definitions Used

The definitions of a water footprint assumed in commodity level studies may be divided into those which define the water footprint from the perspective of production (i.e. the total volume of freshwater that is used to produce a particular good/service) and those which define the water footprint from the perspective of consumption (i.e. the total volume of freshwater that is used to produce the goods and services which are consumed by the inhabitants of a certain geographical area, generally a nation).

In general, the water footprints of commodities are considered from a production perspective. As such, the results are mostly presented as specific measures, i.e. water quantity per unit produced.

Source(s) of Methodology and Modifications

The majority of commodity water footprint studies have been undertaken by Hoekstra and colleagues within the WFN. As such, three publications are frequently cited as the source of the methodology used, namely Chapagain & Hoekstra (2004), Hoekstra & Chapagain (2008) and Hoekstra *et al.* (2009). Prior to the publication of the Water Footprint Manual (Hoekstra *et al.*, 2009, Hoekstra *et al.*, 2011) studies tended to

combine methodological approaches from different sources, however, the WFN method is now widely followed.

The differences in methodology that can be readily identified from the literature include (see also Annex 1):

- use of varying spatial resolutions for calculation of the footprint, together with reliance on different models to calculate effective rainfall and evapotranspiration rates;
- application of local data for some aspects;
- adoption of different assumptions when calculating green water consumption, for example, in relation to evaporation and percolation flows of irrigation water;
- the use of weighted average footprints rather than absolute figures for certain life-cycle stages, and in particular transport; and
- the inclusion of grey water within the assessment, rather than just basing calculations on blue and green water.

A small number of studies have also applied versions of LCA methodologies (for example, Chatterton *et al.*, 2010; Peters *et al.*, 2010; and Humbert *et al.*, 2009), and the WSI methodology of Ridoutt & Pfister (2009) has been applied to the production of wheat, barley and oats in New South Wales.

Impact Assessment

The commodity water footprint studies, particularly those based on the WFN method provide little consideration of the wider impacts of water use. Gerbens-Leenes *et al.* (2009) briefly discuss the consequences of changing completely from fossil energy to bio-energy, but mainly in terms of increasing the size of the water footprint. In contrast, Chapagain & Hoekstra (2007) refer to the opportunity costs of irrigation water and the environmental and social consequences of coffee and tea production, while the more recent study by Mekonnen & Hoekstra (2010b) include a sustainability assessment within their work on wheat.

Humbert *et al.* (2009) address energy and greenhouse gas emissions within their life cycle approach, whilst the WSI based studies carried out by Ridoutt & Pfister and Ridoutt & Poulton will have consider water scarcity issues through application of the stress weighted approach.

In general, though, the wider indirect consequences of water use are not well covered in the commodity water footprinting studies.

Comments

Whilst the majority of the results are presented transparently, the robustness of a number of the commodity water footprint studies is compromised by the use of generic data and methodological assumptions. They are also focused on the academic community and are not intended, for example, for wider communication with a consumer audience.

3.7.3 Corporate Level Applications

Range of Applications

There are numerous examples of business or corporate level footprint assessments. The vast majority of corporate water footprint studies undertaken to-date, however, have been scoping or pilot studies and only a few companies are able to disclose some of their results. Indeed, only a few published water footprint studies in the corporate context (e.g. WWF & SABMiller, 2009; TCCC & TNC, 2010; IFC *et al.*, 2010; Chapagain & Orr, 2010; Ridoutt & Pfister, 2009) provide any significant details on how their water footprint assessment was carried out.

According to the results of a questionnaire survey by the World Business Council on Sustainable Development (WBCSD, 2010), the most represented industrial sector undertaking corporate water footprinting pilot studies has been the food and beverage sector, followed by consumer goods, forest and paper, engineering, water operators, petro-chemical, cement, IT and the oil and gas sectors.

Examples of corporate application of the water footprint which have been, or are currently being undertaken, are given in Annex 1.

Stated Aims

While companies have typically reported on their operational water use (i.e. the amount of water used directly by the business in its own operations – which is mandatory in some countries, especially in Europe), water footprinting is increasingly being used by businesses to assess water use throughout their supply-chains.

Water footprinting has primarily been used by businesses to provide an insight into the largest components and locations of water consumption in the supply-chain. This provides a knowledge baseline, which enables businesses to improve their understanding of the associated risks and to inform the design of water management strategies, investment decisions and product improvement (WBCSD, 2010).

For example:

- companies have used footprinting to assess water use across a single product, from production to farm gate, to identify those stages where water use could be reduced (e.g. Dole Food Company);
- others have assessed water use across a value chain production, from raw materials to installation in consumers' premises, to reduce resource use as part of product design and manufacture (Borealis, pers. comm., 2011; KimberlyClark, 2010);
- others have focused more on water related regulatory and business risk across the value chain (SABMiller & WWF, 2009).

While some businesses which undertake water footprinting studies state that they do so to reduce 'business risks', few define explicitly on their websites or in relevant publications the types of business risk that are of primary concern. However, the WFN

and others note that businesses may use water footprinting as a way of addressing a range of different business risks (WFN, 2011; Barton, 2010).

i) Physical Risk

Companies may use water footprinting to reduce the risk of water shortage in their supply-chain or operations. Physical water risks may arise where there is too little water (water scarcity/drought), too much water (flooding) or where water is unfit for use (pollution) (Orr *et al.*, 2009). In many business operations, water is an irreplaceable resource and declines or disruptions in water supply can have serious implications.

ii) Reputational Risk

Companies may use water footprinting as a way to improve their image (corporate social responsibility), or as a way to reduce reputational risks. Corporate reputation and brand image are important intangible assets for firms wishing to create and maintain a competitive strategic advantage in the global marketplace (Clark & Salo, n.d.). A firm's brand image and corporate reputation can be severely damaged when water scarcity becomes a problem and firms perceived to be intensive users of water and large, high profile corporations are particularly vulnerable to criticism (Orr *et al.*, 2009). Real or perceived inequities between businesses and local communities in terms of their water use can affect businesses profoundly. Not only can such inequities severely damage business brand image, particularly in developing countries where local populations frequently lack access to reliable sources of safe drinking water, in some instances, local conflicts for scarce water resources can result in the loss of firm's licence to operate (Ceres Report, 2009). Hence, reputational risk has implications for insurers and investors. If a firm is able to demonstrate that it has helped to improve water management in a place where it has a significant water footprint, this could conceivably enhance its reputation (Orr *et al.*, 2009).

iii) Regulatory Risk

Companies may use water footprinting to reduce the risk of government interference or regulation in the area of water use. Regulatory change can be a serious problem for business and change to the regulatory regime around water represents a serious business risk (Orr *et al.*, 2009). Regulatory risks may arise when a change in the law or in regulation surrounding water use increases the operating costs of a business, reduces the attractiveness of investment and/or changes the competitive landscape (Orr *et al.*, 2009).

iv) Litigation Risk

Companies may face risks stemming from lawsuits or other legal actions due to the impacts of a company's operations or products on water supplies.

v) Financial Risk

Companies may use water footprinting as a way to identify areas for cost reduction. There are a number of ways in which water shortage can have financial implications for business. For example:

- water shortages can cause hydro-based power production to be restricted, and by extension, affect businesses that rely on those power sources (Ceres Report, 2009). Power plants that run steam turbines, whether fired by coal, natural gas, or nuclear energy, are also dependent on an adequate supply of water for cooling (Ceres Report 2009). Water shortages can, therefore, lead to increases in the cost of power generation and higher energy prices for businesses and consumers (Orr *et al.*, 2009);
- water shortage, or the risk of water shortage, can lead to higher insurance and credit costs and lower investor confidence which can undermine business profitability (Orr *et al.*, 2009);
- as water becomes scarce, water tariffs and other pricing mechanisms tend to increase due to greater competition for water between sectors and higher costs associated with abstraction (for example, if deeper boreholes need to be drilled, if greater pumping is required or if there is a need to invest in water transfer/transport) (Orr *et al.*, 2009). Businesses may find their competitive advantage undermined by cost inflation driven by water scarcity (Orr *et al.*, 2009).

However, Hoekstra *et al.*, (2011) recognise that although unsustainable components in a company's water footprint imply the aforementioned risks (physical, reputational, regulatory etc), carrying out a water footprint assessment is not the same as carrying out a full risk assessment.

The survey by the WBCSD (2010) on corporate bodies undertaking water footprint pilot studies has shown that, in addition to risk assessment and improved decision making, the main drivers for undertaking a water footprint pilot are:

- to raise internal awareness of water challenges and to build capacity (at the pilot stage, external communication is not the main driver for conducting a water footprint);
- to enable meaningful engagement with concerned stakeholders, particularly supply-chain partners (and policy makers in the future);
- to identify where there is potential for water use to have negative environmental impacts in their operations and/or supply-chains so that actions can be taken;
- to evaluate and assess the potential use of the water footprinting methodology by gaining a practical understanding of its strengths and weaknesses;
- to test the methodology from a product life-cycle perspective and to compare it with other methodologies (to help develop synergies with LCA);
- to contribute to the development of a standardized water footprinting terminology and methodology for product water footprints and its evaluation in the context of other environmental impact categories;

- to measure and report on positive impacts (e.g. water efficiency and response strategies and to estimate the return on investing in those measures);
- to perform comparative assessment of different equivalent water treatment solutions through a new environmental performance indicator; and
- to improve/create markets for water management and water saving technologies.

As businesses have to pay for their water use, water footprinting is potentially a useful tool for companies as it can be used to identify the activities/processes which are most water-intensive, thereby highlighting opportunities for cost reduction (Lillywhite, 2011)¹³. Annex 1 provides further details on the reasons given by corporate organisations for undertaking a WF or WF pilot study (as cited in individual studies or through consultation).

Definitions Used

As noted above, the majority of corporate applications of the WFN or stress weighted approaches to water footprint assessment have been pilot studies and, to-date, few organisations have published detailed study reports. Hence, there are only a handful of corporate studies where the water footprint has been explicitly defined.

There does appear to be some general consensus among those corporate organisations who have published reports, however, regarding the definition of the water footprint (although it must also be noted that almost all applications have been undertaken in conjunction with the WFN). It is generally agreed that a water footprint is a measure of both ‘direct and indirect’ water use and that it only accounts for freshwater use. Some studies go further to conclude that the water footprint is as claimed a ‘spatially and temporally explicit’ indicator. There does not, however, appear to be consensus regarding whether the water footprint is a production or consumption oriented indicator.

Source(s) of Methodology

The overwhelming majority of true corporate water footprint/virtual water studies have been carried out in conjunction with the WFN and are, therefore, likely to follow the volumetric methodology outlined in the ‘Water Footprint Manual’ (Hoekstra *et al.*, 2009). Some earlier studies (which pre-date the Water Footprint Manual), such as SABMiller (SABMiller & WWF, 2009) and Nestle (Chapagain & Orr, 2010) have cited the methodology of Gerbens-Leenes & Hoekstra (2008), which is much the same as that for business water footprint accounting outlined in the Water Footprint Manual.

The main application of the stress weighted method developed by Ridoutt & Pfister (2010) is that carried out for Mars Australia, although BASF have also quantified the Water Stress Index at their sites following the methodology of Pfister *et al.* (2009).

The scope of corporate water footprints varies considerably between studies but some general trends emerge. In line with the reasons for undertaking such studies, most are based on a cradle to gate or a cradle to grave approach in terms of the boundaries set for

¹³ Note that this only applies to blue water.

the analysis. Cradle to gate approaches are based on the assessment of the supply-chain from the growing of crops/production of raw materials to the production of the finished product. Cradle to grave studies include the lifecycle from crop production to consumption (e.g. the study for Mars Australia), or crop production to packaging to recycling (e.g. SABMiller).

Impact Assessment

Recognising the significance of local factors (e.g. water scarcity, timing of water withdrawals etc.) in determining the sustainability of water use, some companies are now beginning to shift the scope of their work to include an impact assessment (see Annex 1 for further details). In September 2010, the first comprehensive effort to incorporate a 'sustainability' assessment into a water footprint assessment was published by Jain Irrigation Systems Ltd, who examined the sustainability of groundwater water resource appropriation to provide irrigation water for onion growing, with a focus on potential social and economic impacts.

Mars Australia, together with CSIRO, have completed several product water footprint pilots (i.e. Dolmio pasta sauce, Whiskas cat food, Pedigree dog food and Peanut M&Ms), based on the stress weighted approach (Ridoutt *et al.*, n.d.)¹⁴. In addition to weighting results by the WSI, the revised water footprint calculation method developed by CSIRO (Ridoutt & Pfister, 2010) also modifies the conventional volumetric water footprint methodology by a) not including green water, b) extending the scale of the analysis (through use of life cycle assessment) and c) using supplier data wherever possible. Coca-Cola has also explored the potential utility of water stress indices and has calculated water stress indices for three citrus growing regions. However, a detailed explanation of the stress weighted methodology used by Coca-Cola and results of this study do not appear to have been published.

SABMiller have noted that the volumetric water footprint method gives little provision or guidance on analysing the impacts of water use. In order to try to overcome this issue, SABMiller & WWF (2009) used risk maps to assess where the footprint of their value chain 'lands' in relation to scarcity issues on the ground.

Borealis (personal communication, 2011) have indicated that they have consecutively trialled three different water footprint methodologies. First, a water risk assessment was piloted in-house using the WBCSD Global Water Tool (see Section 4). This was followed by a third party water footprint calculation undertaken by the Swedish Royal Institute of Technology (KTH). Existing water footprint methods were then reviewed in order to begin to develop a local impact assessment. Borealis noted however, that the water footprint impact assessment models/methodologies are still at a draft stage and do not yet consider sufficiently the social dimensions of water use (e.g. impacts on other users, human right to water and so on) that must be considered in a sustainability matrix for management.

¹⁴ Ridoutt *et al.* note that a distinguishing characteristic of this work is that it has its focus is at the product brand level, rather than the product category level, as well as the complexity and variability of the associated supply-chains.

Marks & Spencer (2011) have noted that, in many countries, people simply are not measuring water stress. Hence, there is no way to easily assess environmental impacts, unless one refers to the global database of Water Stress Indicators (as used in the approach by Ridoutt & Pfister. This also limits the applicability of using the stress weighted water footprinting approach.

Comments

The results of water footprint assessments can only be as reliable as the input data. As noted above, corporate water footprint assessments are frequently plagued by unreliable data or data gaps and many studies rely heavily on generic, proxy or modelled data. Many corporate users of the water footprint methodology do not openly publish the limitations of their research.

In many cases, the input data to corporate water footprint assessments are collected directly by the company undertaking the water footprint assessment. As the input data do not come from publically available databases, there is a danger that there are opportunities for companies to be selective in the data that they use to reduce the overall result of their water footprint assessment. Indeed, there is some concern that because there is no internationally recognised approach, businesses can ‘tweak’ methodologies to serve their own interests. As a result, different users may apply different definitions and criteria when reporting water use in environmental reports, in product packaging or documentation. For example, although there is general consensus that the water footprint is based on water ‘consumed’ there is no agreement on what constitutes consumption in terms of scale (basin, region) or hydrology (water body).

Based on the results of Global Water Tool and water footprint assessments, Borealis has sought to ‘neutralise’ any increases in water use as a result of production site expansion in water stressed areas (Borealis, pers. comm., 2011). Water footprinting has been used as part of this to inform water stewardship and sustainable water management and has been integrated in a sustainability assessment (together with issues such as competition for land/food) of possible biofuel supplies.

More generally, it appears that corporate organisations who have undertaken water footprint assessments have had difficulty in deciding how best to effectively communicate the results of their assessment. As explained by Marks & Spencer (2011), it is difficult to effectively communicate the nuances of water footprint data to people who know nothing about water footprints - most people will not know what a blue, green and grey water footprint is and they are difficult concepts to explain. Indeed, most corporate organizations which have undertaken a water footprint simply report the total volume of water used to produce a particular product.

3.7.4 Water Resources Planning Applications

Range of Applications and Stated Aims

The water footprint concept was first suggested as a tool for water resource management by Chapagain & Hoekstra (2004) in a report titled “Water Footprint of Nations”. To-date though few studies have applied water footprinting at the water

resources planning level. Those which do cover a broad range of scales (international, national, regional, river-basin and local) and have primarily been conducted by research institutions, non-governmental organisations and international organisations to try to influence policy indirectly.

Those water footprint assessments which have been undertaken in the context of water resource planning have had as their aims:

- to directly¹⁵ or indirectly¹⁶ inform water resources management policy;
- to raise awareness of issues surrounding water use; or
- to contribute toward the methodological development of water footprinting (e.g. Zhao *et al.*, 2009).

The WFN (2010) suggests that water footprinting, unlike traditional measures of blue water withdrawals traditionally reported by water users, contributes useful information that provides new dimensions to water resource management, including information on the types of water used (blue, green, grey), spatial and temporal localisation of the water footprints and virtual water flows. The WFN also argues that water footprinting could have a wide range of water resource management policy applications. For example, they suggest that national governments could use water footprinting to gain an understanding of their dependence on foreign water resources, or to explore the sustainability of water use in the areas where water intensive import products come from (WFN, 2010).

They suggest a river basin authority could use water footprinting to (WFN, 2010):

- understand whether the aggregated water footprint of human activities within the basin (either for local consumption or export) violates environmental flow requirements or water quality standards at any time;
- explore the extent to which scarce water resources in the basin are allocated to low-value export crops; or
- gain an understanding of the different allocations of water within a given watershed in light of water availabilities and sustainability and equity principles.

The World Wide Fund for Nature (WWF) has undertaken several studies at the national level to raise awareness of the impacts generated by the external water footprint of countries including the UK, Germany and the Netherlands and to feed into debate about how domestic water resources could be managed more wisely. National water footprint studies such as these, however, are yet to influence government policy directly. Despite this, other international organisations, including the FAO and UNEP have continued to show an interest in water footprinting in water resource planning applications. For example, UNEP have included the water footprint in their water efficiency agenda (SIWI, 2011).

¹⁵ E.g. water footprint analyses undertaken in the Guadiana river basin, Spain.

¹⁶ E.g. water footprint analysis undertaken in Indonesia by Bulsink *et al.* (2010) to show how national water-use accounts could be extended by including accounts of interprovincial and international virtual water flows and provincial water footprints.

Methodologies

Although governmental organisations are now beginning to take an interest in the potential use of water footprint assessments to inform public policy, the role of water footprint methods in water policy is still limited to a small number of river basins. For example:

- water footprint analysis around the Guadiana basin in Spain (Aldaya & Llamas, 2008) has resulted in an economic assessment of water footprints that have now been captured as part government policy making, in the context of the WFD;
- in the UK, the Department of Environment, Food and Rural Affairs (Defra) has commissioned a study to produce water footprints for a range of products in order to contribute to policy to reduce the global impact of UK food consumption and production. The study looks at three case study basins in the UK: the Eden, the Hampshire Avon and the Wensum (Rob Lillywhite, pers. comm., 2011);
- in Cyprus, the Water Development Department has started dialogue with local water footprint specialists, inviting them to participate in local expert meetings;
- in South Africa, water footprint analysis for the Breede Catchment is being used to inform the Catchment Management Agency and its water policy and strategy so as to support national policy objectives (Pegasys, 2010);
- in the Netherlands, Ministry of Infrastructure and Environment is considering undertaking water footprinting to use it as a water management and resources priority planning tool during drought-related crises; and the Ministry of Transport, Public Works and Water Management is reportedly also exploring the application of water footprinting to policy development “*with respect to spatial planning, as a tool of communication with the general public and to inform national sustainable production agendas*” (SIWI, 2011)

Spain is the first country in the EU to adopt water footprint assessment in governmental policy making. In September 2008, the Spanish Water Directorate General within the Ministry of the Environment and Rural and Marine Affairs approved a regulation that includes an analysis of the water footprint of the different economic sectors, defining “water footprint” as the total sum of the used water from internal sources with the difference between imported and exported water in each area, as a technical criterion for the development of the River Basin Management Plans that all EU Member States will have to accomplish as part of the requirements of the WFD (Garrido *et al.*, 2010). Several studies have been carried out (e.g. Aldaya *et al.*, 2008; Aldaya & Llamas, 2008; Novo *et al.*, 2008; Garrido *et al.*, 2010) with the aim of assessing water footprints and virtual water trade in Spain and in Spanish river basins.

Garrido *et al.* (2010) have assessed the state of water use in Spain (both Spain and the Guadiana River Basin) by estimating and analysing Spain’s virtual-water ‘trade’ and water footprint to identify options for water resources management. The main development of this study is that it attempts to develop an indicator of the economic productivity of water use by assessing water footprints and virtual water in terms of

m³/€ - thereby providing information to inform how scarce resources may be allocated to activities that generate greater economic value from water use¹⁷. It is pertinent to note that the authors only value blue water from an economic perspective, due to the perceived lack of opportunity cost associated with green water. Unlike previous studies, ground and surface water sources are differentiated. As noted by the authors, this distinction is crucial to inform water policy decisions, and to follow the environmental requirements of the WFD.

The authors argue that a water use-economic productivity analysis can be useful to identify unjustifiable water uses and lead to a more efficient allocation of resources. However, it is noted that implementing a policy on virtual water trade assumes that crops which are not grown domestically will be provided by international trade, which raises questions about food security and the morality of extensive external water footprints. This approach also means that, technically, urban water – which, according to the report, directly contributes very little economic output – is not an ‘economically efficient’ use of water.

An assessment of the potential for mitigating the water footprint related to horticulture in the Naivasha Basin (Kenya) has also been carried out. The potential for involving cut flower traders, retailers and consumers overseas was explored along with the idea of a voluntary sustainable flower agreement between major agents along the flower supply-chain (which includes adding a water-sustainability premium to the price of flowers along with sustainability labelling/certification/information provision at the end of the supply-chain) (Mekonnen & Hoekstra, 2010).

Comments

The application of water footprinting in the context of water resource management for planning purposes has demonstrated some key research gaps, namely (WFN 2010):

- issues surrounding the definition and inclusion of grey water;
- refinement of indicators and methodology for sustainability assessment;
- lack of data, especially at the developing-country level.

In 2010, the OECD held a workshop to examine whether the virtual water and water footprint concepts and indicators could provide useful tools for water resource management. The workshop generally agreed that while the concepts and indicators have raised awareness of water scarcity and allocation issues and gained wide appeal among private companies, private citizens, public officials and the media, they are limited as policy tools as they do not take into account (OECD, 2010):

- the opportunity cost of water in production or the relative opportunity costs of water in alternative locations (hence, they are not analogous to the economic theory of comparative advantage);

¹⁷ The virtual water content of industrial products is expressed inversely, as m³/€, though it is not made particularly clear as to why.

- other inputs used in production, such as labour and energy, which means that the indicators may lead to making sub-optimal policy and production decisions from a private or public perspective;
- the distinction between the management of water resources and water quality; or
- wider policy goals, such as poverty reduction, enhanced food security, economic development and so on.

3.7.5 Applications Aimed at Influencing Consumer Behavior

Range of Applications and Stated Aims

The final level of application is use of footprint assessments to raise consumer awareness. We have identified only one such study within the time available for this project, with this focused on the level of water embedded within consumer products. This study, conducted by WRAP and WWF-UK (2011), was aimed at raising awareness on the external impacts of UK food consumption, specifically food waste in the UK at a household level, due to the avoidable nature of much of the UK's food waste and the presumption that waste should be avoided where possible.

The specific objectives of the study were to (WRAP & WWF, 2011):

- quantify the water footprint of the food wasted by UK households, both in total and by country of origin;
- establish linkages of waste to locations where water resources used, and shed light on potential impacts;
- establish the carbon footprint of UK household food waste;
- classify footprints by waste categories e.g. avoidable, unavoidable; and
- present case studies for specific foodstuffs/locations of origin.

The 'underlying hypothesis' of the study is that, if food and drink were properly 'managed' (e.g. in terms of purchasing and storage decisions), the food currently wasted in the UK would not need to be produced. Therefore, the environmental impacts associated with the production of that food would not be incurred, or would be reduced.

The report provides an account of the water resource impacts of agricultural production inside and outside the UK, and relates this to the UK's food waste, in order to demonstrate the degree to which resources used in production are essentially wasted. This is done using both the water footprints and carbon footprints as an indicator – with the exception of lack of differentiation between the blue, green and grey water components of the water footprint.

Comments

For example, in the case study on wheat, the report presents a table of top producer countries for wheat wasted in the UK. However, because there is no distinction between the components of water, there is no indication as to what proportion of water consumption is rainfed and which is irrigated. As such, Canada is listed as the top 'victim' of the UK's wheat waste, as it provides 50% of the wheat wasted. However, if

one looks at the WSI, Canada has a much lower incidence of water stress than the USA (WRAP & WWF, 2011). Even though the USA only contribute 9% of the UK's wasted wheat, localised water impacts could be greater there.

This leads to a different aggregation issue – national averages and the lack of spatially explicit results. It is difficult to judge water resource impacts without knowing the locations of production, given variations in water stress across countries. This is an issue that arises repeatedly in the report – in the beef case study (where analysis of local conditions is required to properly interpret the water footprint results), and in the case study for Brazil where it is noted that the north-east of Brazil is semi-arid and suffers from water stress, while on average Brazil is a water-rich country with 12% of the world's fresh water supplies. Aggregation becomes an issue because it is difficult to accurately and reliably interpret volumetric water footprint results without knowledge of the local context.

In its discussion of the study findings, the report suggests that there is a need for improved water management and greater attention to water in the supply-chain. With respect to UK imports from water scarce countries, the report recommends 'consideration of how to play a constructive role in improving information flows, stakeholder engagement, data availability and institutional capacity', all steps geared towards local level water policy and management.

3.7.6 Best Practice Applications

As part of our consultation for this study we asked a number of organisations if they would be happy for their use of water footprint assessments to act as an example of best practice. The majority of organisations that were approached preferred not to have their applications/experience being used in this manner for this study (and many requested that their responses to the consultation more generally remain confidential).

In addition, given that the methodologies being used for water footprint assessment are still evolving across all three main methodological approaches, we do not believe it is yet appropriate to provide examples of 'best practice' for wider promotion. Instead, we believe it is more appropriate to identify those types of applications which would appear to be moving towards 'best practice' with a focus on corporate level applications. This is because the commodity level work tends to be undertaken by a small set of academics who are generally applying similar approaches, albeit using varying underlying datasets, while application at the water resource planning level is in its infancy with few concrete examples and it is therefore too early to identify best practice.

Water Footprinting as an Auditing Tool

Many corporate organisations noted that the volumetric water footprint approach is a useful auditing tool as it enables the areas of greatest water use in the supply-chain to be identified. It can provide a useful baseline to identify hotspots in their supply-chain, improve understanding of business risks and to identify opportunities for reducing water use. This is clearly an area of 'best practice' and which therefore could be promoted at the EU and more global level.

Water Footprinting as a Tool for Water Stewardship in the Supply-chain

Because most water footprint assessments have not addressed the issue of the environmental impacts of water use, corporate organisations are increasingly moving away from water footprinting alone (and in some cases at all) towards a more water stewardship based approach. A number of organisations are using a three-tiered approach to water stewardship, which draws on the water footprint methodology. For example, Marks & Spencer (a UK retailer) have applied this in the following manner (Marks & Spencer, 2011):

- **Tier 1: Standards** – Marks & Spencer define criteria that their suppliers have to meet;
- **Tier 2: Risk** – Marks & Spencer are trying to use information on water risk in their supply-chains to identify which products are from areas at risk of water stress (this has included using a water footprint assessment but also use of other tools);
- **Tier 3: Influence** – Using the information on water risk in their supply-chain, Marks & Spencer are identifying which suppliers to target with their water stewardship approach. Note that this does not necessarily mean that Marks & Spencer are only targeting suppliers located in areas at risk of water stress - as a supplier may already be working sustainably even if they are located in a high risk area. They then give sustainable suppliers an award for sustainable practice and are working with WWF and the Food Ethics Council to create stakeholder engagement.

Water Footprinting for Environmental Product Declaration

There is a clear demand for assessments of consumptive water use to be incorporated into LCAs in a manner which will improve the reliability of environmental product declarations across a range of business-to-business and consumer products. The work being undertaken by the ISO to develop a water footprint standard and by CEN level to develop European Standards for environmental product declarations is important in this respect to developing a framework for best practice applications.

4. WATER MANAGEMENT AND RISK ASSESSMENT TOOLS

4.1 Introduction

In addition to the virtual water and water footprint methods discussed in Section 3, it is clear that a second set of tools have been and are continuing to be developed with the aim of enabling companies to undertake risk assessments related to their water use and to identify ‘hot spots’ associated with that use.

We have identified a number of additional tools through both the literature review and consultation with business organisations and their members. These additional tools are focused either on assisting businesses in identifying and managing their direct or indirect (supply or production chain related) water risks; or in order to develop response options, including on disclosure of water related information as part of business and investment risk management.

The tools that we have identified as being the most relevant are:

- the Global Water Tool developed by the World Business Council for Sustainable Development (WBCSD);
- the Corporate Water Tool;
- the CDP Water Project;
- the Global Environmental Management Initiative Tool; and
- the Water Risk Filter Tool.

In addition, the report by the 2030 Water Resource Group on Charting our Water Future (McKinsey, 2009) sets out an approach for more detailed water resource planning with an international focus.

Although they are not the focus of this study, we provide a brief review of the above tools below due to their potential importance to the identification of relevant policy options in relation to certification activities aimed at fostering better water resources management.

Note that this list of tools is not meant to be exhaustive; rather, the aim here is to highlight the other types of approaches that appear to be most used by companies and which are relevant to the objectives of the European Commission in relation to the promotion of better water stewardship and management within the EU and globally. Other tools which have been identified are listed in Table 4.1, based on a report prepared by the WBCSD (2010).

Table 4.1: Further List of Initiatives in Relation to Water Management by the Private Sector						
	Key Focus of the Initiative			Geographic Focus	Leader	More Information
	Identify and Access water-related risk	Measure water use and assess water-related impacts	Develop response options and/or risk mitigation strategies			
Aquawareness		*	*	Europe	Civil Society	www.ewp.eu/projects/aquawareness/water-stewardship
BIER Water Footprint Working Group		*		Global	Beverage Industry	www.bierroundtable.com/water_stewardship.html
Collecting the Drops: A Water Sustainability Planner	*			Global	Business	www.gemi.org/waterplanner
GRI™ Water Performance Indicators		*	*	Global	Business Civil Society	www.globalreporting.org/ReportingFramework/G3Guidelines/
Water Brief for Business	*			Global	Business	www://waterbrief.businessroundtable.org/
Water Footprint, Neutrality and Efficiency Umbrella Project		*		Global	UN	www.unep.fr/en/about/index.htm
WaterSense Program ^R			*	United States	Government	www.epa.gov/WaterSense/
Water Use within Life Cycle Assessment (WULCA)		*		Global	Academia Business	fr1.estis.net/sites/Icinit/

Source: WBCSD & IUCN (2010): Water for Business, Initiatives guiding sustainable water management in the private sector, Version 2.
 Notes: The original source document includes a number of other initiatives, some of which are considered not as relevant to this study while others, such as the Alliance for Water Stewardship, are discussed further in Section 5 in relation to certification.

