CLEAN BALTIC SEA PROJECT

Accelerated Phosphorus Removal from Municipal Wastewaters in Poland

OCTOBER 2008

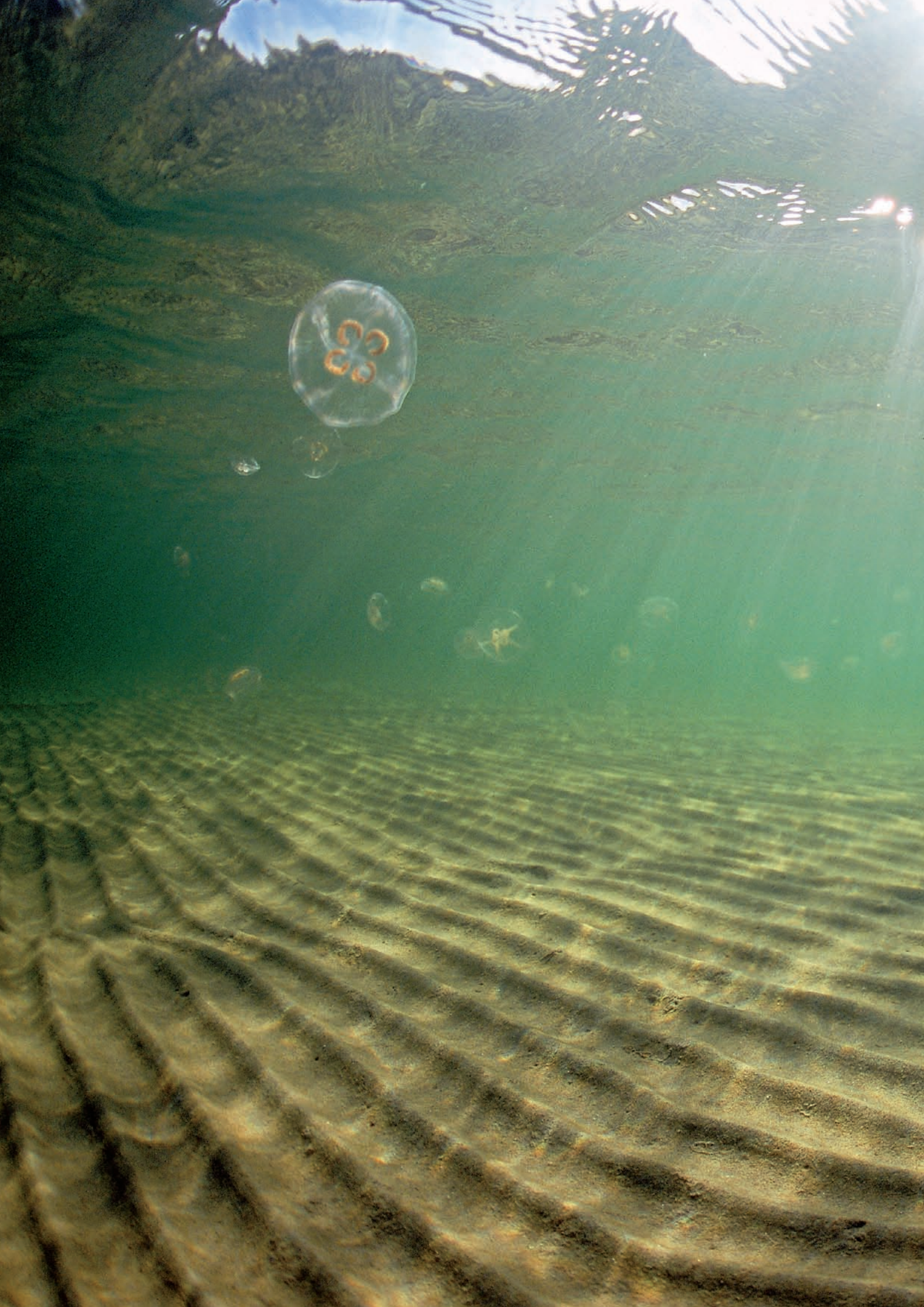


Photo: Jukka Nurminen / Abyss Art Oy

PREFACE

In the late autumn of 2007, the John Nurminen Foundation in Finland and a Swedish foundation, Baltic Sea 2020 agreed to finance a fact-finding mission to Poland in order to gather information about the current situation in wastewater treatment in Polish cities and to prepare a project for accelerated phosphorus removal.

The Project Team of Martti Lariola and Miina Mäki of the John Nurminen Foundation, and Lotta Samuelson of the Baltic Sea 2020 reported its findings to the Steering Group of the Clean Baltic Sea project consisting of Juha Nurminen (Chairman of the Board of the John Nurminen Foundation), Björn Carlson (Chairman of the Board of Baltic Sea 2020), Stefan Widomski (Honorary Consul of Poland), Pertti Salolainen (Chairman of the Foreign Affairs Committee of the Finnish Parliament, MP), Kari Homanen (Senior Investment Manager of NEFCO), Magnus Höglund (Partner of Bain & Company) and Erik Båsk (Secretary General of the John Nurminen Foundation).

