Environment

Standard Summary Project Fiche

Project Number LI 9912.01

1. Title

Strengthening of Environmental Monitoring Capacities

2. Geographical Location

Ministry of Environment (MoE), Joint Research Centre (JRC)

3. Objectives

The objective of this **2.5 MEUR Project** is to develop Lithuania's environmental monitoring capacity to comply with the EC environmental *acquis* requirements and to strengthen enforcement and regulatory capacities for the implementation and monitoring the enforcement of transposed EC legislation. With the support of twinning, the Project will develop policies and strategies for sampling, measurement and monitoring methods required by the EC environmental legislation and for the collection and dissemination of environmental data and information, plus provide support for staff training. These actions will be augmented with a comprehensive investment programme and the development of an integrated environmental information system.

The short term priorities for the environmental sector stated in the Lithuania Accession Partnership (AP) document and the corresponding National Programme for the Adoption of the Acquis (NPAA), have been addressed by previous Phare Programmes and continue to be supported by the State Budget. Therefore this Project is designed to address the medium-term priorities to:

- Approximate Lithuanian environmental legislation with that of the EC, particularly the transposition of framework directives, plus the reinforcement of the divisions of the Ministry responsible for law harmonisation,
- Prepare detailed implementation strategies and plans related to individual acts, including the analysis of and preparation of detailed investment needs and strategies,
- Strengthen enforcement/regulatory capacities for the implementation and monitoring the enforcement of transposed EC legislation,
- Implement investment programmes, particularly in the priority areas of drinking water, wastewater and waste treatment.

4. Institutional Framework

The Ministry of Environment (MoE) was created in 1998 following the merger of the Ministry of Environmental Protection with the Ministry of Construction and Urban Development and the Department of Forestry. The MoE is responsible for the transposition and implementation of the environmental *acquis*, which consists of more than 300 directives and regulations (Ministry of Environment and subordinated institutions chart is presented in Annex 5). The administrative structure of the MoE consists of:

- Central Ministry (5 Departments: Environmental Quality Department, Environmental Strategy Department, Bio-diversity Department, Territorial Planning Department, Housing and Technical Regulation Department),
- 53 subordinated institutions (including Joint Research Centre, 8 Regional Environmental Departments, etc.).

The central Ministry has 182 staff and its institutions have 10,294 employees at all levels.

Lithuania is making intensive preparations for EU membership and one of the main areas being targeted is the effective transposition and implementation of the environmental *acquis*. The MoE has prepared a Master Strategy for Approximation in the Environment Sector, which was approved in October 1998; it sets forth a concrete plan for meeting EC requirements in the environment sector. Its objectives are to:

- Provide an overview of the actions to be taken by public authorities and private persons in order to complete approximation by the projected date of accession to the EC; and
- Set priorities among approximation-related actions on the basis of Lithuania's environmental and economic situation.

This Master Strategy is supported by a number of detailed sectoral approximation strategies, giving the status of the approximation process and recommended actions for further transposition and implementation of the EC environmental law.

Transposition and approximation of EC requirements is progressing in all sectors, particularly in air and water (A chart comparing Lithuania's compliance with Water Directives monitoring requirements is given in Annex 8). There has been substantial progress in transposing IPPC (Integrated Pollution Prevention and Control) directive requirements to Lithuania's environmental legislation. The transposition process is accompanied by implementation programmes, which identify priority actions. The State Budget has allocated a sum of 2 MEUR to support these initiatives and a further 3.5 MEUR for strengthening the institutional basis for monitoring over the next five years.

Most environmental directives make reference to monitoring; therefore sector programmes need to be developed which discuss monitoring with reference to particular directives. Hence the need to develop an overall policy and strategy leading to an efficient system of laboratory control and monitoring. Therefore, further strengthening of Lithuania's monitoring capacity requires more attention to the overall planning process with priorities and better-targeted allocations.

The MoE is concerned that further approximation will be constrained by lack of progress in improvements of monitoring methods and equipment systems on central and regional levels. A similar situation is developing with approximation of the IPPC directive, where implementation will very much depend on transposition of required limit values and appropriate laboratory control and monitoring methods. The summary status of the Water, Air and IPPC sectoral programmes is:

Water

The MoE is finalising a Programme for Approximation EC Water Quality legislation (financed by Phare), part of which deals with monitoring requirements. The key issues that the programme will address are summarised below:

- General Equipment Update

Most equipment is at or nearing the end of its operational life, particularly detection limits for some reactants (pesticides, PCB's, PAH) are not satisfactory, and acquiring spare parts is difficult. There is also a severe shortage of glassware especially micropipettes and automatic dispensers, and it is still difficult to obtaining high purity reagents and gases for calibrations, standards and general operation.

- Analytical Methodologies

Methodologies were last reviewed in 1994; however, performance characteristics (accuracy, precision and limits of detection) fall short of those required for compliance with directives.

- Quality Control and Statistics

Accuracy and detection limits have been calculated for all instruments, which in some cases do not meet EC requirements. The JRC and State Metrology Centre conduct official calibration of the equipment.

- Data Flows, Quality Control and Processing

The MoE produces quarterly and annual reports based upon hydrochemical data from the 8 Regional Authorities, which are submitted every quarter. Hydrometeorology data on rivers, lakes and groundwater is collected and held separately. Information on the catchment pressures such as land use, population density, location and performance of sewage treatment plants and industrial discharges are also either held separately or are not held at all. The MoE wishes to develop an Information Strategy to reflect national, EC and other international needs (such as EEA, Eurostat, and OECD) and this twinning project will assist in its development. The Strategy should integrate data on water flows, water quality and catchment pressures in order to develop modern techniques for the management of the water cycle.

Air

Development of the Approximation programme in air sector will start in June 1999 and will review monitoring requirements. The twin objectives of this programme are the:

(i) Development of an air management system based upon criteria of human health protection, cost effectiveness, enforceability, and reference to constraints generated by the ongoing economic transition, and;

(ii) Foundation of a basis for modern environmental compliance and enforcement system in accordance with the requirements of EC air sector legislation.

