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*Nonpoint Source Problems
in Two Gminas in Poland*



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**NONPOINT SOURCE PROBLEMS
IN TWO GMINAS IN POLAND**

LOCAL ENVIRONMENTAL MANAGEMENT (LEM) PROJECT

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PLEASE NOTE

This is a draft, or working report, based on the consolidation and editing of separate reports written by members of the LEM technical assistance teams focused on each of the participating LEM municipalities. The report, in both its English and Polish versions, has been prepared for the LEM Project Workshop to be held on March 21 and 22, 1994 where it, along with the reports from the other participating gmina, will be the main basis for discussion.

Comments, suggestions, and proposed revisions received at the Workshop will then be evaluated and included in the final version of the report. Recommendations for additional technical assistance, training, and modifications in project direction made by the workshop participants may also be included. Moreover, additional information not available at the time that work for the report was completed will also be incorporated into the final version.

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	1 Department of Soil Science and Environment Protection	
	2 Institute of Hydrology and Geoengineering	
	3 Institute of Amelioration and Environment	
	Institute of Meteorology and Water Management	
	Institute for Land Reclamation and Grassland Farming	
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EXECUTIVE SUMMARY

The LEM/NPS team evaluated nonpoint source pollution in Ziębice and Święta Katarzyna through these activities

- 1 reviewing background reports and materials related to Polish NPS (and point source) pollution,
- 2 conducting field visits and meetings,
- 3 performing selected analyses of data to assist in determining relative magnitudes and possible priorities, and to support conclusions and recommendations, and
- 4 developing conclusions and recommendations

We evaluated major categories of NPS pollution agricultural runoff, animal wastes, unsewered/untreated domestic wastes, atmospheric deposition, urban/suburban runoff, and groundwater contamination

Three technical analyses amplify major points in our study The first analysis examines the variability of soils in Święta Katarzyna to emphasize the important role that soil testing can play in NPS pollution control The second analysis begins a nitrogen budget for each gmina The third analysis develops of an institutional strategy for addressing the NPS problems in the two gminas

Conclusions

- 1 Major NPS problems in the two gminas include untreated/unsewered domestic and animal wastes, agricultural pollution, atmospheric deposition, dispersed solid waste (unknown magnitude), and road/automobile pollution (unknown magnitude)
- 2 The concentrated domestic and animal waste problem is critical and should receive very high priority Human disease or disorders, long-lasting groundwater contamination, and surface water pollution are all created by this problem
- 3 The reduction in fertilizer usage that has occurred over the last 10-15 years has probably improved the situation, the previous levels of fertilizer usage appear too high
- 4 Strong evidence of significant heavy metal contamination from atmospheric deposition indicates that it is affecting surface and groundwater quality

- 5 Many resources (organizations and technical capabilities) in Poland, both Polish and American, are able and, most importantly, willing to work on the NPS-related problems
- 6 Święta Katarzyna seems to be under great stress from NPS problems, and the problems could get worse
- 7 Although Ziębice's problems seem less severe and will perhaps be more easily solved than Święta Katarzyna's, they still require serious attention
- 8 The problems with domestic waste contamination of shallow wells together with the general problems gminas are having in getting properly designed waste treatment confirms that the LEM assistance to gminas in wastewater treatment is right on target with their critical needs

Short-range Recommendations for Gmina Governments

Three specific, self-contained, short-range activities should be undertaken by the gmina governments

- 1 Pursue human health evaluations related to water supply problems, primarily from shallow wells,
- 2 Immediately extend efforts and resources for treating concentrated wastes of both animal and domestic wastes,
- 3 Draft and implement regulations on new suburban/urban development, especially in Święta Katarzyna

Long-range Recommendations

- 1 A mechanism, structure, and process should be started for uniting gmina clients and available resources
- 2 Domestic and concentrated animal wastes are a major drinking water concern, so public health agencies should be brought into the picture
- 3 Increased soil testing and consulting frequency is critical and should be supported by central, regional, and gmina funds
- 4 Organizations should improve data access, coordination, and sharing
- 5 The gminas need to develop public education and outreach programs on NPS pollution
- 6 Various regulatory actions, especially related to proper disposal of domestic waste and control of urban/suburban development, need to be instituted
- 7 The U S Agency for International Development, U S Department of Agriculture, U S Environmental Protection Agency, and American universities could provide assistance to universities in enhancing programs on NPS analysis and control

- 8 Requiring nutrient removal at all wastewater treatment plants may not be warranted, especially given the relatively high treatment costs
- 9 Privatization of large State farms can provide leverage in certain NPS control strategies
- 10 These areas need further study
 - a health effects of heavy metals, nitrates, and bacteria in rural water supplies,
 - b atmospheric deposition of pollutants and their fate in land, surface water, and groundwater,
 - c improved basin-wide monitoring, databases and analyses, taking NPS pollution into account explicitly,
 - d detailed soil characterization studies,
 - e further testing and research on hydraulic modifications and bank filter strips as options for nutrient control,
 - f development and provision of simple rainfall/runoff models under Polish conditions for use in implementation of urban/suburban development stormwater management control

Although this study focuses on Ziębice and Święta Katarzyna, these analyses and recommendations apply to other areas of Poland. Because of the nature of nonpoint source pollution problems, officials and organizations on local, regional, basin, and national levels need to be actively involved in their resolution.

1 INTRODUCTION

1.1 LEM Project Overview

Local Environmental Management (LEM) is a project of the United States Agency for International Development (USAID)/Washington based on a contract between Research Triangle Institute (RTI) and the USAID/Europe (EUR) Environmental and Natural Resources (ENR) Division. The contract is for 3 years, beginning in July 1992 and ending in July 1995.

Originally the LEM project began as a USAID effort to coordinate and/or operate through a variety of environmental projects at the subnational/local level throughout most of the countries of Central and Eastern Europe, however, USAID program reconsideration narrowed the project focus. RTI and USAID/EUR/ENR agreed to focus LEM on specific municipal government environmental projects in Poland and Hungary.

RTI undertook preliminary field trips to Poland in September and November 1992, which included members of RTI, USAID/ENR, USAID's Office of Housing and Urban Programs, and the USAID Representative's Office in Poland. These field trips confirmed the need and importance of working with "local" environmental projects as well as the necessity of narrowing the focus to four or five municipalities and establishing a set of criteria for setting both the project focus and the choice of specific municipalities to be included in LEM.

The LEM project purpose in Poland is threefold: (1) to demonstrate the extent to which local governments can effectively manage their environmental problems if given adequate and consistent support, (2) to assist project municipalities, or gminas, in producing reliable and technically acceptable proposals for the funding of environmental projects for presentation to national and international funding agencies, and (3) to make available for use to other municipalities the replicable details as a result of the former two activities. A project subpurpose is to act as liaison by matching municipal requests for technical assistance not supplied by LEM with various USAID-supported projects that may be able to provide information, data, or assistance.

The overall strategy is to implement project activities in a set of five municipalities in Poland, with each activity focusing on specific aspects of wastewater treatment. The five municipalities and their respective populations are:

<u>Municipality</u>	<u>Population</u>
Miedzna	14,500
Swięta Katarzyna	12,000
Ziębice	20,400

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Nowa Sol	43,000
Namysłów	17,000

The LEM project began to focus on nonpoint source (NPS) pollution in the LEM target area after the Director of the Regional Water Management Authority (RWMA) in Wrocław made a specific request for such assistance. One goal of this particular effort, therefore, was to give the RWMA an idea of potential results of point and nonpoint source pollution mitigation strategies, plus an analysis of what additional work needs to be done. To ensure a manageable scope, this study focuses on nonpoint source pollution problems in the two LEM gminas of Ziębice and Święta Katarzyna. Nevertheless, because solving NPS pollution problems requires active involvement and cooperation of organizations at all levels, solutions and activities need to be addressed locally, regionally, and nationally.

1.2 The Nature of Nonpoint Source Pollution

The analysis and mitigation of NPS pollution differ significantly from that of point source pollution problems. Point sources are generally readily identified, direct effects on water quality are frequently clearly visible, and technical solutions, while challenging, are clear and predictable. Thus, most countries, including the United States, address point source pollution problems first.¹

In contrast, NPS pollution is difficult to identify, evaluate, and resolve. Typical nonpoint sources of pollution include agricultural runoff, animal wastes, unsewered domestic wastes, and atmospheric deposition. These sources are then dispersed so they are often difficult to identify. While effects of NPS pollution can often be seen in places like turbid waters or algae blooms, establishing direct cause-effect relationships are difficult. Estimating the magnitudes of NPS problems, not to mention estimating the effects of various control measures, is far more difficult and time-consuming than addressing point source problems.

In spite of all its inherent difficulties, it is, however, critical to address NPS pollution. In the U.S., for example, NPS was determined in 1992 to be the leading cause of nonattainment of uses of surface waters. The solutions are as complex as the problem, requiring efforts from agricultural extension services, local, regional, and national governments, universities and research institutes, and finally, individual citizens themselves.

¹The primary mechanism for water quality improvement in the U.S. is the Clean Water Act, which is well described in "20 Years of the Clean Water Act: Has U.S. Water Quality Improved?" (Knopman, Debra and Smith, Richard, *Environment* Volume 35, No. 1, January/February 1993). Two excerpts from this article highlight the "point source first" syndrome: "Since 1972, taxpayers and the private sector have spent more than \$541 billion on water pollution control, nearly all of it on the 'end of pipe' controls on municipal and industrial discharges" and "A major deficiency in the existing Clean Water Act is the lack of control of nonpoint sources."

1.3 Team Approach

First, the team reviewed background reports and materials related to Polish NPS (and also point source) pollution before leaving the U S. Four reports have been of particular value: the LEM wastewater studies in Ziębice and Święta Katarzyna and two reports on NPS pollution by the Environmental Protection Institute (EPI) in Wrocław with LEM assistance. Chapter 2 summarizes these reviews.

Second, the team conducted many field visits and meetings. The first three visits were with the team's primary clients, the gminas of Ziębice and Święta Katarzyna, and the Regional Water Management Authority (RWMA) in Wrocław. These three visits clarified the desired outcomes of the NPS task as well as provided a significant amount of information concerning NPS problems.

The remaining meetings had two objectives: (1) to collect additional data and information on NPS problems, and (2) to identify organizations and resources that could be useful in developing the project. The next steps include further analyses of NPS problems and, most importantly, identification of resources to help reduce NPS pollution. A discussion of each major NPS problem along with relevant NPS control strategies is contained in Chapter 3.

Third, the team analyzed preliminary data to help determine relative magnitudes and possible priorities as well as to support conclusions and recommendations. These analyses are contained in Chapter 4.

Fourth, the team developed concrete sets of conclusions and recommendations that focus on practical results. We also offer several areas for productive further evaluation and study. Chapter 5 contains conclusions, and Chapter 6 contains recommendations.

Before leaving Poland, the team gave a brief presentation of findings to the Third Plenary on the Odra River held in Wrocław on December 9. Printed copies of the overhead transparencies used in that presentation are included in **Appendix 2**. The team also debriefed with Mr. Andrzej Pećkiewicz, Program Specialist with USAID in Warsaw, and Tim Bondelid gave Mr. Bill Sommers, the LEM Project Manager, a thorough summary of the team's work.

1.4 Team Profile

The nonpoint source technical assistance team consisted of Mr. Tim Bondelid, an environmental engineer specializing in data management and data analysis modeling, and Dr. Maurice Cook, a consultant and professor emeritus in the Department of Soil Science at North Carolina State University.

Mr. Bondelid, a civil engineer on the staff of the Research Triangle Institute, has extensive experience in Eastern Europe working on decision support systems for water quality management, particularly in the Danube River basin. He also has worked many times with US companies on

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nonpoint source issues

Dr Cook has participated extensively in water pollution studies for the U S Department of Agriculture especially examining the impact of agency-sponsored nonpoint source pollution programs He has worked in Poland and other Eastern European countries on several occasions

These two technical experts shared assignments to review data already collected about NPS pollution problems in Poland assess the sources, magnitude and extent of NPS pollution in the LEM target region, identify principal sources and priorities, assess data availability and collection procedures, advise on best management practices, assess training and program implementation needs, and outline a program of action for the RWMA

2 BACKGROUND ON GMINAS ZIĘBICE AND ŚWIĘTA KATARZYNA

2.1 Ziębice

2.1.1 Water Resources

Both surface water and groundwater are important in Ziębice. The majority of this gmina is in the Oława River watershed with a relatively small area in the south draining to the Nysa Kłodzka Watershed.

Analyses of the Oława River reveal significant amounts of pollutants (Table 2.1). The phosphorus concentration in the upper section of the river causes the river to be classified as a Class II stream in terms of purity. At Ziębice the bacteriological contaminations and contents of BOD₅ and COD place the stream in an unclassified category. Classes range from I-V, with I being the most pure.

Table 2.1 Water pollutants in the Oława River, 1991 (Source: R. Korol)

Pollution Indicator	Unit (approx ppm)	Maximum Concentration
BOD ₅	mg O ₂ /dm ³	20.0
Phosphates	mg PO ₄ /dm ³	2.8
COD-Mn	mg O ₂ /dm ³	12.0
Suspended solids	mg/dm ³	75.0
NH ₄ -nitrogen	mg N/dm ³	4.5

Groundwater occurrence and distribution are related to the geology of the gmina. In old crystalline rock areas, such as the regions around Strzelin Hills and the region of the villages of Lubnow and Głęboka, groundwater is confined to the fissures in the hard rock. Here, groundwater is limited in quantity and distributed irregularly in the crystalline rock areas of the gmina.

Groundwater is more abundant throughout the rest of the gmina. In the young geologic sediments and deposits, some of which are covered by loess (a loamy deposit), groundwater abundance tends to increase with depth in the water-bearing layers of the young geologic materials. Although serious

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bacteriological contaminations have been reported for shallow wells, we did not receive any actual data on groundwater and its contamination

2.1.2 Agricultural Considerations

Land use About 80% of Ziębice's total of 22,000 hectares (ha) is used for agriculture. Of the 18,000 ha of arable land, 15,000 ha (83%) are cultivated. Thus, there is a large potential for land application of agrichemicals and soil amendments in crop production. Most of the remaining 3,000 ha or 17%, of the arable land, is grassland. The largest area of grassland is located along the Oława River in a 0.5-1.0 kilometer-wide belt that provides a good buffer for surface runoff of chemicals and sediment.

Sixty-one percent of the arable land is privately owned. About 31% is owned by the State. The remaining 8% is owned by agricultural associations and by collective farmers.

Farm size Private farms are small (Table 2.2). Over 92% of the farms are smaller than 15 ha, and yet the average private farm size in Ziębice is larger than the national average.

Table 2.2 Private farm size in gmina Ziębice and in Poland
(Source: Reports from EPI)

Farm size, hectares	Ziębice	Poland
	--% of farms--	
< 7	50	68
7-15	42	26
> 15	8	6

Soils Detailed soil surveys were not available. Based on general soils information, the agricultural potential of the soils appears to be above average, even high. Over one-half of the soils are in Land Capability Classes I-III. Class I land is optimal for crop production. As the class number increases, the land production potential decreases. The Class III designation is due to soil compaction as a result of the higher clay content of the soil.