The environmental work of the John Nurminen Foundation is financed by donations from public and private sources. The initial preparation of this project was made possible by donations from Mr. Juha Nurminen, Baltic Sea 2020, Oy Sinebrychoff Ab, Bain & Company, Castrén & Snellman and Art-Print Oy.

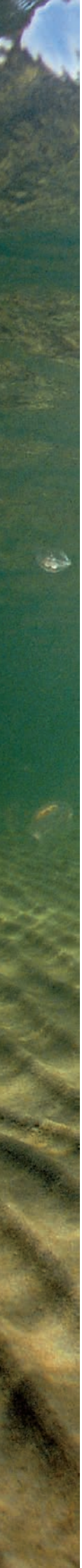
Helsinki, 13 May 2008

Juha Nurminen
Chairman of the Board
John Nurminen Foundation

Björn Carlson
Chairman of the Board
Baltic Sea 2020

CLEAN BALTIC SEA
JOHN NURMINEN FOUNDATION

Baltic Sea 2020



ABBREVIATIONS

BSAP	Baltic Sea Action Plan (HELCOM)
BS2020	Baltic Sea 2020 (Björn Carlsons Östersjöstiftelse)
CBS	Clean Baltic Sea Project
EU	European Union
EUR	Euro, European currency unit
HELCOM	Helsinki Commission
JNF	John Nurminen Foundation
KPOSK	State Programme of Urban Wastewater Treatment, Poland
NEFCO	Nordic Environment Finance Corporation
NGO	Non-Governmental Organisation
NIB	Nordic Investment Bank
NWMA	National Water Management Authority, Poland
P	Phosphorus
p.e.	Population equivalent
UAC	Unit Abatement Cost
UWWTD	Urban Waste Water Treatment Directive (EU)
WWTP	Wastewater treatment plant

CONTENTS

Photo: Jukka Nurminen / Abyss Art Oy

EXECUTIVE SUMMARY

The objective of the Project is to remove 1000 tons phosphorus per annum from municipal point sources in Poland by reaching 0,5 mg P/l in outgoing wastewater.

The objective will be achieved by targeting the effluents of the largest cities and towns in Poland. The selected target cities and towns account for 90 % of the total municipal wastewater flow in Poland.

The total cost of the Project is estimated to be 9.7 million EUR. Unit Abatement Cost of the Project is very low compared to the other possible actions of phosphorus removal.

Funding for the initial stage has been secured by the John Nurminen Foundation (JNF) and Baltic Sea 2020. Additional financing will be sought from private sector, EU, Baltic Sea governments like Finland, Sweden and Poland and financial institutions. In addition, pro bono contributions are raised from advertising agencies, media companies and other professional service organizations.

The Project will be implemented in 2008 - 2013. It is divided into three phases: Phase1 (Pilot) with the City of Warsaw, Phase2 with 30-40 selected cities from the 75 largest Polish agglomerations, and Phase3 with 40-60 selected towns from the 378 medium-sized agglomerations.

Operationally, the John Nurminen Foundation and Baltic Sea 2020 launched the Project in summer 2008 (Phase1) with the City of Warsaw. The target for the Pilot Project is the annual removal of 100 tons of phosphorus by the end of 2010. A scaling of the project concept, organization and administrative procedures will then take place in Phase2 when 30-40 large Polish cities will be targeted, expected to result in the annual removal of 400 tons of phosphorus by the end of 2012. The target of Phase3 is the annual removal of 500 tons of phosphorus by the end of 2013.

Each target city/town/agglomeration is considered as a separate sub-project. Each sub-project will include (i) a technical audit, (ii) grant for investment costs for enhanced process management and monitoring, (iii) grant for phosphorus-related operational costs, (iv) grant for environmentally sustainable recycling, treatment and disposal of sludge and (v) grant for media and NGO support (as needed).

Approval and release of grants is managed through the Clean Baltic Sea Fund, jointly established by the John Nurminen Foundation and Baltic Sea 2020.