As a part of the review a comparative analysis of the existing national ambient air quality and emission monitoring system with the EC requirements will be carried out. The assessment will include evaluating the monitoring methods and equipment employed in Lithuania, dispersion models used, the competence/training of the staff conducting measurements, reporting, procedures for review and analysis of collected data etc. This assessment will provide recommendations concerning improvements of monitoring and reporting to achieve compliance with EC requirements and to increase the reliability of data and possibilities for upgrading the existing monitoring system to comply with the European Union requirements. Evaluation should include possibilities to use ambient air quality monitoring system that combines the current manual and new automatic techniques.

IPPC *(Integrated Pollution Prevention and Control)*

The preliminary assessment of the Lithuania's monitoring system, which one element in the implementation of the IPPC directive, highlights air and wastewater as requiring attention, although issues of soil contamination and the impact of noise will also have to be addressed. The assessment acknowledges that considerable resources will need to be allocated to bringing the monitoring network up to standard and a clear laboratory policy with an investment strategy, identifying clear priorities, will need to be developed to ensure no overlap or duplication of resources.

- Air and Water Quality

A monitoring and analysis strategy needs to be developed with clear priorities for monitoring problem areas and analysis setting determinands for each area. Air quality monitoring is particularly equipment intensive, some techniques conform to European standards, but there is a lack of suitable equipment, not only for analysis but also for sampling and mobile monitoring. There is also a need to develop a systematic training programme to help adopt suitable strategies and methodologies for monitoring, sampling and analysis and quality assurance. An indicative list of equipment needs, based on a preliminary needs analysis is given in Annex 7.

5. Description

This **2.5 MEUR twinning and investment Project** consists of 2 components: (1) **Twinning and Training Package**; (2) **Investment to Strengthen Monitoring Capacities**.

5.1. Twinning and Training Package

This Component is designed to address the transposition of EC legislation and building Lithuania's environmental monitoring capacity. Implementation of this Component will include drafting a broad range of environmental regulations, mainly in water and air monitoring sectors. A monitoring system modernisation programme will be developed, based upon a comparative analysis of laboratory control and monitoring requirements from those directives dealing with these sectors. The programme will lead to an investment plan for Modernisation of Lithuania's Environmental Monitoring system. This programme will be as a follow up activities implementing water and air sectors approximation programmes developed by other projects (See Annex 4).

A twinning team comprising a Pre Accession Adviser (PAA) for a period of 18 calendar months, plus approximately 38 person-months of Short-term Advisers (STAs) will assist the MoE in developing the various draft regulations, programmes and plans. The team will be expected to address the following issues and assist the MoE in the:

- Preparation of Programme for Modernisation of Lithuania's Monitoring System and the Investment Plan based upon:
  - Analysis of EC requirements for monitoring and analytical control methods and systems,
  - Assessment of the current situation in Lithuania,
  - Comparative analysis and recommendations for modernisation,
  - Leading to an integrated detailed investment programme to modernise Lithuania's monitoring system including an estimate of equipment needed, costs, etc.
- Development of draft primary and secondary monitoring regulations establishing EC standard methods and laboratory control and monitoring practices to Lithuania. The drafting should be related to the transposition of EC directives presented in the Annex 6 focusing only on monitoring and control issues. The concrete normative documents to be drafted will be agreed during the Inception phase.
- Preparation of Recommendations on Monitoring Data Management and Information with particular emphasis upon sources of data, accuracy & quality control and data-flows. A data model will be developed to:
  - Integrate data sources,
  - Identifying flows of all essential data,
  - Determine how data quality should be verified,
  - Identify whom is responsible for the whole process of ensuring smooth data flows,
  - Design data assessment, and processing.

  The services and support provided by the PAA and STAs will be augmented by the supply of software services for the analysis development of the information system, the provision of associated translation and interpretation services in support of the PAA and STAs as well as software and hardware to support the PAA and STAs and the development of the pilot Monitoring Data Management and Information System (local tenders within twinning component).
- Development of training programme to the enforcement agencies and Central and Regional laboratories. Topics to be covered include good laboratory practice, quality assurance, sampling methodologies and techniques.
- Procurement (*financed under component 2*) of the first phase of the investment programme and development of bespoke information system. The twinning team is expected to prepare

technical specifications for specific equipment needs and participate in tender evaluation. Procurement should be focused on the implementation of Programme for Modernisation of Lithuania's Monitoring System developed under Component 1.

A chart summarising the indicative inputs from the team is reproduced below:

Activity with indicative inputs	PAA	STAs	Total
General policy & strategy advice; Project Management (PAA)	6	-	6
EC air monitoring requirements (STA-A)	2	4	6
EC water monitoring requirements (STA-B)	2	4	6
EC laboratory practises, analytical, monitoring methods & equipment (STA-C)	4	6	10
Quality assurance & control (STA-D)	2	6	8
Limit values and ambient air and water quality standards (STA-E)	2	4	6
Information system & statistics (STA-F)	2	5	7
Training (STA-G)	2	4	6
Specific ad-hoc technical inputs	2	5	7
Total (person-month inputs)	**24**	**38**	**62**

The PAA should be a practitioner in monitoring management field, who will be placed in the JRC for 18 months. The PAA shall have appropriate language, organisational and technical skills with the following experience:

- Considerable experience in monitoring and laboratory control structures,
- Detailed knowledge of EC monitoring and laboratory control requirements,
- Experience in development of national monitoring programmes.

The PAA responsibilities will include but not limited to:

- Preparation of detailed plan of activities during the inception phase and co-ordination of draft plan with the recipient institution,
- Project management, ensuring that all outputs foreseen are produced as agreed with the recipient institution,
- Keeping contacts with the MoE, JRC, Regional Departments and other stakeholders in the country, involved into monitoring and laboratory control activities,
- Planning, arrangement co-ordination of inputs and visits of STAs,
- Finalisation of tasks for STAs,
- Assist, in co-operation with STAs and recipient institution, development of the monitoring policies and programmes for modernisation of Lithuania's monitoring system and investment plans,
- Overseeing preparation of tendering documents for investment part of the Project and local support services.

It is expected that the PAA will act not only as a manager for the Project, but will also assist in the drafting of required documents and legislation, although STAs will provide specific technical inputs into draft documents and legislation.

The specific activities for the STAs (38 person-months) will be developed by the PAA during the inception phase. At this stage it is foreseen, that following expertise will be required:

- EC air monitoring requirements,
- EC water monitoring requirements,
- EC laboratory practises, analytical and monitoring methods and equipment,
- Quality control,

- Limit values and ambient air and water quality standards,
- Statistics,
- Training.