4.2 Global Water Tool

4.2.1 Scope and Objective

In 2007, the WBCSD launched the Global Water Tool (GWT). The tool is designed to address the needs of business for information on water management issues relative to their own use, in order to facilitate water-related risk assessment and risk management. Rather than generating a volumetric indicator of resource use and impact, the GWT allows companies to compare their own water use with local conditions in terms of water availability, quality, stress, access to safe drinking water sources and sanitation, as well as the associated contextual factors of local population and industrial growth information.

The tool is free and enables companies to map the location of their sites in relation to detailed information on key metrics such as water resource use per capita, mean annual relative water stress index and access to improved sanitation.

The GWT's chief purpose is to provide information on the local water context, which can then be compared with and across operations. To facilitate this, the GWT works on both a country and watershed level, and covers most of the globe (with occasional exemptions where data for a particular factor were unavailable). Note that it is not intended to provide specific guidance on local watershed situations, as this would require a more in-depth analysis and, therefore, cannot be used to support detailed impact assessments. This would require additional information beyond the scope of the GWT, for example, on the quality of discharged water.

The issues that the GWT has been designed to provide information on include:

- how many of a company's sites are in extremely water-scarce areas, which sites are at greatest risk and how this may change in the future;
- how many of a company's employees live in countries that lack access to improved water and sanitation; and
- how many suppliers are in water scarce areas, and how this may change.

As the above suggest, the GWT is perhaps most useful for companies with relatively extensive international operations, spread over diverse areas and where explicit knowledge of the resource contexts of these areas may be lacking at a corporate level.

4.2.2 Methodology and Data

The GWT consists of two parts: an input sheet (in Excel) and an online map feature. Companies use the input sheet to enter data on the size, nature, water consumption and geographical location of their sites. Within the Excel file, this then generates tables and graphs presenting information on the company's water use relative to local context, e.g. distribution of sites by country in relation to associated water scarcity. These metrics and graphs can then be used in assessments and communications.

The online mapping feature, via Google Maps, generates a map of company sites (latitude and longitude are estimated from addresses entered in the input sheet).

Different criteria can then be applied for assessments at the national or watershed level, e.g. water withdrawal per person per country, allowing companies to compare sites.

The datasets that underlie the GWT have been selected based on the following criteria:

- the dataset must have global coverage;
- the dataset must be available in the public domain;
- the dataset must be considered valid by the global community of water stakeholders including academics, non-governmental organisations (NGOs), government organisations and industry;
- the dataset must be recent; and
- there are plans to update the dataset.

The data sets include: Food and Agriculture Organization (FAO) AQUASTAT data on withdrawals, dependency ratios and renewable supplies; World Health Organization and UNICEF Joint Monitoring Program (JMP) data on populations served by drinking water and sanitation; University of New Hampshire (UNH) data on the mean annual relative water stress index; World Resources Institute (WRI) data on annual renewable water supply per person; and the International Water Management Institute (IWMI) data on environmental water scarcity index; and United Nations Population Division data on urban annual growth rates.

4.2.3 Applications

Principally, the GWT is a tool for identifying risks. The WBCSD indicate that it has already been used by over 300 companies. For example, it has been used to indicate “locations that may experience potential water scarcity in the future” (Novartis), areas for companies to “focus conservation efforts” (United Technologies Corporation) and help to “prioritize action for water stressed plants” (Eni). DuPont claim that just mapping company locations and examining the local contextual data was useful, and would “immediately open the user’s eyes to key water issues at those locations”.

The intended role of the GWT is as a basis for a more in-depth analysis and the development of a corporate water management strategy – and this has evidently been followed by some companies: DSM NV state that the GWT “was used to steer the direction of our long-term targets” regarding water management; DuPont highlights plans to “fine-tune” their water goals in order to be more responsive to “true regional concerns and risks”, realised in part due to the GWT; and The Dow Chemical Company notes that the GWT can be used during the “evaluation of new project developments”.

It is also clear that the GWT is being built upon by other water-related risk management tools, for example GEMI’s ‘Collecting the Drops’ (Caterpillar) and the Water Risk Filter Tool.

4.3 The Corporate Water Gauge

4.3.1 Aims and Scope

The Corporate Water Gauge (CGW) has been developed by the Center for Sustainable Organisations (CSO) as a tool to assess the sustainability of a facility's water use, and is therefore similar to the GWT. The principles underlying the methodology are that:

- sustainability of water use should be grounded in knowledge of site-specific precipitation levels;
- renewable supplies should be determined by reference to associated watershed boundaries;
- stocks of surface and groundwater resources should be preserved and not drawn down;
- human use of water resources should be balanced with ecological considerations;
- water use should be measured against available renewable supplies that are allocated to individual facilities using per capita and/or economic criteria.

The CSO note that the results are fully compliant with the Global Reporting Initiative (GRI).

4.3.2 Methodology and Data

There are four steps in the calculation of the CGW:

- 1) Identify the watershed(s) in which the assessed facilities have an impact;
- 2) Determine the net renewable water supplies in the watershed(s) of interest, and allocate proportionate share to facilities;
- 3) Determine actual net water use by facilities in watershed(s) of interest;
- 4) Populate CWG quotient, which is then computed into a sustainability score.

The Center for Sustainable Organisations emphasises the idea of 'sustainability quotients'. Expressed as a fraction, denominators express the impacts an organisation should or should not have on social or environmental conditions (according to the size of the organisation in terms of head count, revenue etc.), while numerators express what the impacts of an organisation have actually been. Essentially, it is the rate of use over the rate of renewable supply and is used to determine sustainability performance. From this quotient, a 'score' can be calculated, where any score equal to or less than 1.0 indicates sustainable performance.

The CWG relies on the use of Geographic Information System (GIS) techniques for its data processing and spatial assessments. GIS is used to determine precipitation, is used in combination with census data to determine human population of watersheds, and is then used to determine per-capita levels of available renewable water resources per watershed. While the exact data sources are said by CSO to vary depending on the location of the assessed facility, certain information is always required:

- Facility name, location and geographic information regarding associated watershed(s);

- Related precipitation volumes;
- Water inflows and outflows for the facility; and
- Facility size in terms of employment and/or other economic measures.

At this time, it is not clear what level of practical use the model has had.

4.4 CDP Water Project

4.4.1 Aims and Scope

CDP Water Disclosure is a program of the Carbon Disclosure Project. It aims to help institutional investors by increasing the availability of high quality information on business risks and opportunities associated with water scarcity and other water-related issues by seeking disclosure from companies about their:

- Water management and governance;
- water-related risks and opportunities; and
- Water withdrawals, discharges and intensity.

Corporate water data is collected annually through a questionnaire survey, with the most recent data published in their 2010 Global Report (ERM, 2010). The report essentially provides an overview of the importance of water related issues and provides examples of best practice towards sustainable water management. This includes measures taken to address physical, regulatory and other risks, as well as various statistics in relation management and governance, communication of water use, water accounting and linkages between water and energy.

4.5 GEMI Tools

4.5.1 Overview

The Global Environmental Management Initiative (GEMI) is a global network for corporate sustainability efforts. It has two existing water sustainability tools – Connecting the Drops and Collecting the Drops – and announced in March 2011 that it is partnering with the WBCSD to develop a new tool to help companies understand water challenges wherever they operate. It is being designed to encourage businesses to conduct systematic local (site specific) assessments of their relationship to water, to identify specific opportunities and risks, and to report key indicators to stakeholders.

When the GEMI Local Water Tool is completed in 2012, it will be free and publicly available tool and applicable to companies globally. The partnership will align the LWT with the WBCSD's GWT to enable companies to easily map their global water use and assess risks in supply-chains at the global, regional, national and local levels. Given this expected development, we provide only brief summaries below of the scope of the two existing GEMI tools.

4.5.2 Connecting the Drops

Connecting the Drops was designed to help individual companies build a business water strategy (GEMI, n.d.) by:

- conducting a systematic assessment of their relationship to water;
- identifying specific opportunities and risks associated with this relationship;
- assessing the business case for action;
- developing a water strategy that addresses specific needs and circumstances of the organisation; and
- ensuring that water-related opportunities and risks are tracked and managed effectively into the future using a continual improvement framework.

The above process of analysis is based on five modules which each include specific steps aimed at answering the key questions associated with each of the above activities. The approach is question based, with profiles or proformas provided to act as the basis for recording responses to each of the key questions. The modules themselves are supplemented by a series of additional resources to aid in answering the questions and case studies of other companies' experiences.

An important component of the tool is its focus on water opportunities and risks throughout companies' value chains. In order to help businesses consider upstream and downstream opportunities and risks related to water, the tool promotes a five-stage value chain (or material flow chain), with the aim of helping companies identify and assess water uses and impacts in places where they might not be immediately obvious. For example, water-related risks and opportunities may appear in raw material or production stages, linked with key process inputs and suppliers, or in later stages, associated with product use or final disposition.

4.5.3 Collecting the Drops

The second of the existing GEMI tools is Collecting the Drops, which was developed to act as a sustainability planner. The tool is based on a series of modules which are aimed at taking a facility operator through a stepped approach to identifying and analysing (GEMI, n.d.):

- a facility's relationship to water on a local and regional basis in terms of its specific uses/needs and the availability of water in the region;
- the specific challenges and opportunities facing a facility with respect to water-related risks (both in terms of its impacts on available water resources and the identification of factors that may pose a risk to an operation); and
- the public, community and social considerations that should be taken into account in developing a strategic water management plan aimed at addressing risks and taking advantage of water related opportunities to better manage water resources.

As with Connecting the Drops, this tool is questionnaire based; a series of questions have been developed with the aim of identifying the information needed to answer questions on vulnerability, etc. The system is supported by a range of databases providing information on rainfall, available water per person per year, etc. (also using

the WRI data providing inputs to the WBCSD's GWT). Answers to the questions are then transformed into, for example, a risk ranking for a facility based on its location and site specific characteristics.

4.6 Water Risk Filter Tool

The Water Risk Filter is being developed by WWF Germany and DEG KfW Bankengruppe (2011). The aim of the tool is to help investors understand and analyse their exposure to water-related business risks. The aim is to help investors work with clients towards more sustainable water management with the aim of mitigating both business and environmental risks. It builds on the WBCSD Global Water Tool and the CDP Water Project described above and will build in the future on water footprint data to be produced by the WFN.

The starting point for the tool is the need to identify and address the business risks associated with poor water management, be they physical, regulatory, or reputational, as all of these can cause disruption of supply and in worst cases, termination of business operations. As a result, the tool was developed to assist financial institutions in assessing the exposure of their investments and portfolios to water-related business risks.

It adopts a staged approach to the analysis of business and investment risks (WWF, DEG & KfW Bankengruppe, 2011).

1. The first step is an initial screening against two indicators. The first is geographically bound water risk level – where this is related to the amount of available freshwater resources per capita per year and the percentage of total actual renewable freshwater resources withdrawn (with data taken from the FAO's Aquastat). The second indicator relies on a qualitative assessment of an industry's relationship to water taking into account both direct operations and those of its supply-chains.
2. Data are then collected at the company level of water withdrawals, reuse, recycling and discharges using the GWT and other more qualitative questions (where these draw on a range of sources including for example those used as part of the CDP Water Project). This includes questions on:
 - a. the extent of recent problems in making water withdrawals;
 - b. the degree to which companies currently measure water quantity and quality;
 - c. the level of enforcement of regulation;
 - d. expected regulatory changes in the future, where this relates to pricing, quality and standards, licences to operate, etc.; and
 - e. other questions including on levels of engagement in planning processes, water efficiency, contingency planning, and water treatment requirements.
3. The WBCSD Global Water Tool is then applied to provide a snapshot and high level screening of potential scarcity issues. GIS mapping is then undertaken against two sets of maps: ones showing areas of low or high threats to human water

security and/or high or low threats to biodiversity; and maps showing the 53 freshwater eco-regions identified by WWF as having particular conservation value.

4. Country data sets (for 85 countries), which provide a combination of descriptive and other risk indicators, are then used to identify a company's water risk exposure in terms of basin specific and company specific mitigation options and opportunities. These may include technology water efficiency based measures or wider water stewardship related activities, where the latter includes communication and engagement with community, other private sector and government stakeholders to implement better basin-wide management.
5. The Risk Filter is then applied with this containing a series of questions which are weighted in terms of their relevance and importance. Based on the answers to these questions, heat maps are created to provide an indication of the company and basin related risk levels, covering issues such as scarcity, pollution, impact on ecosystem, regulatory risks, reputational risks, etc.

As the Risk Filter is currently still under development, full details are not available on the questions that are asked and how the heat maps are generated. A second version is to be released following further testing and modification, with one of the elements highlighted as requiring attention is the inclusion of supply-chain risks.

4.7 Charting Our Water Future

The final 'tool' identified as being relevant is the economics-based framework set out in a report prepared by The 2030 Water Resources Group titled *Charting Our Water Future* (McKinsey & Co., 2009). This was highlighted by consultees as being particularly important at an international level to delivering better management of water resources globally. The aim here is therefore different from all of the tools described above. In this case, the tool is more aimed at water resource managers trying to develop the framework for more integrated water resources planning, with this based on a broader cross-sectoral approach than is generally undertaken; in this sense, the aim is to expand the analysis beyond consideration of infrastructure or agricultural land management alone and to bring all possible actions together to identify the least-cost solution to addressing water scarcity issues.

The report stresses the need for step change in the management of water resources if supply is to meet future demands. It also takes as its starting point the assumption that meeting future demands should be possible if stakeholders act together and put in place the required reforms. It sets out a phased approach to analysing and developing future options for water management. This includes:

- undertaking an analysis at the river basin level to predict the gap between supply and demand by 2030 under base case assumptions;
- developing estimates of the marginal costs of closing the gap across different technical and technique or management based solutions;

- carrying out scenario analysis to define different options or approaches to moving forward, with this including identifying factors which may affect the ease of implementing the different scenarios; and
- highlighting the trade-offs using end-user pay-back curves and other information with the aim of identifying the appropriate levers for action by stakeholders (and their value chains) and providing them with information on the economics of adopting different solutions.

The report provides a summary of the results of applying this approach to four case study countries (Brazil, China, India, and South Africa). The outcome of the analysis for the case studies was a clear identification of the need for both demand and supply-side measures to be considered as well as different future growth strategies.

The approach set out in the report is aimed at supporting water resource management planning in those countries that currently lack integrated approaches. It argues that linking economic data to water resource data - including environmental requirements - is essential to managing the water challenge. The use of cost-curves is promoted not only for identifying cost-effective solutions but also for use by stakeholders in benchmarking their products and services to identify market potential and cost-competitiveness with other types of solutions. Cost-curves also provide transparency on what types of infrastructure will continue to be needed into the future and where alternative solutions would be more cost-effective where linked to end-user data on pay-back periods.

5. CERTIFICATION AND LABELLING

5.1 Introduction

Certification and labelling schemes for agricultural products and foodstuffs are aimed at providing assurances that production methods or product characteristics, as set out in agreed criteria, have been met. The idea of certification and labelling is to make the history of products more transparent to enable consumers to express their environmental and social values through their purchasing decisions.

Schemes currently in operation in the EU address a myriad of different issues and function at different stages of the food supply-chain. This includes schemes that operate within a supply-chain (business-to-business, or B2B schemes) and schemes which are aimed at communicating product qualities to consumers (business-to-consumer, or B2C schemes). The operators of these schemes range from farmers and producers to NGOs, interest groups, retailers, and public authorities.

The European Commission makes an important distinction between ‘certification schemes’ which, by definition, necessitate a third-party attestation procedure and between those ‘voluntary schemes’ which operate on the basis of a label or logo (often registered as a trademark) without involving any certification mechanism (European Commission, 2010e).

This study comprises two Reports relating to the work required under Task 2. In this Report we provide:

- a brief overview of existing certification and labelling schemes; and
- a detailed review of the position of various stakeholders regarding the use of product labels and schemes to communicate information related to water use.

The Part B Report provides:

- a detailed review of certification and labelling schemes, standards and initiatives;
- key requirements of a certification scheme;
- a detailed assessment of the minimum criteria for sustainable water use in existing certification schemes; and
- recommendations for a certification scheme for water.

5.2 Existing Certification and Labelling Schemes

5.2.1 Overview

Recent research (University of Hertfordshire *et al.*, 2010) on the environmental labelling of food products identifies two types of labelling approaches:

- outcome-based labels: which are based on an assessment of the impact of making a particular product – usually using LCA – with the aim of certifying that a product is less harmful to the environment than others; and
- practice-based labels: which use a range of criteria to certify that particular practices were used in producing a product.

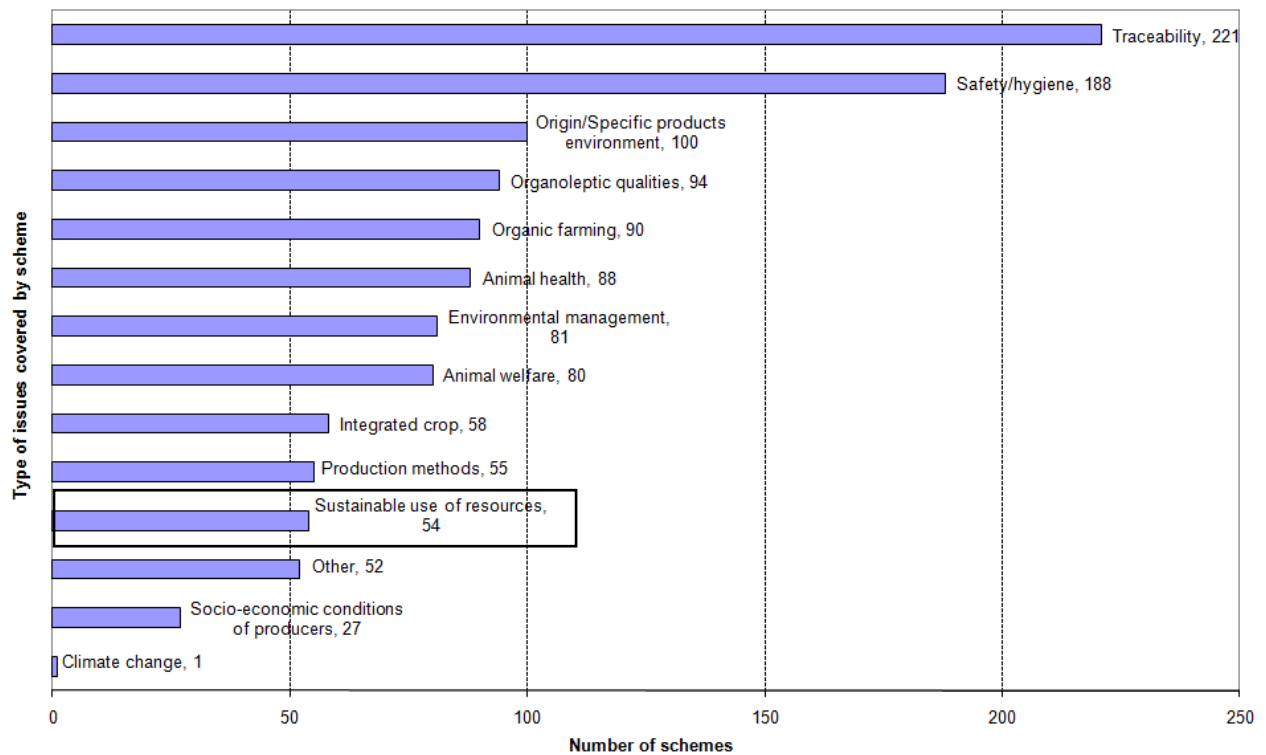
With respect to water management, there appears to be a dichotomy between schemes with a focus on providing information on the amount of water embedded within a product (outcome-based) and schemes that are focused more on encouraging good stewardship of water resources (practice-based). The first type of scheme is focused at the consumer, while schemes which are aimed at encouraging good stewardship can operate at either the B2B or the B2C level. Nearly all environment labels for agricultural and foodstuffs products are stewardship based.

Research by the University of Hertfordshire *et al.* (2010) found that outcome-based labelling is unusual in the food sector, with the majority of food sector environmental labels being practice-based. The outcome-based labels on food that do exist tend to be single issue, for example, carbon labelling (*ibid*). The authors indicate that the main reason for this is due to the difficulties associated with assessing the outcomes in terms of environmental impacts associated with different production activities. The result is a greater use of practice-based schemes, even though it can be difficult to measure the environmental benefits that these deliver (as these are not necessarily guaranteed).

5.2.2 Inventories of Certification Schemes

As noted in Section 2, the Commission's inventory of agricultural labels comprises 441 agriculture-related labelling schemes, which cover a wide range of issues. Figure 5.1 provides an overview of the types of issues covered by the existing schemes. As can be seen, although none of the schemes in the agri-label database relate directly to water footprints, there are 54 schemes which relate to the sustainable use of resources.

The Part B report to this study provides a review of certification and labelling schemes, standards and initiatives that take water usage or management into account. The description of certification schemes includes those that operate within a supply-chain (business-to-business or B2B schemes) and those that are aimed at communicating product qualities to consumers (business-to-consumers or B2C schemes). Labelling schemes that require third party certification are also included, as are standards and initiatives that are focused on water, sustainability or the environment more generally.

Figure 5.1: Issues addressed by certification schemes in the agri-label database

The schemes reviewed in the Part B Report are:

- Global and international schemes:
 - Alliance for Water Stewardship (AWS);
 - Cradle-to-Cradle®;
 - Global Good Agricultural Practice (GLOBALG.A.P);
 - Global Reporting Initiative;
 - ISO (development of a water footprinting standard);
 - Linking Environment And Farming Marque (LEAF);
 - People4Earth;
 - UTZ; and
 - Water Stewardship Initiative (responsible for establishing the AWS).
- European and national schemes:
 - European Water Stewardship Program (regional initiative for AWS);
 - EU Ecolabel;
 - Umweltzeichen (Austria);
 - Raisio's H2O Label (Finland);
 - Milieukeur (Netherlands);
 - Grenelle de l'Environnement (France);
 - NF Environnement (France);
 - QualiTerre (France);
 - Nordic Swan Ecolabel (Nordic countries);
 - KRAV (Sweden);
 - Red Tractor Assurance (UK); and

- Waterwise Marque (UK).
- non-European and national schemes:
 - Smart Approved WaterMark (Australia);
 - Eco-benefits programme/Cleaner Production (Uganda);
 - Earthsure Environmental Product Declaration ecolabel (United States);
 - Green Restaurant Association (United States and Canada);
 - Green Seal (United States); and
 - Water Brief for Business SEE Initiative (United States).

Note that some prominent schemes (for example, Der Blaue Engel in Germany) are not considered because they do not relate to food or agriculture. The majority consider water use as part of a wider range of criteria, often in relation to overall resource use (including raw materials and energy). This typically means that any label or logo for such certification schemes does not specify that water efficiency has been taken into account. There are however a few schemes which focus only on water. These include the Waterwise Marque, which indicates whether a product is water efficient, reduces wastage or raises awareness of water efficiency, and the labelling scheme run by the Finnish based company Raisio to indicate the water footprint of their products on their labels.

5.3 Stakeholder Views on Certification and Labelling

5.3.1 Certification Schemes

Certification programs have emerged as a powerful tool both for influencing business practices and for responding to consumer preferences (Richter, 2009). Richter (2009) identifies two key purposes for water certification:

- encouraging water efficiency or water management more generally; and
- bolstering corporate reputations in relation to social responsibility and sustainability, with this having on knock-on effects in terms of attracting investors and gaining new consumers.

Both consumers and producers can benefit from certification schemes in the following ways (CIAA, pers. com., 2011; FDF, pers. comm., 2011):

- provided that environmental claims are verified by a credible source, certification schemes increase the credibility of environmental claims;
- high recognition levels among consumers of certification schemes leads to more efficient communication, as consumers are quickly able to recognise the message;
- producers/retailers can benefit from improved brand/corporate image; and
- provided that there is an internal commitment to improvement within the scheme, certification can provide incentives for improvement.

As explained by Richter (2009), however, it is important to recognise that the effectiveness of any certification programme will depend on the criteria that underlie

them. There are also a number of challenges with regard to certification schemes (CIAA, pers. comm., 2011):

- in terms of scope, most certification schemes do not cover the full life cycle of a product and, therefore, do not reflect the true environmental impact; and
- as the number of requirements and metrics increase, this proliferation also leads to additional costs for operators, without environmental benefit.

The *State of Sustainability Initiatives* (IISD *et al*, 2010) project provides a review of voluntary sustainability initiatives and standards operating in global markets. It highlights the importance of transparency in providing both supply-chains and consumers with information on markets and it also emphasises the fact that improved access to information helps everyone in the market better understand the implications of their decisions with regard to supply-chain partners, location of new investments, etc. However, there is concern over the ability of both actors within supply-chains and consumers to understand the differences between VSIs and to determine those characteristics of most importance to them. This finding is supported by the CIAA (pers. comm., 2011) which explains that as the number of different certification schemes across Europe grows, consumers are becoming increasingly confused by the meaning of different schemes and by the information they provide. For consumers, it is often difficult to compare products on the basis of certification and impossible to compare the environmental performance of certified products with those which are not certified.

The report by IISD *et al* therefore concludes that as market conditions lead to increased measurement, certification and reporting, it is also becoming increasingly important to ensure the comparability and accessibility of information coming from different sources. If one looks at the plethora of schemes that are currently in place or are developing around the issues regarding water efficiency and water stewardship it is clear that this will be essential for this aspect of sustainability into the future.

Building on this last point, the ever increasing number of different approaches emerging across Europe on how to conduct environmental assessments and how to communicate environmental information presents a number of risks/challenges for consumers, businesses and the environment, namely (CIAA, pers. comm., 2011):

- the environmental effectiveness of approaches driven by consumer demand is undetermined;
- initiatives aimed at improving the environment may be led in adverse directions;
- incoherent or contradictory messages may lead to consumer confusion;
- consumers may lack trust in the entire concept of sustainability and make accusations of “greenwashing”;
- certification may provide an obstacle to the functioning of internal markets and international trade; and
- certification may lead to increased complexities and costs along the supply-chain.

It is these last two points that are of particular concern to industry. Voluntary initiatives, such as GLOBALG.A.P can become *de facto* mandatory where purchasers along the supply-chain require all suppliers to meet these certification standards. Where this occurs, certification is required as a minimum for market access rather than

attracting a premium price to reflect the sustainable approach taken by the farmer. In addition such requirements can act as a barrier for smaller businesses or, where a number of certification schemes exist, differing requirements of the purchaser may prevent producers from achieving the best price for their goods if they are unable to sell to the 'highest bidder'.

Steelman & Rivera (2006) note, however, that voluntary standards and certification schemes (in the form of voluntary environmental programs) are valuable tools that can supplement the regulatory toolkit. They are particularly good at meeting the needs of multiple types of stakeholders within supply-chains in a manner which is more flexible than regulation, has lower administrative burdens, and can deliver superior environmental performance. Steelman and Rivera also conclude that while there are potential weaknesses to such voluntary approaches, these can be minimised by ensuring that such programs are performance-based, have third-party certification or oversight, and include sanctions or rewards.

In 2009 the CIAA, together with its food chain partners and the EC, initiated the European Food Sustainable Consumption and Production (SCP) Round Table. Its objective is to establish an EU-wide assessment methodology for food and drink products that is scientifically rigorous, to identify suitable tools for the voluntary communication of environmental information to food chain partners and consumers and to promote continuous environmental improvement across the food chain with the aim of ensuring that clear and scientifically reliable information on the environment can make a real contribution to sustainable production and consumption in Europe. With regard to certification schemes, the SCP Round Table is considering issues such as scope, meaning, transparency and so on.

5.5.2 Labelling

Sønderskov & Daugbjerg (2010) suggest that at least three conditions must be met to encourage green consumerism:

- firstly, consumers must have a fairly high level of environmental awareness before they even consider buying environmental products;
- secondly, they must be willing to act pro-environmentally when making individual purchasing decisions, because green products are often more expensive than conventional products; and
- thirdly, because of the price premium, consumers must also possess sufficient information to ensure them that a good claiming to be environmentally friendly actually fulfils this promise.

The market share of labelled food products in most European countries is rather small, typically no more than 10%, although research shows that consumers claim to be willing to pay for improvements in the quality of the product and the environmental performance of the production method (Nilsson *et al.*, 2004). In line with this, a survey on consumer attitudes, published by the UK National Food Standards Agency found that 5% of respondents looked for ethical information when purchasing food products

for the first time (including production methods, animal welfare and free trade) (Food Standards Agency, 2008)¹⁸. Information on the premiums that people are willing to pay show that these may be very low for production conditions such as ethical characteristics, animal welfare or the absence of child labour. Bigot (2002, in Crespi & Marette 2003) shows that while 53% of French consumers revealed that they would pay a premium for such characteristics, the premium paid would be no more than 5% (and 44% would pay no such premium) (Crespi & Marette, 2003).

Strengths	Challenges
Can be easily identified by the consumer.	Simplifies (and hides) the complexities related to the environmental impacts of products to the consumer.
Can drive progress by creating competition between producers to obtain the best level of certification.	Consumers cannot assess the relative performance of a specific product.
Makes it easier for the customer to understand the environmental impacts of the particular product.	Defining clusters of similar products and product categories is difficult, due to the variability and characteristics of agricultural and foodstuffs products.
	Supply-chains are diverse and constantly changing.
	No ongoing incentives to improve environmental performance (unless benchmarks are continually reviewed).
	Do not motivate improvements in those products that are unlikely to achieve best in class status.
	The basis of the 'excellence' can be unclear (e.g. should it apply to all agricultural and foodstuffs products, or all products in a certain category).
	There are strict boundaries between those that comply and those that do not comply with the label obligations.
Source: CIAA (pers. comm., 2011)	

With regard to labelling, around 40% of respondents raised concerns about the accuracy of information found on labels (Food Standards Agency, 2006) while almost 30% thought labels were hard to understand (Food Standards Agency, 2008). In order to build credibility, the involvement of stakeholders, including consumer representatives, in the process of criteria development is considered to be a necessity. Third-party verifications or use of independent auditors is a common route to enhance trustworthiness and impartiality. Although the thoroughness of the control systems is

¹⁸ A similar survey carried out by the Food Standards Agency in 2006 found that 15% of respondents looked for ethical information provided on *all food purchased* (Food Standards Agency, 2006). The significant reduction in the percentage of respondents who looked for ethical information on food products between 2006 and 2008 may result from a slight change in the question asked to survey participants. The question in the 2006 survey was: “*thinking just about products that you purchase how frequently, if at all, do you refer to the labelling information?*”, whereas the 2008 survey asked: “*thinking just about products that you purchase **for the first time** how frequently, if at all, do you refer to the labelling information?*”.

less transparent and audit reports are rarely public, consumers seem to accept and trust the mere presence of control systems

While a NGO has shown concern that water labelling may become a tool used by corporations to pass responsibility for their water use along their supply-chain onto their consumers, Sveriges Konsumenter supports the use of environment labelling and considers labels to be an important tool for enabling consumers to make sustainable choices. However, Sveriges Konsumenter has indicated that from a consumer point of view it is important that labels have a strong and clear message.

