



**Water Industry Commissioner
for Scotland**

WICS Reporter Services

**STRATEGIC REVIEW OF
CHARGES 2006**

Second Draft Business Plan

**REPORTER'S REPORT
VOLUME 2**

APPENDICIES

June 2005

Black & Veatch



**WICS REPORTER SERVICES
SR06 2nd DRAFT BUSINESS PLAN AUDIT REPORT**

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Appendix A

COSTING SYSTEMS

**WICS REPORTER SERVICES
Second Draft Business Plan**

**REPORTERS REPORT
Appendix A**

COSTING SYSTEMS

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1. INTRODUCTION

The Water Industry Commissioner for Scotland (WICS) has functions and duties established under the Water Industry Act 1999 and confirmed in the Water Industry (Scotland) Act 2002 for the regulation of the water industry in Scotland.

The WICS has appointed a named regulatory Reporter for the Scottish water industry to assist in the discharge of his duties. Mr David Arnell of Black & Veatch Limited is the named regulatory Reporter (the Reporter).

This report forms Appendix X of the Reporter's Report on the second draft Business Plan prepared by Scottish Water as part of the Strategic Review of Charges 2006 and should be read in conjunction with the main report. The reports builds on the Reporter's report on the Q&SIII Costing Systems submitted in November 2004.

The report describes the findings of the Reporter's audits of the costing systems which Scottish Water used to prepare estimates for the main elements of the Investment Plan within the second draft Business Plan. It has been prepared by a Reporter's team under Mr Arnell's direction, composed of senior staff of Black & Veatch.

Our audits have focused on the systems used to prepare estimates for the larger elements of Scottish Water's proposed capital programme. The audit team has followed audit trails to understand the methodologies and sources of information used in the costing systems and assess their adequacy and accuracy.

We have reviewed the costing systems and concluded that they are broadly reasonable provided the scope of work has been robustly identified in a way which is consistent with the costing systems. We have identified particular reservations in the body of this report and have summarised the reservations we consider to be material in our conclusions in Section 8.

This report has been prepared by the Reporter for the use of the Water Industry Commissioner for Scotland and Scottish Water only and is written assuming the knowledge already held by these organisations and the objectives of these organisations in undertaking the work covered by the report. No responsibility is accepted by the Reporter or Black and Veatch for any reliance that may be placed by any third parties on the information contained in this report.

2. Q&S III COSTING SYSTEMS

2.1 Overview of Costing Systems

Scottish Water has adopted five main costing systems to prepare estimates for the Q&S III consultation process and the Draft SBP as follows:

- Scottish Water’s internal costs.
- Consultants’ estimates.
- Scottish Water’s main capital programme costing systems based around WATCOST.
- Scottish Water Solutions (SWS) Framework Contracts drawing on framework contracts currently in use in Scotland.
- Scottish Water Solutions’ own estimates based on projects carried out in England over the last 15 years.

2.1.1 *Scottish Water internal costs*

Scottish Water internal costs have been used to prepare estimates for investment in management and general, central services and programmes of security and key water resource issues covering the following areas of work and drivers:

- Property.
- Scientific Services.
- Information Technology.
- Security
- Fleet.

The cost estimating systems used to cost these elements of the Business Plan are taken from a range of bespoke sources which do not have broader application across the Business Plan. Therefore we have described and commented on these costing systems in the appropriate section of our report on the second draft Business Plan.

2.1.2 *Consultants’ Estimates*

Consultants’ estimating systems have been used to prepare estimates for specific smaller programmes of work where the scope is not covered in detail in the main costing systems and the consultants have particular expertise in this type of work. Individual consultants prepared estimates for the following areas of work:

Consultant	Scope
• Enviro	Land and waste
• Mott MacDonald	WR1
• Babbie	DW20, WR2, WR4, WR5

- Scottish Executive Document WR2 – Fish ladders
- RPS DW17, CS1 – 1 Pressure
- Scottish Water Framework Manager Instrumentation
- Carl Bro Telemetry
- Marsh Associates Health & Safety

The cost estimating systems used to cost these elements of the Business Plan are taken from a range of bespoke sources which do not have broader application across the Business Plan. Therefore we have described and commented on these costing systems in the appropriate section of our report on the second draft Business Plan.

2.1.3 Scottish Water “WATCOST” SYSTEM

Scottish Water’s main capital programme costing systems based around WATCOST was used to cost the main asset maintenance programmes and other minor programmes as follows:

- Capital Maintenance – Non-infrastructure
- Capital Maintenance – Infrastructure
- First time provision – water mains
- Development constraints – water pumping stations
- DW21 – Critical mains
- Odour

We report on our audit of these systems in Section 4 covering non-infrastructure costs and Section 5 covering infrastructure costs.

2.1.4 Scottish Water Solutions Framework Contracts

Scottish Water has used rates from current Scottish Water Solutions framework contracts to developed some standard cost estimates for non-infrastructure maintenance items in Tables C3 and C7 of the final Cost Base submissions. These costs have not been used to prepare estimates for the Investment Plan within the second draft Business Plan. Scottish Water has undertaken a calibration exercise to demonstrate that the two costing systems are broadly equivalent for the Cost Base scopes.

We report on our audit of these systems in Section 5.

2.1.5 Scottish Water Solutions Estimating Systems

Scottish Water Solutions has prepared estimates or provided cost algorithms for the main quality programmes, some parts of development constraints and first time provision of wastewater services as follows:

- Development constraints – water and wastewater treatment works

- First time provision – wastewater
- Quality enhancements – water and wastewater treatment works
- Quality enhancements – UIDs

We report on our audit of these systems in Section 6.

2.2 Project On-costs

The estimating systems for the main capital programme of asset maintenance and quality obligations are based on historic tender costs and generate tender level estimates.

The estimating systems exclude a range of site specific issues which would introduce significant variation into the cost data, for example rock excavation. To complete a reasonable tender cost estimate it is necessary to adjust the estimates to account for the site specific factors excluded from the estimating cost data.

Variations to the design and unforeseen circumstances identified after tender tends to increase construction costs. To develop a reasonable construction cost estimate it is necessary to adjust the tender estimate to account for tender to out-turn variation.

In addition to the construction cost, Scottish Water will incur costs of project management, project development, project design and project supervision which must be added to the construction cost estimate to produce a complete project estimate.

In developing these on-cost Scottish Water has included an element of regional variation within the “site specific costs” and developed a “company specific factor”. Site specific costs are applied to estimates from all costing systems as appropriate. The company specific factor is applied to estimates prepared using the Scottish Water costing system and the Scottish Water Solutions Framework Systems only.

The costs identified above are covered by a series of project on-cost percentages. We report on our audit of project on-costs and site specific factors in Section 7.

2.3 System Calibration

The cost estimates in the second draft Business Plan are generated directly by the estimating systems outlined above. The estimates have not been adjusted to account for any calibration between estimate and actual out-turn costs for historic projects.

We believe that the lack of this calibration is a significant weakness in the system; such a calibration would have significantly increased confidence in the estimating systems by demonstrating their ability to generate reliable estimates of historic projects. A robust calibration would have allowed any bias in the overall estimating system to be identified and accounted for in the Business Plan.

2.4 Cost Base Consistency

A key element of Cost Base benchmarking is that the estimates in the Business Plan are consistent with the standard cost estimates in the Cost Base within the limitations and qualifications of the standard cost specifications. We have compared the source of costing information in the Business Plan and the Cost Base for the major programmes of work in Scottish Water's Business Plan in the table below. We have commented in detail on the consistency between the Business Plan estimates and the Cost Base estimates in this report and in our report on the final Cost Base submission.

Comparison of Investment Plan and Cost Base estimates:

Programme	Business Plan Estimates	Equivalent Standard Costs
Water Treatment Quality Programme	Estimated using Scottish Water Solutions estimating system	as the Business Plan estimates
Water Infrastructure Quality Programme	Estimated using Scottish Water cost functions	as the Business Plan estimates
Water Infrastructure Maintenance	Estimated using Scottish Water cost functions.	as the Business Plan estimates
Water Non-infrastructure Maintenance	Estimated using Scottish Water costing system.	Estimated using Scottish Water Solutions Framework rates.
Wastewater Treatment Quality Programme	Estimated using Scottish Water Solutions estimating system	as the Business Plan estimates
Wastewater Quality uID Programme	Estimated using Scottish Water Solutions estimating system	Bottom up estimates using rates in part taken from Scottish Water Solutions estimating system.
Wastewater Infrastructure Maintenance	Estimated using Scottish Water cost functions.	as the Business Plan estimates
Wastewater non-infra maintenance programme	Estimated using Scottish Water costing system.	Estimated using Scottish Water Solutions Framework rates.

2.5 Cost Driver Descriptions

A description of the drivers DW1 to DW21 and WR1 to WR5 referred to in Section 2 is included as Appendix A. Not all Q&SIII drivers were supported in the final Ministerial Objectives Statement on which Scottish Water's Business Plan is based.

3. SCOTTISH WATER WATCOST - NON-INFRASTRUCTURE MAINTENANCE ESTIMATES

3.1 Introduction

This section of the report remains substantially unchanged from our report concerning Scottish Water's Q&SIII costing systems of November 2004.

Scottish Water's capital investment costing systems have been used to prepare estimates for non-infrastructure maintenance for the second draft Business Plan.

The costing systems are based on the analysis of data from projects undertaken by Scottish Water or the predecessor authorities supplemented by data from TR61 Version 5.

