CHAPTER 11

CHAPTER 11 WETLAND CONSERVATION PLAN

11.1 Wetland Management Conditions

11.1.1 Natural Parks and Reserves

(1) Legal conditions for natural parks and reserves

1) National environmental policy

The National Environmental Policy Plan (NEPP) for Latvia was accepted by the Cabinet of Ministers of the Republic of Latvia in 1995. NEPP reflects long-term strategy (25~30 years), and has two long-term goals, i) maintenance and protection of existing biodiversity and landscape characteristics of Latvia, and ii) sustainable use of natural resources.

2) National Environmental Action Plan (NEAP)

Since Latvia is a country with limited institutional, human, and financial resources, NEAP is incorporated with the National Biodiversity Strategy and the Action Plan, and it will also incorporate implementation of the Ramsar Strategic Plan. NEAP was adopted in 1997, and it emphasizes an establishment of administrative bodies for the Kemeri national park and Lake Engure which include several internationally important wetlands. An elaboration of the Integrated Management Plan for the Lubana Wetland Complex (LWC) is also placed high priority of nature conservation action.

3) Environmental laws and regulations

Latvian environmental legal system has been prepared rapidly, and the following laws are relevant to protected areas, especially wetlands.

a. The Environmental Protection Law (1991, 1997) determines the general environmental protection objectives, i.e. to ensure preservation of the genetic basis of nature, diversity of biotopes and landscape. It is an umbrella law on nature protection including land use and protection area planning.

b. The Law on Specially Protected Nature Areas (1993, 1997) regulates the categories of protected natural areas, the procedure of their establishment and protection. The rules of this law apply also to the laws on land use and territorial planning, such as Regulation on Territorial Planning (1994), Building Law (1995), and General Building Regulations (1997). The General Provisions for the Law on Specially Protected Nature Areas regulate the hunting of waterfowl by the toxic shots (containing lead or other heavy metals) and a total number of birds in the nature reserves and restricted nature areas. This regulation applies to many wetlands of international importance in Latvia including three Ramsar sites, since they fall under either of the protection categories.

c. The Water Law (1973) applies to all ground and surface water including wetlands for rational use and protection of water bodies.

d. The Regulations on Environmental Impact Assessment (EIA) in 1998 requires the EIA procedure for certain activities which may cause impacts on wetlands.

e. The Law on Protected Belts (1997) determines protected belts on the coast of the Baltic Sea and Gulf of Riga, along water bodies and watercourses, around natural and cultural monuments, and also forest protective belts around towns and cities.

f. The Fishery Law (1995), the Regulations on Angling (1997), the Hunting Regulations (1995), and the Hunting Law (1995) also protect species and habitats of wetlands. It is forbidden to do any actions which cause disappearance of species and change of ecological conditions.

4) Law to protect species

In March 2000, the Latvian parliament adopted the Law about Protection of Species and Biotopes that emphasize protection of species. The law is unique in referring to designating especially protected species, clarifying habitat requirements, establishment of micro restricted areas, duties of landowners and tenants as well as their rights, licensing system to collect individuals, and restrictions on species introduction and reintroduction.

5) International liabilities

The parliament of the Republic of Latvia has ratified all the following biodiversity related conventions. The Ministry of Environmental Protection and Regional Development (MEPRD) is responsible for the Convention on Biological Diversity and the Ramsar Convention, and it maintain regular exchange of information with the Convention on Climate Change. The World Heritage Convention is responsible to the Ministry of Culture. The agreement between the EU member states and Latvia ratified in 1995 also includes cooperation in environment protection.

- Convention on Biological Diversity (Rio de Janeiro, 1992)
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1975).
- Convention on International Trade with Endangered Species of Wild Fauna and Flora (Washington, 1973).
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979).
- Ramsar Convention (Convention on Wetlands of International Importance, Especially as Waterfowl Habitat) (Ramsar, 1971),
- The Framework Convention on Climate Change, and
- The World Heritage Convention

(2) Institutional Conditions

1) National governmental institutions

Implementation of policy, strategy, and action plan related to environment is responsibility for the Ministry of Environmental Protection and Regional Development (MEPRD). Environmental Protection Department is a subordinate institution of MEPRD. The following institutions are under supervision or authority of MEPRD:

- Environmental Consulting and Monitoring Center,
- Latvia Environmental Data Center,
- Environmental State Inspection,
- Regional Environmental Boards,
- Marine Environmental Board,
- Slitere State Reserve,
- Teici State Reserve,
- North Vidzeme Biosphere Reserve,
- Kemeri National Park, and
- Gauja National Park.

2) Regional governmental institutions

The eight Regional Environmental Boards (REBs) are subordinated by MEPRD to carry out the implementation of state policy in the field of environmental protection and regional development on a regional level. Among the REBs, Madona and Rezekne REBs have jurisdiction over the part of LWC: Madona REB for four districts including Madona and Gulbene districts and Rezekne REB for three districts including Rezekne and Balvi districts. In cooperation with municipalities, REBs have the following major tasks under the control of MEPRD.

- management of the environment in the region,
- facilitation of the implementation of environmental policy principles in the management and business activities,
- ensuring rational use of natural resources,
- ensuring sustainable construction activities in the region, and
- controlling state of environment in the region

These tasks include preparation work for EIA, inspection on environmental sectors, and permission to use the natural resources. According to the regulation of REB, the following rights are given to REB.

Regulative Rights of REB

1) to request and receive the necessary information from legal and individual persons without any payment
2) to propose the necessary amendments in the environmental protection and regional development regulations
3) to prepare the resolutions about the environmental protection projects
4) to make the expert groups in the necessary field
5) to stop or forbid economic or any other action if it contradicts the environmental protection and regional development regulations
6) to stop the territorial planning
7) to use district plans, town and township general plans, and basic utilities if it is necessary for environmental protection needs
8) to control any object at any time
9) to make a claim for legal and individual persons for the damage done to the environment
10) to do other actions connected with environment protection, nature resources, regional development and construction works

Source: Regulation of REB, 1999

Based on the circumstance and needs in each region, Madona and Rezekne REBs have different priorities on environment protection with different organization structure as follows.

Organization of Rezekne and Madona REBs

(Unit: persons)

Name of Position and Section	Rezekne REB	Madona REB
- Director	1	1
- Deputy Director	1	2
- Regional inspectorate section	5	-
- Project coordination and examination section	4	-
- Expertise and cadastral section	-	5
- Protection of biological reserve section	-	6
- District inspectorate section	11	8
- Laboratory section	5	4
- Technical staff	-	9
- Bookkeeping and personnel sections	2	-
- Driver	2	-
Total	31	35

Note: -: There is no section.
Source: Rezekne and Madona REBs, Nov. 1998

REBs are operated based on the state budget. However, the state budget is mostly spent for the personnel expenses and other cost within the REB organization. To implement the environmental projects/programs, other sources of fund such as Latvian Environmental Protection Fund and Fish Fund are applied. Each REB submits the annual report to MEPRD. The report includes the information on environmental situation by sectors and projects in region of each REB in charge.

3) Community sectors

A management and administrative system for the Lake Pape wetland provides a base for development of local economy and business through sustainable use of the local environment. A reed-cutting company founded by local community was supported by the World Bank Loan, Danish and Latvian subsidies. It is developing as a company directed for the lake management.

4) NGOs

There are five major NGOs that regularly committed to the wetland conservation. The Latvian Fund for Nature (LFN) and the Latvian Ornithological Society are national NGOs. European Union for Coastal Conservation in Latvia (EUCC) and Coalition for Clean Baltic are regional ones, and the Worldwide Fund for Nature (WWF), Latvian program is an international organization.

They are mostly concentrating on raising awareness of wetland values and are competent in data management for identification of the most valuable wetland areas. They are cooperating with Latvian government in implementing projects on research, management, and public awareness at national level.

(3) Protected areas

1) Protection of habitats

The basis of natural diversity preservation is the protection of natural habitats and the habitats created by traditional management methods. Areas by land use in Latvia are

forests (45%), agricultural lands (39%), mires (5%), roads and yards (4%), inland waters (4%), and others (3%).

Forests occupy considerable areas in protected natural territories. Since 1990, after land privatization and lifting of the many logging restrictions, a relatively strict protection regime has been preserved only in 2-3 % of forest territories.

Protection regime has been established in 93 mires in the area of 76,650 ha (12 % of the total area of marshes). Because meadows must undergo regular mowing, a strict protection regime alone does not guarantee preservation of meadows. In reserves they overgrow, but in other protected territories their mowing must be supported. Therefore, mowing is part of the newly developed nature protection plans of protected territories.

Inland waters such as lakes, streams, ponds, and reservoirs cover 4% of the total land area of Latvia. Mires constitute additional 5%. They make a total area of 5,555 km^2. This figure includes most rivers and also deep lakes. Peat extraction is carried out in some part of mires area, but exact rates of loss of wetlands for mining have not been calculated.

More than 50 lakes have been included in the nature reserves. Many lakes are enclosed by marshes, and on the islands of several lakes virgin forests have been preserved. The lakes of indicating oligotrophic plant species, are of special importance. The protection of river valley sections, river tributaries and glens is chiefly ensured in Nature Reserves, Nature Parks, Gauja National Park, and in the protective belts of water bodies and watercourses. Along the sea coast and dune zone the general regime of protective belts of the Baltic Sea and Gulf of Riga coast is in force, and particularly protected areas have been marked. Unfortunately, the present protection regime does not provide effective control of the recreational load.

2) Classification of protected areas in Latvia

Latvia has the following seven types of protected areas.

State Nature Reserves*:* Territories untouched or unaltered by human activity, where undisturbed development of natural processes is ensured in order to protect and examine rare or typical ecosystems and their constituent parts. Four nature reserves have been established: Moricsala (1912), Grini (1936), Krustkalni (1977) and Teici (1982).

National Parks: Areas enclosing outstanding natural formations of national importance, landscapes untouched or unaltered by human activity, diverse habitats and monuments. Research, education and recreations are important along with nature protection. There are three national parks in Latvia: Gauja (1973), Kemeri (1997) and Slitere (2000).

Biosphere Reserves: Territories enclosing landscapes and ecosystems of international importance. Their aim is to ensure preservation of biodiversity and to promote sustainable development of these areas. In 1997, the North Vidzeme Biosphere Reserve was established. The reserve is a part of an international network of biosphere reserves (UNESCO).

Nature Parks: Territories representing natural and cultural historical values of a certain area, and are suitable for recreation and education of society. There are 21 Nature parks in Latvia, the most popular of them being Tervete Nature Park and the nature park "Daugavas loki".

Natural Monuments: Separate, single natural formations like trees, caves, springs, rocks, boulders etc. with scientific, cultural, historical, aesthetic or ecological value.

Nature Reserves: Natural complexes unaltered by human activity, areas where rare and endangered species can be found. There are 211 natural Nature Reserves in Latvia. A list of special protected areas was prepared in 1987 and ratified in 1994 by the Government of Latvia (GOL). Among the total nature reserves in Latvia, at least 140 are wetland areas.

Protected Landscape Territories: Areas standing out for unique or diverse landscape and special beauty.

(4) Species protection

In Latvia 27,443 species of plants and animals are known. Nevertheless, scientists believe there might be more - about 40,000. From the known number of species, 907 (3.3%) are rare and protected. The Environmental Protection Law says "all species and habitats must be preserved in order to ensure biological diversity and natural phylogenic processes". For the management of flora and fauna species utilized in agriculture, fish farming and forestry special activities and methods have been prescribed. It is allowed to use biological resources in compliance with the following laws: On Forest Use and Management (1994), Hunting Law (1995), Hunting Regulations (1995), Fishery Law (1995) and Regulations on Angling (1997).

The endangered flora and fauna species or those undergoing rapid population decrease are recorded in the Red Data Book of Latvia (1985) and it is the basis of species protection. It is prohibited to gather and sell, or change growth conditions of the plants included in the Book. It is prohibited to catch and hunt the protected animals, to hold them in captivity and destroy their habitats. The valid list of existing species in the Red Data Book does not ensure protection for all rare and endangered species. Specific species conservation plans are in preparation on 14 species including otter, wolf and lynx.

(5) Conservation projects related to wetlands in Latvia

1) Conservation projects in protected areas

The following shows examples of integrated conservation and management projects at wetland-type protected areas in Latvia.

Integrated Coastal Zone Management in the Baltic States and Poland:

The project focuses on a large stretch of coastline in order to set up a framework for long term environmental management and sustainable economic development.

Administration and Management plans for Pape and Jurkalne coastal areas:

The plans including wetlands of international importance such as Lake Pape, Nida bog, and Sarnate bogs has been elaborated.

Integrated Coastal Zone Management Plan project for Engures-Kanieris Task Area:

The plan is under way to elaborate separate management plans for the Lake Engure Ramsar site and the Lake Kanieris Ramsar site.

Planning of North Vidzeme Biosphere Reserve:

The reserve was established in 1997, and includes several important wetland areas such as East coast of Riga bay (a part is the Baltic Sea protected area and is a Ramsar shadow listed site), the Northern bogs (a Ramsar shadow list), a part of the transboundary project area with Estonia, shadow listed Seda marsh, Lake Burtnieks, Ruja fish-ponds, Madiesenu bog, and Lake Augstrozes Lielezers.

2) International cooperation projects

Multilateral research projects on migratory fish, birds, pinnipeds, and bats are carried out by different institutions in Latvia. For instance, regular wintering waterfowl counts run by the Institute of Biology are a part of the Mid-winter waterfowl census coordinated by IWRB and the Wetlands International. Largely supported by the Bird Life partner organizations, the Latvian Ornithological Society organizes a count of migratory swans, goose and cranes at important bird areas. Studies of ecology of bats including their migrations and requirements for wetlands as feeding habitats are carried out by the Latvian Theriological Society with support from the Swedish Environmental Protection Agency and the Natur Schutzbund Deutschland.

The Ziemelu bogs forms an integral transboundary part of the Estonian-Latvian mires complex and is one of the shadow listed sites. Official agreement with Estonia on legal framework for transboundary nature protection would benefit further identification of sites.

A joint transboundary wetland conservation project is being operated to protect and manage a large tract of natural mires that stretch on Latvian and Estonian border. This is a cooperation project of the North Vidzeme biosphere reserve and the Latvian Fund for Nature from Latvian side and the Nigula reserve and the Estonian Fund for Nature in Estonian side. The project area includes the Nigula Bog Ramsar site (Estonia) and the Northern Bogs shadow listed site (Latvia). Moreover, GOL seeks an official agreement with Estonia towards establishment a broader legal cooperation framework for nature conservation.

Multilateral and Bilateral International Cooperation Projects Related to Wetlands

No	Organization	Project Title
1	Ramsar Small Grants Fund	Inventory of Peat lands
2	GEF/UNDP	National Report on Biological Diversity, National Biodiversity Strategy and
3	Swedish Environment Protection Agency	ICZM Plan for Engure-Kanieris Task Area
4	Danish Environment Protection Agency	Pape and Jurkalne Management plans
5	EUCC	Management Plan for Lake Kanieris
6	JICA	Environmental Management Plan for Lubana Wetland Complex
7	European Commission	CORINE biotopes project report
8	EU LIFE	Red Data Book
9	EU PHARE	Integrated Coastal Zone Management in the Baltic States and Poland
10	Dutch Ministry of Agriculture, Nature Conservation and Fisheries	Aerial counts of wintering waterfowl; and with Wetlands International: publication of booklet on wetlands and the Ramsar Convention in Latvia
11	BirdLife International / Swedish Ornithological Society	Inventory of Important Bird Areas
12	MATRA program of the Dutch Ministry of Foreign Affairs	Management Plan for Lake Kanieris

Source: National Report of Latvia for COP7 of the Ramsar convention, 1999

The Lake Engure Ramsar site has exchange programs with the Lake Takern Ramsar site in Sweden. The cooperation with the Lake Takern Funds and the Oestergoetland Ornithological Society has contributed to work of the Engure field station, and has also included regular trips for exchange of experiences. The latter have been invaluable for both professional biologists and students from Latvia visiting Lake Takern to involve in practical field activities and learn its management and administration. MEPRD convened the Ramsar Convention Pan-European Regional Meeting at Riga in 1998.

3) Wildlife population control through hunting

In Latvia, hunting is a very popular recreational activity deeply rooted in its culture. There exists sufficient number of hunters, and the population of game animals and birds are regulated through licensed game numbers. In Latvia, therefore, hunting is serving as an important tool for wildlife population control. This is regarded as a type of civil participation in wildlife conservation.

Legal hunting system

Hunting in Latvia is regulated by the Hunting Law and Hunting Regulations, and the system is being unified with that of EU with esteemed sovereignty of a country. The Chief Forester's Office and the state-shared forest company: 'Latvijas Valsts Mezi' carry out actual hunting administration. Regional offices of the former play general control role by estimating animal population numbers in the field and deciding number of licenses.

The state-shared forest company is in charge of practical licensing work and hunting fee collection at state-owned lands. The company designates hunting territories and leases them to a hunting team respectively for several years term. Leasing fee is about 1,000-1,200 LVL for a territory of 5,000 ha and the rate becomes higher in smaller territories. Hunting fee per animal is not necessary and the team can hunt permitted number of animals. Each team exchange lease agreement (for example 7 years). In Rezekne, Lubana Reesona and Balvi districts there are six hunting teams and each team consists of about 20-35 members with a leader. Each hunting group prepares a management plan of

respective territories. Some teams artificially feed deer and wild boar during winter or all the year round for the purpose of population increase, and others may not. When non-members wish to hunt in the territory, they have to negotiate with the owner.

The number of animals that is possible to hunt in respective territories is figured out from a formula based on the reported population number and the optimal population numbers (refer to Table 11.1.1). This applies to elk, red deer, roe deer, wild boar and beaver. For example, the number of permitted animals at Baltie Klani is 9 elk (2 juvenile included), 21 roe deer and 12 wild boars.

Separately from the above, there are commercial hunting territories but LWC has no territories of this type. They are open to the public including foreign visitors and hunting become possible by paying license fee per animal. For example, license fee for a wild boar with a tusks over 18 cm is US$550, male red deer with antlers of less than 5 kg US$800, wolf US$275, lynx US$750, beaver US$50, black grouse US$175 and wild duck US$10 (price on the regulation is mentioned in DM, US$1=DM2.0). Fox, raccoon dog and marten are free of charge.

There is no limit on the hunting numbers of other game animals birds, but the maximum number of daily catch is limited, for example 5 for birds. To promote selective capture, regulations for trapping is being strengthened and use of leg traps is to be banned within a year. When non-permitted species are accidentally shot or trapped, reporting is obliged.

Hunting of uncontrolled game species is basically allowed at any governmental places including Lake Lubana. Hunting in protected areas is controlled according to respective regulations of those areas. Hunting in private lands requires landowners' permission.

Hunting for pest control

EU Directive (92-43/EEC) includes beaver, wolf, brown bear, lynx, and otter among protected animals in Annex II. In Latvia, however, the numbers of beaver, wolf, lynx and otters are increasing and the tendency is particularly sharp in 1990s. Major reason of game animal increase is the decrease of hunting pressure in 1990s. In 1996 about 26,000 beavers, 5,000 otters, 1,000 wolf and more than 600 lynx are reported as total population in Latvia (State of the Latvian Environment, 1997). Presently in Latvia, only brown bear and otter are protected species and hunting of other animals are permitted. The Latvian Red book (1990) lists brown bear, stoat, and weasel as rare species, but information is available on non-game animals including stoat and weasel.

Beavers once disappeared in the beginning of this century and appeared again around the 1950s-60s, probably by re-introduction in neighboring countries. The number increased sharply in 1990s by the decrease of hunting pressure, and now it is a serious pest animal for forestry. In LWC, beavers have wide distribution all over the area. According to the state-shared forest company, total 100ha of forests in Rezekne, Madona and Balvi districts were damaged by the animal during 1999.

Although the beaver is a protected animal in EU Directive, the number in Latvia should be regulated through hunting control. Presently beaver hunting requires a license per an animal, and hunting season is limited during October to December. For promoting beaver hunting, it is proposed to allow beaver hunting all year round and to list beaver on a group of animals that do not require individual licenses. At the same time, monitoring should be continued periodical re-examination of the regulation.

Elk, red deer, roe deer and hares also damage saplings, but the damage seems not serious and there is no statistics about such damage. Damages by voles are not reported. Influence of mammals on fishery is negligible. Although carnivorous mammals like American mink and otter also eat fish, their population number is limited.

Problems of hunting

Presently hunters' interest is mainly on large game animals and the hunting system is effective for controlling them, but attention to game birds and small animals are not sufficient. Under cooperation with forestry administration, this system can become more effective for wildlife management by 1) applying license number system to more species, 2) improving population estimation method, 3) frequent re-examination permissible hunting numbers and hunting period about 5 years interval, 4) giving training opportunity including hunting education to younger generation, 5) extending hunters' interest in more species by awareness, and 6) more incentives for cooperation in governmental management.

(6) Constraints on natural environmental conservation

Main problems and difficulties that slow down implementation and restrict scale of desirable actions are as follows:

1) Decrease of biological diversity

The main reasons of the decrease of biological diversity are: alteration of natural biotopes (old forests, marshes, floodplain meadows) and their replacement with areas of intensive utilization, stopping of migratory routes of animals and plants, pollution of water, air and soil.

2) Financing problems

An annual budgetary allocation by the government supports conservation and wise use of wetlands forming a part of the state program for development and the implementation of environmental policy measures subprogram for nature protection.

Latvia joined the Ramsar Convention in 1995. Therefore, there is much to do for implementing this convention's requisites. The works of educating of experts, organizing conferences and seminars should be done. Moreover, field projects for wetland conservation needs great financial investments. For example, wet meadows are one of the most endangered biotopes in Latvia, which can not exist if farmers mow the hay for

keeping cattle. Because it is not a profitable work any more Western Europe farmers have subsidies to work on such meadows, but Latvian farmers don't have at all.

3) Institutional and individual capacity building

There are no domestic projects on needs and development of training program for institutions and individuals concerned with wetlands. However, some officers experienced wetland related training opportunities outside the country. Delegates from the Lake Engure Nature Park Board representing different institutions such as the Institute of Biology, the Local Administration, MEPRD, and the Latvian Fund for Nature have been on a short wetland management training visit to Sweden. It included learning case studies and practices of management and administration of Lakes Takern and Hornborgasjon. Actually, both wetlands with their development backgrounds have been less known to a few people in Latvia before. One more delegate has attended the international course on wetland management organized by the Wetland Advisory and Training Center in Netherlands.

4) Lack of awareness

The State Educational Program that includes aspects of public awareness on issues related to wetlands is supported by the Environmental Protection Fund. Priority has been given to development of a media center of the Environmental Film Studio. It is preparing programs for TV broadcasts, focusing on nature protection, and solution of environmental problems. Wetlands conservation aspects and wise use principles are included in educational programs of studies for the master degrees in the Biology and Environmental Sciences in University of Latvia. Other levels of education (primary, secondary, tertiary, and adult) seem not to be included.

11.1.2 Conditions of Environmental Monitoring

(1) National wetland inventories

A preparation of a national inventory of wetlands is essential work for wetland monitoring. Recently, several projects have produced reports, database, and publications related to wetlands. The Inventory of Mires project has analyzed bogs, fens, and marshes with emphasis on their conditions and botany. The data are maintained in a database at the Faculty of Biology, University of Latvia. The Coordination of Information on the Environment (CORINE) Biotope Project completed in 1997 is the most up-to-date database on valuable natural areas including wetlands, for biodiversity conservation. The data are held by the Latvian Environment Data Center. Two consecutive national wetland inventories were produced by the Latvian Fund for Nature and the Latvian Ornithological Society.

The Latvian Fund for Nature and the Latvian Ornithological Society produced national wetland inventories. The latest publication in 1998 has a general introduction on wetlands, and relevant conservation issues, e.g. international conventions and national legislation,

and a detailed overview of the three designated and nine shadow listed Ramsar sites in Latvia. Each site is provided with the basic data on Ramsar criteria it meets, whether it has a management plan, its protection status, administration, location, description, nature conservation values, human activities, threats, conservation and research and details on visiting. A list of further 29 perspective or data deficient wetlands sites is also given. The publication has been distributed to the State authorities, decision-makers, and NGOs countrywide.

There are 58 internationally important bird areas in Latvia in 1998, and 32 of which are wetlands. Besides the above-mentioned inventories, database on the Important Bird Areas (IBA) in Latvia including wetlands have been compiled by the Latvian Ornithological Society and the Bird Life International. The IBA database module forms an integral part of the World Bird Database maintained by the Bird Life International. Wetlands important for birds are selected by using criteria based on estimates of migratory waterfowl populations (e.g. 1% threshold of the flyway population is commonly used). This is in line with Criteria 5 and 6 of the Strategic Framework for the List of Wetlands of International Importance that was adopted by Ramsar Resolution 7.11 in 1999. The Red List of Latvia published in 1985 includes a wide range of wetland species. For example 45-50 bird species of 71 depend on wetlands biotopes. Insect species are listed on the list of 1992 that was ratified by the board of Latvian Red Book.

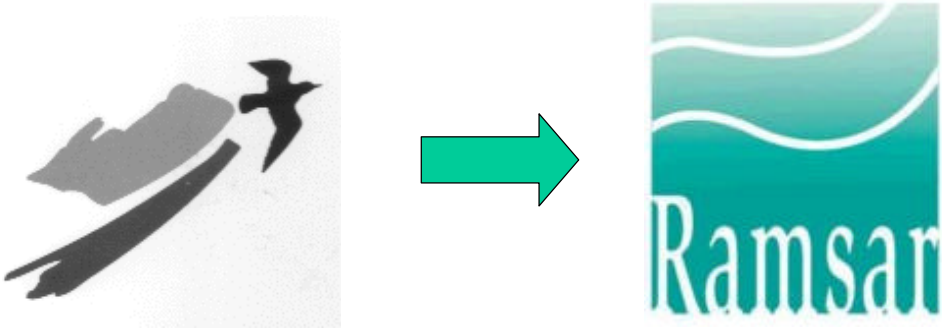
(2) Monitoring by NGOs

The WWF project 4568 “Conservation Plan for Latvia” in 1992 was the pioneer publication to compile data on the network of valuable nature areas including many wetlands, irrespective of their protection status. The Latvian Fund for Nature and the Latvian Ornithological Society have produced wetland inventories.

11.1.3 Requirements of Ramsar Convention on Wetlands

(1) Recent movements of Ramsar Convention

As its formal name “Convention on Wetlands of International Importance, Especially as Waterfowl Habitat” indicates, Ramsar Convention started as a treaty to protect waterfowl habitats. Recent years, however, the Convention is putting more emphasis on its role as a biodiversity convention in wetlands with extended focus on basin management. Symbolizing this change, the logo of the Convention has been changed from “water bird” to “water and life” since 1999. Among titles of 30 resolutions and four recommendations adopted at the 7th Contracting Parties’ Meeting in 1999, the name of ‘waterfowl’ appeared in only one resolution.



Old logo **New logo (from 1999)**

Old (left) and New Logo (right) of the Ramsar Convention

At the 7th Meeting of the Ramsar Convention in 1999, "Strategic framework for the List of Wetlands of International Importance" was newly adopted as the Resolution 7.11. The resolution emphasizes the need to include representatives, rare or unique wetland types as Ramsar sites as well as wetland types based on ecological communities. In the light of these new criteria, flood meadow type wetland needs more attention. The meeting also set a short-term target of the Convention to increase the number of world Ramsar sites from approximately 1,000 at present to at least 2,000 by 2005. This request applies to Latvia, too. As exemplified by the large difference in the number of Ramsar sites, however, registration policy of Ramsar sites depends on respective government.

Number of Ramsar Sites in Selected Countries (as of October 2000)

Latvia	3	UK	148
Estonia	10	USA	17
Lithuania	5	Germany	31
Japan	11	Denmark	27

(2) Latvian national wetland policy

Latvia joined the Ramsar Convention in 1995. Although no national wetland policy exists in Latvia, wetlands related issues are mentioned in NEPP. Measures for solution of specific problems were covered by the National Environmental Action Program which was approved by the State Minister for Environment in 1996. However, steps to incorporate wetland economic valuation techniques into natural resource planning and assessment actions have not been taken.

In Latvia there are many natural and semi-natural wetlands. Therefore, conservation efforts are focused on protection and management of still healthy wetlands, and restoration of degraded or disappeared wetlands is not considered a priority in this country. For instance, conservation of remaining natural peat lands and mires would be a highest priority in Latvia.

A National Ramsar and Wetlands Committee does not exist in Latvia, but several experts and working groups are formed for elaboration of the National Biodiversity Strategy and the Action Plan. They consist of government offices and delegates from professional institutions, and NGOs. One of the working groups is dealing with nature conservation in

particular. Other group is dealing with fishery. They serve as cooperation mechanisms between institutions responsible for impacts on the conservation and wise use of wetlands.

(3) Ramsar sites in Latvia

The internationally important wetlands (Ramsar sites) in Latvia are identified based on the criteria of the Ramsar COP6 Resolutions and Recommendations which include 1) they meet the 1% criterion for water bird populations and 2) they are peat land ecosystems. There are no sites applicable to fish species criteria, as the fish species criteria were worked out only in 1996.

There are three Ramsar sites in Latvia: 1) Bogs Teici and Pelecare, 2) Lake Engure, and 3) Lake Kanieris. As potential Ramsar sites in the future, the shadow list of Ramsar sites in Latvia has been compiled, and Lake Lubana is listed on it as a potential Ramsar site. Of the nine shadow-listed sites in Latvia, all meet bird criteria, and four contain a reasonable proportion of peatland ecosystems.

Fortunately, noticeable changes have not occurred at any Ramsar sites during the latest few years. However, there are apparent long term trends that most prominent and care demanding areas suffer from uncontrolled spreads of reed beds and overgrowing with emergent and water fringe vegetation. Formal management plans are in implementation at Bogs Teici and Pelecare site, and in preparation at Lake Kanieris site. Management status of existing Ramsar sites are as follows:

1) Bogs Teici and Pelecare Ramsar site

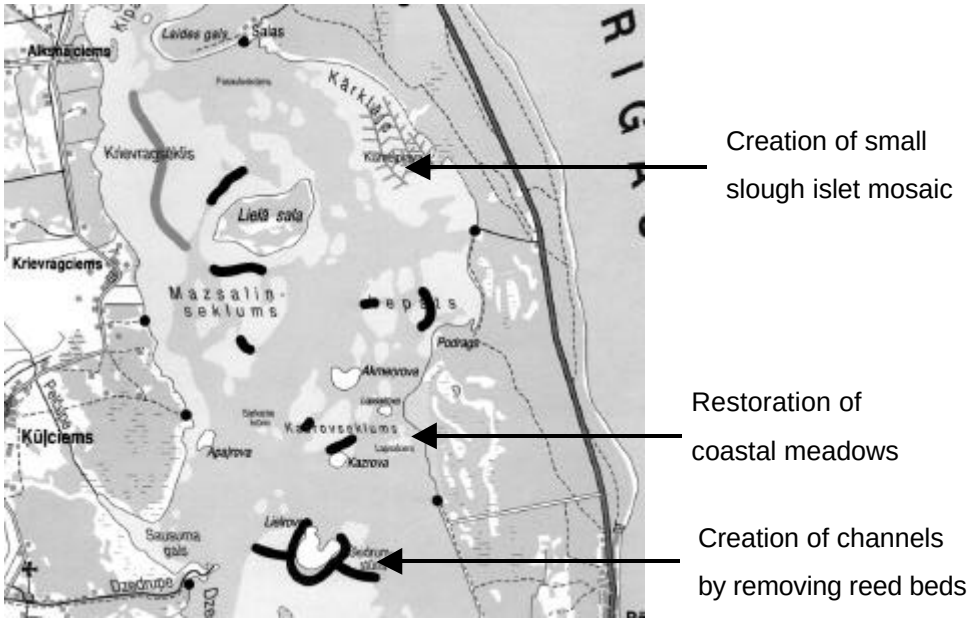
Staff of this site carry out ornithological, theriological, entomological, and botanical censuses that allow for detection in changes in ecological character of this hardly disturbed area since 1982. Hydrological and geological survey data are also available.

2) Lake Kanieris Ramsar site

A management plan of this site does not include a financed monitoring scheme, but continuous studies on bird populations and general ecological status are available.

3) Lake Engure Ramsar site

Although there is no formal management plan, bird conservation efforts and monitoring have been continued by ornithologists since 1982 by using research budget. Construction of artificial islands produced very favorable effects for increasing breeding waterfowl in the initial stage. However, birds are decreasing sharply after 1994 by a) overgrowth of reeds diminished open watershore lands suitable for waterfowl breeding and by b) the increase of exotic predators like mink that appeared in the 1970s. Eutrophication and cessation of traditional land use activities are also influential. Although conservation measures shown in the following figure are proposed, they have not been realized due to financial situation.



Example of Proposed Habitat Management Measures for Lake Engure (Viksne, 1997)

As potential Ramsar sites in the future, the shadow list of Ramsar sites in Latvia has been compiled, and Lake Lubana is listed on it as a potential Ramsar site. Of the nine shadow-listed Ramsar sites in Latvia, all meet bird criteria, and four contain a reasonable proportion of peatland ecosystems.

11.2 Overall Frame of the Wetland Conservation Plan

11.2.1 Approach and Strategy

Since LWC has been used for production, it is not appropriate to apply only the restriction of human activities for nature conservation. Therefore, the following approaches should be taken for the Wetland Conservation Plan (WCP) of LWC.

(1) Biotope oriented approach

Basic approach of the wetland conservation in LWC is to protect respective biotopes by establishing protected territories. Depending on the level of required conservation, each territory is divided into strictly protected quarter, regularly protected quarter, and seasonally protected quarter. Detailed conservation regulation is to be formulated by each territory based on the requirements on conservation and economic usage.

(2) Species oriented approach

Because of bio-geographical location of Latvia, its nature is composed of less number of biological species compared to that of tropical area, and therefore, there is enough reason why each species should be protected at large cost. In LWC there are endangered species such as raptors that needs species-specific protection measures. Because of their endangered status, a restriction of human activities is never enough, and positive and

urgent restoration measures are required. For example, nesting place protection has to be promoted regardless of places they are found.

(3) Awareness oriented approach

The nature conservation cannot be successful unless the local people are educated so as to appreciate the value of nature and have sufficient knowledge for wise use of natural resources. In this WCP, conservation of pastures, crop fields and commercial forests are promoted by awareness of local people and capacity building of relevant administration sectors. This approach is also necessary for promoting eco-tourism. Giving people opportunities to experience varied biotopes is especially important. For example, large raised bogs are normally surrounded by forests and it is difficult for even local residents to observe them.

(4) Strategies for LWC

The Cabinet of Ministers accepted the strategy of the National Program on Biological Diversity (NPBD) in February 2000. The strategy covers nature protection, sustainable use of natural resources, environmental policy instruments, and prerequisites of introduction. Many items in NPBD have close relevance with the environmental management of LWC. The main strategies taken for WCP are in conformity with NPBD but some modifications are made to reflect the situation of LWC.

To emphasize biodiversity in rivers and lake: In view of the uniqueness of LWC, physical conservation measures mainly focus on aquatic and semi-aquatic biotopes. Water level control and habitat improvement at fishponds are among active management measures for waterfowl augmentation.

To preserve fragile wetland vegetation: Importance and fragility of such vegetation as raised bog would justify to restrict economic activities. Peat extraction should be prohibited by respective regulations of protected territories. How to register a Ramsar site needs to be clarified.

To strengthen the function of forests: This is achieved by understanding the importance of forests that provide habitats for birds and animals and resources for eco-tourism. Promotion of understandings includes inventory work of forest fauna and flora, wildlife corridor functions, monitoring of exotic species monitoring, forestry methods, hunting administration, and training and awareness of the local people as well as forest sectors.

To manage game animals and birds through hunting: In Latvia hunter groups traditionally play important roles for wildlife management. Therefore, their cooperation and capacity building need to be emphasized in such aspects as wildlife population estimation and pest animal control. NPBD recommends inclusion of hunting in development plans for tourism, but this is not compatible with bird watching type eco-tourism. It is proposed to restrict hunting in some places that are intensively used for the latter purpose.