With regard to product labelling, the CIAA highlight a number of strengths and challenges of ISO Type 1 labels (i.e. multi-attribute labels developed by a third party), see Table 5.4.

5.3.2 Integration of Water Management Information: Key Issues

Single-dimensional Versus Multi-dimensional Schemes

There is a risk that by focussing solely on water use, the environmental, social or economic burden in another stage of the production process may inadvertently be increased. For example, Sustain have suggested that water footprint labels are probably best compared to distance travelled or air freight labels. Like distance travelled or airfreight labels, water footprint labels highlight a proxy issue (water use as opposed to environmental impact). In 2005, the UK's Department of the Environment, Food and Rural Affairs (DEFRA) published a report on '*The Validity of Food Miles as an Indicator of Sustainable Development*' (Defra, 2005). This study found that a single indicator based on total food kilometres was an inadequate indicator of sustainability as it does not reflect the wider environmental, social and economic impacts associated with food production and transport (for example, transporting agricultural products and foodstuffs over longer distances in order to take advantage of opportunities to reduce water use may not only increase greenhouse gas emissions but also reduce the quality and nutritional value of agricultural products and foodstuffs).

Further, it has been suggested that water footprint labels could omit valuable information for consumers regarding the positive contribution of companies to the local environment in which they operate, such as watershed protection and conservation projects (CIAA, pers. comm., 2011).

Given these issues, several consultees have indicated that environment labels should ideally not be limited to a single impact category, unless there is only a single significant impact category along the entire life cycle of the product. In cases where a single indicator is used, it is important that the scope, limitations and meaning are clear to the consumer, otherwise the label will be misleading (CIAA, pers. comm., 2011).

Furthermore, it has been argued by an NGO that if a water label were to be introduced it would need to show multiple factors, including the time of year that water is taken, degree of water stress in the area from which water was taken, as well as wider environmental, social and economic impacts. Indeed, consultees have also noted that

water footprint information would be misleading if blue green and grey categories were aggregated in a water label.

Several consultees have indicated that multi-criteria labels that address broad aspects of sustainability would be better than single-criteria labels. The CIAA has commented that footprint labels that provide information on the context of water use provide a number of key advantages (CIAA, pers. comm., 2011):

- explanatory information can be used to highlight the most important parts of the product lifecycle and can enhance consumer understanding of environmental impact;
- benchmarking enables consumers to assess the relative performance of a specific product; and
- consumers can compare different products.

The Food Ethics Council has suggested that with regard to multi-criteria labelling, the traffic light label for nutritional information may be a useful point of reference, as consumers have shown commitment to this label.

As noted by Rob Lillywhite and others (e.g. Hogan & Thorpe, 2009), however, the wider environmental, social and economic effects associated with different food supply-chains are complex and very system specific. There are so many elements in food production that are of concern to sustainable development that it would be impossible to convey on a label all the information necessary for consumers to make informed choices. Consumers cannot necessarily assimilate all the information provided on environment labels and labels can give conflicting messages.

Methodological Issues

Research by the University of Hertfordshire *et al.* (2010) has given consideration to how environmental impacts could be measured and aggregated to provide a multi-dimensional environmental outcome-based certification scheme (i.e. a multi-dimensional scheme). The conclusions from the study were that available LCA techniques do not include agreed methods for damage characterisation; and, outside the area of greenhouse gases, there is a lack of standardised methods which are sufficiently accepted by the scientific community to act as the basis for a multi-dimensional environment label. The development of such standardised methods is essential for the creation of robust, outcome-based labelling. In their absence there is the potential for consumers to be provided with inaccurate or distorted information which could lead to detrimental behaviour. In other words, an international standard for the water footprint would need to be developed prior to the introduction of water footprint labelling to ensure that such labels do not provide misleading information on water use and to ensure that products from different companies are comparable on the basis of their water footprint.

With regard to water footprint labelling, concern has also been expressed among our consultees that the methodology is not yet sufficiently reliable to form the basis of an environment label. For example, MacMillan of the University of Hertfordshire *et al*

team has commented that because water footprinting is based on aggregating techniques that rely on proxy data, it would not form a reliable basis for a label.

The CIAA (pers. comm., 2011) have commented that while environment labels based on footprints which do not provide any information on the context of water use would provide a simplified display of information and may help to enhance consumer awareness of environmental problems, they would also provide a number of key challenges, namely (CIAA, pers. comm., 2011):

- the margin of error for footprints can be greater than the observable difference between the products themselves;
- water footprint studies are resource intensive (both in terms of time and money) and data of sufficient quality and quantity is often lacking;
- if the communication of the footprint to consumers does not include all major aspects/impacts or life stages, it may be misleading with regard to the product's overall environmental performance;
- most consumers will not have sufficient background knowledge to interpret the water footprint. Indeed, several consultees have noted that it will be difficult to communicate the concept of a water footprint and the nuances of the data to someone who knows nothing about water footprinting; and
- added-value for consumers is limited.

However, even if an internationally recognised methodology could be agreed, some argue that detailed water footprint labels are an unrealistic prospect as companies produce thousands of products and it would be too time consuming (and costly) to measure everything. Indeed, administrative costs will be an important consideration in weighing up the costs and benefits of water footprint labelling.

Environmental Effectiveness

As explained in the earlier discussion, the idea of certification and labelling is to make the history of products more transparent to enable consumers to express their environmental and social values through their purchasing decisions. As noted by Hoekstra et al. (2011): “in a world where many products are related to water depletion and pollution it is very useful to make the history of products more transparent. It is good to have the facts publicly available, so the consumer has a choice”.

The environmental effectiveness of product label and certification schemes depends on behavioural change. It is, therefore, important to consider the extent to which consumer demand would be influenced by a water footprint label.

As commented by a NGO, consumers are continually faced with ‘guilt’ messages and, given the proliferation of sustainability labels that already exist on product packaging; a new water label would merely be overlooked. The Food Ethics Council believes that we need to move away from the current linear attitude to labelling (i.e. measurement to label to consumer) and begin to change industry behaviour by prompting customers to start asking about water issues. Once customers start asking questions, businesses will respond. As noted by the Food Ethics Council, at the moment, few consumers actually

look at product labels, and fewer still seek information on what the product label actually means.

The success of a water footprint label in achieving behavioural change will largely be determined by how sensitive consumers are to environmental issues (Abe et al. 2002). While consultation suggests that there does appear to be consumer interest in the water content of products, the CIAA note that the interest of consumers should be evaluated through EU-wide consumer research studies as the interest of consumers may differ from region to region. For example, it has been suggested that consumer response to water labelling will, in part, be determined by personal experience of water scarcity/risk (e.g. Sveriges Konsumenter commented that in Sweden, water scarcity has not been a major issue and so has not been a major public concern).

Consultation indicates that while some consumers are motivated by environmental issues, this is generally a secondary concern. Most consumers will be motivated more by issues such as price and brand loyalty. Consumers will also take other factors into account when making purchasing decisions including functionality, quality of the product etc. If less water intensive products prove to be more expensive to produce, there is a risk that some unconcerned consumers may actually increase their demand for water intensive products.

Although, in theory, water footprint labelling would address the negative externalities associated with water use (assuming that consumers are fully rational, have perfect information about the environmental damage that is being caused and respond optimally), the water footprint label is unlikely to fully correct negative externalities due to 'free-riding' and the limited ability of consumers to fully assess environmental damage costs.

Indeed, when asked at a workshop on water footprinting¹⁹ what would happen if water footprint information were put onto product labels, consumers unanimously agreed that it would make no difference to their purchasing decisions.

Water footprint labelling schemes may, however, help to raise consumer awareness of water scarcity and drought and although they may not incentivise consumers to switch to buying less water intensive foodstuffs, they may influence the way that consumers use water in other respects (e.g. using less water in the home).

In 2005, UNEP concluded that there is only limited independent information available on the environmental effectiveness of ecolabelling programmes. Apart from general anecdotal case studies and proxy indicators, the authors were unable to identify any independent information on the effectiveness of the five ecolabels that were examined. In this regard, it concluded that "*there currently appears to be a disconnect between the relative importance ascribed to ecolabelling as an environmental policy tool and the amount of investigation and analysis being carried out in regard to its design.*"

¹⁹ As discussed by participants at British Hydrological Society workshop: *Water footprints, who are they for?* held in London on 17th March 2011.

Consequently, there would seem to be value in reducing the uncertainties that presently surround ecolabelling”.

Social and Economic Issues

Several authors have noted that the compatibility of eco-labelling schemes with current WTO law is unclear (see also Section 2). Assuming that consumers started to make use of water use labels, consumption, production and trade patterns in the world market could become distorted (Hogan and Thorpe, 2009). If water footprint labels discriminate against producing agricultural products and foodstuffs in, say, Africa, a shift in agricultural production patterns may cause people dependent on international trade to lose their livelihoods.

Even within the EU, water labelling may penalise those countries which suffer from water scarcity, particularly those in the Mediterranean region whose economies heavily on agriculture. In addition, mandatory labelling schemes may act as a barrier to trade as it may cause market access difficulties for exporters, particularly in developing countries. Clearly, focussing solely on water use may lead to a sub-optimal situation in terms of achieving wider sustainability objectives and care would be needed in designing any labelling or certification scheme to ensure that it does not contravene WTO rules.

Costs associated with obtaining certification and labelling can be high (refer to the Part B Report) and so concern has been expressed that environment labels or certification may represent a barrier to entry for smaller businesses. The costs associated with certification and labelling can include one-off and ongoing costs, with fees often being linked to number of products, total sales, size of enterprise and/or type of products:

- one-off/set-up costs: covering initial evaluation, registration and rights to use a brand; and
- ongoing costs: including annual registration/membership fees, auditing and certification checking and/or annual monitoring fees, costs of repackaging, costs of training, costs of new infrastructure or activities to meet the requirements of the scheme and enforcement costs.

Research by the University of Hertfordshire *et al.* (2010) notes that the audit burden for practice-based schemes is far lower than for outcome-based approaches, and that one of their big attractions is their accessibility. However costs will depend on the specific requirements of the scheme.

Costs can be higher for businesses which target different import markets demanding different certification and, subsequently, costs per farmer increase. Costs tend to be lower when the actors in the supply-chain are well coordinated and vertically integrated or linked, due to lower transaction costs (Santacoloma, 2007).

However, there are generally considered to be financial benefits from being involved in certification/labelling schemes. Labelled products may have a competitive advantage over those which are not labelled. Having a label may also indicate that a business is socially responsible, thus it may lead to increased trade.

5.4 Stakeholder Recommendations

Given the risk that by focussing solely on water use, the environmental, social or economic burden in another stage of the production process may inadvertently be increased, Sustain (Segal & MacMillan, 2009) has recommended that new labels should stop short of providing information on a product's water footprint. Instead, they should adopted a more stewardship based approach and allow companies to demonstrate that they are investing in water conservation measures. This is one of the reasons behind the proposals by Sustain for the creation of a multi-criteria sustainability label, appropriate for food products, that would grade products according to a number of criteria (including water). It is proposed that this label might take the form of a flower, with each petal representing a different concern, and a petal specifically for water. Rather than showing water litres per kilogram, the food and drink labels would show if a company practiced 'good water stewardship'. Sustain suggests that this information should go alongside other vital elements of sustainability, such as greenhouse gases, nutrition and fair trade, so that consumers can get a full picture of the impact of the food they buy. Consultation supports the view that if water labels are introduced, they should be based on governance and stewardship more generally, rather than on water footprint measurements (personal communication, 2011). As commented by the Food Ethics Council, water footprint information should not be customer facing.

The study by the University of Hertfordshire *et al.* (2010) addressed the practicalities of labelling and what it achieves. It found that the biggest drivers for change were not labels per se but pressures from along the supply-chain; consumers have less leverage than the supply-chain. In this regard, labelling has a role in promoting and supporting change within the industry and for encouraging best practice; however, to really promote best practice then industry itself has to move to carrying out impact assessments. Labelling should therefore be viewed more as an enabler to support a wider set of initiatives, with a focus on providing reassurance that minimum standards have been met.

Both the Food Ethics Council and the FDF think that all parts of the supply-chain have a role to play in reducing water use and that more focus could be put on providing information at a business to business level (B2B), rather than focussing solely on business to consumer (B2C) communication. The SCP Round Table will provide a framework for communicating environmental information, both B2B and B2C. Sveriges Konsumenter has also indicated that environmental information may be better communicated to retailers and professional buyers, rather than directly to consumers. As commented by a NGO, consumers may make assumptions about the manner in which supermarkets source their products - assuming that supermarkets only sell sustainable products and products that are not damaging to the environment. Thus, it has been suggested that the key to reducing water use in the food/agricultural sector is to target supermarkets and pressure them to adopt supply-chain based initiatives. It has been suggested that the Commission should consider funding supermarkets to carry out research into which products are the most sustainable (by working with their supply-chains). Products which are more sustainable than other similar products could then be preferentially advertised in store and could carry a label which suggests ways in which the products with comparatively lower embedded water can be used so as to shift consumer demand. In this way, information on embedded water would attract the

attention of the consumer and may encourage consumers to buy less water-intensive products; this in turn should help increase consumer demand for a wider variety of products in line with some of the current policy initiatives being carried out by DG Agriculture. CLCV have suggested that standards for water use be included in retailer's requirements when buying from food manufacturers. There would need to be legislation, however, to force retailers/buyers to consider such information.

It has been suggested that consumers do not spend so much time considering the purchase of foodstuffs as they do the purchase of products such as washing machines, dishwashers, toilets, taps etc. A NGO has suggested that a good first step would be to include information on water use in these types of equipment rather than on food/agricultural products. Sveriges Konsumenter indicates that there has been some water labelling of white goods in Sweden.

The CIAA note that communication of information should not be restricted to labelling schemes. Indeed, both the Food Ethics Council and the CIAA have commented that labelling may be an inadequate tool for informing consumers, particularly given the complexity of the environmental information that would be required to enable consumers to make informed choices among products. Instead, the CIAA suggest that operators should be free to use whichever means and formats of communication they deem to be most effective, so long as it complies with the Guiding Principles of the SCP Round Table.

6. REVISED POLICY OPTIONS

6.1 Policy Options in Relation to Footprinting and Virtual Water

In the previous sections of this report, we have reviewed the application of footprinting and virtual water methods at the corporate level, commodity level, planning level and with a consumer focus. We have also identified a range of other tools being developed and applied by businesses both within the EU and more globally to respond to water scarcity and water risks more generally. The development of such tools is also being complemented by a range of certification initiatives and the potential for this to be followed by business-to-business or business-to-consumer labelling is also apparent.

Based on the findings presented above, we have identified a series of potential policy objectives to act as the basis for identify possible policy responses. These are as follows (and are based in part on the types of objectives that support current EU policies as summarised in Section 2):

- to increase the extent to which water is used sustainably and the efficiency of water resource consumption;
- to help water users to manage water and water-related risks;
- to provide information on the environmental impact of water use;
- to improve the consistency of the process and tools used;
- to obtain agreement amongst stakeholders on the approaches to be used;
- to provide additional data to inform initiatives, reporting and planning; and
- to identify and target research and data needs.

We have then drawn on the reviews provided in Sections 3 to 5 to identify possible policy options for adoption at the EU level and which help deliver the above objectives. All of these options fit within the approach to water management as advocated by the European Commission (2007) in its Communication on addressing the challenge of water scarcity and droughts in the EU. They involve different types of actions, varying from partnership and promotion, research support, support of international initiatives, and the development of new instruments/tools.

For ease of discussion and coherence, we have organised the options into five sets of related actions:

- 1) options focused on corporate level behavior
- 2) options at the water resource planning level
- 3) options at the international policy level
- 4) options in relation to certification; and
- 5) options in relation to labelling.

Each of the identified options is described in more detail below.

6.2 Options Focused on Corporate Level Behaviour

6.2.1 Overview

The general view of most stakeholders regarding the application of footprinting methods at the business or corporate level was that any EU policy aimed at such applications should be based on ‘promotion’ only of these tools. Industry is actively working on the development and agreement of methods through the ISO and involvement in networks such as the WFN and the WBCSD. However, not all organisations believe that footprint assessments are the most appropriate tools for delivering better water management and believe that their use should be voluntary.

There is clearly also a growing interest in a wider array of water management focused tools, such as those discussed in Section 4. This includes further developing these so that they take better account of supply-chain risks, with increased emphasis on identifying key water using links within the supply-chain and addressing particular ‘hot spot’ issues, risks and opportunities. The work being undertaken by the WBCSD, CDP Water Project, GEMI and others highlights the fact that businesses (as well as investors) need tools aimed at helping them manage water and water-related risks better.

Supporting the on-going development of the current suite of tools and encouraging their use may be an important first step in building corporate understanding and action in relation to better water management both within the EU and more globally. This could include helping improve the databases that these tools rely upon, so as to improve their reliability and the comparability of information across locations.

Finally, if industry is itself trying to develop and “standardise” the use of water footprint assessment (and the other tools), then it is inevitable that they will be used for reporting and communicating purposes. Although this may start at the business-to-business level, such communication is likely to become more consumer-facing over time. Concerns may therefore arise over the extent to which the adoption of different assessment approaches, e.g. in carrying out a water footprint assessment, may lead to businesses making claims on the water footprint of their activities which are not comparable. This in turn could lead to misinterpretation of such claims by consumers. As a result, there may therefore be a role for the Commission in ensuring some degree of harmonisation in the calculation of the water footprint (e.g. with this similar to the development of standard methods for calculation of carbon footprints), or at least in identifying those methods that are ‘fit for purpose’.

Following on from the above, a series of options focused on influencing or incentivising corporate level behaviour have been identified with these listed in Table 6.1.

6.2.2 Option 1a: Defining Best Practice in Water Footprint Assessment

One of the key concerns with regard to the use of water footprinting lies with the inconsistent use and application of water footprint methodologies. Little independent guidance currently exists on how best to undertake a water footprint.

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
1a: Defining best practice in water footprint assessment				•	•		•
1b: Funding research on impact assessment in water footprinting			•	•	•		•
1c: Promoting better corporate water management	•	•				•	
1d: Promotion of water use assessments	•	•	•			•	
Key: • - directly relevant ○ - indirectly relevant							

One of the key on-going initiatives in relation to water footprinting is the work currently being carried out by the ISO to develop a water footprint standard. Consultees for this study have suggested this process could take several more years before it reaches an agreed standard. It is understood that the resulting standard will not recommend any specific method but will be more aimed at providing common definitions and defining the scope of the assessments. Given that the use of footprinting methods varies across the volumetric, stress weighted and the LCA based approaches, and that footprint assessment may be used for different purposes, greater clarity on what type of method is best suited to different applications would be of value. Furthermore, as footprint assessments may be used as a corporate communication tool via websites and other promotional information, it may be important to ensure that there is greater consistency in their application into the future; this would help ensure that the potential for business, consumers and other stakeholders to misinterpret footprint information is minimised.

Under this option, the Commission would add its support to ensuring that the ISO standards reflect the development of best practice in water footprinting, with the aim of improving the credibility, reliability and repeatability of the method across the range of potential users. This would include:

- reaching general consensus on issues such as the scope of green and grey water to be included in the assessment;
- addressing best practice in relation to defining the scope of the footprint itself, e.g. what supply-chain activities are included;
- providing guidance on the appropriate application of the alternative methods;
- overseeing recommendations on the data sets for use in EU footprints, and how to deal with data inconsistencies (e.g. use of default data versus actual data and combinations of both);

- providing advice on incorporating and reporting on uncertainty within the footprint calculations; and
- setting out guidance on reporting of footprinting information so as to ensure transparency and comparability.

6.2.3 Option 1b: Funding Research on Impact Assessment in Water Footprinting

One of the biggest shortcomings identified with the use of water footprinting to date is its failure to address the environmental impacts of water use, where these are spatio-temporal in nature. The two main approaches within footprinting address this issue differently, as do the LCA methods currently under development. Thus, there is currently no agreed approach. If the use of water footprinting is to be more integrated into both corporate and planning level applications, and is to provide the basis for meaningful communication to consumers, then there would be value in the EC funding research on the impact assessment stage of footprinting (for application at the corporate or planning levels).

Under this option the Commission, in addition to gaining stakeholder agreement on best practice in water footprinting (Option 1a), would fund research on best practice in the integration of impact assessment into footprinting. This would include consideration of qualitative as well as quantitative approaches, and when each was more appropriate. It would also identify the databases / sources that should provide the basis for the impact assessment within an EU context. Other actions would include dissemination activities as well as providing recommendations based on the findings to the ISO process.

6.2.4 Option 1c: Promoting Better Corporate Water Management

This option would involve the Commission promoting better corporate water management. This includes promoting better management through the use of risk assessment and risk management techniques but also promoting water efficiency and water stewardship activities. It would involve highlighting the importance of managing future water scarcity risks within supply-chains, and adoption of principles based on the need for better water use efficiency and water stewardship activities (where this is more broadly defined in relation to water management and engagement in this).

The value of developing an overall strategy for managing water related risks would be focused at different levels. For example:

- i) Food product manufacturer level: As a starting point, companies would be encouraged to carry out the necessary work to gain a better understanding of both the potential impacts of their operations on the water environment and also the water related risks that they may face in the future. This would include putting in place a plan for managing such risks.
- ii) Retailer level: As for the food product level, promotion would focus on using risk assessment or risk management tools to understand water resources related business risks through their supply-chain. Retailers would be encouraged to promote the use of such tools throughout their supply-chains and adopt good water stewardship principles.

Additional actions would include preparation of a guide on the principles of good water management, identifying freely available tools and information sources and other dissemination activities.

6.2.5 Option 1d: Promotion of Water Use Assessments

This option is an extension of option 1c (and to a degree also assumes options 1a and 1b) and would involve the Commission promoting the use of the various existing tools reviewed in Sections 3 and 4, as means of better understanding the impact of production activities on local water resources, as well as risks within supply-chains. This would include promotion of these tools to different user groups, but also assumes that businesses at the food product level (e.g. the major brands) and retailers would act as key drivers of good practice (and reflects the fact that consumers have been found to assume that retailers and the major brands monitor and influence actors within their supply-chains). The aim here is to address the longer term need for companies to respond to the impacts that water scarcity will have on their business activities. Promotion would therefore highlight the potential for such tools to help drive water efficiency and demand management as part of overall good stewardship.

Under this option, promotion activities would focus on:

- i) **Agricultural Producers:** water footprinting methods could be used at the farm level to provide an audit of water using activities, with the aim of identifying areas where the efficiency of water use could be improved (e.g. by linking footprinting with benchmarking of water use and water efficiency practices). The focus here would be on estimating the blue water component of production activities, to identify approaches for reducing the impact of blue water consumption through increased efficiency, winter storage, and so on.
- iii) **Food producers:** As a starting point, companies could be encouraged to use one of the tools highlighted in Section 4, with a water footprint assessment then promoted as a second stage to provide an audit of water use across key water using processes. If this were integrated with demand management activities, it could help identify opportunities for water saving across different locations and facilities, and help companies reduce their overall water consumption and its impacts.
- iv) **Retailer level:** As for the food product level, promotion could focus on a two staged approach starting with application of freely available tools moving to those that may require external support. Retailers would be encouraged to promote the use of a set of tools (e.g. use of the GWT, a water footprint assessment or LCA methods) to key actors within their supply-chain; this would build on corporate sustainability initiatives and provide retailers with a means of establishing audits of water use within their supply-chain. It would help identify 'hot spots' within the supply-chain and associated risks and opportunities.

6.3 Options at the Water Resource Planning Level

6.3.1 Overview

With regard to the use of virtual water and water footprint assessment at the local, regional or national planning level, it is harder to identify a clear role at the present time. Although the use of these methods exists as part of water resource planning in Spain, for example, it is not yet clear what role it has actually played in influencing planning activities (consultation is on-going on this issue) *vis a vis* the other types of information that water regulators already use and collect to assist with water resources planning.

Similarly, the study being undertaken in the UK which is examining the application of the methods to three catchments in England and Wales has not yet been completed. Although this will study is linking data on water scarcity at the catchment level with water footprint data for a series of key crops, it is still unclear how this information might be used by authorities for water planning purposes in the future. In addition, the authorities have noted that undertaking such studies is expensive and could not be carried out on a large scale (i.e. for all water stressed catchments). In contrast, there is potentially a greater role for using water footprinting methods to act as a catalyst for stakeholder involvement in water planning at the local level (as has been used by WWF in Kenya).

The development of benchmarking data on water use / consumption by different processing activities could be of value to national authorities. These data would help to identify best practice methods to support regulatory efforts to improve water resource management and for working in partnership with different industry sectors. It may also be of value to industry in identifying those technologies they should be looking to move to when investing in new plant, spurring innovation into lower water using technologies and their cost-competitiveness.

Based on the above, we have identified the three options set out in Table 6.2.

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
2a: Benchmarking water use	●				●	●	○
2b: Footprinting as part of integrated planning	●	●			○	●	
2c: Economic productivity assessments	●				○	●	
Key: ● - directly relevant ○ - indirectly relevant							

6.3.2 Option 2a: Benchmarking Water Use

The aim of this option would be for the Commission to establish a database of information on best practice methods (both technologies and techniques²⁰) for reducing water use and consumption as part of different production and processing activities, with a focus on industrial / manufacturing processes and including food processing and production. This would involve benchmarking water consumption / use across a cohort of firms involved in similar activities and with similar characteristics. Although there may be sources of information at the national level, there is no single source which brings together different authorities' views across the EU as to what constitutes best practice. There is a clear role for a Europe-wide source of such information for use by both regulators and individual businesses, which was readily accessible and up-dated on a regular basis.

Note that this option could be linked to certification activities and to other policy options such as Option 5a (establishment of an EC 'Smart Mark' for water saving technologies). This type of information may also be of value to other policy contexts, such as BREF Documents setting out best available techniques under the IPPC Directive.

6.3.3 Option 2b: Footprinting as Part of Integrated Water Resource Planning

Information on the amount of water embedded in different agricultural products and in different sectoral activities (including different processing methods) could help regulators identify those activities that would be the most unsustainable for catchments or river basins under stress. This could help them target their efforts in relation to changing existing practices through agricultural extension activities (e.g. programmes aimed at driving continuous improvement in water efficiency, shifting agricultural production activities to lower water using crops, catchment sensitive farming, etc.) and/or through planning activities in relation to future development.

Under this option, the Commission would support and promote the use of virtual water and water footprint methods for assessing water consumption flows in catchments with significant water scarcity issues. The aim would be for these tools to feed information into planning at the River Basin, regional or national policy levels.

As part of this option, the Commission would identify the most appropriate data sets for these purposes on water availability, evapotranspiration, etc. This option would also enable the Commission to open up dialogues with particular regions in the EU where there are significant water scarcity issues or hot spots.

6.3.4 Option 2c: Economic Productivity Assessments

As in Spain, under this option the Commission would require Member States with significant water scarcity issues to undertake economic productivity assessments incorporating the use of water footprint assessments and environmental impact

²⁰ Including good housekeeping, auditing, recording and reporting.

assessments to identify the most productive uses of water at a regional / local level. The aim would be for the resulting information to feed into River Basin Management Planning. This type of analysis would be broader than that suggested under Option 2b, as the intention would be to capture economic sustainability considerations and to highlight the trade-offs between water use and economic development. Note that such assessments would need to take into account the opportunity costs of water use from an ecosystem perspective.

6.4 Options at the International Policy Level

Two types of tools have been identified which may have a role at the international policy level. The first of these is the use of water footprint assessments to provide information on the amount of water that is embedded in agricultural products and foodstuffs imported into the EU. Although it is clear that there is concern amongst stakeholders that the data / models underlying these calculations are not reliable, and that the various studies have not been undertaken consistently, there is the potential for the outputs of these studies to be used as the basis for identifying issues in relation to international trade.

The second type of tool is illustrated by the type of economic analysis set out in the report prepared by the 2030 Water Resources Group (Charting Our Water Future – Section 4.7). This would be aimed at a generating a more integrated, cross-sectoral approach to water management.

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
3a: International Partnership and Support	●			●	●	●	●
Key: ● - directly relevant ○ - indirectly relevant							

6.4.1 Option 3a: International Partnership and Support

Under this option the Commission would use the outputs of virtual water studies to open up dialogues with national governments, international funding organisations and others on the tensions between current agricultural export activities and water scarcity issues. In addition, the Commission might encourage key countries to undertake the type of economic analysis of water supply and demand options into the future set out in Charing Our Water Future. Actions could extend to institutional support and capacity building in relation to water resource management or education with respect to water saving techniques (e.g. irrigation methods, etc. and this could draw on any

benchmarking activities undertaken as part of Option 2), etc. For example, this would include feeding information to the most vulnerable trading partners and promoting more cross-sectoral economic analysis into the activities of the EUWI, the ENP and H2020.

6.5 Options in Relation to Agricultural and Food Product Certification

6.5.1 Overview

Consultation in relation to agricultural and food product certification has indicated that:

- there already exist a range of different schemes having varying objectives and which provide examples of best practice; in addition, there are important initiatives in this field which are likely to drive future developments;
- certification of good water stewardship would appear to be generally supported as being of value and important to managing future business and other risks;
- certification in terms of the amount of water consumed in the manufacture (whether cradle to gate or cradle to grave) is not supported due to concerns over the lack of agreement on and the reliability and consistency of the available methods;
- there should be more emphasis on consumer education in relation to the amount of water consumed in different food production activities.

Based on the above, we have identified three potential options, with these set out in Table 6.4. These options could be adopted separately or be combined.

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
4a: Promotion of voluntary certification	•	o				o	
4b: Information dissemination on certification schemes	o	o		o			
4c: Promotion of consumer education campaigns	•						
Key: • - directly relevant o - indirectly relevant							

In relation to certification, we have limited the proposed policy options to promoting voluntary certification schemes for agricultural producers²¹.