The estimating systems follow a reasonable methodology which divides costs into three main levels:

- Element Costs which represent the basic scope of the works, for example the direct costs attributed to the civil works of a settlement tank. The costs of individual elements are taken from tender price schedules. A yardstick measure of the element of work is also recorded, for example the volume of a tank or the installed power of a pump set. Statistical techniques are applied to fit cost functions relating cost to the yardstick for each element of work.
- Level 1 On-costs represent tender costs which cannot be related to specific work items or cannot be readily quantified in outline estimates. For example the general items included to cover contractors' supervision and insurances or the landscaping of a treatment works.
- Level 2 On-costs represent the "Client" costs associated with project delivery such as design, supervision, legal and environmental costs, the central capital investment team and other central support services which contribute to capital delivery.

The estimating system converts all data to a common base date using the Output Price Index for New Construction Work (COPI) to account for inflation. The second draft Business Plan estimates were prepared at a common base date of Q3 2002 using a COPI index of 128. The Cost Base is presented at a COPI index of 128. The B Tables and C Tables in the Business Plan are presented at mid 2003-04 prices at a COPI index of 135.25.

"Site specific factors" and "company specific factors" have been applied to the second draft Business Plan estimates for non-infrastructure maintenance. These have been developed from an assessment of selected cost drivers in different regions of Scotland. In particular, their distribution reflects the difficulty of working in remote areas including increased transport costs and travelling time. The assessment and application of site specific factors and company specific factors are described in Section 7.

The estimating systems for construction costs are substantively the same as those used to prepare the standard cost estimates presented in the 2002-03 J Tables. The design and supervision and management on-cost percentages applied in the second draft Business Plan estimates are different from those applied when preparing the 2002-03 J Tables. While differences exist in individual on-costs, Scottish Water has aimed to ensure that the

totality of the on-costs applied to the second draft Business Plan reconcile to the total on-costs applied to the 2002-03 J Tables (see Section 7).

The estimating system is based on cost data derived mainly from new-build projects (either new works or extensions to existing works). As a result the cost data is not necessarily representative of the cost of maintenance work which will include smaller projects and will be carried out on and in existing assets. Scottish Water has applied on-cost additions to account for additional costs associated with demolition of existing plant and working on live sites. Where necessary, factors have been applied to relevant cost functions to reflect the partial replacement or refurbishment of a plant item. The on-cost adjustments and factors applied are based on expert judgement and not supported by the analysis of historic infrastructure maintenance project data. We understand that Scottish Water is developing its estimating system to record maintenance costs in a systematic way so that future non-infrastructure maintenance programmes can be costed on the basis of relevant historic cost data.

Scottish Water has not applied this costing system to the standard cost estimates relating to non-infrastructure maintenance in Tables C3 and C7 of the final Business Plan Cost Base. A more detailed schedule of rates taken from the current Scottish Water Solutions framework contracts have been used instead as described in Section 6.

In this section we report on the Element Costs and the Level 1 On-costs which generate a tender level estimate. Level 2 On-costs (including site specific factors and “company specific factors”) are covered in Section 7.

3.2 Element Cost Models

The costing system is based on the analysis of elements of work which define the basic scope of a project. The elements used reflect:

- the basic process division of water and wastewater projects;
- common items of plant used;
- the structure of standard price schedules; and,
- the level at which a project can be defined in an outline design.

Separate element cost models are normally developed for civil engineering works and mechanical/electrical works. For example the civil engineering works associated with an aeration tank and the mechanical and electrical works of the associated aeration system.

Element costs are prepared from tender submissions from successful tenders.

Each element cost is identified against an element yardstick measure representing the size of the element. The yardstick selected is a parameter such as volume or installed power which can be defined with reasonable accuracy in an outline design.

The yardstick can be a simple measure (such as the volume of a tank or the installed power of pumping plant). In other cases more complex “omnibus” yardsticks are used to reflect a combination of size and complexity. For example the omnibus yardstick measure used to quantify an inlet works combines the dry-weather flow and the number of plant items included in the works.

The costing system used for the non-infrastructure maintenance estimates in the second draft Business Plan is based on a suite of 79 element cost models. These are derived from 4 sources:

- 32 element cost models are based on Scottish Water data which combines cost data from current Scottish Water projects and projects undertaken by the three predecessor authorities.
- 17 element cost models are based on projects undertaken by individual predecessor authorities (12 based on East of Scotland Water Authority data and 5 based on West of Scotland Water Authority data)
- 29 element cost models are taken from TR61 V5.
- 1 element cost model was adopted from an English WaSC.

Models have been adopted in the order outlined above where there is sufficient data to provide a reasonable statistically based model. This gives priority to recent in-house data and relies on older data and national data when more recent in-house data is not available.

The balance of the numbers of cost models from various sources implies a heavy reliance on either old data or national data over recent in-house data. However the key elements of wastewater treatment, wastewater pumping and buildings are covered by Scottish Water element cost models. There is greater reliance on national cost data for water treatment. But even for water treatment, key elements of plant such as rapid gravity filters and service reservoirs are covered by Scottish Water models. It is likely that element cost models based on Scottish Water data are used for a significantly greater part of the estimated costs than the number of models implies. This could only be confirmed if Scottish Water was able to identify how an individual cost model contributed to the overall cost in a programme of work.

We understand that a facility to trace the use of cost models will be included as Scottish Water introduces a new costing system. This will allow Scottish Water to determine the programme cost generated by individual cost functions and focus review on cost functions which generate a significant cost. It would allow estimates to be updated when individual cost functions change as the underlying data is updated or corrected.

3.2.1 Scottish Water Element Cost Models

A sample audit was undertaken of the Scottish Water element cost models.

A sample of projects was selected which provided element costs for a wide range of models. Scottish Water was not able to provide access to the tender documents for these projects.

Scottish Water offered a sample of projects for which tender documents could be provided. In practice, this sample was limited to projects analysed in the former North of Scotland Water Authority area in 2003-04. Tender cost schedules were available but detailed drawings could not be provided. The documentation offered was reviewed and a sample selected for audit. Through this audit we were able to confirm the mechanics of the system. However, the restricted sample limited the opportunity to test a wider range

of key cost models and build an understanding of their scope and the consistency of data analysis across different areas and different years.

While recognising that the element model data spans a number of reorganisations we were surprised that key data such as tender documents which had been used in recent cost analysis could not be made available for audit. We recommend that Scottish Water reviews its procedures for maintaining audit trails to key data such as tender documentation.

Through audit we were able to confirm reasonable accuracy of data transfer for element costs from the tender documentation to the cost models. However, at times we found it difficult to track costs through the system and could not finally reconcile cost data with the price schedule. We understand that the new estimating system being introduced by Scottish Water will reinforce structures and rules for allocation of each item in the tender price schedule to one or more cost models.

Scottish Water has adopted combined mechanical/electrical cost functions as opposed to separating out mechanical and electrical costs to individual cost functions. This approach avoids the risk of cost duplication caused by different estimators taking a different view on the separation of mechanical and electrical costs in different tender price schedules. This is beneficial when new works are being costed. However, when separate mechanical and electrical equipment replacement is identified in a maintenance programme a further judgement is required to proportion the cost function between the two categories. We understand that the new estimating system being introduced by Scottish water has the ability to maintain separate electrical and mechanical cost functions in addition to the combined mechanical/electrical cost function to improve estimates for maintenance work.

Electrical equipment tends to serve a number of items of plant on a works, for example the MCC on a project may serve all plant and cabling may be billed as a lump sum. As a result some judgement is required when allocating electrical costs to individual elements. Where possible, Scottish Water has attempted to allocate costs directly to individual plant items. Where this is not possible, electrical costs have been allocated in proportion to cost of the mechanical plant.

We noted minor inconsistencies in the allocation of costs between civil engineering and mechanical/electrical cost functions. For example, the cost of pipework in tanks might be allocated as either a civil engineering cost or a mechanical/electrical cost. We identified areas where the scope of an element was not clear, for example whether the pumping plant, chemical dosing plant and backwash tanks are included in a membrane element cost function. We recommend that Scottish Water undertakes internal reviews to identify areas where cost allocation is unclear or inconsistent and revise and reinforce allocation rules as necessary.

We noted examples of site specific costs (say excavation in rock) being excluded from the element cost models. We also found non-specific cost items such as site investigation, site clearance and general surfacing around elements of plant which had not been included in the cost data used to generate the cost functions.

While we were able to identify site specific items excluded from the cost functions, Scottish Water were unable to quantify these items. We recommend that Scottish Water revise its methodology for collecting cost data to ensure that all project cost is accounted for and it is possible to identify the proportion of costs which are not covered by specific cost functions or percentage on-costs.

We were unable to undertake a representative audit of the assessment of yardstick quantities because the necessary drawings and equipment schedules were not available during the audit. From the limited sample of projects reviewed we are concerned that yardstick quantities are not assessed on a consistent basis. For example, we understand that it is Scottish Water's policy to estimate costs on the actual structural volume of a tank including an allowance for freeboard. From the limited data made available in the audit we noted the use of nominal process capacity as the yardstick quantity. It is important that yardstick data is applied in estimates in the same way it was developed from project data. We recommend that Scottish Water reinforces its policy for yardstick quantities and carries out a review of data abstracted to date to confirm both consistency across the project analysis and consistency between project analysis and the way yardstick quantities are assessed for estimates.

The statistical analysis for a sample of the cost curves was reviewed. The analysis complies with standard statistical techniques based on log-normal distributions but without any bias correction. The cost functions developed appear to be a reasonable fit to the data. A range of models are considered when the data is fitted to a cost function. It was apparent that the cost functions and data are inspected to ensure that the cost equation used is reasonable and the cost function is representative of the data.