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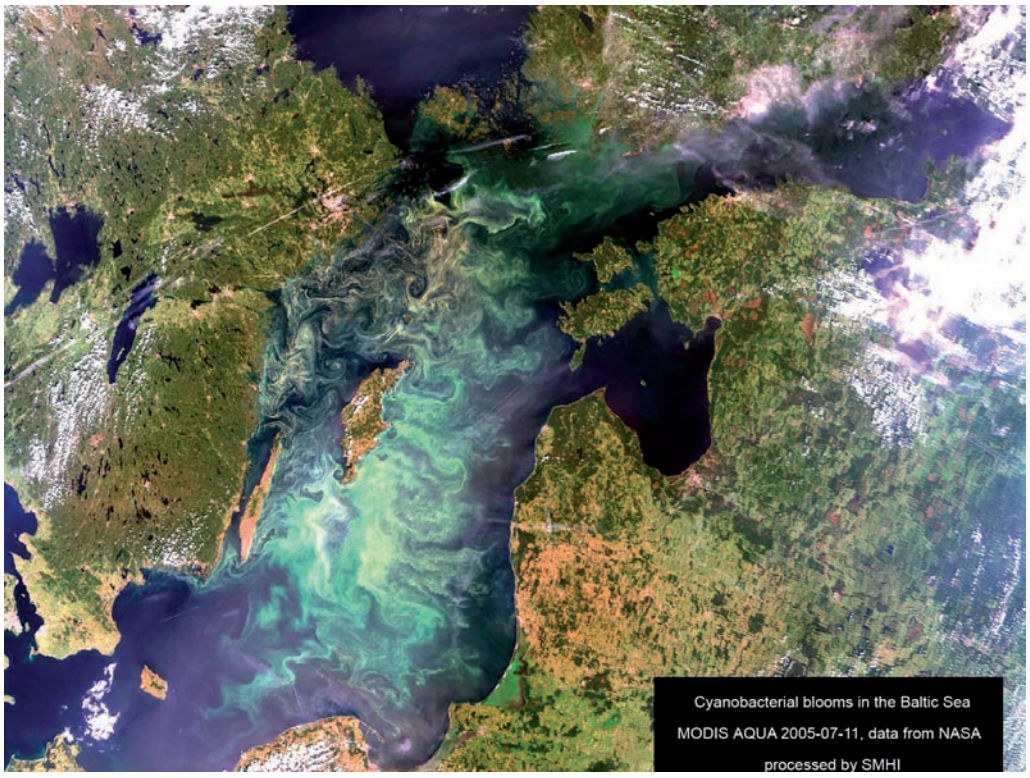


1. BACKGROUND

Mass occurrences of blue-green algae, of which some are highly toxic, are a symptom of eutrophication. Algae growth is mainly limited by two nutrients, nitrogen and phosphorus. Phosphorus supply is a major limiting factor for the blue-green algae growth. Therefore, in order to combat the mass occurrences of the blue-green algae reducing phosphorus emissions is of primary importance.

At least 95 % of the phosphorus load, approximately 28 500 tons in 2005, enters the Baltic Sea waterborne, via rivers or as direct discharges[1]. A major part of it originates from point sources, of which municipal wastewater treatment plants play a primary role . Although half of the total phosphorus load originates from agriculture, there is a difference in which chemical form the phosphorus enters the sea. Main part of phosphorus in municipal wastewaters is directly available for algae growth.

Efficient techniques to remove phosphorus from wastewater exist and are in use for example in the Nordic countries. With biological methods up to 90 % removal of phosphorus can be achieved. Chemical precipitation is a simple and reliable technique in which the dissolved phosphorus is bound with an iron or aluminium compound and removed from the wastewater through sedimentation. With chemical precipitation at least 95 % removal of phosphorus can be achieved.

The largest source of phosphorus input to the Baltic Sea is Poland. Its share of the phosphorus load in 2000 was 37 %[2].

Poland has to two big rivers, Odra and Vistula, which both run through the country. The rivers carry discharges from the whole country into the Baltic Sea. The river Vistula is draining 54 % of the total area of Poland[3].

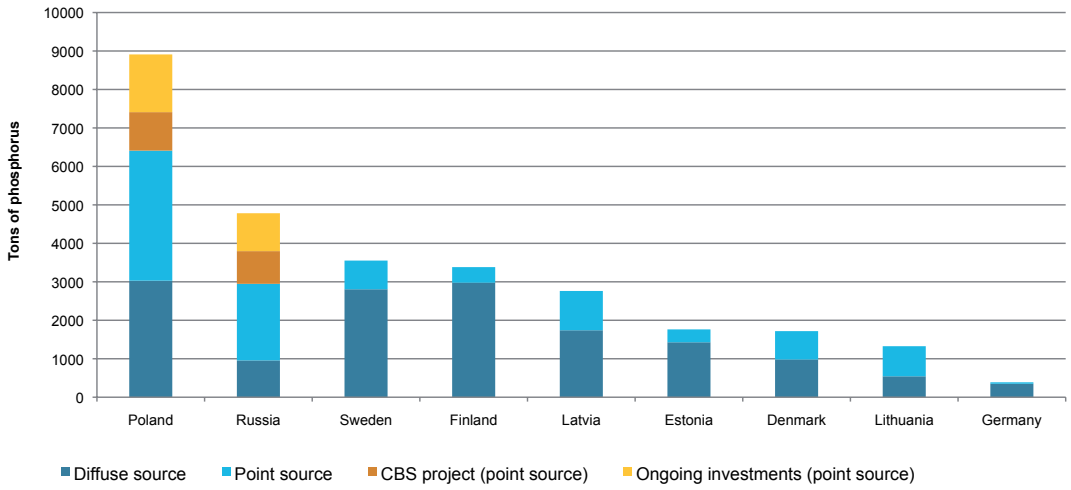


Table 1: Sources of phosphorus into the Baltic Sea 2005 (tons) and CBS impact. [4]

The Polish State Programme of Urban Wastewater Treatment (KPOSK), setup by the government to reach the EU norms, includes construction of 37 000 km of sewers and construction, extension or modernization of 1 734 wastewater treatment plants. The total cost of these investments is estimated at 11.8 billion EUR (42.6 billion PLZ) in 2005 - 2015. The sources of funding include local and national environmental funds (39 %), state budget (3 %), EcoFund (23 %), EU funds (30 %) and other sources (5 %). The KPOSK programme is subject to periodic reviews.