The Component budget also includes support for translation/interpretation, training costs etc..

Outputs of the component 1

It is expected, that this component will have the following guaranteed outputs:

- Programme for Modernisation of Lithuania's Monitoring System and the Investment Plan supported with various policy papers covering EC requirements on monitoring and analytical control methods, equipment needs with a comparative analysis with the situation in Lithuania.
- Draft primary and secondary monitoring regulations previously agreed with MoE.
- Recommendations on Monitoring Data Management with the development of a data model.
- Training Programme focusing on developing sampling strategies for the inspectorates and good laboratory practice in the laboratories.

It is also important to ensure good co-ordination between the Member State(s) input and the investment component (component 2). This will achieved through the twinning teams' support with preparation of a number of policy and strategy papers, leading to decisions on the priority investments. The twinning team will also assist in the overall tender process, including supporting the preparations of technical specifications and tender evaluation.

Timing

The estimated duration of the Component is 18 months, with the PAA being full time over this period and the STAs providing the remaining inputs according to the programme finalised between the PAA and the beneficiary.

Inception Stage

The PAA will prepare an *Inception report*, containing:

- Detailed plan for the implementation of project activities
- List of short term expertise needed for the project implementation,
- List of draft documents to be to be transposed into primary and secondary legislation with assistance of the project team,

Implementation Stage

The implementation of the project will consist of 3 stages each supported with relevant documents. The reports will describe progress achieved in implementation of the project and all draft documents prepared by the project team should be attached to the reports.

First Interim Report should include:

- Draft Programme for Modernisation of Lithuania's Monitoring System with annexes describing:
  - EC requirements for environmental monitoring and analysis,
  - Quality control methods,
  - Priority equipment needs
  - Comparative analysis to the situation in Lithuania,
- Outline of the investment plan for modernisation of Lithuania's environmental monitoring system
- Draft Recommendations on Monitoring Data Management,
- 1st progress report on draft legislation.

Second Interim Report should include:

- Final draft Programme for Modernisation of Lithuania's Monitoring System
- Draft Investment plan
- Tender documents for priority equipment needs
- Final Draft Recommendations on Monitoring Data Management,
- 1st draft Training Programme,
- Proposals for committing contingency
- 2nd progress report in drafting of new legislation.

Third Interim Report should include:

- Final draft Investment plan
- Final draft Training Programme
- 1st progress report on implementation of Training programme
- 3rd progress report on draft legislation, with copies of all legislation drafted.

The *Final Report* should contain detailed documentation for all activities and analyses conducted in accordance with the Project Fiche and any subsequent agreements made on the basis of the Inception Report.

Recipient Institution Inputs

The JRC will provide office space for PAA and STAs, equipped with telephone line and fax with copying services made available. Involvement of JRC staff will be identified and agreed during inception phase and will be documented in the Inception Report. A Steering Committee will be established to monitor the progress of the project and endorse all policy decisions.

The MoE and JRC will provide all information relevant to the project objectives, including reports, produced for air and water sectors, which can be useful for implementation of the project. JRC will assist the team to organise meetings with different stakeholders due to collect necessary information or discuss other project topics. The MoE and JRC will form working groups to discuss draft legal documents, developed by the project team.

The State Budget will commit sufficient resources to complete the investment programme and implementation of the Information Strategy over a reasonable period.

5.2. Investment to Strengthen Monitoring Capacities

The investment component of the Project will target and modernise the JRC and Regional Laboratories, including equipment of premises, complying with Good Laboratory Practice requirements and purchase of new monitoring equipment. An indicative list of monitoring equipment is attached in Annex 7.

The detailed list of investments will be based on the investment strategy developed under the twinning component of this Project, with clear priorities for all the sectors and areas to be covered and the services to be covered. The investment programme would have, at least, a ten-year life cycle, for which support under this Component (to be co-financed from the State Budget) would focus on investments in year 2000 and 2001.

6. Budget (in MEUR)

Component	Investment	Institution Building	Total Phare (= I + IB)	Recipient *	IFI	TOTAL
Twinning and Training Package		1,0	1.0	0.16		1.16
Investment to Strengthen Monitoring Capacities	1.5		1.5	0.14		1.64
TOTAL	**1.5**	**1,0**	**2.5**	**0.3**		**2.8**

* Contribution according to the State Monitoring Programme

7. Implementation Arrangements

The CFCU is the Implementing Agency responsible for tendering, contracting and accounting. Responsibility for the preparation, technical control and implementation will rest with the recipient institution - Ministry of Environment/Joint Research Centre.

It is planned to conclude two contracts: a twinning agreement and the contract for the procurement of monitoring equipment.

8. Implementation Schedule

Institution Building

Start of twinning arrangement: 2Q/00

Completion: 3Q/01

Investment

Start of tender procedure: 3Q/00

Start of project activity: 4Q/00

Completion: 4Q/01

9. Equal opportunity

The institutions involved in the project execution will observe equal opportunity of men and women in its recruitment and human resources development. Lithuania is committed to make all efforts to ensure equal access of men and women to the project activities and results.

10. Environment

n/a

11. Rates of Return

n/a

12. Investment Criteria

n/a

13. Conditionality and Sequencing

The MoE has a comprehensive environmental policy and sectoral strategies and it is currently preparing detailed implementation plans for the transposition of EC Directives on a sectoral basis. The success of this project is dependent upon these plans being in place before the PAA commences his/her activities.

There is a significant amount of extant legislation covering monitoring requirements, the PAA will assist the MoE in reviewing them and subsequently revising the primary legislation and/or secondary regulations as necessary. The MoE is also conducting a review of the enforcement requirements and clarifying which bodies are responsible for statutory monitoring and day-to-day enforcement monitoring.

The project is furthermore conditional on provision of facilities for PAA and STAs and counter-part support by the JRC as well as on the involvement of JRC staff to be identified and agreed during inception phase and documented in the Inception Report. A Steering Committee will be established to monitor the progress of the project and endorse all policy decisions.

The purchase of monitoring equipment is conditional on the assessment of the twinning team and the joint preparation of the technical specifications in line with the implementation of Programme for Modernisation of Lithuania's Monitoring System developed under Component 1.