EPI reports that the soils are slightly acid to neutral in reaction and that they are high in phosphorus (P), potassium (K), and magnesium (Mg). However, we did not see any actual soil test data. Without detailed soil descriptions, it is very difficult to assess the susceptibility of the soils to leaching and to other processes that affect movement and retention of potential pollutants. Soil characterization is an urgent priority in considering nonpoint source pollution abatement in the gmina.

Crop production Several field crops are grown in Ziębice. The amount of cropland devoted to the various crops is shown in Table 2.3. Cropland in cultivation increased by about 1000 ha in 1993, probably because economic conditions improved. This increase does have negative environmental implications, however, in that more land is subject to disturbance and to the application of agricultural chemicals.

Table 2.3 Cropland use, 1989-1993 (Source: Gmina agricultural records)

Crop	Area, ha				
	1989	1990	1991	1992	1993
Winter wheat	2600	2590	2600	2300	2500
Spring wheat	810	962	1100	1300	1800
Winter barley	70	66	80	150	250
Spring barley	975	992	950	900	950
Cereal blend	250	231	450	600	600
Sugar beets	753	900	737	740	728
Potatoes	600	600	650	700	700
Rapeseed	1040	820	550	500	400

Cereals are the predominant crops grown, covering 70% of the cropland area. Of these, wheat, the main crop, was planted in 47% of the cropland in 1993. The hectareage of winter wheat has remained about the same over the last five years, but the hectareage of spring wheat has doubled over the same period. Seeding of cereal blend has also increased. The "blend" is apparently a mixture of different cereals that provides the grower a hedge against unpredictable weather conditions. Rape hectareage has decreased over 50% the past five years. The amount of other crops grown has remained rather stable in recent years.

Crop yields are shown in Table 2.4. Data are not available yet for 1993. In general, crop yields have decreased since 1990, primarily because of inadequate rainfall. A contributing factor may be reduced amounts of fertilizer used, a consequence of higher fertilizer costs. A study of the nutrient status of soils used for cropland and the nutrient requirements of crops would be useful. Growers may apply more fertilizer to their crops when they have the money to do so, however, increased applications may be unnecessary or even harmful to the water.

Fertilizer use Due to increased cost of fertilizer materials, the amount of nitrogen, phosphorus, and potassium applied has decreased in the last 15 years (Table 2.5).

Table 2 4 Crop yields, 1989-1992 (Source Gmina agricultural records)

Crop	Yield, quintals/ha			
	1989	1990	1991	1992
Winter wheat	42	45	42	37
Spring wheat	38	40	39	30
Winter barley	43	40	40	32
Spring barley	34	42	36	24
Cereal blend	38	38	36	25
Sugar beets	320	280	290	220
Potatoes	175	160	180	120
Rapeseed	24	21	21	18

Table 2 5 Fertilizer use in 1993 compared to fertilizer use fifteen years ago (Source Personal communication, gmina agricultural representative)

Fertilizer element	Annual use (kg/ha)	
	1993	1978 (approx)
Nitrogen (N)	50	100
Phosphorus (P ₂ O ₅)	30	60
Potassium (K ₂ O)	40	80

The reduction in fertilizer usage presents an excellent opportunity to assess the appropriate levels of fertilizer recommendations for both agricultural production and environmental protection. This point is expanded on in Chapter 4. The current application rates appear to be adequate for sustained crop production of the cereals. The current rates of nitrogen, phosphorus, and potassium approximate the uptake of these nutrients by cereals grown in the gmina (Table 2 6).

Pesticide use Data on use of herbicides, insecticides, and fungicides were not available. Several personal communications indicated that economic constraints caused a decrease in use similar to that

Table 2 6 Annual uptake of N, P, and K by selected crops for average yield
(Source Gmina agricultural records)

Crop	Annual nutrient uptake (kg/ha)		
	N	P ₂ O ₅	K ₂ O
Rye	50	30	60
Potatoes	90	40	100
Sugar beets	100	60	150

observed in fertilizer use. We were also advised that seed treatment is the preferred method of insect and disease control. This method has negative water quality implications in that active chemical ingredients are concentrated in the root zone and are subject to leaching to the ground water. Another high priority item for data collection by the gmina is pesticide usage, i.e., kinds, application rates, and application methods.

Soil erosion Soil erosion, both by water and by wind, does not appear to be a major problem in the gmina due to the generally flat landscape, low rainfall, and wide grassland strips along the Oława River. Localized areas, however, suffer soil loss and significant consequences associated with it. Sediment (eroded soil) impedes stream flow, clogs streams, and damages the aquatic habitat. Furthermore, erosion is the primary means of phosphorus loss to surface water since phosphorus is confined to the top few centimeters of soil and is, thus, carried away when the surface soil is removed.

Livestock Animal production, mainly cattle and pigs, is secondary to crop production in Ziębice. The number of livestock by categories is shown in **Table 2 7**. In 1993, 83% of the cattle and 73% of the swine were raised on private farms.

Although the numbers of livestock are not high, the quantities of waste generated by the livestock are significant enough to warrant attention in a water quality program, which is more fully discussed in Chapter 3. Animal wastes are high in nitrogen. In several concentrated livestock operations, mainly in the southern part of Ziębice, animal waste management is an important consideration for water quality.

2 1 3 Other Nonpoint Pollutants

Domestic wastes, especially household septage, appear to be a major problem in the gmina.

The proximity of Ziębice to the industrial region of southern Poland suggests that atmospheric

Table 2 7 Numbers of livestock on private farms in gmina Ziębice, 1987-1993
(Source Gmina agricultural records)

Type of livestock	1987	1988	1989	1990	1991	1992	1993
	number						
All cattle	5513	5295	5250	4800	4000	3500	3300
---cows only	2308	2150	2150	2000	1500	1500	1500
All swine	8752	9358	8000	7000	7500	7500	8000
---sows only	971	1039	900	700	600	700	800
All sheep	2443	1629	1200	1000	700	500	300
Horses	371	319	250	250	150	150	160

deposition is possible. Also surface runoff from highway and rail transportation is likely to contain nitrogenous components that can move in and through the soil.

2.2 Święta Katarzyna

2.2.1 Water Resources

Both surface water and groundwater are important in Święta Katarzyna. All of the gmina is in the Oława River watershed, the river is a Class II stream (Classes range from I-V, with I being the most pure). Two tributaries, the Brochowka and Szalona, appear to be especially polluted by point discharges of sewage. Unfortunately, no specific data were available.

Groundwater ranges from 0.25 m to 2.5 m depth below the land surface. The average depth is 0.5 m, which means the groundwater is highly vulnerable to pollution. The total volume of groundwater in Święta Katarzyna is estimated to be 357 m³/h.

2.2.2 Agricultural Considerations

Land use Święta Katarzyna contains almost 10,000 ha. Sixty-seven percent of the land is arable and used for agriculture. Eighty-one percent, or 5,400 ha, of the arable land, is cultivated.

Fifty-seven percent of the arable land is privately owned while about 37% is owned by the State, the remaining 6% is collective farms.

Farm size Most private farms in Święta Katarzyna are smaller than 15 ha, which is smaller than the national average. Private farms are small (Table 2 8). About 97% of the farms are <15 ha. The private farm size is smaller than the national average.

Table 2 8 Size of private farms in Święta Katarzyna

Farm size, ha	Swieta Katarzyna	Poland
	---%---	
0-7	84	68
7-15	13	26
> 15	3	6

Soils Although detailed soil surveys were not available, the agricultural potential of the soils appears to be high. Over 70% of the soils are in Land Capability Class I-III, with Class I being optimal for crop production. (As the class number increases, the land's production potential decreases.) The potential for soil compaction is the cause for the Class III designation. Without detailed soils descriptions, it is very difficult to assess the susceptibility of the soils to leaching and to other processes that affect movement and retention of pollutants. As in Ziębice, characterizing soil is a critical prerequisite to determining NPS pollution solutions.

Several soil chemical analyses have been conducted to assess the soil fertility status. A summary of selected analyses and a discussion of them is presented in Chapter 4.

Crop production Cereal grains are produced on over one-half of the cultivated land. Wheat is the major grain crop, grown on about 80% of the land planted to cereal grains. Row crops, such as corn and potatoes, are planted on 15% of the cultivated land.

Greenhouse operations are a distinctive feature in Święta Katarzyna. In Siechnice and Lukazowice, greenhouses occupy almost 28 ha of land on State and collective farms. A significant number of private greenhouses are also operated within the gmina.

Yield data for field and greenhouse crops were not available.

Fertilizer use Specific data on amounts of fertilizer applied to various crops were not available. Applications of nitrogen, phosphorus, and potassium fertilizers have recently decreased because fertilizer materials cost more. In the 1980s, the average annual application of nitrogen, phosphorus, and potassium exceeded 300 kg/ha. In 1991-92, the amount was slightly over 200 kg/ha. The decrease was even greater on private farms than on State farms.

Chapter 2 Background on Gminas Ziębice and Święta Katarzyna

This reduction in fertilizer usage presents an excellent opportunity to assess the appropriate levels of fertilizer recommendations for both agricultural production and environmental protection. The reduced fertilizer usage may be adequate for sustainable crop production. This point is expanded on in Chapter 4.

Pesticide use Because pesticides cost more now, growers are not applying them as frequently as they recently did (personal communications). Data on specific pesticides used, the quantities, rates, and methods of application were not available. The collection of such data should be a high priority.

Soil erosion Soil erosion, either by water or by wind, does not appear to be a major problem in Święta Katarzyna, the landscape is flat, rainfall is low, and grasslands adjacent to the Oława River serve as excellent filter strips for any eroded materials.

As State farms are privatized, care should be taken to preserve the grassland buffer strips along the Oława River so that soil erosion will not become a problem.

Livestock Animal production, principally cattle and pigs, is secondary to crop production in Święta Katarzyna. On several large livestock operations on State and collective farms in Blizanowice, Smardzow, and Siechnice, livestock numbers exceed 1,000 head.

Animal waste management, particularly with the large operations, is critical to water quality. We observed one swine farm where 30,000 liters/day of liquid effluent is applied over the ground. Careful calculations need to be made on nutrient loading rates to assure that excessive amounts of nitrogen are not being applied, thus posing a threat to groundwater.

2.2.3 Other Nonpoint Pollutants

As the city of Wrocław grows, NPS pollution is beginning to threaten its water quality. For example, domestic waste, especially septage from business and private homes, is a major concern.

Atmospheric deposition of chromium from the smelting works at Siechnice is a special concern. Although the works are closed, chromium is present in a 0.5 km radius from the plant.

2.3 Comparison of the Gminas

Although Ziębice and Święta Katarzyna are similar in several ways, important differences will enable us to address a range of NPS pollution issues. The total program that evolves will serve as a model on NPS measures for other gminas, voivodships, and regions.

Here are some similarities between Ziębice and Święta Katarzyna:

- the Oława River is the prominent river in both gminas,
- landscapes and soils in the alluvial valleys have similar characteristics,

- pollution of shallow wells is significant,
- wheat is the major crop, and
- livestock production is secondary to crop production

Here are some differences between Ziębice and Święta Katarzyna

- Ziębice (222.5 km²) is twice as large as Święta Katarzyna (98.6 km²),
- population in Ziębice (20,400) is almost twice the size of Święta Katarzyna's population (11,800),
- farm size is larger in Ziębice,
- landscapes are flatter in Święta Katarzyna, so there's less surface runoff and erosion than in Ziębice,
- Święta Katarzyna is urbanizing more rapidly, so non-agricultural pollutants are more significant, and
- atmospheric deposition of chromium is present in Święta Katarzyna

3 NPS PROBLEM EVALUATION

The evaluation of NPS problems in Ziębice and Święta Katarzyna is based on a wide variety of information sources. These sources include the background reports by Institute of Environmental Protection (IEP), field visits to each gmina, the start-up meeting at Regional Water Management Authority (RWMA), and meetings with the following organizations

- Wrocław Agricultural Advisory Service (ODR)
- Institute of Environmental Protection (IEP) in Wrocław
- Agricultural University of Wrocław (AUW)
 - Institute of Soil Science and Agricultural Environment Protection
 - Institute of Hydrology and Geoengineering
 - Institute of Amelioration and Environment
- Institute of Meteorology and Water Management (IMWM)
- Institute for Land Reclamation and Grassland Farming (IMUZ)
- U S Department of Agriculture/Poland Agricultural Extension Cooperative
- U S Environmental Protection Agency Region VII
- Volunteers in Overseas Cooperative Assistance (VOCA)

Details of these meetings are presented in **Appendix 3**

One concern in our work, a concern shared by many of the people with whom we met, is the lack of coordination of and access to data. We had very little analytical data to work with. All of the organizations either have valuable data or know where it is, but access to and use of the data, especially integrated use across organizations, is a significant problem. Despite the lack of analytical data, we are confident in our evaluations because, in our considered judgment, the sources mentioned above are universally highly qualified and competent. Primary sources of data include ODRs, EPI, AUW, IMWM, and the voivodship offices.

The evaluations are organized by major category, such as "agricultural runoff". For each category, we describe the general nature of the possible problems and discuss general solutions. Then, we evaluate the magnitude and extent of the problem in each gmina.

Technical assistance to the gminas U S Department of Agriculture is potentially available from several sources, especially the ODRs (with cooperation from USDA), IMUZ (with cooperation from U S Environmental Protection Agency), and AUW.

Appendix 3 provides more information on how these organizations can help.

3 1 Agricultural Runoff

3 1 1 Problem

Agricultural fields can be a major source of surface and groundwater pollution because (1) cultivation increases erosion potential and can increase surface runoff volumes, and (2) fertilizers and pesticides can get into the waters through adhering to sediments and/or by dissolving in the water. Agriculture is the dominant land use in Ziębice and Święta Katarzyna, so a small per-hectare contribution of pollution can become a major factor in the total pollution problem.

The pollution potential for agricultural fields is determined by a combination of natural factors and farm practices. Natural factors that affect the pollution potential of agricultural runoff are soil type, slope, rainfall pattern, and wind patterns. Loose soils, steep slopes, intense rainfalls, and high winds increase pollution potential. Soil and crop management practices can greatly mitigate these effects through "Best Management Practices (BMPs)". BMPs include cultivation across the slope contour, use of cover crops between plantings, controlled, conservative use of fertilizers and pesticides, and use of vegetative filter strips along stream banks.

Implementing BMPs requires a concerted coordinated effort. An infrastructure needs to be in place to provide grower education and training, regular soil testing (see Section 4 1), demonstration and testing fields, development of improved cropping practices, and financial incentives as needed. Fortunately, many BMPs can be related directly to the farmer's "pocketbook" when erosion occurs, the productivity and value of the land drop, fertilizer runoff is almost literally "money down the drain". Demonstration fields showing the benefits of improved cropping practices can help convince skeptical growers of the value and benefit of BMPs.