JNF estimates that the current investment programme in improved wastewater treatment (KPOSK) has already significantly reduced the phosphorus discharges from Poland to the Baltic Sea. Phosphorus discharges are expected to reduce further with over 2 000 tons/year by 2010 (Table 1). CBS project would build on the technological precondition created by KPOSK and decline the phosphorus discharges further by 1 000 tons/year with modest investments and operational costs.

[1] HELCOM PLC-Group, Data Consultant SYKE, 2007: Waterborne loads of nitrogen and phosphorus to the Baltic Sea in 2005. HELCOM Indicator Fact Sheets 2007.

[2] HELCOM 2005: Nutrient Pollution to the Baltic Sea in 2000. HELCOM Baltic Sea Environment Proceedings, BSEP 100.

[3] Kajak, Z. 1993: The Vistula River and its riparian zones. Hydrobiologia, Vol. 251, 1-3/February 1993.

[4] HELCOM: Data based on river flow to the Baltic Sea in 2005 and JNF estimates.

Source: NWMA

Population (p.e.)	Number of agglomerations	Total population (1000)	Population connected (1000)	Wastewater flow in 2006 (m^3/day)
Over 100 000	75	13 475	11 513	3 706 647
15 000 – 100 000	378	9 864	7 126	2 074 407
2 000 – 15 000	1 123	6 480	2 847	655 860
Total	1 577	29 819	21 486	6 436 914

Table 2: Urban agglomerations in KPOSK programme.

For the purposes of urban wastewater treatment, the Polish National Wastewater Management Authority has created agglomerations, which consist of cities and adjacent urban centres. These be managed as local units of wastewater treatment that share networks and treatment facilities.

The 1 577 agglomerations presented in Table 2 cover 78 % of the Polish population. The remaining population live in rural areas. CBS Project will concentrate on the agglomerations with populations over 15 000 p.e. These agglomerations represent over half of the Polish population and about 90 % of the current wastewater flow. These agglomerations number 454 in total, comprising of the group of 75 biggest agglomerations and the group of 378 medium-sized agglomerations. Focusing on these agglomerations will result in maximum environmental impact.

HELCOM's Baltic Sea Action Plan is an ambitious programme to restore good ecological status of the marine environment of the Baltic Sea by 2021. The plan and its recommendations were adopted at the HELCOM Ministerial Meeting on 15 November 2007 in Krakow, Poland.

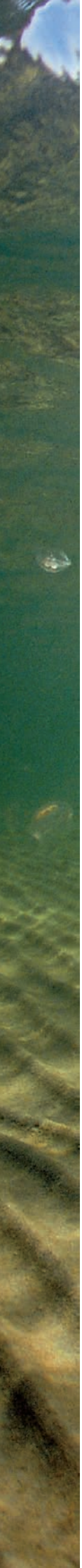
For Poland, adopting and implementing the plan will require new measures to improve wastewater treatment, on top of the EU-programme that is currently under implementation. Although the recommendations set in the Baltic Sea Action Plan are not legally binding for the Contracting Parties, countries are expected to include the effluent standards in national legislation.

Population (p.e.)	EU norm (mgP/l)	EU time schedule	Helcom BSAP (mgP/l)	Helcom time schedule
Over 100 000	1.0 or 90 % reduction	2 010	0,5 or 90 % reduction	2010 – 2012
15 000 – 100 000	2.0 or 85 % reduction	2 010	0,5 or 90 % reduction	2 015
2 000 – 15 000	2.0 (discharges to lakes)	2 015	1,0 or 80 % reduction	2 018

Table 3: EU and Helcom norms for effluents.

Maximum allowable nutrient inputs and reductions needed are defined in HELCOM's Action Plan, based on national data from 1997 - 2003. As urban municipal wastewater is a major source of nutrients, HELCOM sees pertinent a 15 250 ton annual reduction of phosphorus discharges (from all countries and all sources) to the Baltic Sea, of which Poland's share would be 8 755 tons (based on pollution load data from the year 2000 and subject to revision as soon as updated information is available).

A nutrient credits trading system has been proposed as one option of implementing nutrient reductions in the Baltic Sea region. A system operating similarly to the carbon credits trading system (Kyoto mechanism) could offer a cost-efficient way to reduce eutrophication of the Baltic Sea. This initiative, under consideration by NEFCO, HELCOM and various Baltic Sea governments still requires extensive preparatory work and multilateral negotiations. A pilot phase of such a trading scheme could possibly be implemented in a simplified form, involving a limited number of Polish point-source producers of wastewater and the proposed Clean Baltic Sea Fund as buyer.



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2. OBJECTIVE AND APPROACH

The objective of CBS Poland is to support Polish cities and municipalities to reach a phosphorus content of 0.5 mg/l (HELCOM recommendation) in municipal wastewater discharges on continuous basis. This would result in a total impact of 1 000 tons phosphorus being removed annually from 2012 onwards.