Logframe Matrix **Annex 1**

Strengthening of Environmental Monitoring Capacities	Project Number: **LI 9912.01**		Date of Drafting: 05/99
	Contracting Period Expires: 31/10/2001		Disbursement Period Expires: 31/10/2002
	Total Budget: **2.8 MEUR**		Phare Contribution: **2.5 MEUR**
Wider Objectives	Indicators of Achievement	Sources of Information	Assumptions and Risks
Strengthen enforcement/regulatory capacities for the implementation and monitoring the enforcement of transposed EC legislation	EC requirements transposed & implemented according to NPAA timetable Institutional set-up for enforcement & monitoring is agreed Substantial progress in implementation of EC requirements by DGXI	Joint Research Centre EC Integration Unit in the Ministry of Environment Steering Committee of the project Progress reports	EC membership continues to be main foreign policy objective Environmental administration has strong support from Government Ministry of Environment with Joint Research Centre committed to organise approximation process
Immediate Objectives	Indicators of Achievement	Sources of Information	Assumptions and Risks
Development of measurements and monitoring methods required by the EC environmental legislation, Modernisation of the Joint Research Centre and Regional Departments laboratories.	Transposed EC requirements for monitoring and laboratory control Develop Programme & Action plan for modernisation of Lithuania's monitoring system Modernise JRC and Regional laboratories	Joint Research Centre EC Integration Unit in the Ministry of Environment Steering Committee of the project Central and Regional laboratories	Ministry is fully committed to implement Approximation Strategy Appropriate partnership with Member State is guaranteed Institutions co-operate Inter-ministerial working groups established
Outputs	Indicators of Achievement	Sources of Information	Assumptions and Risks
EC monitoring & analytical control methods, equipment & comparative analysis Proposal on priority investment needs, modernisation programme & action plan for monitoring system agreed with MoE	Timely delivery of reports and programs and acceptance by clients Draft legal acts (methodologies) Supplied equipment, agreed in priority list	Joint Research Centre & Laboratories EC Integration Unit in the Ministry of Environment Steering Committee of the project	Participation of the Joint Research Centre staff in working groups and co-operation with other institutions Supply contracts are prepared in time
Inputs			
Long term Pre-accession advisor (14 months) & Short term advisors (9 months) Documentation, equipment and other resources for Joint Research Centre and Regional laboratories	Funds are allocated as foreseen Office space is provided Equipment supplied Training performed	Joint Research Centre Project implementation group Steering Committee & Project Management Unit EC delegation	Qualified experts are available from Member state(s) Joint Research Centre is providing necessary support

Cumulative Contracting and Disbursement Schedule for the Project (MEUR) **Annex 2 a)**

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Cumulative Quarterly Contracting Schedule (MEUR)

Project	4Q/99	1Q/00	2Q/00	3Q/00	4Q/00	1Q/01	2Q/01	3Q/01	4Q/01	1Q/02	2Q/02	3Q/02	Total
Strengthening of Environmental Monitoring Capacities			0.725	0,725	2.5				-------	-------	-------	-------	**2.5**

Cumulative Quarterly Disbursement Schedule (MEUR)

Project	4Q/99	1Q/00	2Q/00	3Q/00	4Q/00	1Q/01	2Q/01	3Q/01	4Q/01	1Q/02	2Q/02	3Q/02	Total
Strengthening of Environmental Monitoring Capacities			0.1	0.25	1.4	2.0	2.1	2.2	2.5				**2.5**

Detailed Implementation Chart

Annex 2 b)

Year	1999			2000												2001												2002								
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Twinning and Training Package Strengthening of Environmental Monitoring Capacities																																				
- *Launch Twinning Request to Member States (after Management Committee – **23 July 1999**)*																																				
- *Selection of Member State(s) for Twinning*	*X*																																			
- *Elaboration of Twinning Covenant*	*X*	*X*	*X*	*X*	*X*																															
- *Submit Twinning Covenant to the Commission & Steering Committee for Approval*				*X*	*X*	*X*																														
Implementation of Twinning Package							**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**												
Equipment Procurement & systems development																																				
- *Tender Launch*												X	X	X																						
- *Contract Signature*															X																					
Procurement															X	X	X	X	X	X	X	X														
Develop information system																X	X	X	X	X	X	X	X	X	X											

Detailed Cost Breakdown (MEUR)

LI 9912.01 **Annex 3**

	1999/2000			*Total*
Component	**National Budget*)**	**Phare**	**Other**	
Institution Building				
A. TA				
B. Twinning	0,16	1,00		1,16
C. Other				
Investment				
A. Studies				
B. Financial Support				
C. Equipment	0,14	1,50		1,64
D. Other				
Total	**0,30**	**1,50**		**2,80**

* Contribution according to the State Monitoring Programme

Relation of Project with Previous Phare Activities

and On-Going Projects Financed from Other Sources **Annex 4**

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There are number of projects on-going to support the Ministry of Environment in the approximation process:

- Preparing of Lithuanian cities for accession - DGXI
- Long term advisor on EC integration - Danish EPA
- Development of programme for approximation and implementation of EC water quality legislation in Lithuania - DISAE
- Project to strengthen the framework and administration of Lithuania's laws on waste management and on environmental management of industry - Danish EPA
- Transposition of requirements on EIA - Finish Ministry of the Environment
- Environmental policy development and regulatory capacity building in air sector - WB IDF
- Development of action programme for implementation of EC legislation on chemicals in Lithuania - DISAE
- Development of Approximation Programmes for EC Legislation concerning Good Laboratory Practice, Animal Experiments GMOs, Mobile sources, Noise - multi-country DISAE
- Strengthening of enforcement structures - PHARE, Danish EPA
- Approximation to the Habitats and Wild Birds directives Nature protection - Danish EPA
- Long-term assistance in the transposition and implementation of the Nitrates Directive Nitrates - Danish EPA

PHARE project LI 9504 on technical assistance to support the process of integration in the environmental sector (completed in November 1998) assisted in development of the Strategy for Approximation in the Environmental Sector, which was approved by the Minister of Environment in October, 1998. This Strategy sets approximation target dates and proposes number of actions to achieve foreseen targets. The Strategy is background document for planning of all other approximation related activities, including these foreseen in this project.