To reduce impacts of hunting on bird behavior, introduction of hunting regulations on non-restricted carnivores should be explored including research on and

<u>To promote eco-tourism for sustainable resource use</u>: Promotion of eco-tourism should be integrated through habitat conservation, nature program for eco-tourists, and training of field guides. Collaboration with the Office of State Nature Reserve Teici, universities and environmental NGOs is promoted as well as capacity building of municipal governments.

<u>To focus on environmental education and public awareness</u>: Environmental education and public awareness is crucial for successful environmental management of LWC. The proposed Environmental Management Center (EMC) has a character as a biodiversity information center, and its environmental database should be accessible on the Internet. Publication, translation, signboard display, school visit activities should be promoted by selecting symbolic species of LWC for awareness purpose.

(5) Mitigation strategy

Latvian NEPP and NPBD aims at maintenance and protection of existing biodiversity and landscape characteristics. Lake Lubana at present, however, is already degraded due to large-scale dyke work. Since the work is largely contributing to flood prevention, it is not appropriate to bring back the lake to a natural wetland what it used to be half a century before. Therefore, e*x situ* mitigation measures such as upgrading neighboring fish ponds as alternative waterfowl habitat is sought. This does not contradict with the concepts of the Ramsar Convention as it admits to compensate for any loss of wetland resources (when they are lost in urgent national interest), either in the same area or elsewhere, of an adequate portion of the original habitat.

11.2.2 Biotopes to be Protected

(1) Definitions and justification of biotope types

LWC is divided into 9 biotope types. Since distributions of most animal species are bound by vegetation types, biotopes of LWC is delineated by modifying vegetation map. Respective biotopes are defined as follows:

1) Raised/Transitional bogs

As Drawing clear lines between raised and transitional bogs is difficult, they were dealt with collectively. Faunas of those bogs are also similar. In view of the habitat use of birds and mammals, fringing forests around bogs are regarded as a part of this biotope.

2) Fens

Fens are characterized by reed with constant high groundwater level. A thick peat derived from dead plant of reed is developed in the area. Topographically, fens distribute where water flow of an annual flood is not so fast as disturbing accumulation of peat in LWC.

3) Inundated grasslands (Klani)

Inundated grasslands are characterized by annual inundation. Comparatively fast water flow during annual flood is maintaining the grassland by disturbing an invasion of bush species in natural ecosystem.

4) Coniferous forests

Natural and afforested coniferous forests are also collectively dealt with due to insufficient faunal data to characterize both vegetations. Though it seems appropriate to distinguish soil woodland and bog woodland as separated biotopes, faunal data and soil type distribution is unclear, presently.

5) Deciduous forests (small-leaved forests) and Broad-leaved forests

Reflecting vegetation difference, Deciduous forests (small-leaf) and Broad-leaved forests are dealt separately. Faunal characteristic of the latter, however, is unclear because the area is limited in LWC.

6) Dry grasslands and Agricultural lands

These include a land with vegetation cover, including natural grassland, pastures, and abandoned agricultural fields, and agricultural lands without vegetation cover.

7) Lakes, rivers and canals

Because many fishes migrate between Lake Lubana and adjoining rivers, the lake and rivers are included in the same biotope. Large canals with persistent water are almost identical with natural rivers. Drainage channels and ditches with seasonal water are not included as they are not fish habitats.

8) Fishponds

Due to fully artificial fish fauna and shallow water depth independent from seasonal flooding, they should be dealt as independent biotope from other water bodies.

(2) Population trends in birds and animals

1) Mammals

Many mammal species in LWC prefer areas mixed with forests and grasslands. Species solely dependent on bogs are few. Although the list of mammal species does not include small mammals like Muridae (voles and mice) and Chiroptera (bats), their distribution is linked with that of soil woodlands. Aquatic mammals like otters and beavers occur along watercourses. Therefore, construction of drainage canals and ditches and plantation functioned favorably to expand their habitats, increasing foods like frogs. (Table 11.2.1).

In LWC, the only information source on mammal population is hunting statistics compiled from the statement of hunter groups in respective hunting areas (Table 11.1.1). Brown bear is near to extinction. Though its footprint was seen in Vilani, it was just a transit. As hunter population decreases, hunting pressure declines. Impact of road is not serious in LWC. Populations of wolf, lynx and otter seem not to be decreasing. Increase of forested areas also functions positively as most game animals are forest dwellers. Consequently, there are no specific mammal species to be protected in LWC.

2) Birds

LWC is included in the List of Important Bird Areas in Europe (BirdLife International), and 224 species out of 325 bird species in Latvia have been recorded. Long term trends in bird fauna in LWC reveal population decrease in birds linked with habitat loss by drainage activities that started in the 1920s. Affected are consequently bog dwellers. Presently, vegetation of inundated grassland is rapidly changing by abandoning hay-making. In the near future, this may affect bird species like great snipe that breed in such wetland types.

Trends of Bird Decrease

No	Species	Major habitats	Reason	Time
1	*Falco columbarius* (Merlin)	lake, bog	-	from 1940s
2	*Falco peregrinus* (Peregrine)	Bog	-	before 1970s
3	*Columba oenas* (Stock Dove)	-	-	between 1940s - 1970s
4	*Bubo bubo* (Eagle Owl)	Bog	-	before 1970s
5	*Coracias garrulus* (Roller)	-	Pan-European decrease	between 1950s - 1970s
6	*Anas platyhynchos* (Mallard)	open water	Habitat change by drainage and lake water level rise	1920s - present
7	*Milvus migrans* (Black Kite)	lake/river surroundings	Drainage	1920s - present
8	*Circus cyaneus* (Hen Harrier)	lake/river surroundings	-	1930s - present
9	*Aquila chrysaetos* (Golden Eagle)	Bog	-	before 1980s
10	*Falco tinnunculus* (Kestler)	Bog	-	Ongoing
11	*Lagopus lagopus* (Willow grouse)	Bog	Pan-Latvian decrease	1930s - 1950s
12	*Tetrao terix & Tetrao urogallus* (Black Grouse & Capeercaillie)	-	-	1980s - 1990s
13	*Philomachus pugnax* (Ruff)	flood grasslands and lakeshore	land conversion by drainage	1950s - present
14	*Numenius arquata* (Curlew)	-	shrinkage of flooded areas	
15	*Asio flammeus* (Short-eared Owl)	Bog	-	1950s - 1980s

Note: "-" means no information.

On the other hand, a population increase is remarkable in some water birds after the 1980s as shown below. Such increase is mainly due to fishpond construction near Lake Lubana in the 1970s. In some species such as gray heron and mute swan, however, the population increase seems to be linked with pan-European trends. Bird species living in bushes or forests seem not to be so much affected. Therefore, it is concluded that priority places for bird conservation are bogs and fishponds, because the former is a vulnerable habitat and the latter is serving a core of water bird distribution.

Trends of Bird Increase

No	Species	Major habitats	Reason	Time
1	*Phalacrocorax carbo* (Cormorant)	open water	fishpond construction	1990s
2	*Ardea cinerea* (Grey Heron)	open water	increase all over Latvia, fishpond construction	after 1950s
3	*Cygnus olor* (Mute Swan)	lake, fishponds	increase all over Latvia	after 1950s
4	*Cygnus cygnus* (Whooper Swan)	-	increase all over Latvia	after 1950s
5	*Anser anser* (Greyleg Goose)	-	increase all over Latvia	after 1980s
6	*Haliaetus albicilla* (White-tailed Eagle)	forest stands and bog	artificial nests	after 1980s
7	*Circus pygargus* (Montague's Harrier)	mire and grassland	-	after 1980s
8	*Pandion haliaetus* (Osprey)	open water	fishpond construction and artificial nest	after 1970s
9	*Pluvialis apricaria* (Golden Plover)	bog	-	after 1950s
10	*Numenius phaeopus* (Whimbler)	bog	-	after 1980s
11	*Tringa stagnatilis* (Marsh Sandpiper)	fishpond	fishpond construction	after 1970s
12	*Xenus cinereus* (Terek Sandpiper)	-	-	after 1980s
13	*Larus munutus* (Little Gull)	lake	-	after 1980s
14	*Larus ridibundus* (Black-headed gull)	lake	fishpond construction	late-1980s - present
15	*Larus argentatus* (Herring gull)	lake	fishpond construction	after 1970s
16	*Chlidonias hybridus* (Whiskered Tern)	open water	fishpond construction	1990s
17	*Chlidonias niger* (Black Tern)	open water	-	after 1980s
18	*Chlidonias leucopterus* (White-winged Black Tern)	open water	-	after 1980s
19	*Strix uralensis* (Ural Owl)	-	-	after 1980s

Note: "-" means no information.

Raptors

The number of some raptor species is no more than a few to several pairs. It should be remembered, however, that population numbers of top ranking predators in the food web are small originally. In the case of Golden Eagle (*Aquila chrysaetos*), judging from its severe habitat preference and large territory which sometimes exceeds 5,000 ha, the original carrying capacity of LWC biotopes will not exceed several pairs. Their nests tend to distribute unevenly in LWC, and it does not depend on naturalness of vegetation. Although it is certain that big trees are their favorable nesting places, further study is necessary to determine their preference for nesting place.

Examples of Rare Species in LWC

Species	Population
Pandion haliaetus (Osprey)	3-5 pairs
Haliaeetus albicilla (White-tailed Eagle)	3-4 pairs
Circaetus gallicus (Short-toed Snake-Eagle)	1-2 pairs
Aquila pomarina (Lesser Spotted Eagle)	20 pairs
Aquila chrysaetos (Golden Eagle)	1 pair
Aquila clanga (Spotted Eagle)	1 pair

Source: Wetland Inventory Work in Latvia, 1995.

Cormorants

Bird species that have potential of damage on aquaculture is shown in Table 11.2.2. Like other places in the world, the population of cormorant in LWC is sharply increasing in the 1990s and it has reached 300 pairs (Opermanis, 1998). Now it is a serious pest for aquaculture. Supposing their fish consumption is 500 g/day/head, their consumption in LWC exceeds 100 ton per year. Since most of their feeding activity seems to be at fishponds, this is a large damage to aquaculture. Presently, cormorant is not included in game birds, and no organization is responsible for their damage. There will be no other

alternatives than continuing hunting for population control combined with continued population monitoring. Some raptors like osprey are fish eaters, but the damage they cause is limited because their population numbers are limited.

3) Fishes

Fish species in Lake Lubana do not include endangered ones, but fish fauna is changing as described in Chapter 7. Eel disappeared after the 1960s and the number of fish species increased in the 1990s. The latter phenomena may be due to introduction of commercial species for aquaculture. The exact influence of water level rise in Lake Lubana in the 1980s needs further investigation.

Fish composition and abundance in Lake Lubana is changing due to flood measures and commercial fishery activities. In particular, construction of water gates impeded migration of many species for spawning. Little is known about their underwater habitat preference and quantitative influence of the above aspects. Further investigation is necessary for fishes.

(3) Conservation value of respective biotopes

Conservation values of respective biotopes are shown in the following table, as a result of the examination of fauna and flora situation of LWC.

Conservation Values by Biotope Types

No	Biotope type in JICA study	Vegetation	Mammals	Water birds	Raptors	Other birds	Fishes
1	Raised/Transitional bogs	++	+	-	++	++	-
2	Fens	+	+	+	-	+	+
3	Inundated grasslands (Klani)	+	+	+	+	+	+
4	Coniferous forests	+	+	-	+	+	-
5	Deciduous forest (small-leaf forest)	+	++	-	++	+	-
6	Broad-leaved forests	++	++	-	+	+	-
7	Dry grasslands/Agricultural lands	+	+	+	+	+	-
8	Lakes, rivers and canals	+	++	++	+	+	++
9	Fishponds	+	++	++	+	-	-

Note: ++, highly valued; +, relevant; -, not relevant.

(4) Implication of habitat requirements with water level

Artificial alterations of LWC biotopes during the last three-quarters of the twentieth century were mostly related to water levels. Drainage works affected on forests, bogs, fen and inundated grasslands, and dyke construction mainly on lake and inundated grassland. The following tables indicate water level requirements of respective mammal and bird species.

1) Mammals

Water levels of Lake Lubana and other water bodies are not so important for mammals because they mostly remain on shores. If water level change leads to decrease of hiding places on shores, it is a negative factor for them. Large and medium size mammals can escape from inundated areas. Although small mammals like moles may not be able to survive at inundated areas, they are common and have high reproduction rates.

Habitat Requirements of Water Levels for Mammals

Mammals that live in LWC		Habitat requirements
Aquatic mammals	Otter	Abundance of prey fish and frogs. Hiding places near water shores. Long total length of water ways due to large home range.
	European beaver	Existence of water bodies in forested areas.
	Muskrat	Shores of gentle or still water bodies.
	American mink	Abundance of fish and frogs for food.
Insectivore	Hedgehog and Mole	Habitat being safe from inundation.
Lagomorpha	Brown hare and Blue hare	Habitat being safe from inundation.
Arboreal species	Red squirrel and Pine marten	Not relevant
Terrestrial carnivores	Raccoon dog, Wolf, Brown bear, Lynx and Badger	Habitat being safe from total inundation (but tolerant to partial inundation of their large home ranges).
Artiodactyla	Wild boar, Roe deer, Elk, and Red deer	Habitat being safe from total inundation (but tolerant to partial inundation of their large home ranges).

2) Birds

Many bird species require shallow waters for feeding. Large waders need water depth less than about 50 cm deep. Small waders like snipes require shallower places. Waterfowls such as ducks and geese that depend on underwater foods, cannot catch bottom foods if water depth becomes deeper than about 3 m. Water depth has little importance as resting sites of water birds. LWC is used as breeding sites for many bird species, and those sites should be safe from inundation during the breeding season. For example, great snipe that breeds only at inundated grassland is directly affected by flooding, and the flooding period is more important than the flooding level. Prolonged inundation is also not favorable for birds having their home ranges in such places.

Lake Lubana has a very flat bottom. At its lakeshore the elevation is 91.5 m above sea level and 90.1 m at deepest part. This means that the lake water depth is 1.0-1.4 m at normal water level (92.5 m). As long as the lake water level is regulated within the planned range of 91.2 - 95.3 m, most areas surrounded by the dyke are filled with water. This means that the lake can serve as a huge resting place for water birds, but is not suitable as breeding places. Colonies of gray heron and cormorant at an island in the lake (93.2 m) will be also susceptible to water level increase. The lake water depth is acceptable as a feeding site for diving waterfowl, but is too deep for waders. However, for securing abundant fish, benthic animals and weeds, lowering of water level below 91.2 m should be avoided as it leads to shrinking of water area like the case that happened in 1995-1996.

Differently from the lake, shallow water levels of fishponds are suitable even for small waders, and there are many suitable breeding places near water shores. For resting, many water birds prefer small ponds to large lakes, and fishponds are appropriate in this sense. This is why breeding of water birds is limited to fishponds and not in the lake. After the construction of dykes in 1983, flooding in LWC is mostly limited to inundated grasslands along the Aiviekste river. Prolonged inundation period, particularly during the breeding season, is not favorable for some birds like great snipe that breed and feed at inundated areas. Bird species in the other areas, however, seem not to be affected by water level.

Habitat Requirements of Water Levels for Birds

Bird species that breed in LWC		Habitat requirements
Diurnal raptors	Osprey	Shallow waters less than 60 cm deep is desirable for catching fish.
	Golden eagle	Its home range seems not affected by water level.
	White-tailed eagle	Because of its fish-eating habit, water level should be controlled so that prey fish is abundant.
	Spotted eagle	Because it breeds near inundated grassland and preys on waterbirds, water level should be kept to allow waterbird abundance.
	Lesser spotted eagle	It mainly prey on terrestrial animals, and seems not affected by water level.
	Short-toed eagle	Since its present breeding site is located near inundated grassland, long flooding seems unfavorable for securing hunting areas.
Colonial water birds	Grey heron	Shallow water is necessary for feeding while wading. Its colony at an island in the lake should be safe from inundation.
	Cormorant	Water level should be controlled so that prey fish is abundant. Its colony at an island in the lake should be safe from inundation.
Wading water birds	Black stork	Shallow water is necessary for feeding while wading.
Anatidae water birds	Underwater food Eaters and fish eaters	Water level of less than about 3 m is necessary for feeding foods under the water. Open water area is necessary for resting. Breeding sites near waters should be safe from inundation especially at breeding season.
	Land food eaters	Open water area is necessary for resting. Breeding sites near waters should be safe from inundation especially at breeding season.
Inundated grassland birds	Great snipe	As it breeds only at inundated grasslands, prolonged inundation period that overlaps with breeding season should be avoided.
Forest birds		Habitat should be safe from inundation especially at breeding season.
Fen and Bog birds		Habitat should be safe from inundation especially at breeding season.
Dry land birds		Their habitats are not affected by water level.

3) Fishes

As long as the lake water level is regulated within the planned control range of 91.2 - 95.3 m, water depth will be sufficient for adult fishes. Although death of carp by freezing has been reported at shallow waters, many fish species can survive the season by becoming inactive and burying themselves in the mud. Research results on necessary water depth are not available. Although the lake water level is sufficient for spawning of most fishes, it is questionable whether there are suitable spawning places endowed with aquatic plants, stony beds, and other substratum to which spawns stick. The importance of Lake Lubana as a spawning place is not clear. Productivity of fish resource is highly related to abundance of zooplanktons and zoobenthos. Shrinkage of open water area that occurs every several years at Lake Lubana is unfavorable for securing weeds and benthos. Some fishes catch insects that have fallen into water, but such does not take place frequently at large lakes but rather at waters in forested areas.

Habitat Requirements of Water Levels for Fishes

Fishes found in LWC	Distribution in LWC	Habitat requirements
Spiny loach	lake and rivers	Spawning place shallower than 1 m.
Perch	lake and rivers	Not particularly.
Verkhovka	lake and rivers	Not particularly
Ide	lake and rivers	Passages to allow migration. Submerged plants for food.
Carp	lake and rivers	Passages to allow migration.
Crucian carp	lake and rivers	Not particularly.
Ruffe	lake and rivers	Not particularly.
Pike	lake and rivers	Abundance of food fish and frogs.
Tench	lake and rivers	Not particularly.
Bream	lake and rivers	Passages to allow migration. Existence of submerged plants at spawning place (if it breed at LWC).
White bream	lake and rivers	Passages to allow migration.
Rudd	lake and rivers	Submerged plants for living place, food and spawning.
Chub	lake and rivers	Submerged plants for living place.
Silver carp	lake and rivers	Submerged plants for food and spawning.
Burbot	lake and rivers	Passages to allow migration. Shallow spawning place (< 50 cm) with submerged plants (if it breed at LWC).
Bleak	lake and rivers	Not particularly.
Pike-perch	lake and rivers	Passages to allow migration. Abundance of food fish. Shallow (< 30 cm) spawning place with stone bed (if it breed at LWC).
Eel	lake and rivers	Passages to allow migration to the sea for spawning.
Dace	rivers	Passages to allow migration. Spawning place shallower than 1.5 m (if it breed at LWC).
Asp	rivers	Passages to allow migration.
Sheat-fish	rivers	Spawning place capable of making 'nest' (if it breed at LWC).

4) Vegetation

The water level conditions in LWC will affect deciduous and coniferous forests at low elevation as well as fen and inundated grassland. According to the preliminary inundated maps shown in Chapter 7, raised bog, transitional bog, dry grassland, and agricultural land seem to be not so much influenced by snow-melting flood in LWC. The vegetation of bogs and peat land forests are rather sensitive to drainage activities.

(5) Problems for biotope conservation

The following problems have been pointed out as factors of environmental degradation in and around LWC:

- water level control unfavorable for waterfowl
- reduction of fish breeding and consequent transformation of the fishpond area,
- reduction of haymaking on floodplain meadows and consequent overgrowing,
- peat extraction is a potential threat for raised bogs,
- drainage of bogs and forests around the lake, and
- intensification of tree cutting damaged on mammal and bird fauna especially those on raptors.
-

11.2.3 Delineation and Description of Protection Area

The Cabinet of Ministers of the Republic of Latvia on June 15, 1999 (Regulations No. 212/199) approved 11 nature protection territories in LWC that belong to the category of "Nature Reserves". According to the Latvian legislation system, each territory needs a specific protection plan including zoning and prohibited activities. Among the 11, management plans presently exist at 3 territories, Pededze River Lower Stretch, Parabaine, and Lubana Depressions.

List of Biotopes to be Protected in LWC

Biotope		Present status	Biotope values and possible use
Name	Area (ha)		
1. Barkava oak stand	62	○	- Forest conservation
2. Berzpils bog	3,319	○	- Raised bog conservation
3. Idinu bog	818	○	- Raised bog conservation, Eco-tourism
4. Idena and Kvapani ponds	1,116	○	- Waterfowl habitat, Eco-tourism, Aquaculture
5. Lagazas-Snitku bog	3,386	○	- Raised bog conservation
6. Lubana depressions	5,905	○	- Wildlife corridor, Forest conservation, Raised bog conservation, Eco-tourism
7. Lubana and Solagala bogs	2,899	○	- ditto
8. Parabaine	approx. 9,822	○	- Inundated meadow, Wildlife conservation, Raised bog conservation
9. Pededze river lower stretch	4,177	○	- Wildlife conservation
10. Sala bog	3,862	○	- Raised bog conservation
11. Tirumnieki bog	266	○	- Raised bog conservation, Eco-tourism
12. Grivu	approx. 930	●	- Habitat for wildlife
13 Lower Aiviekste	approx. 1,950	●	- Habitat for fish and grassland birds
14. Nagli west	approx. 970	●	- Waterfowl habitat, Eco-tourism, Aquaculture
15. Nagli east	approx. 830	●	- ditto
16. Lake Lubana	approx. 7,700	●	- Waterfowl habitat, Fishery Water level control

Notes : ○ = Presently designated as Nature Reserve ; ● = Proposed by the JICA study team

Based on the results of field survey and the secondary evaluation of vegetation, the 16 biotopes to be protected are selected, and their locations are shown in Figure 11.2.1. Out of 16 biotopes, 11 areas (from No.1 to No.11) coincide with the existing "Nature Reserves". Additional 5 are located in the central part of LWC to prevent fragmented distribution of protected areas. In view of the overall management policy of LWC that aims at "protect while using", areas that are used for economic activities are included like the case of Lake Lubana and fishponds. Details of each biotopes are described below by each area.

(1) No.1. Barkava oak stand

General descriptions: It is a small natural oak forest stand surrounded by commercial forests.

Reason of protection: Although the area is small area and not highly evaluated vegetation, it is important because oak forests are not common in LWC and artificial generation of this forest type is not possible. Near the area, several breeding places of lesser spotted eagle (*Aquila pomarina*) are concentrated.

Economic use in the area: There are no roads directly accessible to the forest, and the existence is scarcely known even to the local people.

Threats to the area: Although the neighboring forests have been used for commercial logging, there seems no impeding threats to this forest as it has become a nature Reserve.

(2) No.2. Berzpils bog

General descriptions: It is mostly covered by scarcely disturbed raised bog with fringing forest stands.

Reason of protection: Raised bog has high conservation value due to very long time for its formation. Both bogs and fringing forests are to be highly ranked in the biotope evaluation of this study.

Economic use in the area: Use of the bog is limited to traditional ones by local people like berry picking, toboggan passages during the freezing period and hunting.

Threats to the area: Drainage canals surround the area, and a few drains penetrate into the bog area. Influence of water level of Lake Lubana and the Aiviekste river seems not to affect the bog in view of its high elevation.

(3) No.3. Idinu bog

General descriptions: This is composed of raised and transitional bogs with fringing forest.

Reason of protection: Raised bog has high conservation value. This area also constitutes a part of nature corridor surrounding Lake Lubana.

Economic use in the area: Use of the bog is limited to traditional ones by local people like berry picking. In view of its vicinity to fishponds that are good bird watching places, this bog could be used as the eco-tourism resource. It is necessary to take measures such as construction of observation trails to minimize disturbance by visitors.

Threats to the area: Drainage channels are scarcely formed and there seem no impeding threat. The bog is located near the lake but is safe from inundation due to its high elevation.

(4) No.4. Idena and Kvapani ponds

General descriptions: This area consists of artificially constructed fishponds which now serve as important habitat for water birds in LWC.

Reason of protection: Increase of waterfowl in LWC after the 1980s is mainly attributed to emergence of fishponds. Water bird population of LWC that satisfy criteria as Ramsar site is mostly supported by those fishponds.

Economic use in the area: This is a area developed in the 1980s for large-scale aquaculture. Due to marketing problems of fish forward, aquaculture is presently maintained in a limited scale. In the future, there is a high possibility of total abandoning of aquaculture. There is a small scale attempt for tourism promotion by local capital. Abundance of waterfowl is an important resource for bird watching and eco-tourism, so

enrichment of habitat diversities is required to attract water birds. Construction of observation facilities to minimize visitors' disturbances is also necessary.

Threats to the area: Ponds may dry up if the aquaculture is abandoned, and this means total loss of habitat for waterfowl. Increase of cormorants is a threat to aquaculture. Although fish-eating birds and mammals are often regarded as pests for aquaculture, it is necessary to recognize that sparing some portion of fish resources for them is a legitimate cost for eco-tourism except for extreme cases.

(5) No.5. Lagazas-Snitku bog

General descriptions: It is mostly covered by raised bog. Fringing forest stand is thicker than the case of Berzpils bog.

Reason of protection: Conservation value of this area is the existence of a large scarcely disturbed raised bog fringed with a thin forest area. All the area is ranked high priority to be protected.

Economic use in the area: Use of the bog is limited to traditional ones by local people like berry picking, toboggan passages during the freezing period, and hunting. Northern part of the forest is used for forestry. Small scale peat extraction may exist but has not been confirmed.

Threats to the area: Drainage channels are few and foregoing human disturbances are low. Although drainage canals surround the area, they do not penetrate into the bog area. Influence of water level of the Aiviekste river seems not to affect the bog in view of its high elevation.

(6) No.6. Lubana depressions

General descriptions: This area is bordered by a causeway and characterized by coniferous forests, mixed forests and raised bogs. Raised bogs are surrounded by the forest and are not visible from the outside. This area is now divided into three portions due to land tenure situations, and the gap areas are left as idle arable lands.

Reason of protection: Both forests and bogs are highly ranked in the secondary evaluation of vegetation. They also form a part of ecological corridor circling Lake Lubana.

Economic use in the area: Some forests are for commercial purpose. There is a small-scale tourism development plan in the gap area by local people. Human disturbance by tourism seems not so serious as far as they are limited to strolling for bird watching in the nature.

Threats to the area: It is necessary to substantially manage those areas as one area. There also exists agricultural land in the area though it is not a serious problem for conservation. Some drainage channels invade the area, so closure of these channels is necessary. The two northern portions of this area are located out side of the dyke that surrounds Lake Lubana, and therefore, the raised bog and surrounding forests in the portions may suffer

from inundation of a 10-year flood. Although constructing a new dyke between the area and the lake can prevent such incidents, this does not seem an appropriate solution in view of the large cost for the construction work (about 600,000 LVL). Judging from the fact that serious ecological changes of the area have not taken place for a quarter century after dyke construction till now, this area will be able to maintain basic characters even when special conservation measures are not taken.

(7) No.7. Lubana and Solagana bogs

General descriptions: This area is composed of coniferous forests, mixed forests, raised and transitional bogs. The northern edge of the area faces Lake Lubana, but it is not influenced by lake water level. Drainage ditches are not finely distributed, but some drains cross the bogs.

Reason of protection: Both forests and bogs are highly ranked in the secondary evaluation of vegetation. They are also important as a part of forest corridor surrounding Lake Lubana.

Economic use in the area: Southern fringe of the area is used for forestry.

Threats to the area: Vegetation change along ditches by desiccation is noticeable. The lake shore of this area is to be used for eco-tourism, but disturbance by visitors seems negligible as the route is separated from the area by the diversion channel of Malta river.

(8) No.8. Parabaine

General descriptions: The Parabaine consists of varied biotopes, but they are considerably disturbed area by forestry and drainage. Coniferous forest covers the central and western parts with fringing mixed forests, and raised bogs are situated in it. Large inundated grassland that is the largest of this type in Latvia occurs at Verdes Sala along Aiviekste river. Fen develops at Gomelis and western side of Verdes sala.

Reason of protection: All of these biotopes have high conservation values. Nesting places of endangered raptor species such as short-toed eagle and golden eagle occur in the forest area and there are seven protected forest plots in the area for raptor breeding protection. Oak forest is also included in the forested area.

Economic use in the area: Forestry on the peat soil was extensive by developing dense drainage channels in the area. Inundated grasslands had been used for mowing by local farmers for hay making, but the work has been abandoned due to declining agriculture. Fen area at western side of Verdes Sala has little economic value except for large game hunting. Gomelis is also in the similar situation and is used for waterfowl hunting seasonally. Bog areas are not economically used.

Threats to the area: Succession of inundated grasslands into shrub land is in progress due to cessation of mowing. Dense drainage canals develop at inundated grasslands, and it is also the serious cause of vegetation changes. Raised bog in the forest is also surrounded by drainage ditches.

(9) No.9. Pededze river lower stretch

General descriptions: This is an area dominated by deciduous and mixed forests with patchy distribution of transitional swamps. Drainage canals are densely developed in the forests. Oak forest stand remains along the old Pededze river.

Reason of protection: It is important because it is not common in LWC. There exist nine protected forest plots in the area for bird protection. Probably because of the lack of appropriate nesting trees, breeding of raptors are not frequent. Deciduous forests seem a favorable habitat for forest animals.

Economic use in the area: Forests are mainly preserved without economic use.

Threats to the area: Old Pededze river has almost lost water because it is diverted to the new channel that was constructed for flood control purpose.

(10) No.10. Sala bog

General descriptions: It is characterized by large raised bog in the central part and transitional bog in the eastern part. Western side of the area is connected to a large forest that is now not utilized commercially. Southwestern side is connected to Kvapani fishpond.

Reason of protection: Secondary evaluation of vegetation is highly ranked. Compared to other raised bogs, there are more tree growth in the bog area like islands, and this is a suitable condition for nesting and hunting of raptors.

Economic use in the area: Commercial logging is planned at forests in the eastern edge.

Threats to the area: There is some invasion of drainage canals.

(11) No.11. Tirumnieki bog

General descriptions: This is a small area composed of forests and a raised bog. Outside the area there are mixture of coniferous forests, and transitional swamps and breeding of raptor species are recorded from outside forests.

Reason of protection: Existence of raised bog.

Economic use in the area: Forests are used for commercial logging. Bog has no economic value. In the future, the bog can be used as an educational site to learn bog ecology because it is easily accessible from a road.

Threats to the area: Hydrological changes such as forest logging may affect the water balance of the bog because it is a small bog.

(12) No.12. Grivu

General descriptions: Together with the Verdes Sala in Paribine, the Grivu was a representative inundated grassland in LWC. Elevation of Grivu is higher than the Verdes Sala, and pure inundated grassland vegetation will not be maintained under the present water control scheme. In the Grivu, however, drains are densely laid out in a grid pattern, and trees and bushes are already growing to several meters or more.

Reason of protection: This area should be protected as transitional vegetation between inundated and dry grasslands. Combination of the Grivu and surrounding forests forms ideal forest-grassland ecotones that are favorable to many mammal species. It is also a suitable feeding site for raptor species.

Economic use in the area: It has been used for mowing by local farmers for hay making, but the work has been abandoned due to declining agriculture.

Threats to the area: It is now changing into bushes because of a) cessation of mowing, b) construction of draining ditches, and c) cessation of regular flooding by flood control measures.

(13) No.13. Lower Aiviekste

General descriptions: This is a narrow area along the Aiviekste river that does not belong to any existing protected territories.

Reason of protection: This area is an important mating and breeding places of endangered great snipe that prefers inundated grasslands, especially those located close to rivers. This area is also important to prevent fragmentation of existing protected territories. By protecting this area, the central part of LWC is covered with protected areas collectively and thus conservation efforts become more effective.

Economic use in the area: It is scarcely visited by people except for some anglers.

Threats to the area: There is no impeding threats except for long-term succession due to flood control measures.

(14) No.14. Nagli west

General descriptions: This artificial fishpond was constructed in the 1970s and now serves as an important habitat for water birds in LWC. Compared with the Idena and Kvapani ponds, the Nagli west is more finely meshed for culturing smaller fishes. Its western edge is connected to transitional swamp of the Lubana and Solagala bogs.

Reason of protection: Increase of waterfowl in LWC after the 1980s is mainly attributed to emergence of fishponds. Water bird population of LWC that satisfy criteria as Ramsar site is mostly supported by those fishponds.

Economic use in the area: All the area is used for aquaculture. Due to marketing problems, the industry is now not in full operation. If the industry is left without any administrative measures, it may be privatized and cease operation in the near future.

Abundance of waterfowl is an important resource for bird watching and eco-tourism, so enrichment of habitat diversities is required to attract water birds. Construction of observation facilities to minimize visitors' disturbances is also necessary. Hunting of birds should be restricted for observing birds at closer distance and safety of anglers and tour visitors.

Threats to the area: Ponds may dry up if the aquaculture is abandoned, and it means total loss of habitat for waterfowl. Increase of cormorants is a threat to aquaculture. Overgrowth of emerged macrophytes and shore vegetation are not favorable for many waterfowl and waders.

(15) No.15. Nagli east

General descriptions: This artificial fishpond was constructed in the 1970s and now serving as important habitat for water birds in LWC. This fishpond is more coarsely meshed for aquaculture of larger fishes, and there are natural islands in the area. Across the Tirumnieki bog and surrounding forests, this area is connected to the Idinu bog and the Nagli fishpond (west).

Reason of protection: Increase of waterfowl in LWC after the 1980s is mainly attributed to emergence of fishponds. Water bird population of LWC that satisfy criteria as Ramsar site is mostly supported by those fishponds. Raptors also use this pond as a feeding area.

Economic use in the area: All the area is used for aquaculture. Due to marketing problems, the industry is now not in full operation. If the industry is left without any administrative measures, it may be privatized and cease operation in the near future.

Abundance of waterfowl is an important resource for bird watching and eco-tourism, so enrichment of habitat diversities is required to attract water birds. Construction of observation facilities to minimize visitors' disturbances is also necessary. Hunting of birds should be restricted for observing birds at closer distance and safety of anglers and tour visitors.

Threats to the area: Ponds may dry up if the aquaculture is abandoned, and it means total loss of habitat for waterfowl. Increase of cormorants are threats to aquaculture. Overgrowth of water shore vegetation and increase of cormorants are also common problems with other fish ponds

(16) No. 16. Lake Lubana:

General descriptions: Due to dyke construction and rise of water level as a result, large swampy areas had been lost. Present lakeshore is not an ideal habitat for water birds and aquatic animals. Freezing death of fishes takes place when water level is low in the winter

season. Due to sluice construction, fish migration between lake and rivers has been blocked.

Reason of protection: Although the number of water birds is smaller than that of fishponds, it is serving as resting place for waterfowl, and existence of non-freezing open water area at parts of the lake during migrating season is an asset for migratory waterfowl. For sustainable use of the lake, comprehensive regulations for biological resource utilization are necessary.

Economic use in the area: It is now playing important role as a reservoir for flood control. Commercial fish catch in the lake is approximately 60 tons/year. Recreational angling is also very popular even during the freezing period. It is also a place of leisure hunting for waterfowl. Lakeshore is also a potential place for eco-tourism.

Threats to the area: Habitat conditions are already degraded, and habitat restoration measures are needed. For securing wildlife corridors around the lake, rehabilitation of natural forest at this area is desirable. In particular, the northwestern shore of the lake is directly facing agricultural land, and habitat creation measures such as wildlife corridors will be appropriate.

Inundated Grasslands in No. 8 Parabine (left) and No. 12 Grivu (right).

11.2.4 Conservation and Management Criteria

(1) Chronological change of biotopes in LWC

In the past 75 years, LWC has been exposed to large works such as bog desiccation, afforestation, and flood control measures. Therefore, present fauna and flora of LWC are not what they had been for centuries. Although a long term goal of the National Environmental Policy Plan (NEPP) of Latvia is “maintenance and protection of existing biodiversity and landscape characteristics”, only maintaining present status is not sufficient for the case of LWC. Restoration measures may also be sought for setting a long term conservation target, which needs research and discussion among stakeholders.