²¹

As noted earlier, one of the more important initiatives in relation to water footprinting is the work currently being carried out by the ISO to develop a water footprint standard. This standard is not being designed for certification purposes so there is no option specific to it included here.

6.5.2 Option 4a: Promotion of Voluntary Water Stewardship Certification

A range of schemes aimed at agricultural producers already exists and which includes some requirements in relation to stewardship of water resources. These vary from fairly low requirement schemes, such as under the GlobalGAP, to more demanding schemes such as that represented by the LEAF Marque. At the current time, both have some international standing although the GlobalGAP has a far higher level of participation than the LEAF Marque (which builds on the GlobalGAP). Looking into the future, the EWP and AWS certification schemes are expected to become operational and would then provide standards more focused at brand producers and retailers.

Under this option the Commission would promote the adoption of these schemes both within the EU and externally, highlighting the benefits that could be gained through certification. It would also promote such schemes to food producers and retailers so that water stewardship based certification begins to be demanded across the food production supply-chain. Note that it is not assumed that the Commission would promote any particular scheme, rather the benefits of gaining certification in terms of assurances through the supply-chain, product premiums, etc.; the Commission may, however, provide guidance on what it believes would constitute appropriate certification criteria.

Any promotion activities may need to be complemented by the provision of information on available schemes. Thus, it is assumed that the Commission would support the UNITC in the development of its Standards Map project and encourage EU schemes to feed details to the UNITC.

6.5.3 Option 4b: Information Dissemination on Certification Schemes

The aim of Option 4b would be for the Commission to actively disseminate information on existing certification schemes (which could be linked to Option 4a). Although information is already available on the DG Agriculture website, it is not necessarily presented in a manner which may be of most value to producers and retailers. A clearer indication could be provided on the differences in the actions required to obtain certification under the different schemes, who recognizes the different certifications, their geographic applicability, and the typical costs of gaining certification (application fees, auditing fees, frequency, etc.).

6.5.4 Option 4c: Promotion of National Consumer Education Campaigns

A significant proportion of stakeholders identified the need for consumer education in relation to the level of water embedded in food in general and the need to avoid food waste. The aim of this Option would be to raise consumer awareness of the environmental impacts of wasting food with impacts including those on water resources, the climate, rainforests and so on. The key message of such consumer education campaigns would be that wasting food is wasting resources and that reducing household food waste would be beneficial for the environment as well as beneficial for consumers (through reducing food bills, waste collection bills and landfill taxes). While water footprint information could be used as an awareness raising tool in this context,

care should be taken to ensure that consumers are not led to believe that one product is ‘better’ for the environment than another based on inaccurate information.

Consumer education is generally the remit of DG SANCO. Under this option, DG Environment would support DG SANCO in developing materials that could be used across all Member States with the aim of better educating consumers on the impacts of different consumption patterns and activities.

6.6 Agricultural and Food Product Labelling

6.6.1 Overview

As discussed in Section 5, labelling of virtual water in food products aimed at the end consumer is not supported by most consultees to this study or in the literature. There is an obvious link though between certification and labelling, whether this be focused at the business-to-business level or the business-to-consumer level. Indeed, there are examples of companies labelling particular products for water use and the possibility for this to increase with grater take-up of the types of tools discussed in Section 3. As a result, in the absence of EU-wide action, competing labels may be created with the potential for consumer confusion. This type of dynamic has been recognized already in some sectors as part of business-to-business communication. In this regard, there is also a clear link between the increased inclusion of a water footprint assessment in LCA methods and the on-going development and demand for environmental product declarations across a range of sectors.

In response, we have identified two options in relation to labelling at the business-to-business level (B2B), and a third option aimed at identifying potential mechanisms for labelling at the business-to-consumer level. These are listed in Table 6.5.

Option	Objective						
	Increase sustainable use of water	Help water users manage water and risks	Provide information on environmental impact	Improve consistency	Obtain agreement amongst stakeholders	Provide additional data to reporting and planning	Identify and target research
5a: Establishment of an EC Smart Mark	•	•					
5b: Encourage and monitor voluntary B2B labelling		•	•				
5c: Research on multi-dimensional labelling			•	•	•		•

6.6.2 Option 5a: Establishment of an EC ‘Smart Mark’ for Water Saving Technologies

This option would see the creation of a voluntary EC-based scheme for labelling water efficient equipment to encourage the take up of more efficient water using technologies (similar to the Smart Water Approved Marque operating in Australia). It is therefore effectively a hybrid B2B certification and labelling scheme.

Because there are a number of national/regional eco-labelling schemes already in place across the EU, the scope of this Smart Mark scheme would need to be clearly defined so as not to result in overlaps which would undermine the status of the existing voluntary schemes or those in development. The aim therefore would be to focus on goods and possibly services not covered by the existing schemes, such as agricultural equipment and possibly particularly types of water saving technology used within the food production (or other) sectors (although care is required here as water efficiency may depend more on how equipment is used than on the technology itself).

Although this option is assumed to be focused on technologies used in industry and business, it could also be extended to consumer goods, where these are not covered by ecolabels or other schemes (e.g. different designs of swimming pool covers).

The types of actions that would be undertaken by the Commission as part of this option include:

- creation of an EC organization (or awarding the scheme to an existing organization(s) through competitive bidding to act as its operator) to run the scheme;
- agreement on the scope of the equipment to be included under the scheme;
- assistance in establishing expert panels to set criteria and assess whether or not particular products meet the criteria; and
- monitoring / supervision of the scheme’s operation and evaluation of its impact.

6.6.3 Option 5b: Encourage and Monitor Voluntary Stewardship-based Labelling

There are a few voluntary schemes already in operation which result in labels reflecting either water stewardship or water consumption. As there is considerable concern over the latter type of labelling in terms of its reliability and consumers ability to understand the information being provided, labelling food products based on water consumption is not suggested here.

However, the Commission could promote the labelling of agricultural products that have been produced in line with good stewardship requirements, for example. Producers would be able to use such a label to provide customers with assurances as to the water stewardship credentials associated production activities. By providing clear information on the scope of the production activities covered by the label, retailers would be able to identify those products which were produced in a more sustainable manner, thereby giving market incentives to producers to modify their activities to deliver more sustainable water use. Over time, such labelling could also be taken up by, for example, restaurants / farm stores / retailers which sell produce from farms meeting good husbandry criteria.

Additional actions by the Commission as part of this option might include:

- recommendations on what might constitute ‘best practice’ for certification purposes, and guidance on the use of labelling of water stewardship within the supply-chain; and
- promotion of the use of labelling within the supply-chain, including dissemination activities, for example, at EU events and in different fora (Roundtables, etc.) and through trade associations.

6.6.4 Option 5c: Research on Potential Schemes for Multi-dimensional Environmental Labelling

The final policy option is for the European Commission to commission research into the development of multi-dimensional environmental labels. The aim would be to identify the basis for such a label, its approach to communicating environmental impact information and the degree to which such a label could give consistent and transparent information relating to the environmental performance of products. The research may also need to address concerns over the ability of consumers to cognitively reflect such information in their decisions, when also faced with other types of labelling (e.g. fair trade). There may be links between this option and the type of work currently being undertaken in France in relation to La Grenelle (see Section 5).

It is assumed that this work would be carried out in collaboration with DG SANCO given its consumer focus.

6.7 Policy Option Groups for Impact Assessment

As can be seen from the description above, there are potential synergies between many of the policy options. For example, option 1a (defining best practice in varying applications of water footprinting) could be seen as a necessary precursor to implementing option 1d (promotion of water use auditing through footprinting and other tools such as LCA).

In such cases, combining policy options may lead to added value. For example, option 1c and 2a may be mutually reinforcing and enable greater total benefits if the two options were implemented together than if either were implemented individually. Similarly there may be some overlap between the work that would be undertaken under certain options (for example options 2a and 5a) and that this may enable some cost savings if certain combinations of policy options are implemented.

In order to build on these potential synergies and achieve a more comprehensive approach, policy options have been grouped for the purposes of the impact assessment. These groupings are presented in Table 6.6 together with an indication of their focus and intent.

Table 6.6: Policy Option Groupings and Their Focus		Option Group				
		Group A:	Group B:	Group C:	Group D:	Group E:
		<i>Promotion, Education and Partnership</i>	<i>Promotion, Education and Analysis</i>	<i>Supply-chain Incentivisation</i>	<i>Methodology Development: Clarity, Role and Transparency</i>	<i>Research and Development, Education, Supply-chains and Partnership</i>
1	1a: Defining Best Practice in Varying Applications of the WF				X	X
	1b: Funding Research on Impact Assessment in Water Footprinting				X	X
	1c: Promoting Better Corporate Water Management	X	X	X		X
	1d: Promotion of Water Use Assessments through Footprinting and other Tools		X			X
2	2a: Benchmarking Best Practice in Water Use	X		X		
	2b: Footprinting as Part of Integrated Water Resource Planning					X
	2c: Economic Productivity Assessments		X			X
3	3a: International Partnership and Support in the Area of Sustainable Development	X	X			X
4	4a: Promotion of Voluntary Water Stewardship Certification		X	X		X
	4b: Information Dissemination on Certification Schemes	X	X			X
	4c: Promotion of National Consumer Education Campaigns	X	X	X		X
5	5a: Establishment of an EC ‘Smart Mark’ for Water Saving Technologies	X		X		
	5b: Encourage and Monitor Voluntary Stewardship-based Labelling		X	X		X
	5c: Research on Potential Schemes for Multi-dimensional Environmental Labelling				X	X

7. IMPACT ASSESSMENT OF POLICY OPTION GROUPS

7.1 Impact Assessment Methodology

7.1.1 Approach

Our approach to the impact assessment is based on a multi-criteria analysis approach which takes into account both the monetary and nonmonetary objectives (i.e. environmental and social goals) of the European Commission.

The impact assessment started at the policy option level, with each option initially screened and assessed in terms of their performance against the impact categories set out in the European Commission's Impact Assessment Guidelines (EC, 2009). The types of impacts described under each category have been divided into a number of potential sub-impacts of relevance to the options being considered here; an example is given for competitiveness/competition in Table 7.1.

Impact Category	Description in EC (2009)	Sub-impacts
Competitiveness/competition	What impact does the option have on the global competitive position of EU firms? Does it impact on productivity?	Change in competitive advantage of businesses (e.g. between those who have already applied methods, been involved in development of methods, etc. and others who have not)
		Change in relative competitiveness of newcomers to market (who would have more choice over where to locate, but may need to access specific schemes, information, etc.)
		Change in potential competitiveness of small versus large firms (e.g. farms)

In total, we have identified 27 relevant impact categories and 70 potential sub-impacts of relevance across all of the categories set out in EC (2009). The potential impacts of each of the policy options have been assessed based on our expert judgement (supported by evidence from the literature, by personal interviews and a survey of representatives of organisations with interests in water footprinting'). Policies have been screened for each of the 70 sub-impacts using a simple rating system, aimed at reflecting differences in the likely magnitude of effects and the direction of the outcome (i.e. positive or negative). The rating system ranges from -- to ++, with these ratings defined as:

++	Very significant increase/positive change/benefit
+	Slightly significant increase/positive change/benefit
0	No change/no benefit
+/-	Positive and negative impacts balance out or are uncertain
-	Slightly significant decrease/negative change/damage
--	Very significant decrease/negative change/damage
<i>Not relevant</i>	Impact type not relevant to this option

The full list of impacts is given in Annex 2 (see Table A2.2), together with the subjective ratings assigned to each (see Table A2.3). Note that the intention has been

to reflect the marginal or incremental effects associated with the different options (i.e. the change they imply from the current baseline).

We then moved from assessment at the option level to assessment at the group level, by combining the ratings across all options in a group. As indicated in Section 6, each policy group comprises a set of different policy options such that it provides an overall level of impacts (both positive and negative) that may be greater or lesser than the sum across the individual policy options. In some cases, combining policy options may lead to compounding effects (i.e. where impacts under one option serve to reinforce impacts under another), while in other cases combining policy options may lead to certain impacts being moderated, or cancelled out.

Given the importance of ensuring that the impact assessment methodology allows these complementarities and conflicts to be picked up, we have carried out the assessment on each policy group as a whole.

For key impacts across each policy group, consideration has also been given to:

- the timescale over which the impacts could be felt;
- the geographic scale of the impacts;
- the scale of the impacts in terms of the size and demographic of the population affected; and
- whether impacts reflect direct or indirect effects.

Where possible and appropriate, the impacts have been quantified, although in most cases it has not been possible to quantify or monetise them.

7.1.2 The Baseline – Business as Usual

The baseline (or counterfactual) for the impact assessment is outlined in Table 7.2. This establishes the situation that we *assume* will evolve if none of the policy options described above are implemented. The baseline described here is based on the situation that we consider is *most likely* to occur if none of the above policy options are implemented. Note, however, that the baseline is affected by uncertainties as to the types of measures that may be brought forward under future Water Scarcity and Drought policy and the Blueprint for EU Waters, as well as other EU, national and voluntary measures. Further elaboration of the baseline is provided in the text that follows, and which sets out the results of the impact assessment. Where possible, the baseline has been expressed in quantitative terms, however, it has not been possible to provide quantification in most cases. Supporting data are provided in Annex 2 to this report.

Table 7.2: Baseline for the Impact Assessment	
Impact Category	Baseline
Functioning of the internal market	<ul style="list-style-type: none"> • Uptake of certification/labelling remains low and so does not pose a significant barrier to market entry. • Water scarcity/drought poses an on-going threat to competition in the internal market (e.g. through increasing water prices in certain areas or through restricting the areas where certain activities can take place) although other policies aim to minimize this.
Competitiveness	<ul style="list-style-type: none"> • In the short term, businesses practicing water efficiency and stewardship gain a competitive advantage but take-up of water efficiency and stewardship remains limited. • Those who are already involved, or who become involved, in labelling/certification schemes gain a slight competitive advantage, but in the long term eco-label/certification schemes remain largely ineffective due to lack of consumer understanding/awareness. • The uneven playing field between the relatively small number of companies that have already undertaken water footprint assessments and the relatively large number of companies that have not remains.
Trade	<ul style="list-style-type: none"> • The sustainability of water use only gradually becomes an important consideration in trade decisions. • Certification/labelling does not impact significantly on future trade decisions and trade flows.
Investment flows	<ul style="list-style-type: none"> • Water-related risks, water efficiency and water productivity remain a minor consideration during investment decisions. • Water friendly products do not attract significant investment flows in the short to medium term.
SMEs	<ul style="list-style-type: none"> • Companies continue to face problems including water shortages and rising prices for abstraction. • Industry bodies continue to support the development of freely available tools to assist businesses in assessing and managing their water related risks but this work continues to be driven by the larger corporate organisations. Many small and medium sized businesses remain unaware of the potential importance of water supply and demand imbalances to their activities. • SMEs struggle to meet the stringent requirements of some certification/labelling schemes and so uptake among SMEs remains low.
Operating costs and conduct of business	<ul style="list-style-type: none"> • Many companies continue to face problems including water shortages and rising prices for abstraction. • Although larger corporate organisations begin to assess and manage their water related risks, the majority of businesses continue to be exposed to risks associated with water scarcity and drought. • There are several initiatives aimed at developing standards for certification of water stewardship, with some focusing on global coverage and products and others focusing on agricultural production activities. Although all of these schemes are voluntary, as a wider number of schemes come into being it will become increasingly difficult for businesses and agricultural producers to identify those schemes that are most appropriate to their activities and business objectives. A lack of incentives to subscribe to such schemes will remain, unless there is a growing demand for water stewardship certification across supply-chains.
Administrative burdens on businesses	<ul style="list-style-type: none"> • Administrative burdens in relation to water do not change.
Public authorities	<ul style="list-style-type: none"> • In the short term, public authorities continue to lack reliable information on water resource use but this problem reduces as measures are taken to monitor water use at the catchment level under the WFD. • Water resources planning activities increase under the WFD.
Innovation and research	<ul style="list-style-type: none"> • Water footprint methodologies continue to be developed independently of one another and a lack of consistency in their use remains. • There is some technological progress with regard to water efficient technologies, but take-up is slower than desirable. • Over the long term, the level of knowledge and understanding of water use increases as measures are taken to monitor resource use at the catchment level under the WFD.

Table 7.2: Baseline for the Impact Assessment	
Impact Category	Baseline
Consumers and households	<ul style="list-style-type: none"> • The use and application of water footprint methodologies continues to be inconsistent. Water footprint assessments are used for reporting and communication purposes (with communication becoming increasingly consumer-facing over time) and there is the potential for consumer confusion and misinterpretation. • Over the short to medium term, consumers continue to lack the information needed to make more sustainable purchasing decisions and eco-label schemes remain largely ineffective with respect to water consumption.
Sectors and Regions	<ul style="list-style-type: none"> • Some sectors (e.g. agricultural sector) and some regions (e.g. southern European) are disproportionately affected by water scarcity and drought. • There is a risk that specific sectors/regions may be targeted for action based on inaccurate information regarding water use.
International relations and Third countries	<ul style="list-style-type: none"> • There is some cross border trade in environmentally friendly technologies, and a degree of innovation and knowledge transfer. • There is some international partnership, co-operation and support in the area of sustainable development under the EUWI. As such there is a move toward better water governance, capacity building and awareness of water issues at the international level. • Water resource management does not feature prominently in the ENP Action Plans.
Macroeconomic environment	<ul style="list-style-type: none"> • Water scarcity/drought continues to pose a long term risk to macro-economic stability. • Water scarcity/drought poses a long term risk to economic growth.
Employment and labour markets	<ul style="list-style-type: none"> • There are missed opportunities with regard to job creation.
Social inclusion and protection of particular groups	<ul style="list-style-type: none"> • Some disadvantaged groups, such as small family-farms, are disproportionately impacted by water scarcity/drought. • Water users dependent for their livelihoods on access to water especially in traditional and informal sectors are placed at risk in the future as climate change and development increase pressure on available water supplies.
Crime, Terrorism and Security	<ul style="list-style-type: none"> • Water scarcity/drought poses a long term risk to food security. • Water scarcity has the potential to lead to infringement of water laws and entitlements.
Culture	<ul style="list-style-type: none"> • Water scarcity/drought poses a long term risk to certain culturally important sites, such as wetlands that provide recreational opportunities or specific flora and fauna of local cultural significance. • Greater importance is placed in future on the cultural benefits of water associated with sense of place, history, spiritual wellbeing, tranquillity, recreation and tourism, and associated biodiversity and landscapes.
Social impacts in third countries	<ul style="list-style-type: none"> • Water scarcity/drought is poses an increasing threat to third countries, with social impacts relating to food security, access to drinking water, impacts on farming livelihoods among others.
Transport and the use of energy	<ul style="list-style-type: none"> • Energy prices (which affect the cost of pumping) continue to increase.
Biodiversity, flora, fauna and landscapes	<ul style="list-style-type: none"> • Although there is a continuing commitment to ecological protection under the WFD (with parallel international commitment), water scarcity/drought remains a long term threat to biodiversity, flora, fauna and landscapes. However, an increasing awareness of economic value of ecosystem services adds weight to the protection of freshwater resources.
Land use	<ul style="list-style-type: none"> • In the medium to long term, there is a polarisation of land use in the agricultural sector, with intensification in areas of a comparative advantage and decline in marginal farming areas typically associated with poor soils or water deficits. • Continuing pressure on land associated with development and climate change make water resources a major determinant of land

Table 7.2: Baseline for the Impact Assessment	
Impact Category	Baseline
	capability and land use potential (access to water enhances land value, e.g. for irrigation).
The environmental consequences of firms and consumers	<ul style="list-style-type: none"> • While a small number of retailers and food product manufactures begin to promote water efficiency and water stewardship activities throughout their supply-chains, most firms will not. • Technological progress is increases the availability of more efficient technologies but their uptake remains limited. The lack of accurate and easily accessible information, as well as the lack of education and training with regard to water conservation awareness and environmental technologies continues in the short term. • Some environmental gains that could be achieved with respect to improved water efficiency and better water stewardship are lost. • In the short to medium term, most firms will not be aware of tools available for identifying where water use is greatest in their supply-chain/or during production of their products. • The agricultural sector continues to be a major water user.
Water quality and resources - including waste production	<ul style="list-style-type: none"> • Climate change is exacerbates existing problems of water scarcity/drought. • Climate change and population growth (among other factors) are increase demand for increasingly scarce resources. • There is a (limited) increase in the level of water resource efficiency, driven by increasing water prices, energy prices and planning considerations. • Food waste (containing virtual water) is reduced due to increasing environmental concerns regarding landfill. • Reductions in the availability of water lead to greater waste water reuse. • Water quality improves under the WFD.
The likelihood or scale of environmental risks	<ul style="list-style-type: none"> • Environment and wildlife remain exposed to environmental risks associated with water scarcity and drought.
International environmental impacts	<ul style="list-style-type: none"> • Given the above, some of the environmental gains that could be achieved with respect to improved water efficiency and better water stewardship are lost. This has broader impacts on ecosystems and other policies such as those associated with food security.

7.2 Group A: Promotion, Education and Partnership

7.2.1 Summary

Policy Group A is designed to act as a ‘Promotion, Education and Partnership’ approach and comprises the following policy options:

- 1c: Promoting better corporate water management;
- 2a: Benchmarking water use;
- 3a: International partnership and support;
- 4b: Information dissemination on certification schemes;
- 4c: Promotion of national consumer education campaigns; and
- 5a: Establishment of an EC ‘Smart Mark’ for water saving technologies.

There are several potential synergies between the individual policy options in Group A.

Combining options 1c, 2a and 5a could lead to multiplicative effects. While option 1c should increase corporate interest in water use efficiency and water stewardship, option 2a would provide information on best practice methods for reducing water use and should, therefore, provide a means for ‘corporate interest’ to turn to ‘corporate action’. Option 5a would reinforce this effect by enabling firms to have access to information on the water efficiency of equipment at the point of purchase. A potential limitation with regard to option 5a is that the water-efficiency of technologies (e.g. irrigation equipment) is often dependent on how technology is used, rather than on which technology is used (i.e. there is a difference between smart equipment and smart use of that equipment). Thus, the benefits of implementing option 5a (which would highlight which technologies to use) in conjunction with option 2a (which would provide information on best practice methods for using that technology) should be greater than the benefits associated with implementing these two options individually.

There are potential synergies between options 4b and 4c. Similar actions would be taken under these two options and information on certification schemes could be disseminated through national consumer education campaigns.

Option 3a broadens the scope of the policy Group to the international scale and could logically be combined with any of the individual policy options within Group A.

While options 1c and 2a are targeted on driving sustainability by focussing on producers, options 4b, 4c and 5a focus on the demand end of the supply-chain and consumers). As such, options 1c, 2a, 4b, 4c and 5a are mutually reinforcing in terms of reducing the negative environmental impacts of firms and consumers and improving the sustainability of production and consumption with regard to water (although the effects may not be completely additive).

Figure 7.1 provides a summary of the key impacts by number and nature associated with the individual policy options under policy Group A. Under this grouping, the option associated with the highest number of positive impacts is Option 3a, while options 2a, 3a and 4b are all expected to give rise to at least one significant negative

impact. Care is required in interpreting the data presented in Figure 7.1, however, as it only indicates the number of impacts falling into each rating category; one type of impact associated with very significant positive or negative effects may outweigh several impacts of only slightly positive or negative effects. Thus Figure 7.1 gives a measure of the likely number and hence distribution of positive and negative impacts, together with some indication of their relative significance, based on importance and magnitude. It is not possible, even with the considerable information collected here, to determine the extent to which one type of impact of a given significance (+ or -) is equivalent to, or trades off against, another type and significance of impact.

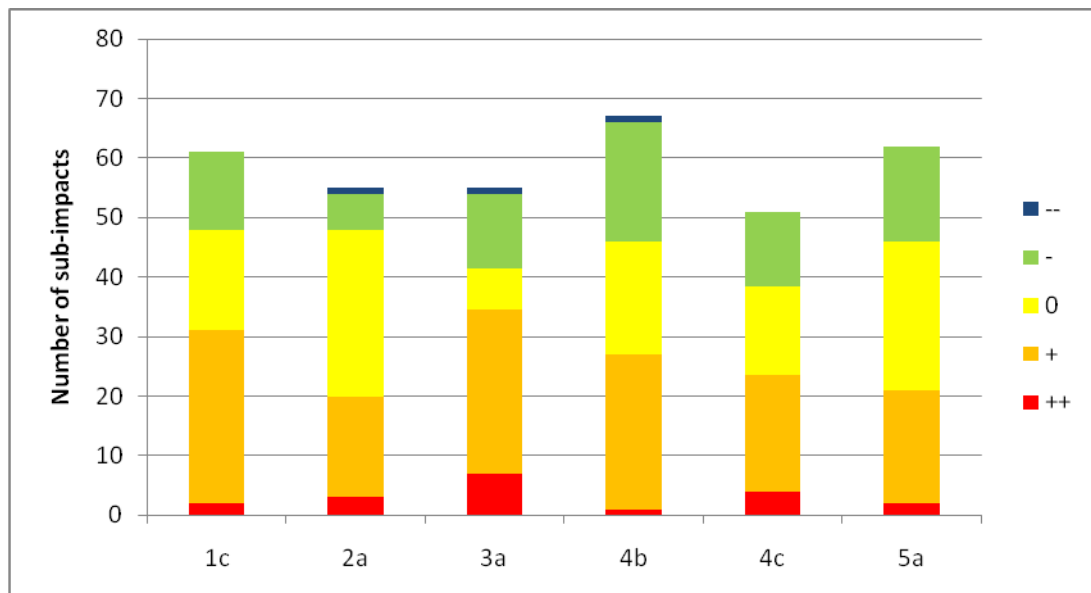


Figure 7.1: Number of Impacts by Option for Policy Group A

For illustrative purposes, impacts rated as +/- in figure have been divided equally between the + and - categories.

7.2.2 Supporting Discussion of Key Impacts

The key impacts associated with each of the individual policy options within Group A are outlined in Annex 2.

This policy Group largely targets the agricultural sector and those with direct links to it (e.g. retailers, food manufacturers) and may give rise to costs to these actors as part of its implementation. This should be an important consideration given that just over 48 million people are employed within the food chain of the EU-27, working in approximately 17 million different holdings/enterprises – the majority of which (81.8 %) are agricultural holdings (EuroStat, 2011).

On average, agriculture accounts for around 5% of jobs within EU Member States, rising to 10% in Greece, Portugal and Ireland (Barthelemy, n.d.), and approximately 2.3% of GDP (Krinner *et al.* 1999). In most countries these percentages have been declining over recent decades, indicating the existing vulnerability of this sector.

Similarly, the agri-food sector accounts for approximately 2% of total EU employment (Germany, France and the United Kingdom provide almost 60% of the EU's agri-food jobs) (Barthelemy, n.d). However, there is considerable disparity between Member States as regards their respective structures within the food chain from agriculture through to retailing and food services (EuroStat, 2011), with this highlighting the need to ensure that impacts associated with the implementation of policy Group A will not have distributional implications.

In terms of water use, agriculture in the EU accounts for approximately 30% of total EU water abstractions and around 55% of consumptive water uses (Krinner *et al.* 1999). However, in southern European countries (Greece, Italy, Portugal and Spain) these rise to 73% of consumptive use and 62% of total use (Krinner *et al.* 1999). Research into the potential for water savings within the EU agricultural sector indicates that significant freshwater savings could be achieved as a result of technological improvements, changes in farm practices, use of more drought-resistant crops or reuse of treated effluent among others, particularly in southern European Member States (Ecologic, 2007). It has been estimated that implementation of such measures could potentially lead to total water savings in the EU irrigation sector of 28,420 Million m³ per year (43% of today's withdrawals) and potential water savings of 52,740 Million m³ per year in 2030 (Ecologic, 2007), although these figures seem optimistic.

More generally, all policy options within Group A should have a positive long-term impact on the likelihood or scale of the environmental risks associated with water stress and drought; they should also have a positive long-term impact on business risks and opportunities associated with water use. This is important as highlighted by the 2010 report by the Carbon Disclosure Project (ERM, 2010). Over two-thirds of companies responding to a survey replied that they were already facing problems including water shortages and rising prices for abstraction. More than half of the risks identified across all categories (physical, regulatory and 'other') were classified as either current or near term (1-5 years) and that 39% of companies have already experienced detrimental impacts (e.g. disruption to operations from drought and flooding, declining water quality, increases in water prices and fines and litigation relating to pollution incidents).

In particular, policy option 3a may have a significant positive impact on business risks through the exchange of information on embedded water and methodologies for better integration of water consumption data into planning. According to the CDP Water Disclosure Survey 2010 (ERM, 2010), sectors reporting the greatest exposure to water risks are food, beverage & tobacco and metals & mining, all of which are likely to have strong international dimensions. The option should also generate significant widespread benefits in terms of enabling greater international cooperation and greater exchange of information between Europe and third countries. As the framework for policy option 3a already exists (e.g. through the ENP), the administrative burden should be low.

Under policy option 1c, the Commission would encourage retailers and food product manufactures to promote water efficiency and water stewardship activities throughout their supply-chains (including at the farm level). Many retailers already work to reduce both their direct and indirect water use. For example, Marks & Spencer (M&S) has been working with WWF to improve water efficiency throughout its supply-chain and

has included water efficiency as an indicator in M&S 'Field-to-Fork' farm standards and published a 'Water Efficiency Guide For Farmers'. Such water conservation awareness has been identified as a significant tool for reducing water consumption in all major economic sectors (Eco-logic 2007).

Although the implementation of policy option 1c should increase firms' awareness of issues regarding the sustainability of water use, it is worth noting that benefits associated with this option will largely depend on the degree to which firms decide to act on the information provided to them through the promotional activities. According to the CDP (2010) Water Disclosure Survey, many of the larger companies are already taking action to cut consumption, setting goals and reporting against performance.

Research by Eco-logic (2007) indicates that part of the reason why environmental technologies are not more widely used is due to a lack of accurate and easily accessible information, as well as a lack of education and training with regard to water conservation awareness and environmental technologies. Thus, when combined with option 1c, option 2a (benchmarking best practice methods in water use) and option 5a (the creation of a voluntary EC-based labelling scheme for water efficient technologies) should address this knowledge gap and enable firms to identify and implement water efficiency measures.

Assuming that there is some uptake of water-use efficiency and water stewardship, the implementation of this option should lead to water savings and benefits in terms of the availability of freshwater resources, with associated positive environmental impacts (which could include reduced pressure on water resources, reduced energy consumption and thus CO₂ emissions amongst others). As food product manufacturers and retailer supply-chains tend to be global in extent, we would expect the environmental impacts of this option to become international in scope.