	Target	P tons p.a. post EU investments (EU target mg/l)	P reduction from EU norm to 0.5 mg/l	CBS target (tons)	Total Cost €M
Phase1	Warsaw pilot	200 (1.0)	100	100	1.4
Phase2	30-40 cities of 75 cities	1500 (1.0)	750	400	4.4
Phase3	40-50 towns	2250 (2.0)	1700	500	3.8
	Total	**3950**	**2500**	**1000**	**9.6**

Table 4. Removal of 1 000 tons of phosphorus.

Cornerstones of CBS Project approach are:
1. Point-source phosphorus discharges
2. Voluntary action
3. Low-cost, high-impact measures
4. Measurable, time-based outcome

1. Although disperse sources of phosphorus are significant, **CBS concentrates on point-sources**, primarily municipal wastewater. Only in this area results can be expected fast enough. The proposed partner cities possess qualified technical expertise and decision-making structures to address the phosphorus issue.

2. Current legislation sets effluent levels that are insufficient to tackle the emergency situation of the Baltic Sea. Therefore, **voluntary action** by the municipalities and by the civil society is necessary. The environmental consciousness in Poland is already advanced. Both political decision makers and non-governmental organizations will be invited to join the Project.

3. Most water utilities in Poland already have – or will have within the next three years – the necessary base technology and equipment for enhanced phosphorus removal. In practice this means a combination of biological and chemical wastewater treatment processes. The short-term solution to reach the target level on continuous basis normally requires additional use of phosphorus-binding chemicals, and reliable monitoring of the treatment process and results. **The task is to support low-cost/high-impact investments and other measures that lead to immediate, significant and controllable reduction of phosphorus discharges.**

4. **An essential pre-condition for the CBS Project is cost-efficiency and measurability.** Each measure must be justified by lowest unit abatement cost (UAC), based on a quick technology audit. Major plant expansion and rehabilitation investments will remain outside the scope of this Project.

PHASING AND TARGETS OF CBS PROJECT IMPLEMENTATION

Phase1 (Pilot) – Cost estimate 1.4 million EUR

The CBS Project Phase 1 (Pilot) partner is Warsaw[5] with a total population of 1.5 million or 3.1 million p.e. Warsaw is implementing the final phases of a major investment programme. City leaders have a high understanding of the environmental issues in general, and of the alarming condition of the Baltic Sea. The technical sophistication and staff competence of the Warsaw wastewater treatment plants meets international standards. The phosphorus reduction potential from 1.0 mg P/l required by EU to 0.5 mg P/l and the CBS Project objective in Warsaw is a reduction of 100 ton/year[6] in phosphorus discharges. The letter of intent with the city of Warsaw was signed in July 2008.

[5] Subject to agreement with the City of Warsaw.

[6] Estimated future wastewater flow 547 000 m^3/d and total P in effluent 200 tons/y at 1 mg P/l in 2010.

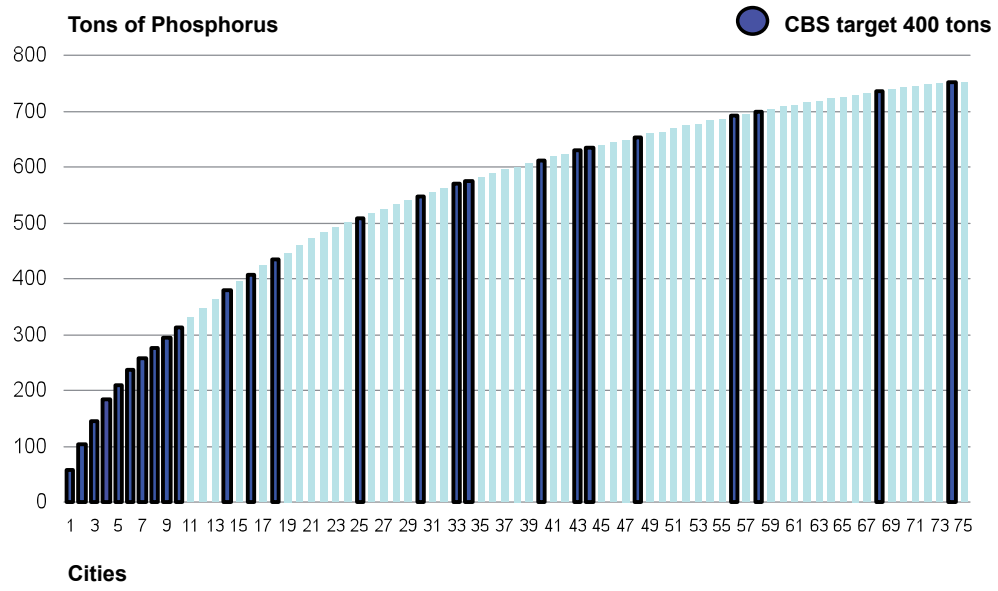


Table 5. Cumulative phosphorus removal potential in 75 cities (shown as dark blue bars). Selection based on their impact on the Baltic Sea.