Some cost functions are applied outside the range of the data used to develop them. The resulting estimates should be treated with caution. We recommend that:

- Any cost function where the exponent is greater than unity should be reviewed (for example fine bubble diffused aeration). Here, extrapolation beyond the upper data range can give unreasonable results.
- Cost estimates below the range of available yardstick data can be prone to significant error particularly when the cost function tends to zero at zero yardstick. Minimum plant size and cost should be considered when extrapolating to small size plant. This should include reviewing whether alternative technology such as package plant becomes the least cost solution for small plant.

We found that project analysis was selective. Not all available projects are analysed. Not all possible element costs had been taken from the projects analysed. We understand that the system was initially developed to provide the data required to complete the Annual Return Cost Base (J Tables). Effort was focused on collecting data necessary to develop and reinforce J Table cost models. Data has not been captured where:

- The relevant plant item did not form part of the standard cost models adopted by Scottish Water.
- Where there was already sufficient model data to provide a robust model.

As a result we believe that Scottish Water has lost an opportunity to:

- Develop cost models that would support a wider costing system including developing estimates for new standard cost models as they arise. For example, we noted projects where data on UV wastewater disinfection had not been captured which could have provided the basis of the new standard cost models in the Annual Return 2004.
- Consider the economic options for a range of wastewater solutions. For example costing SBR plant.

- Refresh well populated cost models with more recent data.

We recognise that Scottish Water has made rapid progress in drawing together and developing its cost data system. As the system develops, we suggest that a more complete analysis should be undertaken considering all projects carried out and accounting for all costs in the projects analysed.

We also understand that Scottish Water has initiated a significant upgrade of its costing processes based on the “Engineering Estimating System” which will address many of the points made above and improve traceability from historic cost data through cost functions to estimates.

Scottish Water does not have a documented quality assurance system for developing the element cost models which specifies the systems used and the level of checks and reviews expected. Despite this, during the audit we were able to observe the following:

- individual documented procedures covering particular aspects of the work;
- a consistent approach to data handling;
- a reasonable degree of checking; and
- data transfer was generally accurate.

We recommend that Scottish Water develops a quality assurance system for its costing systems which would draw together existing procedures, formalise data handling systems and define and document checks and reviews carried out.

3.2.2 Former Water Authority Element Cost Models

Scottish Water was not able to provide the cost data which underlies the models based on the data of the three former authorities. No audit of the underlying data was possible.

We recommend that Scottish Water should review its audit trails to the cost models of the three former authorities.

Where possible we have compared these models with equivalent Scottish Water models or TR61 V5 models and found them to be reasonable.

3.2.3 TR61 Cost Models

In the absence of cost models based on Scottish Water or data from the three previous authorities, TR61 V5 cost models have been used. TR61 is an estimating system for water and wastewater schemes developed by water and sewerage service providers in England, Wales, Scotland and Northern Ireland, including Scottish Water and its predecessor authorities. It has been developed and maintained on behalf of the stakeholders by WRc. Version 5 of TR61 includes an independent audit statement by Halcrow Water Management Sciences Ltd.

The TR61 element cost models adopted by Scottish Water are taken from Version 5 of TR61 dated March 1998 and includes data up to September 1997. TR61 has continued to

be updated and Scottish Water has a copy of the latest version (Version 7). Scottish Water has continued to use Version 5 of TR61 for the Q&S III costing systems because it is consistent with the structure of its in-house estimating system allowing the two systems to be integrated with ease. However it does mean that the resulting costs are based on relatively old data.

During audit we checked and confirmed the cost functions used against TR61.

There is a possibility that differences in the way costs are allocated in different systems will create anomalies when the systems are combined. We recommend that Scottish Water reviews the in-direct cost allowances in TR61 to confirm that they are consistent with the Scottish Water Level 1 on-costs described below.

3.3 Level 1 On-costs

Level 1 On-cost represent tender costs which cannot be related to specific work items or cannot be readily quantified in outline estimates. For example the general items included to cover contractors' supervision and insurances or the landscaping of a treatment works.

Scottish Water costing systems applies the following Level 1 On-costs:

Item	Factor %	In 2DBP Cost Base (NIM)	In 2DBP NIM Estimates
General Items	24.12%	Y	Y
Interconnecting Pipework	4.76%	Excluded by spec.	Y
General site telemetry	3.29%	Specific provision	Y
Site cabling	2.04%		Y
Landscaping	0.92%		Y
Fencing & Gates	0.72%		Y
Site works	0.52%		
Roads & Paths	3.03%		Y
Live site working	10.00%		Y

The Level 1 on-costs (with the exception of “live site working”) are derived from an analysis of tender documents for projects undertaken by Scottish Water.

Each percentage is applied to the total element cost estimate for the works to give an estimated tender cost. The percentages are additive and not compound.

The Scottish Water costing system was initially developed to prepare standard cost estimates in the Annual Return J Tables. As a result the Level 1 On-costs used in the standard cost estimates (General Items, Interconnecting Pipework and General Site telemetry) are well populated with data from a wide range of projects. Other percentage on-costs (excluding “Live site working”) have been populated with data from a limited set of projects and may not be representative of work undertaken by Scottish Water.

The analysis of Level 1 On-costs does not include data from projects where the relevant on-cost value was zero. However, the on-cost percentages are applied to all project estimates. We recommend that the analysis should be reviewed to take account of all on-cost on all projects. This would ensure that estimates are representative of all historic costs.

We reviewed a sample of projects to confirm the capture of Level 1 On-costs from individual projects and the overall assessment of Level 1 On-cost percentages. We found the assessment to be variable.

We found that the choice of denominator for the analysis of general items was inconsistent and the analysis may underestimate the true general items percentage.

We also found that the denominator used for the analysis of other Level 1 On-costs was inconsistent with the way the on-costs are applied and might marginally underestimate the on-cost percentages.

The site cabling on-cost was developed from a limited number of small projects. For projects reviewed in the audit, all cabling and general site electrical work was distributed across the mechanical and electrical element costs. It is probable that the “site cabling” on-cost duplicates electrical costs already covered in the element costs. We recommend that Scottish Water reviews and defines the scope of Level 1 On-costs to ensure that the analysis of element and on-costs are mutually exclusive. We recommend that the Level 1 On-cost for site electrics should not be applied until this review has been completed.

The Level 1 on-costs have been developed for non-infrastructure projects as a whole. For future work we suggest that Level 1 on-costs should be considered for different types of work where there is sufficient data to support separate analysis. In particular we recommend that separate on-costs should be developed for water treatment and wastewater treatment. This would assess whether different types of work or different methods of procurement generate different on-costs. It would provide confidence that the on-costs applied remain appropriate irrespective of the balance of future work between the water and wastewater services.

No assessment has been made of the variability of Level 1 On-costs with size of projects. In our experience the percentage of general items tends to be higher for small projects. Any variation with size could become important if the balance of work in the programme is different from the balance of work covered in the estimating system data. We recommend that Scottish Water considers the variability of Level 1 On-costs with size of project to determine whether size of project has a material impact on cost.

A “Live site working” on-cost of 10% of net construction cost has been included in all non-infrastructure maintenance estimates to cover the additional costs of working within live sites. The addition appears to be reasonable in principle given that most of the underlying cost data has been developed from new works or major works extensions, but the value of 10% has not been supported by historic data. Some element of live site working will be covered by the project data used to develop the cost functions. We recommend that Scottish Water clarifies the circumstances in which this nominal on-cost should be applied and ensure that it is also excluded from project data used to develop the cost functions.

3.4 Inflation Adjustments

Inflation adjustments are based on COPI indices. The estimates for the second draft Business Plan have been prepared for a base date of September 2002 (Q3 2002 COPI = 128). The estimates are presented in the B Tables and C Tables at mid 2003-04 prices using COPI index of 135.25. The Cost Base submission is presented at mid 2002-03 prices, COPI index 128.

In the estimating system cost data used to drive the element cost models are inflated or deflated to a common base date of December 1996 (Q4 1996 COPI = 103). During the audit we identified project cost data which had not been converted to a Q4 1996 base date before the cost functions were developed. We did not observe a consistent pattern in this error. We recommend that Scottish Water review the data, make the appropriate inflation adjustments, regenerate the relevant cost functions and adjust the estimates accordingly.

We noted that it was not always possible to reconcile cost data points in the cost models with the project costs adjusted by COPI. We understand that this minor discrepancy is due to the use of estimated COPI factors at the time the project was analysed which have since been replaced with final values. It is difficult to determine whether this introduces any bias in the estimate or whether a range of minor errors will cancel each other out. For future work we recommend that Scottish Water develops its costing system to allow project data to be entered with a tender date as opposed to a COPI index. As indices are updated the adjustments of the models to true COPI inflation could be automated. While data might be analysed against estimated COPI figures in the first year, subsequent updates of the models would use corrected COPI data.

3.5 Application of the Non-Infrastructure Estimating System

The Scottish Water WATCOST estimating system has been applied to the second draft Business Plan estimates in one of two ways:

- Directly to the asset maintenance interventions identified through a process of BIS workshops carried out on major or critical assets.
- Through the valuation which generated the asset inventory and EARC valuation presented in the 2003-04 Annual return.

3.5.1 Application to BIS Workshop Interventions

We have reviewed a sample of the estimates prepared for the asset maintenance interventions identified through the BIS workshops.

The estimates were prepared to a well defined structure which takes the output from an assessment of capital maintenance “interventions” and provides cost information to the assessment team to allow the scope of capital maintenance in Q&S III to be determined.