Based on the topographical maps in 1916, 1931, 1966, and 1981 (refer to Figures 11.2.2 ~ 11.2.5), noteworthy changes are summarized in Table 11.2.3. In the past, large areas surrounding Lake Lubana were fen and inundated grassland, and the largest change took place in such biotopes. Fen has kept desiccating and shrinking, and is now fragmenting. Inundated grassland has been drained intensively since the 1970s. Fishponds appeared in

the 1970s by converting wet meadows. They are now taking on aspects as semi-natural wetlands. Before dyke construction, open water areas of the lake had covered Gomelis and Kvapani, and the water level fluctuated largely. Present water level is kept higher than that before dyke construction. Considering these chronological change of biotopes, it is concluded that the conservation criteria should be determined not only preserving the present status but also retrieving old status as much as possible.

While, the current situations would bring about some apprehensions in the future of biotopes in LWC when no conservation measures are taken. Raised and transitional bogs could be generally safe, but invasion of trees will advance by desiccation. Fen and inundated grassland will keep shrinking and will be totally changed. Fishponds may totally lose water and turn into wet meadows if pond waters are no longer managed. In this case, the importance of LWC for water birds will be lost. Even when water level is maintained, trees and bushes along pond ridges and canals will grow thicker, the number of vegetated patches in the ponds will increase, and water shore lands will be covered with reed and other plants. Although many migratory birds can still utilize those ponds as temporal visitors, value as breeding habitats of waterfowl will be lost. The results of quick assessment of future biotope change in LWC indicate that active restoration measures should be taken on inundated grassland, fen, lakes, and fishponds.

Lakeshore Trees Dead by Water Level Rise

(2) Management criteria

The plan aims at achieving naturalness of LWC to a level what it used to be around 1930. At the same time, ecologically meritorious nature alterations like fishponds for waterfowl are maintained. Conservation standards and approach methods are shown in Table 11.2.4. This does not mean abandoning all the construction works here. It should be admitted that dyke works has positive function to prevent economic damage by flooding. Drains are also contributing to forestry in some areas as well as preventing flooding of agricultural areas.

With regard to desirable water levels at respective biotopes, raised bogs should be preserved as an irreplaceable biotope and protected from any flooding. Although a raised bog in the western part of the Lubana Depressions could be influenced by water level rise of Lake Lubana once per 10 years, this bog is considered to be a transitional one and should be preserved at present condition. Fen is kept waterlogged most season every year. Areas that are maintained as natural inundated grassland should be flooded at least once every two years for about a month. Forested areas may allow inundation once every several years, and keeping their normal groundwater level deeper than 1 m (at least 0.5 m)

is desirable to facilitate growth of roots. Water levels of fishponds are artificially controlled mainly for water birds, details of which are mentioned in the conservation measures. The desirable water level of Lake Lubana from mid June is 91.2 m so that more shallow water zone (depth of 0.5m) is created in about 65% of the lake, but more shrinking should be avoided for fish protection. In winter, fish wintering place at Kvapani should maintain water depth more than 2 m to prevent them from freezing, but the lake water level should be regulated with priority to prevent floods.

(3) Conservation criteria by plant and animal groups

1) Mammals

Maintaining present condition is necessary. For detailing conservation criteria, cataloguing of mammal fauna and their status is indispensable. Influence of newly emerging threats such as road-kill should be accessed. Construction of corridors will be among effective measures.

Presently, hunting of game mammals and water birds is permitted with seasonal limitation. It is incompatible, however, with bird watching type eco-tourism because birds at hunting areas quickly become very shy of people. For pest animals like beavers, population control is necessary in extreme cases. But scientific statistics are indispensable since such damages tend to be exaggerated.

2) Birds

Decrease of bog birds occurred mainly in raptors, and some of those species are no more than a few to several pairs. For those species, increasing the population close to the carrying capacity should be sought.

Waterbirds

Efforts for maintaining present population and increasing them further should be sought. Keeping fishponds in good conditions is necessary for them. For feeding and resting of waterfowl and waders, sufficient shallow water areas should be secured. For breeding of waterfowl, increase of non-vegetated water shore is indispensable. Keeping water level of Lake Lubana about 92.0 m is most desirable for feeding of water birds because large fluctuation of water level hampers development of ecotone flora and benthic invertebrate fauna. Because they are migratory, international cooperation scheme is necessary for formulating long term protection.

Inundated grassland birds

Preventing bog desiccation is indispensable, and this is achieved by closing drainage ditches. Continuation of mowing at inundated grassland by subsidizing farmers will be among directions for conservation of the latter group. For inundated grassland species, present population should be maintained by securing breeding places.

Raptors

The basis of their conservation is to secure appropriate hunting places and increase biomass of prey animals. Bogs and abandoned agricultural field are appropriate hunting places for them. Increasing prey animals needs comprehensive upgrading of their habitat. Many raptors are quite sensitive to human disturbances, and they easily abandon nesting places without noticeable reasons. Keeping out people from nesting areas is absolutely necessary. Such measures have to be paralleled with monitoring activities. Construction of artificial nest platforms is an effective practice.

3) Fishes

For fishes, water level of the lake should be kept between 91.5-92.5m. Deep wintering places should be secured in the lake. As a preventive measure, intended and unintended introduction of exotic fish species should be avoided for safeguarding natural fauna. Eutrophication should also be avoided. Fishway between lake and rivers has few effects as the river migration has been blocked downstream.

4) Vegetation

Raised bogs should be protected as top priority through measures to prevent desiccation. Inundated grasslands should also be given special attention as a unique wetland type.

Old sturdy trees are apparently scarce in LWC and mainly confined to riverine forests. Preservation of old trees is necessary for not only securing nesting sites of raptors but also protecting themselves, because centuries of time is necessary for their regeneration. Individual old trees should be protected.

Judging from animal habitat preference, various ecotones have importance. Littoral zones between land and waters such as lakes and rivers have crucial importance for many water bird species, fishes, and aquatic mammals. Fringing areas between forests and open lands such as bogs, pastures, and abandoned farmlands, are good habitats for many mammal species and consequently good hunting places for raptors. Inclusion of ecotones is an important criterion for conservation area zoning. Conservation criteria of respective biological groups are mentioned in Table 11.2.4.

(4) Monitoring criteria

Because the major purpose of monitoring is to judge whether the site is managed wisely, not only faunal and floral information but also socioeconomic information needs to be collected from different sectors. Strengthening of socioeconomic information seems necessary for the wetland inventory work at national level, too. The table below indicates necessary monitoring items for environmental management of LWC. Some natural environmental items need initiating regular monitoring because foregoing studies on fauna and flora of LWC are mostly sporadic except for census of migratory birds. By getting cooperation of relevant governmental institutions, most socioeconomic data can be retrieved from statistics that are possessed by those sectors without dissemination.

Monitoring in LWC should be made in accordance with items in the Ramsar Information Sheet as well as national data management system. Monitoring data should be stored at national level like the Latvian Environment Data Center and sent to the electronic database of the Ramsar Bureau that is retrievable through the Internet.

Monitoring Items and Places for Environmental Management

Monitoring items		Monitoring places
Hydrological features	Water quality	Lake and major rivers
	Water level	Lake
	Groundwater level	Bogs and fens
	Flooded areas	LWC
Fauna and flora	Respective endangered species	LWC
	Migrating water birds	Lake and fishponds
	Other birds	LWC
	Fishes	Lake and fishponds
	Mammals	LWC
	Vegetation	Wetlands
	Old trees	LWC
Economic activities	Land use	LWC
	Recreation / Tourism	LWC
	Agriculture	LWC
	Other industries	Protected areas
Educational and research use	Educational use	LWC
	Scientific research	LWC
Conservation measures	Affecting factors	LWC
	Status of conservation measures	Protected areas
	Administrative statistics	LWC

11.3 Wetland Conservation Plan

11.3.1 Projects and Programs for Wetland Conservation

In addition to the regulations of protected areas, biodiversity of LWC is protected by the following active measures as a potential Ramsar site. The Ramsar Convention at present aims at a comprehensive wetland biodiversity convention with extended focus such as basin management and securing fishery resources. All the following projects and programs for wetland conservation for LWC are based on the existing technology, managerial capability as well as local construction materials so that their implementation works would be easy and feasible in Latvia.

(1) Environmental Management Center Construction Project

The Wetland Conservation Plan (WCP) would include concrete projects and programs to be implemented in line with EMP. It is necessary to establish a base for actual implementation of the proposed activities, so the construction of the Environmental Management Center (EMC) is proposed at Idena.

The buildings for EMC should be facilitated a) main building (560m^2, brick wall 2 stories) for actual works, b) sub building (300m^2, brick wall 2 stories) for lodging of group visitors, c) garage (140m^2, brick wall 1 story). The main building consists of the rooms for administration, research and monitoring, meeting, training, aquarium, display hall, and

canoe/cycling service. The required staff number for administration and maintenance would be 12~15 people for permanent bases.

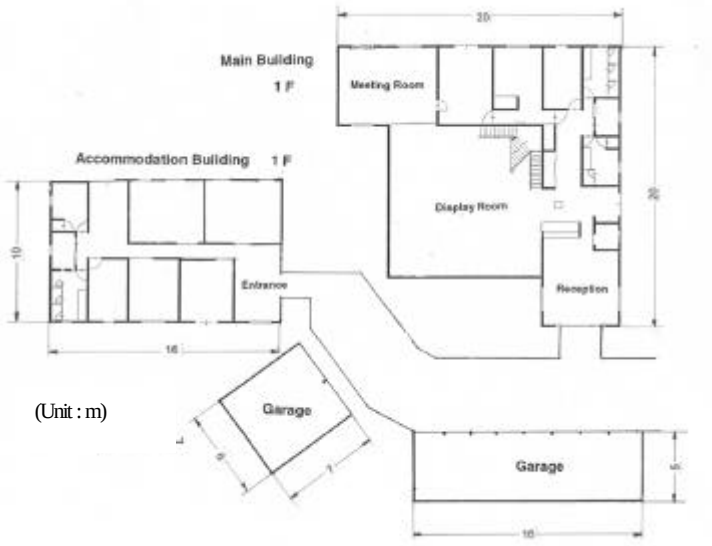


Image of EMC with Main Building (Upper), Accommodation Building (Left) and Garage

(2) Biotope conservation program

1) Bird conservation subprogram

This subprogram is mainly for waterfowl conservation.

Mitigation of Lake Lubana degradation with fishponds

The Latvian University Institute of Biology has continued long-term waterfowl monitoring at Lake Lubana, and the results are reflected in the reports of the institute such as "Importance of Lake Lubana and surrounding fish ponds in hunting waterbirds" (1999), "Changes in waterfowl habitat in Lake Lubana and surrounding areas 1970 - 1999" (1999) and "Dynamicas of nesting waterfowl number in fishponds close to Lake Lubana 1975-1999" (1999). According to these reports, Lake Lubana in 1960s before dyke construction had large marshy area, and the area was an ideal habitat for waterfowl. Although the present waterfowl population that mainly occurs at fishponds is still abundant to satisfy the Ramsar criteria 5 and 6, waterfowl population might have been more in the past. For waterfowl conservation purpose it would be the best solution to lower the lake water to a level before dyke construction. One important point in the present Lake Lubana is that it is contributing downstream flood mitigation. EMP is intended to maintain flood control function of the lake, although it is an artificially added function to the lake. For flood mitigation Lake Lubana has to retain much water during and after flooding period in April-May. This means difficulty in lowering the lake water level at breeding season that starts from May. Moreover, the intensity of flooding differs year by year.

Taking the advantage that present waterfowl population mainly concentrate at fishponds, this plan aims at mitigation of Lake Lubana degradation with improvement of fishponds. This does not mean that Lake Lubana improvement is forgotten. By improving the sluice

operation manual, lake water is lowered as low as possible to a level consistent with flood control and fishery.

Current situation of fishponds

Lots of improvement is necessary, however, to make the ponds ideal for duck moulting and feeding. One of the problems is the overgrowth of vegetation. Almost all ponds in the Nagli fish farm were relatively open during the first years of operation in the 1980s. Mainly fodder grasses grew on natural islands, and recently formed tufts of above-water plants did not form wider homogeneous massifs. Some small artificial islands were made by accident in several ponds during their construction. Generally that created very favorable conditions for nesting of waterfowl species. Each island rapidly overgrew with bushes, trees and reeds year by year. Wide reed stands form around these islands. Initial mosaic-type tufts of above-water plants spread more and more and create homogenous massifs in many places. Due to excessive water level rising in the last years, these tufts are torn off from the bottom and compacted by the wind along shore zone. Due to these factors nesting ducks and waders decreased significantly during the last years.

Fishponds are also meritorious for waterfowl from the point that direct human impact to them in the ponds is significantly less than in most of natural water bodies. Birds living in the ponds have created special behavior. At least during nesting period they get used to personnel and equipment carrying out regular feeding. Behavior of birds changes radically just when the hunting season has started, then they get fearful or leave their initial living places at all.

Future of fishponds

This study revealed that there is no bright future for carp aquaculture at fishponds, and fishponds could possibly to be closed in the future. If the ponds are abandoned or sold to private sectors and used for other purposes than water-filled pond, it is obvious that ponds will lose their value as a waterfowl habitat. EMP is aimed at preventing such disastrous situation by using the ponds for touristic, recreational, educational and conservational purpose. Under EMP, it would be more fitting to call them ‘conservational pond’ rather than ‘fish pond’. In the case when aquaculture of the ponds is abandoned in the future, the ponds need to be managed for conservation purpose including water level control. Costs for water level and habitat maintenance have been appropriated in the conservation budget of EMP. Management of the ponds as public property may also be sought.

Although cooperation of fishpond owners is indispensable for EMP, it is an urgent concern that fishpond privatization plan is in progress. If privatization starts without any agreements on the use of ponds, it would jeopardize EMP. Suspending privatization till go-ahead of EMP and allowing privatization in ways to guarantee habitat conservation are necessary.

Concrete actions

a) Improvement of natural breeding place for waterfowl

The purpose is to secure more breeding places for waterfowl. To eliminate reed and reed mace growths around the islands, trees, and bushes on existing islands in fishponds should be cut with priority on the Nagli fishponds. Cutting bushes and trees along dykes between fishponds can also decrease predation pressures of carnivorous animals for waterfowl. The total area of grass cutting is about 15 ha and maintenance work is to be continued regularly.

b) Artificial breeding islands and nests for waterfowl

For the same reason with the above, 100 artificial islands are constructed at the Nagli, Kvapani and Idena fishponds. Priority of the Nagli west is lower than the Nagli east because each pond area is smaller. Earth island of 5 x 10 x 1.5 m (0.5m over the water level) with wooden frame to protect from being washed away be waves. The construction work is made at ponds without water as mentioned in the water level control activities. Exact places and shapes should be decided by observing bird behavior.

To build and locate artificial nests such as wooden cages and special hay roles designed for waterfowl nesting in those islands and adjacent forests further facilitates the effect.

Presently Trees and Reeds Overgrow at Fishponds (left) and Natural Breeding Places for Waterfowl (right) are not Sufficient

Cutting Trees and Bushes and Preparation of Artificial Islands

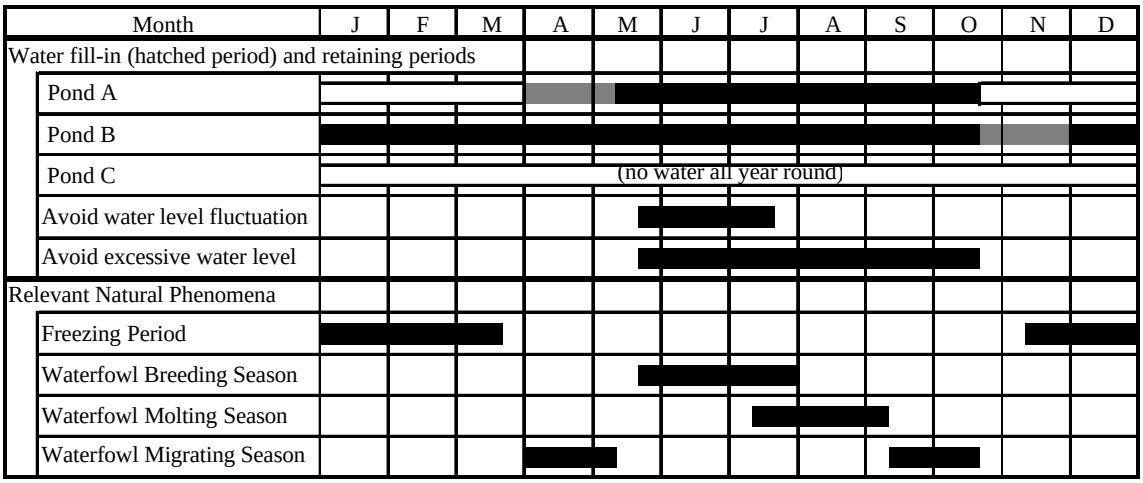
c) Water level control of fishponds for waterfowl breeding

Water level is an important factor determining distribution of migrating birds. In case fishponds are filled up in autumn, they could be used by most of waterfowl in the next spring just when ice has melted. Because of the large area, filling up usually takes about a week. At the beginning of filling process large areas with shallow water and small pools appear. This serves as excellent feeding places both migrating and local waterfowl and

waders. It is very important to finish filling process at least by May l5, before the beginning of mass nesting season of waterfowls.

Ponds that have been with no water during previous season attract most migrating and local waterfowls because they provide intensively developed plants above water level after filling up. These plants are important hiding places for molting birds at the second half of summer. It is observed that ducks, which have nested in the pond that is left dry for one summer, find nesting place in another pond, but return for nesting to the previous pond in the following years.

Water level rising or significant lowering during nesting period would cause loss of nests of waterfowls and waders. When fill up is delayed, almost all waterfowl nests are drowned except species that build floating nests. When ponds are filled only in summer, wader nests that were located in the dry area of the pond before filling up are drowned completely. Crucial is also drainage of the pond during nesting period as most waterfowls leave their nests in such cases.



Water Level Control of Fishponds Favorable for Waterfowl

Therefore, each section of the fishponds should have three different types of water level scheme that are applied by rotation. That is, filling of some ponds should be started in spring not later than in April and should be finished at least by May 15. Some ponds are filled up already in autumn. Remaining ponds are left without water for a year. This is desirable even when aquaculture is abandoned at the ponds.

Fishpond Filled with Water (left) and Without Water Condition (right)

d) Artificial nesting places and feeding for raptors

This is mainly for raptors conservation. Insufficiency of sturdy tall trees suitable for nesting is a limiting factor of raptor populations such as White-tailed Eagle, Golden Eagle, and Osprey. Since it takes tens of years to wait for the growth of those trees, supply of artificial nesting platform is needed. Because it is difficult to locate their preference for nesting places, 100 wooden platforms are placed in various areas of LWC with emphasis on tall trees at fringe of large forests and forest belts between bogs and grassland. In such ecotones, prey animals are abundant. They are regularly monitored and repaired.

Breeding success rate of raptors largely depends on their nutrition conditions during winter. Basically this should be improved by enriching prey animals in their habitat. In view of their endangered status, however, artificial feeding is carried out only during cold freezing season at two open places, one at an island of a fishpond and the other at a bog area. Sufficient care is necessary for predatory animal and poachers.

e) Protect natural nesting places and increase prey animals for raptors

Protection of old trees is a long-term measure for securing their nesting places. Monitoring of old trees is realized in the monitoring program, and their protection is achieved through awareness activities to the forestry sector. Their food conditions are also improved by securing rich prey animals and hunting places. Activities in bog and inundated grassland conservation subprogram are meritorious also for this purpose.

f) Maintain grassland habitat for great snipe

In LWC great snipes mate and breed at least 9 places and at least 109 males are mating. This accounts that at least 1/3 of all Latvian population is breeding here, as number of mating males in Latvia is evaluated to be 200-300 individuals. They choose mating and breeding places in inundated grasslands, especially those located close to river mouths. To prevent their habitat from overgrowth, trees and bushes are cut at breeding places in Verdes Sala, in the Aiviekste river water-meadows from the Ica river mouth to the Abaine river mouth. Drainage ditches of those areas are also closed.

g) Cormorant population control

Presently there are no other effective measures to prevent their damage than direct population control. Setting up strings over the pond has proved to be effective to prevent landing of large number of birds on the water, but this is not realistic in the case of large ponds. Primitive but a sure way is to shoo them away by stationing watchmen. Due to marketing price situation, however, present fish from the ponds in LWC is only a part of the amount that is actually produced, and the rest is left unused. This may benefit food conditions of cormorants and thus causing a vicious spiral to their population increase. Although it will be irritating for fishermen to see cormorants steal their fish, loss by cormorants seems to be not accelerating the decrease of fish forward. Not producing excessive fish will be a long-term measure to decrease cormorants. At present, cormorant is not listed on the game birds, and it is not possible to hunt them even for pest control purpose. Change of hunting regulations is necessary so that population control can

become possible in the extreme damage cases, but it has to be done based on exact monitoring and scientific cost and benefit analysis.

2) Mammal conservation subprogram

This subprogram is for conservation and population control of forested mammals including the following activities.

a) Wildlife corridor construction

Large mammals often have home ranges larger than respective protected territories, and therefore it is necessary that each protected territory not be fragmented. In LWC, forested areas in the northern part of LWC are connected with outer forest areas. Those of southern areas, however, are rather isolated from others. By creating a wildlife corridor along the western shore of Lake Lubana (4 x 0.2 km), all the forested areas that surround Lake Lubana are connected. Presently the area is swampy and a series of bushy islands are lining irregularly along the shore. By filling soil that was produced from dredging work of the fish conservation subprogram, this area turns into a habitat that large mammals can pass by. In the long run, it is expected that trees will grow naturally along the dyke and lakeshore.

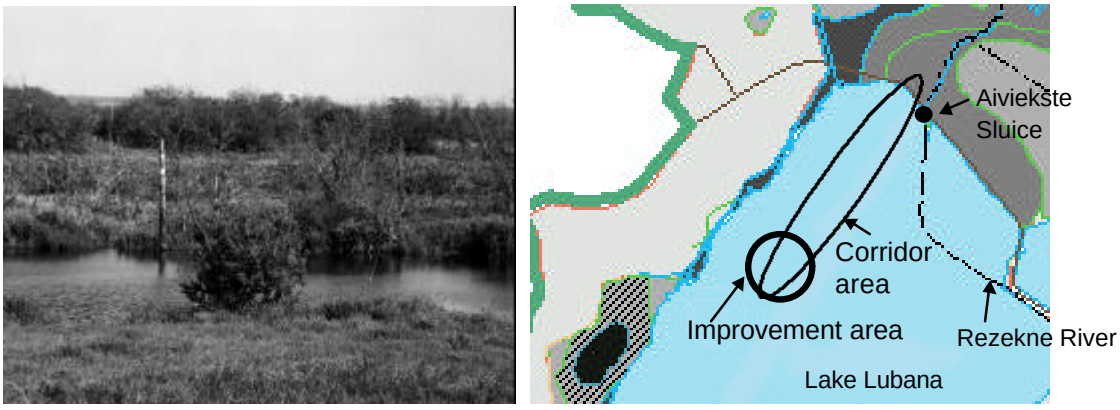


Photo of Lake Lubana Western Shore (left) and the Place of Habitat Improvement by Landfill

b) Enrichment of forest-meadow ecotone

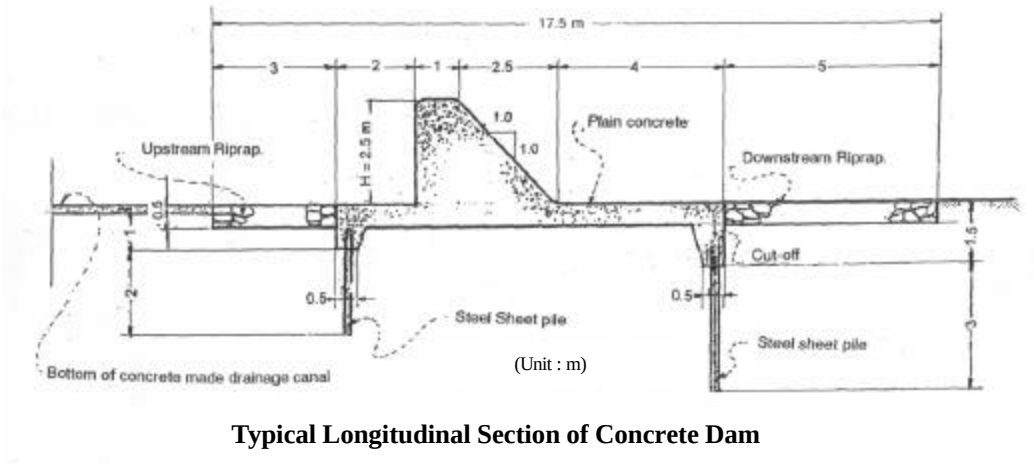
The richest diversity and density of mammals are often found in such ecotones as land-water and forest-meadow where different biotopes are neighboring. In LWC ecotones between forests and meadows are not so rich compared to land-water type. The Grivu's inundated grassland conservation measures also aim at enriching habitat of mammals.

3) Bog and inundated grassland conservation sub-program

Raised bog, inundated grassland and fen are the characteristic biotopes of LWC, and water level management is commonly crucial for their conservation.

a) Raised bog conservation

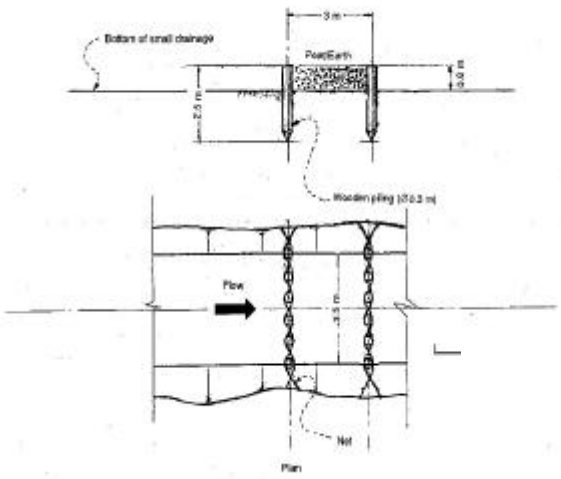
To prevent lowering the groundwater level of raised bogs, large drains penetrating into the bogs are to be closed by constructing 20 RC dams (7m wide x 3m high) at the exit points from bogs of the Snitku, Berzpils, Sala, Lubana, Solagala, and Lubana depressions (refer to Figure 11.3.1). The Parabine bog is already facing many small drainage ditches, and is protected by closing those ditches with 40 small wooden dams (3.5 m wide x 0.8 m high).



Typical Longitudinal Section of Concrete Dam

b) Inundated grassland conservation

Inundated grassland vegetation is maintained by annual flooding that prevents growth of trees and bushes. Although the frequency of flooding decreased after the dyke construction, the vegetation can still be maintained in areas of low elevation. At areas where they still have potential as natural inundated grassland, restoration measures should be taken with priority to the Verdes Sala area. Densely developed drainage ditches in Verdes Sala and surrounding areas along the Aiviekste river are closed by about 160 earth dams mentioned above. Average catchment area of each dam is about 7.5 ha (750 m x 100 m). At the same time, bushes growing along ditches are to be cut. Patchily distributed private lands in the Verdes Sala area are procured for coordinated management. Other potential inundated grassland areas are protected by recommending and subsidizing grass cutting for hay making. For areas of higher elevation that are flooded only once every two years or less, retention of original vegetation seems difficult. It is appropriate to allow natural succession to bushes and forests in those areas. The Grivu area are to be protected by 90 earth dams for drainage closing, and is managed as natural succession due to its elevation (refer to Figure 11.3.1).



Typical Longitudinal Section of a Wooden Weir

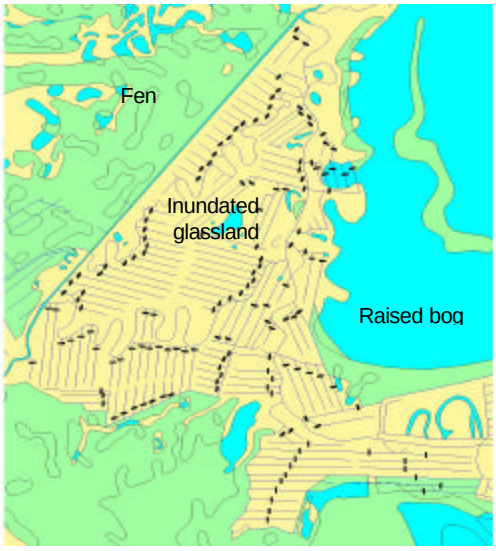


Image of Small Wooden Dam Arrangement at Verdes Sala for Drainage Closure

c) Fen conservation

To protect shrinking of fen in the Baltie Klani area, the water level is maintained by closing a culvert and constructing a submerged bridge at the outlet to the Aiviekste river.

Culvert (left) at Fen Area (right).

4) Fish conservation sub-program

a) Wintering place

To prevent fish death by freezing, it is necessary to secure a deep wintering place in Lake Lubana. An area of the lake near Kvapani has depth of 4 m that was created by previous dyke construction works, and is suitable for such a purpose. Access of fishes from other part of the lake to the deep area during low water period, however, is blocked by abandoned dykes of the Rezekne river that remain in the lake. This is improved by cutting out some part of the abandoned dyke.

b) Patrolling

To protect fishes from illegal commercial fishing and angling, patrol on the lake and major rivers in LWC should be reinforced.

c) Restocking of native fish species

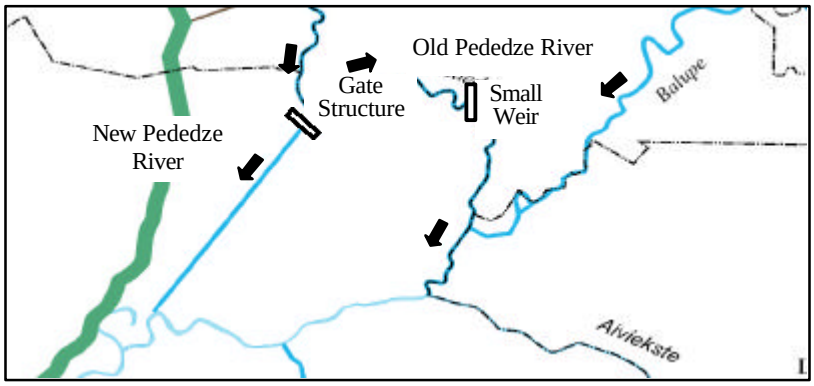
To increase pike resources, stocking of pike is conducted by using fry of native gene group.

d) Spawning place

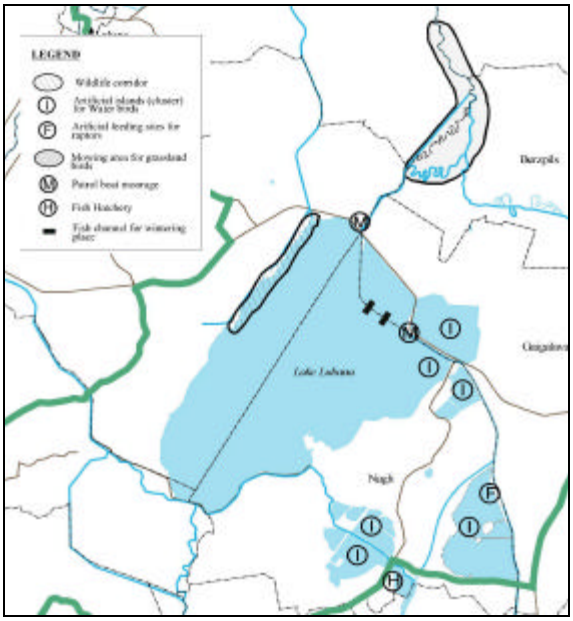
Measures to protect inundated grassland of the Verdes Sala area also beneficial to protect fish spawning places, because old meandering rivers remaining in the area are serving not only as habitat for aquatic mammals like otters but also serving as good spawning place for fishes.

e) River water level control as fish habitat

Existence of stagnant water and hiding places in a river system are indispensable for spawning and growth of fish fries. Together with the meandering part of the Aiviekste river at Verdes Sala, lower stretch of the Pededze river between the Pededze canal and the Balupe river mouth has a potential for such a habitat. Presently, however, this area has little water flow due to diversion to the Pededze canal. It is recommended to restore small water flow for this purpose. Revival of the original large flow that caused inundation of Grivu Sala is not necessary for this purpose. The proposed gate structure and its indicative cost are mentioned in the Water Level Management Plan.



Water Supply to Old Pededze River



Places of Conservation Activities of Mammals, Birds and Fishes

11.3.2 Monitoring Plan

(1) Environmental research

As exemplified by increase of cormorants and beavers, ecological change sometimes occurs rapidly and flexible management becomes necessary. To cope with such emerging issues, research ability to indicate management directions within a few years is necessary. Research in EMC is for management purpose, and pure scientific researches are limited only when they are closely linked with management. Not only conducting own research, EMC can provide opportunities of research for domestic and foreign researchers on following research topics:

Influence of desiccation in bogs and inundated grasslands: Desiccation mechanism should be analyzed through long-term monitoring of ground water level, tree age structure and floral changes along drainages.

Carrying capacity of eco-tourism and recreational activities: Although there already exist regulations on hunting and angling activities, more scientific basis is necessary for sustainable use of those natural resources. Indirect impacts of touristic visitors should also be monitored and studied.

Beaver population control: It should be promoted based on cost and benefit analysis because damage amounts tends to be exaggerated. Assessment of population, damage to forestry and impact of damming on hydrology are firstly necessary. When the results concluded necessity of population reduction, it should be reflected into management plans without delay. After determination of permissible hunting numbers, beaver hunting and trapping can be promoted. Although beaver is a protected species in EU Directive, paying hunting remuneration may be admitted in special areas where the animal is causing serious economic damages. Changing hunting season from October-to-December to all the year round in such places is also possible. Those measures need change of hunting regulations at national level. Cooperation of local hunter groups is also necessary and this should be achieved through sufficient explanation. At the same time, monitoring should be continued for periodical examination of the regulation.

Beaver Dam in a Canal

Water level regulation scheme of fishponds: This report proposes rotatory water level control of those ponds for providing better waterfowl habitat. The concept is based on past managerial experiences at fishponds, but there will be further room for improvement. In particular, suppressing vegetation overgrowth by controlling water level should be explored as a cost effective measure.

Inventory work of fauna and flora: Except for birds, inventory work of fauna and flora of LWC is not sufficient. More study is necessary on mammals, invertebrates and endangered plants.

Fish resources: Quantitative study of fish resources and habitat requirements of respective species should be promoted in major rivers and Lake Lubana for both fishery promotion and nature protection.

Ecological function of pastures and crop fields: Not only water-related biotopes but also pastures and crop fields support significant part of biodiversity in LWC. Rapid change of those biotopes like over-growth at semi-natural pastures should be studied in combination with national-level study scheme.

Telemetric study of migrating birds: Protection of migratory birds is successful only when all the flyway habitats are secured under the international cooperation scheme of flyway countries. To clarify migratory pathways, telemetric study is effective in addition to existing banding research.

(2) Environmental monitoring

For scientific environmental management, especially for early warning, monitoring of natural environment as well as socioeconomic activities is indispensable. In line with the items that are required to the Ramsar information sheet, the following items should be monitored in LWC and related areas. Dissemination of the results through EIMS in the form of annual report is strongly recommended. Original monitoring is limited mainly to faunal and floral items. Other items are collected by cooperation of other organizations.

Fauna and flora: Bird population in LWC has been monitored over a quarter century. Status of unique or bio-geographically important species, rare or endangered species and exotic species (when and why) should be monitores as well. Combined with research activities, special attention should be paid to the population of waterfowl and raptors, vegetation changes of bog, fen, and inundated grassland.

Water-related items: It should include water quality of rivers and lakes (various parameters including turbidity, trophic status and salinity), ground water level at raised bogs, water level fluctuation at Lake Lubana and major rivers, inflow and outflow rivers, changes that took place in the catchment area. Effects of newly constructed dams for desiccation prevention under this WCP should be intensively monitored.

Socioeconomic statistics: It should include fishery, agriculture, forestry, recreation and tourism, status of development projects (including those in planning stage), changes in human population, land tenure and land use.

Environmental and educational activities: It should include conservation measures taken, hunting activities, pollution (urban, industrial and agricultural), waste dumping, newly published bibliographical references, scientific research projects, historical and archaeological sites, NGOs and business/community groups that cooperated in monitoring, awareness and management.