Phase2 – Cost estimate 4.4 million EUR

The proposed CBS Project Phase2 partners will be 24 cities out of the 75 cities/ agglomerations with over 100 000 population (total population 12 million) and 10 cities out of the medium-sized towns with 15 000 - 100 000 population. At least the largest cities have already done major investments and are expected to reach the 1,0 mg P/l effluent level by 2010. Their leaders are environmentally conscious and politically well connected. Their water utilities are modern and staff generally highly competent. The phosphorus reduction potential (from 1.0 mg P/l to 0.5 mg P/l) in this group is estimated at 750 tons/year[7]. The CBS objective is to achieve a 400 tons/year reduction in phosphorus discharges (Table 4 and Figure 1).

[7] Estimated future wastewater flow 4.1 million m^3/d and total P in effluent 1 495 tons/y at 1 mg P/l.

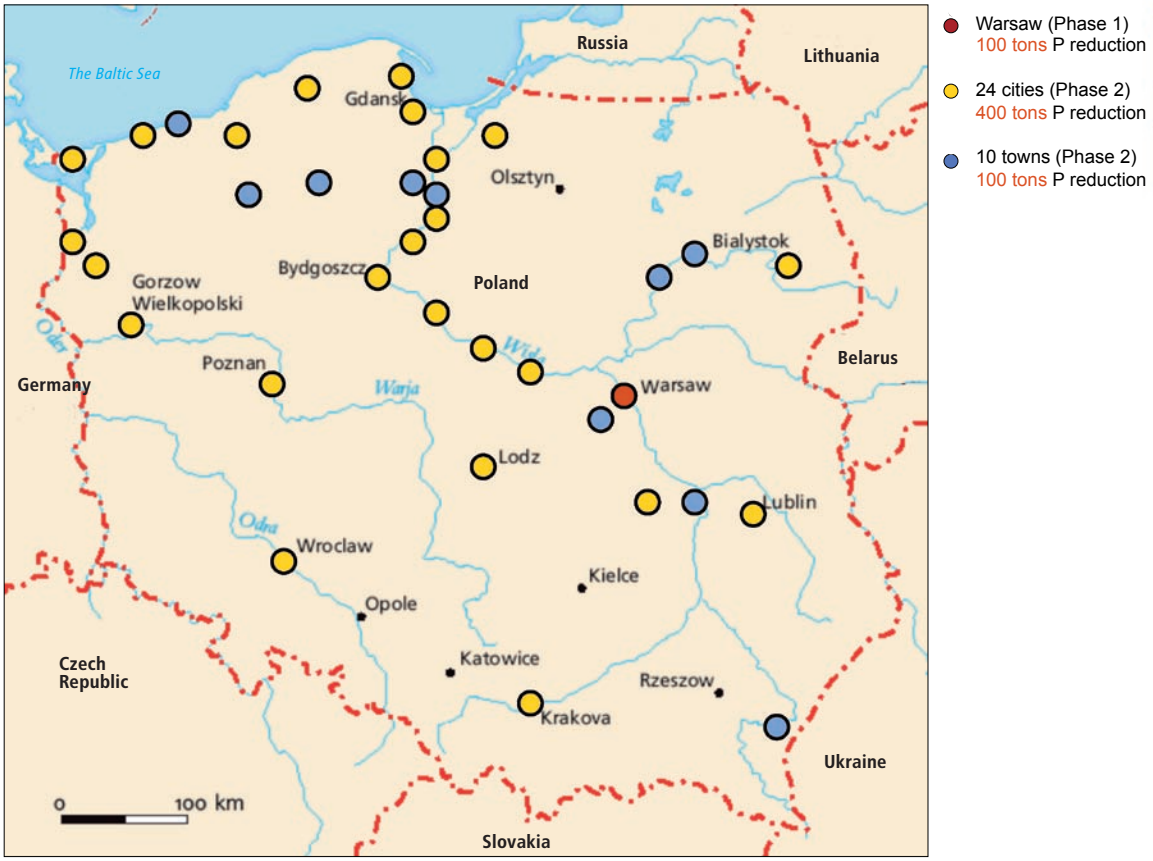
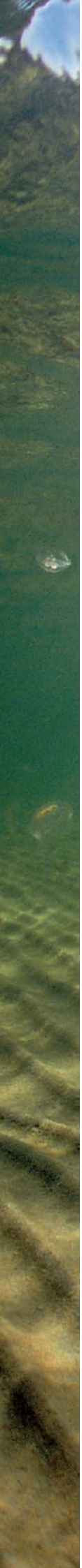


Figure 1. Proposed distribution of partner cities in Phase2, based on their geographic location close to the Baltic Sea or along major rivers.

Phase3 – Cost estimate 3.8 million EUR

For CBS Phase3, 40-50 medium-sized towns of 15 000 - 100 000 population (total population 9.9 million) will be targeted. The CBS Project objective is to achieve a 500 tons/year reduction in phosphorus discharges.

The small towns/agglomerations of 2 000 - 15 000 population (total population 6.5 million), representing a current wastewater flow of 0.7 million m^3/d, are excluded from CBS Project due to low cost efficiency and limited environmental impact.



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3. CBS BUDGET

The budget for the CBS is 9.7 million EUR, divided over seven years. The financing of the Fact-Finding phase was shared by the John Nurminen Foundation and Baltic Sea 2020 on equal terms. Financing for phase1 has been secured by the two foundations on the same basis.