Asset maintenance interventions may form only a part of the scope of works covered by a cost function. To address this, each intervention calls for a percentage of the cost model to be applied. Standard percentages have been developed to cover:

- Minor refurbishment.

- Major refurbishment.
- Plant replacement.

More detailed percentages have been applied to cover replacement or refurbishment of part of the equipment covered by an element cost. The percentages applied are based on expert judgement which adds a level of uncertainty to these estimates.

The description of the interventions from the workshops was not always clear and required some interpretation by the estimator which introduces further uncertainty. To address this two processes were put in place:

- A query process to clarify descriptions.
- A check process whereby the completed estimates were returned to key staff involved in the workshop including the Scottish Water Asset Planner responsible for the works. This allowed the cost estimate to be reviewed to ensure that it was a reasonable reflection of the intention of those who identified the interventions through the workshops.

Through our audits we saw evidence of both processes working. Our conclusions were that:

- For major items of work where plant replacement or major refurbishment was necessary the estimating system was reasonable.
- We had concerns over estimates for small items of work where the limited choice of percentages sometimes generated estimates for small items of plant replacement or refurbishment which appeared to be high.

With the exception of site clearance, Scottish Water applied the full set of Level 1 on-costs set out above to the estimates. The full Level 2 on-cost, site specific factors and company specific factor has also been applied to the estimates. We have the following concerns over the application of the full Level 1 percentages to the non-infrastructure maintenance estimates as follows:

- We believe that it might create overlap with other specific programmes, for example fencing.
- The “site cabling” percentage appears to be based on the analysis of a very limited sample of small projects and appears to duplicate cabling costs which were distributed across the M&E cost functions when historic costs were analysed.
- The maintenance programme tends to be biased towards partial replacement of short to medium life assets (mechanical and electrical plant) within existing structures. The estimating system assumes that an equivalent proportion of longer life assets such as interconnecting pipework, fencing and gates and roads and paths will require replacement at the same rate. While accepting that the percentages represent an overall programme amount, if the analysis was primarily based on green field site works, they may not be appropriate for capital maintenance projects.

The Level 1 on-cost for “site works” has been excluded from the non-infrastructure maintenance estimates for two reasons:

- The item covers site clearance and demolition prior to construction and is based on the analysis of a small number of small projects in the north east. The non-infrastructure maintenance programme is likely to focus on the replacement and repair of mechanical and electrical equipment which is unlikely to require site clearance works.
- Where plant replacement is required, a 10% enhancement has been included in the element costs to allow for demolition disposal and replacement of the existing plant.

This allowance for demolition of existing equipment is reasonable in principle. The cost data in the estimating system is mainly derived from “new-build” projects and does not reflect the additional costs of removing existing plant. However, the percentage has not been justified by the analysis of historic cost data. It is not clear whether it duplicates the cost covered by the “live site working” on-cost.

3.5.2 Application to generic models for non-infrastructure asset maintenance

Scottish Water has adopted a generic assessment to the non-infrastructure models based on the asset inventory and valuation carried out for the 2003-04 Annual Return. The same update cost functions were used to prepare the J Tables (Cost Base) for the 2003-04 Annual Return.

The asset valuation was based on the asset inventory for the 2003-04 Annual Return valued using the Scottish Water WATCOST non-infrastructure maintenance estimates.

The same costing system structure used for the 2002-03 Annual Return which was applied to the BIS model interventions described above was used to prepare the 2003-04 EARC values. The costing data was updated in two ways:

- Additional data was obtained from recent projects to reinforce the cost data on which the cost functions are based.
- Some historic data over 10 years old was “retired” where it was possible to do so without affecting the statistical validity of the cost relevant cost functions.
- The cost functions were updated for inflation.

We audited the updates of the costing systems and their application to the EARC valuation as part of our audits of the J Tables (Cost Base) and the G Tables (Asset Inventory). As part of our audit of the Business Plan we were able to confirm that the asset inventory used in the generic asset maintenance estimates were consistent with the estimates used in the Annual Return 2003-04. The 2003-04 Annual Return asset valuation is also the basis of the depreciation records in the Business Plan.

The generic assessment included an assessment of all assets including those subjected to a detailed workshop. From our audits we were able to confirm that there was not double counting between the generic and workshop interventions. Where a workshop had been held the workshop results were taken. Based on the generic and detailed workshop assessments carried out we note that the estimates prepared using the generic model were generally higher than the estimates from the rigorous work shops. This does not necessarily make the generic model wrong as we noted that the workshops only take an

average risk over the period and there may well be items at high risk of failure towards the end of the period that have not been identified for replacement. However, what it does do is to indicate the uncertainty in the estimates..

4. SCOTTISH WATER INFRASTRUCTURE MAINTENANCE ESTIMATES

4.1 Sources of Cost Data

Scottish Water second draft Business Plan estimates for infrastructure are based on the cost data collated for the standard costs in the 2003-04 Annual Return J Tables (Cost Base) and G Tables (Asset Inventory)

The estimates and valuations in the 2003-04 Annual Returns were developed from the analysis of recent project tender or target cost estimates. The project data was used to prepare either:

- Cost functions typically relating cost to diameter for different surface types.
- Or individual estimates to align with specific cost base scopes (for example new and renew communication pipes for short and long side).

Two cost data sets were prepared allowing two separate sets of cost functions to be prepared:

- Project cost data and cost functions exclusive of the site specific items and other general exclusions required by the standard cost specifications of the Cost Base. These data sets and cost functions were developed for the standard cost specification for sewer depth of 2 m to soffit (data in a band of 2-3 m to invert was used).
- Project cost data and cost functions inclusive of all costs (including site specifics) which made up a project tender cost. These data sets and cost functions were developed for banded depths for sewers (based on depth to invert and with separate functions for depth bands 0-2m, 2-4m, 4-6m and 6-9m).

Not all projects analysed to generate the standard cost data set were reanalysed to generate the project tender cost data sets.

In addition to the basic cost functions which represent tender costs the standard cost estimates and asset valuations in the 2003-04 Annual Returns included two on-cost additions:

- A tender to out-turn margin of 2.82%.
- A Scottish Water management cost of 3.00%.

4.2 Application to the Business Plan estimates

Infrastructure maintenance estimates

The cost data sets and cost functions used to prepare the EARC valuations in the 2003-04 Annual Return G Tables (Asset Inventory) have been used to prepare estimates for infrastructure maintenance in the second draft Business Plan. These cost data sets and cost functions are inclusive of the site specifics and other general costs which make up a tender costs.

The tender cost data sets and cost functions have been adjusted as follows before being applied to prepare infrastructure maintenance estimates for the second draft Business Plan:

- A COPI adjustment to Q3 2002-03 prices at COPI index 128.
- A global adjustment to remove site specific and company specific factors allow these to be reintroduced as regional factors.

In addition to these adjustments, Scottish Water has included a general adjustment to reflect a difference between the cost data derived for Scotland and the cost data from Scottish Water Solutions which has been used to cost the quality programme. We have reviewed the basis of this adjustment and asked Scottish Water to provide further information to demonstrate that the projects considered in the review are representative of the term contracts and programmes of work through which a significant element of the sewerage infrastructure maintenance programme is delivered.

Communications pipes

In the business plan there are two categories of communication pipes that are costed: communication pipes replaced when mains are replaced and lead communication pipes that are replaced following a customer request. The former is replaced under Scottish Water's various frameworks and the latter is replaced by Scottish Water's Direct Labour Organisation (DLO).

For the former Scottish Water has correctly taken the AR 2003/4 cost base cost. For the latter Scottish Water has taken the actual costs expended by the DLO in 2004/5 from its corporate systems.

Enhancement programme estimates

Sewerage infrastructure rates have been used to develop two main elements of the enhancement programme estimates:

- Interconnecting pipework required for the unsatisfactory intermittent discharges programme.
- Provision of first time sewerage.

The sewerage rates used are taken from the Scottish Water Solutions estimating system (see Section 6).

4.3 Application to the final Cost Base submission

The cost data sets and cost functions used to prepare the 2003-04 Annual Return J Tables (Cost Base) have been used to prepare the standard costs in the final Cost Base submission for the second draft Business Plan. These cost data sets and cost functions represent tender costs exclusive of site specifics and the other general exclusions of the standard cost specifications. We believe that they are broadly consistent with the rates, on-costs and other adjustments applied to the Business Plan with the exception of the adjustment made to align the rates with the rates used by Scottish Water Solutions to cost elements of the quality programme.

5. SWS FRAMEWORK ESTIMATES

5.1 Introduction

Scottish Water Solutions Framework estimates have been developed from rates taken from current framework contracts between Scottish Water Solutions and Scottish Water and Scottish Water Solutions supply chain used in the delivery of the Q&SII programme.

This costing system has been used to cost non-infrastructure elements of the Cost Base only (Tables C3 and C7, Pumping Stations)

5.2 Sources of Cost Data

The cost rates are taken from Scottish Water's Framework contracts and suppliers' information as follows:

1. Labour and plant rates from Schedule A of the Q&SII agreement between Scottish Water and Scottish Water Solutions.
2. Plant supply and delivery costs taken from framework suppliers

Installation costs are built up from the Schedules A rates applied to labour hours assessed by Scottish Water Solutions estimating staff.

A general items percentage of 24.13% is applied, consistent with the Scottish Water estimating system. No other on costs are applied because the items of work to be included are clearly set out in the Cost Base item descriptions.