Evidence suggests that while consumers are generally interested in sustainability issues, they often fail to consider these when purchasing products (OECD, 2009). Consumer education can help in this regard by developing critical thinking and raising awareness of environmental issues and the environmental impacts of consumption and lifestyle choices; it can enable consumers to become more pro-active and take practical actions to achieve sustainability goals (OECD, 2009). Under option 4c, the Commission would promote national consumer education campaigns to provide consumers with the information needed to make more sustainable purchasing decisions and to encourage consumers and households to take actions to support positive environmental goals. Data from online shopping and price comparison site Kelkoo show that in 2010 European consumers were willing to pay a price premium of 25% for green food and drink items, compared with a price premium of 27.8% in 2006 (Kelkoo, 2011), although this willingness to pay such premiums is expected to decrease in the future due to the changing economic climate. However, the price of relatively water-friendly products may decrease as demand for them increases.

Implementation of policy Group A could have benefits in terms of stimulating innovation and research, especially with regard to water saving technologies/practices. As noted above, irrigation is a major use of water, especially in southern Member States. In 2009, the total production quantity of agricultural and horticultural watering

devices in the EU-27 was some 11.8 million units, with a production value of €181.1 million (EuroStat, 2011), although the US is currently the world's leading source of irrigation equipment (accounting for around 40% of the global market for all types of irrigation equipment) (Sweeney, 2002). Spain, Italy and a number of other European countries are rapidly emerging as major producers of irrigation equipment (Sweeney, 2002), however, and this group of options could provide additional stimuli (alongside existing drivers such as climate change and water shortages) for the growth of this industry within the EU.

More generally, the Smart Mark (option 5a) should help foster a wider demand for water efficient technologies. Although there may be costs of entry into the scheme to equipment suppliers, these should be outweighed by the market benefits of gaining the Mark. In this respect, there may be a 'first mover advantage', which could be exploited by large or small companies.

There would also be some costs to public authorities, as they should be involved in identifying and defining best practice. As noted above, however, some cost savings could be achieved if options 2a and 5a were implemented together, as work undertaken by public authorities to identify 'best practice' technologies under option 2a could feed directly into the Smart Mark scheme under option 5a depending on its organisation and operation. In order to ensure that an EC Smart Mark differentiates between efficient and non-efficient products and to ensure that certification drives greater efficiency, the specifications for certification would need to be periodically revised and made more stringent to adjust to technical progress²². For example, the specifications for the ENERGY STAR (a voluntary energy-efficiency programme run by the US Environment Protection Agency for the labelling of office equipment, such as computers, displays, servers etc.) have been revised three times since 2000 in order to adjust to technical progress and drive greater efficiency (EC, 2011). This implies that there would be on-going costs associated with the implementation of this option.

7.3 Group B: Promotion, Education and Analysis

7.3.1 Summary

Policy Group B covers promotion, education and analysis, and is made up of the following eight options:

- 1c: Promoting better corporate water management;
- 1d: Promotion of water use assessments through footprinting and other tools;
- 2c: Economic productivity assessments;
- 3a: International partnership and support in the area of sustainable development;
- 4a: Promotion of voluntary water stewardship certification;
- 4b: Information dissemination on certification schemes;
- 4c: Promotion of national consumer education campaigns; and

²² Note that under option 2a best practice would also need to be redefined as technology and techniques evolve – so there are likely to be long-term costs to public authorities.

- 5b: Promotion of voluntary stewardship-based labelling.

This Group therefore incorporates options targeted at a wide range of actors including businesses, consumers and Member State authorities. There may even be implications for international organisations under Option 3a. There is consequently considerable scope for the options combined in this Group to complement each other. For example, the promotion of voluntary stewardship-based labelling and certification to businesses is likely result in greater benefits if implemented alongside information dissemination and a consumer education campaign.

Figure 7.2 provides a summary of the impact ratings assigned to the different options comprising this Group. As discussed above, care is required in interpreting these data, as the graphs provide an indication of the number of impacts rated against each rating category (++ , + , etc.), and not necessarily whether the net effect of the impacts would be greater or lesser for one particular option compared to another.

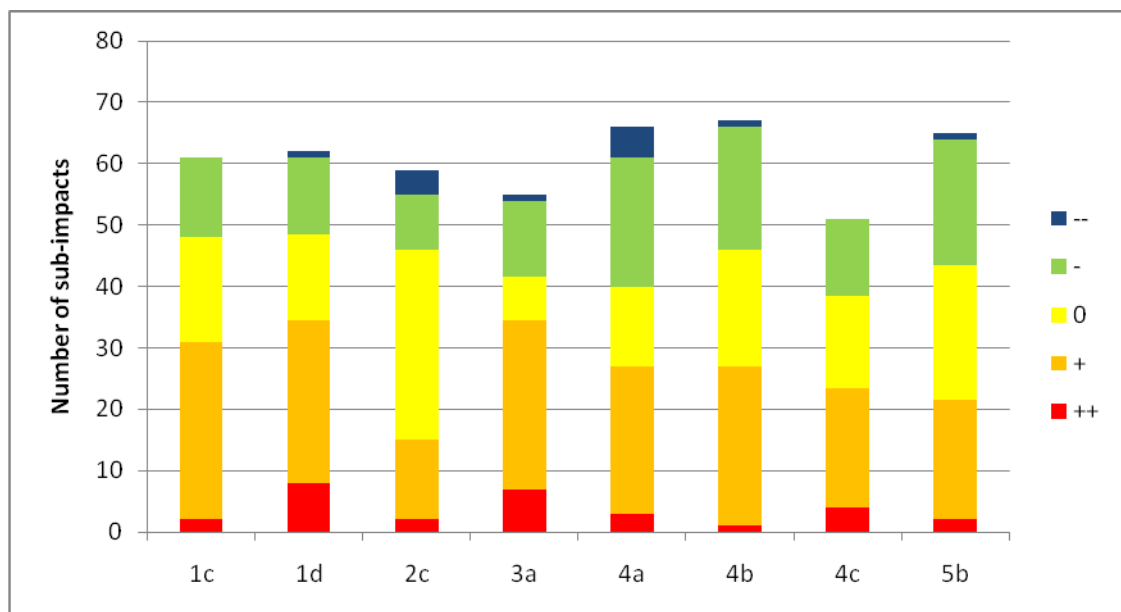


Figure 7.2 Number of Impacts by Option for Policy Group B

For illustrative purposes, impacts rated as +/- in figure have been divided equally between the + and - categories.

7.3.2 Key Impacts

The interactions between the options can be considered by reference to individual impacts assessed as likely to be positive or negative. There are several impact categories across which all the options are likely to result in beneficial impacts:

- the stimulation of research and development;
- a change in the level of innovation in terms of new technologies/water-friendly products. For consumer goods, labelling can encourage manufacturers to reformulate their products so that they match different types of guidelines more

closely (Government Office for Science, 2011). Thus, it is possible that the introduction of footprinting and other tools, labelling and certification schemes for water will push companies to innovate and develop more water efficient techniques and products, simply so that they can use the labels which will be promoted through the supply-chain and to consumers (e.g. under Options 4b and 4c);

- a change in the level of understanding and knowledge on water use. Promotion of certification schemes and business-to-business labels along with dissemination of information and education campaigns should ensure that more businesses and consumers become more conscious of water consumption and water efficiency;
- a change in level of resource efficiency. This is a logical expectation - if careful water management and stewardship schemes are promoted to businesses, and consumers are subsequently educated about such schemes, it is probable that some consumers will choose products which are more water efficient;
- impacts on freshwater quantity – surface and ground and including drinking water supplies; and hence a change in likelihood/scale of environmental risks associated with water stress/drought both within the EU and in third countries.

There are additionally other impact categories where five or more options may complement each other to result in beneficial outcomes. Key positive changes in this respect include potential increases in levels of investment in more water efficient products and businesses. There should also be benefits in terms of a greater awareness of, and hence attention given to, addressing business risks/opportunities associated with water use by SMEs and larger companies (e.g. from the combination of options 1c, 1d, 4a, 4b and 5b). In this case, the benefits from combining the options are likely to be greater than the individual benefits achieved if the options were implemented separately. This is because the success of certification in driving changes in behaviour is likely to be dependent on the combined set of actions as well as consumer demand.

Group B is also anticipated to have positive impacts on the level of international cooperation/globalisation of expertise, while it should also have a positive effect in relation to food security issues and the ability to meet local/national demand; although such impacts are likely to be dependent on the way in which any actions relating to stewardship and resource management are implemented.

Overall, Group B should result in improvements in the relative prices of environmentally friendly goods, with any negative effects from increased costs of certification balanced out by the market premiums generated by labelling. This is likely to be beneficial for overall water consumption, as studies have shown that businesses and consumers are more sensitive to prices than to campaigns to change consumption (Government Office for Science, 2011).

However, there are some impact categories where several of the options may work together to result in significant negative impacts. For example, combining the options on certification and labelling could significantly disadvantage smaller firms over larger ones. Promoting better corporate water management (1c), voluntary water stewardship certification (4a) and voluntary stewardship based labelling (5b), along with

dissemination of information on certification schemes could also negatively impact SMEs in terms of changes in investment costs. When considering food manufacturing businesses (i.e. those involved in processed food as opposed to directly supplying raw materials), large profitable companies are better placed than other businesses to engage in business continuity planning and facilitate communication with other parts of the supply-chain (Defra, 2010). However, there is some evidence (at least in the food and drinks sector) to suggest that the costs of changing labels are lower for small and micro enterprises than for medium and large companies (Campden BRI, 2010). The promotion of certification and labelling schemes could therefore put SMEs at a temporary disadvantage, since their response would likely be slower. This could lead to larger companies gaining a competitive advantage, since their labelled products and services would be available on the market prior to those from SMEs. This impact could be particularly significant if the labelling and certification schemes were simultaneously promoted to consumers.

The promotion of new water management practices, schemes and labels could lead to increased administrative burdens for businesses. Several of the eight options within the Group (1c, 1d, 2c, 4a, 4b and 5b) could have slightly or even very significant negative impacts for the level of administration required for auditing, monitoring, record keeping, and preparation of management plans. Even a supposedly simple activity such as changing a label (for example, to ensure it communicates the water stewardship practices of a company) can involve several administrative steps. Thus any change in practice or membership of a certification scheme is likely to bring significant administrative costs for businesses, particularly where they wish to communicate this change to their customers. These will be on-going costs, since any scheme will likely need regular record keeping in relation to water usage and/or testing of products.

Public authorities are also likely to face an increase in administrative burdens associated with information dissemination (option 4b) and promotion of national consumer education campaigns (4c) since it is likely that authorities would be closely involved with their implementation. Authorities may even be involved with the promotion of certification schemes, in particular if they are the organisations with overall responsibility at the national level²³. This could well be the case if an EU wide certification scheme were implemented. This is important given that one consideration when developing such schemes is the extent to which customers trust the organisations responsible (Government Office for Science, 2011). The value of certification is dependent on two factors - the credibility and reputation of the body which provides the service (USDA Economic Research Service, 2001). If national authorities are involved out of necessity, this could have significant negative implications for their administrative burden.

²³

As an example, the EU eco-label is developed at the European level, but is implemented in different Member States by so called competent bodies, which are often public authorities or government related. The list of competent bodies responsible for the EU eco-label in the different Member States can be found on the DG Environment Internet site:
(http://ec.europa.eu/environment/ecolabel/contacts/competent_bodies_en.htm).

Several of the options (3a, 4a, 4b, 4c and 5b) could also negatively affect the prices of products. As individual options, these changes might not be too significant, but combining the negative impacts could mean that there are considerable detrimental impacts for consumers. Buyers already contend with a multitude of eco-labels (e.g. Marine Stewardship Council certification for seafood, LEAF, Rainforest Alliance, Soil Association Organic Standard, Forestry Stewardship Council, Fairtrade, UK Fuel Economy label (based on EU energy label), Energy Saving Recommended label, etc.). Growth in the number of labelling schemes could affect levels of consumer trust (Government Office for Science, 2011). A further barrier to the use of labelling is that consumers may not believe the claims of industry, or trust advice from governments. This is particularly important given that the overall economic impact of a label is dependent on consumer acceptance (Johnston *et al*, 2001). Indeed, research indicates that for front of pack (FOP) nutrition labels, the presence of many different types of label causes difficulties for consumers trying to interpret them (Malam *et al*, 2009).

7.4 Group C: Supply-chain Incentivisation

7.4.1 Summary

Policy Group C is designed as a ‘supply-chain incentivisation’ based approach and comprises the following policy options:

- 1c: Promoting better corporate water management;
- 2a: Benchmarking best practice in water use;
- 4a: Promotion of voluntary water stewardship certification;
- 4c: Promotion of national consumer education campaigns;
- 5a: Establishment of an EC ‘Smart Mark’ for water saving technologies; and
- 5b: Encourage and monitor voluntary stewardship-based labelling.

While options 1c, 2a and 5a are focussed on driving sustainability through targeting corporate actors (producers), options 4a, 4c and 5b focus on driving sustainability through targeting consumers. As a result, this policy Group incentivises sustainable water use from both ends of the supply-chain.

As discussed under Group A (Section 7.2) options 1c, 2a and 5a are complementary approaches. Option 1c should increase corporate interest in water use efficiency and water stewardship while option 2a would provide corporates with more information on best practice methods for reducing water use. As a result, options 1c and 2a are mutually reinforcing. Any efficiency gains as a result of the implementation of policy options 1c and 2a should be further reinforced by the implementation of option 5a.

Also as discussed in relation to Group B (Section 7.3), options 4a and 5b are complementary approaches. Under option 4a the Commission would promote the adoption of voluntary stewardship certification and such certification may provide a foundation for stewardship-based labelling under option 5b.

The success of any labelling/certification scheme will depend to a large degree on the level of consumer awareness of environmental issues, with research suggesting that eco-

label schemes are largely ineffective in markets which are characterized by a low degree of environmental awareness (Jordan et al., n.d.). As discussed for Group A, consumer education (as under option 4c) can help to develop critical thinking and raise awareness of environmental issues and could be used to raise awareness of water stewardship schemes. Hence, the implementation of option 4c should reinforce the positive benefits associated with the implementation of options 4a and 5b.

Figure 7.3 illustrates the impacts associated with the individual policy options forming Group C (with more detailed data provided in Annex 2). As can be seen from the figure, the majority of impacts associated with this grouping are expected to be positive, with these believed to outweigh the drawbacks. The greatest negative effects would be associated with option 4a given the potential costs of certification to agricultural and other businesses.

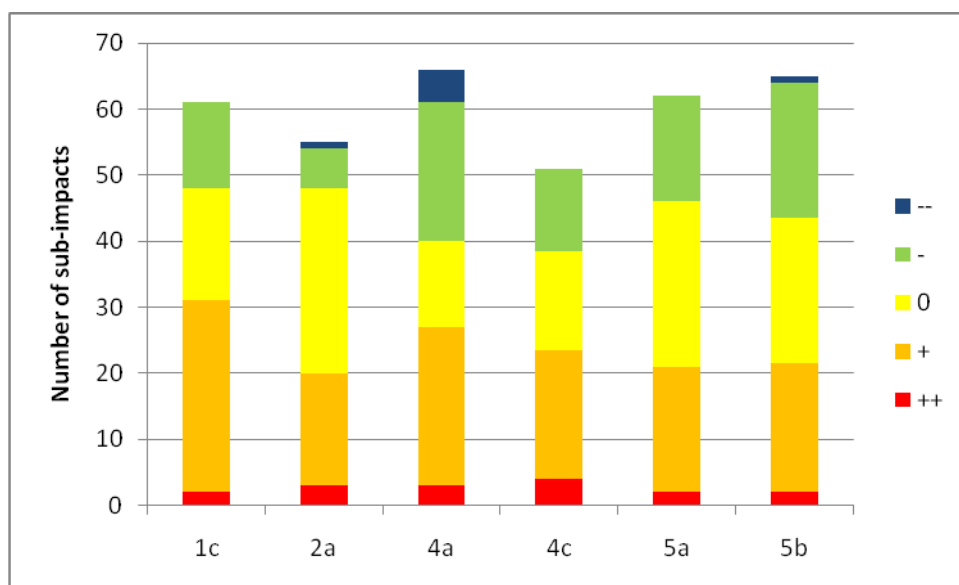


Figure 7.3: Number of Impacts by Option for Policy Group C

For illustrative purposes, impacts rated as +/- in figure have been divided equally between the + and - categories.

7.4.2 Key Impacts

There are several impact categories for which all the options are likely to result in only positive impacts. These include: innovation and research; the environmental consequences of firms and consumers; water quality and resources (including waste production); and the likelihood or scale of environmental risks.

Compared to Groups A and B, Group C may:

- have a greater positive impact on the environmental consequences of the actions of businesses and consumers, due to its greater focus on driving sustainability through increasing demand for sustainable products by promoting/encouraging voluntary

- water stewardship certification (option 4a), business-to-business labelling (option 5b) and raising consumer awareness (option 4c);
- have a greater positive impact with regard to the competitive advantage of businesses practicing water efficiency and stewardship (primarily due to the inclusion of policy options 2a, 5a and 5b). In the medium-term, option 2a could create a more level playing field between those who have already invested in technology or methods to reduce their water use and those who have not. Under options 5a and 5b, businesses applying the Smart Mark or stewardship-based labelling may gain a short-term competitive advantage if buyers preferentially purchase certified/labelled products;
- not be as effective in reducing business risks associated with water use as it does not include policy option 3a (and international promotion of better water management); and
- not be as effective at stimulating research and development (although this Group should still have significant positive effects in this regard).

As Group C focuses more on certification than Group A, there are likely to be greater costs to businesses associated with supply-chain pressures to obtain certification/labelling. As a result, cost burdens (operating and administrative) are likely to be higher for Group C than for Group A, due to the nature of the information obligations that would be placed on businesses (including measuring, recording and reporting information on water use, producing management plans, etc.). However, Group C should imply lower costs than Group B in this regard.

Group C also performs better than Group A with respect to ‘investment flows’ due to the inclusion of policy options 4a and 5b, which could lead to businesses who choose to obtain certification and labelling attracting greater levels of investment (due to the increased credibility of their products and production methods compared to uncertified products).

This Group of options would have some cost implications for public authorities associated with providing funding, direction and development under the different options; on the whole though, these costs would only be short-term. In this respect the discussion on Group A is also relevant.

7.5 Group D: Methodology Development - Clarity, Role and Transparency

7.5.1 Summary

Policy Group D has been designed to act as a *de minimis* option, involving a focus on methodological developments, aimed at fostering greater clarity on the use of water footprint assessments, setting out their potential role in different types of applications and increasing transparency on what the outputs mean. It is a research-based option.

It comprises the following policy options:

- 1a: Defining best practice in varying applications of the WF;
- 1b: Funding research on impact assessment in WF; and

- 5c: Research on potential schemes for multi-dimensional environmental labelling.

The implementation of option 1b is effectively a prerequisite for the implementation of option 5c, as it is important that any environmental labelling is based on the impacts of water use (as opposed to the quantities of water consumed). We also believe that 1b is in part dependent on 1a, if the aim is to ensure that there is greater consistency and transparency in the use of water footprint assessments across the range of potential future applications.

Figure 7.4 outlines the impacts associated with the individual policy options under Group D. Most impacts are expected to be positive, with this particularly the case for implementation of option 1b (although given the strong synergies between this and option 1a, there is the potential for some double-counting). The impacts of option 5c are less certain as the outcome of such research cannot be predicted (with the impacts illustrated in Figure 7.4 reflecting the costs of commissioning research on labelling). Note however that a smaller number of impact sub-categories are relevant to this Group than for the other groups (38 compared to 68).

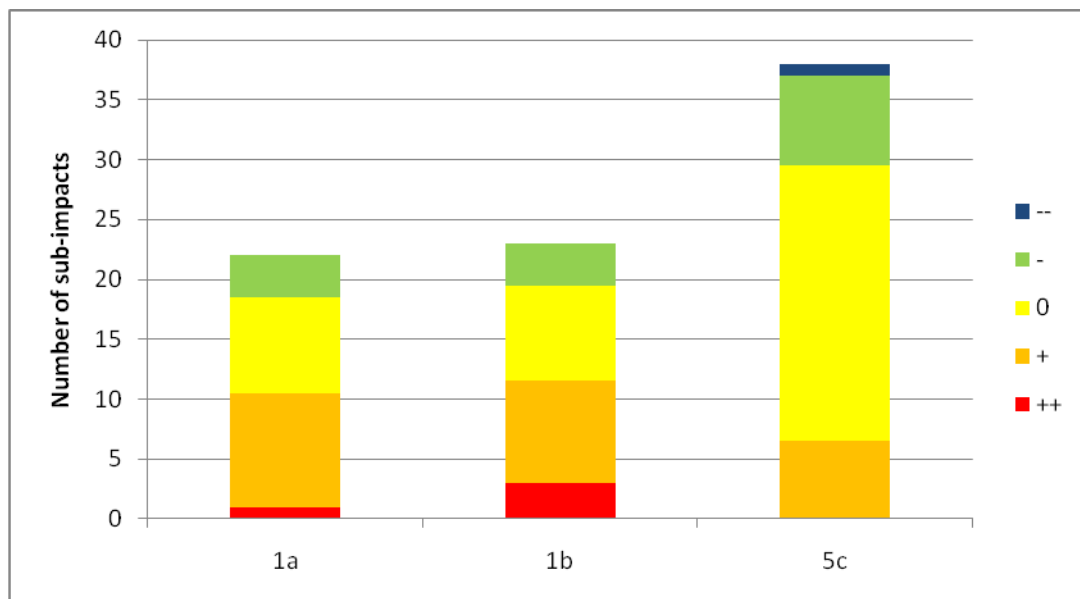


Figure 7.4: Number of Impacts by Policy Option for Group D. For illustrative purposes, impacts rated as +/- in Figure ... (above) have been divided equally between the + and - categories.

The key benefit of Group D is that it provides a foundation for subsequent actions. As a result, many of the impacts that are likely to arise from its implementation are indirect effects. They will depend on the degree to which knowledge exchange and capacity building take place and whether industry and government act upon the outcomes of the options.

This combination of options should increase the level of understanding and knowledge on water use (as an indirect impact), with there being differences in the types of information that options 1a and 1b would provide. While option 1a would provide for more consistent and transparent methods for water accounting (which may be beneficial for companies wishing to obtain an insight into the largest components and locations of water consumption in the supply-chain), option 1b would provide the additional benefit

of increasing the potential for understanding the impacts of water use. This would not only be of value to companies wishing to identify water scarcity risks but may also be valuable for Member State authorities from a water resources planning perspective). In this respect, Group D may also provide a strong foundation for future research and development.

As Group D generally addresses methodological issues and research gaps, it is unlikely to deliver the same efficiency gains as Groups A, B, C and E. Although there should be a positive impact on the level of sustainable production and consumption of water, this assumes that businesses and others make use of the research carried out under this option to increase the sustainability of their activities (in other words, this is an indirect effect). Given the existence of different water footprinting methodologies, it is not yet possible for consumers (whether business or end-consumer) to accurately compare products on the basis of their water footprint. The implementation of options 1a and 1b should help to reduce the risk of public confusion if information on water footprinting is reported.

Options 1a and 1b should have a positive impact with regard to the competitiveness of business as they should help level the playing field between the relatively small number of companies that have already undertaken water footprint assessments and the relatively large number of companies that have not. According to the WBCSD, around 300 companies have used the Global Water Tool since its launch in 2007 and so we can assume that a similar number have undertaken water footprint assessments.

As noted in Section 5, the Commission's inventory of agricultural labels comprises 441 agriculture-related labelling schemes within the EU, 54 of which relate to the sustainable use of resources. Research into the potential for multi-dimensional labelling schemes may enhance, or reduce, the credibility of some of these schemes. While research into multi-dimensional environmental labelling may involve discussions and co-operation with third countries (particularly given the international nature of the food supply-chain), it is possible that this option may clash with similar schemes in other countries.

7.6 Group E: Research and Development, Education, Supply-chains and Partnership

7.6.1 Summary

Policy Group E brings together most of the identified policy options to form a comprehensive package of 'Research and Development, Education, Supply Chains and Partnership'. It comprises:

- 1a: Defining best practice in varying applications of the WF;
- 1b: Funding research on impact assessment in WF;
- 1c: Promoting better corporate water management;
- 1d: Promotion of water use assessments through footprinting and other tools;
- 2b: Footprinting as part of integrated water resources planning;
- 2c: Economic productivity assessments;

- 3a: International partnership and support in the area of sustainable development;
- 4a: Promotion of voluntary water stewardship certification;
- 4b: Information dissemination on certification schemes;
- 4c: Promotion of national consumer education campaigns;
- 5b: Encourage and monitor voluntary stewardship-based labelling; and
- 5c: Research on potential schemes for multi-dimensional environmental labelling.

This Group, therefore, incorporates options targeted at both ends of the supply-chain (businesses and consumers) as well as Member States.

Group E is quite ‘heavy’ in terms of number and scope of its policy options, with only options 2a and 5a excluded. The intention of excluding these options from the Group is to reduce the burden on the Commission associated with its implementation. As noted above, although policy options 2a and 5a should deliver benefits in terms of improving the sustainability of water use (particularly when implemented together), they could both require significant actions by the Commission in their establishment and on-going operation. Significant positive effects with regard to the sustainability of water use should still be achieved through implementation of the other options within this Group.

Figure 7.5 provides a summary of the impact ratings for the individual policy options under policy option Group E. For a full description of impacts under this policy option Group refer to Annex 2.

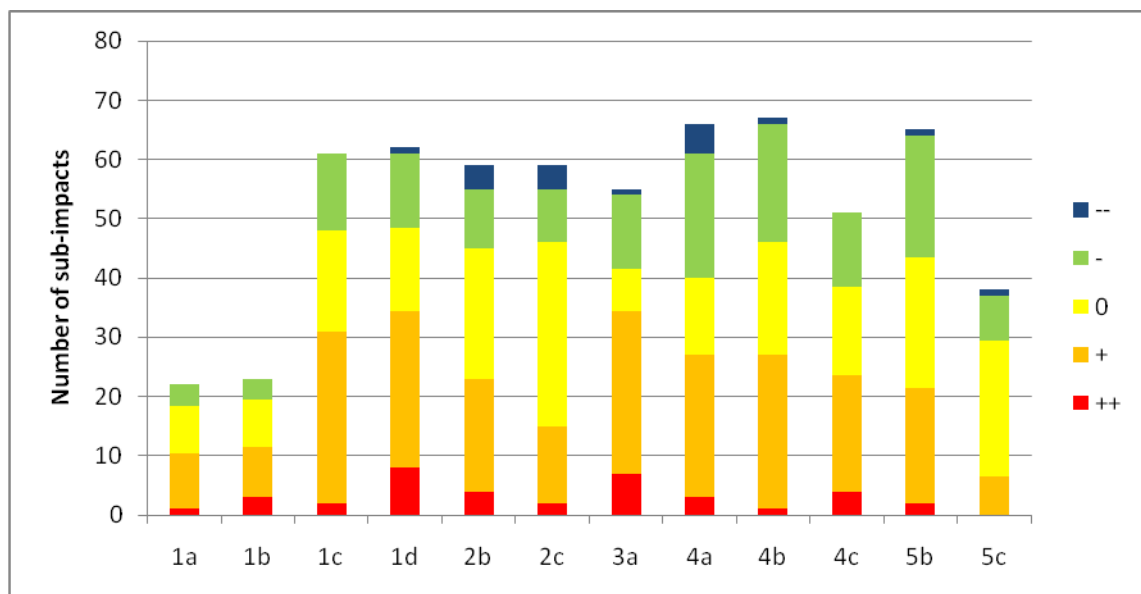


Figure 7.5: Number of impacts by policy option for Group E. For illustrative purposes, impacts rated as +/- in Figure ... (above) have been divided equally between the + and – categories.

7.6.2 Key Impacts

Complementarities between the individual policy options in Group E are discussed in detail below, but in summary these are between:

- the research-based options (1a, 1b and 5c), as discussed for Group D;

- the corporate water management (1c and 1d) and water-stewardship approaches (options 4a and 5b), as discussed for Group B;
- the consumer awareness raising options (4b and 4c), as discussed for Group A;
- the resource planning applications (options 2b and 2c);
- the research-based options (1a and 1b) and the resource planning applications (2b and 2c);
- options 4a, 4b and 4c (as discussed for Group B); and
- option 3a with most of the other options and in particular those focused on corporate water management and resource planning.

As discussed above, under option 1d, the Commission would encourage or promote the use of the various existing tools (e.g. the Global Water Tool, water footprint assessment, etc. as discussed in Sections 3 and 4) for undertaking formal assessments of business risks, water use and the impacts of water use. There would, therefore, be merit in reaching agreement on best practice in the varying applications of the water footprint (option 1a) and in undertaking research on impact assessment in water footprinting (option 1b) to ensure the reliability of these tools before they are encouraged or promoted for use in corporate water management (option 1d). Combining policy options 1a, 1b and 1d, should significantly improve businesses access to information on best practice methods for assessing water consumption and should have significant benefits with regard to:

- the level of understanding and knowledge on water use;
- business risks/opportunities associated with water consumption and use (for both larger and smaller enterprises) and within the EU and third countries;
- the level of sustainable production and consumption of water; and
- the likelihood/scale of environmental risks associated with water stress/drought.

Note that the benefits associated with implementing options 1a, 1b and 1d together would be greater than the sum of the benefits associated with implementing these options individually (i.e. implementing these options together would lead to added value).

The implementation of policy options 2b and 2c could create benefits with regard to the level of understanding and knowledge on water use. Information obtained through undertaking water footprint assessments and economic productivity assessments may help identify activities that would be most unsuitable for catchments or river basins under stress and could be used to target efforts in relation to changing existing practices and to inform future development plans. However, against a baseline of increased planning under the WFD, it is likely that the value of such assessments would be limited to particular locations and within the EU.

In these cases, the implementation of options 2b and 2c should have significant benefits with regard to:

- levels of resource efficiency;
- levels of sustainable production and consumption of water;
- the likelihood/scale of environmental risks associated with water stress/drought; and
- the provision of information on the economic sustainability of water consumption.

The implementation of policy options 2b and 2c may also have indirect benefits with regard to: impacts on freshwater quantity; food security issues; the attractiveness of low and high water productivity sectors for investment; and spurring research and development for example into new technologies/water friendly products. Note that option 2b should only be implemented in conjunction with option 1a (or option 1a and 1b) as footprinting should not be used for integrated water resources planning before ‘best practice’ in this application has been defined.