3 1 2 Gmina Evaluation

Ziębice and Święta Katarzyna are blessed with natural conditions that mitigate agricultural runoff problems: mild slopes (higher in Ziębice than Święta Katarzyna), good soils, gentle rains, and mild winds. These natural conditions combined with lower fertilizer application rates indicate that agricultural runoff is not a major problem at this time. However, action is needed now to prevent a problem in the future. A major concern is that farmers will unnecessarily increase fertilizer use as economic conditions improve. A complicating factor is the small farm size, which reduces BMP implementation options: increases the number of farms that need to be addressed, many growers need technical training and assistance.

3.2 Animal Wastes

3 2 1 Problem

Animal wastes (manure and urine) contain high levels of nitrogen and phosphorous. For instance, uncovered manure on the ground can be a significant source of ground- and surface water pollution.

rain will wash the nutrients out, and they will either seep into shallow groundwater or run off into a stream. The problem can be NPS, such as cows roaming in fields and in streams, or it can be a point source problem, such as concentrated animal operations. The problem can shift from point to nonpoint, or vice-versa. For instance, if a concentrated animal operation collects the waste, the problem is point source, then if the operation spreads the waste on fields, it becomes an NPS problem.

Two key points to consider in the animal waste problem are (1) the process of feeding crops to animals results in a concentration of potential pollution, and (2) the total pollution potential of livestock can easily exceed the human waste potential. For instance, the waste from one cow equals the waste of about 12 people. Thus, the concentration of waste can increase the severity of the pollution problem because the waste can enter rivers and streams in a more concentrated form. Moreover, the wastes tend to be closer to people's homes, causing more severe effects on shallow groundwaters in villages and the nearby surface waters. The nitrogen budget analysis in Section 4.2 highlights the concentration problem.

Accepted BMPs for animal wastes include storing manure on covered concrete pads or properly applying manures on fields as fertilizer.

3.2.2 Gmina Evaluation

The nitrogen budget in Section 4.2 shows that in Ziębice the animal waste problem is potentially 3.5 times greater than the human waste problem. In Święta Katarzyna, the quantity of the animal and human wastes is approximately equal. These numbers show clearly how important it is for the gminas to address the animal waste problem. Focusing only on the domestic waste problems would still leave major potential pollution problems.

Indirect evidence of the animal waste problem manifests itself in the high concentrations of nitrogen in shallow wells in villages, we believe that animal wastes are a major source of this problem along with the unsewered/untreated domestic wastes. We are also concerned about the proper application of liquid manures on fields in Ziębice, the application rates should be carefully examined with assistance from the ODR in Wrocław and/or experts from the AUW.

U.S. Environmental Protection Agency Region VII, in cooperation with IMUZ, has set up demonstration projects in northern Poland that are targeted specifically at BMPs for manure storage. Information from this project could be valuable to the gmina governments.

3.3 Unsewered/Untreated Domestic Wastes

3.3.1 Problem

Unsewered domestic wastes are an NPS problem because they are dispersed pollution coming from each household. The problem is similar to the problems of animal wastes, with additional health

C Chapter 3 NPS Problem Evaluation

concerns from bacteria, viruses, and other pathogens. There are four basic options to treat domestic waste safely:

- 1 **Install sewers connected to a wastewater treatment plant.** This classic sanitary engineering solution is being pursued in both gminas with the LEM project actively providing assistance. Costs are a major limiting factor, however, especially for small villages or villages that are far from the treatment plant.
- 2 **Install small village sewer systems that go to a common drain field.** We see this as an excellent, cost-effective alternative. The WODR is providing assistance to several villages in setting up these systems; the gminas should contact their appropriate ODR main office to obtain information, advice, and financial support for villages where option number 1 is not feasible.
- 3 **Install closed septic tanks that are periodically pumped out and the waste transported by truck to a treatment plant.** This option has been tried in both Gminas, with very little success. In our opinion, it is unrealistic because of the problems with ensuring regular pumping and proper disposal of the wastes. Relying on all or most individual households to perform this task on their own is highly problematic, especially given the tough economic conditions. The administrative costs and enforcement responsibilities are mammoth for this option to work.
- 4 **Install open septic systems with a drain field that filters and treats the waste.** For this option to work, there needs to be enough land for the drain field; our understanding is that most lot sizes in the gminas are too small to support open septic systems.

3.3.2 Gmina Evaluation

Unsewered/untreated domestic wastes are a major problem in both gminas, especially in Święta Katarzyna where only 2,000 out of 12,000 people have proper waste disposal. In contrast, more than half of the population in Ziębice is sewerred. The problem in Święta Katarzyna could easily worsen because of the population growth expected soon.

Święta Katarzyna needs to immediately enact and enforce regulations requiring proper waste disposal for any new housing. These regulations could, in the short term, cause some political and financial problems because they will make construction more expensive. Unless legislation is enacted soon, however, pollution problems will render the gmina an unappealing place to live. The legislation could permit options 1, 2, or 4 depending on the situation. Option 3 should not in any case be permitted because of the continuing enforcement burden it would place on the gmina administration. LEM could help the gminas locate expert assistance for writing and administering the legislation.

3.4 Atmospheric Deposition

3.4.1 Problem

Atmospheric deposition of pollution has been increasingly recognized as a major NPS component. Problems include acid rain, nitrogen in rainwater, and heavy metals from industrial operations. Sources can be local, such as local industries, automobiles, and homes heating with wood or coal. The sources can also be regional, such as many large industrial emissions that enter upper levels of the atmosphere, only to come down later. One unfortunate solution to local air pollution has been to build tall smokestacks, which only shifts the problem from local to regional.

Most solutions require national-level action, such as setting automobile exhaust limits and industrial emission standards. It is important to recognize the atmospheric effects at the local level in order to get a complete picture of the gmina pollution problems.

3.4.2 Gmina Evaluation

The nitrogen budget in Section 4.2 shows that rainwater is a significant source of nitrogen in Ziębice and Święta Katarzyna, this source needs to be recognized in any nutrient control strategies undertaken by the gminas. The copper smelter in Święta Katarzyna caused significant local problems, but it is now closed. We suspect, but cannot confirm, three other possible atmospheric NPS problems: (1) heavy metal deposition from the mining industries in southern Silesia, (2) automobile exhausts, especially lead, and (3) local problems from the heavy reliance on coal for home heating. We encourage further research into these problems.

3.5 Urban/Suburban Runoff

3.5.1 Problem

The process of changing from a rural area to an urban or suburban area impacts the hydrology (rainfall/runoff characteristics) and the nature of the NPS pollution problems. The hydrology changes because more area is impervious, water runs off of roofs, streets, and parking lots instead of being absorbed into the ground. This increased runoff picks up pollution, such as street litter, dirt, road particles, and automobile residues. The increased flows can scour drainage channels and increase flooding.

Solutions to urban runoff are extremely difficult to implement after the problem occurs, ideally, the solutions should ideally be implemented as the cities grow. Urban NPS pollution in established U.S. cities is a major problem. Many newer developments have fared much better because they have been required to install stormwater management (SWM) controls as a condition for development. One prime example is that most new, large developments in the U.S. "feature" a beautiful, manmade lake in their plans. These lakes are not included because of the developer's love of aesthetics, rather, the lakes are included to meet local or state SWM regulations because they control flooding and greatly

Chapter 3 NPS Problem Evaluation

reduce NPS pollution problems. Smaller SWM basins are common in smaller developments. SWM is an important issue in urban/suburban growth and needs to be included as an integral component in land use planning, zoning, and construction.

3.5.2 Gmina Evaluation

Urban/suburban runoff does not appear to be a significant issue for Ziębice, especially compared to the other NPS problems such as animal and domestic wastes.

The problem, however, is very important for Święta Katarzyna right now, officials expect 600 ha to convert from rural to residential soon. This gmina currently relies on an old German drainage system that could be easily overloaded with significant growth. Three areas of assistance are required: (1) help in drafting the SWM regulations in new developments, (2) technical help in establishing the hydrologic methods to be used in designing SWM controls, and, (3) assistance in setting up the administrative structure for enforcing the regulations. LEM could perhaps help locate resources for the first and third areas, and the Agricultural University of Wrocław has the technical expertise needed for the second area.

3.6 Groundwater Contamination

3.6.1 Problem

After pollution enters the groundwater (either from point or nonpoint sources), it can then be considered an NPS of pollution. The polluted groundwater can flow into rivers and lakes, migrate to other areas, and pollute other groundwater layers. Once pollution enters the groundwater, it is there for a very long time, groundwater moves very slowly, maybe only centimeters in a year. Groundwater cannot practicably be removed and can be effectively controlled in only very limited site-specific situations. Their long-term nature is why groundwater contamination problems should be given very high priority.

3.6.2 Gmina Evaluation

Contamination of shallow groundwater, especially by nitrogen, is alarmingly prevalent in both gminas. The problem is serious because most villages rely on shallow wells for drinking water. We strongly suspect significant health problems exist because of this contamination, but we could not locate any data. Lack of data is a serious concern, and we strongly recommend that both gminas

interview local doctors and health clinics ² LEM could be useful in locating and providing literature on the health effects of contaminated wells

One solution in both gminas to the drinking water problem has been to build water supply systems to villages. The lack of wastewater disposal systems, however, has meant that this solution has exacerbated the domestic NPS problem. Another solution is to drill deeper wells to uncontaminated aquifers. The causes of the contamination must be addressed as officials consider the deeper wells, or the pollution will be drawn into these deeper aquifers. We believe that the concentrated animal wastes and the untreated/unsewered domestic wastes are the major NPS problems in Ziębice and Święta Katarzyna.

²Many studies link high nitrate content in water supplies with methemoglobinemia ("blue baby syndrome"). The following abstract states the problem very clearly:

The contamination of groundwater and rural drinking water supplies by nitrates from livestock and human excrement, other organic waste, or chemical fertilizers is a potential hazard throughout the world. Infant illness and death from nitrate-induced methemoglobinemia is probably often misdiagnosed, perhaps as sudden infant death syndrome, and certainly contributes to the national infant death rate statistics. A 1950 report listed 144 cases of infant methemoglobinemia with 14 deaths in one 30-month period in Minnesota. Infant deaths resulting from misdiagnosis of this preventable, treatable intoxication were still occurring as recently as 1986 in South Dakota. In this state, about 39% of dug or bored wells were unsafe due to high nitrate content, compared with 22% of drilled wells and 16% of driven wells. Properly constructed wells more than 30 m deep are more likely to be safe. Groundwater concentrations of nitrate may be unsafe for consumption, and standards are needed to regulate such contamination. Such standards could serve as guidelines and could be enforceable in the case of water systems dependent on wells. (From Johnson, C J and B C Kross, "Continuing Importance of Nitrate Contamination of Groundwater and Wells in Rural Areas," Department of Preventive Medicine and Environmental Health, University of Iowa, Iowa City)

4 SELECTED ANALYSES

The following analyses amplify major points in our study. The first analysis examines the variability of soils in Święta Katarzyna to emphasize the important roles of soil testing in NPS control. We did not analyze soils Ziębice, data was not available, but the results would have been similar and are not necessary to illustrate the point.

The second analysis begins a nitrogen budget for each gmina. The budgets are incomplete but do provide a strong basis for our conclusions concerning the significance of the concentrated animal and domestic wastes in each gmina.

The third analysis is our development of an institutional strategy for addressing the NPS problems in Ziębice and Święta Katarzyna. These problems need the help, cooperation, and coordination of many organizations, this strategy can help prepare the gminas for action.

4.1 Soil Variability in Święta Katarzyna: the Importance of Regular Soil Testing

The nutrient status of the soils in Święta Katarzyna is highly variable. Over two-thirds of the soils are rated medium to very high in available phosphorus, an important element in environmental considerations. Phosphorus contents, range widely, however. Eighty-six percent of the soils in Ozorzyce District test very high whereas only 3% of the soils in Katowice and Lukaszowice test very high.

Potassium and magnesium have little or no environmental implications, but they are very important for plant growth. The soil levels and ranges are listed in **Table 4.1** to demonstrate the high variability within the gmina. They reflect the need for a careful, regular soil testing program throughout the gmina in order to recommend appropriate fertilizer levels to achieve economically efficient crop production.

The fact that almost one-half of the soils in the gmina are very strongly acid ($\text{pH} < 4.5$) has significant ramifications regarding the availability of phosphorus. Phosphorus is unavailable in low pH systems due to precipitation with iron and aluminum. This process is called phosphorus fixation. As the pH is increased, the iron and aluminum become less soluble and fixation is reduced. Thus, the amount of available phosphorus increases. Although the phosphorus fixation process is desirable environmentally, it is undesirable for agricultural production. Most soils at pH 4.5 or less need lime (CaCO_3) to reduce acidity and promote plant growth. Liming increases the pH and, thus, it increases phosphorus availability. This interaction of soil acidity and phosphorus availability reinforces the need for a good soil testing program to monitor phosphorus levels that may change as soils are limed.

Table 4 1 Soil fertility status in gmna Święta Katarzyna

	-----% of soils-----				
	very high	high	medium	low	very low
Phosphorus					
Average	31	24	23	15	7
Range	3-86	0-62	6-43	0-37	0-55
Potassium					
Average	35	16	29	13	7
Range	0-76	3-25	6-46	0-46	0-45
Magnesium					
Average	32	25	30	9	4
Range	0-100	0-87	0-65	0-23	0-11
	v strongly acid	strongly acid	moderately acid	slightly acid	neutral/basic
Acidity					
Average	42	19	10	12	17
Range	0-78	3-33	0-22	2-30	0-54

and their pH values change. Changes in pH and, hence, phosphorus availability, occur slowly with liming. For example, liming is recommended only once every three to five years.

These general comments stress the importance of nutrient management in water quality evaluation. The comments should not be interpreted as a universal recommendation for fertilization and liming of soils in the gmna. Certain soils undoubtedly are not suited for agriculture and, thus, their nutrient values bias the percentages listed in **Table 4 1**. For example, many soils in Kotowice are very strongly acid and very low in phosphorus. Such soils probably should be omitted in estimating nutrient requirements for agricultural land in the gmna.

The wide diversity of nutrient levels in the soils indicates a strong need for soil testing and fertility evaluation in the gmna. Annual testing should be completed on those farms where phosphorus

contamination of surface water and/or ground water is likely. Testing may be done less frequently, approximately every two years, where the risk of water contamination is less likely.

4.2 NPS Loads: Preliminary Nitrogen Budgets for Ziębice and Święta Katarzyna

Nutrient budgeting is similar to financial accounting except it tracks nutrients (nitrogen in this case) instead of money. The budget estimates inputs, transfers within the area (gmina), and outputs. The nitrogen (N) budgets in this analysis are incomplete, but enough of the important processes are included to show some significant results. Completion of the budgets, or at least some of the remaining critical portions, could help guide action and policy regarding nutrient reduction programs.