The live site working and demolition percentages included in the non-infrastructure maintenance estimates for the Business Plan are not applied. We consider that the hours included in the Cost Base estimates are reasonable for the type of work specified and therefore a further allowance for live site working is not necessary.

The design and supervision percentages of 2% and 4.5% respectively are lower than the equivalent percentages applied to the non-infrastructure estimates in the Business Plan (a total of 20% for smaller projects similar to the Cost Base examples). Scottish Water considers that the detailed requirements outlined in the Cost Base specification shows that the plant has been investigated, scoped and the outline design developed based on like for like replacement. As a result design and supervision will be significantly reduced.

The standard cost estimates do not take account of any pain/gain payments which may be incurred under the contract. Scottish Water reports that it is too early to include a realistic assessment of whether the Q&SII programme will be delivered for less or more than the target cost.

The rates have been adjusted for inflation as follows:

1. Schedule A rates: no adjustment as the agreement with SWS was signed in October 2002 and the rates can be applied to a Q3 2002 base date.
2. Current budget or framework prices: Assumed to be Q1 2005 at a COIPI index of 145 and adjusted to Q3 2002 using a factor of 128/145.

6. SWS ESTIMATING SYSTEMS – QUALITY PROGRAMME

6.1 Introduction

Scottish Water commissioned Scottish Water Solutions (SWS) to prepare estimates for the following parts of the Q&S III programme:

- Wastewater treatment quality programme.
- Water treatment quality programme.
- Unsatisfactory intermittent discharge (UID) quality programme.
- First time provision of sewerage and associated wastewater treatment.
- Development Constraints (water and wastewater treatment).

The estimating system is based on tender data from projects undertaken in England over the last 15 years.

The estimating system follows a reasonable methodology which divides costs into three main elements:

- Direct Costs which represent the basic scope of the works. The costs of individual elements are taken from tender price schedules or bottom up estimates where there is insufficient data to create a reliable cost function. A yardstick measure of the element of work is also recorded. Statistical techniques are applied to prepare cost functions relating cost to the yardstick for each element of the work.
- Site Specific Add Ons which represent tender costs which cannot be related to specific elements of work or cannot be readily quantified in outline estimates. These costs are included either as percentage additions developed from historic tender data or as specific estimates prepared from an assessment of an individual site. In some instances the Site Specific Add Ons available in the estimating system have been replaced by Scottish Water's on-cost percentages to reflect Scottish Water's experience and approach to costing. Costs which can be considered as site specific add ons are:
 - Interconnecting pipework.
 - Ground conditions.
 - Location costs.
 - River/stream diversions.
 - Service diversions.
 - Demolition costs.
 - Contractors additional costs
 - Other costs

- Land costs.
- Level 2 On-Costs. Scottish Water's Level 2 on-costs have been applied to the SWS estimates to represent costs associated with project delivery such as design, supervision, legal and environmental costs, the central capital investment team and other central support services which contribute to capital delivery. Scottish Water's site specific factors have also been applied in place of some of the site specific add-ons outline above. Scottish Water's estimated company specific factor has not been applied to the Scottish Water Solutions estimates. The Level 2 on-costs are commented on in Section 7.

The estimating system converts all data to a common base date using COPI to account for inflation. The Q&S III estimates are prepared for Q3 2003 using a COPI index of 128 consistent with other estimates in the second draft Business Plan and the final Cost Base submission.

6.2 Direct Cost Estimates

6.2.1 Project analysis – cost data

We have reviewed the cost data and direct cost functions developed by Scottish Water Solutions. We have noted that a substantial review of the cost data has been undertaken since our initial audits in June and September 2004 and substantive improvements made to the costing systems. Significant changes include:

3. Identification and elimination of rogue yardstick data which were distorting some cost functions over the range of yardstick values which are material in Scottish Water's Business Plan.
4. Extending the range of data available to improve the fit between cost functions and cost data. For selected cost functions with a significant impact on the programme alternate small yardstick cost functions were developed from bottom up estimates.
5. Ensuring that the Business Plan estimates are based on the required yardstick value and not limited to the minimum data point used to generate the cost function.
6. Identifying and eliminating areas of double counting between cost functions for different process units or between the electrical and mechanical cost functions for an individual cost function.
7. Introducing cost data for nano-filtration plant from Scottish Water. Nano-filtration is common quality intervention in the Business Plan in response to colour and THM drivers. It also addresses cryptosporidium risk on those sites (although it is not a direct response to the cryptosporidium driver). Scottish Water has recent experience of this type of plant which provide a robust cost function over the range of yardstick values relevant to Scottish Water's Business Plan.
8. Developing a specific interconnecting pipework percentage for the UID programme based on a review of a random sample of projects in the programme.

SWS was only able to offer a restricted sample of recent project data for the audit. In particular, it was not possible to obtain project data from before 2000. Our conclusions are based on an assumption that the sample available is representative of the cost data as a whole.

During the audit cost data from 12 projects were reviewed in detail covering water treatment, wastewater treatment and UID projects.

From our sample audit we found the collation of cost data and the transfer of costs to the database was accurate. The allocation of direct costs to the elements required in the costing structure appeared to be reasonable. We continued to note some mis-allocation of historic project data which will give rise to limited double counting in the estimates.

The direct costs include a distribution of general items such as:

- Preliminaries (including temporary works and staffing).
- Contractor design.
- Testing and commissioning.
- Risk allocation.
- Provisional sums and dayworks.
- Management fee.

These general items are distributed in proportion to the costs which could be allocated directly to each element of the works. We found the detailed cost allocation was robust with good supporting audit trail.

This approach differs from the Scottish Water system described in the previous sections in that the resulting cost functions are broadly inclusive of the Level 1 on-costs developed by Scottish Water. They are also inclusive of risk allocation, provisional sums and dayworks. We believe that this approach helps ensure that the general costs included in an estimate take account of potential cost drivers such as the size of project and type of work which might not be reflected by global percentages developed from a range of historic projects.

A downside of this approach of distributing general costs is that the general costs cannot be varied to suit the type of work being costed. However, in this case we take comfort from the fact that the work being costed is similar in nature to the projects from which the cost data was derived.

The direct costs collated for an element of work aims to include all costs associated with that area of work, for example:

- The road around the item of plant.
- Landscaping around the item of plant.
- The proportion of electrical equipment necessary to serve the item of plant.

During the audit we found that these supporting items were either attributed to the element of plant, accounted for as a separate direct cost function (for example access

roads or general site landscaping) or deemed to be covered by the interconnecting pipework percentage. As a result they are fully accounted for when an estimate is prepared.

We noted that some minor items of electrical work could be allocated to a general code during project analysis. It is possible that the estimating system does not account for these costs when an estimate is prepared. We suggest that the system is reviewed to ensure that these electrical costs (and any other similar item) are either allocated to specific direct cost categories, distributed across direct cost categories in the same way as general items, or used to develop a general electrical percentage.

The SWS data set contains data up to 15 years old. We recommend that the data should be reviewed to determine whether old data can be retired while maintaining the statistical validity of the cost functions.

It was recognised that in some cases the Scottish Water Solutions cost data sets did not cover the range of yardstick values which were important for Scottish Water's Business Plan. For selected cost functions with a significant impact on the programme alternate small yardstick cost functions were developed from bottom up estimates. Examples include lamella separators for washwater treatment, small pumping stations, measurement and sampling for disinfection control and dirty backwash-water balancing tanks. We have reviewed a sample of these cost functions developed from bottom up estimates and concluded that:

- The costs are either bottom up estimates based on detailed scopes of works or developed from project data over a limited range of yardstick data.
- SWS demonstrated that the bottom up estimate for lamella plant was consistent with historic costs for similar plant.
- The estimated cost of small dirty backwash tanks are greater than the costs of larger tanks which were developed from historic data. We believe that a simpler scope could be developed which would generate a lower cost consistent with the historic cost function for larger tanks.
- We remain concerned by the cost of small pumping stations which are a frequent component of the water quality programme and would like further justification of the underlying data.

It was also recognised that Scottish Water had more recent experience and a more appropriate range of nanofiltration plant commonly used as an intervention in the Business Plan against colour and THM drivers at small treatment works. Data from Scottish Water was provided to Scottish Water Solutions and used to prepare a cost function in the SWS estimating system. From a review of this analysis we have concluded that there were a compensating errors in the analysis. Scottish Water has confirmed that this is the case and stated that the combined effect was to underestimate the cost of nanofiltration in the Business Plan by £1.7 m. We have not audited the revised cost function.

6.2.2 Project analysis – yardstick quantities.

A substantive review of the project data has been undertaken since our initial audits of the SWS costing system including a review of yardstick quantities. This review focused on “rogue” data points where either the yardstick quantity was obviously not representative of the project or the data point appeared to be significantly out of place compared with the broad trend of the data. Where possible, data was reviewed and yardstick values adjusted. Data points which represented partial replacement or refurbishment of a process element were eliminated. It was not always possible to obtain the source data. If a data point was doubtful and the source data could not be obtained it was omitted from the analysis.

We have reviewed a sample of the amended cost functions and observed changes made as part of other audit trails through the revised cost data. We believe that the process described above was appropriate and applied in a robust way.

Through our audit we were generally able to confirm that the yardstick values had been derived and applied in the same way. We normally found that the nominal process volume has been used as the yardstick in both the cost function and the Business Plan estimates.

We have not been able to finally resolve a query in respect of the yardstick for the cost function for wastewater treatment plant pumping. The yardstick quantities in the Business Plan estimates includes an allowance for stand-by capacity. We have not been able to confirm that this is consistent with the yardstick data used to derive the cost function.