Other projects, which will influence development of this project are Development of programme for approximation and implementation of EC water quality legislation in Lithuania (DISAE), Environmental policy development and regulatory capacity building in air sector (WB) and Project to strengthen the framework and administration of Lithuania's laws on waste management and on environmental management of industry (Danish EPA). All of them are developing approximation programmes, which will include recommendations on monitoring system as well.

* Joint Research Centre (JRC) is responsible for implementation of State monitoring system.

** Regional environmental departments and agencies take role of enforcement of State environmental policy and requirements.

Organisation of environmental monitoring

1. Organisations participating in Monitoring Programme

The State Monitoring Programme is co-ordinated by the Joint Research Centre. The analysis of majority of difficult to analyse parameters is performed in the laboratories of JRC. Nevertheless, there are a number of organisations involved in monitoring of the status of environment:

- JRC
- Regional Departments of Environmental Protection
- Lithuanian Geological Survey
- Lithuanian Hydrometeorological Service
- Marine Research Centre

Following organisations also perform research and local monitoring of aquatic environment:

- Institute of Water Economy
- Ltd. “Vilniaus Hidrogeologija”
- Ltd. “Grota”, Department of Hydrogeology
- Institute of Physics, Laboratory of Environmental Radioactivity.
- Institute of Botany, Laboratory of Hydrobotany
- Institute of Energetic of Lithuania, Laboratory of Hydrology
- University of Vilnius, Faculty of Chemistry.

2. Functions of the Institutions

2.1 JRC

- develops monitoring system (parameters to be monitored, sampling points, frequency)
- co-ordinates the monitoring system
- processes and stores the data collected by other organisations executing state monitoring programme
- publishes annual rapport
- executes lake monitoring (13 lakes)
- analyses hydrobiological samples from all sampling stations
- assesses chemical composition of water in small creeks in three National parks (3 creeks once a month)
- analyses of “difficult” to analyse parameters (e.g. heavy metals, pesticides)

- monitors Radioactivity in surface waters (radioactivity of water and sediments in 17 sites)
- Monitors concentrations of radioactive substances in water, sediments, plants and animals of Curonian lagoon and the Baltic Sea. (6 sites, once a year).

2.2 Regional Departments of Environmental Protection

8 regional environment protection departments carry out the State Environment Protection Inspection: Vilnius, Kaunas, Klaipëda, Siauliai, Panevësys, Utena, Alytus and Marijampolë. Each department guides the work of the subordinate urban and district environment protection agencies and inspects their activities:

- Ensure healthy and sound environment and rational use of natural resources.
- Protect the landscape, ecosystems, environment objects and biodiversity, characteristic for the region.
- Inspect how economic entities and natural persons keep to the requirements of environment protection and usage of natural resources.
- Inspect how the waste discharge norms are observed, carry out the State laboratory inspection on the pollution of environment components, control the discharges of the economic entities and quality of research of the environment components.
- Co-ordinate within the competence carry out, and control environment monitoring in the region.
- Give, in the established order, the permits for using natural resources, organise control on the fulfilment of the requirements, defined in the permits.
- Provide with technical terms for the preparation of special planning documents and projecting objects.
- Co-ordinate in the established order the projects on special planning, also enterprises and other objects, having impact on environment and status of natural resources in the construction site.
- Take part in the joint committees for acceptance of the economic entities and other objects, and evaluate its conformity with the environmental requirements.
- Control the estimation of the natural and juridical persons' dues (fees) for environment pollution and State natural resources. Apply sanctions, provided by the law.
- Analyse the status of environment protection in the region and take State environment protection measures of control for improving it. Give proposals for the regulation of the usage of natural resources and improvement of the environment quality control.
- Control the use of the regional town and municipality environment protection fund means.
- Take part in the preparation of the regional environment protection projects and within the competence controls their implementation.
- Control on behalf of the Ministry the implementation of the international agreements on environment protection.
- Work in co-operation with the public for the implementation of the environment protection tasks, inform the public about the environment quality changes, and take part in the educational activities of the environment protection.

2.3. Lithuanian Geological Survey

Geological Survey performs monitoring of groundwater, namely:

- assessment of changes in quantity and quality of underground water resources in 40 underground water monitoring stations (about 120 wells);
- Assessment of quality of underground water in 4 water intake sites. Sampling performed once a year;
- monitoring of chemical composition of underground water in carstic region (50 monitoring sites, chemical composition, water level);

2.4. Lithuanian Hydrometeorological Service

Assessment of water level, temperature, flow in rivers and lakes, also in the Baltic Sea and Curonian lagoon (78 stations).

2.5. Marine Research Centre

Monitoring of the status of Curonian lagoon and coastal waters of the Baltic Sea (1-2 times a month from April to November).

2.6. Institute of Water Economy

- Assessment of the influence of agriculture on quality of water in drainage water and water of the small creeks Graisupis and Vardas (middle Lithuania):
- Monitoring of concentrated pollution. (Sampling in drilled wells situated in the territories of big animal farms).
- Sampling of underground water (4 samples a year), drainage and surface water (once a month).

2.7. Ltd. "Vilniaus Hidrogeologija"

- Monitoring of water in water-intake sites in Lithuania.
- Measurements are carried out 2-4 times a year
- Water level measurements - 4-10 times a month.

2.8. Ltd. "Grota", department of hydrogeology

Monitoring of underground waters in the carstic region in Northern Lithuania.(about 50 sampling points, 2 times a year)

2.9. Institute of Physics, laboratory of environmental radioactivity.

Monitoring of radioactivity in aquatic systems (occasional sampling at 22 sites in rivers, lakes, the Baltic Sea and Curonian lagoon).

2.10. Institute of Botany, Laboratory of Hydrobotany

Monitoring of the primary production of phytoplankton in Druksiai Lake which is Ignalina nuclear power plant cooling basin (6 stationary stations, 3 sampling sessions a year).

2.11. Institute of Energetic of Lithuania, Laboratory of Hydrology

Hydrotermical monitoring in Druksiai Lake which is Ignalina nuclear power plant cooling basin. (Sampling every day during the months of May and October).

2.12. University of Vilnius, Faculty of Chemistry.

Hydrochemical monitoring of Ignalina nuclear power plant cooling basin. Observations every season.