4.2.1 The Nitrogen Cycle on a Gmina Level

Figure 4.1 shows a schematic of the overall nitrogen (N) cycle on a gmina level. N enters the gmina from three sources: (1) fertilizer application, (2) rain deposition, and (3) "other" sources that include N from N-fixing plants such as legumes, runoff from outside the gmina, and so on. N can then remain on the land, be absorbed by crops, be converted into domestic and animal wastes (manure and urine), or leave the gmina via food shipped out or surface runoff. An important N repository is the groundwater, which is where the N generally stays in the gmina. N can be recycled through land application of animal wastes or crop residues. N pollution occurs when the N goes to the surface or groundwaters.

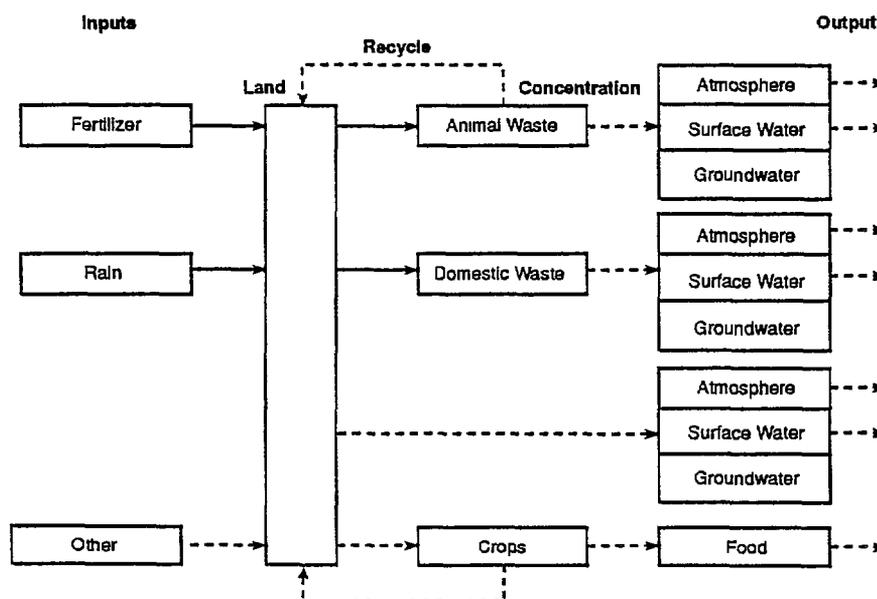


Figure 4.1 Gmina-level nitrogen level

Chapter 4 Selected Analyses

4 2 2 Nitrogen Loading Rates

In **Figure 4 1** the solid lines indicate the parts of the cycle for which we have estimates in the two gminas. These estimates are generated using loading rates, such as kg of N per ha applied as fertilizer. See **Table 4 2** for the N loading rates in Ziębice, see **Table 4 3** for the N loading rates in Święta Katarzyna. The animal and human waste loading rates came from values from various U S literature that should apply in Poland. The fertilizer application rates came from the interviews with gmina officials. The rain deposition loading rate came from our interview with Dr. Sapek. The size values (ha, populations, number of animals) came from the IEP reports commissioned by LEM.

Table 4 2 Nitrogen loading rates in Ziębice

Source	Size	Unit Loading Rate	Annual Load (1000 kg/yr)
1 Input to Gmina			
a Fertilizer	17,765 (ha ag)	50 (kg/ha/yr)	888
b Rain Deposition	22,500 (ha tot)	15-20 (kg/ha/yr)	338-450
c Other	NA		NA
Total Input			1226-1338
2 Human Wastes			
	(Pop)	(kg/cap/yr)	
Sewered	11,606	3 318-5 475	39-64
Unsewered	8,760	3 318-5 475	29-48
Total	20,366		68-112
3 Animal Wastes			
a Hogs	11,000	9 19-14 51	101-160
b Cattle	4,000	34 44-64 88	138-260
c Poultry	NA		NA
Total Animal Waste			239-420

4 2 3 Discussion

In the cases of Ziębice and Święta Katarzyna, we believe the "other" sources are relatively insignificant. Under "Fertilizer," poultry animal wastes may be significant and should be readily

Table 4 3 Nitrogen loading rates in Święta Katarzyna

Source	Size	Unit Loading Rate	Annual Load (1000 kg/yr)
1 Input to Gmina			
a Fertilizer	6,663 (ha ag)	60 (kg/ha/yr)	400
b Rain Deposition	9,857 (ha tot)	15-20 (kg/ha/yr)	148-197
c Other	NA		NA
Total Input			548-597
2 Human Wastes			
	(Pop)	(kg/cap/yr)	
Sewered	2,000	3 318-5 475	7-11
Unsewered	10,000	3 318-5 475	33-54
Total	12,000		40-66
3 Animal Wastes			
a Hogs	1,800	9 19-14 51	17-26
b Cattle	490	34 44-64 88	17-32
c Poultry	NA		NA
Total Animal Waste			34-58

obtainable from estimates of number of chickens in the gmina. The N content of "outputs" is appropriately significant, values for this category can be derived from crop and animal sales. N volatilized as ammonia from urine is probably significant. The N entering the groundwater and surface water are the critical values in measuring N pollution. The completion of the N budgets, combined with analysis of stream and groundwater monitoring data, can lead to fairly accurate estimates of the true N pollution. Also, these analyses can be used to formulate priorities for N control strategies.

In both gminas roughly 70% of the N input comes from fertilizer application and 30% from rainwater. Fertilizer application rates seem reasonable right now, they are about one-half of rates last decade. The rainwater could be a significant source of N in groundwater and surface runoff in wet periods and always when falling on surface water itself. Further, there is a possibility of over-

fertilizing if the rainwater contribution is not accounted for

Of concern is the amount of N being concentrated in human and animal wastes. In Ziębice, approximately 30% of the N entering the gmina is converted into concentrated wastes. In Święta Katarzyna, approximately 17% is concentrated. These wastes are a significant potential source of pollution; they tend to be concentrated where people live and are clearly the reason for high nitrate levels in the shallow wells in villages, nitrate levels in shallow groundwater outside of the villages tend to be significantly lower.

Of further interest are the proportions of concentrated N wastes in human versus animal wastes. In Ziębice, roughly 70% of the concentrated waste is animal manure. In Święta Katarzyna, it is split about evenly between animal and human wastes. Thus, focusing only on domestic wastes will account for only 30% to 50% of the concentrated N sources that are of high pollution potential, clearly, efforts must also focus on animal wastes.

4.3 An Institutional Strategy for Addressing NPS Pollution in the Odra River Basin

Nonpoint source pollution needs to be included as part of the total water management strategy in the Odra River Basin. Accomplishing this objective requires the involvement of numerous agencies because of the complexity of nonpoint source pollution. A proposed organizational scheme for addressing nonpoint pollution is shown in **Figure 4.2**.

The management entity would include five people who represent significant agricultural and environmental interests; their job would be to establish policy and oversee its implementation. The RWMA would assume leadership of the management entity since its mission would be to develop and administer the total water management program in the region. Other members would include 1) the Agricultural University of Wrocław, which has a fundamental mission of educating agricultural specialists, 2) the Voivodship Center for Agricultural Consulting, the primary source of agricultural information for farmers and agricultural consultants, and 3) the Institute of Environmental Protection, the agency responsible for conducting research and investigations on the protection of water resources.

A technical steering committee of 10-12 people would develop and implement specific Best Management Practices (BMPs) for controlling NPS pollution. This committee would consist of representatives from agencies that have the capability to provide technical assistance. Leadership of the technical steering committee would be designated by the management entity.

4.4 Recommendations

We recommend that a catchment (watershed) agricultural program be executed to demonstrate the positive impacts of proper agricultural management practices on water quality. To be successful, such a program would require 1) financial assistance, 2) technical assistance, 3) education of

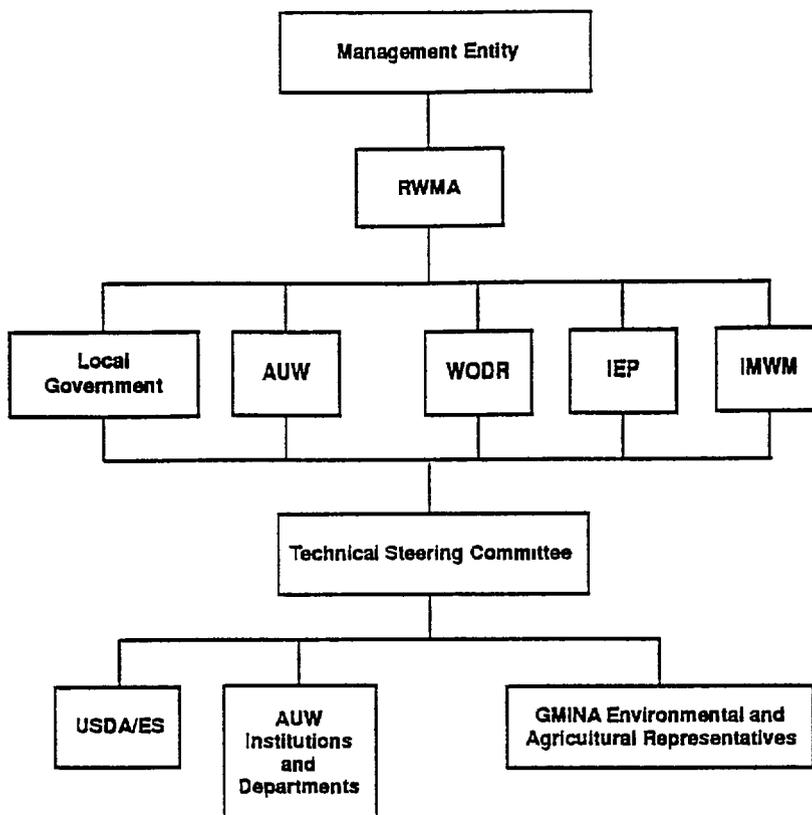


Figure 4 2 Organization for controlling nonpoint source pollution in selected catchments of the Odra River Basin

growers, and 4) evaluation. These functions and the agencies responsible for them are shown in Figure 4 3.

Financial assistance would be provided as indirect benefits rather than direct payments. Tax incentives, such as lower assessments and/or lower tax rates for cooperators in the catchment area, may be provided by the gmina. The gmina may also assist with cost-sharing. For example, the gmina could purchase the necessary supplies and equipment, and the grower could provide the labor for installation and application. U.S. Department of Agriculture-Extension Service will be asked to provide an agronomy specialist through the Polish/American Extension Project.

Organizations providing technical assistance would address critical, overarching needs such as soil characterization, soil analysis and recommendations, fertilizer technology, nutrient management, pesticide technology, pesticide management, tillage practices, livestock management, and water management.

The aim of the education emphasis is to heighten public and grower awareness of the NPS pollution issue and to inform growers of BMPs and their implementation. These objectives would be

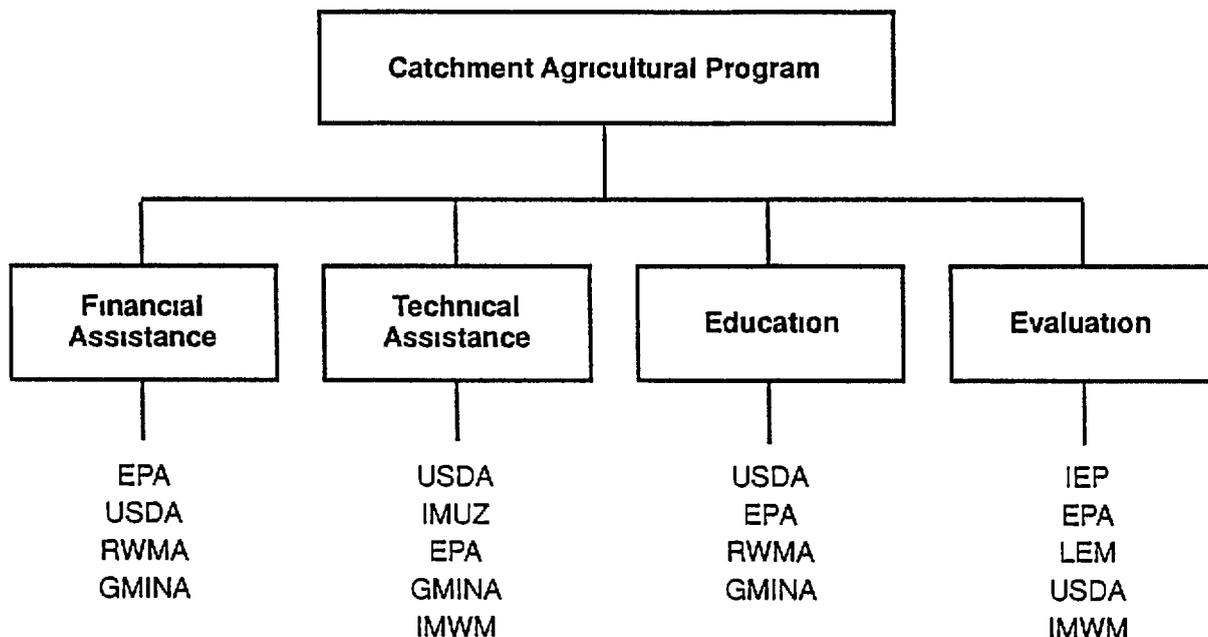


Figure 4.3 Component functions and agencies in catchment agricultural program

accomplished through brochures, news releases, videotapes, grower meetings, agricultural advisor groups, agribusiness groups, agricultural supply dealers, agriculture teachers, and on-farm tests

Ongoing evaluation would be essential to the program's success. Its technical components include surface and groundwater monitoring, implementation of BMPs, and data management. Its non-technical components include surveys of producer behavior regarding water quality and their adoption of BMPs, and assessment of changes in public awareness of water quality problems, especially as they relate to agriculture.

5 CONCLUSIONS

These conclusions are based on the data and analyses throughout this report as well as the Best Professional Judgment of the LEM NPS Team. A consistent theme has emerged from our investigations and analyses and is reinforced and corroborated consistently from all of the reports, data, and experts.

- 1 The major NPS problems in Ziębice and Święta Katarzyna are the same although they differ in magnitude
 - untreated/unsewered domestic waste,
 - animal wastes,
 - atmospheric deposition of nitrogen and heavy metals,
 - agricultural pollution of surface and groundwater,
 - dispersed solid waste (unknown magnitude),
 - road/automobile pollution (unknown magnitude),

Specifics related to each gmina and the major categories of NPS pollution are presented in separate conclusions below. Nothing indicates that Ziębice and Święta Katarzyna have unusual problems. Rather, we feel that their problems reflect broader problems in Lower Silesia (and perhaps throughout Poland). Thus, the remaining conclusions and our recommendations apply on a much wider scope than on these two gminas alone. Many of the recommendations do, in fact, require wider action.

- 2 The concentrated domestic and animal waste problem is critical and should receive very high priority. Human health, long-lasting groundwater contamination, and surface water pollution are all affected by this problem.
- 3 The reduction in fertilizer usage over the last 10-15 years has probably improved the situation, the previous levels of fertilizer usage appear too high. It is very important to provide agricultural training, soil testing, and extension services soon so that the problem will not increase with improved agricultural economics.
- 4 Strong evidence indicates that significant heavy metal contamination from atmospheric deposition is affecting surface and groundwater quality. The environmental effects on surface water quality are documented. We have not been able to properly investigate the groundwater effects during this study, but we predict a strong potential for groundwater contamination. Human health effects could be serious and should be investigated.