11.3.3 Environmental Education and Public Awareness Promotion Program

By using facilities installed by the EIMS subprogram and the Environmental Education subprogram, the following activities are proposed for promotion of wetland conservation:

(1) Mobile EMC

The diversity of biotopes in LWC has precious educational value that cannot be found in any other places of Latvia. Not only local sectors but also national levels should utilize this value. Because of its less known location, however, it seems difficult for EMC to have many visitors if it is a passive center just waiting for visitors to come. Environmental education and public awareness functions of EMC becomes fully operational when the center actively attracts visitors and bring services to requested places. As a program under the annual schedule, EMC organizes the following activities in close collaboration with schools and administrations. Bus and accommodation facility of the center is fully utilized. Operation cost is borne by the center, but meals and accommodation are borne by visitors.

Target: Major target is school children of about 10 years. Schoolteachers, officers and decision-makers of national government and municipalities, NGO staff, community leaders, representatives of business associations and mass media should be given similar opportunities. EMC invites those groups nationwide, and priority groups are those in and around LWC. Group visitors (each 30-50) experience 2-day or 3-day field tours under the guidance of experienced staff members. EMC is capable of organizing max. 200 trips. By 2010, at least one member of every household near LWC participates in EMC activities.

Activities: This activity aims at introducing varied biotopes of LWC to many visitors. At EMC they learn the wise use concept. Tool kits produced by the Ramsar Bureau can serve as teaching materials. In the field they experience varied biotopes of LWC (refer to Figure 11.3.2). Birds are observed in fishponds. Wildlife observation including nocturnal and small mammals are carried out by visiting fen and inundated grassland via boat trip on the Aiviekste river. Since the nature of LWC has a clear timetable as shown below, visiting places are combined flexibly. Trips may include the Krustkalnu reserve and Teici reserve that have different biotopes. In autumn, each species has its hunting season. Because hunting seasons often coincide with bird migration seasons, hunting at observation sites should be prohibited for security.

Month		J	F	M	A	M	J	J	A	S	O	N
Field Education and Awareness					■	■	■	■	■			
Major Hunting Season	Waterfowl									■	■	■
	Large Mammals								■	■	■	■
Relevant Natural Phenomena	Freezing Period	■	■	■								■
	Spring Flooding				■	■						
	Waterfowl Breeding						■	■				
	Waterfowl Migration				■	■				■	■	

Proposed Wetland Observation Period and Related Phenomena

(2) Baltic Ramsar Center

To promote international cooperation in wetland conservation such as migratory bird conservation, it is necessary to exchange information and learn experiences in conservation activities. Since Latvian information sources are not understandable for non-Latvian speakers, printing in international languages such as English is necessary. Latvians might feel the same way. Translation of wetland related materials between Latvian and English/Russian/other Baltic languages are promoted by using EIMS facilities and disseminated through the Internet. Though such a function can be placed in other part of Latvia, this is beneficial to LWC to make it well known to the world. Because of seasonal field activities of EMC, this project should be mainly promoted during the off season in winter.

(3) On-the-job capacity building

EMC should annually accept at least two seconded staff members from educational and administration sectors. One is trained as an expert in the nature observation program and the other is to incorporate wise use concept in development administration.

(4) Training and seminar

Due to geographic location, transporting facilities of the center should be fully utilized to bring participants to the center. When necessary, dispatch of lecturers and materials should be sent actively to requested places. Since field projects of WCP mainly consist of those targeted at water-related biotopes, conservation of dry lands should be achieved training and awareness of forestry and agriculture sectors.

11.3.4 Cost Estimation for Projects and Programs for WCP

The total cost for WCP is indicatively estimated at about 2.3 million LVL including O/M costs up to 2010 as shown in the next table. The cost for the EMC construction project is about 375,000 LVL including necessary indoor and outdoor facilities. The cost for the Biotope Conservation program which consists of 4 subprograms is about 796,000 LVL. The costs for the Environmental Research and Monitoring program and the

Environmental Education and Public Awareness program are 166,000 LVL and 107,000 LVL, respectively.

Estimated Costs for Wetland Conservation Plan

(Unit:1,000 LVL)

Projects, Programs and activities	Cost	Type
1. Environment Management Center Construction Project	**375**	-
- Construction of EMC buildings	237	B
- Indoor and outdoor facilities of EMC	138	E
2. Biotope Conservation Program	**796**	-
2-a. Bird conservation subprogram	114	-
- Removal of overgrown grasses at fishponds for waterfowl	63	C
- Construction of artificial islands for waterfowl at fishponds	34	C
- Nesting places for raptors and grassland birds and others	17	C
2-b. Mammal conservation subprogram	19	C
2-c. Bog and inundated grassland conservation subprogram	208	-
- RC dam construction to prevent drain from bogs	172	C
- Small wooden dam construction to close drains (290 dams in total)	21	C
- Land acquisition and others	15	C
2-d. Fish conservation subprogram	455	C
- Fish wintering place	390	C
- Fish habitat conservation of the old Pededze river	65	C
3. Environmental Research and Monitoring program	**166**	-
- Equipment for water-related wetland monitoring	20	E
- Equipment for aquatic environmental monitoring	53	E
- Equipment for fishing control and patrol	93	E
4. Environmental Education and Public Awareness Promotion Program	**107**	-
a. EIMS subProgram	74	E
b. Environmental Education subprogram	33	E
Total Initial Cost	1,444	-
O/M Cost up to 2010	879	-
Grand Total	**2,323**	-

Note: B= building work; C= civil work; E= equipment.

11.3.5 Organization and Institution

(1) Wetland conservation functions of EMC

In EMC, the Wetland Conservation Plan is borne by the Management House and Information House. The former deals with ecosystem oriented approach and species oriented approach, and the latter is in charge of awareness oriented approach.

The Management House is composed of 3 sections, that is, the Protection and Management unit, Research unit and Monitoring unit. The Protection and Management unit deals with the Biotope Conservation program. Field activities are mainly entrusted to the local communities, and the EMC's administrator is in charge of contracts and negotiations. The Research and Monitoring unit literally deals with those activities mentioned in the Environmental Research and Monitoring program.

The Environmental Education and Public Awareness Promotion program is borne by two sections of the Information unit in the Information House. The Exhibition and Observation unit is in charge of both indoor and outdoor education and training.

Construction and maintenance activities such as trimming of roadside trees for visibility improvement and construction of bog observation tower are entrusted to the Protection and Management unit in consultation with the Eco-tourism House. The Exhibition and Observation unit mainly targets at group visitors for educational purpose. The Eco-tourism

House receives individual and small group tourists. Those two sections should keep close contact to avoid bureaucracy. The Information unit is for EIMS. The unit compiles monitoring data into a database and dissemination. Website activities and publication are borne by this unit.

(2) Collaboration with other organizations

Because resources of EMC are limited, above activities have to be promoted in close collaboration with relevant organizations as shown for the following.

Office of State Nature Reserve Teici:

The office manages neighboring Teici and Krustkalnu reserves. Although human activities in those reserves are not allowed and the approach is somewhat different from those in LWC, the office has excellent expertise in management and research. Foregoing researches on waterfowl and raptors in LWC were borne by the researchers of the office. Therefore, natural environmental research and monitoring of EMC should be conducted jointly with the office as far as possible. Collaboration in field education activities may also be sought.

Universities:

Universities are also important research partner. Particularly the Daugavpils Pedagogical University (DPU) and Latvia University has accumulation of bird research in LWC over a quarter century. For training of resource wise use, not only natural science professors but also those in socioeconomic field are necessary. University students can be involved in EMC activities in various ways such as intern for field activities, volunteers for translation work and trainees of education activities. EMC can also accept graduate students for conducting their studies.

MEPRD:

The ministry's major role resides in the Implementation Committee (IC), but they may be consulted frequently in the process of activities. In particular, database of EMC have to be linked with those at national level, and international activities are basically in charge of MEPRD. Cooperation of REB Laboratories is also indispensable for water quality monitoring. Since EMC has no wet-laboratory, water quality analytical equipment under the Environmental Research and Monitoring program is to be placed in the former laboratory.

District Governments and Municipalities:

Capacity building of those staff members is a crucial point for promoting decentralized environmental management. In particular, the wise use concept should be understood by them not only as a theory but also as actual success and failure stories. In addition to seminars, acceptance of a limited number of on-the-job trainees at their cost is desirable. It is also important that even administration officers get field experience.

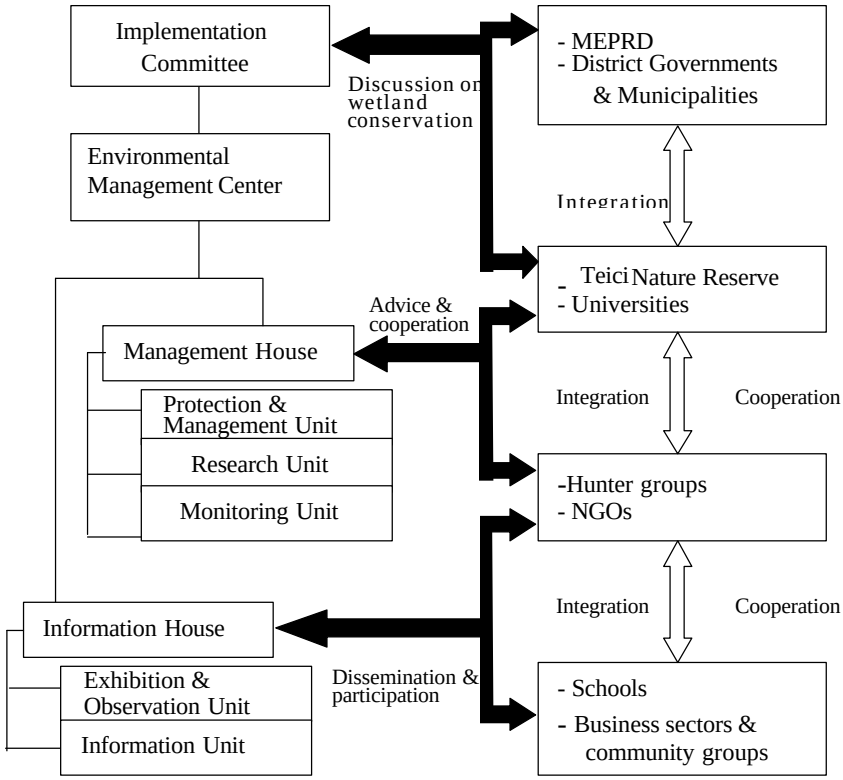
Schools:
Latvian education system obliges a certain period of field experiences to school children. Field observation activities of EMC should be incorporated in such program. In the initial stage, however, priority target should be teachers because the number of teachers who can serve as excellent interpreters in the field is limited. Like the case of government officers, acceptance of a limited number of teachers as on-the-job trainees as leaders of field activities is desirable. Schools adjoining LWC are expected to participate in environmental monitoring such as meteorological data and simple measurements of river water quality.

NGOs:
Environmental NGOs in Latvia have largely contributed to wetland inventory and monitoring work. Their cooperation is indispensable in the census of many migratory birds.

Business sectors and community groups:
These sectors in and around LWC are mainly linked with wetlands through forestry, agriculture, and fishery. The biotopes can not be protected without their understanding. They are targets of awareness and training. Receiving miscellaneous reporting from them benefits environmental monitoring.

Hunter groups:
This group is regarded as collaborators of participatory environmental management. In Latvia hunting is a very popular recreation deeply rooted in its culture. Many hunters in Latvia are already involved in wildlife management through a reporting system of wildlife population and control of game animals. EMC can cooperate with forestry administration responsible for hunting in 1) joint research to make population reporting system more accurate, 2) providing training opportunities to them before issuing hunting licenses, 3) expanding hunters' interests from large game animals to wider species by education on wildlife ecology.

In any cases when collaboration is on a voluntary basis, their responsibility and names of collaborators, the mode of their cooperation should be credited and clarified on the outputs. This is a key point for long-lasting cooperation.



Organizational Relations for Wetland Conservation

11.4 Application to Ramsar Wetland

11.4.1 Proposed Ramsar Site

This proposed site is internationally important as bog areas, habitats for waterbirds, and inundated grassland which is not represented in other Ramsar sites in Latvia. Bog areas are represented by the Berzpils bog, the Idinu bog, the Lagazas-Snitku bog, the Lubana depressions, the Lubana, and Solagala bogs, the Sala bog, and the Tirumnieki bog. Habitats for waterbirds are represented by the Idena and Kvapani ponds, the Nagli fishpond (west), the Nagli fishpond (east), and Lake Lubana. Large inundated grassland is represented at Verdes Sala in Parabaine along the Aiviekste river.

Since LWC fulfills the criteria, it is proposed to register those territories collectively as a Ramsar site (refer to Figure 11.4.1) at the commencement point of EMP. Collective registration is necessary to prevent fragmentation of conservation areas. Only Barkava oak stand, however is excluded from the Ramsar site because it has few wetland components in its biotope and is fragmented from the main area.

There are the following merits for designation: 1) monitoring is obliged, 2) the result is shared worldwide by the Ramsar Bureau, 3) local people can easily understand the wetland values, and 4) meritorious for attracting tourists.

11.4.2 Action Plan for Application

(1) Adaptability of LWC to Ramsar Criteria

Chapter 2 of the Ramsar Convention requests contracting parties to designate suitable wetlands for inclusion in a List of Wetlands of International Importance. Latvia is a signatory of the Ramsar Convention and three wetlands have been registered including neighboring the Teici nature reserve.

The status of LWC with relevance to the criteria for Ramsar registration is shown in Table 11.4.1. LWC satisfies the Criterion 1 as representative rare or unique wetland type, because existence of large inundated grassland can not be seen in other part of Latvia. LWC also satisfies Criteria 2, 3, 5, 6 and 8 on biological diversity. It supports 20,000 or more water birds and 1 % of the individuals in a population of one water bird species. Linked with the State Nature Reserve Teici, another Ramsar site, conservation value of LWC is increased. Compared to bogs of surrounding areas that are no more natural bogs due to intensive peat extraction, large high bogs in LWC is a typical biotope that retain high quality of naturalness. LWC is also characterized by containing most biotope diversities that are seen in inland areas of Latvia.

Anseriforms Species of Lake Lubana related to Ramsar Criteria 5 and 6

Latin Name	English Name	No. of counted individuals	1% of global population	Conformity with Criterion 6
Cygnus olor	Mute Swan	253	1,800	C
Cygnus cygnus	Whooper Swan	2,433	250	A
Cygnus columbianus	Bewick's Swan	940	170	A
Anser fabalis	Bean goose	800	800	B
Anser albifrons	White-fronted Goose	3,000	3,000	B
Anas penelope	Wigeon	8,560	7,500	A
Anas crecca	Teal	1,866	4,000	C
Anas platyrhynchos	Mallard	2,542	50,000	C
Aythya ferina	Pochard	810	3,500	C
Aythya fulgila	Tufted Duck	1,006	7,500	C
Bucephala clangula	Goldeneye	137	3,000	C
Mergus albellus	Smew	364	150	A
Total		22,711	-	-

Note: A: criteria satisfied, B: barely satisfied, C: not satisfactory.

The present number of water birds is supported by fishponds. Before construction of fishponds, those areas were seasonally flooded wet meadows, and not suitable habitats for waterfowl. Probably, Criteria 5 and 6 had not been satisfied in the past. Dyke construction also prevented migration of fishes between the lake and rivers though it seems not a decisive impact on the fish abundance.

If no conservation measures are taken in LWC, Criteria 5 and 6 will not be satisfied because inundated grassland will lose its original vegetation by desiccation and cessation of mowing. Fishponds will also soon lose its function as good bird habitats. By implementing Environmental Management Plan, however, these problems will be solved and LWC will be able to accommodate more water birds, and to improve habitats for fishes and mammals.

(2) Adaptability of WCP to the main text of the Ramsar Convention

Table 11.4.2 indicates relevance of WCP with the main text of the Ramsar convention. All the relevant items of the main text are satisfied by WCP.

(3) Adaptability of WCP to the Ramsar Strategic Plan 1997-2002

The Ramsar Convention had been a treaty for waterfowl conservation. Presently, the Convention emphasizes overall wetland ecology including hydrological issues as its directions are clearly shown in the Ramsar Strategic plan 1997-2002. As shown in Table 11.4.3, promotion of wise use, raising awareness, reinforcing the capacity of institutions, increasing the number of Ramsar sites and mobilizing international cooperation are among emphasis points of the Convention nowadays. Those points are also emphasized in WCP.

It is a prerequisite for registration as a Ramsar site that the area satisfies the above-mentioned criteria and that a plan to promote the conservation of wetlands is formulated and implemented. For registration, the administrative authority (MEPRD for Latvia) fills out 'Information Sheet on Ramsar Wetlands', and submits it attached by appropriate maps to the Ramsar Bureau along with an official letter. Upon the receipt, the bureau starts internal procedure for its inclusion in the List of Internationally Importance, but it does not include screening process.

Table 11.1.1 (1) Number of Game Animals in 1999 Reported by Hunter Groups

Forestry area	Elk (*Alces alces*)			Red Deer (*Cervus elephas*)			Roe Deer (*Capreolus capreolus*)		Wild boar (*Sus scrofa*)	Wolf (*Canis lupus*)	Lynx (*Lynx lynx*)	Fox (*Vulpes vulpes*)	Hare		Beaver (*Castor fiber*)	Otter (*Lutra lutra*)	Racoon Dog (*Nyctereutes procyonoides*)	Marten (*Martes martes*)	Badger (*Meles meles*)	Polecat (*Putrius putrius*)	Red Squirrel (*Sciurus vulgaris*)	Brown bear (*Ursus arctos*)	American mink (*Mustela vison*)	Mustrat (*Ondatra zibethicus*)
	Adult male	Adult female	Juvenile	Adult male	Adult female	Juvenile	Male	Female					Brown hare (*Lepus europaeus*)	Blue hare (*Lepus timidus*)										
1. Gaigalava	22	25	12	-	-	-	107	140	66	4	2	79	123	89	422	56	82	74	20	111	153	-	155	93
2. Vilani	14	17	7	3	2	1	162	299	41	8	2	230	205	68	214	67	90	158	57	77	213	1	212	62
3. Rezekne	13	10	6	-	-	-	129	204	40	7	1	383	264	146	479	87	777	125	34	75	131	-	62	9
4. Malta	22	31	21	11	26	10	147	247	61	8	7	238	303	159	256	123	102	115	54	100	290	-	249	61
5. Kacenata	10	16	10	5	4	4	89	125	38	11	7	134	152	100	291	41	89	77	30	75	115	-	34	6
6. Reesona	19	31	16	6	9	6	111	158	21	8	3	156	188	106	170	44	79	114	35	21	167	-	68	69
Total	100	130	72	25	41	21	745	1,173	267	46	22	1,220	1,235	668	1,832	418	1,219	663	230	459	1,069	1	780	300

Source: Rezekne Forestry

Table 11.1.1 (2) Permitted Hunting Numbers during the Season of 2000/2001

Forestry area	Elk						Red Deer						Roe Deer						Wild Boar				Beaver			
	Registered population number	Hunted number in previous season	Permitted number				Registered population number	Hunted number in previous season	Permitted number				Registered population number	Hunted number in previous season	Permitted number				Registered population number	Hunted number in previous season	Permitted number		Registered population number	Hunted number in previous season	Permitted number	
			Adults	Juvenile	Total number	Ratio of permitted/registered number			Adults	Juvenile	Total number	Ratio of permitted/registered number			Adults	Juvenile	Total number	Ratio of permitted/registered number			Total number	Ratio of permitted/registered number			Total number	Ratio of permitted/registered number
1. Gaigalava	59	11	10	4	14	24%	0	0	0	0	0	-	247	17	20	51	21	9%	66	12	32	48%	422	4	163	39%
2. Vilani	38	9	9	2	11	29%	6	0	1	1	2	33%	461	70	63	112	24	5%	41	10	27	66%	214	70	107	50%
3. Rezekne	29	3	4	1	5	17%	0	0	0	0	0	-	333	51	34	68	20	6%	40	8	21	53%	429	7	239	56%
4. Malta	74	9	15	3	18	24%	47	8	4	4	8	17%	394	30	29	59	15	4%	61	10	28	46%	256	13	64	25%
5. Kacenata	36	7	8	4	12	33%	13	1	2		3	23%	214	27	29	62	29	14%	38	7	11	29%	291	2	128	44%
6. Reesona	66	10	16	3	19	29%	21	1	1	2	4	19%	269	28	39	66	25	9%	21	1	7	33%	170	1	55	32%
Total	302	49	62	17	79	26%	87	10	8	7	17	20%	1,918	223	214	418	134	7%	267	48	126	47%	1,782	97	756	42%

Note: Permitted hunting number is figured out from a formula based on the reported population number of previous year and the optimal population numbers in respective areas.

Source: Rezekne Forestry

Table 11.2.1 Status of Mammal Species in LWC

No.	Name	Status at LWC
1	*Erinaceus europaeus* (Hedge hog)	Common through Europe to Asia at various habitats including agricultural area. No conservation need in LWC.
2	*Talpa europaea* (Mole)	Common at varied habitats including agricultural lands, but does not occur in peat soil due to scarcity of underground food animals. No conservation need in LWC.
3	*Lepus europaeus* (Brown hare)	Common in varied habits including agricultural land. Fringe areas between grass/peat land and forest is a favorable habitat. It is an important prey animal for many raptor species, and its abundance is necessary for raptor conservation.
4	*Lepus timidu* (Blue hare)	Status is similar to brown hare.
5	*Castor fiber* (Beaver)	Beavers make dams even at small ditches in the forest as far as running water exists. Conversion of peatlands into forests and development of drainage ditches helped expanding beaver habitat. Declining of hunting pressure is also a positive factor for them. Though it is listed on Annex II of EU Directive, population in LWC is not endangered.
6	*Ondatra zibethicus* (Muskrat)	It has wide distribution in the world as exotic species. As an exotic animal, there is no conservation need.
7	*Sciurus vulgaris* (Red squirrel)	Common in varied types of forests, but there is no reliable population estimation. It is a prey animal for many raptors and carnivores.
8	*Nyctereutes procynoides* (Raccoon dog)	It is omnivorous and prefer bushes and forests. Conservation need in LWC seems low.
9	*Canis lupus* (Wolf)	It is listed on Annex II of EU Directive, but common in LWC.
10	*Vulpes vulpes* (Fox)	It is common in LWC. It has preference to more open habitats including bogs, pastures and agricultural lands near villages. Therefore roadkill often takes place.
11	*Ursus arctos* (Brown bear)	It is actually an endangered animal in LWC. Judging from its wide home range, LWC is visited only occasionally.
12	*Lynx lynx* (Lynx)	It is listed on Annex II of EU Directive, but there is no detailed information for its status in LWC.
13	*Meles meles* (Badger)	Similar to raccoon dog, it is omnivorous and prefers bushes and forests. Probably it is common in such habitats in LWC.
14	*Lutra lutra* (Otter)	It is listed on Annex II of EU Directive. It already disappeared from many part of western Europe, but still common at eastern half of Europe including LWC. Otter footprints can be easily observed along riverside and muddy drainage ditches. It normally requires wide home range extending more than10 km along water bodies, and the population density cannot become high.
15	*Martes martes* (Pine marten)	It is an arboreal animal and common in European forests. It mainly live on small animals like squirrels and small birds.
16	*Mustela erminea* (Stoat)	It has wide Euro-Asian distribution. Though it is listed on Latvian Red Data Book, there is no detailed information for their status in LWC.
17	*Mustela nivalis* (Weasel)	- ditto-
18	*Putorius putorius* (Polecat)	There is no detailed information for their status in LWC.
19	*Mustela vison* (American mink)	It is an exotic species and attacks waterfowl. No conservation needs.
20	*Sus scrofa* (Wild boar)	It is common at bushes and forests. Under the declining hunting pressure, conservation need in LWC seems low.
21	*Capreolus capreolus* (Roe Deer)	It prefers forest habitat. Hunting pressure is declining, but population trend has not been studied in LWC.
22	*Alces alces* (Elk)	- ditto-
23	*Cervus elaphus* (Red Deer)	- ditto-

Table 11.2.2 Major Bird and Mammal Species at Fishponds and their Relevance with Aquaculture

	Name		Ind. Number in LWC	Food Habits	Potential Damage to Aquaculture
Birds					
Raptors	*Pandion haliaetus*	Osprey	3-5 pairs	fish	Possible, but negligible due to small population number
	Haliaeetus albicilla	White-tailed Eagle	3-4 pairs <30 inds wintering	fish and waterfowl	Possible, but negligible due to small population number
	Circaetus gallicus	Short-toed Snake-Eagle	1-2 pairs	terrestrial animals	none
	Circus aeruginosus	Western Marsh-Harrier	-	terrestrial animals	none
	Circus cyaneus	Northern Harrier	-	terrestrial animals	none
	Circus pygargus	Montagu's Harrier	-	terrestrial animals	none
	Aquila pomarina	Lesser Spotted Eagle	20 pairs	small mammals, frogs, insects	none
	Aquila chrysaetos	Golden Eagle	1 pair	mid-to-small terrestrial animals	none
	Aquila clanga	Spotted Eagle	1 pair	terrestrial small animals	none
	Strix uralensis	Ural Owl	-	terrestrial animals	none
Waterfowl	*Cygnus cygnus*	Whooper Swan	500	aquatic plants	none
	Cygnus columbianus	Tundra Swan	250	aquatic plants	none
	Anser fabalis	Bean Goose	2,000	aquatic plants	none
	Anser albifrons	Greater White-fronted Goose	2,000	aquatic and terrestrial plants	none
	Anas penelope	Eurasian Wigeon	4,000	aquatic plants	none
	Anas acuta	Northern Pintail	3,000	aquatic omnivorous	none
	Anas crecca	Common Teal	4,000	terrestrial omnivorous	none
	Aythya ferina	Common Pochard	4,000	aquatic omnivorous	none
	Mergellus albellus	Smew	300	aquatic omnivorous	none
	Podiceps auritus	Horned Grebe	-	aquatic insects and molluscs	none
	Phalacrocorax carbo	Great Cormorant	200 pairs	fish	Already serious. Need population control.
Other birds that utilize fishpond	*Ciconia ciconia*	White Stork	-	fish and terrestrial small animals	Possible for small sishes, but negligible.
	Ciconia nigra	Black Stork	20 pairs	fish and terrestrial small animals	Possible for small sishes, but negligible.
	Botaurus stellaris	Great Bittern	25 pairs	fish and terrestrial small animals	Possible for small sishes, but negligible.
	Tringa stagnatilis	Marsh Sandpiper	10 pairs	bentic animals	none
	Gallinago media	Great Snipe	-	small aquatic animals	none
	Xenus(Tringa) cinerea	Terek Sandpiper	2-4 pairs	small aquatic animals	none
	Sterna albifrons	Little Tern	-	fish and small animals	negligible
	Chlidonias leucopterus	White-winged Tern	-	insects over water	none
	Chlidonias niger	Black Tern	-	insects over water	none
	Alcedo atthis	Common Kingfisher	-	small fishes	negligible
	Porzana porzana	Spotted Crake	-	small aquatic animals	none
	Porzana parva	Little Crake	-	small aquatic animals	none
	Acrocephalus dumetorum	Blyth's Reed-Warbler	-	Insects	none
	Remiz pendulinus	Eurasian Penduline-Tit	-	Insects	none
Mammals					
Carnivores	*Nyctereutes procynoides*	Raccoon Dog	common	semi-aquatic carnivorous	negligible
	Canis lupus	Wolf	small	terrestrial carnivorous	none
	Vulpes vulpes	Fox	common	terrestrial carnivorous	none
	Lynx lynx	Lynx	rare	terrestrial carnivorous	none
	Meles meles	Badger	-	terrestrial omnivorous	none
	Lutra lutra	Europian Otter	common	mainly fish and frogs	possible, but not in large scale
	Martes martes	Pine Marten	forest only	terrestrial carnivorous	none
	Mustela erminea	Stoat	-	terrestrial carnivorous	none
	Mustela nivalis	Weasel	-	terrestrial carnivorous	none
	Putorius putorius	Polecat	-	terrestrial carnivorous	none
	Mustela vison	American Mink	common	Semi-aquatic carnivorous (often fish)	possible, but not in large scale
Others	*Castor fiber*	European Beaver	increasing	aquatic hervivorous	none
	Ondatra zibethicus	Muskrat	-	aquatic hervivorous	none

Note: - no information

Table 11.2.3 Chronological Change of Biotopes in LWC

Biotope type	1916	1931	1966	1981	1998
Raised/ Transitional bog	- No change	- No change	- Lubana depressions surrounded by channels	- Drainages intrude Lubana depressions	-
Fen	- Fen at Baltezeri had large open water area - Zvidze river was larger than the present status	- Fen at Baltezeri had large water area - Zvidze river was apparent	- Shrinkage of open water areas Baltezeri - Upstream area of Zvidze river desiccated by canal construction	- Open water areas Baltezeri shrank	- Open waters at Baltezeri scarcely visible - One of outflowing ponds of Zvidze river almost disappeared
Inundated grassland	- Both Grivu Sala and Verdes Sala are water-logged	- Grivu Sala was drier than Verdes Sala	- Drainages still scarcely seen	- Verdes Sala and Grivu Sala covered by dense drainages	-
Coniferous forest	- No drainages	- Main drainages appear at western half of Parabine	- Drainages extend to eastern-half of Parabine	- Drainage became denser at most areas	-
Small-leaved deciduous forest	- No drainages	- Main drainages appear at western side of Pedezne river	- Drainage become denser	- Lowlands near Balkava became forested	-
Agricultural land	-	- Western lakeshore was still a wetland	- Western lakeshore becomes agricultural land	-	- Western lakeshore becomes abandoned
Lake	- Open water area extends to Gomelis and Kvapani	- Open water area extends to Gomelis and Kvapani	- Dyke construction at western half completed - Open water area largely shrinks	- Dyke construction and diversion of Malta river completed	-
River and Canal	-	-	- Diversion canals of Aiviekste and Pedezne rivers appear	- Old Pedezne river shrank	-
Fish pond	- Kvapani was a part of the lake	- Kvapani was a part of the lake	- Mostly wet meadows with a pond at Kvapani	- Fishponds appeared except for Kvapani	-
(Information	(Hand-written map)	(Map of 1:200,000)	(Map of 1:100,000)	(Map of 1:100,000)	(LANDSAT imagery)

Table 11.2.4 Conservation Criteria and Approach Methods in LWC *1

Target groups			Environmental Zones		
			NPZ	AMZ	DZ
Flora	Raised/Transitional bog		- Preserve spaces and biodiversity of existing bogs together with fringing ecotones - Prevent succession of bog vegetation caused by deccicasion	- Preserve spaces of present bogs and fringing forests - Prevent vegatational succession of bogs by deccicasion	does not exist
	Fen		- Maintain present space and biological diversity	- Maintain present space and biological diversity	- Admit conversion to other land type
	Inundated grassland	Regularly inundated area *2	- Maintain biotope quality by not using	- Restore typical 'Inundated grassland' vegetation at selected areas - Maintain net areas of this biotope type - Maintain biotope quality by either artificial mowing or natural succession	does not exist
		Used-to-be inundated area *3	does not exist	- Admit succession from grassland to natural bushes/forests - Admit conversion into commercial forestry at abandoned agricultural lands	- Admit conversion to other land types
	Coniferous forest	Non commercial forest *4	- Maintain existing areas and biodiversity	- Maintain net areas and biodiversity	- Admit conversion to other land types
		Commercial forest	- Prohibited	- Admit forestry under regulations of respective territories	- Admit conversion to other land types
	Small-leaved Deciduous forest	Non commercial forest *4	- Maintain existing areas and biodiversity	- Maintain net areas and biodiversity	- Admit conversion to other land types
		Commercial forest	- Prohibited	- Admit forestry under regulations of respective territories	- Admit conversion to other land types
	Broad-leaved forest		- Preserve spaces and biodiversity of existing forests	- Preserve spaces and biodiversity of existing forests	does not exist
	Dry grassland		- Prohibit agriculture	- Admit agricultural and other ecological use	- Admit conversion to other land types
	Agricultural land		- Prohibit agriculture	- Admit agricultural and other ecological use	- Admit conversion to other land types
	Lake/River/Canal		- Preserve riverine forests	- Preserve old riverine forests	- Admit alteration for improvement works
	Fish pond		does not exist	- Create vegetation favorable for waterfowl	does not exist
	Overall areas		- Preserve trees older than 200 years (D.B.H. >60 cm approximately)		
Fauna	Mammals	Game species	- Prohibit hunting	- Maintain present population through habitat conservation and hunting control - Control population if necessary	-
		Other species	- Promote inventory work	- Promote inventory work	- Promote inventory work
	Birds	Raptors	- Increase population numbers by habitat protection and active measures.	- Increase population numbers by habitat protection and active measures.	-
		Waterfowl, Waders, Gulls	- Prohibit hunting	- Secure 20,000 or more waterbirds - Allow population control for harmful birds	-
		Other endangered birds	- Take measures to rehabilitate disappeared species - Maintain present population through habitat conservation	- Maintain present population through habitat conservation	-
		Forest birds	- Maintain present diversity through habitat conservation	- Maintain present diversity through habitat conservation	-
		Village birds	-	- Maintain present biodiversity through awareness	- Maintain present diversity through awareness
	Fishes		- Maintain present diversity through habitat conservation	- Increase population numbers through protection and upgrading of their habitat	-
	Other animals		- Maintain present diversity through habitat conservation - Promote inventory work	- Maintain present diversity through habitat conservation - Promote inventory work	- Promote inventory work
Human association with nature			-	- EMC has at least 10,000 nation-wide visitors annually	- at least one member of every household in and around LWC gets to participate in EMC programs - Provide all relevant officers with training opportunities on wise use methodologies

Note: *1 National and regional regulations already enforced are not included, *2 Inundated at least every 2 years under present water control scheme,
*3 Inundated only spontaneously, *4 Forests without maintenance.

Table 11.4.1 Status of LWC with Relevance to Criteria for Ramsar Registration

Criteria Group	Criteria and examples of relevant attributes	Past LWC without dyke/fish pond	Present LWC	Future LWC without EMP	Future LWC with EMP
A: Sites containing representative, rare or unique wetland types	**Criterion 1:** It contains a representative/rare/unique example of a natural or near-natural wetland type within the appropriate biogeographic region.	○	○	△	○
	70-i: natural control, amelioration or prevention of flooding	○	×	×	×
	70-ii: seasonal water retention for wetlands or other areas of conservation importance downstream.	×	×	×	×
	70-iii. recharge of aquifers.	×	×	×	×
	70-iv. form part of karsts or underground hydrological or spring systems that supply major surface wetlands.	×	×	×	×
	70-v. major natural floodplain systems.	◎	○*1	○	○
	70-vi. hydrological influence on regional climate regulation or stability.	×	×	×	×
	70-vii. maintaining high water quality standards.	×	×	×	×
B. Sites of international importance for conserving biological diversity	**Criterion 2:** It supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	○	○	○	○
	74-i. support a mobile population of a species at different stages of its life cycle.	×	×	×	×
	74-ii. support a population of a species along a migratory pathway or flyway.	○	○	×*6	○
	74-iii. providing refuge areas to populations.	○	○*2	△*7	○
	74-iv. adjacent to other wetlands included in the Ramsar List.	×	○*3	○	○
	74-v. hold a high proportion of the population of a dispersed sedentary species that occupies a restricted habitat type.	×	×	×	×
	75-i. include significant areas having certain communities, particularly where these are of high quality or particularly typical of the biogeographic region.	○	○*4	○	○
	75-ii. are sites which have rare communities.	×	×	×	×
	75-iii. include ecotones and communities which exemplify particular processes.	×	×	×	×
	75-iv. have communities that can no longer develop under contemporary conditions.	×	×	×	×
	75-v. have communities of a long developmental history.	×	×	×	×
	75-vi. have communities that are functionally critical to the survival of other perhaps rarer communities or particular species.	×	×	×	×
	75-vii. contain communities which have been the subject of significant decline in extent or occurrence.	×	×	×	×
	Criterion 3: It supports populations of plant/animal species important for maintaining the biological diversity of a particular biogeographic region.	○	○	△	○
	78-i. are "hotspots" of biological diversity and are evidently species-rich.	×	×	×	×
	78-ii. are centres of endemism or otherwise contain significant numbers of endemic species.	×	×	×	×
	78-iii. contain the range of biological diversity including habitat types occurring in a region.	○	○*5	△*7	○
	78-iv. contain a significant proportion of species adapted to special environmental conditions.	×	×	×	×
	78-v. support particular elements of biological diversity that are rare or particularly characteristic of the biogeographic region.	×	×	×	×
	Criterion 4: It supports plant/animal species at a critical stage in their life cycles, or provides refuge.	-	×	×	×
	Criterion 5: It regularly supports 20,000 or more waterbirds.	×	○	△*8	◎
	Criterion 6: It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.	×	○	△*8	◎
	Criterion 7: It supports a significant proportion of indigenous fish subspecies, species or families.	×	×	×	×
	Criterion 8: It is an important source of food for fishes, spawning ground, nursery and/or migration path.	○	×	×	○

Note: Criteria and attributes are those in the Resolution VII.11 (1999) of the Ramsar Convention.
◎: satisfactory, ○: applicable, △: questionable, ×: not applicable; -: no information.
*1: Existence of large inundated grassland, *2: Bogs for raptors and lake and fishponds for waterfowl,
*3: Neighboring Teici Ramsar Site, *4: Existence of large high bogs, *5: Varied biotopes exist in LWC,
*6: Loss of Great Snipe habitat for example, *7: Possible loss/degradation of high bogs,
*8: Future of fishpond habitat are not clear.