3. Monitoring of Discharges

According to the Law on Environmental Protection monitoring of discharges falls under responsibility of dischargers. Special statistical account forms were developed and required to be filled once a year by dischargers, which discharge into environment more than 5 m^3 of effluents. The same forms are also required to be filled by water users which abstract more than 10 m^3 per day from individual abstraction sites and for water users, which use more than 50 m^3 per day of water supplied by the distribution network. This requirement is set by the regulation "Instruction on Filling the State Statistical Account form No 1 -Water" (adopted by the Order of the Department of Environmental Protection No 151 of December 10, 1991).

Parameters to be monitored by the dischargers include pH, suspended soils, COD, BOD_7, NH_4, nitrites, nitrates, $N\text{-}_{total}$, phosphates, $P\text{-}_{total}$, $Fe\text{-}_{total}$, Cu, $Cr\text{-}_{total}$, Ni, Pb, Cd, Hg, Mn, sulphates, chlorides, grease, oil products, phenols, detergents, *Collie* fag, and *Collie* index. However, the full set of analysis of all the parameters is costly and commonly only main parameters, such as BOD_7, $N\text{-}_{total}$, and $P\text{-}_{total}$ are monitored.

There are two types of laboratories, which perform the analysis of effluent samples. The first type include laboratories which belong to discharger and perform analysis only for that discharger (around 40 laboratories around the country). The second type of laboratories performs analysis on commercial basis (around 30-40 laboratories). Geographical distribution of the laboratories is quite aggregated with lack of laboratories in Eastern and Northeastern Lithuania.

The analysis of effluent samples is organised by the dischargers and data is stored in the laboratories, which perform these analyses. The data on analysis of the samples shall be submitted to the Regional Departments if requested. Regional Departments carry out the control of the discharges by taking occasional samples of the effluents.

4. Monitoring of sewage sludge

These is no monitoring system for sewage sludge in Lithuania. The wastewater treatment plant must fill the statistical form and send it to the division of waste and contaminated soils in the Ministry of Environment. Enterprises, which obtain the permits for use of natural resources and discharge of effluents into environment, are obliged to fill the statistical account form #3 "Waste" adopted by the Order of Director of Department of Environmental Protection No 106 of November 20, 1992. The Ministry receives only data on amounts of sewage sludge produced. The "producers" in these cases assess the quality of sewage sludge when sewage sludge is planned to be used in agriculture.

5. Quality assurance scheme

Quality assurance of the laboratories is organised by the JRC. There are three levels of quality assurance schemes: international, national and local.

There are 11 or 12 laboratories participating in international quality assessment scheme. The laboratories of JRC, laboratories of Regional Departments (8) and few independent laboratories (2 or 3) take part in international intercalibration. According to the specialists of JRC, these laboratories achieve quite high level of accuracy.

On the national level, quality assessment is organised by the JRC. The assessment is a two step process and is organised twice a year. The participation in the assessment is not obligatory.

At local level performance of laboratories owned by dischargers and performing the analysis only for that the laboratories of Regional Departments control discharger. The independent laboratories and the laboratories, which perform analysis of the samples for several dischargers, must obtain the permit.

6. Collection and processing of data

The JRC processes data on quality of surface waters (both river and lake monitoring). Data concerning river quality is sent by Regional Departments four times a year and data concerning the lakes once a year. Regional Departments send the data in digital format (computer diskette containing data in *.dbb format) and printed on paper (for quality assurance).

However, the database of the JRC on quality of surface waters is not complete. JRC does not receive data from the Marine research Centre (which publishes it's own annual rapport). Monitoring performed by the Institute of Energetic of Lithuania (Laboratory of Hydrology) and University of Vilnius (Faculty of Chemistry) are specific to Ignalina nuclear power plant cooling basin, but nevertheless are not integrated into the uniform data base. Lithuanian Hydrometeorological Service collects data about quantity of surface waters. Some of this data (data obtained at the same sampling points where water quality sampling is done) is supplied to the JRC, other data is stored at Lithuanian Hydrometeorological Service.

There is still no uniform system of collection and processing of monitoring data in Lithuania. Monitoring of underground water is co-ordinated by Geological Service (which employ some other organisations for specific tasks). All data from analysis of underground water samples reach to the Geological Service and is processed and stored there. GIS system is currently under development. After the reorganisation of the Government Geological Service is subordinated to the Ministry of Environment.

Annex 6

List of Key EC Directives

LI 9912.01

Directives on dangerous substances:

Waste Framework directive 75/442/EEC, amended by 91/156/EEC, Hazardous waste 91/689/EEC, Decision 94/904/EC, Disposal of waste oils 75/439/EEC, amended 87/101/EEC, Packaging waste 94/62/EC, Supervision of shipment of waste 259/93/EEC, Batteries 91/157/EEC, amended 93/86/EEC, Hazardous waste incineration 94/67/EC, Municipal waste incineration, existing installations 89/429/EEC, Municipal waste incineration for new installations 89/369/EEC, Disposal of PCBs and PCTs 96/59/EEC, Waste from the titanium dioxide industry 78/176/EEC, amended 83/29/EEC, Harmonisation of reduction programmes 92/112/EEC, Procedures for the surveillance of titanium dioxide industry 82/883/EEC

Water sector Directives:

Dangerous substances to the aquatic environment 76/464/EEC, Mercury discharges from chlor – alkali industries 82/176/EEC, Cadmium discharges 83/513/EEC, Other mercury discharges 84/156/EEC, HCH discharges 84/491/EEC, List one substances 86/280/EEC, amended 88/347/EEC, amended 90/415/EEC, Drinking water directive amended 91/692/EEC, proposed water quality framework directive,

Air sector (monitoring) Directives:

Air quality Framework 96/62/EC, SO2 and particulate 80/779/EEC, amended 89/427/EEC, Lead 82/884/EEC, Nitrogen oxide 85/203/EEC, Tropospheric Ozone Pollution 92/72/EEC, Long – rang transboundary air pollution concerning the control of emissions of nitrogen oxides or their transboundary fluxes 93/361/EEC, Monitoring mechanism of Community CO2 and other greenhouse gas emissions 93/389/EEC.