- 5 Many organizations and technical capabilities in Poland, both Polish and American, are able and, most importantly, willing to work on the NPS-related problems. Some increase in resources is needed (for example, more and better soil testing), but a very strong base is in place. All of the agencies and organizations that we worked with recognize the need for better institutional coordination and cooperation.
- 6 Święta Katarzyna seems to be under great stress from NPS problems, and the problems could get worse. A combination of pressures includes (1) Wrocław regarding protection of the water supply, (2) a significant untreated domestic and animal waste problem, and, (3) transition to urban/suburban land use, which creates quite different NPS problems. This transition can provide some opportunities for improvement, such as requiring developers to pay for sewerage and treatment. These opportunities require action very soon to be most effective.
- 7 Ziębice's problems are more tractable compared to Święta Katarzyna's, nonetheless, they require serious attention. The concentrated domestic and animal wastes will be an ongoing problem and may be a serious health problem as well. In terms of pollution to the Oława river, Święta Katarzyna is fortunate to have most of the river bank in grass strips, which provide a good pollution filter, especially for nutrients.
- 8 The problems with domestic waste contamination of shallow wells together with the general problems gminas are having in getting properly designed waste treatment confirm that the LEM assistance to gminas in wastewater treatment is focusing on their critical needs.

6 RECOMMENDATIONS

These two sets of recommendations are based on the LEM/NPS team's activity and analysis. The first set of recommendations suggests short-term, specific actions that the gmina governments can accomplish. The second set of recommendations proposes comprehensive goals that could be enacted in various time frames as needs and opportunities for action arise.

The teams used the following criteria to develop the recommendations:

- each recommendation addresses an important element of the NPS problem,
- each recommendation is independent of the other recommendations,
- practical solutions to problems are emphasized,
- Polish resources and constraints are recognized to the maximum extent, and
- U S assistance opportunities are identified and proposed.

6.1 Short-term Action Plan for Gmina Governments

Three specific short-term activities should be undertaken by the gmina governments:

- 1 Pursue human health evaluations related to water supply problems, primarily from shallow wells. The health of gmina residents is of paramount importance to the gmina, so this evaluation is essential for understanding the immediate importance and priority that may need to be placed on the concentrated waste problems. One way to approach this activity would be to interview doctors in the region, specifically asking about drinking water-related problems. The involvement of the Ministry of Health and other health professionals would also be important in this evaluation.
- 2 Immediately extend efforts and resources for handling concentrated wastes, include animal wastes as well as domestic wastes. Cite the immediate human health and environmental consequences of no action. Resources include Wrocław Agricultural University, RWMA, and LEM. These organizations can provide grants, technical assistance, or training. U S Department of Agriculture and U S Environmental Protection Agency projects in Poland may also be helpful, LEM could possibly coordinate their involvement.
- 3 Draft and implement regulations on new suburban/urban development, especially in Święta Katarzyna. These regulations can provide finances to offset the costs of the new development and could possibly help the overall gmina pollution problem, as areas are developed, they could be transformed from NPS problem areas to environmentally benign areas. Implementation of land use plans will also help greatly and is a necessary

first step in regulation of development

6.2 LEM/NPS Team Overall Recommendations

- 1 A mechanism, structure, and process should be organized to unite gmina clients with the available resources. Most of the people we spoke with encouraged this activity. The RWMA seems to be an excellent "home" for coordinating this effort with LEM, initiating this process by conducting a workshop that introduces clients, agencies, and issues. Using current NPS work as a starting point, the workshop could enable participants to arrive at a consensus for action and cooperation. The fostering of cooperation between the agricultural and sanitary/environmental communities should be a key workshop objective. Section 5.3 of this report presents a useful preliminary institutional strategy. Ziębice and Święta Katarzyna would be an excellent pilot for implementing plans because the work performed in this study as well as the other LEM activities provide a solid foundation for action. Also, these two gminas provide a range of conditions, problems, and potential activities that will be widely applicable in other areas.

Inclusion of Polish national-level representatives as well as regional and local representatives would empower the workshop. We also suggest inviting the following organizations to participate in the workshop: RWMA, several gminas, WODR, EPI, HWM, Agricultural University of Wrocław, Institute of Land Reclamation and Grassland Farming, USEPA Region VII, USDA/Poland Agricultural Extension Project, MOE, MOAg, MOH, VOCA.

- 2 Domestic and concentrated animal wastes are a major drinking water public health concern. The Ministry of Health or other public health agencies should be solicited to completely clarify the health consequences which, in turn, will clarify priorities and commitment for action.
- 3 Increased soil testing and consulting frequency should be supported by central, regional, and, if possible, gmina funds. The entire region would benefit through reduced grower costs, improved crop yields, and improved water quality. The U.S. Department of Agriculture is already helping in agricultural extension (through the ODRs) and could perhaps provide further help in this specific area. Other multilateral help, perhaps through Poland-Hungary Aid for Restructuring Economies (PHARE) should be encouraged.
- 4 Organizations need to strengthen their data access, coordination, and sharing efforts. Although Polish technical capabilities are excellent, serious weakness in coordination and sharing of data is hindering identification and resolution of NPS problems. The Danube Emissions Decision Support System (DEMDESS) of the Water and Sanitation for Health Project can provide a model for development and use of integrated

information for water quality decisionmaking. This model emphasizes institutional development as much as technical development. The development of an integrated water quality information management system such as DEMDESS as part of the process in Recommendation #1 would help demonstrate the benefits of such a system. Also, it would develop the strategy for overcoming the current institutional barriers.

The DEMDESS process has focused on full development in one major basin in the host country, with that development serving as the prototype for eventual national-level implementation. The development of DEMDESS in the Odra basin in coordination with the other activities should work quite well.

- 5 Public education and outreach programs on NPS pollution need to be developed. Because NPS problems aren't always obvious until they're advanced, the general population doesn't usually recognize NPS pollution or understand its hazardous impact. The public should be educated on NPS problems and issues, especially because the diffused nature of NPS pollution requires the public to be an integral part of the solution.
- 6 We recommend the following regulatory actions:
 - voluntary controls on fertilizer and pesticide in conjunction with recommendation #3 above (based on U.S. experience, mandatory limits on fertilizer and pesticide application are difficult to administer and not very effective),
 - some basic regulations, such as restricting cattle access to streams,
 - proper facilities and arrangements for disposal of domestic waste as a requirement when property is sold (this requirement has been followed in the U.S., leading to better control of improper waste disposal), and
 - regulations on urban/suburban development (there is an obvious need for proper wastewater disposal, but also need for stormwater/urban runoff controls such as stormwater detention basins).
- 7 Polish universities need to enhance programs on NPS analysis and control. Organizations such as the U.S. Agency for International Development, the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, and American universities could assist.
- 8 We strongly recommend that nutrient budgeting be a part of the process for determining, on a plant-specific basis, the necessity of such treatment. Another strategy that should be considered is "nutrient trading," in which the point source agencies "trade" a portion of their expensive nutrient removal processes for the costs of greater NPS controls (such

as better manure storage facilities) Preliminary nutrient budget analyses indicate that nutrient loads from domestic waste can be less significant than other nutrient sources Requiring nutrient removal at all wastewater treatment plants may not be warranted, especially given the relatively high treatment costs The idea is to get maximum nutrient reduction for the funds expended This strategy is being tried in several parts of the United States, such as the Tar River Basin in North Carolina

- 9 Privatizing the large State farms can provide some interesting leverage in certain NPS control strategies For instance, vegetative filter strips along stream banks could be a requirement upon sale of the State farms The total price could be reduced somewhat to compensate, the value to Polish ecology (and to the Black Sea) could be well worth the loss of the farm sales revenue Another possible leverage from the State farms could be using some of the land to compensate private farmers for putting filter strips on their land
- 10 The following areas are especially important for further study or investigation
 - health effects of heavy metals, nitrates, and bacteria in rural water supplies,
 - atmospheric deposition of pollutants and their fate in land, surface water, and groundwater,
 - improved basin-wide monitoring, databases and analyses that take NPS pollution into account explicitly,
 - detailed soil characterization studies,
 - further testing and research on hydraulic modifications and bank filter strips as options for nutrient control, and
 - development and provision of simple rainfall/runoff models under Polish conditions for use in implementation of urban/suburban development stormwater management control

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APPENDICES

Appendix 1
Scope of Work

LOCAL ENVIRONMENTAL MANAGEMENT (LEM) PROJECT

SCOPE OF WORK

TECHNICAL ASSISTANCE ON NON-POINT SOURCE POLLUTION IN LEM PROJECT TARGET AREAS IN POLAND

Background

Since February 1993, the Local Environmental Management (LEM) project has been working with local, regional and national officials and organizations in Poland in the area of wastewater management. Specific assessment studies have been completed for 3 local governments ("gminas") and two additional assessments are currently underway. These assessments focus on point discharge wastewater pollution, for which wastewater collection and treatment systems are planned. Four of the five gminas are located territory overseen by the Wroclaw Regional Water Management Authority (RWMA).

However just focusing on point discharge emissions in the semi-rural gminas in the Silesia will not address the full range of water pollution threats in this area. Lessons from US experience and experience in other countries in Central and Eastern Europe has indicated that non-point sources are a major contributor to water pollution. A recent World Bank study indicated that "estimates for the rivers draining into the Baltic Sea put the share of non point sources [pollution from BOD₅, nutrients and suspended solids] at a minimum of 50% ". Non-point source pollution has been the subject of previous efforts by the EPA Region 7 Office in northern Poland, in cooperation with the Baltic Sea Program, with funds from USAID. Some activities to develop training materials and conduct demonstration projects have been initiated by EPA personnel. To date all these activities have been focused in northern Poland, and not focused on the potential role of regional or local officials.

The LEM project began to focus on non-point source pollution in the LEM target area after a specific request was made to the LEM project manager. The request for technical assistance came from the Director of the Wroclaw Regional Water Management Authority. This technical agency conducts assessments on water and wastewater management issues and assists other regional officials and local governments to implement programs and prepare and execute investments in the sector.

The RWMA requested the assistance of non-point source expert(s) to make an examination of NPS pollution in the LEM target gminas which would supplement the work being done on point source pollution. For example, in the case of Swieta Kataryzna, this effort would tie in with a larger, long range planning for the smaller villages in the gmina for example, which will not

be served under the first two phases of the latter's project. In addition the effort would tie into important concerns for the water quality of rivers and streams in the gmina which serve as the principal drinking water sources for Wrocław.

The Regional Water Authority will thus have a better view of the potential results of the point and non-point source solutions coupled with an analysis of what additional work needs to be done. It is likely that a program to address non point source pollution will require the collaborative efforts of the RWMA, gmina administrations, agricultural groups, industries, other technical institutions and perhaps other regional agencies. While the RWMA will need to provide the leadership to coalesce such a collaborative effort, input is needed on the experience in the US, and other parts of (Eastern) Europe. LEM resources will likely not allow in-depth assessment of NPS in all the LEM target areas, nor will they be able to support a full-blown demonstration effort. LEM assistance can, however, provide key technical inputs and a framework for RWMA to implement a follow-up set of activities in integrated water / wastewater management.

In preparation for this activity, the RWMA has conducted a special effort to collect relevant NPS data. Arrangements have been made for translation of these data and associated reports into English for use by the team upon their arrival in Poland.

Activities to be conducted:

The US-based technical experts will conduct the following activities:

- 1) Collect and review data, reports and other information on NPS pollution problems and mitigation strategies in Poland from US sources prior to departure for Poland, and from Polish sources while in Poland.
- 2) Conduct a brief, basic assessment of the sources, magnitude and extent of NPS pollution in the LEM target region of southern Poland, based on data provided by the RWMA. These investigations should focus on the target LEM gminas, to the extent possible, to identify principal sources and priorities.
- 3) Briefly assess current NPS-related data availability and data collection / analysis procedures, assess the need for additional data collection and analysis and outline required new procedures, if any.
- 4) Provide advice, reports, training materials or other information on Best Management Practices (BMPs) relating to NPS which appear to be useful in the LEM target region in Poland.
- 5) Assess current infrastructure for program implementation and training on NPS reduction / mitigation strategies.

- 6) Briefly outline a program of action for RWMA in collaboration with LEM target gminas, and other potential collaborators
- 7) Prepare a brief field report emphasizing basic assessment and follow-up activities
Prepare a more in-depth report upon return to the USA
- 8) Provide additional technical assistance in the area of NPS pollution in the LEM project target areas, or other related activities requested by the LEM Project Manager

Technical Expertise Required

This activity will require the services of two US based technical experts

- 1) Expert in non point source pollution assessment, data collection and program design and evaluation Extensive experience required in the US on non-point source pollution assessment, modeling and evaluation of alternative control strategies Experience in Eastern Europe required, familiarity or experience in Poland preferred
- 2) Expert in Best Management Practices relating to NPS and program design and evaluation Extensive experience required in the US on technical and management issues related to implementation of NPS programs Experience in Eastern Europe required, familiarity or experience in Poland preferred

The expert in NPS assessment will serve as team leader

Level of Effort Required:

The estimated level of effort required is shown below

	In Poland	In USA	Total
1 NPS Expert	12 days	8 days	20 days
2 BMP Expert	12 days	5 days	17 days
Total	24 days	13 days	37 days

Appendix 2

**Overhead Transparencies used in NPS
Team Presentation to Third Plenary on
Odra River Basin**

PROGRAM ZARZĄDZANIA OCHRONĄ ŚRODOWISKA
NA SZKIEBLU LOKALNYM LEM

LOCAL ENVIRONMENTAL MANAGEMENT PROJECT LEM

- USAID / RTI
- WSPÓŁPRACA Z WŁADZAMI LOKALNYMI, REGIONALNYMI I CENTRALNYMI

WORK WITH LOCAL, REGIONAL, NATIONAL OFFICIALS

- PROGRAM OBEJMUJE PIĘĆ GMIN
TARGETING FIVE GMINAS
- GŁÓWNYM PRZEDMIOTEM ZAINTERESOWANIA JEST GOSPODARKA ŚCIEKANAMI
WASTEWATER IS PRIMARY FOCUS
- ZESPÓŁ KONSULTANTÓW ZAJMUJĄCYCH SIĘ ZANIĘCZYSZCZENIAMI OBSZAROWYMI.

NONPOINT SOURCE (NPS) POLLUTION TEAM.