6.2.3 Preparation of cost functions

During our final audits it was possible to obtain complete copies of a sample of the data sets used to generate the cost functions including: the project reference, yardstick quantity, project cost and inflated project cost. Plots of the cost functions were made available, plotted against the inflation adjusted cost data. A list of the cost function parameters were made available.

For a sample of the data we were able to confirm that the cost functions are based on cost data inflated to Q3 2003.

The statistical analysis used to prepare the cost functions for the estimates are built into the cost database. Only one type of equation is considered for the cost functions, based on a log normal bias corrected power regression. The formula tends towards zero cost at zero yardstick. This constraint appears to create a tendency to overestimate costs at low yardstick values and under-estimate costs at large yardstick values. The work undertaken to eliminate rogue data has significantly reduced this effect when compared with the cost functions reviewed in our initial audits.

It is likely that alternative cost equations would improve the fit between the cost data and cost function for some cost functions. However, we recognise that this would require additional intervention when cost functions are developed to ensure that the most suitable equation is used to represent the data. It would reduce the rate and reliability with which data improvements could be introduced into the cost functions and programme estimates. It could generate further anomalies, for example negative costs at small yardstick values. A more complex bias correction and an alternative cost function were considered by

Scottish Water Solutions but it proved impractical to apply these within the costing system database.

Scottish Water Solutions undertook an exercise to review the impact of an alternative cost function based on a log normal distribution but including an off-set value and more complex bias correction. The exercise was undertaken for 16 cost functions which generate over 75% of the quality programme in the second draft Business Plan estimates. The alternative cost functions applied to the yardstick quantities in the second draft Business Plan generated an estimated cost 3% less than the estimating system applied to the Business Plan.

During our audit we were unable to obtain electronic copies of the data to undertake a similar exercise. We carried out an alternative, more subjective, exercise based on a visual inspection of the cost functions against the distribution of yardstick quantities in the second draft Business Plan. We concluded that the limited choice of cost function in the estimating system results in the Business Plan estimates being high by 2.7%

We accept that the impact of the shape of the cost functions is marginal and probably within the accuracy of the costing system. If any adjustment to the Business Plan estimates was considered to account for the impact of the shape of the cost curves then a similar adjustment would be required to the Cost Base.

It was apparent from our inspection of the cost functions that the potential bias generated by the shape of the cost functions which had caused us concern in our initial audits had been substantially reduced by work done to eliminate rogue cost data and extend the range yardstick quantities in the data set. It has also been balanced by the inclusion of a number of large plant items in the second draft Business Plan which were not included in the first draft Business Plan.

During our initial audits we identified a concern over double counting of cost between cost functions and between separate electrical and mechanical cost functions within individual process units. During our final audits we were able to confirm that these issues had been considered and addressed in a reasonable way. We still noted some examples where possible duplication exists but these appear to be individual errors rather than systematic and material failings in the methodology. We note the need for continuous review of allocation of project costs to maintain a robust data set.

6.3 On-cost Additions.

6.3.1 Interconnecting Pipework

An interconnecting pipework percentage is applied to the estimates to cover the site pipework which has not been attributed to the direct cost of individual elements of work as follows:

- Wastewater projects (excluding UIDs) 18.58%
- Water projects 14.27%

(as a percentage of civil engineering and mechanical plant only)

We understand that these percentage additions were developed in 1992 and have not been updated since. The summary data was provided during the audit but supporting project data was not available. From a review of the interconnecting pipework analysis, we believe that the percentages used may marginally underestimate the historic cost data.

During the project audit we noted that the costs of interconnecting pipework were collated for each project analysed with the data entered in the cost database. This could form the basis of an update of the on-cost percentages for water and wastewater treatment. The pipework percentages have not been updated for the second draft Business Plan.

For the second draft Business Plan Scottish Water Solutions analysed a sample of uID projects included in the second draft Business Plan to develop a separate interconnecting pipework percentage for the uID programme. A scope of works was developed for the sample projects and costed using infrastructure rates developed for work in England. The cost data in the costing functions was reviewed to ensure that interconnecting pipework was not double counted through the cost functions. In our final audits we identified a number of concerns regarding these estimates:

- Some general items and other on-cost appear to be double counted within the rates.
- The base data underlying the cost rates appear to be substantively higher than the equivalent standard costs in the final Cost Base submission which are based on tendered sewerage rates in Scotland.
- The estimates assume that every new CSO will be built off-line. We understand that this is broadly representative of current practice but may not be representative of the cost data used to derive the CSO cost functions.
- The rates are based on a reasonable assessment of layout which should works but without detailed investigation of risks which would increase scope and cost and opportunities which might reduce costs.

We believe that Scottish Water has not demonstrated that the rates are reasonable for Scotland and consistent with the costing system used to generate other cost functions. We believe that an alternative of developing a percentage based on projects in the cost database would have provided a reasonable percentage consistent with the cost functions and the risks and opportunities encountered when developing a detailed solutions.

6.3.2 *Ground conditions.*

This allows for work required to deal with unusual ground conditions and covers issues such as piling, cofferdams and over-pumping. This add-on is deemed to be covered by the site specific factor applied as Level 2 On-cost by Scottish Water and therefore was removed by Scottish Water Solutions from the construction estimates.

6.3.3 *Location costs*

This allows for unusual general siteworks required to fit the work onto a site, for example bulk excavations and retaining walls. This add-on is deemed to be covered by the site

specific factor applied as Level 2 On-cost by Scottish Water and again has not been applied within the construction estimates.

6.3.4 River/stream diversions

This category of on-cost is a manual entry based on an assessment of stream and river diversions for a specific site. This add-on is deemed to be covered by the site specific factor applied as Level 2 On-cost by Scottish Water and has not been applied within the construction estimates.

6.3.5 Service diversions

This category of on-cost is a manual entry based on an assessment of stream and river diversions for a specific site. This add-on is deemed to be covered by the site specific factor applied as Level 2 On-cost by Scottish Water and has not been applied within the construction estimates.

6.3.6 Demolition costs

This category of on-cost is a manual entry based on an assessment of stream and river diversions for a specific site. A minor allowance for demolition costs have been included in the wastewater treatment programme based on particular site issues identified by Scottish Water staff..

6.3.7 Other costs

This category allows for the manual input of costs which cannot be determined from the database. For example new processes not represented on the database or modifications to existing assets requiring part of a cost function included in the database. This add-on is deemed to be covered by the site specific factor applied as Level 2 On-cost by Scottish Water and has not been applied within the construction estimates.

6.3.8 Land costs

Land costs are included to cover the cost of additional land required to construct the works. Additional land take has been assessed using a standard algorithm developed from historic projects. Additional land take is only included in the estimates where Scottish Water staff have identified a restriction on the site. The cost of land purchase was provided by Scottish Water and has not been subject to audit.

6.3.9 Contractor's Design Costs

These have been applied to UID projects only and cover traffic management, safety measures, dealing with existing flows and Needs and Study work specific to UIDs.

During our project audit we undertook a detailed review of the cost analysis of three UID projects and noted that the project costs appeared to cover traffic management costs, safety costs and the cost of dealing with existing flows. Scottish Water has not demonstrated to us that the application of this percentage on-cost to demonstrate that it does not duplicate costs covered in either the cost functions based on the analysis of historic projects or the Level 2 on-costs.

6.4 ICA Costs.

For each element of work separate cost functions are normally prepared to cover civil, mechanical and electrical work.

The electrical cost function is subsequently allocated between electrical and ICA work and overall costs presented in three separate categories of civil, mechanical and electrical (combined) and ICA. We assume that the ICA costs will be attributed to short life assets and the electrical costs to medium life assets.

The split of cost between electrical and ICA works is based on the following proportions:

Type of asset	Electrical	ICA
Water treatment	43%	57%
Wastewater treatment	67%	33%

These proportions were developed in 1992 and have not been updated since. The source data was not available for audit.

Scottish Water has confirmed that these percentage splits have not been applied to distribute costs between depreciation categories in the Business Plan. Instead the allocation of quality programme costs to depreciation categories has been based on an analysis of projects in Scottish Water's fixed assets register as moderated by the finance department, see out report on Table B7 of the Business Plan report.

6.5 First Time Sewerage Estimates

The estimates for first time sewerage have been developed in two parts:

- A sewerage estimate.
- Sewage treatment costs.

We understand that the estimating systems used for sewage treatment and pumping stations are derived from the costing systems outlined above. They have not been subject to a specific audit. The estimates were prepared before the review of the estimating

system. They have not been updated to take account of any changes to cost functions arising from that review.

The sewerage costs are based on a detailed assessment of a sample of schemes where an outlined design has been prepared and a detailed sewerage schedule developed. The outline scope of work has been costed using a schedule of rates developed from work in England. In our audits we noted that some general items and other on-cost appear to be double counted within the rates. We also noted that the base data underlying the cost rates appear to be substantively higher than the equivalent standard costs in the final Cost Base submission which are based on tendered project in Scotland.

The sample scheme cost estimates were used to develop a cost algorithm of first time sewerage against population served which has been applied to generate the complete Business Plan estimate.

We note that Scottish Water is actively engaged on a programme of first time sewerage in Q&SII. We believe that these historic scheme costs would have provided a useful benchmark for the Business Plan estimates.