Provisional Equipment Requirements **Annex 7**

LI 9912.01

A provisional equipment needs analysis has identified the following requirements:

- Combustion gas monitors (CO, O_2, CO_2, NO_x),
- Variable sampling equipment for gasses (SO_2, NH_3, organic compounds),
- Protective clothing and equipment to allow monitoring and sampling in adverse conditions,
- Analytical equipment for heavy metals (AAS), SO_2 and organic compounds,
- Odour measurement and
- Environmental noise analysis
- Biological toxic

The detailed, final list of investments will be based on the investment strategy developed under the twinning component of this Project, with clear priorities for all the sectors and areas to be covered and the services to be covered. The investment programme would have, at least, a ten-year life cycle, for which support (to be co-financed from the State Budget) would be envisaged in year 2000 and 2001.

Annex 8

Summary of basic monitoring requirements made in directives for surface water compared with the actual situation and capabilities in Lithuania

LI 9912.01

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Sampling And Analysis of Surface Water for Abstraction for Drinking Water (75/440/EEC) and (79/869/EEC)	Designated sites 4-12 times per year	pH, Turbidity, Colour, Temperature, Total Suspended solids, Conductivity, Odour, DO[2], BOD5[2], COD,[2] substances extractable with chloroform[2], Total Organic Carbon[1], Residual Organic Carbon[1], Ammonium[2,] Nitrogen Kjeldahl[2], Nitrates, Fluorides, Total extractable organic chlorine, Dissolved Fe, Mn, Cu, Zn, B[2], Be[1], Co[1], Ni[1] V[1] , As, Cd, Total Cr, Hg, Se, Pb, Ba, CN, Sulphates, Chlorides[2] , Surfactants[2] , Phosphates[2], Phenols, Dissolved/emulsified Hydrocarbons, PAHs, Total Pesticides, Total Coliforms[2,] Faecal Coliforms[2,] Faecal streptococci[2], Salmonella[2]	Sites not designated for this directive. According to Lithuanian Water Law only groundwater is to be used for drinking water.	

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Quality of Freshwaters to support fish life. (78/659/EEC)	Agreed sites in designated areas Weekly-Monthly	Temperature, DO, pH, Suspended Solids[2], BOD_5[2], Total Phosphorus[1], Nitrites[2], Phenolic compounds, Petroleum Hydrocarbons, Non-ionised ammonia,· Total ammonium , Total Zn, Dissolved Cu[2]	Sites not designated for this directive. Waters will need to divided into salmonid and cyprinid waters. This may be done using data from the existing impact monitoring network. Interpolation of quality parameters between points may require some additional monitoring to validate designations based on existing data and local knowledge of catchment activities between impact network stations. Determinedness monitored at Regional laboratories: Temperature, DO, pH, Suspended Solids[2], BOD7[2], Total Phosphorus[1], Nitrites[2], Total ammonium	Lithuania measures BOD7 rather than BOD5. Non-ionised ammonia will need to be calculated. Frequency of all determinands is monthly (satisfactory) except for JRC determinations, which are 3-4 times per year. This frequency will need to be increased to monthly to comply with the directive.

			Determinands monitored at JRC: Phenolic compounds, Petroleum Hydrocarbons, Total Zn, Dissolved Cu^2	

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Exchange of Information about Surface Fresh Water (77/795/EEC) as amended by (86/574/EEC)	Selected sites. Member States to decide the frequency, usually monthly but may be reduced if there is no significant variation. Member State to organise intercalibration at national level to ensure comparability. Sampling stations must be representative and not directly influenced by a source of pollution, upstream of confluences, not more than 100km apart on main rivers	Rate of Flow, Temperature[3], pH, Conductivity Chlorides Nitrates, Ammonia, DO, BOD_5, COD, Total Phosphorus, Surfactants, Total Cd, Hg, Faecal Coliforms, Total Coliforms, Faecal Streptococci, Salmonella, Biological Quality (frequency to be decided on by Member States)	No sites selected in Lithuania.	Directive is aimed at large rivers but does not specify size criteria. Some of the transboundary and flux stations in Lithuania may be suitable candidates. All physico-chemical parameters can be measured regionally or nationally.

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Dangerous substances (76/464/EEC) and daughter directives	Areas affected by discharges Monthly for water, annually for sediments	Cd, Hg, HCCH, HCBD, PCP, Chloroform, DCE, Drins, DDT, HCB, Carbon tetrachloride, TCE, PCE, TCB	Monitoring of discharges is the responsibility of the discharger. Self-monitoring is compulsory for effluents greater than 5 cumecs. Dischargers analyse their own effluents (40 laboratories) or commission analyses from commercial laboratories (30-40 laboratories). Analysis of dangerous substances is costly and often only simple parameters (BOD and nutrients) are monitored.	Compliance with this directive will require a much more stringent approach to self-monitoring. Laboratories will need to demonstrate their capability to analyse dangerous substances to the required limits of detection and accuracy. Accreditation of laboratories will be required and regular inspection of results and verification of analyses by the competent authority will be necessary.

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Drinking water (80/778/EEC)	Initially before source exploited. All water intended for human consumption to be monitored at the point where it is made available to the user in order to check that it meets with the requirements laid down in Annex 1. Points of sampling to be determined by the competent national authorities. Frequency of sampling varies according to group of parameters and to volume of water produced/distributed. Range is from 360 to 1 or 2 samples per year.	Colour, Turbidity, Odour, Taste, Temperature, pH, Conductivity, Chlorides, Sulphates, Silica, Ca, Mg, Na, K, Al, Dry Residues, DO, free CO2, Nitrates, Nitrites, Ammonium, Kjeldahl N, Permanganate Value, TOC, H2S, Substances extractable in chloroform, Dissolved or emulsified hydrocarbons, Phenols, B, Surfactants, Fe, Mn, Cu, Zn, P, F, Co, Suspended solids, Residual chlorine, Ba, Ag, As, Be, Cd, CN, Cr, Hg, Ni. Pb, Sb, Se, V, Pesticides (separately and total), PAHs, Any other organochlorine compounds. Total Coliforms, Faecal Coliforms, Faecal Streptococci, Clostridia, Total bacteria.	Monitoring according to old Soviet regulations GOST 2874 (1984). Aesthetic parameters: Odour, Taste, After-taste, Colour, Turbidity. Chemical parameters: pH, Hardness, Be, Mo, As, Pb, Se, Sr, F, Fe, Mn, Cu, Zn, Residual Al, Phosphate, Nitrate, Sulphate, Chloride, Polyacrylamide. Microbiological parameters: Total bacteria in 1ml, Numbers of E. coli on 1 litre. Frequency of monitoring and list of chemical parameters to be agreed with State Hygiene Inspection and depends on local conditions. Frequency of monitoring of water as distributed depends on size of population served:	Major gaps are in the microbiological parameters measured where the GOST 2874 list is rather limited. List of aesthetic and chemical parameters is sufficiently similar not to cause major concern. Frequency of sampling in Lithuania will need to be increased to comply with this directive. See additional Table D3a/1 below