- DR MAURICE COOK (UNIWERSYTET STANU PŁN. KAROLINA / NC STATE)
SOCJALISTA W DZIEDZINIE ROLNICTWA
Ag. Specialist

- TIM BONDELID

INŻYNIER / SPECJALISTA W DZIEDZINIE
SYSTEMÓW DANYCH

ENGINEER / DATA SYSTEMS EXPERT

- PRZEDMIOT DZIAŁAŃ : GMINY ZIEBICE
, ŚW. KATARZYNA
FOCUS ON ZIEBICE I ŚW. KATARZYNA

DXIĄŁANIA ZESPOŁU KONSULTANTÓW :

NPS TEAM ACTIVITIES :

- ANALIZA OPRACOWAŃ I DANYCH
REVIEW REPORTS , DATA
- SPOTKANIA :
MEETINGS :
 - Z NIEADZAMI GMIN
GMINA OFFICIALS
 - Z POLSKIMI I AMERYKAŃSKIMI EKSPERTAMI
POLISH AND US EXPERTS
- OCENA PROBLEMÓW ZANIECZYSZCZEŃ OBSZARONÝCH
ASSESS NPS PROBLEMS
- IDENTYFIKACJA MOŻLIWOŚCI REDUKCJI I KONTROLI
ZANIECZYSZCZEŃ OBSZARONÝCH
IDENTIFY RESOURCES TO REDUCE / CONTROL
NPS POLLUTION
- SFORMULOWANIE KONKRETYNYCH ZALECENÍ
ODNOŚNIE DALSZYCH DXIĄDANÍ
PROVIDE SPECIFIC RECOMMENDATIONS FOR
ACTION AND NEXT STEPS
- OPRACOWANIE RAPORTU
PRODUCE REPORT

CONCLUSIONS

WYŁANIA SIĘ WSTĘPNY ALB NRYAŻNY OBRAZ SYTUACJI.
PRELIMINARY BUT CONSISTENT "STORY" EMERGES:

- ZANIECZYSZCZENIA RODNICIE (SĄBYNY POWIERZCHNIOWE I ZANIECZYSZCZENIA WÓD GAUNTONYCH) NIE WYDAJĄ SIĘ BYĆ OBECNIE POWAŻNYM PROBLEMEM, SZCZEGÓLNE PRZY OMIYKONYM STOSOWANIU NAWOZÓW.
POLLUTION FROM AGRICULTURAL FIELDS (SURFACE RUNOFF, GROUNDWATER) DOES NOT SEEM TO BE MAJOR PROBLEM RIGHT NOW, ESPECIALLY WITH REDUCED FERTILIZER USE.
- GŁÓWNY PROBLEM - ŹRÓDŁA "SKONCENTROWANE"
"CONCENTRATED" SOURCES MAJOR PROBLEM
 - ODPADY POCODZBNIA ZWIERZĘCEGO
ANIMAL WASTE
 - ODPADY BYTOWE
DOMESTIC WASTE
 - ZAGROŻENIE ZDRONIA I ŚRODOWISKA
HEALTH AND ENVIRONMENT HAZARD
- ZANIECZYSZCZENIA OBSZARÓW O CHARAKTERZE MIEJSKIM / PODMIEJSKIM MOGĄ SIĘ STAĆ POWAŻNYM PROBLEMEM, SZCZEGÓLNE N GMINIE ŚW. KATARZYNA
URBAN/SUBURBAN NPS CAN BECOME MAJOR PROBLEM ESPECIALLY IN ŚW. KATARZYNA

- LICZNE ORGANIZACJE I INSTYTUCJE POLSKIE I AMERYKAN-
SKIE MOGA I CHCA ZAJAC SIĘ TYM PROBLEMEM.
NUMEROUS ORGANIZATIONS AND RESOURCES (POLISH-USA)
ABLE AND WILLING TO WORK ON THE PROBLEM.
- POTRZEBA I CHĘĆ LEPSZEJ KOORDYNACJI I WSPÓŁPRACY
NEED AND WANT BETTER COORDINATION AND COOPERATION
- W CHWILI OBECNEJ JEST TO „OKNO NA MOŻLIWOŚCI”
RIGHT NOW IT SEEMS TO BE A „WINDOW OF OPPORTUNITY”
- SZCZEGÓLNA POTRZEBA ZAANGAŻOWANIA
EKSPERTÓW Z DZIEDZINY OCHRONY ZDROWIA
A SPECIAL NEED TO INVOLVE HEALTH EXPERTS

END

Appendix 3

A. Draft Agenda

B. Meeting Summaries

A DRAFT AGENDA
Non-Point-Pollution Workshop
Wroclaw, Poland

1 First Day

0800 - 0930 Registration

0930 - 1000 Opening

Director, Wrocław Voivodship Department Environmental Protection

Chairperson, Wrocław Environmental Protection Committee

Representatives of USAID/Warsaw and LEM Project

Director, Regional Water Management Authority (Wrocław), Chairman of the
Workshop

Workshop Coordinator Explanation of Organization and Goals of the Workshop

1000 - 1130 Summary of the Non-Point-Source Pollution Report on Ziębice and Święta Katarzyna

Exposition of the Report with major Conclusions by Mr Tim Bondelid and Maurice
Cook with representatives of the Institute for Environmental Protection

Identification of three major objectives of Report and of the Workshop

a Description of problems and recommendations for action in Ziębice/Święta
Katarzyna

b Coordination of NPS efforts in Poland an organized effort

c Effecting, through DEMDESS, an integrated data base as a first step

1030 - 1050 Coffee Break

1050 - 1130 Question and general discussion

1130 - 1245 Break out of Workshop Participants into two groups to discuss the report focusing
on Ziębice and Święta Katarzyna Organize for discussion aimed toward evolving
an NPS remedial action plan for the two gminas

1245 - 1345 Dinner

1345 - 1515 Continue discussions on the two groups noted above Prepare for summary of conclusions and presentation of action plans

1515 - 1545 Coffee Break

1545 - 1730 All participants gather together to hear presentation on proposed action plans from two groups

Discussion of presentations

Workshop approves action plans for each gmina

End of First Day of Workshop

2 Second Day of Workshop

0930 - 1045 Opening Session with all Workshop Participants

General discussion on the two remaining issues of the Workshop and the Report as noted above, namely, "b" and "c" - breakout of workshop participants into two working groups to cover "b" and "c" based on recommendations in the Report and the discussions

1045 - 1100 Coffee break

1100 - 1245 Began discussions in the Two groups

1245 - 1345 Dinner

1345 - 1530 Continue discussions and come to conclusions and recommendations for action plan

1530 - 1545 Coffee Break

1545 - 1700 Presentation of the conclusions and recommendations for action plans of the two groups

Discussion of presentations

Adoption by Workshop of recommendations with any amendments during discussion

Appointment of a NPS/DEMDESS Steering Committee to work with the Director of Regional Water Management Authority, Wrocław, to put the action plans into effect

Conclusion of the Workshop

B MEETING SUMMARIES

The following meeting summaries provide detailed background information related to the problem evaluation, recommendations, and conclusions contained in the body of the report

III A Regional Water Management Authority

The Regional Water Management Authority (RWMA) at Wrocław met with the LEM team on November 29, 1993, to begin the NPS activities. The Institute of Environmental Protection (IEP) presented its NPS report. Dr. Nalberczynski, Director of RWMA, chaired the meeting.

- Introductory remarks by Dr. Nalberczynski

We would like improvement in water management, requirements, standards, regulations, land use planning, etc. for agriculture as related to control of NPS pollution. We also need to consider economic issues because agriculture is important to economic base of the gminas under study. Our focus now is on the gminas of Ziębice and Święta Katarzyna, but they will be used as "models" for other gminas and for RWMA.

- Key points of report presentation

- Two reports were given, one each for Ziębice and Święta Katarzyna,
- 1:5,000 scale maps showed land use patterns, general soils classes, etc,
- Study objectives include providing information related to NPS problems, specifying problems as known, not presenting solutions,
- Each report has three chapters
 1. General information on the gmina that is designed to address external (i.e., the LEM NPS Team) needs and to describe of the general situations in each gmina,
 2. Information that is especially related to agriculture, such as crops, number and sizes of farms
 3. Some general conclusions about problems
- One issue is that regulation of private farms is harder and a greater problem than is regulation of State-owned farms, especially in protected zones,
- Are the gminas "typical" or "special" cases for agriculture,
- Production details are in the report, and

- Animal farms are considered point sources
- Key issues
 - Could regulations that are developed and applied to certain local conditions also apply to other gminas as general regulations, for example, regulations regarding applications pesticides and other toxic chemicals?
 - An alternative approach would be to find different areas and apply different regulations based on the situation Perhaps we should apply regulations at the village level since application at the farm level VERY difficult
- Questions and remarks

1 Maurice Cook led off with questions/discussion

Dr Cook agrees that agriculture and water quality are often in conflict Experience in the U S has shown that a voluntary system often works best

Question What is the attitude of farmers in Poland and especially in the gminas we are working in?

Answer The problem seems remote to farmers because it's for the Wroclaw water supply, they think that maybe only those near the river or in sensitive areas need regulation Regulation for this situation is an art The farmers currently have no experience in land use planning, public participation, etc

A key element is good education in application of fertilizers, etc

Question Is there a local agriculture advisory group?

Answer There are local agriculture advisory groups, but they need support, information, etc Two advisers are in the gmina, but they need information and training

There is a Polish-American agriculture extension project with 18-24 American extension specialists Have any been in this area?

Answer Yes, in 1991 People from Massachusetts and Iowa, came and spent four months in the Voivodship, we had some contact with them The visits seemed more "social" than business Also, they were more involved with production than environment

Bill Sommers First, a key question to address is if there were a program to ameliorate NPS pollution based on farmers' habits, what would be the farmer gain? If there exists a public information system, there has to be a reason for the farmer to do it Second, what we need out of this meeting is what you want the team to accomplish

Answer We want strategy for next steps We cannot say right now how complete the studies are "Next steps" are how to have profitable farms with good water quality for Wrocław We want a plan for reducing NPS pollution to the river

What about the relative effects of point versus NPS pollution, tradeoff between point and nonpoint controls, etc

Answer Don't mix point and NPS issues at this time in this study

Professor Nyc of the Agriculture University of Wrocław There are two or three solutions to explore Laws and regulations would be most important Of importance also is how to introduce new methods of agriculture Agricultural advisers are concerned with production reductions They are interested in new structures of land usage, e g , nutrient-reducing plantings A problem to consider is drainage, improved drainage leads to increased production but also to increased runoff Are there structural solutions, e g , groundwater retention? A current issue is that NPS may be low now due to reduced fertilizer usage but could increase as economic conditions improve and application rates increase Should there be limits on fertilizer and herbicide application rates? There is currently a long-running study of retention of runoff

What would the Mayor and Deputy Mayor of Ziębice want to see out of the NPS study?

Answer Information on laws and regulations for control There is a conflict between farmers and city dwellers and a lack of overall control of the Basin It should be RWMA, but they have no legal authority at present They are looking for suggestions in the meantime and hope to apply USA experience to the problem The gmına can prepare and apply legal actions in conjunction with economic actions (e g , taxes), implemented via land use planning/zoning They need the rationale for zoning and need to effectively communicate it to the citizens Ecological education is important, the public is not aware of the direct relationship between production and pollution We need to educate young farmers in methods that can preserve water quality to standards Therefore, they would like agricultural advisers, public information, information sources for their agricultural advisers to share with residents and farmers It is a long-term activity, especially considering the former and current State-owned farms Another problem is amelioration, there are detention basins in western part of the Gmına with lots of weeds What should be done to improve them? They very much need techniques for safe application of fertilizers and herbicides Some options to consider might be groundwater storage, stream hydraulic modifications, plantings along stream beds To reiterate, they would like to "reach agreement" on fertilizer application limits based on soils, groundwater, etc

Feedback by Dr Maurice Cook There is a huge need for technical assistance, e g , agronomy, engineering, etc Very positive steps can be taken on fertilizer application because there is a real cost savings that accompanies it There needs to be a good soils

testing lab with regular sampling. Whatever plan is adopted will take time (years) to show results. There is a need to educate the public. Improvements on the farm benefits all of society, so society should help with the costs.

Dr. Nalberjnski: We would like something positive from the study without going into a "loop" of information gathering, analysis, more information gathering, etc. Two paths should be considered: agriculture practices and hydrologic/hydraulic controls.

There will be a conference on the Odra Basin on December 9. Dr. Nalberjnski asked the LEM NPS team to make a presentation on results and findings at the conference. The team accepted the invitation.

III B Ziębice Gmina

The meeting and field visit to Ziębice Gmina occurred on Tuesday, November 30, 1993, in the gmina office in Ziębice. The participants included the LEM NPS team (Cook and Bondelid), a translator Mr. Cichocki of IEP, and gmina representatives. The primary gmina representatives were Ms. Wojtczuk, Inspector for Environment Protection and Water Management, and Mr. Nicieje, Inspector for Agriculture, Land Improvement, Forestry, and Hunting. These two officials often work together and will cover for one another if one of them is away.

The first topic of the meeting was eliciting the gmina representatives' professional judgment concerning major water quality problems in the gmina.

Wells and Groundwater Problems Most wells are shallow and many show nitrates and bacteria contamination. Deep wells have good water.

Surface Water Problems These problems occur mainly the Oława River. There used to be many problems, but it is better now. There were some problems in the Oława such as strong odors. Samples were taken, but did not show problems, they suspect incorrect sampling techniques (or perhaps inadequate analytical procedures). There have no fish kill. There used to be problems with septage discharged to drainage ditches. There was one problem with organic acid containers being emptied into the river, but that was a one-time event. The main cause of improvement is the farmers are using 50% less fertilizer now than in past years. Farmers are using organic fertilizers with foliar application. One current problem is that seeds are being treated with insecticides.

Monitoring Samples are taken by the Sanitary and Epidemiological Center. There is no permanent monitoring program. The Manager of Water and Wastewater takes monthly samples at the WWTP.

Overview of Agricultural Situation There are fewer cattle now, there were 6,000 cattle in 1987, 4,000 cattle in 1993. There has been no change in the pig population. They have no historical data on fertilizer application.

Fertilizer application (kg/ha)

	<u>1993</u>	<u>15 Years Ago</u>
N	50	100
P	30	60
K	40	80

The change occurred about 5 years ago

Crop yields overall (100 kg/ha)

1989	40.5
1992	31
1993	35

[Note the drought in Poland for the last three years has been a major factor in the crop yields]

Farm trends Around 1989, a lot of young farmers took over and need time to learn. There is a gradual tendency for weaker farmers to lease lands to stronger farmers. A new Act in 1991 was not favorable for farmers to buy land, prices are too high because State farms have to be bought in large blocks. The State farms are considered in good condition and provide a lot of employment. New owners of State farms would reduce employment significantly. Price of land is about 30 million zl/ha, income is about 3-5 million zl/ha. There is not much farm credit available, interest rates are 40 to 50 percent.

Other known NPS problems There is a mine in a neighboring gmina. Untreated septage is an important problem. Houses discharge directly to ditches, a situation that may also cause well problems in many areas. New construction requires closed septic tanks, lot sizes are too small for open septic tanks. They feel current regulations are not adequately enforce septic disposal, but gminas have authority to develop adequate regulations. The gmina has passed a resolution that they can fine violators, but there still exists the problem of control and enforcement. They would like to know how they can enforce the regulations.

Health problems The threat exists. Sometimes people get jaundice.

Water supply systems The first water supply system was installed in 1978. There are currently eight villages with systems.