Funding Need (1000 EUR)	Years 2007	2008	2009	2010	2011	2012	2013	Total
Fact Finding	53							53
Total Fact Finding								**53**
Phase1 / Pilot Project, Warsaw								
Technical Audit		20						20
Grants for Investments			200					200
Grants for Operational Costs			300	100				400
Media & PR			100					100
Fund Management		260	430					690
Total Phase1		280	1 030	100				**1 410**
Phase2 / 34 Cities								
Technical Audit				100				100
Grants for Investments				800				800
Grants for Operational Costs					1 200	400		1 600
Media & PR				250	250	100		600
Fund Management				430	430			860
Reservation for sludge handling							430	430
Total Phase2				1 580	1 880	500	430	**4 390**
Phase3 / Cities to be spesified								
Technical Auditing					100			100
Grants for Investments 50%					700			700
Grants for Operational Costs						1 000	400	1 400
Media & PR					150	100	100	350
Fund Management						430	430	860
Reservation for sludge handling							430	430
Total Phase3					950	1 530	1 360	**3 840**
GRAND TOTAL	53	560	2 060	3 360	5 660	4 060	3 580	**9 693**

Table 6. CBS Budget (1 000 EUR).

The financing of Phases2-3 is proposed to be sourced 50 % from the public sector (states and institutions) and 50 % from the private sector (private companies, foundations, private persons, pro bono work).

For Phase1, the additional annual operational cost – and CBS Fund grant support – in the case of Warsaw pilot project is estimated at 0.4 million EUR, and the grant for investments at 0.2 million EUR (investment grants are capped to 50 % of one year's operational cost). The annual additional cost of water and wastewater services per capita would be 0.27 EUR.

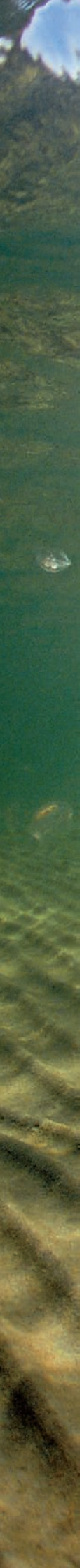
For Phase2, the daily total flow of wastewater from the 75 target agglomerations is estimated at 4.1 million m^3 in 2010, corresponding to an annual operational phosphorus removal cost of 3.0 million EUR. Assuming a participation rate of 50-60 % required to reach 400 tons reduction of phosphorus in effluent, CBS Fund share of operational costs would be 1.6 million EUR.

For Phase3 the annual operational phosphorus removal cost of partner towns is estimated to be 1.4 million EUR to reach the target of 500 tons reduction. A reservation of total 0.86 million EUR will be made relating to sludge handling and funding of innovations in sludge handling techniques.

An allocation of 1.0 million EUR is budgeted for media and NGO support during 2008 - 2013. Funding for this Project component could be outsourced.

CBS Fund management is estimated to consist of a Managing Director, a Deputy Managing Director, two Project officers and three administrative staff. The total annual cost of fund management in 2009 - 2013 is estimated at 430 000 EUR/year.

The Project should win, from the very beginning, public support and good media coverage. CBS mission is to make environmental protection of the Baltic Sea a priority issue in Poland.



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4. FUNDING

The fundraising target for the CBS Project is 8.2 million EUR (for Phase2 and Phase3). Investors in the Clean Baltic Sea Fund are expected to provide funding for the operation as a whole, not for individual Project components. Potential sources of funding include the following:

1. Former donors of the CBS Project in St Petersburg
These public and private donors are committed to the cause of saving the Baltic Sea. They are familiar with the JNF approach and way of working and appreciate the focused and efficient operation.

2. Private banks, companies and foundations
Finnish and Swedish financial institutions and companies, particularly those that have a business interest in Poland, as well as leading, environmentally conscious Polish institutions and companies. Also leading Nordic, Polish and international foundations are invited to participate.

3. Private individuals
CBS Project would give a possibility for private individuals in Poland, Finland and Sweden to participate in the Project through cost-effective fundraising campaigns.

4. Pro Bono work
Pro Bono work is very important especially in media sector and other professional services, and is a means to get considerable in kind donations for CBS Project.

5. Institutions
Institutions include EU and its different funds, government ministries in Finland, Sweden and Poland.

5. ENVIRONMENTAL FUND FOR PHOSPHORUS REMOVAL

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The Project proposes to establish a fund for the implementation of the Project. The Clean Baltic Sea Fund would be a Polish institution, established for a limited period of time. Baltic Sea 2020 would have the chairmanship of the Board of the CBS Fund. The John Nurminen Foundation would be the Manager of the CBS Fund. The Fund Manager would prepare phosphorus removal Projects and submit them to the Board for decision-making. The Board would consist of stakeholders representing major sources of financing for the CBS Fund. It would approve the CBS Fund Business Plan and supervise the implementation of the Project.