Other potential benefits include:

- International relations and third countries: In particular, policy option 3a should have significant benefits in this regard (as discussed in Section 7.2);
- The environmental consequences of firms and consumers: Group E should have significant benefits in terms of the level of sustainable production and consumption of water, as well as benefits in terms of overall impact on the environment. If policy option 4a were implemented in isolation, there is a risk that this could lead to an increase in the price of environmentally friendly goods; by combining policy options 4a with policy options 5b, 4b and 4c, this risk would be reduced by an expected increase in demand for products from businesses that could demonstrate a higher level of water stewardship;
- Impacts on water quality and resources: Such benefits could arise at a local level through policy options 2b and 2c, although we believe that option 4a (when combined with 1c and 1d) is likely to have the greatest effect in terms of freshwater quantity as water stewardship and supply-chain initiatives should drive agricultural and other producers towards more efficient practices (although the scale of impact would depend on nature of the certification scheme and on the degree to which markets respond); and
- Likelihood/scale of environmental risks: Similarly, there should be significant benefits with regard to a reduction in the likelihood/scale of environmental risks stemming from water stress/drought from implementation of Group E. Options 1d and 2b would have the greatest benefits in this respect.

The above benefits would need to be weighed against the negative effects of the combined group of options. In particular, policy options 2b and 2c may have very significant costs associated with their implementation. Consultation has indicated that preparing a water footprint assessment for a single catchment could cost in the region of €100,000, with an economic productivity assessment costing significantly more. It has been indicated that one of the greatest issues to overcome would be to map agricultural yields to individual catchment boundaries, as yields are currently only collected and collated by county and region level rather than by catchment (Pers. Comm.). In our view, these costs are greater than the benefits which might be gained from option 2b alone for most EU countries given that water resource planners will have a range of other data to call upon; this is certainly the case if impact assessment is not addressed.

If no robust or standardised water footprint methodology were developed through options 1a and 1b, the implementation of options 2b and 2c could lead to a significant risk that specific sectors and regions are targeted for action based on uncertain/inaccurate results.

It is possible that the Group E combination of options could result in some shifts in the relative competitiveness of small versus larger firms. Larger firms may be better able to take up stewardship-based certification and labelling (options 4a and 5b) so smaller firms may be at a competitive disadvantage, particularly if demand for certified/labelled products increases (as under options 4b and 4c). Firms investing in certification/labelling schemes may want to invest in additional marketing to advertise their newly certified/labelled products (with associated costs/benefits) but smaller firms may not be in a position to invest in additional marketing. The direction of impacts under policy will depend on whether best practice reduces resource requirements by making application of the various tools more accessible to smaller firms.

7.7 Assessment Summary

Figure 7.6 provides an overview of the direction and magnitude of relevant sub-impacts for each of the Groups, taking into account complementarities and conflicts between the individual options within each Group. Where several policy options within a Group have been assigned a +/- score or where some options within the Group deliver +/++ while other options deliver -/--, the weight of evidence has been reviewed for the Group as a whole and a subjective but expert judgement, supported by evidence where possible, has been used to determine whether the Group would provide positive or negative effects overall. Supporting data are provided in Annex 2 to this report.

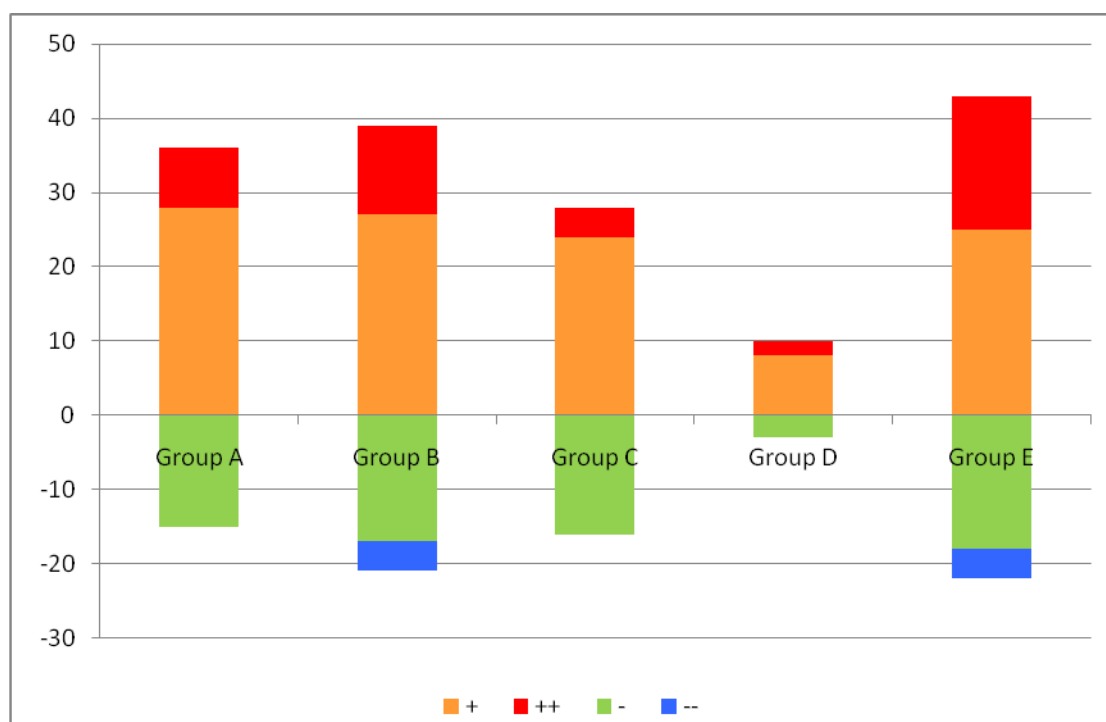


Figure 7.6: Number of impacts by policy option Group. For illustrative purposes the number of ++ and -- have been multiplied by two to take account of the fact they are more significant

While Groups B and E deliver the most benefits, it is clear to see from Figure 7.6 that there is the potential for significant negative effects associated with both of these Groups. On the other hand, Group C, and particularly Group A deliver significant benefits without the potential for significant negative effects. It is worth noting that the main impact categories under which Group A performs better than Group C are ‘innovation and research’ and ‘international relations and third countries’. This is largely due to the inclusion of policy option 3a (international partnership and support in the area of sustainable development) under Group A. The addition of option 3a to Group C could, therefore, help to deliver additional benefits.

In order to summarise the above assessment, we have drawn out the key conclusions of the impact assessment against four criteria: environmental outcomes; cost and other impacts on businesses and authorities; ease of implementation; and risks.

The potential impacts of each Group have been assessed using a simple rating system aimed at reflecting the *relative* performance of each Group under each assessment criterion. The rating system used is from 0 to 5, with the highest score awarded to the Group which would perform best. Again, these ratings are based on the project team’s subjective judgement, taking into account the projected baseline and arguments made above as to the potential nature and significance of the effects associated with each policy option and hence Group of options. Note that it is important to recognise that better performance in one category does not necessarily compensate for worse performance in another. For example, although Group C performs slightly better in terms of environmental outcome and ease of implementation, Group C is also much more risky and would have greater impacts on businesses and authorities. We consider that the additional benefits in terms of environmental outcome and ease of implementation that would be derived from implementing Group C (rather than Group A) would not compensate for the additional risks and impacts on businesses and authorities that would be derived from implementing Group C rather than Group A.

7.7.1 Environmental Outcome

Figure 7.7 sets out an overall relative rating for the expected environmental outcomes of the different policy option Groups. These ratings reflect the degree to which the different Groups are likely to deliver benefits in terms of improving the sustainability of water use, increasing the efficiency of water use, and mitigating the impacts of water consumption. As can be seen from Figure 7.7, Groups C and E are expected to perform the best in this regard, followed by Groups A and B. These ratings are driven in part by the emphasis placed on better corporate water management and water stewardship certification within the business-to-business supply-chain on the one hand, and the use of benchmarking across cohorts of businesses and the creation of an EC Smart Mark on the other hand. The international dimension (option 3a) is also important given the importance of managing global water risks and impacts.

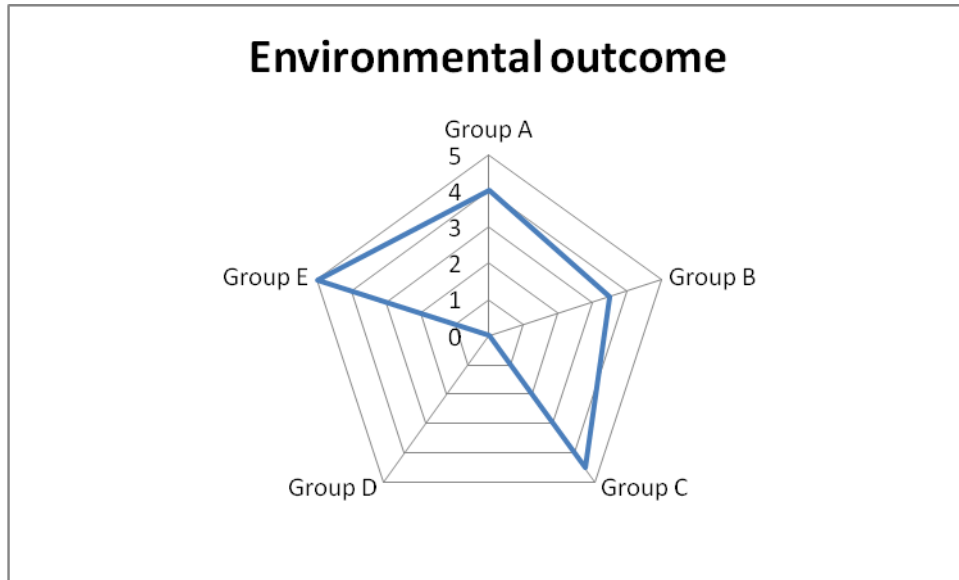


Figure 7.7: Comparative rating of options on environmental outcomes
(the higher the rating the higher the environmental benefits)

7.7.2 Impacts on Businesses and Authorities

The conclusions regarding the impacts of the different option on businesses and authorities are more complex, taking into account impacts on operating cost, administrative burdens, competitiveness of SMEs versus larger companies and potential increases in the ability to attract investment. The overall comparative ratings are set out in Figure 7.8.

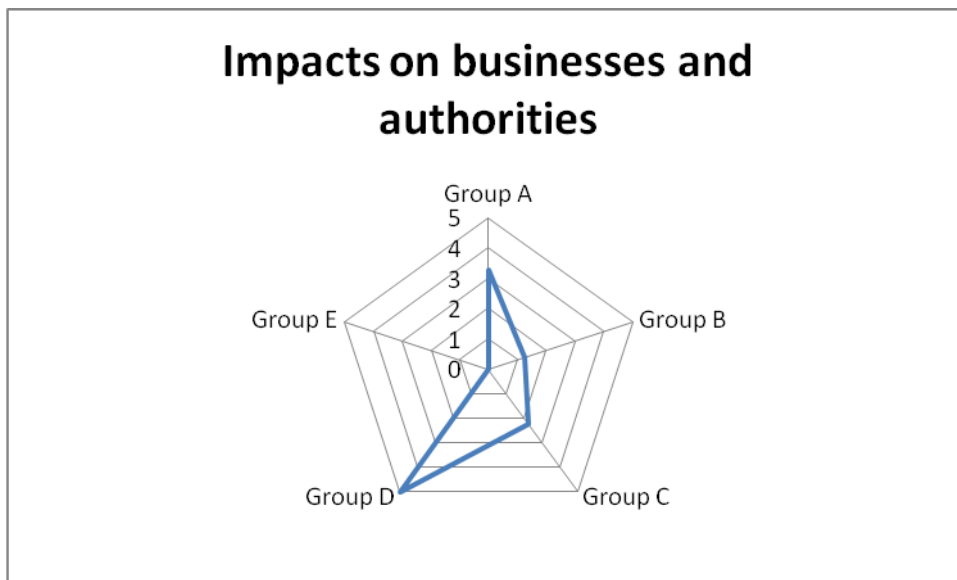


Figure 7.8: Comparative rating of impacts on businesses and authorities
(the higher the rating the lower the negative impacts)

These ratings reflect the fact that promotion of supply-chain initiatives to improve water management and water stewardship certification could result in significant operating costs and administrative burdens for some supply-chains, particularly agricultural producers and the associated food and drink supply-chains. As a result, Groups A and D fare relatively better than the other Groups as they are expected to give rise to significantly lower cost impacts; in addition, Group A has the potential for improving the relative competitive position of small companies involved in the production of water saving technologies and may help them identify water saving methods and techniques.

Offsetting the potential costs to businesses of the combined sets of actions in Groups E and B, are the potential investor-related benefits that may stem from companies having addressed water risks and being able to do this through supply-chain based labelling. However, these larger sets of actions may also give rise to competitiveness issues should small companies be left behind; although the inclusion of promotion and dissemination activities should mitigate this and help ensure a level playing field. International partnership and support is also key in this regard with respect to global suppliers of agricultural and food products, as well as other goods and services, to the EU.

Costs to authorities (including the European Commission and Member States) will arise from promotion and dissemination activities, as well as overseeing and contributing to benchmarking, establishment of an EC Smart Mark and consumer awareness and education campaigns.

7.7.3 Ease of Implementation

Given that each of the policy Groups involves a series of different actions, it is important to consider whether there are any institutional, capacity or other barriers to their implementation. In essence, the aim has been to consider the ease with which the European Commission could implement each policy Group.

Clearly, as illustrated in Figure 7.9, the combined set of options forming Group D would be the easiest to implement as they essentially involve support to existing initiatives (i.e. development and agreement of the ISO Standard on water footprint assessment) and funding of research on impact assessment in water footprinting and multi-dimensional environmental labelling aimed at consumers.

There should also be few barriers to implementation of Groups A, C and D. In the case of Group C, the greatest difficulties may come from any requirements for economic productivity assessments to be carried out in EU river basins that are essentially water scarcity/drought 'hot spots'; the remainder of the activities are promotion and dissemination based. For Group A, there may be both capacity and institutional constraints affecting up-take of the options involving the benchmarking of best practice and establishing an EC Smart Mark. Such issues should not arise in relation to consumer awareness and education campaigns, assuming these can be designed to complement the other consumer initiatives undertaken by DG SANCO. Similarly, there are already international initiatives in the field of water and sustainable development which can provide the focus for the types of awareness raising and assessment activities associated with option 3a on international partnership.

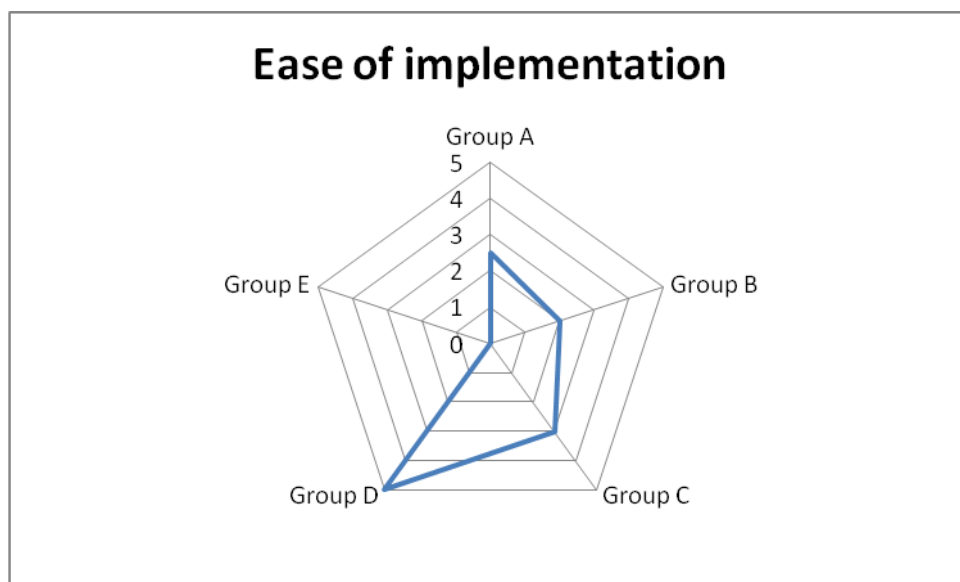


Figure 7.9: Comparative rating of ease of implementation
(higher the rating the greater the ease of implementation)

The sheer number of options comprising Group E would make its implementation more complex. However, some of the institutional and capacity requirements that arise under Groups A and C are reduced here, due to the fact that Group E does not involve either benchmarking or the creation of a Smart Mark.

7.7.4 Risks

This latter criterion has been included to act as a final ‘catch all’ to provide an indication of the potential risks of either not taking the actions set out in the policy Groups or indeed by implementing the different Groups. The comparative ratings assigned to the different policy Groups are set out in Figure 7.10.

Group D is considered to pose the lowest risks, in part because it does not require a large number of actions to be implemented. However, it also addresses two of the biggest concerns associated with the current level of activity surrounding the development and application of water footprint assessment. In particular, it is aimed at reducing the risk that such assessments continue to be carried out in an inconsistent manner and that practice becomes fragmented across different users and types of applications. Importantly, it also addresses one of the key failings of the current methods, which is the incorporation of a strong, robust and repeatable impact assessment methodology.

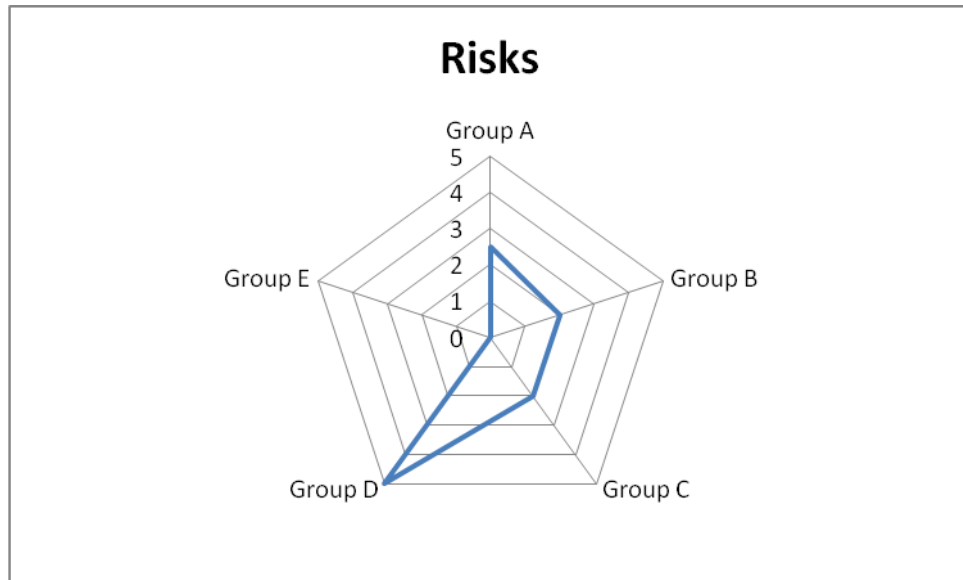


Figure 7.10: Comparative rating of risks under each Group
(higher the rating the higher the risks)

In comparison, Groups B, C and E are assessed as being more risky due mainly to the increased emphasis on corporate water management, water stewardship certification and associated business-to-business labelling. The concern here is that this may place significant burdens on farm and other businesses and, unless properly targeted and designed, may not deliver the required environmental benefits in terms of improved water management. As Group A puts less emphasis on certification and labelling, it is viewed as slightly lower risk in this regard while it is still expected to deliver some benefits through the promotion of benchmarking and a Smart Mark, as well as a focus on promoting better corporate water management through the supply-chain.

8. SUMMARY AND CONCLUSIONS

8.1 Approach to the Study

Water scarcity is not only an issue for the EU but is a concern more globally. This stems not only from the potential impacts of scarcity on the environment, but also the wider risks to businesses and national economies in terms of food security and the sustainability of their production activities.

The work to be carried out for this study was divided into two related Tasks, with the following specific objectives:

Task 1 – Virtual water and water footprinting approaches:

- A. review the current applications of water footprinting and virtual water approaches;
- B. identify best practice examples of practical applications of water footprinting in policy making from around the world;
- C. develop proposals on if and how the water management related information presented by these approaches could be applied in policy making; and

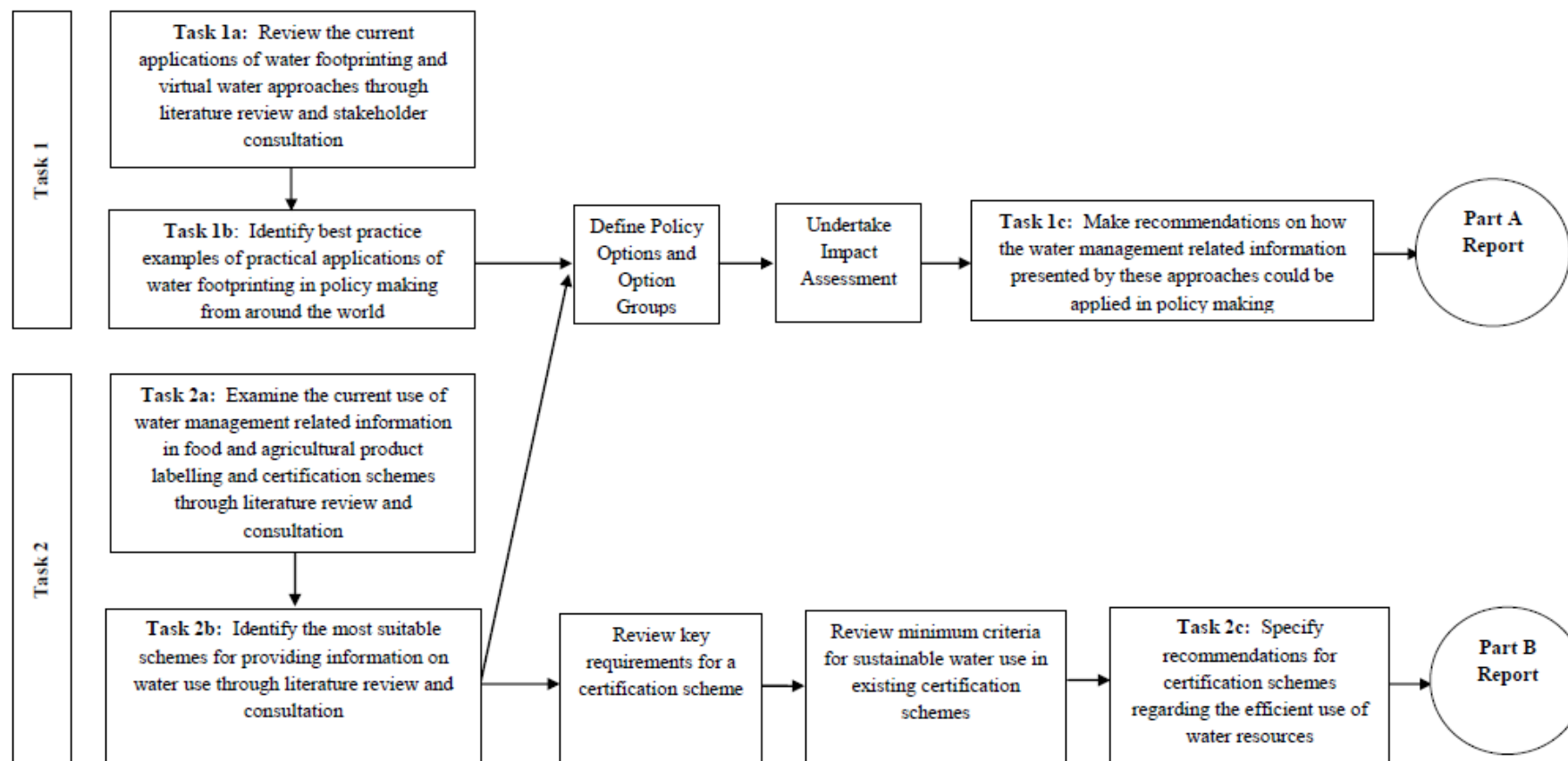
Task 2 – Water management related information in agricultural product and foodstuff labelling:

- A. examine the current use of water management related information in food and agricultural product labelling and certification schemes;
- B. identify the most suitable schemes for providing information on water use; and
- C. specify recommendations for certification schemes regarding the efficient use of water resources.

Figure 8.1, overleaf, illustrates the linkages between the two Tasks and how information fed from Task 2 into the Task 1 assessment. As can be seen from the Figure, the outputs of the two tasks are summarised in two separate reports, with this report (Part A) primarily focused on actions carried out under Task 1 and the second report (Part B) focused on actions carried out under Task 2. However, Tasks 2A and 2B also fed into the policy options discussed in this report.

Our approach to Tasks 1A and 1B was based on a combination of literature review and consultation, with the latter task involving Member State authorities, international organisations, stakeholders involved in the development of footprinting methodologies, as well as corporate entities experienced in their application. We also held a targeted stakeholder workshop aimed at testing the study conclusions at an interim phase and validating the relevance of the proposed policy options. Following this workshop, further targeted consultation was undertaken with key stakeholder organisations and individuals, to gather additional information on specific schemes and on the potential role that the different tools reviewed by the study could play in EU policy. Additional data collection and literature review work was also carried out to help provide a more quantitative basis for the impact assessment of the policy options.

Figure 8.1: Relationship Between Tasks and Associated Reporting



8.2 Conclusions on the Role of Water Footprinting and Other Tools

Although water footprinting has been a useful tool for raising awareness over the need to reduce unsustainable water consumption and for assessing the extent to which countries export or import water as part of international trade, it also appears to have a role in corporate supply-chain management. However, a wide range of additional tools have been, and are continuing to be, developed with the aim of enabling companies to undertake risk assessments related to their water use, to identify ‘hot spots’ within their supply-chains, and/or to aid in the disclosure of water related information as part of business and investment risk management. With regard to corporate supply-chain management, it could be argued that best practice could involve:

- the use of the other types of tools that have been developed with the aim of identifying water-related business risks and opportunities;
- WF as an auditing tool to provide an insight into the largest components and locations of water consumption in the supply-chain;
- WF as a tool for water stewardship to identify which products are sourced from areas at risk of water stress.

The research undertaken for this study, however, has identified several key concerns with regard to the use of water footprinting. These lie mainly with the inconsistent use and application of the methodologies and the failure of the methodologies to provide a reliable indicator of the environmental impacts of water consumption. Care should be taken, therefore, in promoting or encouraging the use of water footprinting more generally and especially as a tool to support agricultural products and food labelling. Given these findings, certification of water stewardship activities or water efficiency would appear to be more appropriate (for detailed conclusions regarding the work undertaken under Task 2, the reader is referred to the Part B Report). Given the on-going development of the methods and the continually evolving nature of their use, we have been unable to reach conclusive recommendations on those applications that reflect best practice models for promotion as part of future policy.

8.3 Assessment of Potential Policy Options

Possible policy options, relating to the provision of information on water use for adoption at the EU level have been identified and a detailed assessment of the environmental, social and economic impacts of viable policy options has been carried out based on a multi-criteria analysis approach. Policy options have been assessed against the impact categories set out in the European Commission’s Impact Assessment Guidelines (EC, 2009) and a subjective but expert judgement (supported by evidence from the literature, by personal interviews with and an electronic survey of representatives of organisations with interests in water footprinting’) has been made regarding the likely

outcomes of their implementation. Given the potential for synergies between many of the policy options and the potential for gaining added value through joint implementation, five policy option Groups have been designed to achieve a more comprehensive approach. An overall assessment has been carried out for each of these Groups as a whole.

Based on the findings of the impact assessment, it is clear that policy option Groups A and C would both deliver significant benefits without the potential for significant negative effects, with Group A likely to perform slightly better in this regard (this is largely due to the inclusion of policy option 3a within Group A). Although Group C would probably provide a slightly better environmental outcome than Group A, Group C is viewed as posing slightly higher risks, with greater potential for negative impacts on businesses and authorities due to a greater emphasis on certification and labelling.

It is clear that there are policies which the Commission could pursue based on promotion, partnership and education which may deliver significant benefits for the environment but also for businesses and hence national economies in terms of reducing water related risks. In this regard, if the Commission were to take further action with respect to the 2012 review of water scarcity and drought policy, and the development of a Blueprint for EU water, we recommend that consideration should preferentially be given to the policy options combined to form Group A. This would entail the actions outlined in Table 8.1.

Policy Option		Actions
1c	Promoting better corporate water management	Promote better water management (at food product manufacturer and food retailer level) through use of risk assessment and risk management techniques but also promoting water efficiency and water stewardship activities.
2a	Benchmarking best practice in water use	Establish a database of information on best practice methods (both technologies and techniques) for reducing water use and consumption as part of different production and processing activities, with a focus on industrial / manufacturing processes and including food processing and production.
3a	International partnership and support in the area of sustainable development	Use the outputs of virtual water and other studies to open up dialogues with national governments, international funding organisations and others on the tensions between current agricultural export activities and water scarcity issues. Encourage key countries to undertake the type of economic analysis of water supply and demand options into the future set out in Charing Our Water Future. Actions could extend to institutional support and capacity building in relation to water resource management or education with respect to water saving techniques.
4b	Information dissemination on certification schemes	Actively disseminate information on existing certification schemes.

4c	Promotion of national consumer education campaigns	Support DG SANCO in developing materials that could be used across all Member States with the aim of better educating consumers on the environmental impacts (including those on water resources, the climate, wildlife etc) of wasting food. While water footprint information could be used as an awareness raising tool, care would need to be taken to ensure that consumers are not led to believe that certain products are 'better' for the environment than others based on inaccurate information.
5a	Establishment of an EC 'Smart Mark' for water saving technologies	Establish a voluntary EC-based scheme for labelling water efficient equipment to encourage the take up of more efficient water using technologies, with a focus on goods and possibly services not covered by existing schemes (e.g. agricultural equipment).

8.4 Indicators for Monitoring Success

Because the proposed set of policy actions is based on promotion, partnership and education, there are few direct outputs which can be used to monitor and evaluate their success. As a starting point, we have identified the following possible indicators for measuring the effectiveness of the different actions.

1c: Promoting Better Corporate Water Management

We have identified the following as possible indicators of the success of such promotion activities:

- review of industry association initiatives in response to Commission promotion activities and feedback on the success of these, including for example the level of take-up in using existing tools (e.g. the Global Water Tool, Water Footprint Assessments, etc.);
- evaluation of the extent to which water consumption and impact data gains wider reporting and assessment in corporate sustainability reporting;
- evaluation of trends in environmental protection expenditure, with a focus on water efficiency targeted expenditure.

With respect to the latter, statistics are gathered every two years at the EU level on environmental protection expenditure by the public sector, private and public specialised producers and industry. At the present time, data are collected on activities directly aimed at the prevention, reduction and elimination of pollution resulting from the production or consumption of goods and services. However, data on expenditure for improving the sustainability of water use could be gathered through this survey, at relatively little additional cost, and would provide a means to test the ongoing efficiency of implementing option 1c.