Table 11.4.2 Relevance of Wetland Conservation in LWC with the Main Text of the Ramsar Convention

Type of requirements	Relevant texts in the Ramsar Convention	Measures to be taken in the Plan
Establishment of Ramsar site	Article 2-1: Contracting Party shall designate suitable wetlands. Wetlands should be selected for the List on account of their international significance.	LWC satisfy criteria for Ramsar registration, and establishment of a Ramsar site is proposed.
International responsibility	Article 2-6: Contracting Party shall consider its international responsibilities for the conservation, management and wise use of migratory stocks of waterfowl.	International cooperation with countries on migratory routes is promoted through EMC activities such as 'Baltic Ramsar Center.
Planning	Article 3-1: The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.	This plan itself satisfies this condition. Wise use is emphasized in the rules of protected territories. Educational use of wetlands is among wise use measures.
Monitoring	Article 3-2: Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference.	'Early Warning' is realized through monitoring program.
	Article 4-1: Promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.	Research is conducted in collaboration with other organizations, and educational activities are linked with other nature reserves.
Reporting	Article 3-2: Information on changes (in Article 3-2) shall be passed without delay to the responsible organization or government.	Environmental Information Management System includes reporting system.
Mitigation	Article 4-2: Where a Contracting Party deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection.	This plan mainly aims at conservation on the existing site, and mitigation concept is not emphasized.
Research	Article 4-3: Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.	This is reflected in the research and monitoring activities.
Waterfowl augmentation	Article 4-4: Contracting Parties shall endeavor through management to increase waterfowl populations on appropriate wetlands (whether they are included in the List or not).	Improvement of fishponds and Lake Lubana as waterfowl habitat is a major part of the plan.
Training	Article 4-5: Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening.	Capacity building of governmental sectors is emphasized.

Table 11.4.3 Relevance of the Wetland Conservation Plan with the 'Ramsar Strategic Plan 1997-2002'

Major objectives of the Strategic plan	Action-level strategies that are relevant to LWC	Relevant activities in the Plan
1. To progress towards universal membership of the Convention.	・Not relevant.	・Not relevant.
2. To achieve the wise use of wetlands by implementing and further developing the Ramsar Wise Use Guidelines.	・Formulation/implementation of national environmental strategies. ・Integrated land/water planning ・Publication of reference materials on wiseuse. ・Enactment/enforcement of environmental laws (such as those on EIA, water use, and pollution). ・Introduction of wetland economic valuation techniques. ・Establish wetland restoration / rehabilitation programmes ・Ensuring participation of local communities/private sectors/NGOs. ・Introduction of incentive/disincentive measures.	・Wetland Conservation Plan is formulated in accordance with such strategies as National Environmental Action Plans and National Programme on Biological Diversity. ・Publication of wise use materials is realized in the awareness part. ・The Plan is formulated based on effective environmental laws. ・Economic valuation method was examined in the preparation process of the Plan. ・Lake and fishpond restoration is proposed. ・Involvement of varied sectors are proposed. ・Incentive measures are not adopted.
3. To raise awareness of wetland values and functions at all levels.	・Education and public awareness focus on wetlands. ・Inclusion of wise use principle in educational curricula.	・Education and public awareness is a component of the Plan. ・Recommendation to the school curricula is described in the Plan.
4. To reinforce the capacity of institutions to achieve conservation and wise use of wetlands.	・Institutional coordination mechanism. ・Training activities.	・Proposed Environmental Management Center has a coordinating function. ・Training is included in the activities.
5. To ensure the conservation of all sites included in the Ramsar List.	・Establishment of management plan ・Monitoring scheme	・This plan itself is the management plan. ・Monitoring scheme is also proposed.
6. To designate for the Ramsar List those wetlands, especially wetland types still under-represented in the List and transfrontier wetlands.	・Promote inventory work including loss/ conversion of wetlands	・Inventory work is dealt both in research and monitoring part. ・Inundated grassland is a type of under-represented wetland.
7. To mobilize international cooperation and financial assistance for wetland conservation and wise use in collaboration with other conventions and governmental/ non-governmental agencies.	・Promote international cooperation projects ・Promote international exchange programmes	・Already realized as Latvia-Japan cooperation. ・International exchange is already realized by the above cooperation and promoted through eco-tourism.
8. To provide the Convention with the required institutional mechanisms/resources.	・Not relevant.	・Not relevant.

Note: Ramsar Strategic Plan 1997-2002 which was adopted at COP6 (1996) of the Convention, includes eight General Objectives, 28 Operational Objectives, and 125 concrete actions to be taken.

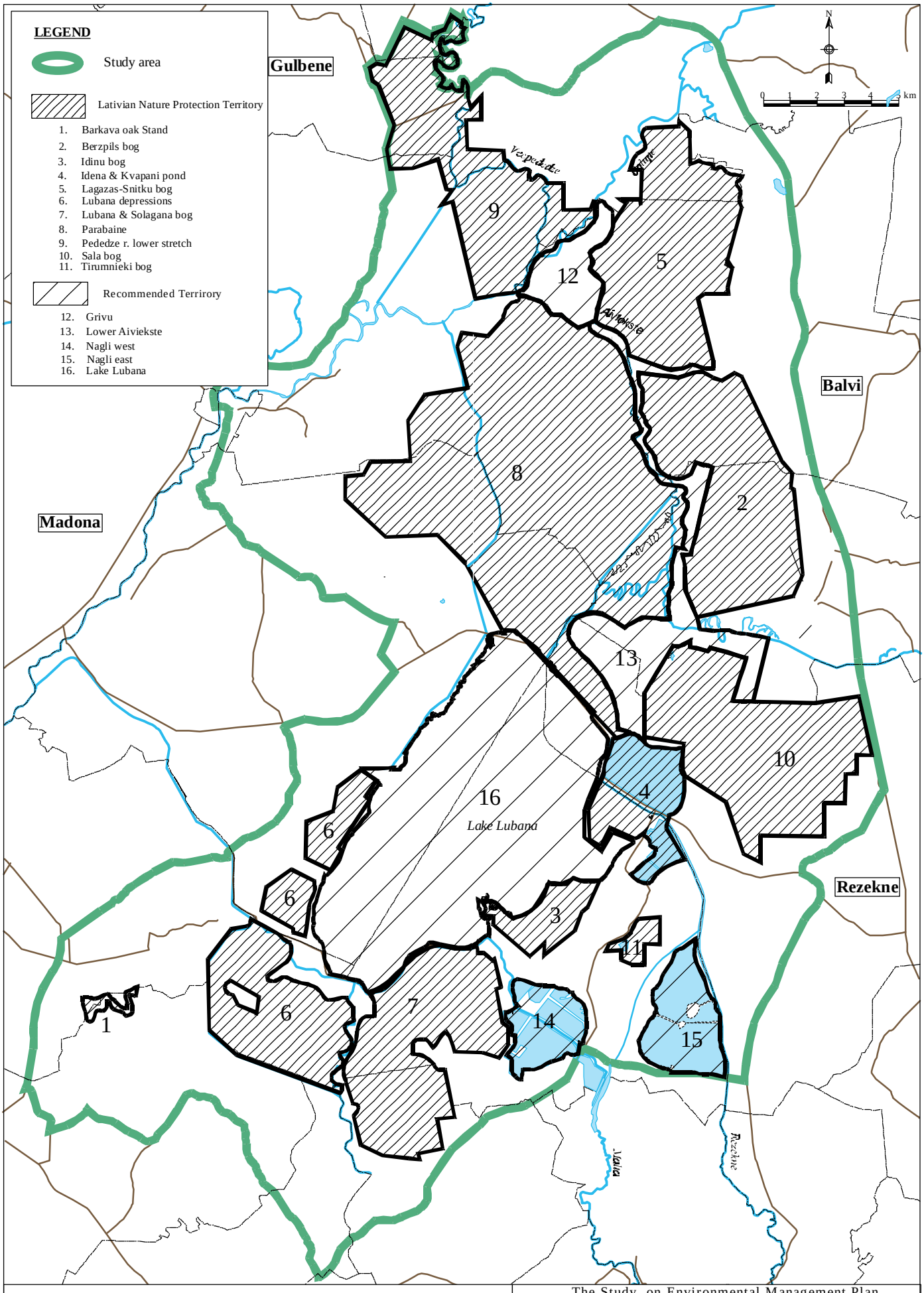


Figure 11.2.1 Proposed Biotopes for Conservation

The Study on Environmental Management Plan for the Lunaba Wetland Complex in the Republic of Latvia

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Figure 11.2.2 Map of LWC in 1916 (Scale: not know)

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

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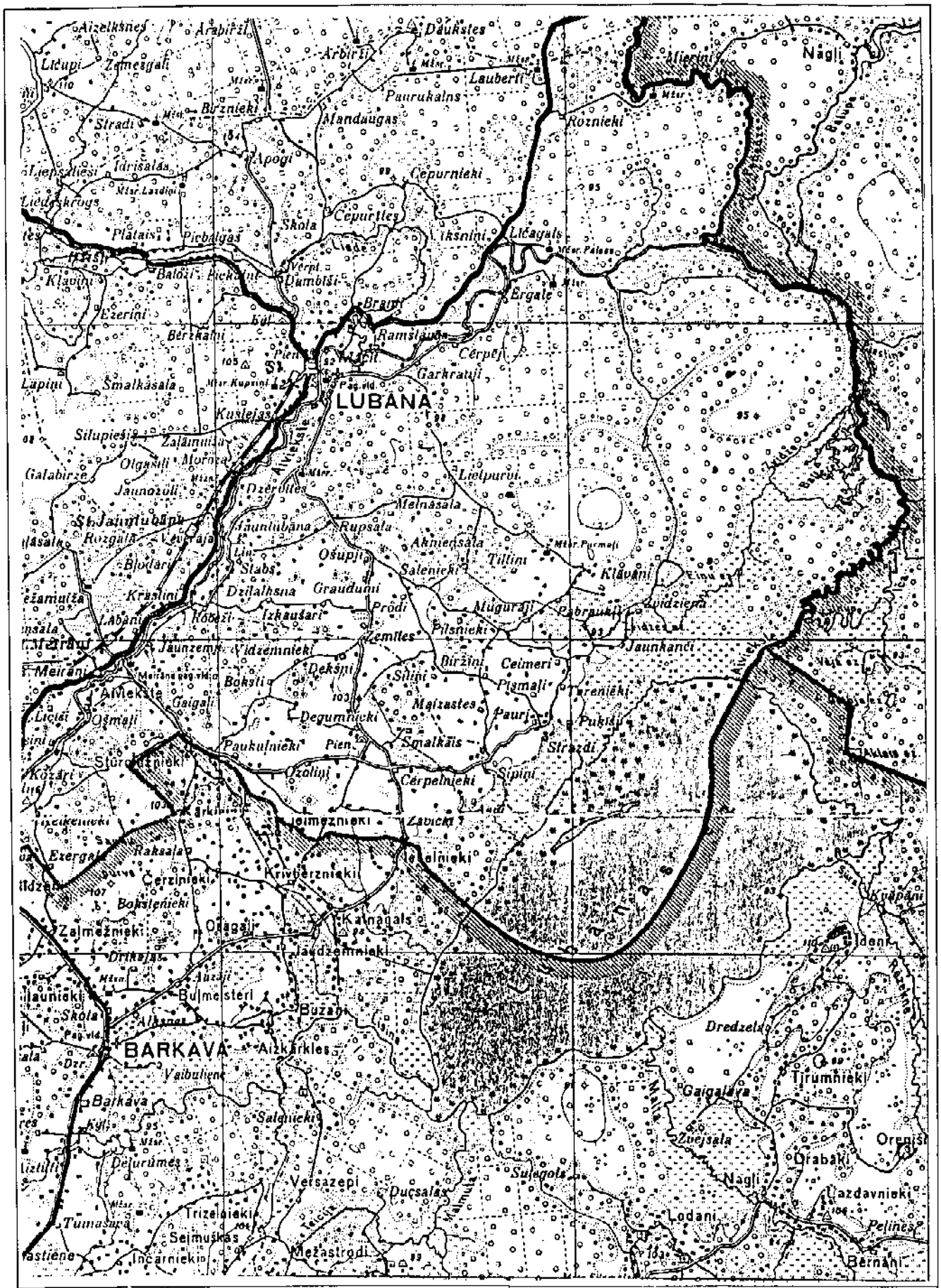

Figure 11.2.3 Map of LWC in 1931 (1:200000)

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

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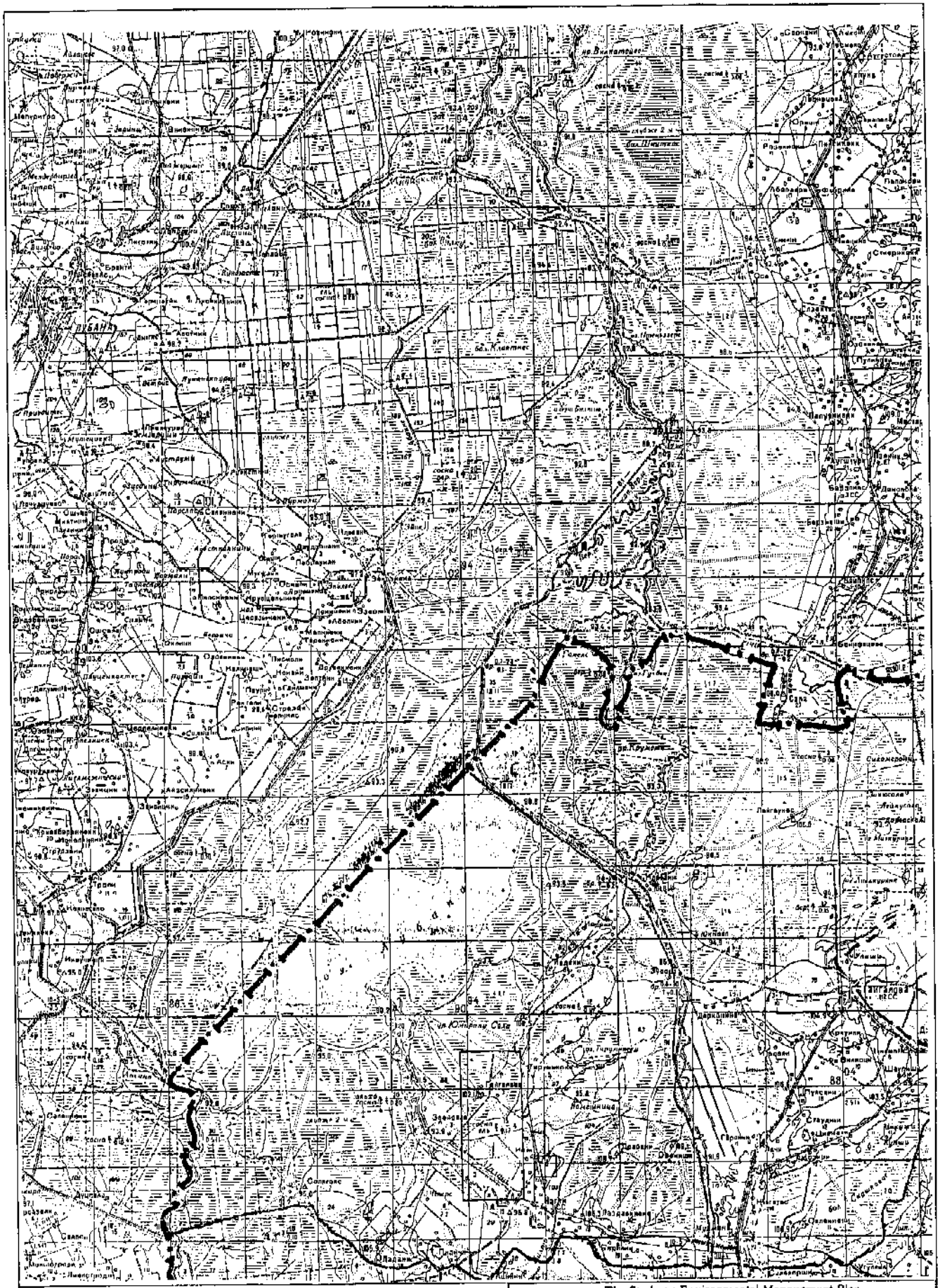

Figure 11.2.4 Map of LWC in 1966 (1:100000)

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for Lubana Wetland Complex in the Republic of Latvia
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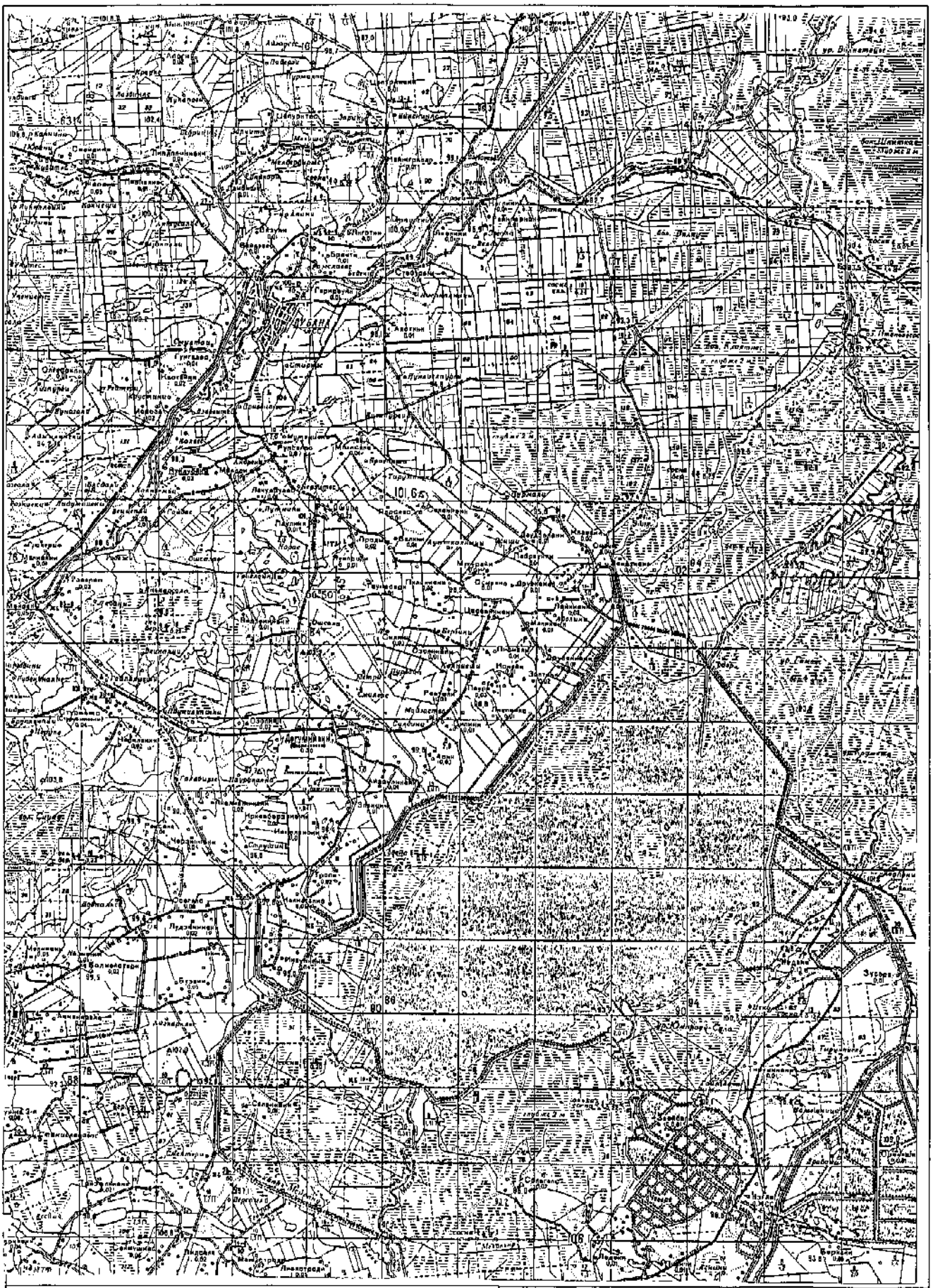

Figure 11.2.5 Map of LWC in 1981 (1:100000)

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for Lubana Wetland Complex in the Republic of Latvia
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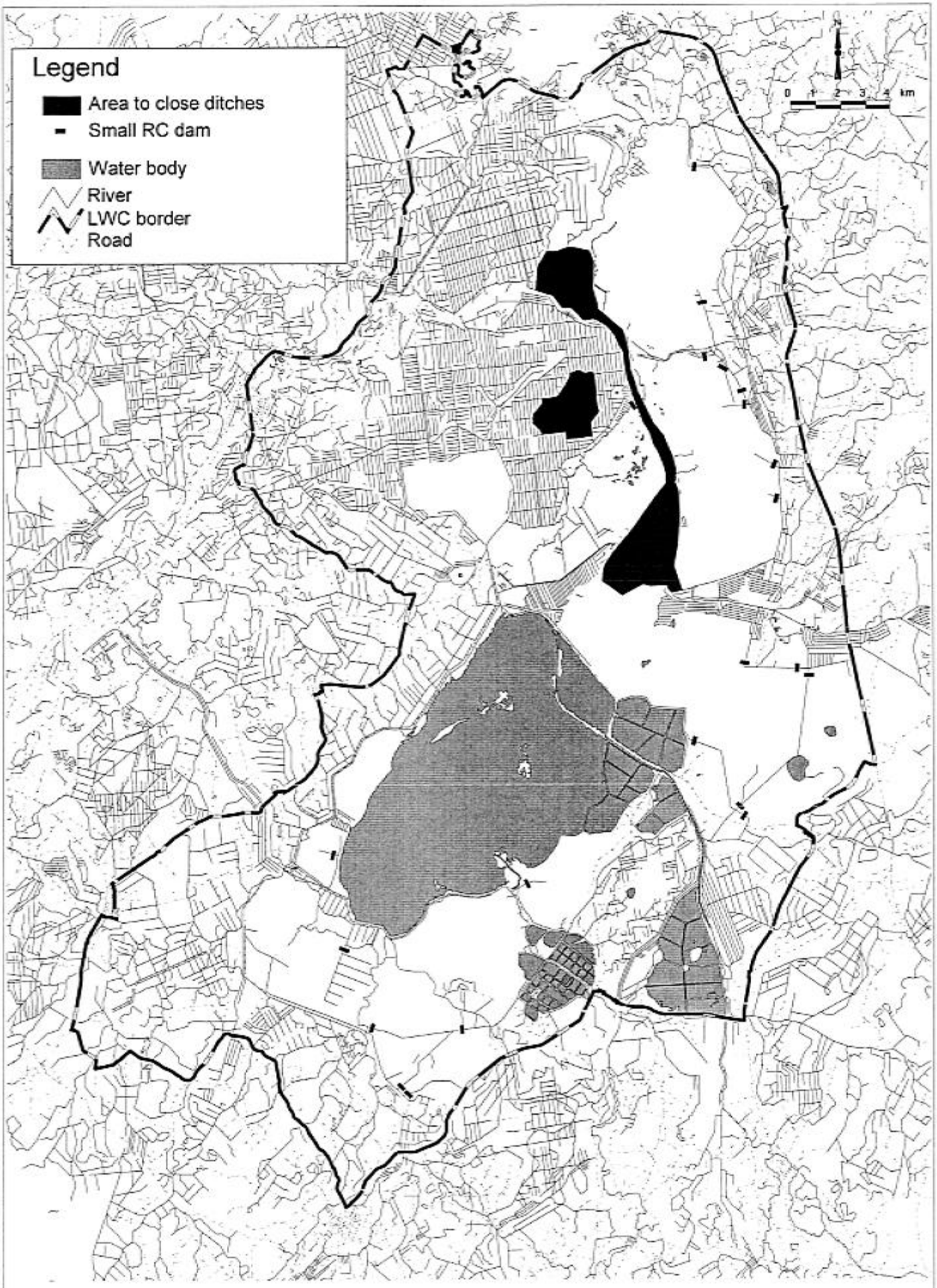

Figure 11.3.1 Points and Area to Close Drainages

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

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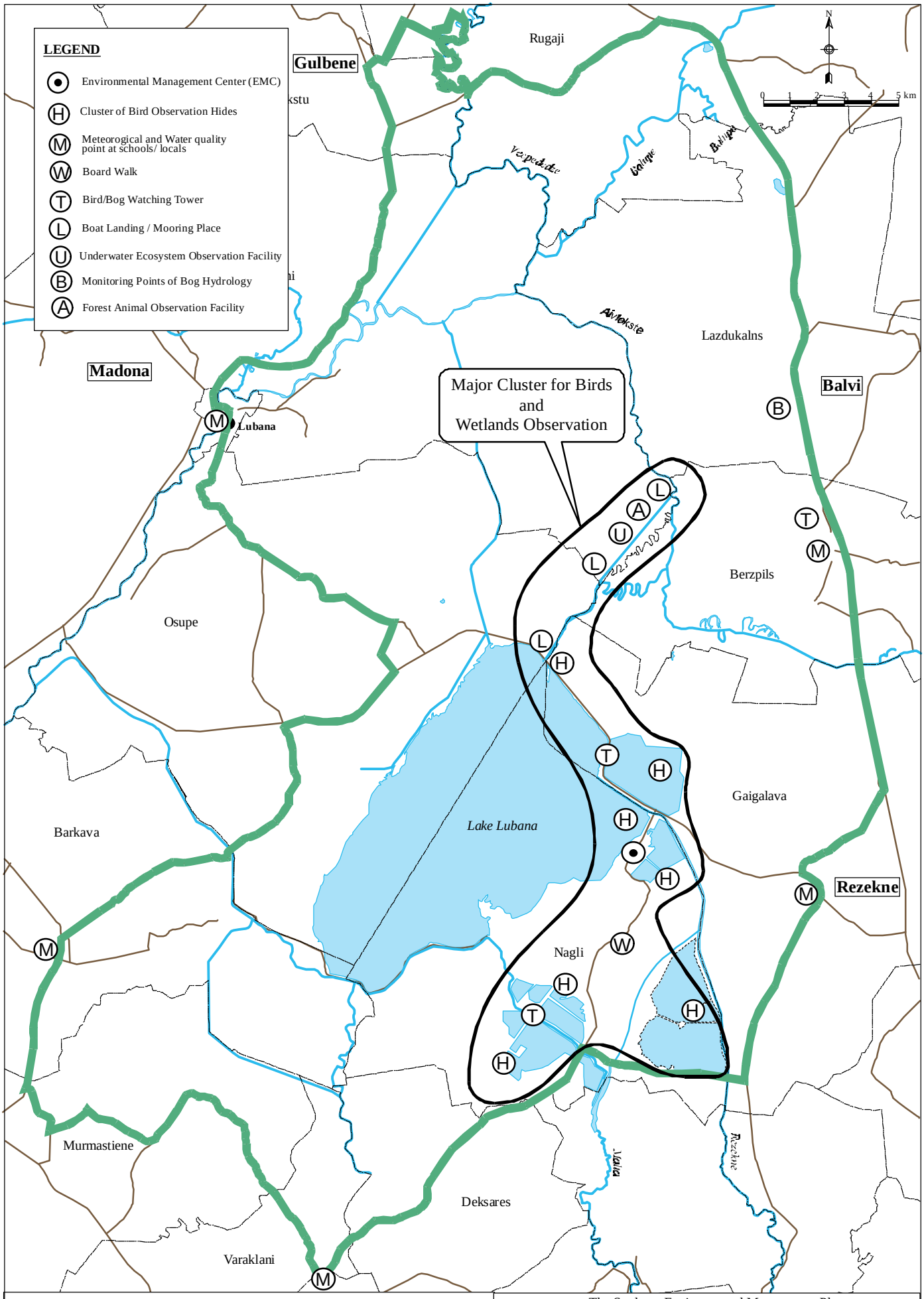

Figure 11.3.2 Facilities of Nature Observation and Monitoring

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

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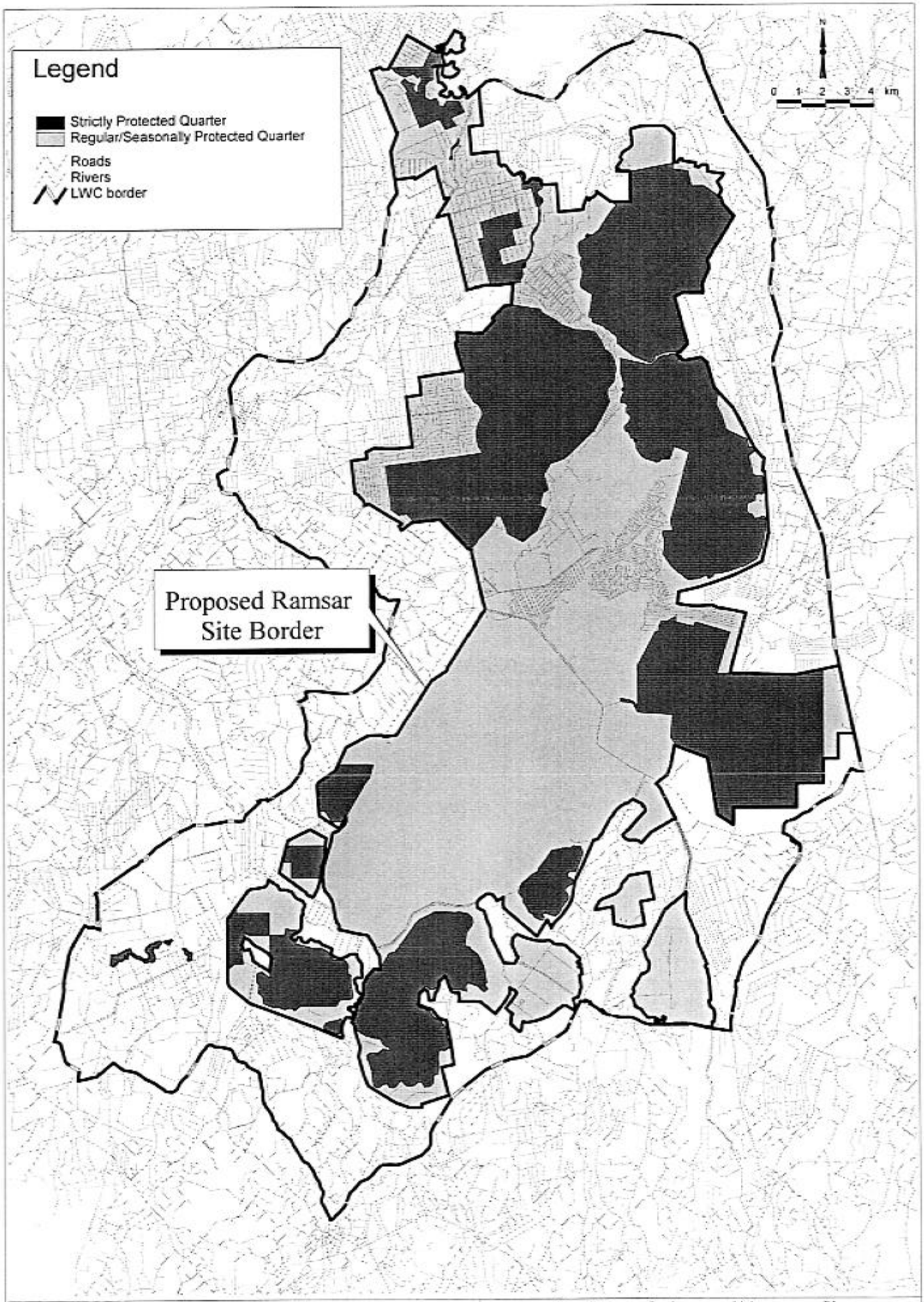


Figure 11.4.1 Proposed Ramsar Site

CHAPTER 12

CHAPTER 12 GUIDELINE FOR ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM (EIMS)

12.1 Geographic Information System (GIS) on Environmental Management

12.1.1 Condition of GIS Use on Environmental Management

(1) GIS network system

In the National Environmental Policy Plan for Latvia (NEPP), one of the priorities in the development of environmental protection infrastructure is the development of a uniform environment data system, which should become transparent and open to the public and state institutions through the Government Data Communication Network (GDCN) in Latvia and via the Internet worldwide. Currently, certain measures are taken to transform databases to an Oracle data server by using Web technology to process requests of remote users.

In Latvia, GIS has been broadly used for environmental management. The national GIS network system in Latvia consists of three agencies, namely the Latvian Environmental Data Center (LEDC), the State Hydro-meteorological Agency, and the State Geological Survey. LEDC has commenced spatial linkage of point sources relevant to environment and formation of the GIS database. Establishment of a connection point of GDCN and a node point of the Environment Information Observation Network (EIONET) of the European Environment Agency in the LEDC opens the European network for Latvia. The establishment of the EIONET node point is financed by PHARE and its maintenance costs are borne by Latvia.

Main functions of LEDC are i) to test environmental quality, ii) to develop environmental quality analysis method, iii) to establish a unified environmental data information system, and iv) to coordinate its operation. LEDC is comprised of the data processing department which aims to establish an unified environmental data information system, and the laboratory department which aims to establish an quality test system. The GIS potential is much wider compared with current utilization. However, a more complete and professional use in Latvia is limited by the lack of high-quality digital maps, especially basic maps, and the low level of knowledge and skills of users.

(2) Available digital database and GIS software

Data required for needs of the regional development policy and spatial planning are mostly stored in information servers of institutions subordinated to the ministries and local governments, such as the Land Information System, the Local Government Uniform Information System, and the State Committee for Statistics. For the purpose of processing pursuant to the needs of spatial planing and development planning, necessary application software should be developed. Access to the corresponding information servers will be ensured by GDCN.

Main tasks in the GIS software development are to perform spatial identification of pollution sources and establishment of database, preparation and purchase of digital maps, providing the use of environmental data in GIS and decision-making support system, and to introduce the GIS in spatial planning and forecasting in environmental changes, thereby providing powerful means of analysis for decision-makers.

Through the international cooperation activities, LEDC has worked out several digital information database maps up to 1996, and recently prepared two useful digital maps, namely the topographical map in scale of 1:50,000 and the land cover database of the Coordination of Information on Environment (CORINE). These are important from the environmental management viewpoint. At present, the major GIS software used in Latvia are the Arc/Info and the ArcView. However, most frequently used software still does not correspond to current technical requirements and norms contained in legislative acts in Latvia.

(3) Current situation of GIS database in the study area

In the field of regional development and spatial planning, information and data have been collected and systematized by different local government services. However, there is no unified structure for data collection. The volume of information stored in different local governments also varies. Cartographic materials in digital form and GIS have been gradually used for regional development and spatial planning problem solving, but not enough. Currently, GIS is mostly used as information systems and for the purpose of thematic map-making. In order to ensure decision-makers work with GIS also at the regional level, each Regional Environmental Board (REB) received GIS software ArcView and the digital basic maps of the respective regions.

In fact, Rezekne and Madona REBs have own database using the ArcView software. Besides, the Office of Land Registered Service in Rezekne district records land information such as boundary, land use, acreage, and tenure, using the Microstation of GIS software. This office also has much information of aerial photograph taken in the 1980s to be used for orthophoto maps.