7. PROJECT ON-COSTS

7.1 Introduction

The estimating systems used by Scottish Water to prepare the main elements of the quality programme and the asset maintenance programmes are based on the analysis of tendered costs. Each system generates a project estimate which is the equivalent of a tender estimate which is exclusive of:

- Tender to out-turn adjustments including risk, contingencies, contractual claims, pain-gain payments or other general adjustments.
- Professional services and surveys procured outside the main project contract(s) directly by either Scottish Water or its current main procurement organisation Scottish Water Solutions. These include design costs, environmental costs and legal costs.
- Project and programme management fees to Scottish Water Solutions.
- The costs of managing the capital programme incurred directly by Scottish Water.

In this section of the report we outline the approach taken by Scottish Water to estimate these costs.

In general we have found the approach taken by Scottish Water to be complex and it is difficult to establish a direct audit trail to historic data to support the percentages used.

The direct relationship between the Business Plan estimates and historic data has been complicated by the introduction of new procurement procedures. While reflecting these new procurement procedures in the structure of its estimates, Scottish Water has aimed to ensure that the overall on-cost additions was broadly consistent with historic costs related to the procurement models on which the cost data used in the costing systems is based.

The approach taken has been further confused by the introduction of regional factors which have been developed from bottom up estimates but have not been supported by historic costs. While these regional factors have been applied the intention was that they would not of themselves affect the overall programme level estimate. In the final analysis it was found that the regional factors used resulted in a 2.1% increase in the overall programme level estimate. This has been noted as a Company Specific Factor and has been included in the Cost Base submission to maintain consistency with the investment plan.

The main Business Plan estimates have been developed using two costing systems:

- Scottish Water's WATCOST based on historic projects in Scotland supplemented by cost functions from TR61, a national costing system based on historic projects carried out by the water industry across the United Kingdom. This costing system has been used to develop estimates for infrastructure and non-infrastructure maintenance projects.
- Scottish Water Solutions estimating system based on historic project data from one water and sewerage company in England. This costing system has been used to develop estimates for the main quality programmes.

The percentage on-costs have been developed from Scottish Water data. These costs have been applied to estimates prepared using the Scottish Water system and the Scottish Water Solutions system. No assessment has been made of whether the Scottish Water Solutions project estimates are compatible with the percentage on-costs developed from historic Scottish Water data based on Scottish Water's historic procurement systems.

7.2 Percentage on-costs applied to the Business Plan.

Scottish Water has applied the following percentage on-costs to the project estimates prepared for the second draft Business Plan

- Site specific factors
- Company specific factors
- Design costs.
- Scottish Water Solutions “contractors design cost” for the UID quality programme.
- Scottish Water Solutions project and programme management costs.
- Scottish Water's environmental and legal costs.
- Scottish Water's capital programme management costs.

No tender to out-turn adjustment is applied. While a tender to outturn percentage was not applied it is probably accounted for within the overall on-cost applied – see the subsequent discussion under Section X7.3.

Site specific factors

The site specific factors applied by Scottish Water are intended to account for the site specific factors which should be excluded from the Cost Base in accordance with the standard cost specifications.

It was apparent from our audits of Scottish Water's costing system that site specific items such as rock were excluded from the cost data collected from tenders and the cost functions developed from them. It has not been possible to identify the same range of exclusions in the analysis of data for the Scottish Water Solutions costing system.

Two site specific categories of the site specific factors have been identified: rock and “other” (the latter covering items such as major earthworks support, groundwater, power supplies, access and abnormal weather conditions). A range of percentages were postulated for different categories of work in different areas of Scotland and a percentage for each area chosen. The site specific factors used are higher in the north and west reflecting a higher incidence of rock, more extreme weather conditions and more limited services such as power. The site specific factors used range from 3.34% in the Central Belt to 18.67% in the North West Highlands. The weighted average of site specific factors across Scotland (based on the distribution of work in the Q&SIIIA desirable programme

is 5.03%. These site specific percentages are applied to the construction level estimate and are not applied to the subsequent on-costs described in this Section.

Because the site specific factors are not based on the analysis of historic projects we have not been able to confirm that they are consistent with the costing system data. Based on other audits that we have undertaken the weighted average of 5.03% across the programme does not appear to be unreasonable. Overall consistency between the percentage on-costs in the Business Plan and the Cost Base is supported by the comparison with 2002-03 Annual Return data described in Section X7.3 below.

The regionally varied percentages have been applied to all estimates for the Investment Plan but have not been applied to the standard cost estimates in the Cost Base. We believe that this is consistent with the Cost Base specifications.

Company Specific Factors

In addition to the site specific factors, Scottish Water has developed a series of Company Specific Factors to represent some of the variability of costs across Scotland. These are based around four headings of:

Subsistence: to cover the additional cost of accommodation for staff working on remote construction sites.

Flights & Ferries: to cover the additional travel for staff working on remote construction sites.

Materials: to cover the higher cost of materials in remote areas due to limited numbers of suppliers.

Delivery: to cover the additional cost of delivery of materials which cannot be sourced locally.

Overall the headings appear to be a reasonable set of categories for additional costs in remote areas. We believe that Scottish Water could also have considered issues such as labour costs and overhead base for contractors in remote areas which may lead to lower costs.

Scottish Water has made a bottom up assessment of additional costs under each heading based on a series of assumptions applied to different regions of Scotland. The assumptions are not unreasonable but have not been supported by data or the analysis of historic projects which would demonstrate that the overall percentages calculated are reasonable.

The company specific factors calculated by Scottish Water range from zero in the Central Belt to 17.8% in the North West Highlands.

Scottish Water has recognised that some of these Company Specific Factors will be included in the tendered rates which are used to develop the Scottish Water costing systems. It has therefore been assumed that 25% of the costs are included in the cost functions and only 75% of the calculated percentages are applied to the Investment Plan estimates. These company specific percentages are applied to the construction level estimate and are not applied to the subsequent on-costs described in this Section.

It has been assumed that the Scottish Water Solutions costing system already takes account of different levels of subsistence, flights and ferries, materials and delivery across

the region the data was derived for. It has not been possible to quantify this or to separate the appropriate cost from the overall cost data. As a result the Scottish Water Company Specific Factors have not been applied to estimates prepared using the Scottish Water Solutions costing systems.

The weighted average of company specific factors applied to the Scottish Water estimates (based on the distribution of work in the Q&SIIIA desirable programme) is 2.1% (equivalent to 1.61% of the total cost).

The company specific factor was developed to represent regional variations of costs across Scotland. It has not been claimed as a capital explanatory factor which would explain differences between the cost base in Scotland and the cost base of water and sewerage companies in England and Wales. Scottish Water has applied the weighted average of company specific factors to the standard costs in the Cost Base which were estimated using Scottish Water systems (infrastructure and pumping station standard costs). No adjustment has been made to the standard costs estimated using Scottish Water Solutions estimating system because the company specific factors were not applied to the Investment Plan estimates prepared using this system.

Design and Supervision Costs

The design and supervision costs applied to the estimates for the second draft Business Plan were provided by Scottish Water Solutions based on its assessment of the design and supervision costs which will be required to complete the Q&SII programme. The estimate is based on future estimates as opposed to historic costs. Scottish Water Solutions analysis gives a weighted average of design and supervision costs across the current Q&SII programme of:

- Infrastructure 10.34%
- Non-infrastructure 13.03%
- Combined 12.27%

Based on these figures, Scottish Water has developed a set of design and supervision costs based on bands of construction values as follows:

Construction value (£k)	0-250	250-500	500-2000	>2000
Infrastructure D&S percentage	11.0%	9.5%	8.0%	7.0%
Non-infrastructure D&S percentage	20%	15.5%	13.0%	11.5%

The distribution of on-costs is based on expert judgement by Scottish Water staff and is not based on historic data.

The banded design and supervision costs have been applied to estimates prepared by Scottish Water.

The same banded percentages were used by Scottish Water Solutions to develop a design and supervision cost algorithm which was applied to the quality programme estimates. The algorithm appears to marginally increase the percentages used by Scottish Water. Scottish Water Solutions applies the same algorithm to both the Investment Plan estimates and the non-infrastructure quality Cost Base estimates.

Scottish Water's Solutions project and programme management costs

A further percentage has been applied to non-infrastructure and uID estimates to represent Scottish Water Solutions' project and programme management fee.

A common percentage of 6.24% is applied across the programme based on an assumption that the programme will be split equally between projects undertaken by Scottish Water Solutions' in-house companies and projects sub-contracted to stand alone delivery partners.

Based on the split of work described above, the percentage is consistent with the current contractual relationship between Scottish Water and Scottish Water Solutions for the Q&SII programme.

Scottish Water's legal and environmental costs

A percentage on-cost has been applied to the Business Plan estimates to cover legal and environmental work undertaken by Scottish Water to promote, develop and support capital projects. A percentage of 1.31% has been applied based on an analysis of historic projects in 2002-03.

Scottish Water's capital programme management costs

A percentage on-cost has been applied to the Business Plan estimates to cover Scottish Water's costs of managing the capital programme. This includes the costs of the Capital Investment Team and other corporate costs. A percentage of 3.14% has been applied based on an analysis of historic business costs in 2002-03.

We note that this percentage represents a corporate overhead spread across a turnover. Current percentage corporate overhead is expected to be lower due to a combination of greater efficiency and a higher turn over. If the Q&SIII programme has a significantly higher average investment value than the 2002-03 programme, then a lower corporate overhead may be appropriate.

Risk and contingencies

No specific allowance is made in the Level 2 on-costs for risk and contingencies which is assumed to be accounted for within the other on-costs or within the construction cost functions. It was apparent in the SWS quality programme estimating system that the tender risk allowance was included in the construction estimates. It is less clear from the Scottish Water systems whether risk was consistently included in the Level 1 on-costs.