Types of assistance desired They are always trying to obtain more information and knowledge. Farmer training was stronger in 1970's, they would be interested in better farmer training. They would be interested in participating in field trials, etc. They have some technical assistance, for instance, there will be two lectures in December by the

Sanitary/Epidemiological Center on safety Technical assistance should be through the Mayor they personally are very busy and think assistance should maybe be through the Center for Agricultural Consulting (ODR) Currently soil samples and maps are done for each farmer every 5 to 10 years The gmina subsidizes the cost of the soil samples The samples are analyzed by the Agriculture and Chemical Station in Swidnica There are two Agriculture Consultants assigned to the gmina

Visit to pig farm This is a confined operation with all of the pigs in enclosed buildings The operation has about 1,000 pigs at any given time It is a litter-free operation generating about 30,000 l/day of liquid waste The liquid manure tanks are emptied and spread on designated fields every two days They rotate the fields used for manure every year Corn is grown on the fields

The following requested data was sent to us via fax from Ziębice

There are 28 villages with a total population of 10,207

Water Supply	313 households in 9 villages, 1,293 people
No Water Supply	1,200 households with shallow wells 30 households with deep drilled wells 600 households on communal wells

Sewered	60% of people in Henrykow with water supply are sewered
No Sewers	1,537 households, including 750 with closed septic tanks

III C Święta Katarzyna Gmina

The meeting and field visit to Święta Katarzyna Gmina occurred on Tuesday, November 30, 1993, in the gmina office in Ziębice The participants included the LEM NPS team (Cook and Bondelid), a translator, Mr Cichocki of IEP, and Mayor Zdeb Later in the meeting a gmina agricultural specialist, Mr Michal Kret, was called in for expert advice

The meeting started with a brief overview of the LEM NPS study objectives and expected outcomes The Mayor was asked to provide his views on NPS problems in the gmina and to identify what he would like out of our study

Overall situation (Mayor) NPS is very important but has received little attention so far, most attention has focused on point sources, landfills, and dumps Some work has been done but the current dynamic situation means most work needs to be re-done The work has been fragmentary, not the general comprehensive approach that is needed From the gmina perspective, it is not clear who should be responsible, we need decisions on who should do what and how Polish legislation is imperfect, and the fact that he is posing the question indicates this imperfection The report by IEP can serve as a basis for starting, it indicates some NPS problems Are these all or most of the problems? Are there other problems? What priorities, magnitudes, and actions should we establish? There are two type of problems (1) local, which stay within the gmina, (2) air and water pollution, which go

outside of the gmina. The gmina is trying to do something about both types, but the situation is still bad and they don't know how efforts can be speeded up. It boils down to what will it cost and who will pay?

Solid waste (Mayor) There is no landfill in gmina, so residents have to take solid waste outside of gmina. Most people cannot afford to pay now. The Mayor knows no one else will help them with solid waste, they will build their own landfill, which will be cheaper for residents and allow regulation of the solid waste problem. The site is selected, Polish law requires careful analyses and siting studies with ongoing monitoring. They have been fulfilling these requirements. The current situation is that individuals have to have their own "contracts" for solid waste disposal. Currently, 380 households, more than 60 institutions, and the gmina government have contracts. Exact figures on uncontrolled solid waste are difficult to find, but estimates are that of the approximately 2,600 households in the gmina, 25-30% have some organized method for disposal.

Finally, the Mayor reiterated that he would like a comprehensive study of NPS pollution.

Following the Mayor's input on problems, priorities, and desired outcomes, eight specific areas related to NPS were explored.

- 1 **Land use changes** The gmina has no land use plan now, but efforts are currently under to develop one, Mr. Czekowski of IEP is performing the work now. The gmina is undergoing a change from agricultural/rural to residential, 600 ha is expected to change from agricultural to residential/commercial soon. They need to structure growth to include commercial and industrial use to provide revenue. The gmina is attractive because utilities (electricity, water, roads) are available.

Another problem is that most farms are small, and they feel these farms will need to be consolidated into larger operations. It is a social problem concerning what will happen to these farmers. It is also an environmental problem because pollution problems are different for the different sized farms. It would be good to identify trends and future problems now.

Mr. Czekowski worked on the land use plan for the gmina, and two options were considered: increase farm size and keep crops the same, or stay with smaller farms and shift to vegetables and fruits for Wrocław. It is difficult because the soil is considered "too good" for vegetables. Even before the war, the Germans used the land for beets and wheat. Therefore, change in crops is considered theoretical. With existing crops, the minimum effective farm size is estimated at 30 ha. Also, there seems to be too much machinery for the area being farmed. The current thinking for the water-bearing area in the northeast part of the gmina is to use the area for parks, recreation, etc. Another idea is to use the closed smelter site as a type of "farmer's market."

- 2 **Unsewered households and septage disposal** 2,000 of 12,000 people have sewer connections or proper disposal. Most of the rest is discharged without treatment to ground, streams, storm sewers. There are septic tanks but cost of disposal is high, so most people don't dispose properly. The number of contracts for septic disposal is less than 380. The populace is very "creative" in disposal methods.

- 3 **Agricultural use of fertilizers** Before 1990, 60 kg/ha N, 80 kg/ha P, 120 kg/ha K It is probably less now Up until 1990 data was easy to obtain because fertilizers were centrally distributed Now it is a free market They have maps and analyses of nutrient content of soils for 1989 There will be a study next year to update the data and maps, funding will be 50% from central government, 50% will probably need to come from gmina budget Distribution of fertilizers, while decentralized, is from a limited number of outlets so data on overall fertilizer usage could be collected
- 4 **Animal wastes/manures/slaughter wastes** These wastes are not a big problem in Święta Katarzyna There is very little liquid manure, not much litter-free animal production is done, and it is decreasing
- 5 **Storm sewers** The storm sewers are an old German system and are separate from the sanitary sewers There seems to be a lot of pollution coming from them The storm sewers cover the entire gmina, discharging to drainage canals and then to the river Mr Kret feels that a combined system would be preferable to treat stormwater along with sanitary wastes
- 6 **Agricultural advisers** The Center for Agricultural Consulting (ODR) has a person in the gmina Until recently, there were six people assigned The quality of advice is good, but many farmers are old-fashioned and don't/aren't willing to listen Further, there is a big change now that farmers have to sell on the open market, they hope Agricultural Consulting will help teach them how to sell
- 7 **Farmer organizations** (e.g. Wheat Growers' Association) Under communism, organizations with these types of names were used for political control of farmers Farmers are skeptical, some farmers are aware such organizations are useful, but they don't have experience and confidence in how to form them Some horticultural organizations were not political and are useful
- 8 **Crop yields** These data are available and will be provided

IV A Wrocław Voivodship Agricultural Advisory Service (WODR)

Key Contact Ms Ewa Mankowska Director of WODR

We met twice with the WODR, the first meeting was not long enough to cover all of the topics The ODRs have a very important role in agriculture NPS pollution and should be considered an important partner We learned (and confirmed) much of the information concerning the overall agricultural situation in Lower Silesia during our visits They are performing many activities that parallel and complement other pollution control activities

The WODR was re-organized in 1991 and seems well funded by the MOAg They currently have 150 employees in three departments (1) information/education, (2) economics, and, (3) farmer consulting They maintain databases on agricultural prices and markets, produce magazines, videos, pamphlets, workshops, lectures, etc WODR has nine district offices that

correspond to the pending re-instatement of the Poviát level of government. They work closely with individual farmers and have representatives in all of the gminas. The ODRs have received significant assistance from the Polish/American Extension Project (U.S. Department of Agriculture Extension Service).

The Center for Agricultural Consulting focuses on helping farmers set up business plans for obtaining loans from banks. The current interest rate runs 24-36% for farm loans. In the last three months, they have set up 564 business plans. They maintain databases on crop prices and markets. They also advise on fertilizer and herbicide application rates, this information is an essential part of the business plans. The Center charges a 1% fee for preparation of the plans, commercial organizations typically charge 10%. The 1% fee is charged to promote use of the plans and prevent abuse of the service.

The Agricultural Economics Department has been working on investments in environmental protection, including introducing small wastewater treatment plants in villages for domestic and animal wastes. They are currently working with the village of Kały Wrocławskie on a model treatment plant. The village has a population of 450. They are looking for a design agency and in getting grants and soft loans for the plant(s). They expect the system to be four or five biological/root treatment ponds. The work will be cooperative with the village residents performing much of the labor. Other research includes meat markets, farmer attitudes, agricultural equipment/costs, control of road pollution by planting bushes along roads.

The Marketing and Promotion Department is involved in promoting local wastewater treatment. They do not consider themselves in wastewater treatment, but as marketers they saw a big need and felt they had to try to fill it. For example, they organized a 2-day seminar/fair/exhibition on wastewater treatment. The target was the gmina officials, who were preparing budgets, they wanted the officials to have information for budget purposes. This year, there is no fair because they cannot compete with the Poznań eco-fair.

Mr. Targosz, the Marketing and Promotion Department head, feels that local officials are often building wastewater treatment plants with "decisions being made by lawyers instead of engineers." There is a lack of coordination. The voivodships have grant funds, but no mechanism for proper allocation of grants. They have offered to help gminas review plans and proposals, but they have had no takers so far. There is no obligation for gminas to get independent evaluations, and Mr. Targosz thinks a lot of companies are taking advantage of the situation, there is a clear need for technically sound, solid solutions. The Department would be happy to cooperate with LEM.

The WGD Department (Rural Household Management) has 11 specialists working throughout the region. They are currently focusing on

- 1 alternative income sources, such as agri-tourism, production of health foods, "environmentally correct" gardening, and
- 2 health, food, and nutrition, including improved sanitary conditions and improved village aesthetics. They recently provided about 500 farmers with complete physicals,

the data is being used for assessment of rural population health. Lots of serious diseases were found including diabetes, heart disease, cancer, hearing and sight impairment. The general conclusion is that rural health is poor. Many farmers have gotten treatment as a result of the physicals. The connection between water pollution and health is a new area for them, they are promoting measures to improve water quality.

IV B Institute of Environmental Protection in Wrocław (IEP)

Key Contact: Dr Janusz J. Przewlocki

The IEP is under the Ministry of Environment. The Wrocław office is one of three IEP branches in Poland. The headquarters (140 people) in Warsaw is concerned with all aspects of environment: soil, air, landscape, water. The Gdansk office (~40 people) is concerned with sea and coastal issues. The Wrocław office (~40 people) is concerned with water and land use planning. They have had large staff and funding cutbacks in the last few years. Before, all of their funding came from the central government, now they get 10% from central funds and have to contract out for the remaining 90%.

There are three departments in the Wrocław office:

1. The Land Use Planning Department is concerned with developing ecologically sound land use plans. They frequently contract with gminas (e.g., Niemice and Święta Katarzyna) to develop the land use plans.
2. The Water Protection Department is concerned with water management, water quality modeling, water balances, streams and lakes, planning protected zones around lakes and industrial plants, and biological monitoring. They have computer systems and databases for water management. They frequently cooperate with the voivodships. In the mid-1980s they developed water management plans for all of Poland, including water quality modeling, wasteload allocations, treatment levels, and predictions of water quality under different plans. The work was based on 1980s laws. There are different standards now. On November 5, 1989, new standards were adopted using discharge standards instead of water quality standards. Sensitive waters, such as small streams, national parks, and water supply areas, can still require standards based on receiving water quality. In 1987-1988, they prepared a national environmental protection plan covering all media and included costs. Two years ago, they developed a master plan for the Odra Basin in conjunction with the Institute of Meteorology and Water Management. Several scenarios were modeled. The LEM/NPS team were given a paper published as a result of that work, it has some very interesting and relevant analyses of heavy metals problems including estimates of point versus nonpoint source contributions. Their analyses indicate that most of the heavy metal pollution in the Odra river basin is coming from NPS.
3. The Wastewater Technology and Solid Waste Branch is concerned with treatment technologies, including nutrient removal and sludge. They have performed a review of many of the common treatment plant designs in Poland and have found many deficiencies.

The LEM/NPS team received a copy of their report (in Polish) This document could be very useful reference work for future wastewater assistance tasks

IV C Agricultural University of Wrocław (AUW)

Key Contact Prof Dr Jerzy Kowalski - President of AUW

We had three separate meetings with these divisions of AUW

- 1 Institute of Soil Science and Agricultural Environment Protection,
- 2 Institute of Hydrology and Geoengineering, and
- 3 Institute of Amelioration and Environment

The university seems quite active in research and teaching in many of the areas directly related to the NPS problems, there are easily a dozen departments in AUW that directly relate The key word "environment" shows up a lot Dr Kowalski is interested in outreach and application as well as U S assistance One specific area of assistance he mentioned is in agricultural economics, most of the faculty is trained in the "old" economic system and he would like to strengthen the university in the "new" economic systems

Some of the areas in which the university has valuable expertise and knowledge related to NPS pollution include

- 1 rainfall/runoff,
- 2 erosion,
- 3 stormwater management control,
- 4 sewerage and wastewater treatment in rural areas,
- 5 soil science,
- 6 construction and maintenance of hydraulic structures for control, including ponds, drainage ditches, and water storage/control mechanisms,
- 7 groundwater pollution, and
- 8 soils contamination, including heavy metals

Dr Kowalski feels the problem of coordination is very difficult, one data bank for all would be excellent

One specific area of interest is that the Institute of Soil Science has funds for research in

Lower Silesia and would be interested in a cooperative project with a gmina such as Ziębice or Święta Katarzyna

Other key points from our meetings include

- 1 detailed soils maps are in Voivodship offices,
- 2 more than 50% of Polish soils are acidic, Święta Katarzyna soils, which are not acidic, are among the best in Poland,
- 3 they have a small experimental watershed (~40 sq km),
- 4 they possess hydrologic data for Lower Silesia,
- 5 health problems due to environmental pollution have not been studied in the Wrocław area (the problems have been studied in the Krakow and are significant, we can expect the to be significant in the Wrocław area),
- 6 large slaughterhouses are probably a big pollution problem, (the Faculty of Food Processing may have information), and
- 7 problems from channel scouring in the Odra are due to poor hydraulic management, e g , locks

IV D Institute of Meteorology and Water Management - Wrocław (IMWM)

Key Contact Ms Rafalina A Korol, Head of Department of Surface Water Monitoring

Ms Korol's department is responsible for monitoring of all surface waters in Poland They have three major programs

- 1 monitoring of boundary waters in cooperation with border countries 57 sites, parameters vary depending on the bordering country They coordinate results with the border countries In the case of discrepancies, they "negotiate" results, usually being able to come to agreement on reasons for discrepancies on technical bases
- 2 special monitoring at main points—20 sites, one sample per week, 52 parameters including flow Results are published every 10 days to two weeks
- 3 360 sites on 21 rivers sampled twice per month, including flow

IMWM analyzes river profiles, comparing results to standards and classifying the waters into the three water quality classes They also have regional and local monitoring paid for by voivodships based on need, primarily on smaller rivers

The main function of the monitoring is evaluating Poland water quality, comparing year by

year Changes are evaluated for cause A report on status of Polish waters is published every year for the national government

Point source emissions are supposed to be monitored by the voivodships, but it is very inconsistent and not very systematic The river monitoring network is set up to sample before and after major point sources so IMWM can evaluate effect on water quality