(4) Future development plan of GIS

In the Concept of Information Technology Development Strategy for 1997-2002, the Environmental Data Information System (EDIS) is intended to contain data and information related to environmental protection, construction, tourism, formation and development of regional development planning and local government policy.

Currently, the upgrade of hardware is performed using state budget resources, including resources from the State Investment Program project “EV17 Establishment of Uniform Environment Data Information System” (1996-2001), the Environmental Protection Fund and foreign technical assistance as well. All users of EDIS will be guaranteed access to the state registers and information systems established under ministries and institutions, and incorporated into GDCN consisting of the Local Government Uniform Information

System, the Land Information System, and the State Revenue Service Information System.

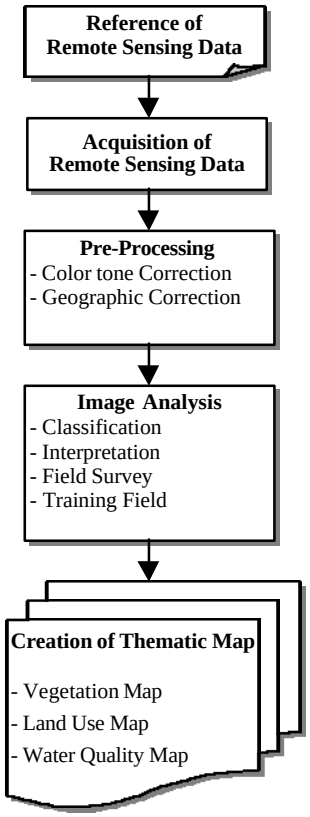
Distribution of data such as thematic maps will be made through EDIS. LEDC has maintenance contact with the Arc/Info representatives in Latvia with regard to maintenance of Arc/Info under which it is intended to replace outdated version with new version. This will allow efficiently prepare digital maps of higher quality for different users. At present, topographical maps are under maintenance by scale of 1:50,000 for the whole country, some parts of which have already been distributed as a paper drawing. It is planned to distribute their digital data utilizable for GIS in the near future.

12.1.2 Environmental Monitoring by Remote Sensing and GIS Data

(1) Overall frame

Environmental monitoring is a tool to investigate changes of environmental situation between the past and the present. The collected information and data are significant to formulate or modify an environmental management plan, to identify implementation results of the plan, and to develop necessary environmental measures. The information to be monitored consists of natural and social conditions, among which the most fundamental information collected through remote sensing and GIS is data related to land cover. Remote sensing technology validly grasps the land cover situation of a wide area among environment information, in the same accuracy on the instant. The main information collectable from remote sensing is on vegetation, land use, and water quality, all of which can be accumulated as a database of GIS and utilized in serial analysis. Therefore, the objective of the environmental monitoring by remote sensing and GIS data is to collect and provide updated information mainly related to land cover situation for environmental management of LWC, as a part of the Environmental Information Management System (EIMS).

In Latvia there is little use of remote sensing except that this technology has been currently utilized under the CORINE Land Cover Project in the University of Latvia and EIONET. The overall framework to apply remote sensing and GIS technology into environmental monitoring is charted in the right figure. The general flow of remote sensing is reference and acquisition of artificial satellite data, pre-processing such as color tone and geographic correction, and creation of thematic maps (such as vegetation, land use and water-quality distribution maps) by image analysis.



Remote-sensing Process for Environmental Monitoring

Main artificial satellite data are LANDSAT of USA. and SPOT of France. Each artificial satellite data has a difference in

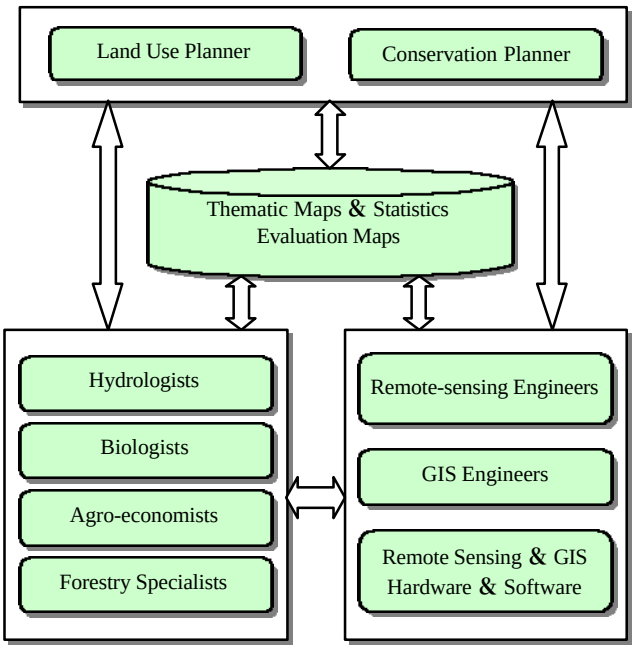
resolution ability, observation range, and observation wavelength belt. These data are usually used for some investigation purposes. Observation of artificial satellite data about Latvia is performed at the Kiruna observatory station in Sweden. Lists of archived data and pictures acquired by the observation come in handy through the Internet homepage of the Kiruna station, so that suitable data can be searched according to investigation purposes. Then, the selected data are obtained in form of CD-ROM from the station.

Pre-processing of the artificial satellite data is carried out using image analysis software. Pre-processing for satellite data is divided into color tone correction and geography correction. The color tone correction deciphers original data mainly by image enhancement processing, and changes the data into a clear image. The geographic correction rectifies position distortion peculiar to the artificial satellite, coinciding position of the existing topographical map with that of the artificial satellite data.

Next, using rectified artificial satellite data, image classification and image interpretation are performed, and thematic maps of an investigation area is created. Thematic maps are accumulated as database of GIS, and used for environmental monitoring.

(2) Organization

A systematic organization is needed in order to advance the environmental monitoring with remote sensing and GIS. Staff of LEDC, REBs, and the State Geological Survey have reviewed the basic principles of GIS operation and possible directions of its use. It requires introduction of software and hardware for remote sensing analysis as well as training of remote sensing engineers, as well. These compositions are essential to build up an organizational system enough to implement the environmental monitoring with remote sensing. The right figure shows the concept of the organization.



Conceptual Network of GIS/Remote-sensing and Environmental Management

In order to advance remote sensing, introduction of utilizable software and hardware is needed. Now, the worldwide general-purpose analysis software of remote sensing is ERDAS Imagine of U.S. ESRI Co. and TNTmips of U.S. Micro Image Co. As hardware, personal computers are needed at least.

Remote sensing engineer here means the engineer who can play an interface role with environmental engineers in charge of environmental monitoring, rather than merely an image processing engineer. Training should be provided to such engineers who can

prepare thematic and evaluation maps utilizable for environmental monitoring, or who can offer necessary information to other engineers concerned.

12.1.3 GIS on the Environmental Information Management System (EIMS)

(1) Purpose and functions

EIMS is proposed to utilize GIS aiming at construction and management of environmental information database in association with the environmental monitoring of LWC, which is also useful for environmental education. The purpose of environmental management itself with an active use of GIS in the study area is to monitor and evaluate the land conditions. Monitoring items consist of meteorological/hydrological data, land use, inundation in swamp, water quality of Lake Lubana, and distribution of wild animals and vegetation. In addition, land evaluation data is needed for implementation of suitable land use such as agriculture, pasture, forest, nature conservation, and flood control. In line with these purposes, GIS functions within the EIMS framework as technological tool to monitor the land cover related situations, to update and manage the monitored data, to provide necessary maps for environmental conservation, and to prepare materials for environmental education to visitors, local residents, and the other Latvians.

(2) Environmental items to be managed

Environmental items which should be managed in EIMS are various, because EMP for the study area is to be for both sides of continuous development and environmental preservation. The environmental items to be collected for GIS also vary reflecting multiple management viewpoints, as listed in the table below. The table shows what items are needed and managed with GIS, being largely categorized into basic data, data for land use, and data for environmental preservation.

Basic data: Basic data is information which is needed when analyzing all information, and can be divided into natural conditions and social conditions. Natural conditions can be further divided into geomorphology, productivity, weather, and hydrology. Social conditions can be divided into geographical features, social statistics, and land use situation.

Data for land use: It can be divided into six management area of land use, namely, agriculture, stock farming, fishing, afforestation, bogs and swamp, and water body. The managed items differ for each area depending on its land use features.

Data for environmental preservation: Management area of environmental preservation can be divided into preservation of vegetation, preservation of ecosystem, and restriction of artificial alteration.

(3) Networking

The Internet can be a prospective alternative for mutual use of available data and information open to the public. The free access to LEDC, EIONET, and the Ramsar Convention on Wetlands Wise Use Resource Center through the Internet makes environmental data and information available to the public. EIMS connected to the three

networks will make the information dissemination of LWC conservation possible and helps update the environmental monitoring data continuously. The direction of information exchange should not be one-sided. As the aim of the EIMS includes to extract the public opinions on EMP for LWC, the Internet has a high potential for direct public participation of creative opinion makers throughout Latvia, Europe, and the world.

The institutions subordinated to MEPRD constitute an intricate and spatially distant network covering the entire territory of the country which requires preserving efforts and resources to connect them within a wide area. The territory of Latvia is covered with network of operative and mode observation stations of environment quality monitoring (including automated) which constitutes a significant component of the information network. By means of using the SIP resources and foreign technical assistance, the formation of LAN has been completed in the sites including RREB (Windows NT) and MREB (Windows NT). The REBs' connection to the wide area network of MEPRD has been implemented by connection to LEDC via dial-up telephone lines. But significant problems have been caused by poor quality of analog telephone lines connected with RREB and MREB, which hinder normal information exchange.

Environmental Items to be Managed

Data	Category	Management Viewpoint	Managed Items
(1)Basic Data	1) Natural Condition	Geomorphology	a)Drainage system, altitude
		Productivity	a)Soil quality
		Weather	c)Precipitation, temperature
		Hydrology	b)Water temperature, c)Water flow
	2) Social Condition	Geographical features	a)Road, colony, name of place, administration classification
		Statistics value	a)Administration, population, output, circulation
		Land-use situation	b)Present condition and change
(2) Data for Land Use	1) Agriculture	Defense of a flood	a)Water level, area
		Agricultural proper arrangement	a)Productivity, land ownership, manure
	2) Stock Farming	Aptitude of grassy place	a)Geographical feature, soil quality, livestock kind, feces and urine
	3) Fishing	Fish species extinction	a)Water level, kind of fish, aquatic plant
		Water-quality preservation	a)Eutrophication b)Water temperature
	4) Forestry	Suitable management of the reforestation ground	a)Plant species b)Forest cover and distribution c)Biomass
	5) Bog and Swamp	Preservation of bogs and vegetation	a)Penetration of vegetation
		Swamp reforestation	a)Drainage level
	6) Water Body	Water level management	a)Bank, water gate, drainage system
(3) Data for Preservation	1) Preservation of Vegetation	Restriction of plant extinction	b)Distribution of vegetation
	2) Preservation of Ecosystem	Animals and plants of precious kinds	a)Distribution of precious animals and plants
		Preservation of biotope	a)Distribution of biotopes
	3) Restriction of Artificial Change	Prevention of land abuse	b)Land-use change

Notes: a)Items with GIS, b)Items with remote sensing, and c)Items though field survey.

12.2 Overall Frame of EIMS

(1) National Environmental Policy Plan (NEPP)

The NEPP touches upon the policy on an environmental information system stating, "*Adopting and implementing any environmental decision, as well as evaluating its results, is impossible without adequate information. The benefit of environmental policy directly depends on the quality of the information used to develop it. Therefore, Latvia needs a well-developed environmental information system that ensues information for decision-makers and the public.*"

The NEPP regards the establishment of a unified environmental data system as a priority institutional structure for national environmental management. It states, "*communication is a continuous, mutual exchange of information between decision-makers and the public at large*", putting an emphasis on the communication functions so as: 1) to make information available to the public, 2) to focus public attention on specific problems, 3) to involve the public in the discussion and solution of specific problems, 4) to promote the public opinions and knowledge, and 5) to influence changes of public behavior and attitude.

On decision-making, the NEPP expresses the importance of public direct involvement in decision-making. It declares, "*The sooner the public starts to participate in policy elaboration, the sooner and better public opinion will be observed. By involving the public, more and more diverse aspects of an issue appear. Even if the final decision does not agree with public opinion, the public would at least understand why the decision was made.*" EIMS enables the public direct participation in decision-making by the help of information technologies (IT).

On monitoring, NEPP affirms, "*monitoring falls into three functional blocks: 1) monitoring of environmental quality, 2) policy implementation monitoring, and 3) early warning monitoring.*" Policy implementation monitoring is defined as "*the systematic evaluation of changes in the environmental situation in connection with the operation of policy instruments, based on cause-effect relationships*". EIMS deals with the monitoring of conservation measures determined by the Implementation Committee of Environmental Management Plan (EMP) for LWC.

The objectives of environmental education set by NEPP include: 1) to promote sustainable development, 2) to increase public responsibility and active public involvement in environmental protection and remediation, 3) to increase the level of public awareness on environmental issues, and 4) to involve responsible organizations, education institutions, experts and activists in environmental education to widen the public support for environmental protection. EIMS provides a dynamic approach to environmental education and the proposed activities for the public.

On public awareness, the NEPP pronounces, "*Public awareness is another pre-requisite for environmental policy, since efficiency of environmental measures is directly dependent on the level of knowledge, understanding of situation and sense of responsibility of all the persons involved in the process. The higher the level of public awareness, the wider and more effective will be public participation in the elaboration and implementation of environmental policy.*"

On science promotion, NEPP remarks, "*Coordination of fundamental (pure) and applied research in accordance with actual needs is very important, particularly so that limited financial resources and scientific staff may be utilized with maximum efficiency. Science also provides the basis for the development and improvement of environmental education systems.*"

(2) Current Information Network

The Concept of Information Technology Development Strategy for 1997-2002 elaborates the goals of the information technology development in MEPRD, the current state of information technologies and theirs development, and requested investments and maintenance costs. The intention of Latvian Environmental Data Center (LEDC) to form the Environmental Data Information System (EDIS) is clearly stated in the document. The unified and computerized EDIS is to contain the data and information on environmental protection, construction, tourism, regional development planning, spatial planning, tourism and local government policies. It is necessary to ensure decision-makers with information needed to establish a unified classification, codification, natural resource use and pollution limits permitting system for the institutions subordinated to MEPRD. All users of EDIS will be guaranteed access to the state registers and information systems established under other ministries and institutions and incorporated into the Government Data Communication Network (GDCN) via the Internet.

The establishment of GDCN node point of the Environmental Information and Observation Network (EIONET) of the European Environment Agency in the LEDC accelerates the provision of the information on the international obligations accepted by the government of Latvia. The node point to connect the Ramsar Convention has yet to be established.

The selection of hardware and software should be consistent with the current system in Latvia when it comes to the information system structuring. In most cases, Windows 95 or Windows NT is running on PCs of MEPRD and its subordinated organizations. MS Word for documentation, MS Access for database processing, ArcView and Arc/Info for GIS processing, MS Internet Explorer and Netscape Navigator for Internet services are used as the widely accepted software. The PHARE sponsored CORINE Land Cover project completed in 1998 has a lot of information on LWC and can be applied to environmental management for LWC. In eastern Latvia, Daugavpils Pedagogical University (DPU) is the main IT institution to provide the know-how on data processing and information

networking. MREB opens its World Wide Web (WWW) home page to the public with rich information relevant to environmental protection, though RREB almost lacks its ability to distribute its information to the public.

(3) Objectives of EIMS

The objectives of EIMS are summarized into five categories: 1) decision-making, 2) monitoring, 3) environmental education, 4) public awareness, and 5) science promotion. The overall framework of EIMS is shown in Figure 12.2.1 with the EIMS objectives and outputs.

12.3 Decision-making with EIMS

12.3.1 Advantages of Decision-making by EIMS

The introduction of EIMS improves 1) clarity, 2) accountability, 3) applicability, and 4) integrity of the decision-making on conservation management, water level management, education plan, regional development, water quality management, and facilities plan.

1) Using the decision-making process proposed here, decision-makers are given a clear methodology for management issues to be solved. What factors are in decision-makers' minds is a critical question in the democratic society, particularly for Latvia which has made great efforts to join the EU membership since the end of the Soviet regime. EIMS gives politicians and public servants clarity in decision-making and an incredible advantage.
2) The politics accountable to the public is an issue in the European Union. Accountability derives from a decision-making process where the public can follow the exact procedures politicians have taken. EIMS reinforces a function to persuade the public.
3) As MEPRD has many issues related to environmental management and sustainable development, the possibility of applying EIMS proposed here for environmental management in LWC to other nature preserves and national parks considerably remains. The application of EIMS is expected to improve management capacity of MEPRD and other administrative agencies.
4) To integrate information in the same format has been a long-standing issue in the field of environmental management. EIMS using the GIS coordinate system enables concerned organizations to easily and consistently share and process information and data necessary, which makes the environmental management system in Latvia more integrated.

12.3.2 Decision-making Process of EIMS

The decision-making process of EIMS is presented in Figure 12.3.1.

(1) Specification of decision items and target areas

The first step of decision making specifies the decision items and target areas to be focused on. The management types for decision-making are mainly categorized into six: 1) conservation management, 2) water level management, 3) educational plan, 4) regional development, 5) water quality management, and 6) eco-tourism development plan (see Table 12.3.1). The decision items are specified for each management type, and decision-makers need to select one of them to specify the necessary decision item for the time being. The necessary GIS data (layers) for it is marked with "x" in Table 12.3.1 to clarify which data is used to make thematic maps for decision-making. The geological areas to be focused on should be also specified by the Implementation Committee of EMP in accordance with the decision-making items. Current environmental zones, administrative units (townships or districts), nature protection territories, or biotopes could be targeted for the purpose of decision-making. The information on both the decision items and target areas is directed to the policy analysts of EMC for further process of decision-making.

(2) Specification of data arrangement and detailed researches

The policy analysts of EMC specify the data arrangement and researches to be detailed to obtain the necessary information based on the decision items and necessary GIS data matrix specified by the Implementation Committee. Digital or analog maps and data essential for decision-making should be arranged in the formats in which decision items are clearly focused on and easily readable on thematic maps. Making the best of the GIS technologies, information interpretation on a digital screen is a replacement for hard copying of thematic maps. The scope of selection of information and data is expanded by means of the highly developed GIS technologies. Scientific research should be carried out in accordance with the decision items specified by the Implementation Committee. The policy analysts give their directives to science-based analysts to conduct further researches to fill in as much information as possible to make decisions.

(3) Interpretation of outputs and decision making

Based on the analyses of distribution and overlaid maps, the policy analysts interpret the information on the maps 1) to focus on the decision items, 2) to clarify the meanings of overlapping areas of more than two layers of GIS data, and 3) to calculate the area where overlapping takes place. This process needs a high standard of analysis to avoid misinterpretation of the information.

12.3.3 GIS and Remote-sensing Usage for Decision-Making

(1) Advantages of GIS and remote-sensing

GIS forms a digital database in which the commonly used spatial coordinate system in Latvia (LKS-92) is made fit for geological reference. GIS is used as a means of 1) data input from maps, aerial photos, satellites, and surveys, 2) data storage, retrieval, and query, 3) data transformation, analysis, modeling, and spatial statistics, and 4) data reporting such as maps, reports, and plans. The advantages of GIS ensue from its functions as the decision-making, data integration, and statistic analysis tools. GIS technologies enrich accuracy and continuity attributed to the necessary data and information. In addition, GIS software provides analytical tools to calculate area and a query system in which necessary information is automatically returned.

(2) Information created by GIS and remote-sensing

The GIS data inputted by the JICA study team in collaboration with RDC includes 1) environmental zones, 2) current biotope map, 3) nature protection territories, 4) current land use map, 5) educational & eco-tourism resources map, 6) topographical map, 7) land tenure/ownership map, 8) inundation map, and 9) water quality map. A soil map and facility plan can be digitized by GIS in the future depending on the future needs. The information produced with remote-sensing technologies includes 1) water quality distribution (turbidity and chlorophyll-*a*), 2) water temperature distribution, and 3) 3D simulation of water level conditions. Decision-makers and policy analysts can use these data to make decisions for the six management types specified previously.

(3) Limitations of GIS and remote-sensing

As GIS technologies require experienced know-how to deal with spatial data and query tools, training courses should be arranged for GIS and IT engineers at the local level. Though GIS software is installed in the local agencies' information systems, purchasing remote-sensing technologies might be expensive for them. Financial arrangements for remote-sensing technologies are necessary to give an impetus for technological upgrade at the local level. Coordination between the local institutions should be promoted to exchange their data/information and know-how on digital data processing. Special attention should be put on networking for the local GIS and remote-sensing engineers since little cooperation has been made between the local institutions. The fact that DPU has a great deal of experience in GIS data processing paves the way to a possible solution for technological advancement at the local level.

(4) Usage of biotope maps

The biotope map can be used for the policy making on nature protection. First, scientists and science-based analysts make a biotope map describing which part is important in terms of biodiversity and the protection of endangered species in cooperation with GIS

engineers. Then, each biotope is evaluated based on the necessity of protection by the scientists. Finally, policy analysts and decision-makers determine how to protect the biotopes which are highly rated by the scientists. A biotope which has not yet been designated as a Latvian nature protection territory might be specified as one if decision makers feel the importance of the designation and agree with the scientists. In other words, decision-makers can focus their efforts to address the most critical areas of conservation and mitigation efforts.

12.4 Monitoring with EIMS

(1) Guideline on monitoring

Monitoring is one of the main pillars of EIMS to collect, analyze, and deliver the information necessary for conservation management, water level management, education plan, regional development, water quality management, and eco-tourism development plan. The Information Sheet of Ramsar Convention that elaborates the necessary information and data to be collected for wetland conservation worldwide could be a basis for the monitoring system of EIMS. Data collection should be conducted in cooperation with data source authorities that monitor the necessary information in LWC to minimize monitoring costs and to maximize data reliability. Data should be analyzed using GIS and remote-sensing technologies to posses accurate and visualized information for clear and accountable decision-making. Data should be delivered at minimum costs making the best of the Internet or WWW services. When it comes to monitoring, user needs are to be kept in mind to decide which information or data is more necessary and how often it should be collected.

(2) Monitoring items and information sheet of Ramsar Convention

The necessary monitoring items are categorized into six with regard to the Information Sheet specified by the Ramsar Convention. Monitoring needs and human resources should not be missed since the optimal usage of limited human and financial resources to monitor and collect the information is a critical issue in environmental management. The more demanded information, the more attention should be given to it. Table 12.4.1 shows the necessary monitoring items, their locations, frequencies, and collaborating organizations relevant to data collection.

Physical features: The physical features consist of geology (soil types, altitude), hydrogeology including groundwater level, air temperature, and water quality. The data of altitude has already been inputted in the GIS database by using the Soviet topographical maps made in 1973 before the dyke construction around Lake Lubana. Amelioration of the contour lines inputted will be needed in the course of the implementation of EMP. Air temperature is for the snow-melting model, while the water quality monitoring covers biological and chemical substances to check dissolved oxygen, BOD/COD (indicator of saprobic conditions), and T-N/T-P (indicator of eutrophication). Though the State Hydro-

Meteorological Agency (SHMA) has been downsizing its capacity of monitoring, the organization is recommended to resume the monitoring in Lake Lubana. RREB and MREB need to expand their capacity to regularly monitor the water quality in the rivers within LWC.

Hydrological values: For the water level simulation model, daily flow rates in the upstream rivers, daily water level in Lake Lubana, and rainfall in the catchment area are collected in cooperation with SHMA and ALRSA. Lake Lubana's retention time is used to extrapolate the lake's self-purification capacity. The fact that any wetland has its role in flood control and cleaning of water should be clearly mentioned to promote public awareness on wetland conservation.

Ecological features and noteworthy fauna and flora: The ecological features include botany (vegetation types), zoology (important mammal species including aquatic mammals, and game mammals), ornithology (raptors, waders, gulls, and other important birds), and ichthyology (typical fish species). Noteworthy fauna and flora is anticipated to be selected for the proof of the wetland's peculiarity. Description of seasonal variations and long-term changes enriches the monitoring and analysis of ecological features. The monitoring of the ecological features by the Latvian Fund for Nature, the Latvian Ornithological Society, Teici Nature Reserve, and the Institute of Limnology, DPU is highly recommended due to their long-standing experiences in LWC.

Educational and eco-tourism resources: The main goal "Wise Use of LWC" is attained through the monitoring of educational and eco-tourism resources found in LWC. The area in and around the Kvapani fishpond has the high potential to attract many schoolchildren and tourists due to its biodiversity and educational value. The Teirumniku bog can be an educational resource. If a proper conservation measure is taken, the raised bog can be introduced to the public. The Pededze river is rich in beavers' dams and suitable for canoeing routes full of wildness. The Orenisi fishpond provides a beautiful scenery for eco-tourists with bird watching opportunities. The staff of EMC is obliged to prevent these attractive educational and eco-tourism resources from disappearing by visitors' misconduct. The help of the Center for Nature Research and Environmental Education at DPU can provide the information on the educational and eco-tourism resources.

Current land use and socioeconomic data: For the purpose of regional development and optimal natural resources allocation, land use planning is conducted in consideration of LWC's socioeconomic conditions. Currently, the production yield of the forestry sector shows an upward tendency, while the fishery and agricultural sectors are faced with a severe economic condition. The land use planners are to analyze the current and future conditions of the primary industry and determine which sector should be expanded or downsized. Townships and the forestry company can provide the necessary information on the current land use.

Monitoring needs and human resources: The names, positions, organizations, and motivations of the scientists and administrators interested in LWC give the information on

how to use the monitoring data collected. The publications and references on LWC help to understand the scientific and social value of LWC. Monitoring should not be a useless activity but should be valuable to the public. Monitoring needs in the society gives a rationale of environmental management activities in LWC.

(3) Monitoring collaboration system and data sources

Figure 12.4.1 shows the collaboration framework for data monitoring and collection. The organizations currently engaging in the monitoring of necessary data for EMP are listed. Each collaboration organization has the right to access to and obtain the data stored in the server of EMC in exchange for the effort to monitor/collect/deliver its information. Access to the documents, models, GIS/remote-sensing data, and other monitoring data is exclusively limited to the collaborating organizations registered by EMC. Any scientific, administrative, and non-governmental organizations have a chance to register in this collaboration system. The collaboration system should contain a mechanism in which scientific networking is promoted as a result of the collaboration.

(4) Monitoring and evaluation system of conservation measures

Monitoring of conservation measures should never be despised. Following the conservation criteria, activities in NPZ and AMZ are constantly monitored to avoid prohibited hunting for game species and to preserve such precious vegetation as raised bogs. To monitor illegal commercial activities in the forests of the strictly nature protected territories fulfills a protection need in natural resource management. The monitoring of conservation measures evaluates the rationality of the measures and is expected to feedback to conservation management. The evaluation system decides if any other regulations or guardian systems are necessary or not.

12.5 Environmental Education with EIMS

(1) EIMS functions for environmental education

The functions of EIMS for environmental education include: 1) introduction of the proposed environmental education and training (EE&T) activities, 2) evaluation and feedback system for EE&T, 3) publication of EE&T award winners, and 4) information dissemination through an education center on the Internet. EIMS makes schoolteachers actively involved in EE&T activities. A success in EE&T depends on the level of computer and information technologies of the local schoolteachers and children.

(2) Evaluation and feedback system of EE&T

Figure 12.5.1 shows details of the evaluation and feedback system for EE&T. The proposed EE&T activities should be evaluated and revised regularly while minimizing the cost. The most efficient way is to feedback through the WWW home page of EMC if most schoolteachers are informed of the feedback system. The cooperation between EMC and

the local education agencies is crucial to succeed in the dynamic environmental education implementation. Through the evaluation system, award winners of sophisticated and creative EE&T activities are selected to promote school activities for nature protection. The evaluation system takes into account candidates' experiences, knowledge, creativity, and performances when selecting.

(3) Education center on the WWW

The WWW site of EMC is created to cover the topics related to environmental education including the support for teachers trying to carry out EE&T activities, the proposed EE&T activities, education program development hints, the educational resources in LWC, technical supports from CNREE at DPU, the environmental themes and explanations, comments to be collected, and the contact list. The activities proposed by the Plan of EE&T are supplied on the WWW site to enable the local schoolteachers to access to them and to feedback their experiences to EMC through the Internet. The prize is to be given to schools or classes which have shown their efforts to deepen the knowledge and change their behavior by proposed or invented EE&T activities. The evaluation is conducted through the feedback system on the WWW site. The fact that RDC has started to provide the Internet services to every public school in 2000 makes the Education Center on the WWW quite feasible. Organic relationship between the local schools and EMC is expected by the help of the Internet.

12.6 Public Awareness

12.6.1 Promotion of Public Awareness

EIMS is to promote public awareness on sustainable development and wise use of wetland. EIMS specifies the activities of public awareness at the local, regional, national, European, and international levels. The strategy is based on the idea that the value and importance of LWC means differently to each level. Direct involvement in public awareness promotion focuses on the eco-tourism development in LWC. The local people can easily understand the importance of nature protection, if efforts to conserve the environment are benefitial. The local people should be directly involved in the activities provided by EMC for wetland management of LWC. For tourists and NGOs, eco-tours and public awareness programs are organized and developed by EMC. Indirect involvement focused on the people at the regional, national/Baltic and international levels uses mass media and publications prepared by EMC as a primary medium for public awareness. EIMS enables the staff of EMC to clearly systemize and to easily repeat the activities aiming at public awareness promotion.

12.6.2 Strategy and Target Groups

Public awareness on sustainable development and nature protection is promoted by focusing on each geographical level as a matter of convenience. The awareness of the

primary sector, anglers, hunters, and eco-tourism developers at the local level is promoted by the seminars/workshops, discussion meetings, training programs, and reconnaissance to LWC. The awareness of the tourists and NGOs at the regional, national, and international levels is encouraged by the help of advertisements, eco-tours, and special activities created by EMC. Direct involvement by the staff of EMC stimulates people's participation in its activities.

The awareness of people at the regional, national/Baltic, and European/international levels is assisted through the use of mass media. A frequent contact with concerned newspaper, TV, radio, Internet companies is a key to a success in the public awareness promotion. The Environmental Film Studio established by MEPRD in 1996 is specialized in production of wildlife and environmental issues documentaries including the films on Lake Lubana taken in November 1999 and on the Nagli fishpond in October 1999. They regularly broadcast their products as a 15- to 30-minute documentary on the national TV programs. A close relationship should be constructed between the EMC and the Environmental Film Studio.

DPU has a sophisticated multi-media center to deal with CD and video creation for images. The know-how of DPU is applied to the promotion of public awareness through vivid images of LWC. DPU has also been engaged in TV program development in collaboration with the Latvian TV (LTV1) and their programs are broadcast for several minutes everyday. A close relation and technical support are crucial from DPU to promote public awareness on LWC.

12.6.3 Activities for Public Awareness

(1) Local level

The activities for the forestry sector include seminars on the regulations within a protected nature territory to inform foresters of their obligations to abide by the rules. Particularly, some strictly nature protected quarters in LWC are designated as places where any forestry activities are prohibited. Broad-leaved forests are considered to be precious by many botanists, while raised bogs are easily damaged by the careless and random drainage construction. As the forestry sector is the most potential economic activity in LWC, one might duly consider the importance of sustainable development. For the fishery sector, natural resource management is quite an adequate topic to provide. To maintain their businesses the fishery sector should realize that the only way of surviving is to develop eco-tourism nearby their fishponds. The agricultural sector needs to understand harmful pesticides cause the destruction of ecology in and around Lake Lubana. For eco-tourism developers, training programs are provided by EMC to promote sustainable development.

(2) Regional and national level

Eco-tours, activities in EMC become the main activities to promote public awareness for tourists and visitors from the regional, national, international levels. Advertisement on the

regional, national newspaper, and the Internet activates the public participation in the eco-tours. NGOs are expected to actively participate in the program development for EE&T activities and to improve them by their creative ideas and experiences. Publication activities initiated by EMC help NGOs obtain the know-how to participate in public awareness promotion. Direct involvement from Latvian Fund for Nature and the NGO Center is essential to promote awareness among NGOs.

(3) European and international level

At the European and international levels, the Internet is the most powerful tool to promote awareness at a minimum cost. Cost-effective information technologies should be fully used. EIONET provides a lot of links to the European information sources on environmental management. When it comes to the Internet, DPU has already developed the home page of LWC. With the technical support from DPU, an informative home page will be posted up on the WWW. The site map of the EMC's home page includes 1) explanation of wetlands, the Ramsar Convention, and the environmental management in LWC, 2) actual examples of wise use and eco-tourism in LWC, 3) the virtual Education Center on the WWW page to promote environmental education and provide the proposed EE&T activities for schoolteachers, 4) the Information Sheet of Ramsar Convention to open the monitoring results to the public, 5) science network & partnerships to encourage the registrations from scientific and administrative organizations, 6) contacts & links to make contact with the staff of the EMC an link to the relevant institutions, and 7) comments & feedback to squeeze any constructive comments from the public and revise the home page to make the more user-friendly home page.

12.7 Science Promotion

EIMS has a scientific value with a view to sharing the information on ecology of LWC. The effective use of EIMS makes it possible to connect a variety of scientific institutions to promote science and to augment its achievements. Latvian Fund for Nature (LFN) is an experienced non-governmental organization (NGO) and has been engaged in the scientific research to demarcate the nature protection territories within LWC. LFN, Latvian Ornithological Society and Teici Nature Reserve have conducted a lot of ornithological researches to understand ecological biodiversity and features in LWC have close relations with each other to promote science. The Institute of Limnology, Daugavpils Pedagogical University (DPU) has been one of the main institutions to conduct ecological research in wetlands including Lakes Razna and Lubana. The Center for Nature Research & Environmental Education (CNREE) at DPU is proposed to take a responsible role in environmental education due to its long-standing experience in the field. All the scientific institutions concerned are expected to have close relations and promote scientific research in LWC through the proposed networking system.

(1) Collaboration system and agreement

The mechanism of the monitoring collaboration system could be a driving force to promote scientific cooperation between the organizations. An incentive-based approach should be taken to promote the monitoring collaboration. One way is data source clarification. The data sources should be attached to the monitoring data to clarify which organization is involved in the data collection. The users of a data should refer to the data sources whenever they publish the research containing the referenced data. The EMC and the collaborating organizations should make an agreement stating that any documents on wetland conservation published by the collaborating organizations shall be listed and regularly updated on the Web site. As the use of documents as reference materials is essential for science promotion, an article to make mutual referencing easy should be taken into consideration in the agreement.

(2) Information management

Information management is crucial for a success in long-term monitoring and accurate data assessment activities. Data integration, consistent and accurate data collection, information accessibility, data exchange, minimization of redundant data storage, network connection to EDIS are the main themes for information management.

1) Data integration and specification

As environmental assessments typically include multiple types of information and graphics at multiple spatial scales, interchangeability of data is crucial for scientific analyses and assessments. The use of different kinds of software sometimes causes inaccessibility to the data needed. Particularly, an exchange of graphic information is hard to achieve unless users are quite familiar with complicated interchangeable formats. Specification of software and data/information format should be coordinated between the collaborating organizations. Through the data integration activities, redundant data collection can be minimized. Data specification should be unified in the same format, which enables scientists to conduct analyses smoothly. Particularly, GIS and remote-sensing data should be carefully formatted with the standardized methods. Documentation should be carefully arranged so as to download the documented information from the Internet since each user has his/her limited capacity to connect to the Internet. Tabulation and graphic design should be in accordance with the memory capacities of users.

2) Consistent and accurate data collection

Updating carried out by the collaborating network needs a special treatment. Consistent data is delivered through the Internet only when applicable data volume is acceptable to the capacity of the Internet by which delivery costs are minimized. Frequent monitoring and data input require a thorough cooperation from all the scientific and administrative institutions relevant to LWC. The proposed collaboration network helps accurate data collection only when a good coordination is arranged by EMC. Frequent contact with the

scientifically authorized collaborating organizations will benefit the networking of accurate data collection, and continuous data collection will be materialized.