7.3 Comparison with Historic Data and Cost Base

A number of the Level 2 on costs applied to the Business Plan estimates have been developed from sources which cannot be linked back to historic costs (for example the site specific factors and company specific factors). Others represent a Q&SII procurement system based on Scottish Water Solutions which is not compatible with the procurement system for the projects on which the construction cost estimates are based. The estimating systems applied by Scottish Water and Scottish Water Solutions to prepare tender level estimates for the Business Plan also draw on data from different procurement systems which may account for different levels of project on-costs within the construction level estimates. These differences raise a concern that the on-costs

applied to the construction level estimates might not be appropriate. Scottish Water has addressed this concern in two ways:

- By referencing the costs back to historic on-costs. In doing so, the tender to out-turn margin identified in the historic costing systems have been eroded to zero to balance out increases in other on-costs which might have been included in all or part within the tender level estimates.
- By ensuring that the Level 2 on-costs applied to the Business Plan and the Cost Base for are consistent within the scope of the Cost Base definitions.

The comparison of historic Level 2 on-cost against the structure of on-costs applied to the Business Plan is as follows:

Description	Historic 2002-03	2DBP	Notes	CBS
Site specific factors	11.245%	5.03%	The higher percentage is applied to SWS estimates and the lower percentage to SW estimates. Applied to construction cost only. No strong audit trail for the historic percentage. 2DBP percentages from bottom up analysis described above	N
Company specific factors		3.77%		2.1%
Design & supervision	11.23%	12.27%	Historic percentage from project analysis. 2DBP percentage based on forward projections by SWS. SWS costs might include some element of cost previously carried by tender costs.	Y
SWS project and programme management	0.00%	6.24%	Management fee covers costs previously carried in tender costs.	Y
Tender to out-turn adjustment	5.93%	0.00%	Historic percentage based on historic project analysis. Reduced to zero to accommodate introduction of costs above previously carried in tender costs.	Y/N
SW legal and environmental costs	1.31%	1.31%	No change. May now be covered in part by SW corporate costs and SWS costs.	N
SW corporate overhead	3.14%	3.14%	2DBP based on 2002-03 data. Percentage dependent on size of capital programme.	Y
Total excluding site specifics and company specific factor	21.61%	22.96%	Overall percentage applied to 2DBP (excluding site specifics and company specific factor) is broadly compatible with historic costs.	

The comparison tabulated shows that there is broad consistency between the on-costs applied to the second draft Business Plan estimates and historic on-costs.

The comparison also shows that there is broad consistency between the on-costs applied to the second draft Business Plan and the Cost Base within the limits of the Cost Base specifications.

The comparison also demonstrates that the historic tender to out-turn adjustment has been eroded to zero in the Business Plan estimates to accommodate on-costs which have been identified separately to reflect current procurement techniques but were probably covered in the historic project costs which are used to develop the tender level estimates. This explains Scottish Water's statements that tender to out-turn adjustments are included in the Cost Base and the Business Plan estimates as zero (non-infrastructure).

The only element of the percentage on-costs which sits outside this comparison is the element of site specifics which are not applied to the Cost Base estimates and have not been developed from historic costs. These amount to 3.77% applied to Scottish Water estimates and 5.03% applied to Scottish Water Solutions estimates.

From our review of the on-costs, we concluded that the overall percentages applied are broadly consistent with our knowledge from elsewhere. A calibration of the estimating system against actual outturn costs would have given confidence in the accuracy of the overall estimating system and indicated whether any adjustment of the final estimates was appropriate.

8. CONCLUSIONS

We have reviewed and audited the systems used by Scottish Water to cost the Business Plan and have set out our comments in the preceding sections of this report. On the basis of our audits we have concluded the following:

9. We concluded that Scottish Water's capital investment costing systems used to prepare estimates for non-infrastructure asset maintenance work was reasonably well structured. We believe that further improvements could be made to formalise the procedures for the estimating system and standardise the way project cost data is analysed.
10. We concluded that Scottish Water's capital investment costing systems for non-infrastructure maintenance makes significant use of Scottish Water's own historic project data supported by national data where Scottish Water data is not available. We found that project analysis only used those parts of the project costs required by Scottish Water for the particular function. This means that the analysis was not comprehensive leaving some concern that the estimates might not always be complete. In particular, we were concerned that the analysis may underestimate Level 1 on-costs. We found that some cost functions had not been adjusted for inflation.
11. We found that Scottish Water's capital investment costing systems for non-infrastructure maintenance was developed from historic projects which consisted of new works or major extensions to existing works. In the Business Plan percentage adjustments are applied to the cost functions to represent the scope of maintenance work as a proportion of the complete replacement of the asset. We have concerns that these percentage adjustments are a fairly crude way of costing the detailed requirements developed from workshops reviewing the bigger works (BISS). In a number of cases we noted a tendency for the adjustments to over estimate the actual requirements. However, our concerns need to be kept in proportion, much of the estimated non-infrastructure maintenance is based on a generic model projecting when old plant is due for complete replacement or is management and general spend where the costs are developed in many different ways.

Percentage adjustments were also applied to represent live site working and the demolition of existing assets. While we believe that an adjustment for live site working is reasonable the 10% assumed by Scottish Water is not supported by data analysis.

12. We concluded that Scottish Water's estimating systems for infrastructure maintenance was based directly on the 2003-04 Annual Return J Table (Cost Base) and H Tables (Asset Inventory).
13. We concluded that the Scottish Water Solutions costing systems applied to the main quality programmes in the Business Plan are well structured with well documented procedures. The systems are largely based on historic project data. Consistent, transparent methods of cost analysis had been applied.
14. We noted improvement to Scottish Water Solutions' estimating system to align the cost data and the development and application of cost functions with the scale and type of work in Scottish Water's Business Plan. We concluded that this estimating system is now broadly capable of developing robust estimates for the

scale and type of work in Scottish Water's Business Plan. We continue to have specific reservations over:

- a. The pipework percentage applied to the uID programme.
 - b. The sewerage rates used to estimate first time sewerage provision.
 - c. The estimates for sludge treatment where we have not been able to audit supporting data.
15. We concluded that overall the percentage on-costs applied by Scottish Water are broadly reasonable and consistent with historic data. The system applied is complex and not all the on-costs are supported by data. The on-costs include an element of site specific costs which are not included in Cost Base estimates and have not been developed from historic costs. The scale of the percentage applied for site specifics appears to be not unreasonable. We have gained some comfort from the fact that the overall on-costs are reasonably consistent with knowledge that we have from elsewhere.
16. A calibration between the estimating system outputs and actual project outturn cost has not been undertaken. Such a calibration could have demonstrated that the overall estimating system (including the on-costs and site specific factors) was robust or added an adjustment for estimating bias. We recommend that Scottish Water ensures that it can do such a calibration for future business plans.
17. There is broad consistency between the estimates for the second draft Business Plan and equivalent Cost Base estimates. Any specific inconsistencies are highlighted in our report on the final Cost Base submission.
18. We found that Scottish Water Solutions and Scottish Water could only provide access to a limited sample of supporting documentation for the historic cost data in the costing systems. Our conclusions are based on an audit of these limited samples of data.

Appendix A.1
Water Quality Drivers

X1. COST DRIVER DESCRIPTIONS

A description of the drivers DW1 to DW21 and WR1 to WR5 referred to in Section 2 (descriptions to the costing systems) above is set out for reference below.

Driver Code	Driver Name
DW1	EC Directive 98/83/EC (the Drinking Water Directive) compliance with lead standard
DW2	EC Directive 98/83/EC (the Drinking Water Directive) compliance with THM standard
DW3	EC Directive 98/83/EC (the Drinking Water Directive) compliance with all other standards
DW4	Cryptosporidium (Scottish Water) Directions 2003
DW5	The quality of the water put into supply must not be degraded by the condition of the mains.
DW6	The Abstraction Directive
DW7	The Birds Directive/The Habitats Directive
DW8	Reduce reliance on mutual aid during emergencies
DW9	Physical security arrangements at WTW to protect drinking water quality
DW10	EC Directive 98/83/EC (the Drinking Water Directive). Supplies from raw water aqueducts and raw water mains must comply with Directive standards
DW11	Prevention of backflow contamination from WWTW's
DW12	EC Directive 98/83/EC (the Drinking Water Directive) Compliance with tighter THM standard following review under Article 12.
DW13	Improve the aesthetic quality of drinking water by meeting chlorine targets set by DWQR and customer service standards for colour
DW14	Compliance with the protocol for provision of telemetry at works and service reservoirs
DW15	Compliance with recommendations from historical WQ reports
DW16	Water Safety Plans - managing microbial and chemical risks from source to tap
DW17	Removal of cross-connections between water mains and sewers
DW18	Extend public water network at "unreasonable cost" to provide first time connection
DW19	Provision of a wholesome supply of water sufficient for the domestic purposes as required by the Water (Scotland) Act 1980
DW20	New methods for calculating design rainfall depth require an increase in the spillway capacity of reservoirs
DW21	Duplication of critical mains to provide Security of Supply

Driver Code	Driver Name
WR1	Water Framework Directive (2000/60/EC)-Controls on Abstraction
WR2	Water Framework Directive (2000/60/EC) - Controls on Impoundments.
WR3	Water Framework Directive (2000/60/EC)-Drinking Water Protected Areas.
WR4	Water Framework Directive (2000/60/EC) - Restoration of abandoned engineering works.
WR5	Water Framework Directive (2000/60/EC) - New licensing regimes for abstraction and impoundment.