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Bathing water (76/160/EEC)	Designated sites, Fortnightly in bathing season	Total Coliforms, Faecal Coliforms, Faecal Streptococci[4], Salmonella[4], Enteroviruses[4], pH[5], Colour, Mineral Oils[2],, Surfactants, Phenols, Transparency, DO[4], Tarry residues and floating materials, Ammonia[6],, Nitrogen Kjeldahl[6], Pesticides[6], As[6], Cd[6], CrVI[6], Pb[6], Hg[6], CN[6], Nitrates[6], Phosphates[6],	No regulations concerning the designation neither of bathing waters nor for bathing water quality monitoring in Lithuania. A preliminary inventory of bathing beaches (14 marine and 229 in freshwater or not defined) has been prepared. Public Health Centre and State Hygiene Inspection take samples and may close beaches if there is a risk to bathers.	Policy decisions are required on what constitutes bathing water and what is the bathing season. Consideration will be needed on the technical and financial implications of designation of bathing waters where there may be high levels of bacteria. This will be particularly important in rivers and in coastal areas with marine discharges of sewage effluent (e.g. Klaipeda). The design of a monitoring programme for the directive is straightforward once the waters have been designated.

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Urban Waste Water Treatment Directive (91/271/EEC)	Waters receiving discharges of urban waste water from agglomerations with collecting systems. (Certain Industrial Sectors are also covered and will need to be monitored – see final column of this table) Member States should identify Sensitive Areas which are natural freshwater lakes, other freshwater bodies, estuaries and coastal waters which are eutrophic or in danger of becoming so. Less Sensitive Areas are open bays, estuaries and coastal waters with a good water exchange and are not subject to eutrophication due to the discharge of urban wastewater. Monitoring is carried out on the outlet of the urban wastewater treatment plant (flow or time proportional samples). Minimum number of samples is according to size of treatment plant and be at regular intervals during the year: 2000-9000pe 12 samples per year (reducing to 4 in subsequent years) 10000-49999pe 12 samples per year >50000pe 24 samples per year	BOD5 at 20oC without nitrification Chemical Oxygen Demand Total Suspended Solids And in Sensitive Areas subject to eutrophication: Total Phosphorus Total Nitrogen For all parameters there are minimum percentage reductions to be achieved by the treatment plant, which means that, monitoring of the parameters before treatment is also required.	There are no specific national monitoring programmes to monitor the performance of treatment plants in Lithuania. This is a Municipal responsibility, which have formed 40 water service companies to undertake this duty. Monitoring by the Regional authorities is focused on the impact of the discharge on the receiving water quality, which is not relevant to this directive.	Sensitive Areas and Less Sensitive Areas need to be identified. Agglomerations need to be identified and pre-and post-treatment monitoring programmes designed. Discharges from the following industrial sectors will need to be identified and included in the monitoring programme: Milk-processing, manufacture of fruit and vegetable products, manufacture and bottling of soft drinks, potato processing, meat industry, breweries, production of alcohol and alcoholic beverages, manufacture of animal feed from plant products, manufacture of glue from hides, skin and bones, malt-houses and, fish processing industry. A database will be required, for use at national level, on the concentrations discharged and the percentage reductions achieved by treatment.

DIRECTIVE	LOCATION/FREQUENCY	DETERMINANDS	SITUATION IN LITHUANIA	GAP/ACTIONS
Nitrates Directive (91/676/EEC)	Designated sites (groundwater and fresh water). Member States shall designate as Vulnerable Zones all known areas of land, which drain into waters and which contribute to pollution. Member States should establish codes of good practice for farmers. Monitoring at surface water sampling stations representative of surface waters is required at least monthly and more frequently during flood periods. Similarly, monitoring at groundwater stations, which are, representative of the aquifers is required at regular intervals. These programmes to be repeated every four years together with a review of the eutrophic state of fresh surface waters, estuarial and coastal waters.	NO_3	Lithuania has taken no specific action relevant to this directive.	Surface waters and groundwaters affected by agricultural sources of nitrate need to be identified. The 20 river stations in the State Monitoring Programme concerned with agricultural pressures may give some guidance but it is likely that more investigations will be required. The network of groundwater monitoring stations appears to give a representative picture of the aquifers. Vulnerable zones will need to be identified and codes of agricultural practice drawn up and implemented. A monitoring network specifically designed for this directive will be required (or will be part of the Representative Network required for the EEA needs). Four-yearly surveys of eutrophication status of freshwaters will be required.

Comparison of Frequency of Monitoring of Aesthetic and Microbiological Parameters under Directive 80/778/EEC (1980) and the Current System in Lithuania.

Population Served	Frequency of Minimum Monitoring	Frequency of Current Monitoring	Lithuanian Monitoring
500	2	2	-
5 000	2	2	-
<10 000	-	-	2
10 000	12	3	-
10 000 – 20 000	-	-	10
20 000 – 50 000	-	-	30
50 000	60	6	-
50 000 – 100 000	-	-	100
100 000	120	12	-
>100 000	-	-	200
150 000	180	18	-
300 000	360	36	-
500 000	360	60	-
1 000 000	360	120	-
5 000 000	360	120	-
Parameters covered	Odour Taste Conductivity or other physico-chemical parameter Residual chlorine Total coliforms or Total counts at 22o and 37o Faecal coliforms	Odour Taste Turbidity (appearance) Temperature Conductivity or other physico-chemical parameter pH Residual chlorine Nitrates Nitrites Ammonia Total coliforms Total counts at 22o and 37o Faecal coliforms	Odour Taste (After-taste) Colour Turbidity (appearance) Total micro-organisms 1ml Numbers of E. coli in 1 litre