The IMWM maintains databases of all of their data The data seems well organized and would be highly useful for many purposes Poland has a standard river kilometer network, which is important for properly integrating river data There is a problem in sharing the data because it is owned by the Ministry of Environment, specifically the State Inspectorate of Environmental Protection in Warsaw, and they must give permission for dissemination They cooperate closely with the IEP

The IMWM is a key player in water quality data and analysis, and their cooperation and data is essential in water pollution abatement

IV E Institute for Land Reclamation and Grassland Farming - Warsaw (IMUZ)

Key Contact Prof Dr Andrzej Sapek, Leader of Department of Soil and Water Chemistry

John Ragland of U S Department of Agriculture accompanied us on our visit with Dr Sapek Dr Sapek is working closely with USEPA Region VII His views were very helpful in clarifying many points

Dr Sapek believes that a major weakness in the approach to water problems in Poland is its focus on industrial and domestic wastewater, \$4 billion, mostly on these sources Animal wastes are actually a major source and needs to be actively addressed along with the industrial and domestic wastes, there is an "artificial separation" between point and NPS based on occupation (NPS=agriculture, PS=sanitary engineers) He sees this as a good time for bringing the MOE and MOAg together because the respective Ministers agree and have been meeting and sharing

Some technical comments from Dr Sapek include

- 1 pig farms and liquid manures are a big problem (ammonia volatilized from urine is considered the main source of ammonia in the atmosphere),
- 2 there should be a national program for water protection,
- 3 rainwater contains ~ 15-20 g N/ha/yr, mostly ammonia,
- 4 biggest pollution of wells occurs where central water supplies exists,
- 5 the largest farms should be approached since they are the biggest contributors,

- 6 they must help farmers better use animal wastes as fertilizers, since fertilizer is expensive,
- 7 ~20% of pollution to Baltic is from human/domestic sources, and
- 8 "blue baby" syndrome exists in Poland, the MOH blames it on carrots

The IMUZ contact in Wrocław is Dr Cebula at 67-80-92 or 67-80-91 He speaks English and is working on village wastewater treatment We did not have an opportunity to follow up with Dr Cebula

IV F Polish/American Extension Project (USDA Extension Service) - Warsaw

The Polish/American Extension Project was initiated in 1991 as a cooperative effort by the U S Department of Agriculture and the Polish Ministry of Agriculture Dr John Ragland is Director of the Project The principal aim of this effort is to restructure and revitalize the agricultural advisory service (ODR) in Poland

The procedure to date has been to have American teams of Extension specialists locate in selected ODRs for six-month stays So far 19 of Poland's 49 ODRs have hosted American workers The Ministry of Agriculture has made a strong request for the Project to be extended long enough for teams to work in most, if not all, provinces

American Extension specialists have helped the ODR Advisory Service improve its skills in farm management business planning, the formation and maintenance of advisory councils, and collaboration with agriculture vocational schools and universities

The Project has initiated several new programs in 1993, namely development of the National Advisory Council, Advanced Business Planning System, International Trade and Investment Assistance Project Impact on Women, and Youth (4-H) Education

We met with Dr John Ragland, who heads the program for USDA, in the Ministry of Agriculture building in Warsaw Dr Ragland suggests that we bring the relevant parties together and get them to decide how to work together (see our recommendation #1) He thinks it is important to get LEM, EPA, and USDA working together, and we may need a full-time person to accomplish this

Dr Ragland's opinion of Polish agricultural sector is that there is a strong base of technical support and the USDA work in Poland gets quickly assimilated and used There are ~1,000 agricultural technical education schools in Poland with good people and strong programs

Other "leads" suggested by Dr Ragland

- 1 Anne Bellows from Rutgers, program coordinator for the Local Democracy in Poland project,

- 2 Dr Halina Burzynask-Chitasombat, USAID program Director for the Foundation in Support of Local Democracy,
- 3 the Environmental Health Institute in Katowice (Richard Skarbek in MOE is a suggested contact person),
- 4 "Pilot Report on Pollution and Contamination of Agricultural Land, Food Raw Materials, and Food in 1989," a synthesis report (we have a copy of the cover page (in Polish) and the first few pages translated into English)

IV G USEPA Region VII

Key Contact Susan Gordon, Assistant Regional Administrator for Policy and Management

USEPA Region VII (Kansas City) is working with Iowa State University and IMUZ on a three-year project Poland with the following objectives

- 1 demonstrate environmentally and economically sustainable technologies and land management in the agricultural community,
- 2 foster environmental education in rural communities, and
- 3 promote development of infrastructure and public policies to support sustainable technologies

Their work includes setting up demonstration projects, conducting "field days" for outreach, and working with the Ministries of Agriculture and Environment on policy promotion. In discussions with key contacts and in a meeting in Warsaw (they happened to be in Poland at the same time), we discovered much mutual interest. Their work fits in well with the NPS Team efforts, and especially with the conclusions and recommendations we are reaching. USEPA is very interested in cooperating and coordinating with us, as are we with them. They are very interested in assisting in future efforts.

Two key areas where EPA can assist is their collaboration with IMUZ and their work with central government officials. The central government policy activities can be very helpful in getting central government involvement in regional LEM activities.

IV H Volunteers in Overseas Cooperative Assistance (VOCA)

Key Contact Carl Hammerdorfer, Country Representative for Poland. Nina Mejer is the USAID Manager in Warsaw.

VOCA is a private, non-profit international development organization providing high-level technical volunteers for short-term assignments. They are currently providing assistance to Polish agricultural and agri-business enterprises. The structure is fairly flexible, and they

have recently started work in environmental areas related to agriculture. VOCA work in Poland is funded primarily by USAID.

VOCA's flexible structure, emphasis on agriculture, and recent interest in environmental topics makes them a potentially valuable "partner" in NPS problem-solving. We met with Mr. Hammerdorfer in Warsaw, and he has expressed a strong interest in being included in future efforts.

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Appendix 4
NPS Workshop

Appendix 4 NPS Workshop

Introduction

The LEM NPS study has identified serious pollution problems that have significant ecological/environmental consequences as well as potentially serious public health ramifications. The study also identified many resources and organizations, both Polish and American, that are either active in addressing the problem or could become active. A NPS workshop will be invaluable in bringing these resources together to actively address the NPS problems.

The detailed design and schedule should be left to experts in workshop planning. This appendix presents our primary ideas for guiding the NPS workshop, including our suggestions for the purpose, participants, objectives, and primary working groups. This report should be considered the starting point for the workshop.

Purpose of Workshop Bring Polish and American resources together to better focus efforts at addressing the serious NPS problems, with special emphasis on

- 1 Description of problems and recommendations for action in Ziebice and Swieta Kataryzna
- 2 Coordination of NPS efforts in Poland as an organized effort
- 3 Effecting, through DEMDESS, an integrated data management system as a first step in improving data coordination and access

The Workshop will be held in Wroclaw, hosted by the Regional Water Management Authority (RWMA), which has been the center of activities to date. Wroclaw is an ideal location, because the regional organizations, and several of the national-level organizations, are located in Wroclaw.

Workshop Participants The following organizations, with key individuals noted, are identified in the LEM NPS report as important "players" in addressing the Polish water quality problems.

- 1 Regional Water Management Authority (RWMA) - RWMA is the primary Polish facilitator of the NPS study and will serve as the host and central coordinating organization for follow-up activities. The RWMA has a watershed perspective, and this approach is an essential organizing principle for addressing water quality problems.

Key Contact Mr. Nalberczynski

- 2 LEM (Bill Sommers, Tim Bondelid, Maurice Cook) - LEM is the USA sponsor of the NPS Workshop. LEM has been the USA project spearheading the work to date, and is the key American project "on the ground" in the region.

Key People William Sommers, Maurice Cook, Tim Bondelid

- 3 Gmina representatives, especially from Ziebice and Swieta Kataryzna The Gminas are the primary action level for addressing NPS problems The Mayors should be consulted for specific staff participation in the Workshop
- 4 Wroclaw Agricultural Advisory Service (WODR) - WODR is actively involved in several aspects of the NPS pollution problem, especially providing technical and business advice to farmers They are also active in helping villages with low-cost waste treatment alternatives, providing medical checkups, and trying to mitigate road pollution Ewa Mankowska, and/or two other staff members, should be included in the Workshop A representative from the Agriculture Economics Department working with the village waste treatment projects should be invited, on advice and consent from Ewa Mankowska Also, the local ODR staff in Ziebice and Swieta Kataryzna should perhaps be invited, since they will be the direct contacts and "activators" of gmina-level action plans that include the ODR

Key Contact Ewa Mankowska A E , Director
ul Zwycieska 12
55-033 WROCLAW
tel 67 58 12

- 5 Institute of Environmental Protection Office in Wroclaw (IEP) - The IEP performs data analysis and modeling of water quality and is currently working with Swieta Kataryzna to develop the gmina's land use plan Another relevant activity in IEP has been reviews of the waste treatment technologies currently available in Poland Dr Przewlocki will be an important contributor to the NPS Workshop, he should be asked to recommend one or two other representatives of IEP to attend the Workshop in addition to himself, or if he cannot attend

Key Contact Dr Janusz J Przewlocki, Head
ul Wystawowa 1
51-618 WROCLAW
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- 6 Institute of Meteorology and Water Management (IMWM) - The IMWM is the primary water data collection and analysis organization in Poland They possess most of the surface water quality data needed for the initial implementation of DEMDESS Ms Korol attended the DEMDESS Regional Workshop in Budapest, and her presence at the NPS Workshop will be very important for moving forward on the data access and coordination problems

Key Contact Rafalina A Korol, M Sc
Head of Dept of Surface Water Monitoring
Parkowa 30
51-616 WROCLAW
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- 7 Institute for Land Reclamation and Grassland Farming (IMUZ) - IMUZ is working with USEPA Region VII on the NPS demonstration projects Dr Sapak is one of the clearest

thinkers regarding the total pollution problem in Poland and his presence will bring a valuable perspective, both technically and institutionally, to the development of solutions. In addition to Dr Sapak, Dr Cebula of the Wroclaw office of IMUZ would be a valuable, more local, participant.

Key Contact Prof Dr Andrzej Sapak
Leader of Dept of Soil and Water Chemistry
05-090 RASZYN
tel (22) 56 05 31
fax (2) 628 37 63

Dr Cebula
IMUZ, Wroclaw
tel 67 80 92
67 80 91

- 8 United States Department of Agriculture/Poland Agricultural Extension Cooperative (USDA) - USDA is very active in working with the agricultural community in Poland, primarily through the ODRs. It is important to bring this valuable USA resource into the solution. Dr John Ragland is in charge of the USDA program in Warsaw, his presence at the Workshop will be very useful in helping to coordinate USA resources.

Key Contact Dr John Ragland
Warsaw

- 9 USEPA Region VII (USEPA) - USEPA is working with IMUZ and the Center for Agricultural and Rural Development of Iowa State University (CARD) on the Poland Agriculture and Water Quality Protection Project. The USEPA project is active in addressing agricultural NPS problems in Poland, including demonstrating the proper methods for handling and storing manure. USEPA has expressed strong interest in cooperating and coordinating with the LEM NPS activities. Susan Gordon of USEPA is in charge of the project. The other key people on the project are Walter Foster of USEPA, Aziz Bouzaher of CARD, and Stanley Johnson of CARD. Invitations should be directed through Susan Gordon.

Key Contact Susan Gordon
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- 10 Volunteers In Overseas Cooperative Assistance (VOCA) - VOCA is a flexible means for getting USA experts involved in helping Poland, primarily in agriculture VOCA has recently
- 11 Agricultural University of Wroclaw (AUW) - The AUW is active in teaching and research in many of the important areas related to NPS problems Prof Dr Jerzy Kowalski, Rector of AUW, presented a clear vision of the future role of AUW in helping solve Poland's pollution problems, he absolutely should be invited, and his advice and cooperation concerning AUW Workshop participation is essential Mr Nalberczynski should also be consulted concerning AUW participation Prof Dr Tadeusz Chodak would be a particularly valuable participant Staff from other departments could be involved in the Workshop, including

- Institute of Soil Science and Environment Protection
- Institute of Hydrology and Geoengineering
- Institute of Amelioration and Environment

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Prof Dr Tadeusz Chodak
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- 12 Voivodship Representatives - The Voivodships are an important source of resources for the gminas We did not meet any Voivodship representatives, so Mr Nalberczynski should be consulted concerning who would be best to invite

- 13 USAID Mission, Warsaw - Andrezej Pecikiewicz of USAID is providing approval, support and encouragement for USAID resources to be used for the NPS study and the Workshop His participation should certainly be requested and encouraged
- 14 USAID Water and Sanitation for Health Project (WASH) - WASH has lead the development of DEMDESS and will be able to provide follow-up support for implementing DEMDESS in Poland Mr James Taft of USAID is in charge of the DEMDESS project and his participation in the Workshop would be very helpful in allocating and coordinating WASH resources Tim Bondelid of LEM is also the primary technical developer of DEMDESS for WASH and will provide the technical follow-up support

Key Contact Mr James Taft
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Workshop Objectives and Outcomes

The following key objectives and outcomes should be used as a guide by the workshop designers

1 Agree on

- What is known about the total pollution picture, what is known about NPS
- What is not known about the pollution problems and how to address

2 Identify

- Currently available resources for addressing NPS pollution
- Future resources
- Key players, roles they can/should play
- Actions that can be taken now and specific things that have to happen to take those actions
- Institutional and technical roadblocks

3 Actions

- Prioritize action items, identifying lead and key players for each item
- Develop an action plan with specific activities for each player, time frame, roadblocks, predicates

Action Levels

- Gmina
 - [Poviat]
 - Voivodship
 - Basin
 - National
- Set up a time and place for follow-up meeting(s)

Suggested Working Groups

We see four distinct areas in which to focus efforts. These areas can be addressed by setting up separate working groups either in the workshop and/or as an ongoing activity after the workshop. It is important that these working groups regularly cooperate and coordinate with each other!

1 Data Management and Coordination

Key issues implementation of DEMDESS, where should the primary technical "home" be for DEMDESS, who are the primary "clients" for DEMDESS application, strategy for implementation of DEMDESS, where is the primary data for DEMDESS

Key participants IMWM, IEP, RWMA, WASH, AUW, ODRs, Voidvoidships

2 Training, Education, and Information Sharing

Key issues Current resources, overlaps in activities, coordination of activities, needed activities not being addressed and how to address them

Key participants ODRs, gminas, AUW, IMUZ, EPA, LEM, VOCA, USDA

3 Technical Issues

Key Issues wastewater treatment technologies, BMPs, evaluation of pollution magnitudes, health effects, modeling/prediction

Key participants RWMA, IEP, IMWM, IMUZ, AUW, LEM, EPA, WASH

4 Policy and Institutional Issues

Key issues Baltic Sea Convention, environmental protection strategy, economic development, institutional conflicts and roadblocks

Key participants RWMA, Ministries of Environment and Agriculture, EPA, USDA, LEM, gminas