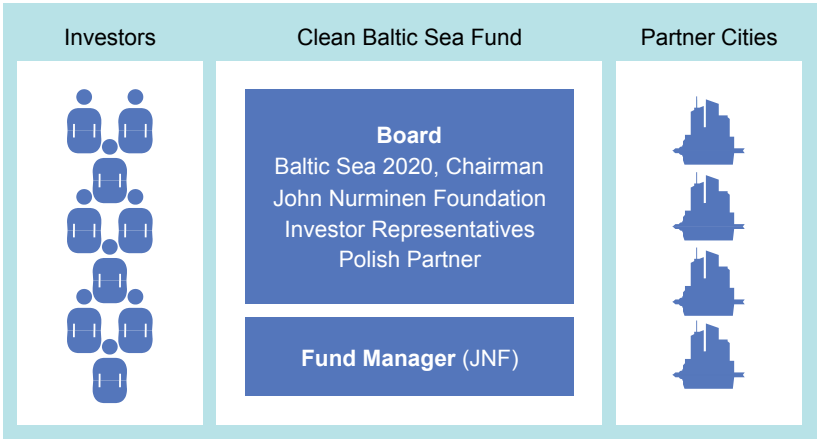
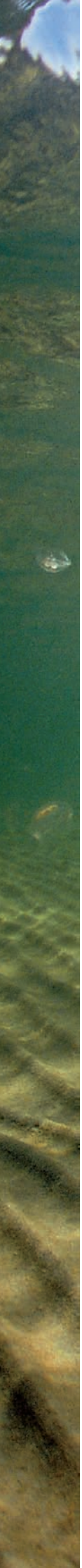


Figure 2. Clean Baltic Sea Fund concept.



The proposed CBS Project Fund support windows are the following:

Technical Audit
As the very first measure, a quick and concise technical audit will be performed to establish the most cost-effective measure of phosphorus removal to reach 0.5 mg P/l. CBS Fund would finance external costs and the recipient would provide its contribution in-kind (staff time).

Grant for investments
Grant to reimburse part of investments needed for improvement of chemical feeding, mixing, reporting and monitoring systems.

Grant for operational costs
Grant to reimburse one-year additional direct cost of phosphorus removal, spread over several years. The conditions would include independent monitoring until the legal requirement for 0.5 mg P/l is in force.

Public awareness
The CBS media strategy invites publishing houses, professional service providers, non-governmental organizations and other civil society actors to join the project on pro bono basis.

Grant for innovations
Grant to advance the development of new technologies for the recycling of phosphorus and environmentally sustainable treatment of sludge.

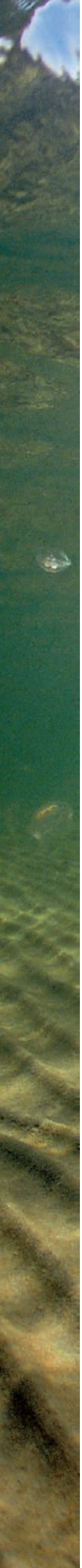
The CBS Fund would provide a strong financial incentive to bring phosphorus content of outgoing wastewater down to the level recommended by HELCOM. It would require immediate, voluntary compliance with expected future legislation. Financial support from the CBS Fund would be catalytic, and would be phased out in two to five years. The NGO support window and related media campaigns would create a bottom-up civil society support for the Project.

Figure 3. CBS implementation process.

The process for the implementation of CBS projects will be standardized for all partner cities/towns/agglomerations. The sequence of steps is illustrated in figure 3.

The Letter of Intent would express the mutual interest in implementing the phosphorus removal project to achieve the objective, expressed in effluent concentration (max. 0.5 mg P/l) and actual tons/year. It would also include the understanding of long-term commitment to the maximum level of phosphorus.

The Technical Audit would recommend the most cost-efficient measure to reach the objective. The CBS Fund proposal would present the support package and contractual conditions to the city/town decision-makers. The Project agreement would be the basis for implementation and monitoring. All procurement would follow principles of open competition and transparency.



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6. MITIGATION OF RISKS

There is a widely acknowledged need for urgent action to save the Baltic Sea. The John Nurminen Foundation has demonstrated the efficiency of projects implemented jointly with private and public sectors. This brings tangible, measurable improvements to the condition of the Baltic Sea. Therefore, the idea and feasibility of CBS Project are on a solid foundation. The CBS Project risks relate mainly to financing and implementation.

Fundraising risk
A well-designed, targeted fundraising strategy and media campaign, involving industry professionals, political leaders and NGOs will secure success.

Administrative risk
Approaching the selected potential partner agglomerations will be managed by qualified professionals, with good understanding of the local conditions in Poland.

Local financial risk
Although the budgetary finances of the cities and towns in Poland are tight, the additional financial burden from accelerated phosphorus removal will be small and manageable.

Public opinion
The financial incentives offered by CBS Project and raising public awareness will secure wide acceptance and support to the Project.

Lack of interest in partner cities/towns
Raising awareness among public and media will ensure positive publicity and participation of local authorities, and boost their public image.

7. CONTACT INFORMATION

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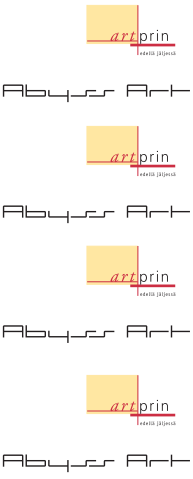

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