2a: Benchmarking

As this option involves the creation of a database of information on best practice methods for reducing water consumption as part of manufacturing activities, several direct indicators of success can be established:

- successful development of the database, with contributions provided by a range of Member State Authorities and possibly industry associations as to those methods considered to reflect best practice;
- ‘hit rates’ or visits to the website holding the database on an annual basis;
- extent to which new methods are added to the database and others are removed as technology progresses;
- evaluation of the level of innovation in the technologies providing the basis for best practice over, say, a 5 to 10 year period;
- evidence of the establishment, continuing use and updating of benchmarks against which products are compared.

3a: International Partnership and Support

It is more difficult to identify possible indicators for policy option 3a. In this case, success may best be reflected by the degree to which third countries modify their activities so as to improve their efficiency of water use and to take better account of the degree to which water consuming activities are impacting on the environment. This could include determining the extent to which analyses are carried out with the aim of quantifying the economic value of water in its different uses and those aimed at environmental protection and improvement. It could also include evaluation of the number of joint actions undertaken which are focused on better understanding the impacts of water consuming activities on the environment and people. It could also include evaluation of the degree to which the capacity of target countries to address water resource management issues has improved over a fixed timescale.

4b: Information Dissemination on Certification Schemes

Under this option the Commission would engage in the active dissemination of information on existing certification schemes, and would provide information on what it believed constituted best practice in water stewardship certification. Thus, the key indicators of success for such dissemination activities are:

- the degree to which they result in an increase in take-up and reporting of certification across target sectors of activity (farming, food and drink, and other high water using sectors such as paper and pulp, etc.), i.e. being certified becomes the norm rather than the exception;
- the degree to which certification requirements evolve over time by increasing the minimum levels needed to obtain certification; and
- the extent to which certification results in shifts in behaviour in key water using sectors, which may require surveys or other targeted data collection to ascertain.

4c: Promotion of National Consumer Education Campaigns

As proposed, these campaigns would be aimed at educating consumers about the environmental impacts of wasting food (and possibly other wastes) with the aim of encouraging more sustainable consumption activities. Highlighting the volumes of water that go into food production is obviously an important element of any such education campaign, but it is likely that an indicator of success would need to focus on assessing changes in consumer water use and waste patterns more generally, with this then working back to identify savings in virtual water content. There are studies which have done this type of assessment and which could act as a model for such assessments (e.g. the WRAP 2009 study on Household Food and Drink Waste in the UK).

5a: Establishment of an EC Smart Mark

Direct indicators of effectiveness (and indeed cost-effectiveness) could be established to monitor the performance of the proposed voluntary EC-based scheme for labelling water efficient equipment to encourage the take up of more efficient water using technologies. These could include:

- number of sectors developing Smart Mark labelling criteria;
- number of applications for the Smart Mark over a pre-defined time period;
- data on changes in market share of Smart Mark labelled equipment;
- data on changes in water consumption across adopters of Smart Mark labelled equipment through a self-reporting initiative.

Clearly there is scope for some of the above indicators to be developed in tandem so that information collection activities could be shared or so that a single indicator can be used to monitor performance across more than one policy action. For example, this may be the case with regard to increased use of the environmental expenditure survey carried out across the EU, which could include questions not only on investment in water saving technologies, but also what these are (to check against best practice or whether they hold a Smart Mark) and whether companies are also obtaining water stewardship certification.

The regimes for monitoring the implementation and evaluating the impact of water footprinting policies will also need to assess the effects of any changes in broad contextual factors, such as the relative importance given by Governments to the use of regulatory versus market oriented instruments, or the relative importance given to domestic versus international interests. Changes in these external factors, many of which were identified for the baseline case, may serve to promote or restrain the impact of policy options. Thus, the performance of policy options must be subject to periodic review that considers whether they remain fit for purpose and context.

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ANNEX 1

Examples of Water Footprint Studies

A1.1 OVERVIEW OF COMMODITY AND CORPORATE WATER FOOTPRINT APPLICATIONS

This Annex provides supporting material to Section 3 of the Main Report. It gives an overview of commodity and corporate applications of the water footprint.

A1.2 COMMODITY LEVEL APPLICATIONS

Table A1.1a gives examples of commodity level water footprint and virtual water studies. As can be seen from Table A1.1, water footprinting has found a wide range of applications at the commodity level, with water footprinting undertaken for biofuels, cut flowers, paper and rice among others.

Table A1.1: Examples of Commodity Level WF and VW Studies	
Gerbens-Leenes <i>et al.</i> (2008)	Biofuels (Bio-energy production and other primary energy carriers).
Gerbens-Leenes <i>et al.</i> (2010)	Biofuels in transport (comparing different forms of biofuels and estimating the WF if 10% of European transport fuels were replaced by bio-ethanol).
Chapagain <i>et al.</i> (2005)	Cotton (worldwide consumption)
Chapagain <i>et al.</i> (2010)	Rice (global assessment of the green, blue and grey water footprint of rice)
Van Oel & Hoekstra (2010)	Paper (production and consumption)
Aldaya & Hoekstra (2010)	Margarita pizza and pasta (produced in Italy which is a huge producer and consumer of both products)
Chapagain & Hoekstra (2007)	Tea and coffee (Dutch consumption per annum)
Ridoutt & Poulton (2009)	Wheat, barley and oats (production of wheat, barley and oats in New South Wales)
Galloway <i>et al.</i> (2009)	Pork and poultry (a VW, as opposed to a WF, assessment and an assessment of land and nitrogen use for international pork and poultry production)
Mekonnen & Hoekstra (2010a)	Global wheat (global wheat production (and wheat products) and international virtual water trade)
Mekonnen & Hoekstra (2010b)	Cut flowers (WF for cut flowers produced in the Lake Naivasha Basin, Kenya)
Chapagain & Orr (2009)	Spanish-grown tomatoes
Humbert <i>et al.</i> (2009)	Coffee (forms of). Study is not only WF, but also identifies critical environmental issues of the whole spray dried coffee compared to drip filter and capsule espresso
Galan-del-Castillo & Velazquez (2009)	Biofuel (production to satisfy Spanish consumption objectives)
Peters <i>et al.</i> (2010)	Red meat (not really a WF, but a Life Cycle Inventory of red meat production (beef) at 3 farms in Australia)
Gerbens-Leenes <i>et al.</i> (2009)	Bio energy

Table A1.2: Stated Aims of Various Commodity Level Studies	
Study reference	What is the intended purpose of the WF?
Gerbens-Leenes <i>et al.</i> (2008)	To assess the impact on water resources of a shift towards other sources of energy.
Gerbens-Leenes <i>et al.</i> (2010)	To assess the impacts of a potential change in fuel consumption on water resources.
Chapagain <i>et al.</i> (2005)	To assess the water required for global cotton consumption, per country.
Chapagain <i>et al.</i> (2010)	No reason given.
Van Oel & Hoekstra (2010)	To increase literature on water footprints of non-food products and to address issues surrounding the assessment of paper specifically.
Aldaya & Hoekstra (2010)	To apply the water footprinting methodology to a specific consumer product. The authors note that disclosing information on WF of specific consumer products could make consumers more aware of water issues and motivate them to improve water governance. The study concludes saying that advising consumers about the WF of the products they buy could have an impact on types of commodities they choose (and therefore their sources), and would improve Italian irrigation schemes and water collection technology.
Chapagain & Hoekstra (2007)	To examine the external WF of a developed nation for consumption of a product produced exclusively abroad.
Ridoutt & Poulton (2009)	To assess the usefulness of the water footprint, and the specific methodology applied in this report.
Galloway <i>et al.</i> (2009)	To assess the impact of changes in the production patterns of meat, and to examine effects of trade (thus, tying in with historical use of VW).
Mekonnen & Hoekstra (2010a)	To estimate the green, blue and grey water footprint of wheat in a spatially-explicit way, both from a production and consumption perspective. Estimates are made of international virtual water flow and overexploited countries/areas are identified.
Mekonnen & Hoekstra (2010b)	To develop a WF for the cut flower industry and to assess the potential for reducing water use by involving traders, retailers and consumers. Essentially aims to assess the possible application of WF to informing business practice.
Chapagain & Orr (2009)	To extend existing methods for WF to more localised levels and by looking at open/covered systems of agriculture.
Humbert <i>et al.</i> (2009)	Compare energy use, greenhouse gas emissions and WF of preparing 1decilitre of 3 different coffee types.
Galan-del-Castillo & Velazquez (2009)	To establish the relationship between biofuels and water, by estimating the VW and WF of Spanish biofuel consumption targets.
Peters <i>et al.</i> (2010)	To assess environmental damage caused by meat production by classifying water use LCI data in a manner consistent with the contemporary definitions of sustainability.
Gerbens-Leenes <i>et al.</i> (2009)	To assess the WF per unit of energy from biomass (in m ³ /GJ) and to compare this with the WF of other primary energy carriers (oil, coal, gas, uranium, wind, solar energy and hydropower). In addition, the study aims to estimate how much additional fresh water is needed if a shift occurs towards energy from biomass and how this relates to the water needs for food and fibres.
Chatterton <i>et al.</i> (2010)	To quantify the amount of water used in the production of meat.

Table A1.2 sets out a list of the commodity level water footprint/virtual water studies examined for this study and their stated aims, while Table A1.3 provides a summary of the methodologies applied and how these may reflect modifications from the standard WFN or other methods.

Table A1.3: Commodity Level Methodologies and Modifications		
Study reference	Source of methodology	Modifications to the methodology?
Gerbens-Leenes <i>et al.</i> (2008)	Not explicit, but mention Hoekstra & Chapagain (2008) as the most developed form of the WF methodology.	No.
Gerbens-Leenes <i>et al.</i> (2010)	Follows the conventional methodology of WFN.	Calculates weighted (by energy requirement) WF averages per transport mode rather than absolute figure.
Chapagain <i>et al.</i> (2005)	Multiple sources. Many aspects of the methodology derived from Chapagain & Hoekstra (2004).	Introduces 'dilution water' - grey water.
Chapagain <i>et al.</i> (2010)	Hoekstra & Chapagain (2008) and Hoekstra <i>et al.</i> (2009).	Using a higher spatial resolution than earlier studies and applying local data on actual irrigation. In an earlier study, Chapagain & Hoekstra (2004) have assumed a constant percolation loss of 300 mm of water per year from the rice field and added that to the total water footprint of rice. In this study, a clear distinction between the evaporation and percolation is made. The percolation flow is not included in the water footprint.
Van Oel & Hoekstra (2010)	Multiple sources.	Grey water not included, blue and green are included as a total sum as considered to be too difficult to differentiate between them in forestry.
Aldaya & Hoekstra (2010)	Hoekstra <i>et al.</i> (2009); Hoekstra & Chapagain (2008).	Assesses a product rather than a crop/material.
Chapagain & Hoekstra (2007)	Chapagain & Hoekstra (2004).	Unclear
Ridoutt & Poulton (2009)	Ridoutt & Pfister (2009).	The paper adapts the WFN methodology. Green water is excluded, and water footprints are weighted by a Water Stress Index in order to provide consideration of resource context within the WF result.
Mekonnen & Hoekstra (2010a)	Hoekstra (2003); Hoekstra & Chapagain (2008); Hoekstra <i>et al.</i> (2009).	Aims for a higher spatial resolution - 10km X 10km
Mekonnen & Hoekstra (2010b)	Hoekstra <i>et al.</i> (2009).	Includes a sustainability assessment.

Table A1.3: Commodity Level Methodologies and Modifications		
Study reference	Source of methodology	Modifications to the methodology?
Chapagain & Orr (2009)	Multiple sources. Cites specifically Hoekstra & Chapagain (2008) but adapts this methodology.	States that the methodology in above paper 'does not address the different conditions of production under covered systems' and that 'crop water requirements calculated for one dominant season is assumed to be valid for crops grown at different seasons in a year'
Humbert <i>et al.</i> (2009)	Life cycle impact assessment (LCIA) is performed using the IMPACT 2002+ method (Humbert <i>et al.</i> , 2009; Frischknecht <i>et al.</i> , 2006)	Not specified
Galan-del-Castillo & Velazquez (2009)	VW has been estimated following Hoekstra & Hung (2002), where the crop water requirements were calculated with CROPWAT (FAO, 2007).	Not specified
Peters <i>et al.</i> (2010)	Multiple sources. Input-output modelling: Australian hybrid LCA model (Rowley <i>et al.</i> , 2009). Classification of flows: Udo de Haes <i>et al.</i> , 1999; Owens, 2002; Stewart & Weidema, 2005; Bayart <i>et al.</i> , 2010.	Not specified.
Gerbens-Leenes <i>et al.</i> (2009)	No reference for the methodology.	
Chatterton <i>et al.</i> (2010)	The authors use "a modified version of the Cranfield LCA model (Williams <i>et al.</i> , 2006)"	Cranfield LCA model has been improved for beef and lamb as part of phase 1 of the EBLEX roadmap (EBLEX 2009)

A1.3 CORPORATE LEVEL APPLICATIONS

Table A1.4 gives an overview of corporate level applications of water footprinting/virtual water and lists publications relevant to these studies. Table A1.5 outlines corporate reasons for undertaking a water footprint or water footprint pilot study while Table A1.6 shows how these studies have defined the water footprint.

A1.4 CRITIQUE OF COMMODITY AND CORPORATE APPLICATIONS

The Dole Food Company has used the water footprint method of the WFN to assess water use through the full process of banana cultivation and in 2010 the Dole Food Company announced that it had introduced a new system to dramatically reduce water use in its packaging operations. Likewise, Borealis (a plastics materials provider) and Uponor (a plumbing and heating systems

company) have initiated a study to assess the water footprint of their plastics value chain, from raw materials to plumbing and water systems installed in a home with the aim of reducing resource use in product design and manufacture as well as developing more water efficient products.

Kimberly-Clark conducted a cradle to grave water footprint assessment of its Scott Naturals toilet paper and reported that 85% of water use associated with its product takes place during flushing. Two years later, Kimberly-Clark began giving away free Smart Flush bags which save one litre of water per flush (KimberlyClark, 2010).

WWF & SABMiller (WWF & SABMiller, 2009) have undertaken a water footprint study to identify and address water risks in the value chain. The study evaluated the water footprint of the entire value chain for SABMiller's beers in two producer countries (South Africa and the Czech Republic), from crop cultivation and processing to brewing and distribution, while highlighting both direct and indirect water use. For SABMiller, water footprinting was used to inform three areas relating to business planning and decision making:

- to provide an overview of water use (quantity and location) in the value chain;
- to assess physical and regulatory risks to SABMiller's operations; and
- to equip senior managers with information regarding the broader issues surrounding water management, enabling them to engage proactively with stakeholders and, where necessary, to establish partnerships to address problems outside of SABMiller's breweries that are likely to provide benefits for its operations.

A1.4.1 Comprehensiveness of the Methodologies

Table 1.2d reviews the comprehensiveness of the methodologies used by corporates to assess their water footprint.

Type of Water Included

The majority of studies aim to include blue, green and grey water although green water has excluded some studies (e.g. Mars Australia) or net green water has been estimated (e.g. SABMiller). There are a few studies where grey water is not included, and the reasons for this are not clear. A couple of studies do not distinguish between different water types at all.

Apart from Ridoutt & Poulton (2009), which does not include green water as specified in the WSI methodology, the variations in whether different types of water are included or not, do not reflect differences in methodology or author. In other words, the same author, following the WFN methodology, may or may not include grey water. Similarly, those following an LCA methodology range from no separation by water type, through just blue and green, to blue, green and grey.

Truncation

There appear to be few truncation issues for commodity water footprints since the majority of studies are associated with crops, and thus the initial growth of the product. However, the extent to which the water footprints of input products, such as fertilisers, are included is not explicitly discussed in all studies, and therefore it is possible that some variations do occur amongst studies.

Spatiotemporal Variability

When assessing the comprehensiveness of water footprinting studies, it is important to consider the level of spatiotemporal variability that has been taken into account. Table A1.7 outlines the approach used by corporate studies to addressing spatial/temporal variability. Where commodities are considered on a global basis, national averages are generally used. Other studies look at production of a commodity in a specific area, for example, Adaya & Hoekstra (2010) and Mekonnen & Hoekstra (2010), and these use regional data. There appears to be a move towards using data at a higher spatial resolution, for example 10 km x 10 km (Mekonnen & Hoekstra, 2010) but this is not yet common practice. Ridoutt & Poulton (2009) use local data but there is only one example of the WSI method at the commodity level.

The approach to addressing temporal variability is less clear across the commodity studies. In general, annual averages appear to be used; however, Chapagain & Orr (2009) use a mixture of 1 day and 10 day time periods as required for different components of the calculations.

Few corporate water footprint studies provide any detail of how their water footprint assessment was undertaken and so it is difficult to tell from literature review alone the degree of spatiotemporal variability that has been taken into account. Table 3.5 outlines how some corporate organisations have addressed spatiotemporal variability in their water footprint assessments.

Specific examples include:

- **Jain Irrigation Systems** have given consideration to the time of year by accounting for monthly differences in climate, production rates and factory water use; and
- **Borealis** has indicated in its response to our questionnaire survey that it has used site and location specific data to inform its operational blue and grey water footprint assessment but have had to use generic data (Ecoinvent/Ecoprofiles) for their supply chain water footprint (i.e. for feedstocks and suppliers).

This type of assessment is often referred to as a ‘hot spot’ assessment and is the type of assessment used in the online mapping system of the Global Water Tool to put information about water use in the context of local issues (e.g.

water sanitation, scarcity, etc). In response to our questionnaire survey, LaFarge have indicated that this ‘landing’ approach is preferable to the LCA ‘weighted approach’ as the latter is not a good representation of water impacts nor useful for communicating the impacts of water use. While a hotspot assessment provides an indication of where impacts are likely to be greatest and, therefore, where priority should be placed with regard to policy formulation, hotspot assessment does not offer comparable information for the impact itself (Katsoufis, 2009).

It appears that Unilever are also exploring the application of new methods which are being developed for impact assessment for water scarcity by mapping their water footprint on a scarcity map to identify hotspots (Jefferies et al., 2009). Unilever are, however, yet to publish any reports on their use of water footprinting.

Table A1.4: Corporate water footprint and pilot water footprint studies which are currently, or which have recently, been undertaken				
Who		What	Where	Publications
Anglo American	Anglo American	Calculating the WF of each business unit.	Worldwide	No published reports to date.
Borealis	Borealis, Swedish Royal Institute of Technology	Calculating the WF of polyolefins chain.	Europe, USA, Brazil	Borealis (2009) <i>Water in action: assessing our water footprint</i> , report downloaded from Water for the World Internet Site (http://waterfortheworld.net/uploads/tx_casestudy/Water_footprint_-_W4W_2009_08_BB_2.pdf) Katsoufis, S. (2009) <i>Cradle-to-Gate Water Footprint Analysis of Borealis Group Polyolefin Value Chain</i> , MSc Thesis downloaded from Water for the World Internet Site (http://waterfortheworld.net/fileadmin/w4w/pdf/case-studies/WF_Thesis_Final_Report_internal_version.pdf)
Concha y Toro	Concha y Toro, Fundación Chile, WFN	Calculating the WF of a bottle of wine.	Chile (from Limarí to Maule Valley)	Concha Y Toro (2010) <i>Alliance with Water Footprint Network: and Fundacion Chile: Concha Y Toro first winery in the world to measure its water footprint</i> , Report downloaded from Concha Y Toro Internet Site (http://www.conchaytoro.com/desarrollo_sustentable/en/pdf/marca_de_agua_en.pdf)
Dole Food Company	Dole Food Company, WFN	WF of full process of banana cultivation.	Costa Rica	No published reports to date. Study is listed on the WFN's 'Policy Work Programme' webpage, though no further detail in terms of timescale or future publications are given
Jain Irrigation System	Jain Irrigation Systems, IFC, LimnoTech, TNC, WFN	Calculating the WF of onion supply chain, mango supply chain, micro-irrigation system product, plastic park, (manufacturing facility) agri park (processing	India (Tapi watershed in the Jalgaon District, Marahastra State)	IFC, Jain Irrigation Systems Ltd., LimnoTech, The Nature Conservancy (2010) <i>Water Footprint Assessments: Dehydrated Onion Products Micro-Irrigation Systems</i> , report downloaded from WFN Internet Site (http://www.waterfootprint.org/Reports/IFC-2010-WaterFootprintAssessments-JainIrrigationSystems.pdf)

		facility).		
Kimberly-Clark	Kimberly-Clark, WFN	Calculating the WF of Scott Naturals toilet tissue	UK, USA	No published reports to date.
Lafarge	Lafarge, WWF	Calculating the WF of cement plant, plasterboard plant, aggregate quarries, concrete plant.	Romania (Medgidia), UK (Bristol), Spain, Morocco, Egypt	No published reports to date.
Mars Australia	Mars Australia, CSIRO	Calculating the WF of Dolmio® pasta sauce, Peanut M&M's®, Whiskas® cat food and Pedigree® dog food	Australia (ingredients sourced globally for some products)	Ridoutt and Pfister (2010) <i>A revised approach to water footprinting to make transparent the impacts of consumption and production on global freshwater scarcity</i> , <u>Global Environmental Change, Vol. 20, Issue 1</u> , pp 113-120.
Multi-One Design	Multi-One Design, Quantis	Calculating the WF of the company MOD MOD 70" catamaran (its main product)	Switzerland, Lausanne but will be extended to the entire world.	No published reports to date.
Natura	Natura, WFN	Calculating the WF of cosmetic products, body oil, perfume.	Brazil and other countries	No published reports to date. Study is listed on the WFN's 'Policy Work Programme' webpage, though no further detail in terms of timescale or future publications are given
Nestlé	Nestlé, WWF-UK, University of Twente	Calculating the WF of Bitesize Shredded Wheat	UK	Chapagain AK & Orr S (2010): Water Footprint of Nestlé's 'Bitesize Shredded Wheat'. A pilot study to account and analyse the water footprints of Bitesize Shredded Wheat in the context of water availability along its supply chain, WWF-UK
PepsiCo	PepsiCo, WFN	Calculating the WF of Tropicana Orange Juice	From the UK to Brazil via Holland	No published reports to date. Study is listed on the WFN's 'Policy Work Programme' webpage, though no further detail in terms of timescale or future publications are given.
Raisio	Raisio	Calculating the WF of	Finland	No published reports to date.

Water Footprinting and Certification and Labelling Schemes

		Elovena Oat Flakes		
Royal Dutch Shell	Royal Dutch Shell	Calculating the WF of oil sands mining operations, traditional oil operations	Canada, Iraq	No published reports to date
SABMiller	SABMiller, WWF, URS	Calculating the WF of SABMiller beer	Czech Republic, South Africa	WWF & SABMiller (2009): Water footprinting: Identifying & addressing water risks in the value chain, SABMiller, Woking, UK / WWF-UK, Goldalming, UK.
Stora Enso	Stora Enso, WFN, WWF and the Alliance for Beverage Cartons (ACE)	Calculating the WF of liquid packaging board	Sweden	No published reports to date
Suez Environment		City-wide footprint assessment	Dijon and Bordeaux	No published reports to date
The Coca Cola Company	The Coca Cola Company, The Nature Conservancy, WFN, University of Twente	Calculating the WF of 0.5l PET plastic bottle of Coca-Cola (w. ingredients grown and bottled in the Netherlands), European sugar beet production, and Coca-Cola owned orange juice products.	Europe and North America	The Coca-Cola Company & The Nature Conservancy (2010): Product water footprint assessments: Practical application in corporate water stewardship, The Coca-Cola Company / The Nature Conservancy
The Danone Group	The Danone Group, Quantis, WFN			No published reports to date.
Unilever	Unilever, University of Twente	Calculating the WF of Lipton Yellow Label tea, Rama margarine.	Ingredients sourced from: India, Indonesia, Kenya (tea); Ukraine, Argentina (sunflower oil); Germany, Poland, Czech Republic	No published reports to date. Study is listed on the WFN's 'Policy Work Programme' webpage, though no further detail in terms of timescale or future publications are given.

			(oilseed rape); Hungary, France (maize); Indonesia (oil palm).	
UPM Kymmene	UPM Kymenne, WFN	Calculating the WF of woodfree coated and uncoated paper	Germany (Nordland Mill, Dörpen) global supply chain.	No published reports to date. Study is listed on the WFN's 'Policy Work Programme' webpage, though no further detail in terms of timescale or future publications are given
Veolia Environment		Calculating the WF of mater management activities such as potable water production, wastewater treatment, industrial water management	Not yet defined but worldwide	No published reports to date.
Note: this is not an exhaustive list of studies.				

Table A1.5: Corporate reasons for undertaking a WF or WF pilot study	
Anglo American	Using WF as a first step to identify areas to reduce water use.
Borealis	Primarily using WF to understand business risks, for corporate social responsibility and to analyse potential scenarios/options but are also using WF to raise public awareness, to inform water resources policy, to use as part of certification/product labelling and to integrate in product LCA as a core indicator alongside carbon and energy.
Concha y Toro	Using WF to achieve water savings and to increase efficient water use with the ensuing positive impact on the environment.
Heineken	Primarily using WF to understand business risks, to inform water resources policy, for corporate social responsibility and to analyse potential scenario's/options but WF also being used to raise public awareness.
Jain Irrigation System	Using WF to help achieve business sustainability for Jain Irrigation, and wider agricultural sustainability for India and Indian economy.
Kimberly-Clark	Using WF to identify areas to reduce water use.
Lafarge	Using WF to understand business risks, for corporate social responsibility and to analyse potential scenarios/options.
Mars Australia	Development of the water footprinting methodology, to include weighting of results by a Water Stress Index (WSI).
Nestlé	Development of a standard water footprinting methodology that can be adopted by businesses.
Raisio	To use WF on product label.
SABMiller	Development of the water footprinting methodology. To identify and address water risks in the value chain.
Stora Enso	Using WF to develop product range to include less water intensive products.
The Coca Cola Company	To develop water footprinting and explore its potential future use in water management. Coca-Cola want to be seen to be demonstrating good water stewardship in order to preserve a 'social license' to trade.
Unilever	Using WF to identify which product categories are most water intensive and to identify opportunities for water use reduction. Undertaking study to contribute to methodological development.
UPM Kymmene	Using WF to gather information on sustainable water management in the entire process of paper production, especially with regard to how different pulp supplies can influence the overall water footprint of UPM's products.

Table A1.6: Definition of the Water Footprint		
Organisation	Definition	Reference
Mars Australia	Product WF defined as: "the sum of all water consumed in the various stages of production and therefore the same as its virtual water content".	Ridoutt & Pfister (2010) <i>A revised approach to water footprinting to make transparent the impacts of consumption and production on global freshwater scarcity</i> , <i>Global Environmental Change</i> , Vol. 20, Issue 1, pp 113-120.
SABMiller	A WF is defined as: "a spatially and temporally explicit indicator of direct and indirect water use by consumers and producers".	WWF & SABMiller (2009): <i>Water footprinting: Identifying & addressing water risks in the value chain</i> , SABMiller, Woking, UK / WWF-UK, Goldalming, UK.
The Coca Cola Company	Product WF defined as: "the total volume of freshwater consumed, directly and indirectly, to produce a product. A full water footprint assessment considers the impacts of this water consumption, as well as appropriate response strategies to minimize those impacts".	The Coca-Cola Company & The Nature Conservancy (2010): <i>Product water footprint assessments: Practical application in corporate water stewardship</i> , The Coca-Cola Company / The Nature Conservancy

Table A1.7: Comprehensiveness of Water Footprint Methodologies			
	Comprehensiveness of the methodology	Consideration given to the opportunity costs of water use?	Includes an impact assessment?
Borealis	Water footprint is calculated for the polyolefin chain. Both direct (operational) and indirect (supply chain) water use are addressed. Grey water footprint is excluded.	Yes. Report mentions that blue water has a higher opportunity cost than green water.	No. Borealis has apparently mapped its plants water footprint against a local water stress index, however, this aspect of the study does not appear to have been published. Borealis have indicated in their response to our questionnaire survey that they are in the process of developing their own local impact assessment.
Jain Irrigation Systems	Separate water footprints are calculated for two products (JISL's MIS drip irrigation and dehydrated onion products). Both direct (operational) water use and indirect (supply chain) water use are addressed. Goes beyond water accounting to consider the sustainability of water use.	Not explicitly. Differentiation between blue, green and grey water but no specific recognition of varying opportunity costs.	Yes. The social and economic sustainability of JISL's blue water footprint is carried out, at the scale of the Tapi River basin. The sustainability assessment was conducted in accordance with the method developed by the WFN sustainability assessment working group.
Mars Australia	Study focuses at the product brand level rather than the product category level. Goes beyond water accounting to consider the sustainability of water use by weighting results by a Water Stress Index. The water footprint calculation method introduced in this report does not specifically account for green water consumption because green water consumption does not contribute directly to water scarcity	Yes. Report mentions that different types of water will have a different opportunity cost. On this basis, green water is excluded.	Yes. Results are weighted by a Water Stress Index
Nestlé	Takes into account most direct (operational) and indirect (supply chain) water use associated with the final product but some indirect water use excluded (e.g. no data were available on the supply chain of the packaging material). Although Nestle tried to use a LCA approach by including water used in the end use (consumption and waste disposal) of the product they found that this was very complex and invited rather complex boundary issues. A complete estimation of the end use WF of Bitesize Shredded Wheat was, therefore, not undertaken, but Nestle have included in the WF of Bitesize Shredded Wheat the WF of the recommended portion of milk to be taken with the cereal.	Not explicitly. Differentiation between blue and green water but no specific recognition of varying opportunity costs.	Yes. Water footprints are compared to a water resources availability map.

	Comprehensiveness of the methodology	Consideration given to the opportunity costs of water use?	Includes an impact assessment?
SABMiller	Study looks at the beer value chain in two producer countries: South Africa and the Czech Republic. WF calculation covers entire production process (from growth of crops and production of packaging up to bottle recycling) and includes both operational and supply chain water use.	Yes. Report mentions that green water generally has a lower opportunity cost than blue water and that a distinction should, therefore, be made between the different types of water.	Yes. Risk maps used to assess where footprint of value chain 'lands' in relation to scarcity issues on the ground
The Coca Cola Company	Study calculates the WF of three products: 0.5l PET plastic bottle of Coca-Cola, European sugar beet, and Coca-Cola owned orange juice products. Includes both operational and supply chain water use. As supply chains were found to be very complex, for Coca-Cola owned orange juice products representative farms and plants were selected for analysis. The utility of water stress indices was explored as part of the study and water stress indices were calculated for three citrus growing regions. However, it was found that these indices are only indicative of potential impacts. A detailed explanation of the methodology and results does not appear to have been published.	No specific mention made. Implied by assessment of green water footprint in comparison to consumption by natural vegetation.	Impact assessment accompanies each WF assessment, which examines the effects of water use. Actual water footprint value gives fairly little contextualised information itself, however can help identify best practise in production (when comparing components of WF, not comparing final published WF).