3) Information accessibility

Information accessibility to specific data should be exclusively limited to the collaborating organizations unless they agree to distribute the data to the public. In other cases, data collected by them need to be open to the public as much as possible to promote public awareness. Data should be shared with the public at the maximum level except when the distribution of data causes nature destruction and poaching.

4) Data exchange

A smooth data exchange is possible by the help of integration and standardization of data formats and delivery system well prepared. EIMS aims at encouraging direct data exchange between the collaborating organizations through indirect exchange via EIMS which provides the data storage space for scientists and administrators. Protection of intellectual property rights is a critical issue of information management. An agreement on data exchange should be carefully arranged to avoid a conflict between the collaborating organizations. For example, an agreement stating the partners may determine what data is distributed and to whom might be convenient.

5) Minimization of redundant data storage

Little coordination among scientific and administrative organizations causes redundant collection of data. For example, even though SHMA and RREB have been monitoring the water quality of the Rezekne river, they do not have close relations with each other. Although ornithological data is collected by Latvian Fund for Nature (LFN), Teici Nature Reserve, Latvian Ornithological Society, and DPU, information exchanges are rather limited. Particularly, a relationship between DPU and LFN is quite essential for the advancement of scientific researches and minimization of redundant data collection. EIMS aims at networking the existing scientific and administrative organizations that might have missed a lot of potential of science promotion.

6) Network connection to national network

The national integrated system for environmental data is the Environmental Data Information System provided by LEDC. EIMS should be connected to EDIS by the help of the staff of LEDC. Though technical details are not mentioned here, full technical support from LEDC should be provided with the help of MEPRD.

(3) Networking of scientists

Networking of parties in a competitive relation is hard to achieve. Coordination to form an outstanding scientific network which becomes one theme of the EMC needs to the collaborating organizations. Cooperation form such a key organization as Latvian Fund for Nature and DPU is a crucial factor of the networking process.

12.8 EIMS Working Plan

12.8.1 Institutional Setting for EIMS

(1) Necessary staff

Figure 12.8.1 illustrates the institutional framework of EIMS that is under the jurisdiction of the Management House of EMC. The director of the house is in charge of the analysis of policy-making entrusted by the directing board of the Implementation Committee of EMP. Three system engineers relevant to GIS data input, public awareness promotion, and environmental education promotion should be staffed to activate the evaluation/feedback and monitoring systems provided by EIMS. In addition, an ornithologist, a botanist, and a hydrologist will be manned in accordance with the conservation needs.

(2) Terms of Reference (TOR) of staff

The TORs for the three system engineers and the three science-based analysts are described in Figure 12.8.1. One system engineer will be responsible for GIS/remote-sensing data input, monitoring data collection, home page design/construction, data analysis, computer networking, and technical support for information management. Another system engineer will be in charge of publication of the annual reports of EMP for LWC, comments collection from the public through the Internet, bibliography making of the relevant scientists' researches, advertisement of EMC activities and eco-tourism products through mass media, and registration of the newly admitted collaborating organizations. The last system engineer will be necessary to provide technical support for the proposed EE&T activities and program development for schoolteachers and NGOs, to evaluate school activities, to develop NGO training programs and courses at EMC, to form constant relations with the local municipalities, NGOs, and CNREE at DPU.

The biologist will take the responsibility of monitoring raptors, waterfowls/waders/gulls, other important birds, important mammals, game mammal species, other mammals, and typical fish species, making biotope maps, and contacting LFN, LOS, TNR, and the Institute of Limnology at DPU. The botanist will assume full responsibility for botanical subjects including the monitoring of raised bogs, fens, inundated grasslands, and broad-leaved forests. The hydrologist will collect the hydrological dada, carry out runoff analyses, conduct the water level simulation modeling, make inundation maps, and provide the water level analyses for the policy analyst.

12.8.2 Training for EIMS Construction

(1) Training for system engineers

The GIS/IT engineers of the local agencies have quite a potential to implement EIMS if financial resources are fully ensured. Engineering training courses for EIMS are formulated taking into consideration IT/GIS engineers' skills and potential. In MREB, one

IT engineer is voluntarily making its WWW home page. In RDC, one expert on GIS cooperated with the JICA study team. These facts vividly illustrate the possibility of potential development of GIS/IT engineers at the local level. As the technical level of the local engineers is highly evaluated, the main focus of the engineering training should be placed on applications and improvement of EIMS for their convenient use. Training of the basic skills of GIS/remote-sensing and IT is rather a matter of supplemental courses. In other words, the main focus should be the role of EIMS and system engineers' roles in environmental management.

For environmental education and public awareness, the local skills and know-how require more experience. The systematic EE&T has to be fully taken into consideration to develop the training courses for the system engineers responsible for environmental education and public awareness. The principles and educational goals, the evaluation/feedback system through the Internet, and the formulation of the proposed EE&T activities should be the contents of the training courses for the system engineer in charge of environmental education. The system engineer for public awareness promotion will be required to master how to contact mass media, cooperate with the local NGOs, and teach the regulations relevant to nature protection. The eco-tourism development plan also should be fully understood by the system engineers.

(2) Training for Science-based Analysts

The main topic of the training for a biologist, botanist, and hydrologist is the objectives of environmental management in LWC. They are not scientists but science-based analysts for environmental management. Just collecting data is not worthwhile. The objectives of EIMS include science promotion and decision-making. Science promotion will be completed only through strenuous efforts devoted by science-based analysts. The training should emphasize socialized communication skills required for the networking of scientific and administrative networking. Teici Nature Reserve can provide the training courses for a biologist and a botanist based on their scientific experience.

12.8.3 Systems Structuring for EIMS

Hardware and software necessary for EIMS are shown in Table 12.8.1. All equipment can be procured in Latvia and will not require special knowledge for operation. The grand total for the hardware and software is about 74,000 LVL. Monthly salaries are 100 LVL/month for 6 engineers and analysts, 300 LVL/month for one director. The annual labor cost for EIMS is, therefore, 10,800 LVL/year.

Table 12.3.1 Decision Items and Necessary Data Matrix

Management Type	Decision Items	Environmental zones			Current biotope map												Nature protection territories			Current land use map						Current land tenure map					Education and eco-tourism resources map					Inundation map			Soil map			Topographical map			Current eco-tourism plan					Water quality								
		NPZ	AMZ	DZ	raise&transitional bogs	fens	inundated grasslands	broad-leaved forests	coniferous forests	small-leaved deciduous forests	other forests	habitat of important mammals	habitat of game mammals	habitat of important birds	habitat of fish	adverse human impacts	strictly protected quarters	regularly protected quarters	seasonally protected quarters	forestry development area	potential development area for forestry	fishery development area	agricultural development area	abandoned arable land	state forests	state land	township land	private land	public land under privatization	eco-tour routes	beautiful landscape sites	bird-watching sites	archeological sites	camping sites	10% probability	20% probability	50% probability	land productivity	sandy soil	pesticides use	drainage conditions	rivers and lakes	contour lines	facility allocation	access roads	underground pipes and cables	electrical network	night soil and waste collection network	water temperature	DO	turbidity	chlorophyll a	COD	NH4	coliform bacteria	T-N, T-P
(1) Conservation Management	important mammal species protection											X					X												X																										
	game mammal species protection												X				X	X											X																										
	important bird species protection													X			X	X	X										X		X																								
	fish species protection														X																																				X	X						
	raised bog preservation				X												X	X																																						
	inundated grassland conservation						X										X	X					X																																
	broad-leaved forest preservation							X									X	X		X	X																																		
	other forest preservation and restoration								X	X							X	X		X	X																																		
	environmental zoning				X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																												
(2) Water Level Management	for nature conservation				X	X	X					X	X	X	X																				X	X	X	X	X																
	for eco-tourism																													X	X	X	X	X	X	X	X							X	X	X	X	X								
	for agriculture																						X												X	X	X																		
	for forestry																			X	X														X	X	X																		
	for fishery																					X															X																		
(3) Education Plan	education routes				X	X	X	X								X	X	X	X									X		X	X		X																			X	
	archeological routes																											X				X																				
(4) Regional Development	agricultural development			X																			X	X				X									X		X	X		X		X										
	forestry development			X				X									X	X		X	X				X												X			X		X		X										
	fishery development		X	X																		X																											X	X			X			
	eco-tourism development		X	X													X	X	X										X	X	X	X	X													X	X	X	X	X			X		X		X	
	Construction material excavation		X	X												X	X	X	X																		X									X								
(5) Water Quality Management	DO control																					X																										X						
	hygienic conditions																																					X												X	X	X		
	eutrophication control																																																					X
(6) Eco-tourism Plan	facilities plan																X	X	X						X	X	X	X	X	X	X	X	X											X	X	X	X	X								
	sanitation management																																																X	X			X				
	land acquisition	X															X	X	X								X	X	X								X	X	X								X	X	X	X	X								
Data format	polygon data	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X		X	X													
	line data																													X											X	X			X	X	X	X	X								
	point data															X															X	X	X	X											X					X		X	X	X	X	X
	raster data																																																			X		X	X				
	others																																																						

Note: Data necessary to make a management decision is marked with "X".

Table 12.4.1 Monitoring in LWC

Monitoring Component	Monitoring Item	Detailed Item	Unit	Monitoring Location													Frequency						Data Collection Collaborating Organizations												Note
				catchment area	all LWC	raised/transitional bogs	fens	inundated grasslands	coniferous forests	deciduous forests	broad-leaved forests	dry grasslands	lake	fishponds	Rezekne, Malta, Aviekste rivers	Pededze river, Idena canal	daily	weekly	monthly	seasonal	yearly	randomly	Town/ Townships	Nagli fish firm	Relevant Districts	Madona Regional Environmental Board	Rezekne Regional Environmental Board	State Hydro-meteorological Agency	Aviekste Land Reclamation System Administration	Latvian Fund for Nature	Latvian Ornithological Society	Institute of Limnology, DPU	Center for Nature Research & Environmental Education at DPU	Teici Nature Reserve	
(1) Physical features	geology/ air	soil types	-		X																	X													for agriculture, forestry
		altitude	m		X																	X													for water level simulation
		groundwater level	m			X	X										X																		for flood control
		air temperature	℃	X													X											X							for snowmelt model
	water quality	water temperature	℃										X	X	X	X	X							X			X	X							mainly for fishery, remote-sensing data is available
		pH	-										X	X	X	X			X								X	X							
		DO	mg/l										X	X	X	X		X	X					X			X	X							mainly for fishery
		turbidity	NTUs										X		X				X									X							indicator for eco-tourism, remote-sensing data
		EC	μ S/cm										X		X				X									X							
		Hardness	CaCO3mg/l										X		X				X									X							
		SS	mg/l										X	X	X	X			X							X	X	X							
		CODcr	mg/l										X	X					X							X	X	X							indicator of lake saprobity
		BOD_7	mg/l												X	X			X							X	X	X							indicator of river saprobity
		N/NH_4	mg/l										X	X	X	X			X							X	X	X							
		N/NO_2	mg/l										X	X	X	X			X							X	X	X							
		N/NO_3	mg/l										X	X	X	X			X							X	X	X							EU Directive puts emphasis on nitrate
		total N	mg/l										X	X	X	X			X							X	X	X							indicator of eutrophication
		P/PO_4	mg/l										X	X	X	X			X							X	X	X							indicator of eutrophication
		total P	mg/l										X	X	X	X			X							X	X	X							indicator of eutrophication
		pesticide	ng/l										X						X									X							
		oil	mg/l										X						X									X							
		coliform bacteria	MPN/100ml										X	X	X	X			X									X							indicator for eco-tourism
		minerals	mg/l										X						X									X							
		SO_4	mg/l										X						X									X							
(2) Hydrological values	hydrology	flow rate	m3/s												X	X	X											X							for water level simulation
		water level (in Lake Lubana)	m										X				X												X						for water level simulation
		groundwater level	m		X												X												X						for inundation control
		precipitation (rainfall, snowfall)	mm/day	X													X											X							for water level simulation
(3) Ecological features and Noteworthy Fauna & Flora	botany	raised/transitional bogs	-			X																X							X		X				prevent succession by deccicasion
		fens	-				X															X							X		X				maintain present space
		inundated grasslands	-					X														X							X		X				maintain regularly inundated grasslands
		broad-leaved forests	-								X											X							X		X				preserve limited space
		other types of forests	-						X	X												X							X		X				maintain non-commercial forests
	zoology	important mammal species	-				X	X	X	X	X		X	X	X	X						X							X		X		X		maintain present population
		game mammal species	-			X	X	X	X	X	X	X			X	X						X							X		X		X		prohibit hunting in NPZ
		other mammals	-		X																	X							X		X		X		promote inventory work
	ornithology	raptors	-										X	X						X									X	X			X		increase population
		waterfowls, waders, gulls	-		X																	X							X	X			X		prohibit hunting activities in NPZ
		other important birds	-		X																	X							X	X			X		maintain present population
	ichthyology	typical fish species	-																			X		X											increase population in AMZ
(4) Educational & eco-tourism resources	education & eco-tourism	archeological sites	-		X																	X											X		preserve present sites
		allowable high bogs	-			X																X											X		Sala bog adjacent to Kvapani fishpond
		beautiful landscapes	-			X	X	X						X								X											X		Gomelis marshy grassland, fishponds
		bird-watching sites	-										X	X								X											X		especially fishponds
		schools active in environmental education	-																			X											X		through EIMS
(5) Current land use & Socio-economic features	general	population	persons		X																X		X													
		average annual income	LVL/year		X																X		X													
		unemployment rate	%		X																X		X													
		land tenure	ha		X																	X	X													monitoring privatization
		persons with secondary education	-		X																X		X													
	forestry	annual yield	t/year		X																X		X													for forestry development
		forestry area	ha		X																X		X													for land use planning
		retail prices of forestry products	LVL/kg		X														X				X													for forestry development
		forestry productivity	m3/ha/year		X																X		X													for land use planning
	fishery	annual fish catch	t/year		X																X		X													monitoring pike development potential
		aquaculture area	ha		X																X		X													for land use planning
		retail prices of fish products	LVL/kg		X														X				X													for fishery development
		fishery productivity	kg/ha/year		X																X		X													for land use planning
	agriculture	annual yield	t/year		X																X		X													for agricultural development
		agricultural area	ha		X																X		X													for land use planning
		retail prices of agricultural products	LVL/kg		X														X				X													for agricultural development
		agricultural productivity	t/ha/year		X																X		X													for land use planning
	eco-tourism	number of tourists	persons		X														X																	for eco-tourism development
		popular sites	-		X														X																	for eco-tourism development
		popular eco-tourism menu	-		X														X																	for eco-tourism development
(6) Monitoring needs & Human resources	needs in general	monitoring needs in the society	-																			X	X		X	X	X								to optimize human/financial resources
		administrators interested in LWC	-																			X	X		X	X	X								administrators' names, positions, organizations, motivations
		NGOs interested in LWC	-																			X													hearing from NGOs
	needs in science	scientists interested in LWC	-																			X								X	X	X	X	scientists' names, positions, organizations, motivations
		list of bibliographies	-																			X								X	X	X	X	authors, year, page, contents

Note: Relevant item is marked with "X".

Table 12.8.1 Hardware and Software for EIMS

Item		Specifications	Unit Price (LVL)	Quantity	Total (LVL)
Hardware	PC for Server	CPU : Pentium III Xeon 700MHz, Dual Processor	23,000	1	23,000
		RAM : 512MB			
		HDD : 4x18GB (Hot swap)			
		CD-ROM : 14/32x Speed SCSI			
		CD-RW : HP CD-Writer Plus 9210i SCSI Retail			
		FDD : 3.5"1.44MB			
		IBM Netfinity Server RAID 3HB Ultra 2 SCSI Adapter			
		IBM Netfinity 42URack-includes front/rear doors			
		Network : 10/100 EtherLink PCI Server Adapter by 3Com			
		Monitor : T55 15" Flat Panel Color Monitor (Stealth Grey)			
		Netfinity Flat Panel Monitor Rack Mount Kit			
		Keyboard : Black Track Point Spacesaver keyboard - English			
		Netfinity Power Cable (required for server, monitor, console switch, devices)			
		UPS 3000 VA RACK MOUNTED - Black			
		42U Rack Lockable Side Covers			
		4 Port Videa Switch - required to switch one or more servers			
		Console Cable Set (one per server)			
		Mouse : Logitec System Mouse 2button			
	PC for Client (sutable for system engineers)	CPU : Pentium III Xeon 550MHz or more	7,000	3	21,000
		RAM : 512MB			
		VIDEO: 80Mb			
		HDD : 2 x 9.1 GB			
		CD-ROM : 50xSpeed SCSI			
		CD-RW : SCSI			
		FDD : 3.5"1.44MB			
		Slot : 1PCI, 1ISA, 1shared			
		Network : Integrated 3 Com 10/100 Mbit			
		Monitor : 21"			
		Keyboard : IBM 105-keyboard			
		Mouse : Microsoft			
	PC for other staff	CPU: Pentium III 500MHz or more	800	4	3,200
		RAM : 64MB			
		VIDEO: ATA 66 8Mb			
		CD - ROM: 40x			
		FDD : 3.5"1.44MB			
		Network : Integrated 3 Com 10/100 Mbit			
		Monitor :17"			
		Keyboard : IBM 105-keyboard			
	Network Equipment	15 port Micro HUB/ dural serial router	1,800	1	1,800
		Jack RJ-45			
		Cable RJ-45 UTP 5 Category			
		Installation of the network and cabling			
	Scanner	Input size : up to A3	900	1	900
		Quality : optical 600-2400, 9600dpi-max			
	Plotter	Quality : 600dpi-black, 300dpi-colour (line drawings)	2,000	1	2,000
		Aoutput size: up A0			
		4MB			
	Digitizer	Input size : 914mm x 1219mm	2,000	1	2,000
	Copy Machine	Size : up to A3	3,000	1	3,000
		Speed : 16ppm(A4), 9ppm(A3)			
		Including printer, scaner			
		Zoom : 50-200%			
	Uninterruptible Power Supply	APC 500	70	7	490
Software	GIS software	ESRI ArcView GIS 3.2	1,500	1	1,500
		3D Analyst	2,000	1	2,000
		Spatial Analyst	2,500	1	2,500
	Remote Sensing	ERDAS Imagine	5,400	1	5,400
	Other software	Windows Advanced Svr 2000 Intl CD 25 Clt	3,000	1	3,000
		MS Ofiice Pro.	300	7	2,100
Grand Total					**73,890**

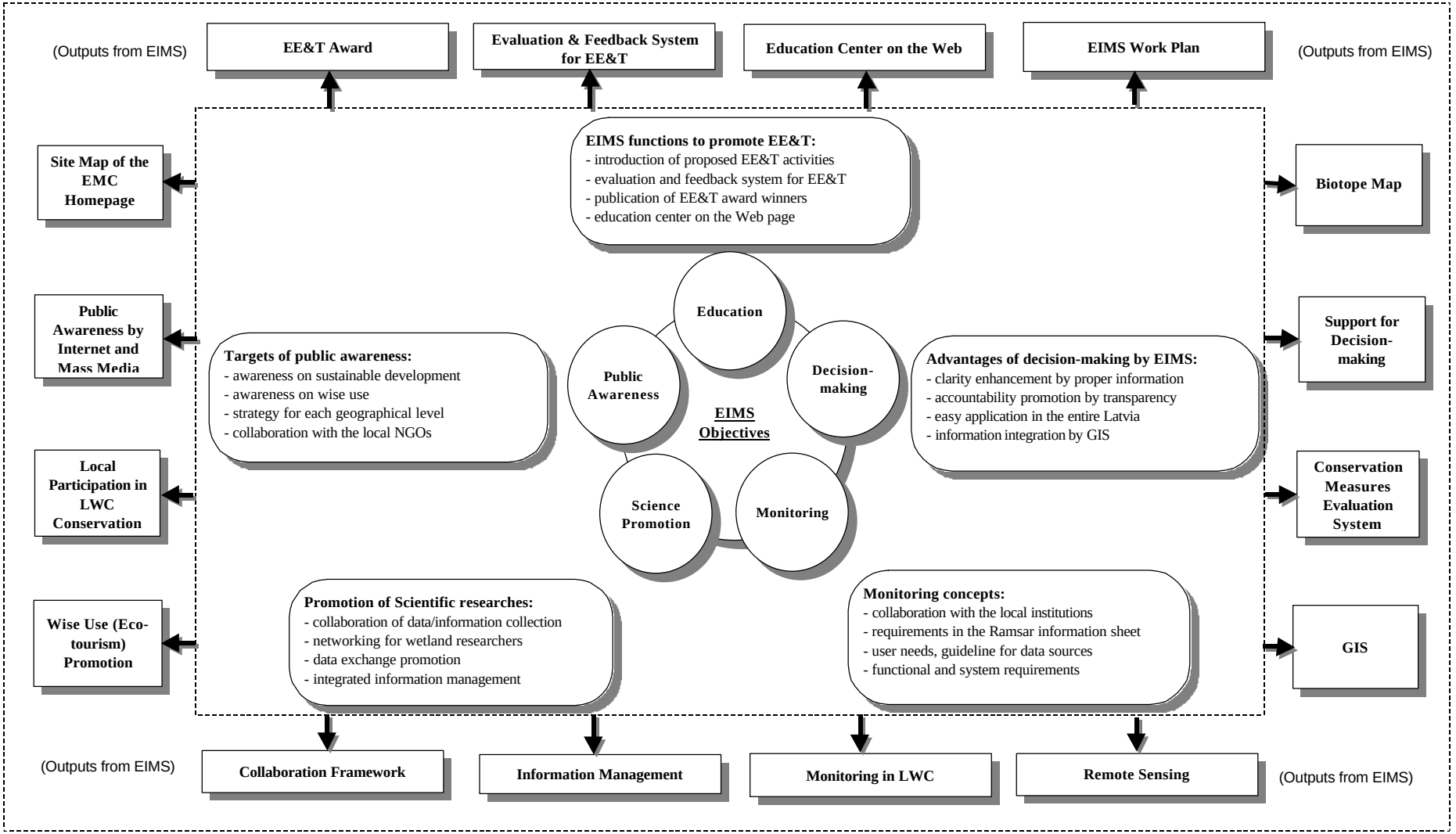


Figure 12.2.1 EIMS Framework

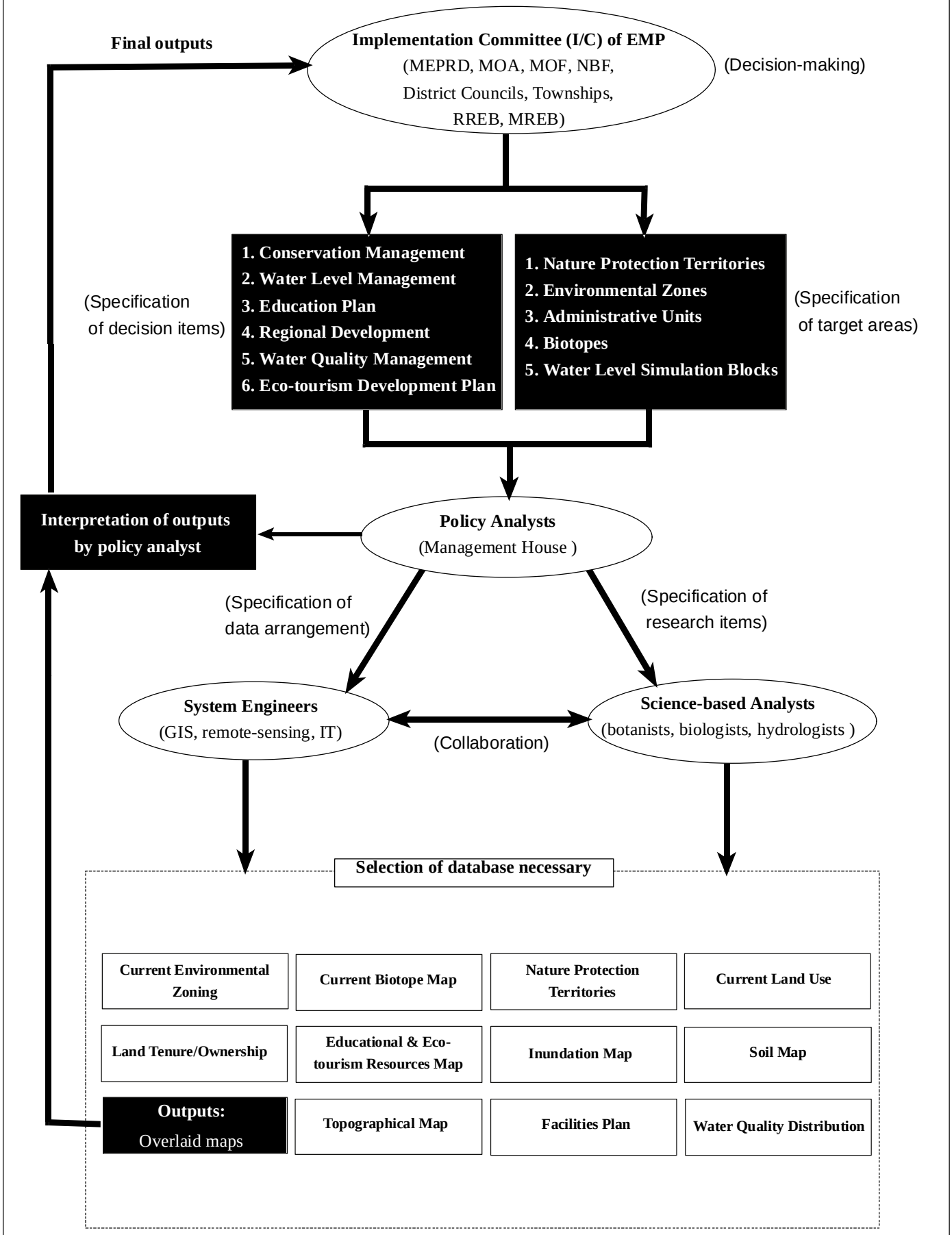


Figure 12.3.1 Decision-making Process with EIMS

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

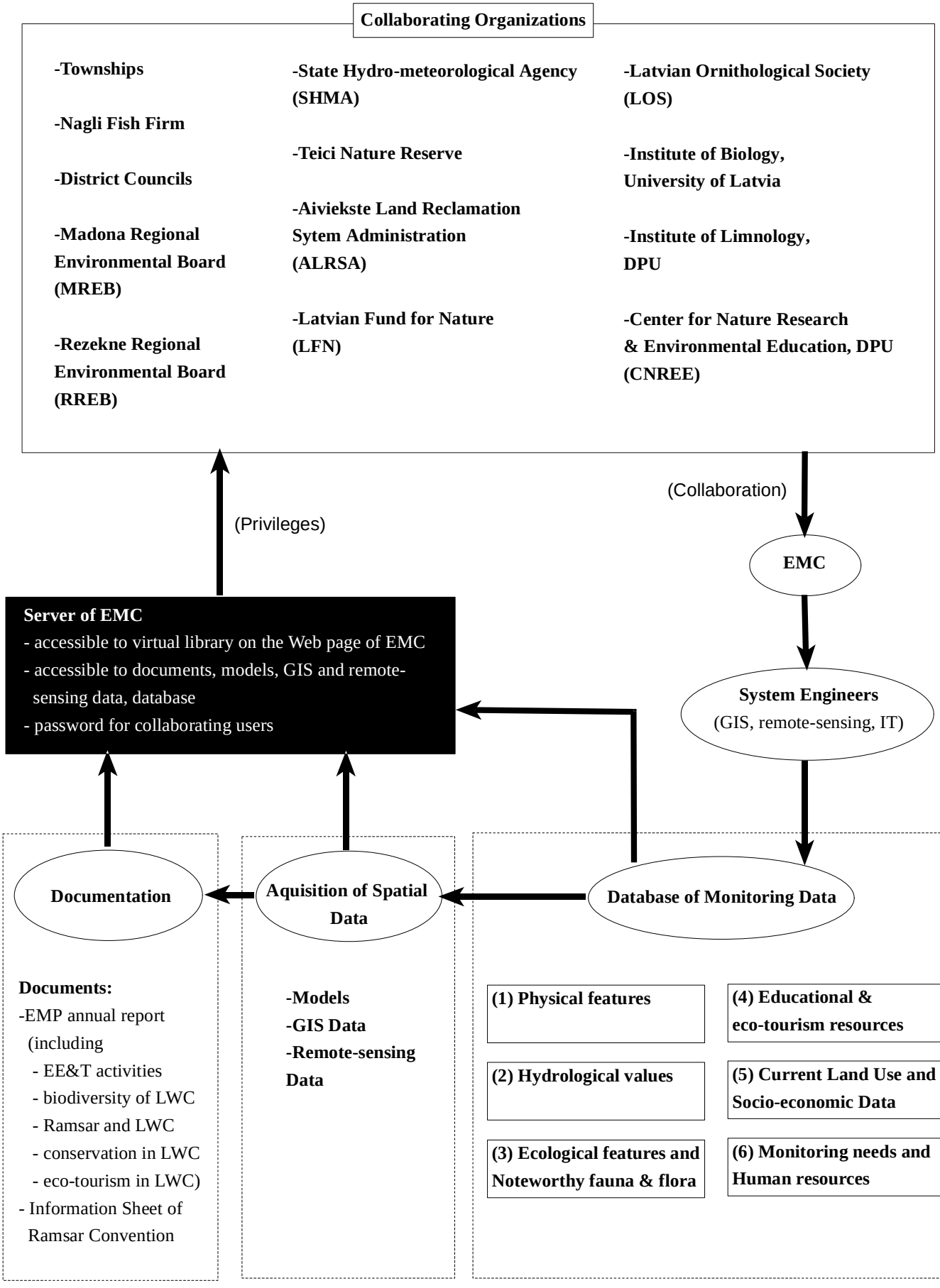


Figure 12.4.1 EIMS Collaboration Framework for Monitoring Data

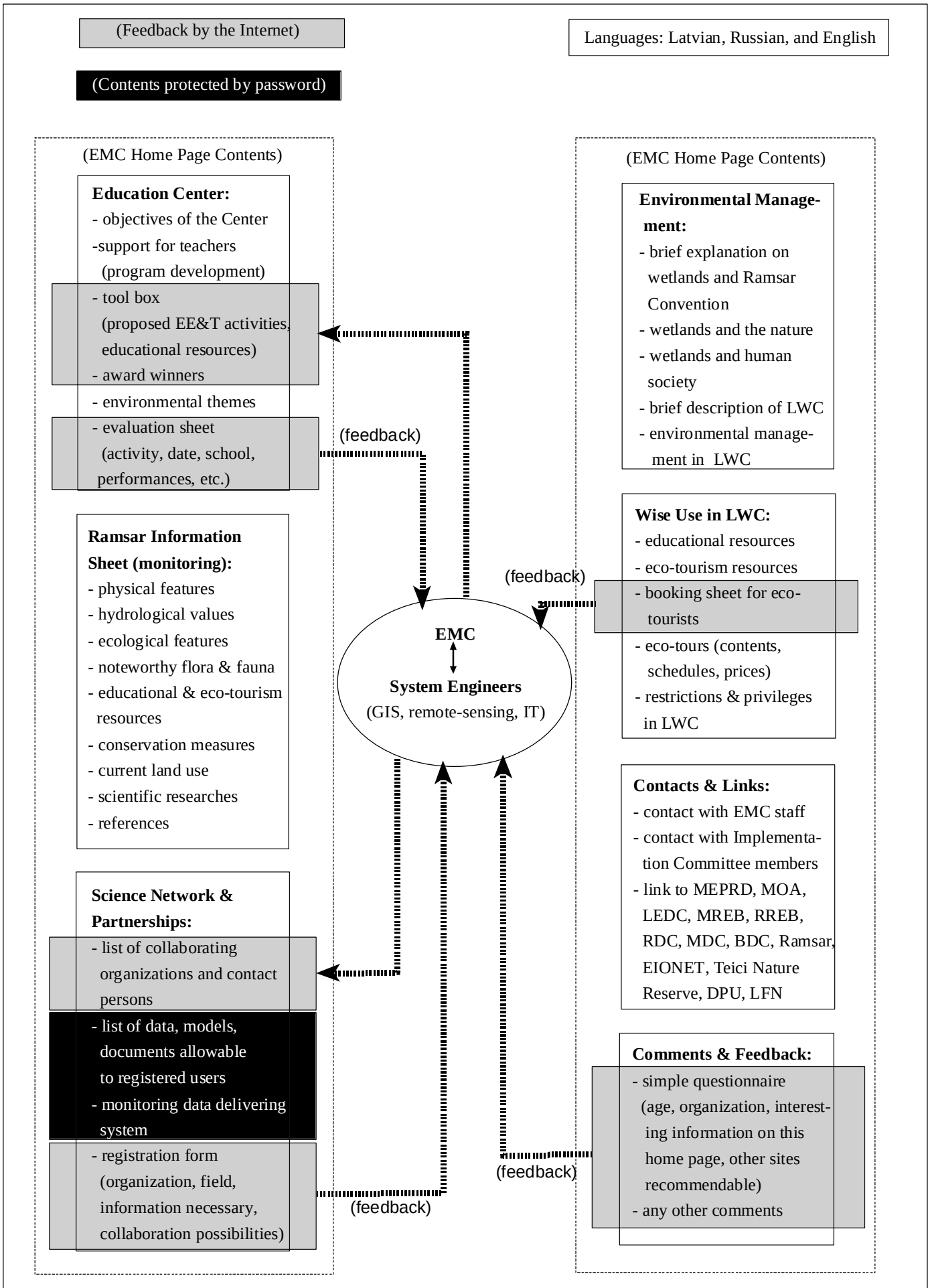


Figure 12.5.1 Site Map of EMC Home Page & Feedback System

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

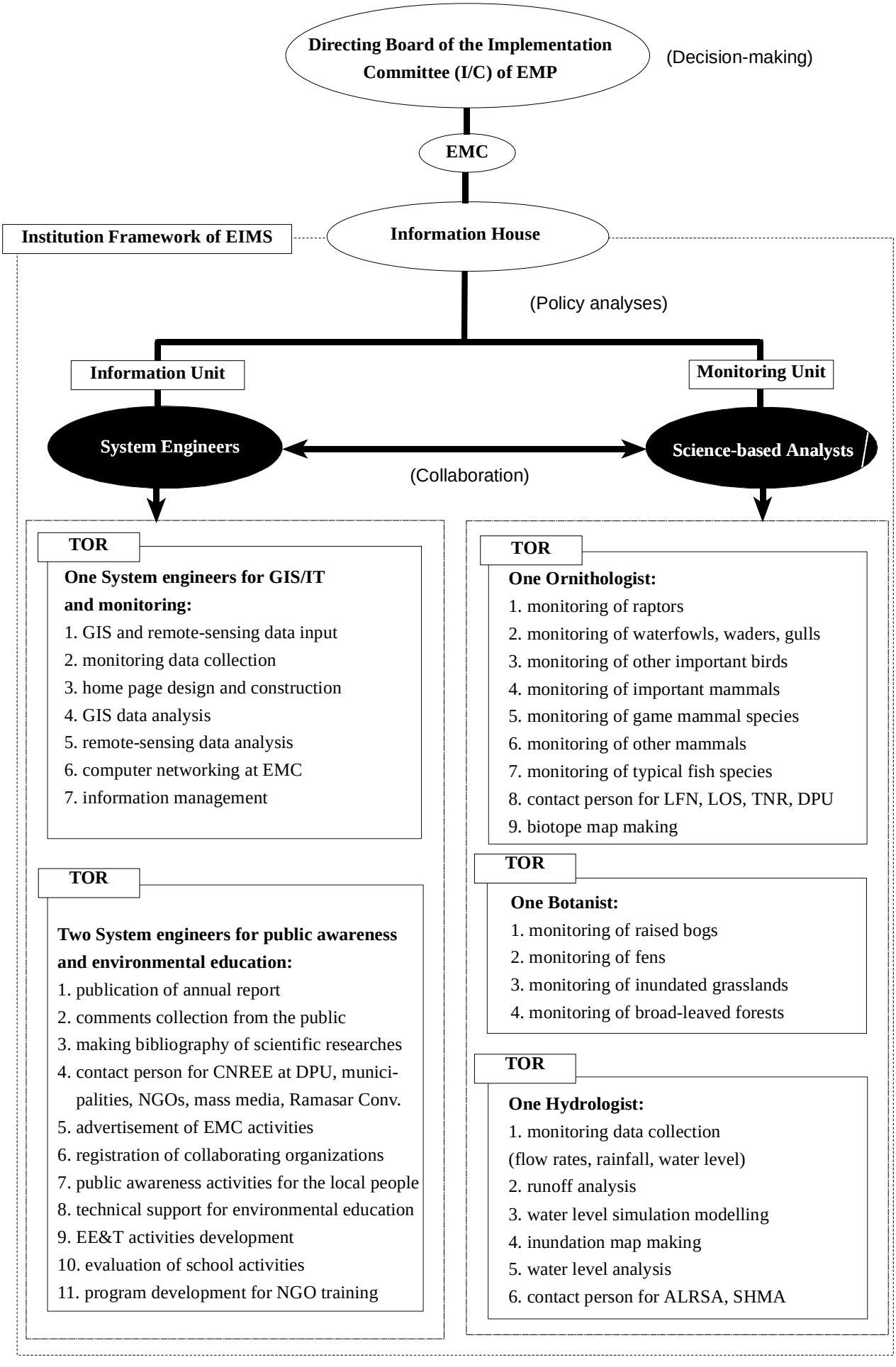


Figure 12.8.1 Institutional Setting for EIMS

CHAPTER 13

CHAPTER 13 ENVIRONMENTAL EDUCATION AND TRAINING (EE&T) PLAN

13.1 Overall Frame of EE&T Plan

13.1.1 National Education Policy and EU Directive

(1) National education policy and EE&T

The National Standard of Basic Education designated by the Ministry of Education and Science clearly touches the necessity of environmental education setting empirical study, problem-solving and analytical ability promotion, sensibility enlargement, creative education, self-control skill advancement, and knowledge construction as the educational goals with emphasis on sustainable development. Ministry of Education and Science (MES) has already started the state project related to EE&T and resulted in the document "Environmental Education in Basic Schools" saying, "*The theme of environmental education is to give schoolchildren an opportunity to develop their analytical ability to solve any problems.*" The Education Act of 1991 states, "*The principle goal of education is to provide conditions for development and perfection of one's spiritual, creative, physical and professional abilities.*" It should be mentioned that environmental education ensures not only environmental protection but also education by the use of natural resources.

(2) Education system of Latvia

Primary and secondary education is completely state-funded, including both Latvian schools and the schools for ethnic minorities. The education system in Latvia is regulated by the Education Act adopted in 1991. Compulsory primary education lasts 9 years (4 years in primary school plus another 5 years in basic school) and shapes uniformly throughout the country. Secondary education lasts 3 years, and specialized secondary or vocational education optionally takes the place of secondary education. Each district council is in charge of basic and secondary education in its district in Latvia. There is no special plan for education in Rezekne District, much less for environmental education. Therefore, the national guideline on education formulated by MES, which elaborates how many and which classes should be taught in each grade, is directly applied to the local schools. Each teacher makes decisions on her/his class' curriculum based on the numerical requirements of the guideline.

(3) National environmental policy on EE&T

The National Environmental Policy Plan (NEPP) regards the field of EE&T as one of the priority programs to be developed along with a specific plan of activities, organizational structure, timetable, and state budget funding. The goals of environmental education set by NEPP include: 1) to promote sustainable development, 2) to increase public responsibility and active public involvement in environmental protection and remediation,

3) to increase the level of public awareness on environmental issues, and 4) to involve responsible organizations, education institutions, experts and activists in environmental education to widen the public support for environmental protection. Though NEPP clarifies the necessity of training of public officials to make them familiar with environmental issues, a concrete framework of coordination between MEPRD and MES has yet to be stated in the NEPP.

(4) EU Directive

The European Commission gives EE&T a high priority stating, "*Education should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues.*" (Agenda 21, chapter 36) Formation of the balanced way of thinking on sustainable development is a purpose of environmental education.

The direction of the EU policy on EE&T has moved from vertical to horizontal education. Instead of top-down (vertical) knowledge accumulation on the environment, "learning", which is a process requiring to experience in the nature, to think by oneself, and to provide feedback to teachers (horizontal), is recommended. LWC has a high potential for EE&T through nature experience as it embraces rich biodiversity and an issue in sustainable development.

(5) Regional commitment to EE&T

In Madona District, a center for ecological education was established by MREB in 1994. MREB sets the long-term goals for environmental protection as to preserve biodiversity, to integrate environmental education and public awareness promotion into environmental policy, and to implement sustainable development in Madona region. MREB developed its World Wide Web (WWW) page and briefly disseminates the information on environmental education in its jurisdiction.

In Rezekne District, a couple of seminars on EE&T were held by RREB. A Danish school was once cooperating with RREB to promote environmental education in Rezekne District. The education department of RDC regards EE&T as an essential component of school education. It is, however, afraid that teachers might have little interest in environmental education unless it is reassured that environmental education is seen as an improvement of established education practices and as a part of their routine curriculum. As for implementing EE&T programs at the regional level, financial resources for EE&T should be prepared, and a system for providing small grants for the local schools is necessary.

The Center of Nature Research and Environmental Education (CNREE) founded in 1993 at the Daugavpils Pedagogical University (DPU) deals with environmental education programs development for the local schools and NGOs with various financial resources. CNREE has a close relation with the Institute of Limnology, DPU where an

environmental education is provided for students. A cooperative commitment from CNREE and the Institute of Limnology is a key to success in promotion of EE&T in eastern Latvia.

13.1.2 Framework of EE&T Plan

The framework of the EE&T Plan is elaborated in Figure 13.1.1, which clarifies the players, tasks, and outputs of EE&T at the national, EMP, and regional/school levels.

(1) Framework

At the national level, MEPRD and MES are recommended to have a close relationship to coordinate each policy on environmental education and to avoid overlapping activities and politic difference in the national government. The main policies related to environmental education are NEPP and the national guideline on education, both of which state the importance of education for sustainable development and nature protection. The EE&T Plan is formulated based on the directives and principles stipulated in the national policies on environmental education.

As no intention to formulate an education plan can be seen at the regional level, it is advisable to integrate the EE&T Plan formulated by EMP for LWC into the national guideline on education and NEPP through MEPRD, a component of the Implementation Committee of EMP for LWC. Following the national guideline on environmental education, the regional education authorities and local schools can arrange their classes for environmental education. Success in integrating the EE&T Plan clearly depends on the well-established coordination between the two ministries concerned. Nothing can be done and proceeded without their cooperation and coordination in the field of EE&T. DPU, which has a lot of experience in programs development of EE&T, could be a driving force to bring LWC into use as an environmental education resource.

(2) Implication of EMP with regional education

In Latvia, autonomy is generally given to the regional level. The EE&T Plan formulated by EMP is expectedly used by the local schools with the full support of the Rezekne, Madona, and Balvi District Councils. All the district councils are proposed to be the members of the Implementation Committee, which makes the EE&T Plan implemental and feasible in the districts. Particularly, as the Latvian education system is faced with financial difficulties such as underpaid teachers and unsatisfactory educational facilities and materials, to make the plan applicable to each district educational benefits should be maximized and expenses for education minimized by EMP. Then it can be integrated into regional school education with utmost support from the education sector of the districts. At the school level, each school should have access to the Internet by the year 2010 which enables information distribution on LWC to the public. Each teacher can obtain information on the proposed EE&T activities and send the evaluation results of their

programs to the Environmental Information Management System (EIMS). The database of EIMS is fully utilized by the local schools and NGOs.

13.1.3 Principles and Educational Goals of EE&T

Taking into consideration the national policies, the principles and the educational goals of EE&T are set as follows:

(1) Principles of EE&T

Wise use of LWC: The first-priority principle is concerned with the basic vision of the EMP "Wise use of LWC". Environmental education is not only for nature protection but also for ability development with help of natural resources. LWC has an educational value and should be optimized by the local people, with the help of the eco-tourism sector.

Step-by-step education: Each grade has its specific and limited ability to learn. Sensibility, developed at the early ages, is an ability to feel the nature as it is, while analytical ability is required more at older ages. Education should follow the process in which learners can develop their ability gradually through the use of natural resources in LWC.

Holistic and interdisciplinary education: An action to protect nature should not be drastic or extreme. Children are required to have a holistic point of view taking into consideration natural, artificial, technological, social, aesthetic, political, economic, cultural and scientific factors in dealing with environmental issues abundant in LWC. Interdisciplinary education is recommended.

Long-term vision formation: As a short-term vision often leads the people to think little of the value of natural resources, formulation of a long-term vision is crucial for sustainable development in LWC from generation to generation. One is requested to focus on the past, the present, and the future situations with a historical view point.

Information technologies (IT) education: Information technology is getting cardinal for education. Skills of information processing and collecting make schoolchildren competitive enough to deal with the information society. An information system that is an integral part of EMP should be incorporated into the guideline on EE&T.

Analytical ability development: To foster problem-solving and analytical ability is essential to live through the society. Natural and artificial resources in LWC that stay on the balance sensitive to human activities play a big role in providing complicated issues to be solved.

Lifetime education: Lifetime education is necessary as situations change all the time when it comes to environmental issues. From childhood to adulthood one should have appropriate education according to his/her ability and educational level.

Empirical education: Instead of only accumulating knowledge, experiencing in the nature of LWC gives a chance to realize how closely nature relates to a human life. Empirical and practical education leads to a fruitful result for children with a help of direct participation in environmental issues.

Environment and development: To learn a complicated issue of economic development harmonious with environmental protection in LWC gives learners a chance to balance

their vision on human activities. Children full of future are expected to decide which way to go according to their balanced vision on environment and development.

Domestic and international cooperation: To solve and prevent environmental issues, regional, national, and international cooperation is essential. The deeper the understanding on the nature, the wider the scope of vision.

(2) Educational Goals of EE&T

The objective of environmental education is not limited to environmental protection. The main pillar of education is learning with the help of natural resources. Educational goals include promotion of sensibility, knowledge, conscience, clarification ability, creativity, analytical ability, persuasion skills, evaluation ability, self-control, responsibility, evaluation skills, teaching skills, voluntary participation, and leadership. The details of respective abilities and their proper stage of learning are presented in Table 13.1.1.

Education with environmental resources and themes helps people develop their own abilities with which they can live through in the real society. One is required to attain every goal through lifetime education according to his/her ability. Sustainability of human activities is accomplished only through human development meant to be creation of highly inspired and well-balanced human resources in the society.

13.2 EE&T Working Plan

13.2.1 LWC Nature School

A room for the Nature School in the Environmental Management Center (EMC) is proposed to provide environmental education for schoolchildren, local people, and tourists. The objectives of the Nature School are: 1) for grade 1 to 3 to learn biodiversity, 2) for grade 4 to 6 to perceive the relationship between fauna and flora, and 3) for grade 7 to 12 to understand the causality between human impacts and the nature and to behave themselves wisely. For the local people and tourists, the activities for promotion of public awareness are arranged.

In the Latvian system, every grade has to have a one-week field visit organized by each school, and the regional education authority mentioned the possibility of using this field visit activity for environmental education in the Nature School. Aiming at education of sustainable development, the Nature School should develop education programs based on the natural and artificial resources in LWC. The Nature School is equipped with a couple of computers to deal with EIMS that visually and briefly shows visitors what LWC looks like, and a telescope to watch the twinkling stars at night. The Nature Center plays an important role as a lifetime education and self-learning place.

13.2.2 Educational Resources in LWC and Eco-tourism Development

Table 13.2.1 shows how unique and important LWC is. Compared with the other two nature reserves of Latvia, LWC embraces both natural and artificial resources for

educational purposes. The purpose of EE&T "learning of sustainable development" can be easily achieved in LWC abundant in educational resources. One of the purposes of the EE&T Plan formulation is to clarify the educational resources in LWC that correlate to eco-tourism development. In Figure 14.3.3, the bird-watching routes surrounding Lake Lubana and the fishponds, and the canoeing route along the Aiviekste river are proposed. The southwestern part of the Tirumnieku bog can be seen by schoolchildren and visitors if special attention is provided with proper conservation measures. These ecologically valued natural resources can be shared by the eco-tourism sector, while artificial ditches and dykes become the educational targets to explain human impacts. The archeological sites scattered in and around LWC have a potential as an educational resource, particularly for history. The camping sites are used for nature observation places for visitors. Star watching helps visitors understand that human beings live in the context of the nature and the universe.

13.2.3 Subject Planning for Environmental Education

The Standards and Programs of Basic and Secondary Schools (the Standards) designated by MES states the main tasks and goals of basic and secondary education and specifies the numerical requirements of each subject. Each teacher decides how many classes for each subject are taken within the standard requirements and formulates detailed programs based on the Standards. The Standards clearly mentions that environmental education should be integrated into every program. The subjects particularly related to environmental education in basic schools are: nature studies (1 lesson/week for grade 1 to 4), biology/zoology/anatomy (2 l/w for grade 6 to 9), health education (1 l/w for grade 5), history (2 l/w for grade 5 to 9), art (1 to 2 l/w for grade 1 to 9), and ethics (1 l/w for grade 7). Geography, basic economics, civil science, chemistry, computer, and handicraft might supplement the contents of environmental education. For secondary education, nature studies (8 l/w), biology (6 l/w), health education (2 l/w), and ethics (2 l/w) are the elective subjects highly related to environmental education, while compulsory basic economics, computer, and chemistry might enhance environmental education. The sophistication of the Latvian education system is detected from the fact that nature studies is incorporated into basic education as a compulsory subject and into secondary education as an elective subject.

The environmental themes to be discussed should be specified for promotion of awareness. About ten themes are considered: (1) environmental & development, (2) correlation and coexistence with the nature, (3) biotope and habitat, (4) water balance, (5) conservation (nature protection), (6) carrying capacity, (7) renewable natural resources, (8) environmental education, (9) water quality and pollution control, (10) information dissemination. These themes are to be incorporated into the proposed activities.

The subject plan matrix is presented in Table 13.2.2. It illustrates each activity's attainability of the educational goals and the environmental themes to be discussed, and shows which subject is related to a specific activity and which grade is appropriate for it.

EMP presents the proposed activities for environmental education as a part of the EE&T Plan. The local teachers, schools, and NGOs can easily arrange their educational programs based on the subject plan clarified by EMP. They can select a specific activity by choosing an educational goal or an environmental theme which learners are required to achieve based on the subject plan for environmental education. The priority principle "Environmental education is not only for nature protection but also for ability development with the help of natural resources" should be strictly cohered and consistent.

13.2.4 Proposed Activities

The list of proposed activities is presented in Table 13.2.3. The objectives of each activity to achieve the set principles and goals are given, and general/overall methodologies and natural/artificial resources necessary for each activity are described. To recognize and explain a problem, to collect and analyze information, to evaluate a situation, and to develop and implement a solution are the core part of the EE&T activities proposed. Each activity should be thought out according to the educational goals to be achieved for each grade. Teachers are to select the most appropriate activities for children's ability development. The local governments and NGOs choose an activity satisfying the environmental theme to be discussed. All the recommended activities deriving from LWC are listed along with the subjects incorporated in Table 13.2.2.

From kindergarten to grade 3, the activities focusing on experience in nature and wildlife promisingly develop sensibility. The five senses of feeling, seeing, hearing, smelling, and tasting to observe the nature mature at these ages. It takes at least 2 years to reach the level at which classification and comprehension of spatial relations are possible. Another main goal for these ages is to realize conscience to embrace natural wonders. From grade 3 to 6, understanding information gets developed gradually. A recognition level deepens as knowledge accumulates. From grade 7 to 9, the ability to plan and implement gets widened. The ability to analyze, to apply, and to integrate starts to be intensified based on the sensibility and knowledge developed at younger ages. For step-by-step ability development, EE&T activities should be well taken shape.

13.2.5 Program Development and Evaluation/Feedback System for EE&T

Figure 13.2.1 describes the process of program development and evaluation/feedback system for EE&T with connection to EIMS. Teachers, local schools, and NGOs who decide to achieve the educational goals through EE&T or to discuss the environmental themes related to LWC pick up a set of activities proposed by EMP in accordance with the subject plan. The activities selected are materialized into programs with the more precise objectives, contents, and materials to be covered. A teaching strategy is prepared in an attempt to include the desired principles and educational goals. A teacher, if possible as a group of teachers, or an NGO implements the programs developed by them. The organizers of the programs should take care of the responses from schoolchildren or trainees.

An evaluation and feedback system is fully connected to EIMS. EIMS should be integrated to improve the effectiveness and efficiency of EE&T for the local schools and NGOs. A simple questionnaire on a WWW page tells how the public changes by environmental education and what they can recommend for more creative environmental education. Direct participation makes the public well motivated and informed, and they feel close to ad hoc environmental issues. Policy makers are able to reflect the results from the evaluation/feedback system on their decision-making. If model schools or classes of environmental education are introduced on the WWW page and become famous, schoolchildren are motivated to cooperate with environmental protection. Though unique activities are to be shared by as many schools as possible, information kept in private is difficult to approach. The database formation by EIMS makes the information on EE&T available to the public through the open-to-the-society database of unique activities for environmental education.

13.2.6 Training Program for Local People, Teachers and NGOs

CNREE at DPU provides courses and programs of environmental management for local people, teachers and NGOs in cooperation with MEPRD. The Ecological Laboratory of DPU also has been engaged in a series of researches to clarify the natural resources of LWC. The fact that DPU is an adviser of the proposed Implementation Committee of EMP makes it feasible to have environmental education training programs for local people, teachers and NGOs through DPU. CNREE obtains its financial resources from Latvian Environmental Protection Fund, Soros Foundation, UNDP, NGO Center, several private companies, and so forth. Technical support from DPU is essential to implement EE&T programs.

The Center for Environmental Science and Management (CESAMS) of the University of Riga aims at academic and professional training of environmental policy, planning and management skills. CESAMS has several courses on environmental management including environmental impact assessment, problem solving, decision making, and public awareness raising for the officials of MEPRD, local authorities. CESAMS has developed the interdisciplinary database containing the inventory of specialists, scientific institutions and universities that deal with environmental management and education, the education database including the information on the training programs and lecture courses on environmental science and management at the Latvian universities.

The University of Latvia Ecological Center (ULEC) is an independent and registered NGO working for training and curricula design in EE&T for environmental NGOs and schoolteachers. PHARE has supported two projects focusing on public participation in decision-making on environmental issues and public access to environmental information.

More than one-third (39%) of about 60 environmental NGOs active in Latvia dedicate themselves to environmental education. It is advisable that a part of the state budget for environmental protection and environmental education is directed towards NGO or schoolteachers training by specialized NGOs. CNREE, CESAMS, ULEC, Children'

Environmental School of WWF, and other experienced NGOs have a potential to expand their capacity and train the other NGOs if they have enough financial background from the state government, the international aid organizations, and private supporters. The expansion of the existing programs of the specialized NGOs is the main strategy of the training programs for local people and teachers. Some incentives such as financial support should be given to NGOs to promote EE&T in LWC.

Table 13.1.1 Educational Goals

Step	Educational Goals	Descriptions and Hints	Grade at which the goal attained												Relevant Educational Resources in LWC (marked "X")													
			1	2	3	4	5	6	7	8	9	10	11	12	raised bogs and buffer areas	inundation	commercial forests	protected forests	idle arable lands	Lake Lubana	fishponds	bird-watching sites	feeding places for migrating birds	storks' nesting places	dykes	drainage systems	quarry	sluice control	conservation measures
1	**Sensibility development**	- to develop the five senses of seeing, hearing, smelling, tasting, and touching are developed - to embrace and feel the nature profoundly	■	■	■	■									X		X	X				X	X	X					
2	**Conscience nourishment**	- to change human attitudes towards environmental friendly - to nurture common sense ruling human attitude - to intuitively judge good or evil based on ethics	■	■	■	■	■	■	■	■	■	■	■	■			X	X							X	X			
3	**Knowledge enlargement**	- to enlarge knowledge through experience - to enlarge views to protect and wisely use natural resources - to hold visions to embrace the future generations			■	■	■	■	■	■	■	■	■	■	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	**Clarification ability**	-to distinguish facts from presumptions - to avoid any prejudices and stereotype ideas - to attain sufficient communication skills				■	■	■	■	■	■	■			X	X	X	X	X				X	X	X	X	X	X	X
5	**Creativity development**	- to advance curiosity - to participate in as many exciting activities as possible - to combine many ideas and see the results				■	■	■	■	■	■	■	■	■			X	X								X			X
6	**Analytical ability promotion**	- to find relevant facts - to analyze relations between the facts - to think of the results of the matter in question							■	■	■	■	■	■			X	X							X	X		X	X
7	**Persuasion skills**	- to make people understand what you are talking about - to logically persuade - to visually explain							■	■	■	■	■	■			X	X							X	X		X	X
8	**Self control**	- to avoid adverse impacts on others and the nature - to understand that preventive measures spare natural resources							■	■	■	■	■	■			X	X								X	X	X	X
9	**Responsibility fulfillment**	- to become a leader for sustainable development - to take care of the results from what you do or did - to take action with precautious minds							■	■	■	■	■	■			X	X							X	X	X	X	X
10	**Evaluation ability advancement**	- to evaluate feasibility and applicability of ideas and solutions - to develop sensibility, knowledge, conscience, analytical and persuasion abilities obtained beforehand.										■	■	■	X	X	X	X	X				X	X	X	X	X	X	X
11	**Teaching skills promotion**	- to endure repetitive processes - to embrace others' mistakes - to realize what others' do not understand and why										■	■	■	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	**Voluntary participation encouragement**	- to act and participate in solving actual problems - to be based on never-dying conscience - to strengthen responsibility that leads to a prospectus solution										■	■	■			X	X								X			X
13	**Leadership attainment**	- to play a leading part in solving a problem - to encourage others' to act more - to persuade others of the benefits of sustainable development												■			X	X										X	X

Note: This table shows the educational step-by-step process which every child or person goes through. Though the order of the steps is generally following from top to down, all the steps are related to each other and at all the educational steps one should have all the ability more or less.

Table 13.2.1 Educational Resources in LWC

Biotope type/ Human activity		Noteworthy points to observe	Observation places*		
			LWC	Teici Reserve Observation House	Krustkalnu Reserve Observation House
Natural Vegetation Types	Raised bogs	- long history for bog formation - succession by deccication - bog birds	A	A	C
	Inundated grasslands	- role of flooding for vegetation formation - succession by deccication - role of agriculture for maintenance of vegetation - natural flood control function	A	C	C
	Fens	- role as fish spawning place	A	C	C
	Coniferous forests	- peat swamp forest - inorganic soil forest - importance of old trees for wildlife - forest birds	A	A	A
	Small-leaved deciduous forests	- forest birds - habitat for beaver	A	A	A
	Broad-leaved deciduous forests	- only small parts in LWC	B	C	C
	Dry grasslands	- grassland birds	A	A	A
Natural Water Types	Rivers	- mammal foot prints along river shore. - fish ecology	A	B	B
	Lake	- comparison of habitat with fishponds (LWC only) - fish ecology (LWC only)	A	C	A
Human Activities	Aquaculture development	- carp aquaculture is the main activity of the fishponds around Lake Lubana - abundant in waterfowls	A	C	C
	Forestry development	- forestry is not restricted in some areas of LWC	A	C	C
	Agricultural land	- between the Idena fishponds agricultural land can be seen	A	A	C
	Dyke construction	- dyke construction has changed biological and hydrological patterns around Lake Lubana - Gomelis marshy grasslands hydrologically changed after the construction of the dyke in the NE of Lake Lubana	A	C	C
	Canal/drainage system construction	- water is directed to the Aiviekste river through the Merani canal built in the 1970s - ecological change by deccication	A	C	C
Overall characteristics as field observation sites			- Varied biotope types - Abundant waterfowls - Economic development	- Mainly bog biotope	- Mainly forest biotope

Note: Shown above are biological diversity and artificial structures that can be easily observed within walking distances (about 2 km) from respective observation facilities.

*A means highly visible, B means slightly visible, and C means not visible

Table 13.2.2 Subject Plan Matrix

	Proposed Activity	Subjects to be taught												Target Groups						Educational Goals*1													Environmental Themes*2									
		nature studies	biology	health study	history	art	ethics	geography	basic economics	civil science	chemistry	computer	handicraft	grade 1-3	grade 4-6	grade 7-9	grade 10-12	NGO	local government	1	2	3	4	5	6	7	8	9	10	11	12	13	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A	Footsteps of wildlife	X											X	■	■					X	X												X	X							
B	Drawing or taking a picture of the nature					X								■	■					X	X																			X		
C	Tree planting	X											X	■	■	■				X	X												X						X			
D	School biotopes	X	X					X				X		■	■	■						X	X	X										X	X							
E	Check quality of rivers and lakes	X		X							X				■	■						X	X		X							X								X	
F	What happened to them?	X	X				X								■	■					X	X	X		X								X			X	X				
G	Archeological field trip				X										■	■						X	X										X								
H	Information for the nature	X										X					■					X		X												X	X			X	X
I	Let's contact experts on nature conservation through Internet	X										X				■	■					X		X						X						X	X			X	X
J	How do others' opinions effect on yours on environmental management?	X					X			X						■	■						X		X	X	X									X					
K	Cause and consequence	X	X				X			X						■	■				X		X		X	X							X			X					
L	Eco-tourism development	X						X	X								■	■	■					X	X	X						X						X			X
M	Water levels								X			X					■	■	■				X		X	X	X					X			X						
N	Scoring of nature protection measures	X								X							■	■	■				X		X	X			X							X			X		
O	Land use planning for humans and wildlife																	■	■				X		X	X				X		X			X		X			
P	Environmental auditing																	■	■				X		X	X		X	X		X							X		
Q	Decision-making process																	■	■				X	X	X	X		X	X			X			X	X	X	X	X	X

Note: Relevant activity is marked with "X".

*1) the figures are corresponding to Table 9.3.1

*2) The figures are corresponding to Section 9.4.3

Table 13.2.3 List of Proposed Activities

	Proposed Activity	Preparation in Advance	Visit to Environmental Management Center	Field Trip to LWC	Educational Resources	Critical Questions to Children
A	**Footsteps of wildlife**	-list animals -check names and pictures of animals	optional	recommended	-beaver dams -bird-watching sites -LWC nature museum in Varaklani	-What do animals eat? -Where do they live?
B	**Drawing of or taking a picture of the nature**	-mapping and scheduling of field trips	optional	recommended	-nests of storks -Kvapani and Orenisu fishponds	-What are the natural elements depicted in your drawings and pictures?
C	**Tree planting**	-contact with the local forestry authorities	optional	recommended	-commercial forests -broad-leaved forests -artificial ditches	-How do trees grow? -How water levels affect trees?
D	**School biotopes**	-get consltancy from science and biology teachers	optional	optional	-biotope maps made by EMP -nature around schools	-What are biotopes? -Where are habitats for wildlife?
E	**Check quality of rivers and lakes**	-contact with regional environmental boards	optional	optional	-portable water quality measures	-What affect water quality in rivers and lakes?
F	**What happened to them?**	-list reference books and materials	optional	optional	-Red Data Book -research reports on LWC	-What are the endangered species? -Why are they endangered?
G	**Archeological field trip**	-contact with archeological specialists	optional	recommended	-archeological sites in LWC -archeological amusement park in Indrani	-Why the ancient Latvians chose LWC as a living place?
H	**Information for the nature**	-check homepages related to LWC	optional	optional	-Internet -video tapes taken by Environmental Film Studio	-How important is information for environmental management?
I	**Let's contact experts on nature conservation through Internet**	-checkhomepages related to nature protection in Latvia	optional	optional	-Internet	-What are the motivations of nature protection by scientists?
J	**How do others' opinions effect on yours on environmental management?**	-list possible opinions	optional	optional	-laws and regulations related to environmental protection	-Who will be affected by the laws and regulations?
K	**Cause and consequence**	-list reference books and materials	recommended	recommended	-development histroy on LWC -scientific researches on LWC	-What are relations between development and nature?
L	**Eco-tourism development**	-make appointments with eco-tourism developers	recommended	recommended	-eco-tourism development maps	'-How can you develop eco-tourism in LWC?
M	**Water levels**	-reading regulations on water level management	recommended	recommended	-water level simulation models -water level regulations	-Who will be affected by high water levels or low?
N	**Scoring of nature protection measures**	-understanding of conservation measures	recommended	recommended	-conservation plan formulated by EMP	-Why are conservation measures necessary?
O	**Land use planning for humans and wildlife**	-collect basic information	optional	optional	-GIS data on land use	-How to use land for society?
P	**Environmental auditing**	-understand backgrounds of the related organizations	optional	optional	-Nagli fish firm -local eco-tourism enterprises -government offices -schools	-What the necessity of environmental auditing?
Q	**Decision-making process**	-understand hot issues in terms of decision-making	recommended	recommended	-reports on EMP -GIS data for EMP	-How can you persuade your decisions?

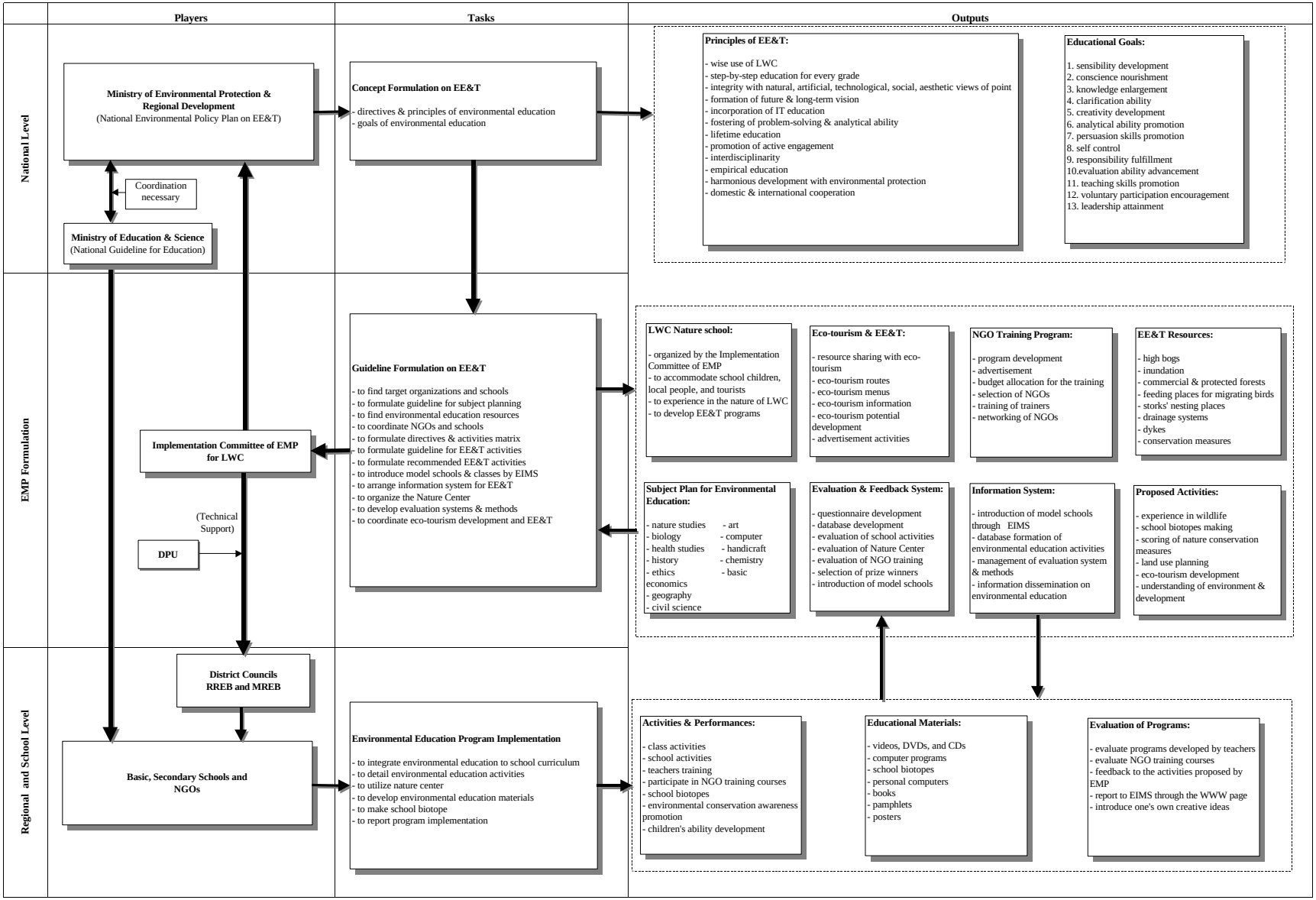


Figure 13.1.1 Framework of Environmental Education & Training (EE&T) Plan

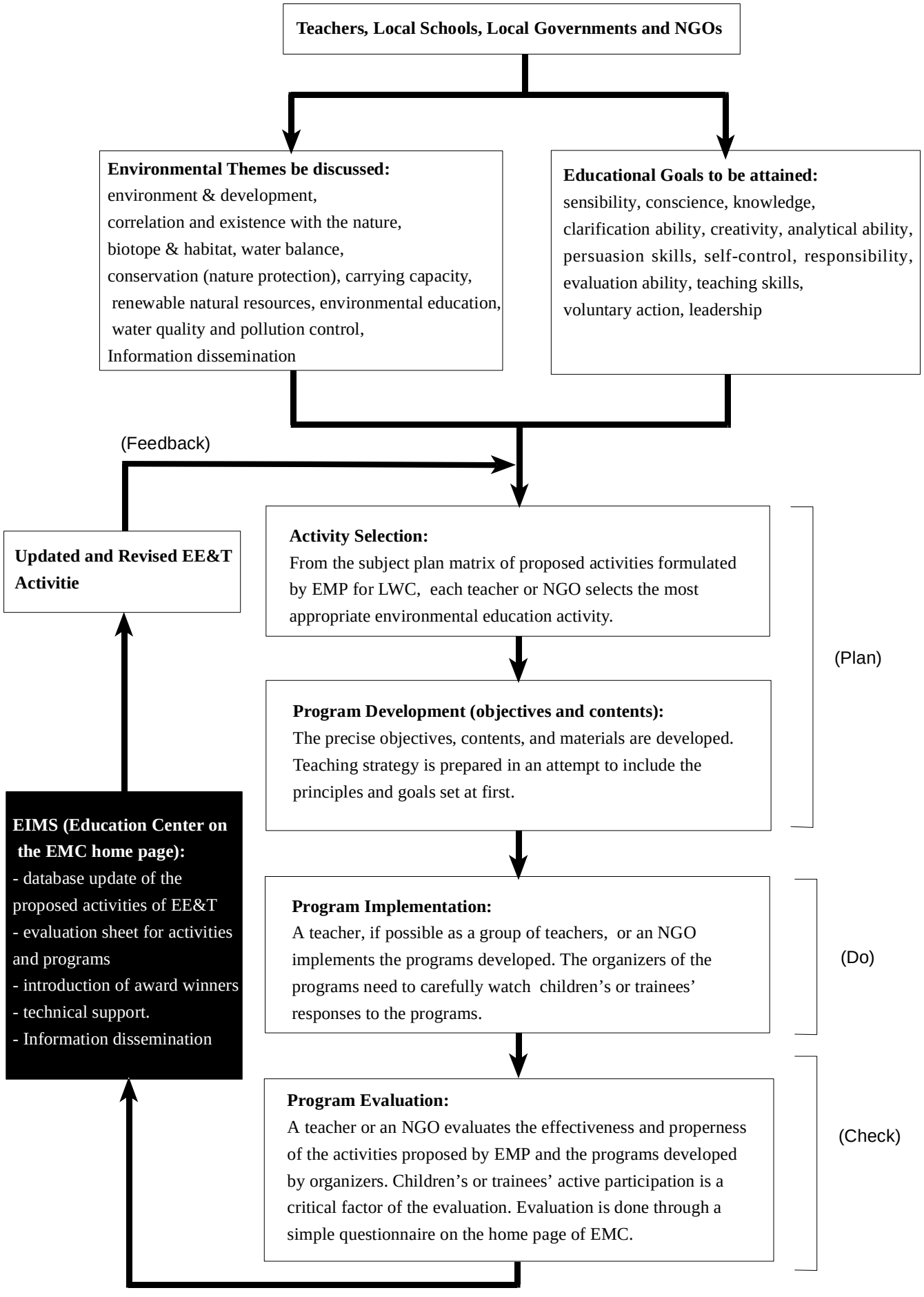


Figure 13.2.1 Process of Program Development and Evaluation & Information System