Table A1.8: Approach to addressing spatial/temporal variability in corporate studies	
Borealis	Water inventory data collected over period April-November 2008. Site and location specific data have been used to inform the operational blue and grey water footprint but generic (Ecoinvent/Ecoprofile) data have been used for feedstocks and suppliers.
Jain Irrigation System	Examine a fairly specific region. Seasonal climatic variability assessed and accounted for, in relation to crop growth (calendars used, for example).
Mars Australia	Combination of WSI/supplier data means that spatial variability fairly well addressed. Temporal variability not made clear, assumed aggregated over growth period.
Nestlé	Temporal variability not specifically addressed, and seemingly aggregated e.g. crop water requirement of wheat is '397mm/season', regardless of stage in the plant's growth. Seemingly similar with spatial variability e.g. only one measure given for effective rainfall. This is potentially justified as all the wheat is grown in a area of 50 miles radius, and so significant climatic differences are unlikely.
SABMiller	Czech study addresses issue of annual climatic variation and South African study addresses of issue of spatial variation in water footprints. Presumably the final results are aggregated for the litres of water/litres of beer values.
The Coca Cola Company	Spatial and temporal dimension unclear. Presumably the entire growth/production stage (as appropriate to product assessed) is taken as the temporal scale. Regionally varying blue and green water footprints produced for the Netherlands in the 0.5l assessment. Original 0.5l overestimated blue water footprint associated with sugar beets grown in Netherlands, however, second assessment found irrigation generally lower than average in Netherlands (in comparison to the rest of Europe).

A1.4.2 Data and Methodological Issues

Data Gaps and Uncertainty

As noted in the Water Footprint Assessment Manual (Hoekstra *et al.*, 2011), data uncertainties in water footprint accounting can be very significant. How to deal with such data uncertainties, however, remains a major challenge for the water footprint methodology. While the Water Footprint Assessment Manual advises that an uncertainty assessment and sensitivity analysis are carried out, it is acknowledged that time restrictions will often not allow for this and it is noted that no uncertainty studies have yet been carried out. Indeed, the Manual does not give any guidance on how to deal with such uncertainties.

Many corporate studies have been limited by data constraints with respect to tracing water use back through their supply chains and so rely on generic, proxy or modelled data, which inherently include a degree of error. While corporate users of the water footprint methodology are often able to measure their own operational water use, gathering data on supply chain water use is more problematic. For example:

- Marks & Spencer (2011) was unable to trace its cotton supply chain as the cotton they bought is traded through a co-operative. Marks & Spencer, therefore, had to

use global average data for calculating the water footprint of cotton production. This meant that the water footprint of the cotton items they stock would be exactly the same as for any other retailer.

- Nestlé has tried to increase the scope of their pilot water footprint study by taking a LCA approach to estimating the end use water footprint of Bitesize Shredded Wheat, but found that the estimation was very complex and that it was difficult to make boundary definitions. For example, it was not clear whether water from washing utensils should be taken into account. In order to calculate the water footprint at the level of the consumer, they simply add the water footprint of the recommended portion of Bitesize Shredded Wheat to the water footprint of the recommended portion of milk to be taken with the portion of Shredded Wheat. They noted that data limitations made this problematic as it was almost impossible to trace the source of other ingredients (such as milk) that a consumer buys. In order to overcome this problem, Nestlé used the national average water footprint of milk from the UK.

Data gaps and errors arise from both primary and secondary data, but many water footprint studies do not make clear their approach to addressing these gaps and uncertainty. In general, it is thought that average figures are used to fill data gaps. Of those that provide further information, Chapagain & Hoekstra (2010) indicate that they compared their data to other independent sources and found it to be consistent, whilst Aldaya & Hoekstra (2010) makes assumptions supported by the available literature. A more detailed approach is taken by Mekonnen & Hoekstra (2010) which provides an uncertainty range of $\pm 17\%$. Galloway *et al.* (2007) also undertook sensitivity analysis, which was used to support the study's recommendations. From the literature review it appears, that no corporate organisations have published the margin of error in their water footprint assessments and few organisations even publish their data sources.

Both Nestlé and Borealis experienced problems with data gaps in their water footprint accounting. Borealis, for example, in their response to our questionnaire survey have explained that “*water data in supply chain and life cycle inventories are at best partial or missing*”. Borealis note that a major effort is needed to fill the gaps in water footprint data inventories.

It is interesting to note that Quantis²⁴ is working in partnership with Ecoinvent, Danone (France), Kraft Foods (USA), Moslon Coors Brewing Company (UK) Ltd, Natura (Brazil), Unilever PLC (UK), Veolia Environment (France) and Steelcase (USA) to create the first comprehensive database of water footprints across various sectors of manufacturing. The purpose of Quantis' Water DataBase is to fill the existing data gap in order to enable water footprint and water use impact assessment to be performed. The aim is to provide a neutral inventory that will not rely on a specific methodology, thus enabling the life cycle community, water managers, etc. to perform water footprinting by applying their preferred impact assessment methodology.

²⁴ Personal Communication, 2011.

Information in the inventory includes all water withdrawal sources, turbined water, precise pollutant emissions to water etc., and not only blue, green and grey water. The Water DataBase also contains an additional section that shows all existing and applicable methodology results, including the methodology provided by the Water Footprint Network. It covers several thousand processes (Quantis are collaborating with Ecoinvent, a leading supplier of Life Cycle Assessment data, whose database contains 4000 processes, most of which are industrial processes) and will include agricultural processes and derivative products. The WFN database on agricultural crops and derivative products will also eventually be included in the Water DataBase.

The Water DataBase is adaptable to different regions so that local conditions can be taken into account. Although processes and data are currently regionalised at country level (for most processes this will be enough as companies generally only know the country of origin of a product), information at watershed or region level will be included when it becomes available. Inventory flows at a watershed level will be weighted by a water stress index. As the database includes the whole life cycle of each process, it will be possible to identify where along the life cycle of a process the impacts on the environment/ society are the greatest.

Calculation of Grey Water

Borealis, Mars Australia, Heineken and SABMiller have expressed doubts regarding the method used to quantify the grey water footprint. Mars Australia, for example, note that grey water is an imperfect measure that is not physically or conceptually in line with blue water consumption. Indeed, Heineken have indicated that in some (less developed) countries it is not clear what the desired surface water quality is. Due to uncertainties regarding the assumptions used to quantify the grey water footprint, SABMiller has excluded grey water from their calculation. SABMiller, however, notes that the inclusion of grey water estimates for South Africa significantly increases the water footprint of SABMiller Beer production – from 155 litres/litre to 191 litres/litre.

Borealis indicated in their response to our questionnaire survey that they found it extremely difficult to calculate their grey water footprint as production is undertaken on a complex manufacturing site where there are many types of pollutants and where recipient bodies change over time. In order to make it easier to calculate the grey water footprint, Borealis only estimate the grey water footprint if specific pollutant loads are above BAT levels over a period of time. The grey water footprint is also based on the quality of the recipient water body.

Feasibility

Marks & Spencer stock c.100,000 products from c.6,000 suppliers and these products are derived from most countries of the world. As noted by Marks & Spencer (2011), the sheer amount of data that would be needed to undertake a water footprint assessment for all these products renders water footprinting infeasible. Marks & Spencer suggest, therefore, that water footprinting may be more useful at the product brand level, rather than for retailers as brands only deal with a small number of products.

ANNEX 2

DETAILED IMPACT ASSESSMENT RESULTS

A2. IMPACT ASSESSMENT

This Annex provides supporting data for the Impact Assessment. For ease of reference, Table A2.1 sets out the policy option groups.

Policy Option Group	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
Group A			X		X			A		X	X	X		
Group B	X	X	X	X		X	X	X	X	X	X		X	X
Group C			X	X			X	X	X	X	X		X	
Group D			X		X				X		X	X	X	
Group E	X	X												X

Table A2.2 sets out the impact and sub-impact categories used for the impact assessment. In total, we have identified 27 relevant impact categories and 70 sub-impacts of relevance across all of the categories set out in EC (2009). Each sub-impact category has been allocated a ‘sub-impact category number’ – these numbers should be referred to when looking at the data in Table A2.3.

Table A2.3 provides supporting data for the impact assessment. The potential impacts of each policy option have been assessed against each sub-impact category using a simple rating system which is designed to show the likely magnitude and direction of effects. The methodology used for the impact assessment and justification for the ratings assigned are elaborated in Section 7 of the Main Report.

Table A2.4 gives an overview of the significance of impacts for each policy option, while Table A2.5 gives an overview of the significance of impacts for each policy option group.

Table A2.6 gives impacts by category for each of the five option groups.

An overview of these data is provided in Section 7 of the Main Report.

Table A2.2: Impact and Sub-impact Categories for Impact Assessment		
Impact Category	Sub-impact Category	Sub-impact Category No.*
Functioning of the internal market	Barriers to new suppliers or market segmentation?	1
	Reduction in choice or higher prices due to reduced competition	2
Competitiveness	Change in competitive advantage of businesses (e.g. between those who have already applied methods, been involved in development of methods, etc. and others who have not)	1
	Change in relative competitiveness of newcomers to market (who would have more choice over where to locate, but may need to access specific schemes, information, etc.)	2
	Change in potential competitiveness of small versus large firms (e.g. farms)	3
Trade	Change in trade flows within the internal market	1
	Change in demand for products from outside EU (due to increased costs of EU products or due to unsustainability of non-EU products)	2
Investment flows	Change in investment flows (due to improved credibility, reliability of information on water use)	1
	Change in attractiveness of low and high (water) productivity sectors for investment	2
	Change in level of cross-border investment	3
SMEs	Change in own operating costs	1
	Change in investment costs	2
	Change in business risks/ opportunities associated with water use	3
	Change in costs of obtaining certification/ labelling (down/through supply chain)	4
	Change in costs of marketing products	5
Operating costs and conduct of business	Change in own operating costs	1
	Change in investment costs	2
	Change in business risks/ opportunities associated with water use	3
	Change in access to information on best practice in water use, methods, advice, etc.	4
	Change in costs of obtaining certification/ labelling (down/through supply chain)	5
	Change in costs of marketing products	6
	Change in costs for not-for-profit organisations (e.g. labelling) with implications on demand for their services	7
Administrative burdens on businesses	Budgetary consequences related to method development, etc.	1
	Change in admin burden associated with record keeping on water use, to inform certification/labelling, management plans	2
	Change in admin burden with reporting to public authorities	3
Public authorities	Change in costs	1
Property rights	Change in value of/ownership of intellectual property rights (e.g. Water Footprinting TM)	1

Impact Category	Sub-impact Category	Sub-impact Category No.*
	Change in value of businesses, property, land	2
	Change in value/ownership of certification/ labelling schemes	3
Innovation and research	Stimulation of research and development (e.g. academic, industry, into company's water use, methods, tools, etc.)	1
	Change in level of innovation in terms of new technologies/water-friendly products	2
	Change in level of understanding and knowledge on water use	3
	Change in level of resource efficiency	4
Consumers and households	Change in price of products	1
	Change in availability/range of products	2
Sectors and Regions	Change in investment in certain regions (e.g. drier regions could be impacted if business choose to relocate to more water rich areas)	1
	Impacts on specific sectors	2
	Change in rural/urban inequality	3
	Equity of treatment - impact on some regions more than others?	4
International relations and Third countries	Impacts on trade and investment flows between EU and Third countries	1
	EU trade policy, foreign policy or development policy	2
	Change in level of international co-operation/ globalisation of expertise	3
	Impact on goods and services produced or consumed in developing countries	4
Macroeconomic environment	Macro-economic stabilisation	1
	Economic growth	2
Employment and labour markets	Job creation	1
	Job losses	2
	Impacts on particular professions	3
	Change in distribution of jobs - this double counts to a degree with regional impacts	4
Social inclusion and protection of particular groups	Access to services and goods	1
Governance, participation, good administration, access to justice, media and ethics	Impacts on public institutions and administrations	1
	Impacts on stakeholder involvement in governance	2
	Does the option make the public better informed and affect their access to information	3

Table A2.2: Impact and Sub-impact Categories for Impact Assessment		
Impact Category	Sub-impact Category	Sub-impact Category No.*
Crime, Terrorism and Security	Food security issues and ability to meet local / national demand (forcing businesses to compete nationally, internationally)	1
Culture	Change in impacts on traditional lifestyles (e.g. farming)	1
Social impacts in third countries	Change in location of supply chain businesses	1
	Change in potential for education opportunities (water training along supply chain)	2
	Change in ability to adapt to changing climate (e.g. water availability, crop requirements, demand for products, etc.)	1
Transport and the use of energy	Change in energy use (e.g. reduced pumping)	1
Biodiversity, flora, fauna and landscapes	Change in impacts on biodiversity, flora and fauna, landscapes	1
Land use	Change in land use (e.g. with relocation of supply chain, change in crops grown, irrigation used, etc.)	1
The environmental consequences of firms and consumers	Change in level of sustainable production and consumption of water	1
	Change in relative prices of environmentally friendly goods; promotion or restriction of environmentally friendly goods	2
	Change in overall impact on the environment	3
Water quality and resources - including waste production	Impacts on freshwater water quality	1
	Impacts on marine and coastal water quality	2
	Impacts on water freshwater quantity - surface and ground and including drinking water supplies	3
	Impacts on waste	4
The likelihood or scale of environmental risks	Change in likelihood/scale of environmental risks associated with water stress/drought	1
International environmental impacts	Impact on environment in third countries relevant to overarching EU policies?	1

*Sub-impact category numbers should be referred to when looking at the data in Table A2.3

Table A2.3: Direction and Magnitude of Impacts for Policy Options															
Impact Category	Sub-impact Category No.*	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
Functioning of the internal market	1	N/A	N/A	0	+/-	-	0	0	0	+/-	0	N/A	-	-	N/A
	2	N/A	N/A	0	0	+/-	0	0	0	-	0	N/A	0	-	N/A
Competitiveness	1	+	+	+	+	+	0	0	N/A	+/-	+/-	N/A	+	+	-
	2	N/A	N/A	0	0	0	0	0	0	-	-	0	0	+/-	N/A
	3	+/-	+/-	+/-	+/-	0	0	0	+/-	-	-	-	-	-	N/A
Trade	1	N/A	N/A	+/-	+/-	0	+/-	+/-	0	-	-	+/-	0	-	N/A
	2	0	0	+/-	+/-	+/-	0	0	+	+/-	+/-	+/-	0	+/-	N/A
Investment flows	1	+	+	+/-	+/-	+	0	0	+/-	+	+	+	+	+	-
	2	N/A	N/A	+	+	0	+	+	+/-	+/-	+/-	+	+/-	+/-	0
	3	N/A	N/A	+	+	0	0	0	+	+	+	+/-	0	0	0
SMEs	1	N/A	N/A	+/-	+/-	+/-	+/-	+/-	N/A	--	-	+/-	-	+/-	N/A
	2	N/A	N/A	-	+/-	0	0	0	+/-	-	-	0	-	-	N/A
	3	N/A	N/A	+	++	0	+	0	++	+	+	+/-	+	+	N/A
	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	+/-	--	-	N/A	-	-	0
	5	N/A	N/A	-	-	N/A	N/A	N/A	+/-	-	-	+/-	-	-	N/A
Operating costs and conduct of business	1	N/A	N/A	+/-	+/-	+/-	+/-	+/-	N/A	-	+/-	+/-	+	+/-	N/A
	2	N/A	N/A	+	+	0	0	0	+/-	-	-	0	-	-	N/A
	3	N/A	N/A	+	++	0	+	0	+/-	+	+	+/-	+	+	N/A
	4	++	++	0	++	++	0	0	+/-	0	0	0	0	0	0
	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	+/-	--	--	N/A	-	-	0
	6	N/A	N/A	-	-	N/A	N/A	N/A	+/-	-	-	+/-	-	-	N/A
	7	0	0	0	0	+/-	0	0	0	+/-	+/-	N/A	0	+/-	--
Administrative burdens on businesses	1	+	+	0	0	0	0	0	N/A	0	-	N/A	-	-	-
	2	N/A	N/A	-	--	+/-	--	--	N/A	--	0	N/A	-	--	-
	3	N/A	N/A	0	N/A	N/A	--	--	N/A	0	0	N/A	0	0	0
Public authorities	1	-	-	-	-	--	--	--	-	-	-	-	-	-	-
Property rights	1	-	-	0	0	N/A	+/-	+/-	N/A	N/A	0	N/A	+/-	+/-	+/-
	2	N/A	N/A	0	0	0	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	+/-	+/-	N/A	N/A	N/A	0
Innovation and research	1	+	++	+	++	+	+	+	++	+	+	+	+	+	+

Table A2.3: Direction and Magnitude of Impacts for Policy Options															
Impact Category	Sub-impact Category No.*	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
	2	N/A	N/A	++	++	+	+	+	++	+	+	+	+	+	0
	3	+	++	+	+	+	++	++	+	+	++	++	+	+	+
	4	0	0	+	+	+	++	++	+	+	+	+	+	+	0
Consumers and households	1	N/A	N/A	0	0	+	0	0	-	-	-	-	-	-	0
	2	N/A	N/A	N/A	0	+	0	0	+	-	0	+/-	0	-	0
Sectors and Regions	1	N/A	N/A	+/-	+/-	0	+/-	0	++	-	-	N/A	N/A	N/A	+/-
	2	N/A	N/A	-	+/-	0	+/-	0	--	-	-	+/-	-	-	+/-
	3	N/A	N/A	N/A	+/-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4	N/A	+	0	++	0	--	--	+/-	+	+	0	0	0	N/A
International relations and Third countries	1	0	0	+/-	+/-	0	N/A	N/A	++	+	+/-	+/-	0	0	0
	2	0	0	+/-	+/-	0	N/A	N/A	++	+	+	+/-	0	0	0
	3	+	+	+	+	+	N/A	N/A	++	+	+	+/-	0	+/-	+/-
	4	N/A	N/A	+/-	+/-	+/-	N/A	N/A	+/-	+/-	+	+/-	0	+/-	N/A
Macroeconomic environment	1	N/A	N/A	+	+	0	+	+	+	N/A	N/A	N/A	0	0	N/A
	2	N/A	N/A	+	+/-	0	+/-	0	+/-	0	0	N/A	0	0	N/A
Employment and labour markets	1	N/A	N/A	0	0	0	0	0	N/A	0	0	0	+	0	N/A
	2	N/A	N/A	0	0	0	+/-	-	N/A	0	0	0	0	0	N/A
	3	0	0	+	+	0	+/-	-	N/A	+/-	+	0	0	0	N/A
	4	N/A	N/A	0	0	0	+/-	-	N/A	0	0	0	0	0	N/A
Social inclusion and protection of particular groups	1	N/A	N/A	0	0	+/-	-	-	+/-	0	0	0	+	0	N/A
Governance, participation, good administration, access to justice, media and ethics	1	+/-	+/-	+	+	-	-	-	+/-	+/-	0	-	+/-	0	0
	2	+/-	+/-	-	-	+	+	+	0	+/-	+/-	+	+	+	0
	3	+	+	0	0	+	+	+	0	0	0	++	+	0	0
Crime, Terrorism and Security	1	N/A	N/A	+	+	0	+	+	+	0	0	+	0	0	N/A
Culture	1	N/A	N/A	N/A	N/A	N/A	-	0	-	-	-	0	0	0	N/A
Social impacts in third countries	1	N/A	N/A	+/-	+/-	N/A	0	0	+/-	+/-	+/-	+/-	0	+/-	N/A
	2	N/A	N/A	N/A	N/A	N/A	0	0	+	+	+	0	0	+	N/A
	1	N/A	N/A	N/A	N/A	N/A	+	0	+	+	+	N/A	N/A	0	N/A
Transport and the use of energy	1	N/A	N/A	+	+	0	0	0	+	+	+	N/A	+	0	0
Biodiversity, flora, fauna and landscapes	1	N/A	N/A	+	+	N/A	0	0	+	+	0	0	N/A	N/A	N/A

Impact Category	Sub-impact Category No.*	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
Land use	1	N/A	N/A	+/-	+/-	N/A	+/-	+/-	+/-	0	0	N/A	N/A	0	0
The environmental consequences of firms and consumers	1	+	+	++	++	++	++	+	+	++	+	++	++	++	+
	2	0	0	+	+	++	0	0	+	--	+	++	++	++	0
	3	0	0	+	+	0	0	0	+	++	+	+	+	+	+
Water quality and resources - including waste production	1	N/A	N/A	+	+	0	+	0	+	0	0	0	0	0	0
	2	N/A	N/A	0	0	0	+	0	N/A	0	0	0	0	0	0
	3	N/A	N/A	+	+	+	+	+	+	++	+	+	+	+	0
	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	+	N/A	N/A	N/A
The likelihood or scale of environmental risks	1	N/A	N/A	+	++	+	++	+	+	+	+	+	+	+	0
International environmental impacts	1	N/A	N/A	+	+	0	N/A	N/A	+	+	+	N/A	N/A	+	N/A

*Sub-impact category numbers refer to the 'sub-impact categories' described in Table A2.2 (above)

Table A2.4: Impacts by Significance for Policy Options														
Count of Impacts by Significance for Policy Options														
Significance Rating	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
++	1	3	2	8	3	4	2	7	3	1	4	2	2	0
+	8	7	23	18	13	13	10	18	18	21	11	17	14	4
0	8	8	17	14	28	22	31	7	13	19	15	25	22	23
+/-	3	3	12	17	8	12	6	19	12	10	17	4	11	5
-	2	2	7	4	2	4	6	3	15	15	4	14	15	5
--	0	0	0	1	1	4	4	1	5	1	0	0	1	1
N/A	48	47	9	8	15	11	11	15	4	3	19	8	5	32
Total (excluding N/A)	22	23	61	62	55	59	59	55	66	67	51	62	65	38
Percentage of Impacts by Significance for Policy Options														
Significance Rating	1a	1b	1c	1d	2a	2b	2c	3a	4a	4b	4c	5a	5b	5c
++	5	13	3	13	5	7	3	13	5	1	8	3	3	0
+	36	30	38	29	24	22	17	33	27	31	22	27	22	11
0	36	35	28	23	51	37	53	13	20	28	29	40	34	61
+/-	14	13	20	27	15	20	10	35	18	15	33	6	17	13
-	9	9	11	6	4	7	10	5	23	22	8	23	23	13
--	0	0	0	2	2	7	7	2	8	1	0	0	2	3

Table A2.5: Impacts by Significance for Policy Option Groups					
Count of Impacts by Significance for Policy Option Groups					
Significance Rating	Group A	Group B	Group C	Group D	Group E
++	19	29	16	4	37
+	103	133	96	19	165
0	111	138	120	39	199
+/-	70	104	64	11	127
-	45	69	57	9	82
--	3	13	7	1	18
N/A	69	55	74	82	55
Total (excluding N/A)	351	486	360	83	628
Percentage of Impacts by Significance for Policy Option Groups					
Significance Rating	Group A	Group B	Group C	Group D	Group E
++	5	6	4	5	6
+	29	27	27	23	26
0	32	28	33	47	32
+/-	20	21	18	13	20
-	13	14	16	11	13
--	1	3	2	1	3
Total	100	100	100	100	100

Table A2.6: Impacts by category for policy option groups		A	B	C	D	E
Functioning of the internal market	Barriers to new suppliers or market segmentation?	-	0	-	0	0
	Reduction in choice or higher prices due to reduced competition	0	-	-	0	-
Competitiveness	Change in competitive advantage of businesses (e.g. between those who have already applied methods, been involved in development of methods, etc. and others who have not)	+	+	+	+	+
	Change in relative competitiveness of newcomers to market (who would have more choice over where to locate, but may need to access specific schemes, information, etc.)	0	-	0	0	-
	Change in potential competitiveness of small versus large firms (e.g. farms)	-	-	-	0	-
Trade	Change in trade flows within the internal market	-	-	-	0	-
Investment flows	Change in investment flows (due to improved credibility, reliability of information on water use)	+	+	+	+	+
	Change in attractiveness of low and high (water) productivity sectors for investment	+	+	+	0	+
	Change in level of cross-border investment	+	+	+	0	+
SMEs	Change in own operating costs	-	-	-	0	-
	Change in investment costs	-	-	-	0	-
	Change in business risks/ opportunities associated with water use	+	++	+	0	++
	Change in costs of obtaining certification/ labelling (down/through supply chain)	-	-	-	0	-
	Change in costs of marketing products	-	-	-	0	-
Operating costs and	Change in investment costs	-	+	-	0	+

Table A2.6: Impacts by category for policy option groups		A	B	C	D	E
conduct of business	Change in business risks/ opportunities associated with water use	+	+	+	0	+
	Change in access to information on best practice in water use, methods, advice, etc.	+	+	+	++	++
	Change in costs of obtaining certification/ labelling (down/through supply chain)	-	--	-	0	--
	Change in costs of marketing products	-	-	-	0	-
	Change in costs for not-for-profit organisations (e.g. labelling) with implications on demand for their services	0	0	0	-	0
Administrative burdens on businesses	Budgetary consequences related to method development, etc.	-	-	-	+	+
	Change in admin burden associated with record keeping on water use, to inform certification/labelling, management plans	-	--	-	0	-
	Change in admin burden with reporting to public authorities	0	-	0	0	--
Public authorities	Change in costs	-	-	-	-	-
Property rights	Change in value of/ownership of intellectual property rights (e.g. Water Footprinting TM)	0	0	0	-	-
Innovation and research	Stimulation of research and development (e.g. academic, industry, into company's water use, methods, tools, etc.)	+	++	+	+	++
	Change in level of innovation in terms of new technologies/water-friendly products	++	++	+	0	++
	Change in level of understanding and knowledge on water use	++	++	+	+	++
	Change in level of resource efficiency	+	+	+	0	++
Consumers and households	Change in price of products	-	-	-	0	-
	Change in availability/range of products	+	-	-	0	-
Sectors and Regions	Change in investment in certain regions (e.g. drier regions could be impacted if business choose to relocate to more water rich areas)	+	-	0	0	-

Table A2.6: Impacts by category for policy option groups						
		A	B	C	D	E
	Impacts on specific sectors	-	-	-	0	-
	Change in rural/urban inequality	0	-	0	0	-
	Equity of treatment - impact on some regions more than others?	0	+	0	0	+
International relations and Third countries	Impacts on trade and investment flows between EU and Third countries	+	+	0	0	+
	EU trade policy, foreign policy or development policy	+	+	0	0	+
	Change in level of international co-operation/ globalisation of expertise	+	+	+	+	+
Macroeconomic environment	Macro-economic stabilisation	+	+	+	0	+
Employment and labour markets	Impacts on particular professions	+	+	0	0	+
Social inclusion and protection of particular groups	Access to services and goods	0	0	0	0	-
Governance, participation, good administration, access to justice, media and ethics	Impacts on public institutions and administrations	-	+	-	0	+
	Impacts on stakeholder involvement in governance	+	+	+	0	+
	Does the option make the public better informed and affect their access to information	+	+	+	+	+
Crime, Terrorism and Security	Food security issues and ability to meet local / national demand (forcing businesses to compete nationally, internationally)	+	+	+	0	+
Culture	Change in impacts on traditional lifestyles (e.g. farming)	-	-	0	0	-
Social impacts in third countries	Change in potential for education opportunities (water training along supply chain)	+	+	+	0	+
	Change in ability to adapt to changing climate (e.g. water availability, crop requirements, demand for products, etc.)	+	+	0	0	+
Transport and the use of energy	Change in energy use (e.g. reduced pumping)	+	+	+	0	+

Table A2.6: Impacts by category for policy option groups						
		A	B	C	D	E
Biodiversity, flora, fauna and landscapes	Change in impacts on biodiversity, flora and fauna, landscapes	+	+	+	0	+
The environmental consequences of firms and consumers	Change in level of sustainable production and consumption of water	++	++	++	+	++
	Change in relative prices of environmentally friendly goods; promotion or restriction of environmentally friendly goods	++	++	++	0	++
	Change in overall impact on the environment	+	+	+	0	+
Water quality and resources - including waste production	Impacts on freshwater water quality	+	+	+	0	+
	Impacts on water freshwater quantity - surface and ground and including drinking water supplies	+	+	+	0	+
The likelihood or scale of environmental risks	Change in likelihood/scale of environmental risks associated with water stress/drought	+	+	+	0	++
International environmental impacts	Impact on environment in third countries relevant to overarching EU policies?	+	+	+	0	+

ANNEX 3
CONSULTEES

A3.1. CONSULTEES

With regard to Member State (MS) Authorities, members of the ‘Strategic Coordination Group’ were contacted, as recommended by the Commission. A total of eight questionnaire responses were received from MS:

- Cyprus: Water Development Department;
- Netherlands: Ministry of Infrastructure and Environment, Flemish Environment Agency (VMM);
- Italy: Ministry of Environment;
- Slovak Republic: Ministry of Environment;
- Spain: Dirección General del Agua;
- Estonia: Ministry of the Environment; and
- Latvia: Latvian Ministry of Environmental Protection and Regional Development.

Teleconferences were also held with the UK Environment Agency and Department for Environment Food and Rural Affairs, as well as:

- European Environment Agency;
- Smart Approved Water Mark;
- Food Ethics Council;
- Borenbond;
- Food and Drink Federation (CIAA);
- University of Warwick;
- Sveriges Konsumenter;
- Waterwise;
- CLCV;
- WBCSD;
- WWF Geneva;
- LEAF;
- COPA COGECA;
- Milieukeur; and
- European Water Partnership.

With regard to the private sector, questionnaires were sent through the WBCSD but also directly to over 30 organisations known to have undertaken WF studies or with an interest in the WF approach. In addition, teleconferences were carried out with key industry stakeholders. Respondents to the industry questionnaire and key industry stakeholders with whom consultation was undertaken via teleconference did not wish to be identified.

Email/questionnaire responses were received from the following NGOs:

- CIAA;
- Ecolife vzw;
- Quantis; and
- ISO.

The following stakeholders participated the May 3rd Workshop:

- European Commission: DG Environment, DG Trade, and DG Agriculture;
- Technische Universität Berlin (for head of ISO Working Group);
- University of Twente (by phone);
- University of Warwick;
- Water Footprint Network;
- UK Defra;
- COPA COGECA;
- WBCSD;
- WWF; and
- CIAA.